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AN 01-5MA-2

Handbook of Erection and Maintenance Instructions

NAVY MODEL

PBY-5 • PBY-5A Airplanes

Airplanes - Contract NOa(s) 91876

Serial Nos. 08124 - 08176 incl.

Serial Nos. 08178 - 08210 incl.

Serial Nos. 08226 - 08549 incl.

PBY-5A Airplanes - Contract NOa(s) 464

Serial Nos. 33960 - 34059 incl.

Serial Nos. 46450 - 46638 incl.

Serial Nos. 48252 - 48451 incl.

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15 May 1945

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INTRODUCTION

This publication is intended primarily as a reference handbook. It is arranged to provide a complete treatment of each component of each system or major assembly in the PBY-5 and PBY-5A airplanes, with the exception of structural repair which is covered in the STRUCTURAL REPAIR MANUAL. Additional information on the airplanes may be obtained from PILOT'S HANDBOOK OF FLIGHT OPERATING INSTRUCTIONS (AN 01-5MA-1) and ILLUSTRATED PARTS CATALOGUE (AN 01-5MA-4.)

The serial numbers of airplanes covered by this manual are:

PBY-5	PBY-5A
08124-08176 inclusive	33960-34059 inclusive
08178-08210 inclusive	48252-48451 inclusive
08226-08549 inclusive	46450-46579 inclusive
	46580-46638 inclusive

During the course of manufacture of the airplanes listed, numerous changes and improvements were incorporated. Since it would be impractical to cover all these differences, this manual will be based on a description of latest type PBY-5 and PBY-5A airplanes manufactured. Where lack of information on earlier type aircraft on a certain part of the airplane would prevent flight operations or curtail the use of the airplane for combat, such information will be given along with the subject matter on the latest type.

To avoid duplication, all illustrations showing the partial or entire outline of the airplane will be of the PBY-5A type unless the differences between the PBY-5A and PBY-5 are great enough to require an illustration for each type airplane.

The book is subdivided into the following sections:

INTRODUCTION
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SECTION I—DESCRIPTION, DIMENSIONS AND LEADING PARTICULARS
SECTION II—SHIPMENT AND ERECTION PROCEDURE
SECTION III—HANDLING AND GENERAL MAINTENANCE INSTRUCTIONS
SECTION IV—MAJOR COMPONENT PARTS AND SYSTEMS
SECTION V—USEFUL OR MILITARY LOAD
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SECTION VII—FINISH SPECIFICATIONS

SECTION VIII—TUBING CHARTS
SECTION IX—CHARTS AND TABLES
SECTION X—SERVICE INSPECTION
ALPHABETICAL INDEX

The TABLE OF CONTENTS, located at the front of the book, is arranged by major headings according to their arrangement in the book. Each major heading is subdivided into sub-headings to enable the reader to locate material when nomenclature or titles are unknown.

The Alphabetical Index, located at the back of the book, is arranged in such a manner that all individual items are listed in alphabetical order regardless of what major component part they may fall under.

This book will be revised periodically and new pages will be distributed by the Bureau of Aeronautics to the activities possessing copies. The new revision pages are to be inserted in place of the superseded material.

Throughout this manual references are frequently made to certain Sections and Paragraphs to avoid repetition. An understanding of the reference methods used will assist the reader in using the manual.

Each section of the book is broken down into two or more MAIN paragraphs which are always identified by a name and number in large black type. The number appears at the top of each page covered by that paragraph.

Three methods of referencing are used.

1. Reference to other parts of the same MAIN paragraph.

This reference will be written: "(See paragraph *a*, (1), (*a*)).". Note that the word "paragraph" is spelled out in lower case letters. Find the reference by looking for "*a*" which is given at the top of the page with the MAIN paragraph number. The sub-paragraph numbers "(1), (*a*)" will be found by inspecting the pages marked "*a*".

2. Reference to parts of another MAIN paragraph in the same section.

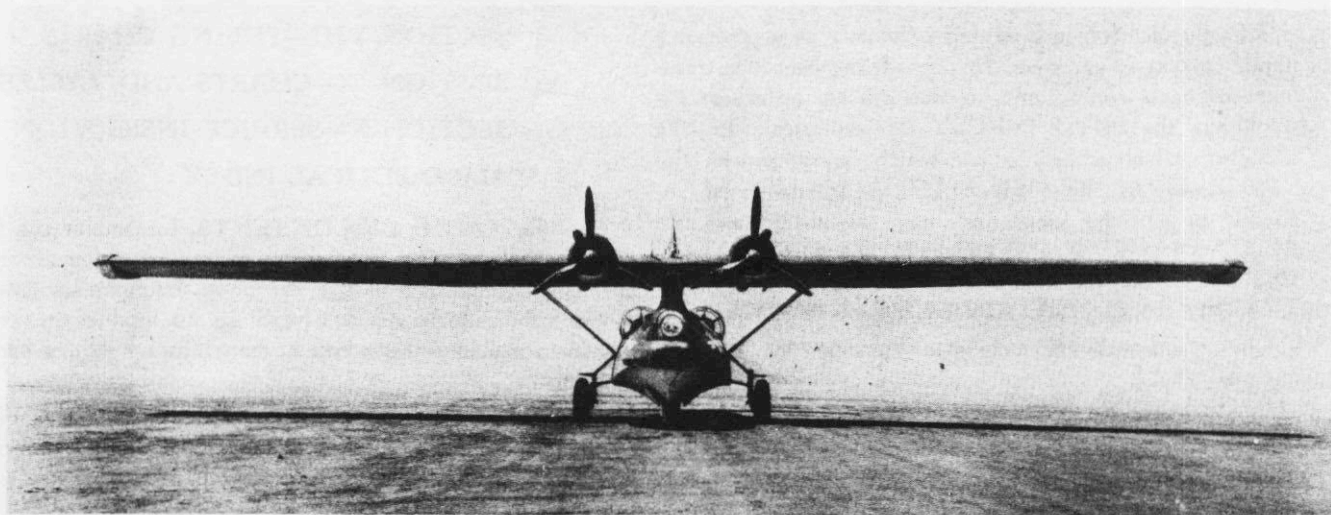
This reference will be written: "(See Par. 17, *a*, (1), (*a*)).". Note that the word paragraph is abbreviated and starts with a capital letter. Find the reference as outlined for method 1, locating the paragraph identification at the top of the page.

3. Reference to parts of a MAIN paragraph in another section.

A reference given according to method 3 will be written: "(See Section 7, Par. 6, *a*, (1), (*b*)).". To find the reference, turn to Section 7 in the manual and locate Par. 6, *a*, at the top of the page. Proceed as above for locating the sub-paragraphs.

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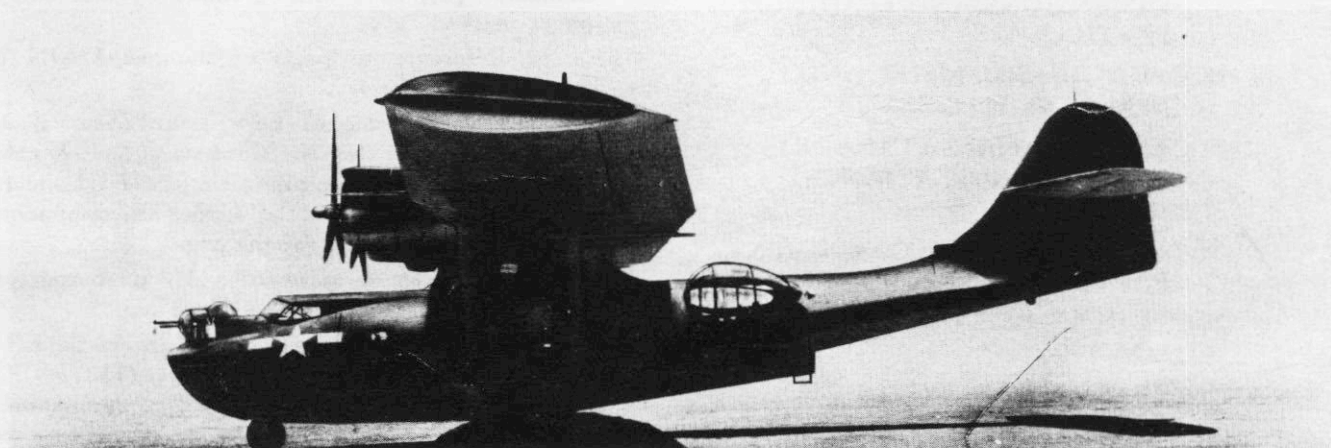
FRONT VIEW (PBY-5A)



THREE-QUARTER FRONT (PBY-5A)



PORT SIDE (PBY-5A)



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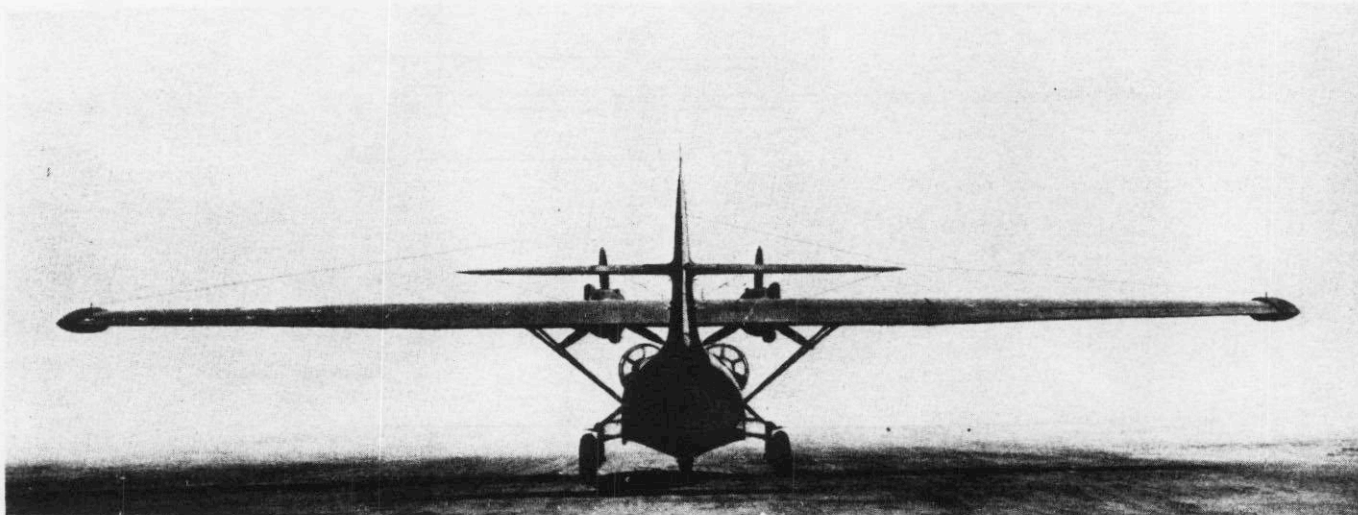
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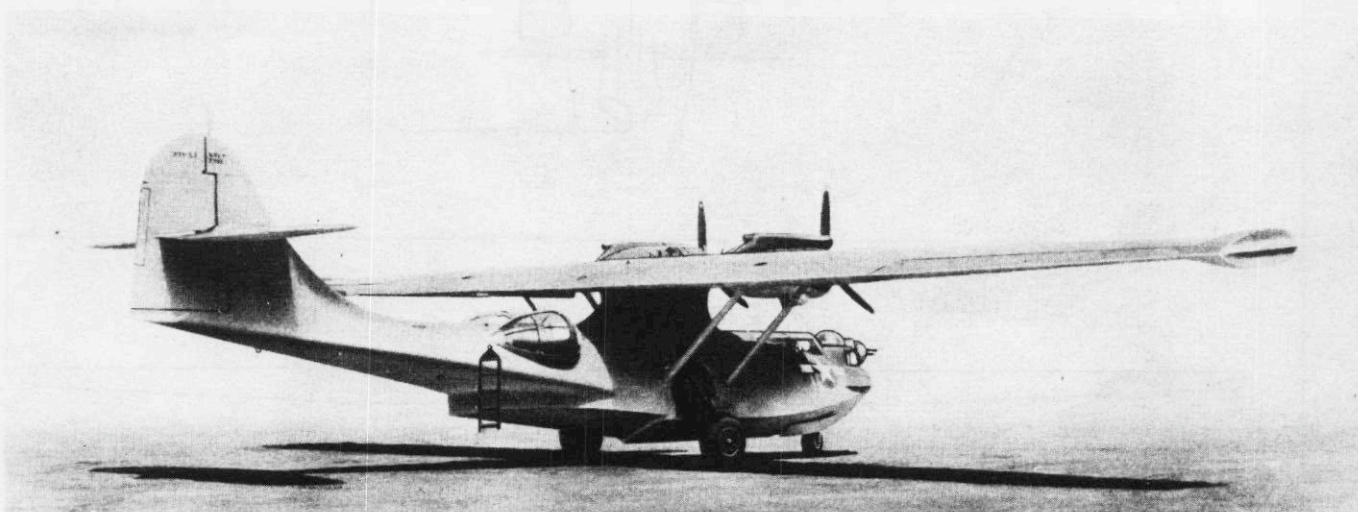


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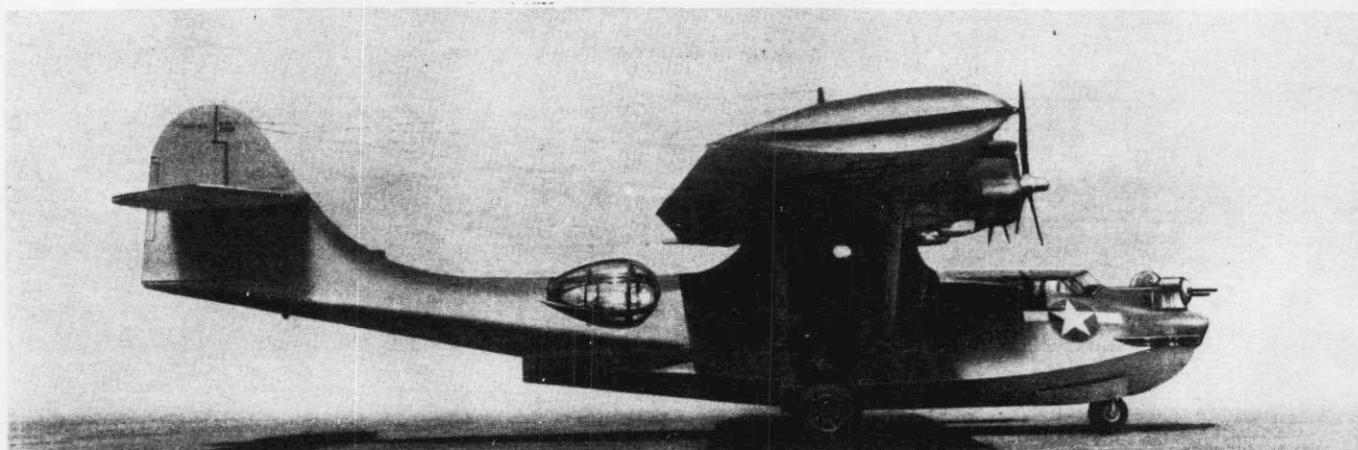
REAR VIEW (PBY-5A)



THREE-QUARTER REAR (PBY-5A)



STARBOARD SIDE (PBY-5A)



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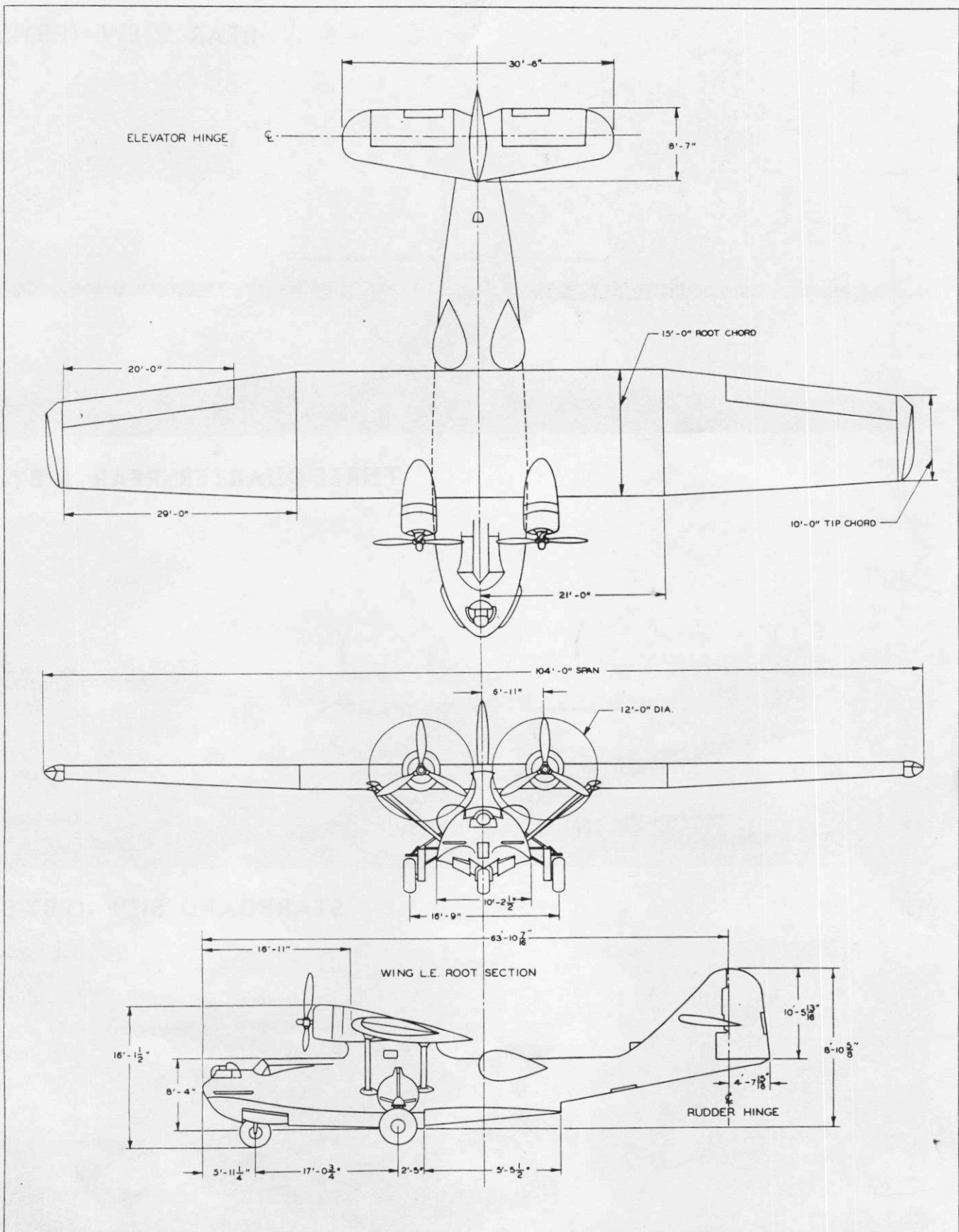
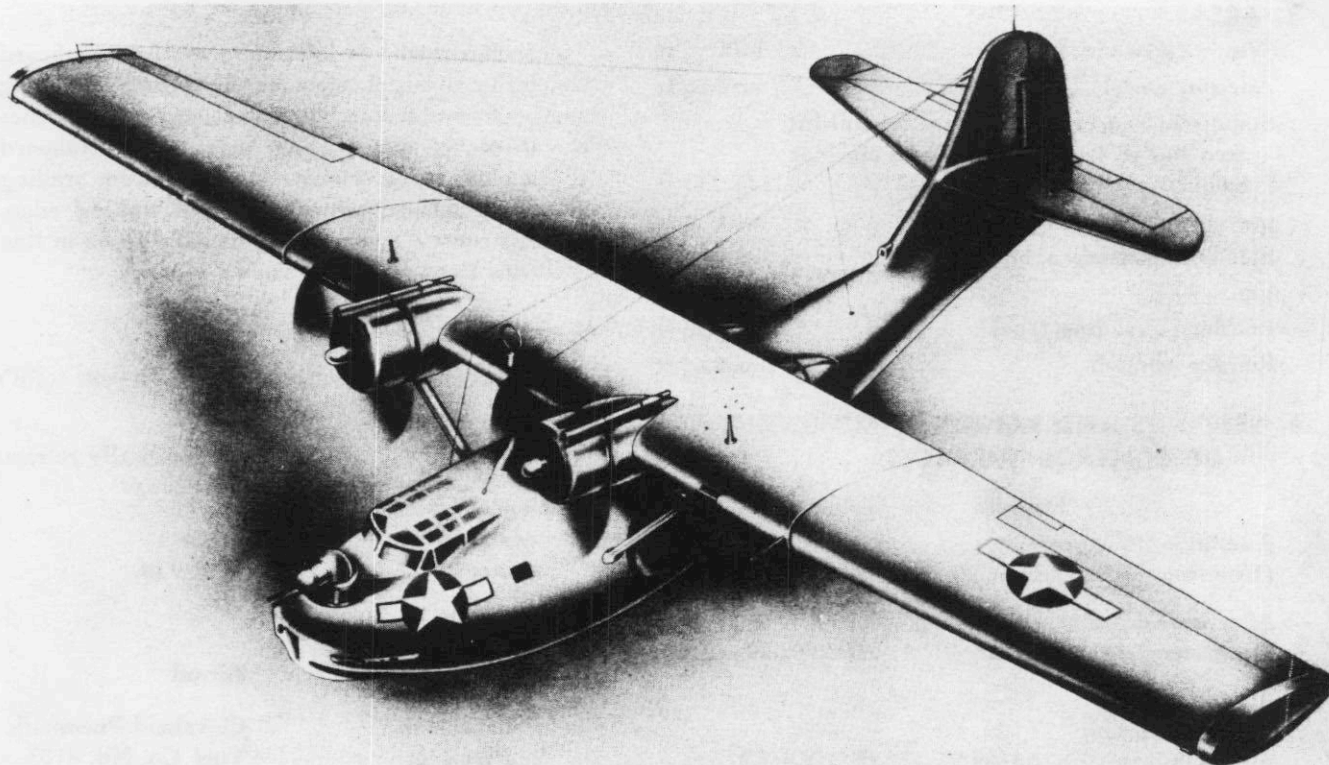


Figure 1—Three View Drawing of PBV-5A Airplane (PBV-5 Similar)



SECTION I DESCRIPTION, DIMENSIONS, AND LEADING PARTICULARS

1. DESCRIPTION.

The PBY-5 and PBY-5A airplanes are twin engine flying boats whose main difference is that the PBY-5A is equipped with a retractable tricycle type landing gear whereas the PBY-5 is not.

Both the PBY-5 and PBY-5A type of airplanes, which may be used as bomber, patrol, or torpedo airplanes, are manufactured by Consolidated Vultee Aircraft Corporation under contracts 91876 (PBY-5) and NOa(s)-464 (PBY-5A).

Both types of airplanes are powered by two R1830-92 engines and are equipped with floats which retract to form wing tips.

The wing is mounted on a superstructure built up from the hull and is braced by four struts, two on each side, extending from the hull to the under surface of the wing.

Accommodations for an eight man crew are provided.

2. PRINCIPAL DIMENSIONS.

(Aircraft in level flight position.)

a. GENERAL.

Span	104 ft 00 in.
Length (over-all)	63 ft 10-7/16 in.

Height (over wing)	13 ft 5½ in.
--------------------	--------------

Height (PBY-5A on landing gear with propeller blade vertical at top)	21 ft 1 in.
--	-------------

Height over propellers with airplane on beaching gear	17 ft 11 in.
---	--------------

b. WINGS.

Airfoil Sections (curve identification)	NACA 21
---	---------

Chord at root	15 ft 00 in.
---------------	--------------

Chord at tip	10 ft 00 in.
--------------	--------------

Incidence	+ 6°
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Dihedral (outer panel taper only)	2° 20'
-----------------------------------	--------

Sweepback at outer panel	2° 58'
--------------------------	--------

c. STABILIZER.

Span	30 ft 6 in.
------	-------------

Maximum Chord	8 ft 7 in.
---------------	------------

Incidence	+ 4°
-----------	------

d. HULL.

Width (maximum)	10 ft 2½ in.
-----------------	--------------

Height (maximum)	8 ft 4 in.
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Length	63 ft 10 7/16 in.
--------	-------------------

3. AREAS.

Wings (less ailerons)	1300 sq ft
Ailerons (total)	100 sq ft
Stabilizers (including 3.5 sq ft hull-fin area and 18.4 sq ft of contained elevator balance)	138.2 sq ft
Elevators, two, including tabs	66.6 sq ft
Elevator trim tabs (total)	3.9 sq ft
Fin	3.5 sq ft
Rudder (including tabs)	40.4 sq ft
Rudder trim tab	2.6 sq ft

4. SETTINGS AND RANGES OF MOVEMENT OF CONTROL SURFACES.

	Degrees	Inches
Ailerons—up (from neutral)	21($\pm 1\frac{1}{2}$)°	12 $\frac{3}{8}$ ($\pm 29/32$)
Ailerons—down (from neutral)	19 $\frac{3}{4}$ ($\pm 1\frac{1}{2}$)°	11-21/32($\pm 29/32$)
Elevators—up (from streamline with stabilizer)	30($\pm 1\frac{1}{2}$)°	21-15/16($\pm 1-3/32$)
Elevators—down (from streamline with stabilizer)	20($\pm 1\frac{1}{2}$)°	14-23/32($\pm 1-3/32$)
Rudder—right (from streamline (+2)° with fin)	22(—0)°	21-11/32 ($\begin{smallmatrix} +1-15/16 \\ -0 \end{smallmatrix}$)
Rudder—left (from streamline (+2)° with fin)	22(—0)°	21-11/32 ($\begin{smallmatrix} +1-15/16 \\ -0 \end{smallmatrix}$)
Trim Tabs:		
Elevator—up (from elevator trailing edge)	5(± 1)°	$\frac{3}{4}$ ($\pm 5/32$)
Elevator—down (from elevator trailing edge)	10(± 1)°	1 $\frac{1}{2}$ ($\pm 5/32$)
Rudder—right (from rudder trailing edge)	15(± 1)°	1 $\frac{7}{8}$ ($\pm \frac{1}{8}$)
Rudder—left (from rudder trailing edge)	20(± 1)°	2 $\frac{1}{2}$ ($\pm \frac{1}{8}$)
Aileron—up (from aileron trailing edge)	15(± 1)°	2-7/32($\pm 5/32$)
Aileron—down (from aileron trailing edge)	15(± 1)°	2-7/32($\pm 5/32$)

Note

Inches throw of aileron measured at inboard trailing edge; elevator at inboard trailing edge; rudder at bottom trailing edge. Inches throw of elevator tab measured at inboard trailing edge; rudder tab at bottom trailing edge; aileron tab at outboard trailing edge. All control surfaces are assumed to be in line with fixed surface when in neutral.

5. ALIGHTING GEAR.

a. WHEEL TYPE LANDING GEAR. (PBY-5A ONLY.)

Type	Hydraulically retractable
Tread (width from center of tire to center of tire)	16 ft 9 in.
Shock Struts (main)	
Type	Air-oil
Maker and Part No.	Cleveland Pneumatic Tool Co. No. 8103
Fluid required	Oil (Petroleum Base)
Trade name identification (Commercial)	Aerol Strut Mineral Oil
AN Specification No.	AN-VV-O-366
Approximate maximum air pressure	Per nameplate
Wheels (main)	
Type (trade name, size and Part No.)	Goodyear—25 $\frac{3}{4}$ in.—No. 530144A
Tire (trade name, type tread and size)	Goodrich—smooth contour—47 inch
Tire pressure	At 27,300 lb gross weight, 54 lb/sq in.

Brakes

Type (trade name and actuating medium)	Goodyear, Hydraulic fluid
--	---------------------------

b. NOSE WHEEL UNIT (PBY-5A ONLY).

Type	Hydraulically retractable
Shock struts:	
Type	Air-oil
Make and Part No.	Cleveland Pneumatic Tool Co.—No. 8104

Fluid Required:

Trade name, identification (Commercial)	Aerol Strut Mineral Oil
AN Specification	AN-VV-O-366
Air Pressure	Per nameplate

6. ENGINES.

Number	2
Designation	R1830-92
Gear ratio (propeller drive)	16:9
Fuel	Spec. AN-F-28, Gr 100/130
Oil	Spec. AN-VV-O-446, Gr 1110/1120
Impeller gear ratio	7.15:1

Wheel (s)

Type (trade name, size and part No.)	Hayes—12 $\frac{3}{8}$ in. G-3-96
Tire (trade name, type tread and size)	Goodrich—smooth contour 30 inch
Tire pressure	35 lb/sq in.

7. PROPELLER.

Manufacturer	Hamilton-Standard
Type	Hydromatic (3 blades)
Hub	23E50-473
Blade (3)	6353A-12
Diameter	12 ft
Control (governor)	4-L-11
Pitch Setting	
Low (fine)	17°
High (coarse)	88°

c. FLOAT TYPE ALIGHTING GEAR.

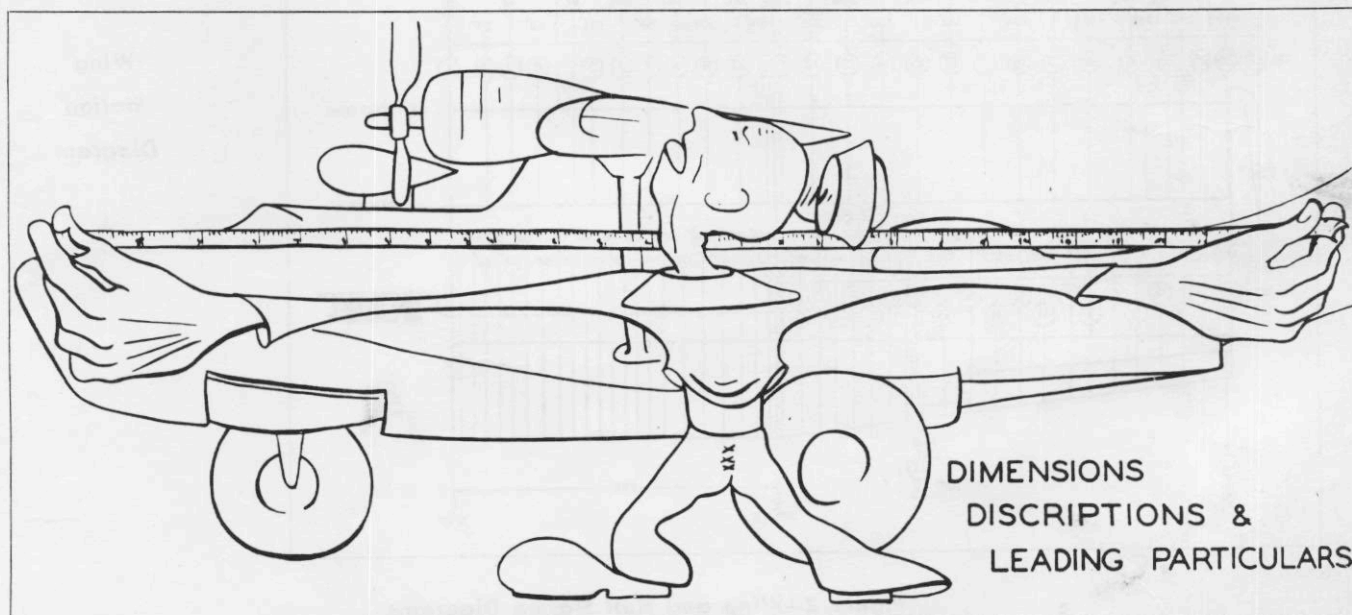
Type of floats (trade name and material)	Consolidated Design, Aluminum Alloy
Tread (from keel to keel)	89 ft 4 in.
Length of float	10 ft 3 $\frac{7}{8}$ in.

8. TANK CAPACITIES.

a. FUEL.	Gallons
Integral tank	875 U. S. (728.6 IMP.)
Fuel cells	622 U. S. (516 IMP.)
Total (integral one side, cells on other)	1478 U. S. (1230.7 IMP.)
b. OIL.	
Tank	65 U. S. (54.1 IMP.)
Expansion space (each tank)	11 U. S. (9.2 IMP.)
Total oil	76 U. S. (63.3 IMP.)
Total both tanks	152 U. S. (126.6 IMP.)

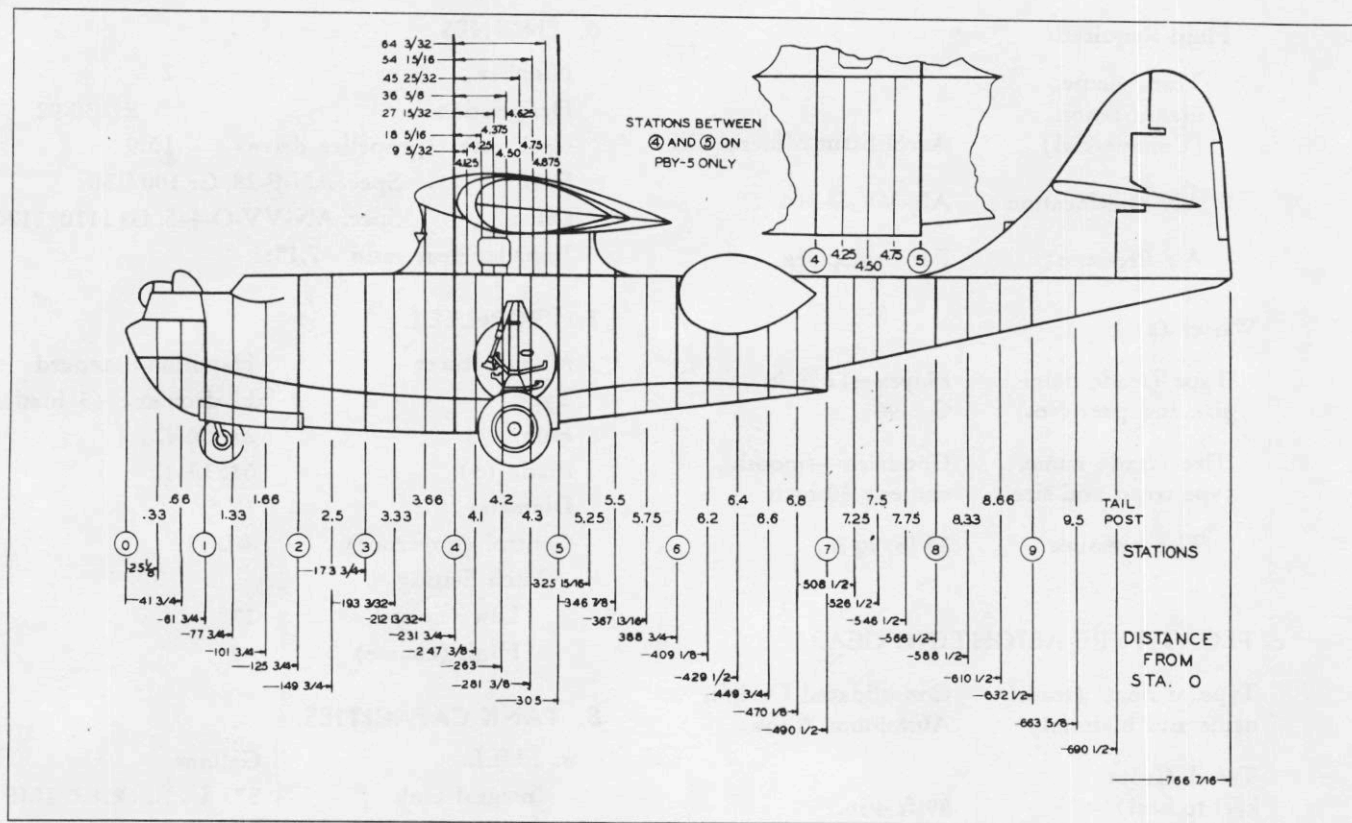
d. HULL.

Type construction— material	Aluminum Alloy and Alclad
Wing tip floats	Retractable

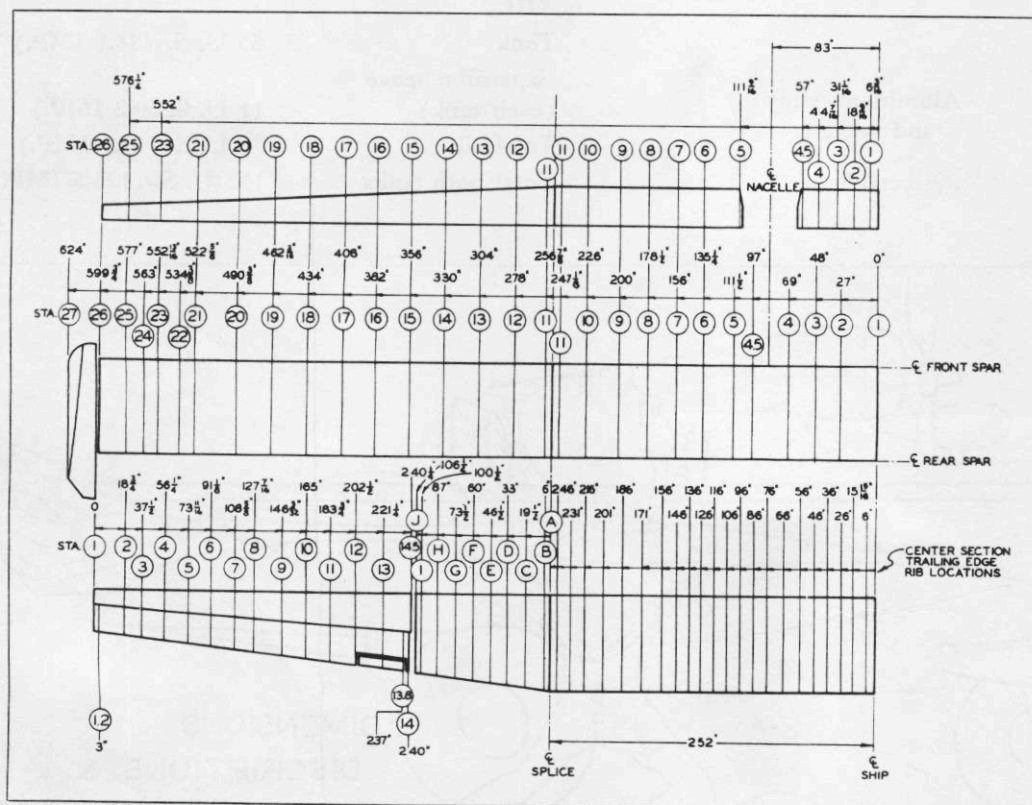


DIMENSIONS
DISCRIPTIONS &
LEADING PARTICULARS

RESTRICTED
AN 01-5MA-2



Hull Station Diagram



SECTION II. SHIPMENT AND ERECTION PROCEDURE



1. SHIPMENT.

a. GENERAL.—The following information is an accumulation of the latest data and procedures on shipping and corrosion prevention. These procedures, arrived at by experience, have proved to allow a minimum of damage and corrosion during shipment.

The method of cradling and crating of small parts is optional, as long as damage during shipment is prevented. On major components, such as the hull, wing center section, or wing outer panel, care must be taken to cradle and crate as per instructions.

When cradling, care should be taken to support the object at points that are structurally sound. Felt padding should be used where the cradle supports the object to prevent scratching.

Crates must be structurally stable to safely handle the object encased, and also to protect it from external damage. Crates should be made from lumber that is sound, and free in general, from defects. (See Specification 39P16a.)

While all crates for overseas shipment must be lined with waterproof paper, those for domestic shipments need not be.

For the prevention of corrosion, the following two methods are used: The applied method, which consists of coating the object with a corrosion-preventive compound, and the dehydrating method, which consists of enclosing the object with a moisture-proof covering and the utilization of a dehydrating agent.

b. MATERIAL REQUIREMENTS.

(1) PRESERVATIVES.

(a) LOW TEMPERATURE LUBRICANT (SPECIFICATION AN-G-3).—This compound is applied to bare metal surfaces such as a bearing surface, or a working surface. It is easily removed when the part is ready to be put into service.

(b) CORROSION-PREVENTIVE COMPOUND (SPECIFICATION AN-C-52, TYPE I).—This compound is applied to cable assemblies, bare metal surfaces, such as bolt heads, caps which are not painted, etc. It is relatively difficult to remove, and is generally used in places where it is not necessary to remove the corrosion-preventive compound when the part is put into service.

Note

Compounds (Specifications AN-G-3 and AN-C-52, type I) are interchangeable in many places, depending on which is on hand and what facilities are available for preserving and removal of preservative.

(c) CORROSION-PREVENTIVE COMPOUND (SPECIFICATION AN-VV-C-576).—This compound is less viscous than the two previously mentioned compounds (Specifications AN-G-3 and AN-C-52, type I). It may be sprayed or applied by a brush. It is used inside oil tanks, auxiliary gas tanks, oil coolers, radiators, etc. In most cases, it is not necessary to remove this corrosion-preventive compound when the part is put into service.

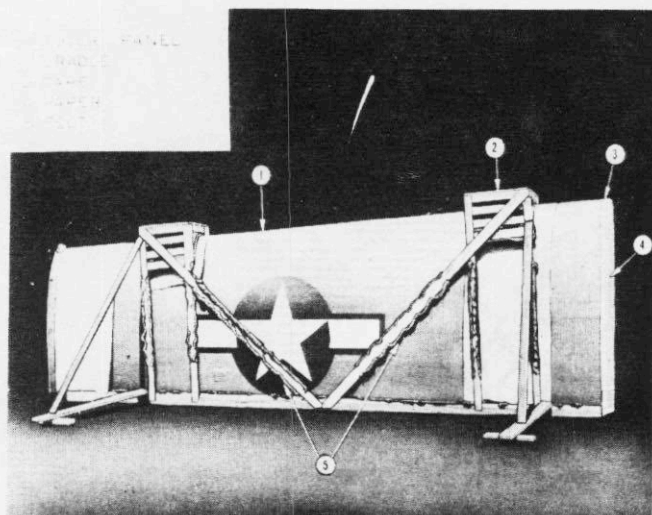


Figure 3—Outer Panel Cradling

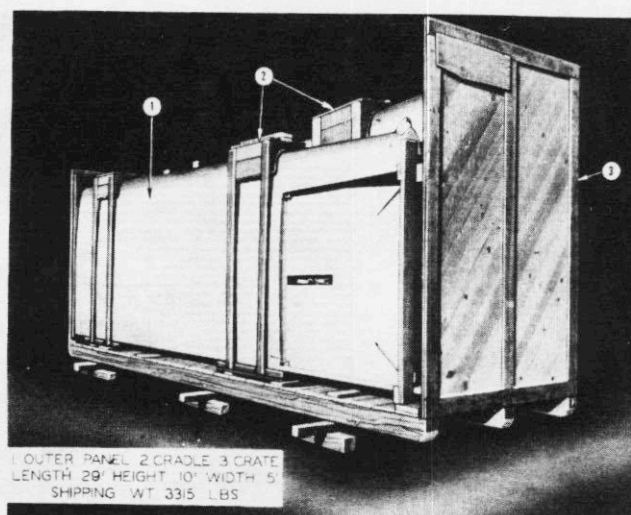


Figure 4—Outer Panel Crating

(d) **HYDRAULIC OIL** (SPECIFICATION AN-VV-O-366).—This fluid is used inside hydraulic jacks, oleo struts, shimmy dampers, hydraulic propeller hubs, etc. For any hydraulic equipment, this may be used as a preservative.

(e) **MOISTURE-IMPERVIOUS ENVELOPE** (SPECIFICATION AN-E-1).—This is a flexible, transparent envelope which can be sealed by means of heat. An active dehydrating agent should always be used with it. It should be protected from external damage by a crate or carton. Care should be taken not to allow sharp corners or other projections to bear against the envelope.

(f) **DEHYDRATING AGENT** (SPECIFICATION AN-D-6).—This is a compound that is used inside a moisture barrier, such as a moisture-impervious envelope, a sealed engine case, a lined crate, etc. It absorbs moisture inside the container and minimizes possibilities of corrosion.

(g) **HUMIDITY INDICATOR** (DRAWING Nos. AN7511, AN7512, or AN7513).—Humidity indicators are used to ascertain the degree of humidity inside a moisture barrier.

(h) **DEHYDRATOR PLUGS** (SPECIFICATION AN-P-47).—These plugs are inserted into spark plug holes in the engine. They reduce the amount of moisture existing within the cylinder.

(2) PACKING AND CRATING.

(a) **GREASEPROOF WRAPPING PAPER** (SPECIFICATION AN-P-12, grade A and grade B).—This paper is intended for wrapping metal parts and equipment which will usually be coated with corrosion-preventive compound. It is intended for initial wrapping of metal parts prior to additional packing. Grade A paper is used where a non-corrosive paper is desired for machined or polished surfaces. Grade B paper

is used as a covering for painted metal parts, and where non-critical surfaces, whose serviceability will not be impaired by slight corrosion, are involved.

(b) **NON-HYGROSCOPIC ADHESIVE TAPE** (SPECIFICATION AN-T-12).—This adhesive tape is intended for use as a moisture-proof covering, and in sealing apertures in containers or parts to permit dehydration of interiors.

(c) **CELLULOSE WADDING** (COMMERCIAL GRADE).—This material is used for shockproofing articles in cartons and crates.

(d) **SHREDDED PAPER** (COMMERCIAL GRADE).—This material is used for shockproofing articles in cartons and crates.

(e) **FELT** (COMMERCIAL GRADE).—This material is used for padding in cradles and crates to prevent scratching of the article by the supporting members.

(f) **UPHOLSTERER'S WEBBING** (COMMERCIAL GRADE).—This material is used for holding down parts in the cradle to prevent movement.

(g) **WATERPROOF PAPER** (SPECIFICATION UU-P-27/a).—This paper is used for lining crates, wrapping parts, and making waterproof seams.

(h) **LUMBER**. (Refer to Spec. 39P16a.)—Any good grade of lumber may be used for crating or cradling.

(i) **WATERPROOF PAPER** (60-60-60).—This paper is used for general wrapping and protection against scratching.

c. METHOD OF SHIPMENT.

(1) **RAIL SHIPMENT**.—When shipping by railroad, all major components of the airplane are crated

or cradled in box cars or flat cars. Wing outer panels, empennage assemblies, or similar components may be put in cradles and packed in box cars without being crated.

Fabric covered parts, such as trailing edges, ailerons, elevators, or rudders may be wrapped in grade A waterproof paper and then packed in box cars. In all these cases, the box car serves as the crate during shipment.

On flat cars, parts, except hulls and center sections, should be packed as for overseas shipment; that is, crates should be lined with waterproof paper, etc. Hulls and wing center sections are cradled and then covered with waterproof canvas. (See 39P16a and AN-C-118 for general specifications.)

(2) OVERSEAS SHIPMENT.—For overseas shipment, all parts are cradled and crated in waterproof paper-lined crates with active dehydrating agent enclosed. On all large containers such as those encasing hulls, wing outer panels, wing center sections, engines, etc., provisions for permanent hoisting slings shall be made. Slings must also be furnished with the crate. (See 39P16a and AN-C-118 for general specifications.)

(3) AIRBORNE SHIPMENTS.—The following factors must be taken into consideration when shipping by air: Lightness, strength, dimensional limits, and weather resistance. It is extremely important to take utmost care in protecting the article against changing weather conditions. Facilities along most overseas air routes are not as good as those at normal warehouses. All articles should be carefully tied down to prevent shifting of loads. (See Specification 39P16a and AN-C-118 for dimensional limits and other information.)

d. SHIPMENT OF COMPONENT PARTS.

(1) WING OUTER PANEL.

(a) PREPARATION.

1. REMOVAL OF EQUIPMENT.—Remove the magnesyn compass transmitter (in left hand panel only), all electrical wire harnesses, flexible conduit, limit switches, the anchor light, recognition lights, the formation light, and electrical junction boxes. The float, drag panel, float operating struts, trailing edges, and aileron are to be shipped separately. Control cables and other loose equipment should be tied down to prevent movement during shipment. See that the float operating mechanism is secure.

2. CORROSION-PREVENTION.—All surfaces that are to be coated with a corrosion-preventive compound should be cleaned with a suitable solvent in order to remove oil, dirt, or metal shavings which may have accumulated during fabrication.

All bare metal surfaces such as bolt heads, nuts, cable assemblies, and cable fittings should be coated with corrosion-preventive compound (Specification AN-C-52, type I).

The ball bearings on the bell cranks should be protected with grease (Specification AN-G-3), and then covered with paper and tape to prevent dirt and dust from entering. Seal the open end of the wing outer panel with paper (60-60-60) and non-hygroscopic adhesive tape (Specification AN-T-12).

(b) CRADLING AND CRATING.

1. CRADLE.—The cradle used for supporting and handling the outer panel is constructed as shown in figure 3. The usual materials used for construction of the cradle are lumber, nails, and felt.

2. CRATE. (See figure 4.)—The crate is fabricated from wood and lined with waterproof paper according to Specification 39P16a. Be sure that a permanent hoisting sling is included. The wing outer panel and cradle is placed within this crate and supported so that no movement occurs during shipment. This type of box is used for overseas shipment. When the wing outer panel is shipped by rail, it should be packed into a boxcar.

(c) PARTS REMOVED. (See paragraph d., (20).)

(2) FLOATS, FLOAT STRUTS, AND DRAG PANEL.

(a) PREPARATION.—These parts should be packed separately within a crate. The bearing, working, and other bare surfaces must first be cleaned with a suitable solvent, such as petroleum naphtha, or an equivalent cleaning fluid. Then, either grease (Specification AN-G-3), or corrosion-preventive compound (Specification AN-C-52, type I) is applied, as applicable, to each particular surface.

(b) CRADLING AND CRATING.—The cradle and crate are of the conventional type.

For domestic shipment, the crate need not be lined with waterproof paper, whereas, for overseas shipment, it should be. (Typical arrangement of crate and parts is shown in figure 5.)

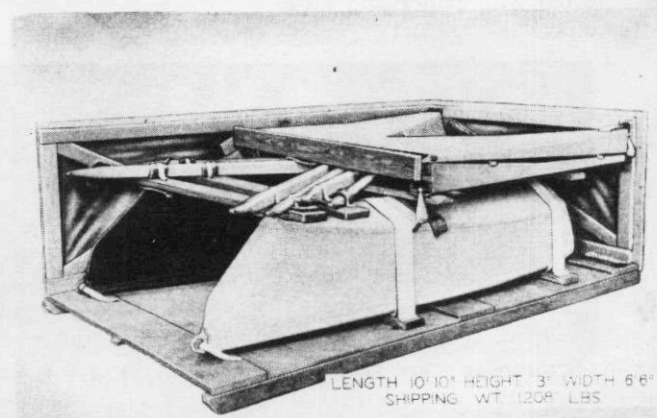
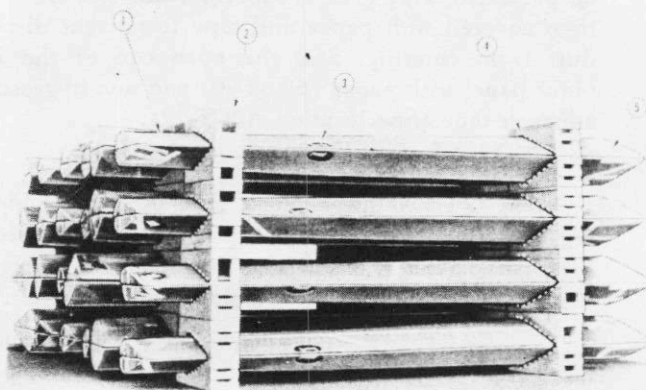


Figure 5—Crating of Float



1. CRADLE 2. IDENTIFICATION TAG 3. FELT & TAPE
SHIPPING WT 186 LBS FOR 2 AILERONS

Figure 6—Cradling of Aileron

(3) AILERON.

(a) PREPARATION.—Properly clean all bare metal surfaces, and then coat with corrosion-preventive compound (Specification AN-C-52, type I) or grease (Specification AN-G-3), as applicable. Wrap with waterproof paper and non-hygroscopic adhesive tape.

(b) CRADLING AND CRATING. (See figure 6.)—When the aileron is shipped by box car, place it in a conventional cradle, and then pack into the car.

For overseas shipment, a waterproof paper-lined crate is required. (See Specification 39P16a.)

(4) TRAILING EDGE—OUTER PANEL.—This trailing edge is prepared for shipment and then shipped in the same manner as the aileron.

(5) TRAILING EDGE—AILERON CUTOUT—OUTER PANEL.—This trailing edge is prepared for shipment and then shipped in the same manner as the aileron. However, the ball bearings should be protected with paper and tape.

(6) LEADING EDGE—OUTER PANEL.

(a) PREPARATION.

1. REMOVAL OF EQUIPMENT.—Remove electrical harness, flexible conduit, and the running light on outboard end of leading edge.

2. CORROSION-PREVENTION. — Clean properly and then apply corrosion-preventive compound (Specification AN-C-52, type I) or grease (Specification AN-G-3), as applicable.

(b) CRADLING AND CRATING. (See figure 7.)—When shipping in a box car, only a conventional type cradle is required. The part should be carefully packed in the box car so that equipment adjacent to it will not damage it.

For overseas shipment, the leading edge and cradle is placed within a waterproof paper-lined crate.

(c) PART REMOVED.

(See paragraph d., (20).)

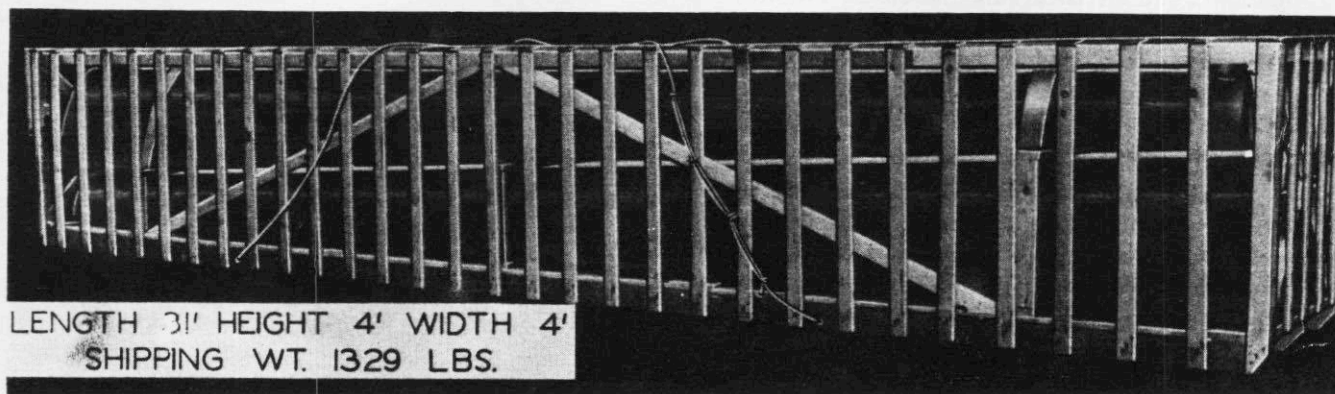
(7) WING CENTER SECTION.

(a) PREPARATION.

1. REMOVAL OF EQUIPMENT.—All electrical harnesses, flexible conduit, junction boxes, lights, receptacles, bomb racks, antenna masts, the pitot static tube head, and the aileron push-pull tube are to be removed and shipped separately.

Secure cables, fuel lines, and other loose equipment to the structure to prevent movement during shipment. The trailing edge is not included, but is shipped separately.

2. CORROSION PREVENTION.—Properly clean all bare metal and bearing surfaces and apply corrosion-preventive compound (Specification AN-C-52, type I) or grease (Specification AN-G-3), as applicable. Grease (Specification AN-G-3) or corrosion-preventive compound (Specification AN-VV-C-576) should be applied to the float operating mechanism. Rigid conduit and tubing must be sealed with tape or wood or fibre plugs. Cover the bearing assemblies that guide the aileron push-pull tube along the rear spar



LENGTH 31' HEIGHT 4' WIDTH 4'
SHIPPING WT. 1329 LBS.

Figure 7—Cradled and Crated Leading Edges

with paper and tape to prevent dirt and dust from entering. Cover pulley brackets with paper and tape to protect pulley and bearing. Seal the wing center section ends with paper and tape.

The wing center section may also be prepared for shipment after removing the leading edge between the nacelles, including all its equipment intact. (See paragraph d., (8).)

(b) CRADLING AND CRATING. — When shipping by rail, the wing center section should be cradled on a flat car. It will overhang about a foot on each end, since a conventional flat car is 40 feet long and the wing center section is 42 feet long. Cable and turnbuckle assemblies should be used to tie the shipment to the flat car so as to prevent shifting. A waterproof canvas should be placed over it. The canvas must not be secured too tightly over the shipment as it may get wet and shrink, thus putting an unnecessary stress on the wing center section.

When shipping overseas, the wing center section should be crated in a waterproof paper-lined crate which has a permanent hoisting sling.

(8) LEADING EDGE—CENTER SECTION—
BETWEEN NACELLES.

(a) PREPARATION.

1. CLEANING AND SECURING LOOSE EQUIPMENT.—All open ends of hydraulic tubing, rigid conduit, and fuel lines should be sealed with tape or plugged with wood or fibre plugs so that no foreign matter enters them while being handled.

By means of a cleaning solvent, such as petroleum naphtha, remove all factory oil, metal chips, and grit which may have accumulated during fabrication. Put matting and other protecting material on corners.

2. CORROSION PREVENTION.—Place the leading edge, complete with harnesses, junction boxes, hydraulic tubing, etc., into a moisture-impervious envelope with a dehydrating agent, and then seal.

(b) CRADLING AND CRATING. (See figure 7.)—The leading edge assembly, after being inserted into a moisture-impervious envelope, should be cradled and crated. For domestic shipment, the crate need not be lined, but for overseas shipment the crate must be lined with waterproof paper.

(9) LEADING EDGE—CENTER SECTION—
OUTBOARD OF NACELLES.

(a) PREPARATION.

1. REMOVAL OF EQUIPMENT.—Electrical equipment such as the landing light, flexible conduit, and pitot-static tube head should be removed and packaged separately.

2. CORROSION PREVENTION. — Clean all bare metal surfaces, and then apply corrosion-preventive compound (Specification AN-C-52, type I).

(b) CRADLING AND CRATING. — When shipment is by rail, this leading edge may be cradled in a conventional type cradle, and then placed in a box car. For shipment overseas, the cradled leading edge is put into a waterproof paper-lined crate. For domestic shipment, the crate need not be lined with waterproof paper.

(10) WING STRUTS.

(a) CORROSION PREVENTION. — Apply grease (Specification AN-G-3) in the bolt holes at each end of the strut; apply corrosion-preventive compound (Specification AN-C-52, type I) for a distance of 18 inches from each end.

(b) CRADLING AND CRATING. — The struts should be cradled and crated before being shipped. For overseas shipment, the crate must be lined with waterproof paper. For domestic shipment, lining with waterproof paper is not necessary.

(11) RUDDER.

(a) PREPARATION.—Apply grease (Specification AN-G-3) to each ball bearing and then cover with paper and tape to prevent dirt and dust from entering. Cover the rudder with waterproof paper.

(b) CRADLING AND CRATING. (See figure 8.)—When shipping by rail, the rudder may be cradled inside a box car. For overseas shipment, it should be cradled and then placed inside a waterproof paper-lined crate.

(12) STABILIZER AND FIN ASSEMBLY.

(a) PREPARATION.—Properly clean all bearing and bare metal surfaces. Apply grease (Specification AN-G-3) on bearing surfaces and corrosion-preventive compound (Specification AN-C-52, type I) on other surfaces. Wrap with waterproof paper.

(b) CRADLING AND CRATING. (See figure 9.)—When shipping by rail, put stabilizer and fin assembly in cradle and pack into box car. For overseas shipment, it should be placed within a waterproof paper-lined crate.

(13) ELEVATOR.—The elevator is prepared for shipment in the same manner as the rudder. (See paragraph d., (11).)

(14) HULL.

(a) PREPARATION.

1. REMOVAL OF EQUIPMENT.—All detachable radio and radar equipment, electrical harnesses, flexible conduit, receptacles, switches, junction boxes, instruments, dynamotors, etc., must be removed and packed separately for shipment. Secure all loose equipment such as cable assemblies, control wheels, bunks, seats, etc. to prevent movement of parts during shipment.

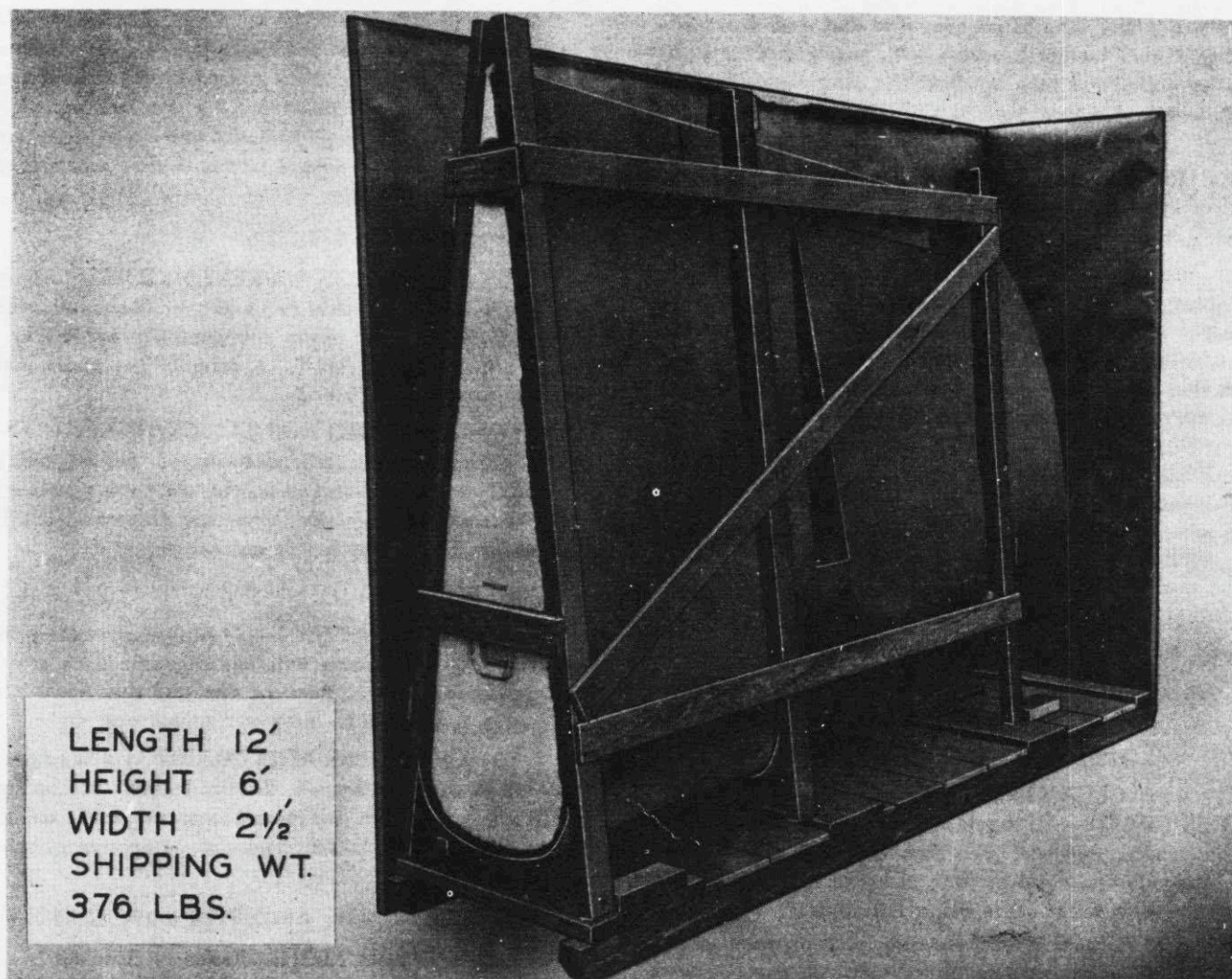


Figure 8—Cradled and Crated Rudder

2. CORROSION PREVENTION.—Seal all open hydraulic lines and rigid conduit with tape. Properly clean all bare metal surfaces and apply grease (Specification AN-G-3) or corrosion-preventive compound (Specification AN-C-52, type I), as applicable. Use corrosion-preventive compound (Specification AN-VV-C-576) on float operating mechanism, outside hydraulic jacks, and oleo struts. Use fluid (Specification AN-VV-O-366) inside all oleo struts, hydraulic jacks, shimmy dampers, accumulators, deboosters, etc.

(b) CRADLING AND CRATING. (See figure 10.)—When shipment is by rail, the hull should be cradled on a flatcar. It will overhang the ends of the flat car since it is approximately 10 to 15 feet longer, depending on the length of the flat car used. The cradles are nailed and bolted to the floor of the flat car, and are braced in a fore and aft direction by supporting members made of heavy lumber. To prevent the hull from shifting in the cradles, turnbuckles and cable assemblies are used. One end is tied to a structural point

on the hull such as a cleat, rear towing fitting, strut fittings, or pendant ring, and the other end tied to the flat car. Slack is then taken up by the turnbuckles.

A waterproof canvas should be put over the hull to protect it from the weather. Care must be taken not to secure canvas too tightly as it will shrink upon getting wet.

For overseas shipment, the hull must be cradled inside a waterproof paper-lined crate which contains a permanent hoisting sling.

(15) ENGINES.

(a) PREPARATION FOR CORROSION PREVENTION.

1. PRELIMINARY PRESERVATION.—At the end of the final run, the engine shall be operated on a clear fuel, conforming to Specification AN-F-22, at a 40 per cent speed for a minimum of 15 minutes. During the run, the lubricating oil inlet should feed

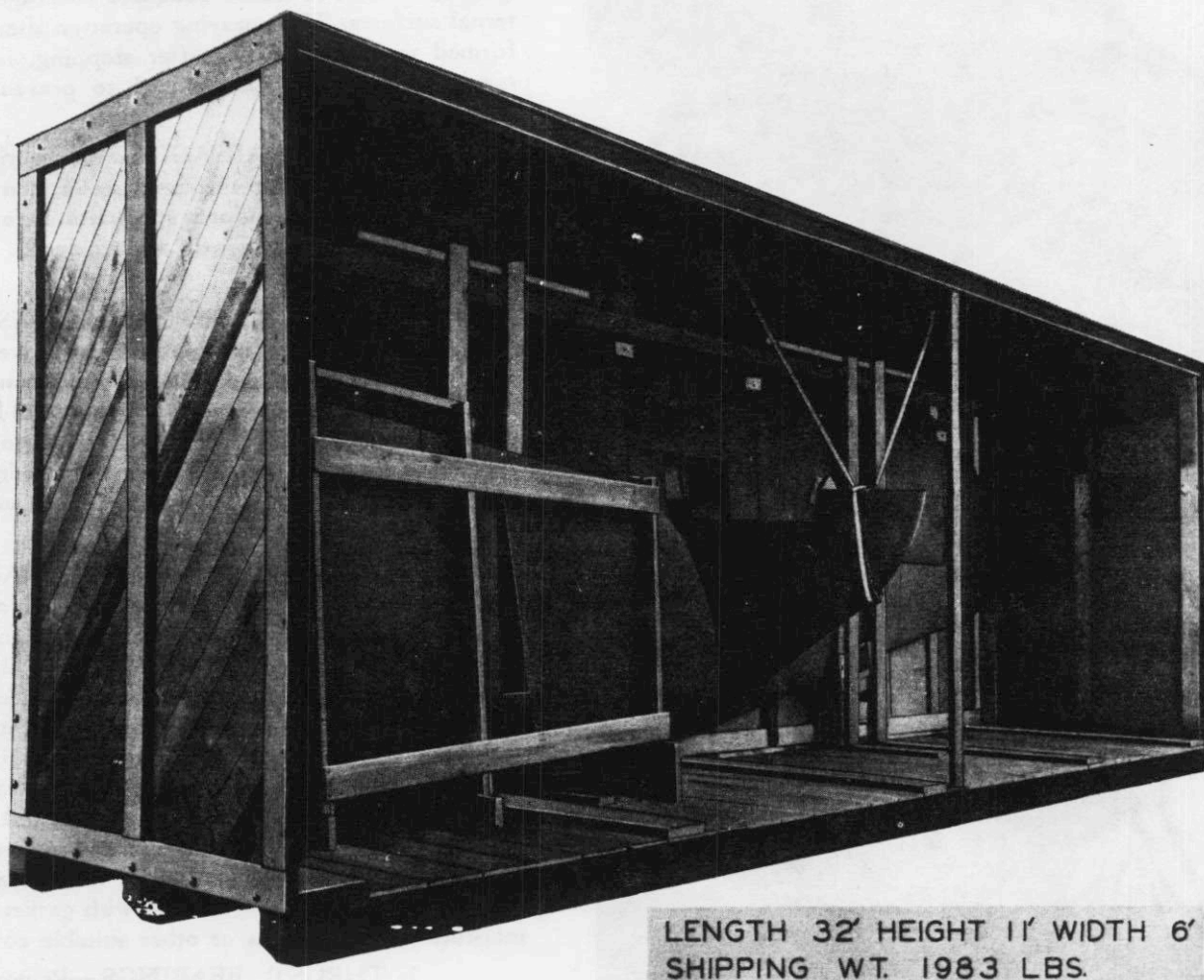


Figure 9—Cradled and Crated Horizontal Stabilizer

from an auxiliary oil tank, and the inlet oil temperature should be maintained at such a temperature as to produce a crankcase outlet oil temperature of 104.4-121°C (220-250°F).

The lubricant used shall consist of a blend of three parts of lubricating oil (Specification AN-VV-O-446, grade 1120), and one part of preservative compound (Specification AN-VV-C-576).

A minimum oil-outlet temperature of 105°C (221°F) is specified to provide for adequate venting of moisture from the engine. Runs on test stands have indicated that where oil-outlet temperature below 200°F is indicated, moisture tends to condense in the cooler sections of the engine, such as nose section, and rocker boxes. However, oil-inlet temperatures in excess of 120°C (248°F) may cause difficulties, due to inadequate lubrication, since the viscosity of the oil is lower at the higher temperatures. Accordingly, a minimum oil-outlet temperature in excess of 105°C (221°F) should

be used, unless this requires the use of oil-inlet temperatures in excess of 120°C (248°F), in which case the oil-inlet temperature should be maintained at 115-120°C (239-248°F).

At the end of the clear fuel run, the engine should be stopped by closing the valve on the fuel line. The throttle should be opened sufficiently and in time to permit the engine to reach a speed of 1500-1600 rpm at the time the engine stops firing. If alternate cutting out and surging is encountered as the carburetor runs dry, the mixture control should be moved to the idle cut-off position when the fuel pressure drops. The purpose of this shutdown procedure is to have the engine rotating at a comparatively high rpm while allowing no fuel to enter and dilute the oil preservation mixture. Simultaneously, a supplementary quantity of oil-preservation mixture is introduced by injection through the impeller and into the intake manifold, allowing the engine inertia to supply the aspiratory suction necessary

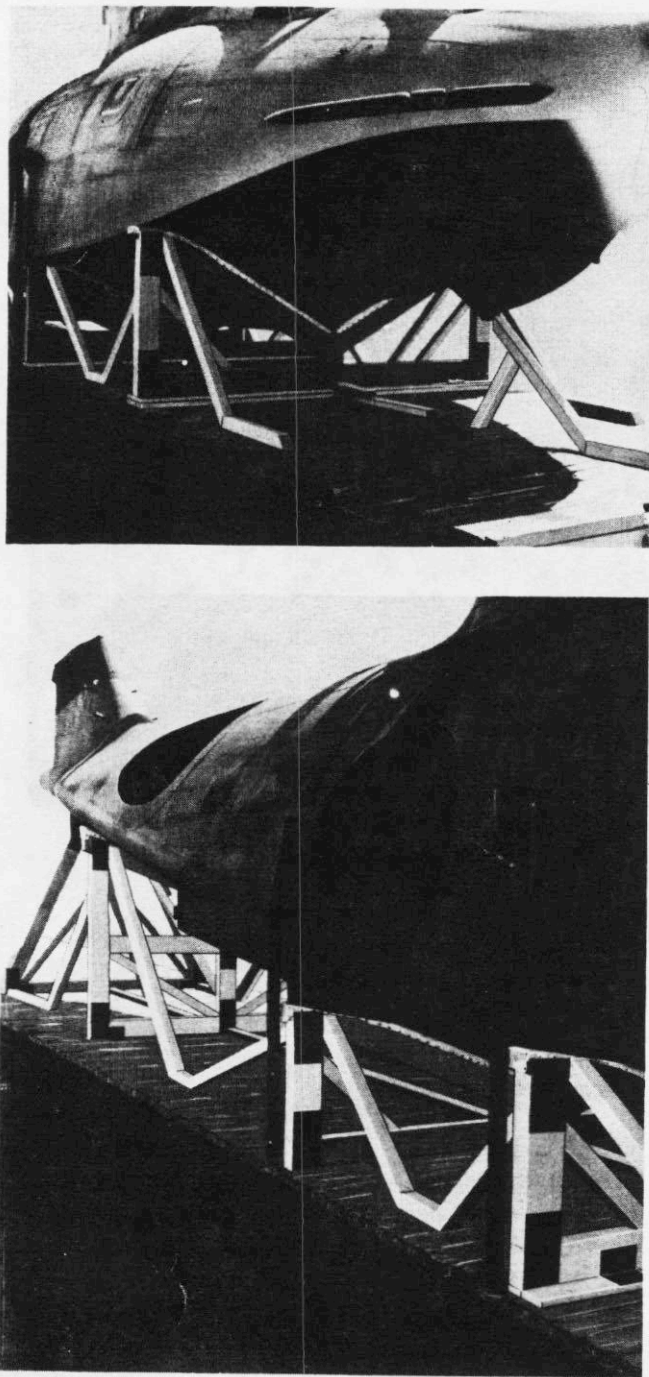


Figure 10—Cradled Hull

to cover the induction system and the cylinder heads with the preservative compound. The amount of compound-lubricating oil mixture introduced by this method should be $\frac{1}{8}$ to $\frac{1}{4}$ pint per cylinder.

In the event that it is impracticable to introduce the supplementary mixture simultaneously during shutdown procedure, the specified lubricating oil mixture should be sprayed into each cylinder through the spark plug holes with the piston at the bottom of its stroke. A sufficient quantity of lubricating mixture

should be used to insure adequate coverage of all internal surfaces. This spraying operation should be performed within two hours after stopping, in order to obtain venting of moisture and to prevent incipient corrosion.

2. OIL DRAINAGE.—The lubricating oil should be drained from the crankcase, screen chambers, and sumps while the engine is still warm. Screens should be removed, cleaned, oiled, and replaced. All drain plugs should be replaced.

3. CAM AND ROCKER BOXES.—Within three hours after the clear fuel run, the rocker and cam box covers should be removed, and each cam or rocker box so sprayed with the specified compound-lubricating oil mixture as to thoroughly coat the valve rocker arms, valve stems, springs, push rod ends, and interiors of boxes. Covers should then be replaced and screwed down to an air-tight seal.

4. EXHAUST PORTS AND MANIFOLD.—Each exhaust port should be sprayed with a sufficient quantity of the specified compound-lubricating oil mixture to thoroughly coat the exhaust valve. The exhaust manifold, if shipped with the engine, should be attached. After a bag containing a dehydrating agent (Specification AN-D-6, type V) is placed in the exhaust opening and anchored in place, the opening should be sealed by covering with an oil and moisture-resistant cap or diaphragm. If the exhaust manifold is not shipped with the engine, the individual exhaust ports should be sealed by closing with gasketed oil and moisture-resistant plates or other suitable covers.

5. THRUST BEARINGS.—Remove thrust bearing cover plates and thoroughly coat the thrust bearing with the specified compound-lubricating oil mixture. Replace the cover plate.

6. ACCESSORY DRIVES.—The cover plates should be removed and the specified compound-lubricating oil mixture applied to the accessory drives.

7. CARBURETOR (STROMBERG TYPE.)

a. Remove the complete carburetor from the engine and then, in order to close off the engine induction system, install a sheet metal or wooden cover-plate on the flange of the engine from which the carburetor was removed.

b. Remove the drain plugs (1) and (2) (See figure 11.) from the bottom of the unmetered and metered fuel chambers of the carburetor regulator, and then allow all fuel within the carburetor to drain through these openings.

CAUTION

Make sure that all fuel in the passages which connect with the fuel inlet (4) is allowed to drain out through the fuel inlet. It may be necessary to remove and replace the fuel strainer in order to drain these passages completely.

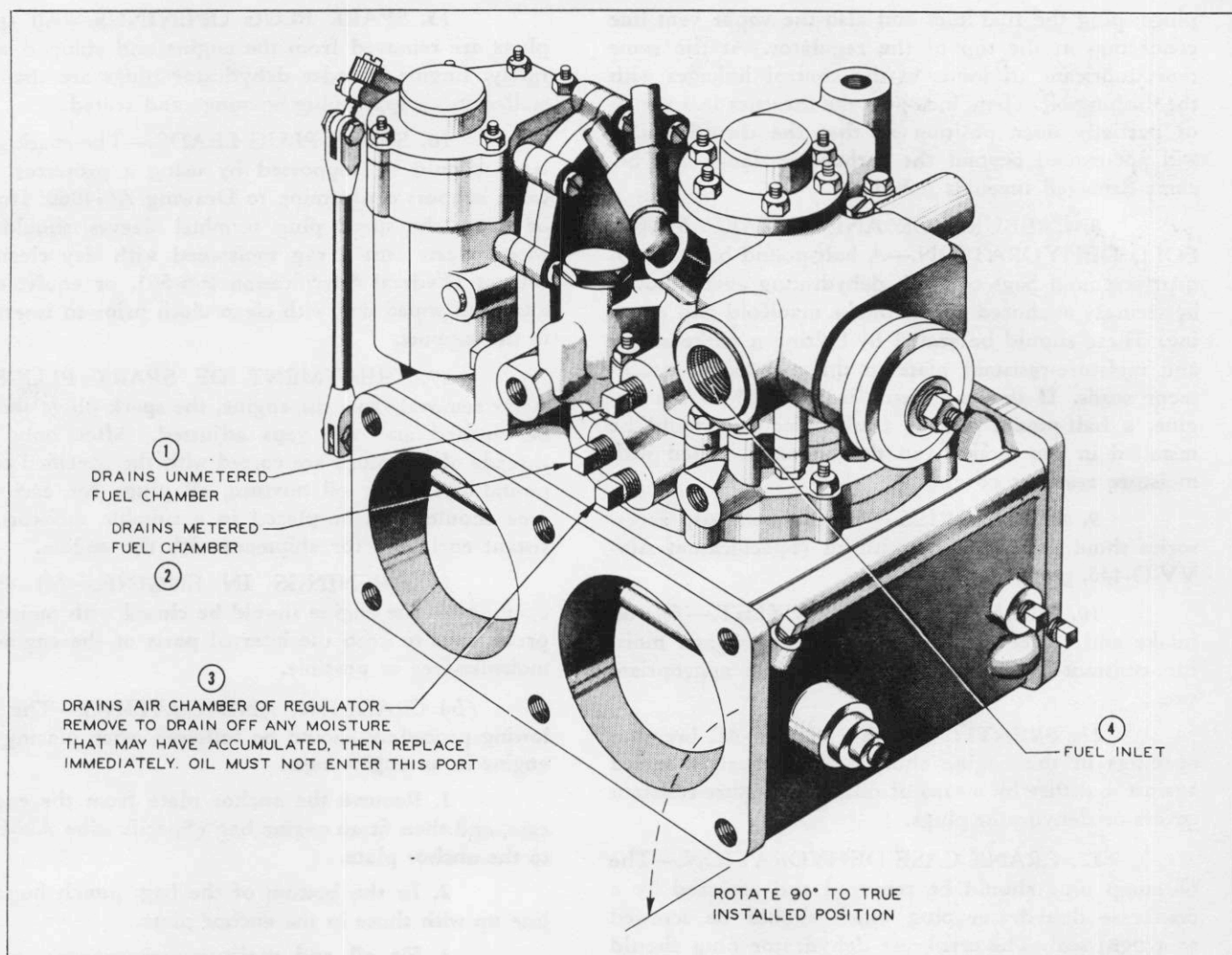


Figure 11—Carburetor Regulator

The fuel line from the Fuel Control Unit to the discharge nozzle should then be removed and drained. Also drain the discharge nozzle valve and accelerating pump.

c. A third plug (3) drains the air chambers of the regulator. This plug should be removed to drain off any moisture which may have accumulated in these chambers, and then it should be immediately replaced.

CAUTION

Flushing oil must not be allowed to reach the air chambers of the carburetor.

d. After the carburetor has been thoroughly drained, the Manual Mixture Control on the Fuel Control Unit should be placed in the "AUTOMATIC RICH" position. Place the carburetor with the regulator rear body up; attach an oil line to the drain plug hole (2) in the metered fuel chamber and then pump in grade 1065 oil (Specification AN-VV-O-446) until

this oil overflows from the drain hole (1) in the unmetered fuel chamber, and also from the fuel inlet.

CAUTION

Make sure that all fuel chambers in the discharge nozzle valve and in the accelerating pump are filled with flushing oil. Do not permit the overflowing oil to come in contact with the main or boost venturi surfaces, with impact tubes, or with the Automatic Mixture Control Unit.

The oil pressure applied to the carburetor in the above step must not exceed eight pounds per square inch. Oil which does not meet the specification AN-VV-O-446 should not be used as a flushing oil for the carburetor.

e. Now drain the carburetor of flushing oil, repeating the process described under paragraph d., (15), (a), 7., b. Replace and lock-wire all drain

plugs; plug the fuel inlet and also the vapor vent line connection at the top of the regulator. At the same time, lubricate all joints in the control linkages with the flushing oil. Then, lock-wire the throttles in an open or partially open position so that the throttle valve will not extend beyond the carburetor flange and become damaged through handling.

8. CARBURETOR AND INTAKE MANIFOLD DEHYDRATION.—A half-pound bag, or two quarter-pound bags of fresh dehydrating agent should be securely anchored in the intake manifold and opening. These should be sealed by bolting a gasketed oil and moisture-resistant plate to the carburetor attachment studs. If the carburetor is attached to the engine, a half-pound bag of fresh silica-gel should be installed in the intake, and the openings closed with moisture resistant covers.

9. ACCESSORIES.—When installed, accessories should be preserved with oil (Specification AN-VV-O-446, grade 1065).

10. OIL INTAKE AND OUTLET.—The oil intake and outlet should be sealed with oil and moisture-resistant blank caps or covers of the appropriate size.

11. BREATHER OPENINGS.—All breather openings in the engine should be adequately sealed against moisture by means of oil and moisture-resistant covers or dehydrator plugs.

12. CRANK CASE DEHYDRATION.—The oil sump plug should be removed and replaced by a crankcase dehydrator plug which should be screwed to a tight seal. The crankcase dehydrator plug should conform to drawing AN4061.

13. PROPELLER SHAFT AND EXTERNAL BRIGHT METAL SURFACES.—The exposed surface of the propeller shaft and all external bright metal surfaces, except stainless steel exhaust stacks, should be thoroughly coated with corrosion-preventive compound (Specification AN-C-52, type I).

14. CYLINDER BORES.—Following the mechanical checks which require rotation of the propeller shaft, the interior of each cylinder should be sprayed through the spark plug holes with corrosion-preventive mixture. This initial spraying should be accomplished with the piston at bottom dead center. Following the initial spraying, each cylinder should then be re-sprayed through the spark plug holes without rotation of the crankshaft.

CAUTION

Do not rotate the propeller shaft following this procedure. If by accident the shaft is rotated, the cylinders must be re-sprayed according to the foregoing procedure in order to insure adequate unbroken coverage of corrosion-preventive mixture on all surfaces.

15. SPARK PLUG OPENINGS.—All spark plugs are removed from the engine and shipped separately. Engine cylinder dehydrator plugs are then installed in all spark plug openings and seated.

16. SPARK PLUG LEADS.—The spark plug leads should be supported by using a protector and cable support conforming to Drawing AN4060. If oily or dirty, the spark plug terminal sleeves should be wiped clean with a rag moistened with dry cleaning solvent (Federal Specification P-S-661, or equivalent) and then wiped dry with clean cloth prior to insertion in the support.

17. TREATMENT OF SPARK PLUGS.—After removal from the engine, the spark plugs should be cleaned and the gaps adjusted. After only the threads of the plugs are coated with the specified compound-lubricating oil mixture, all plugs for each engine should then be placed in a suitable moisture-resistant enclosure for shipment with the engine.

18. OPENINGS IN ENGINE.—All other openings in the engine should be closed with moisture-proof seals to keep the internal parts of the engine as moisture-free as possible.

(b) CRADLING AND CRATING.—The following procedure should be followed when placing the engine in an engine case:

1. Remove the anchor plate from the engine case, and then fit an engine bag (Specification AN-E-1) to the anchor plate.

2. In the bottom of the bag, punch holes to line up with those in the anchor plate.

3. Fit oil and moisture-resistant gaskets on both sides of the bag at each bolt hole.

4. With the bag placed around the engine, insert the anchor bolts and then secure the backing plates to the engine by tightening the bolts in place.

5. After the engine is placed in the case, bolt the anchor plate to the case.

6. Secure a humidity indicator conforming to Drawing AN7511-1 to the engine in such a manner that it will face outwards from the engine and be located opposite the inspection door in the shipping case. This will allow the humidity indicator to be easily observed thru the inspection port on the outside of the case.

7. Hang symmetrically, 28 pounds of dehydrating agent conforming to Specification AN-D-6, type V about the engine.

8. Close the open end of the envelope by heat-sealing it near the edge to provide a moisture-proof joint in accordance with the instructions appearing on the envelope.

9. After the sealing operation is complete, the excess material of the envelope should be folded around the engine and secured so that there is not

1. CRATE
2. PROPELLER DOME
3. FELT
4. PROPELLER

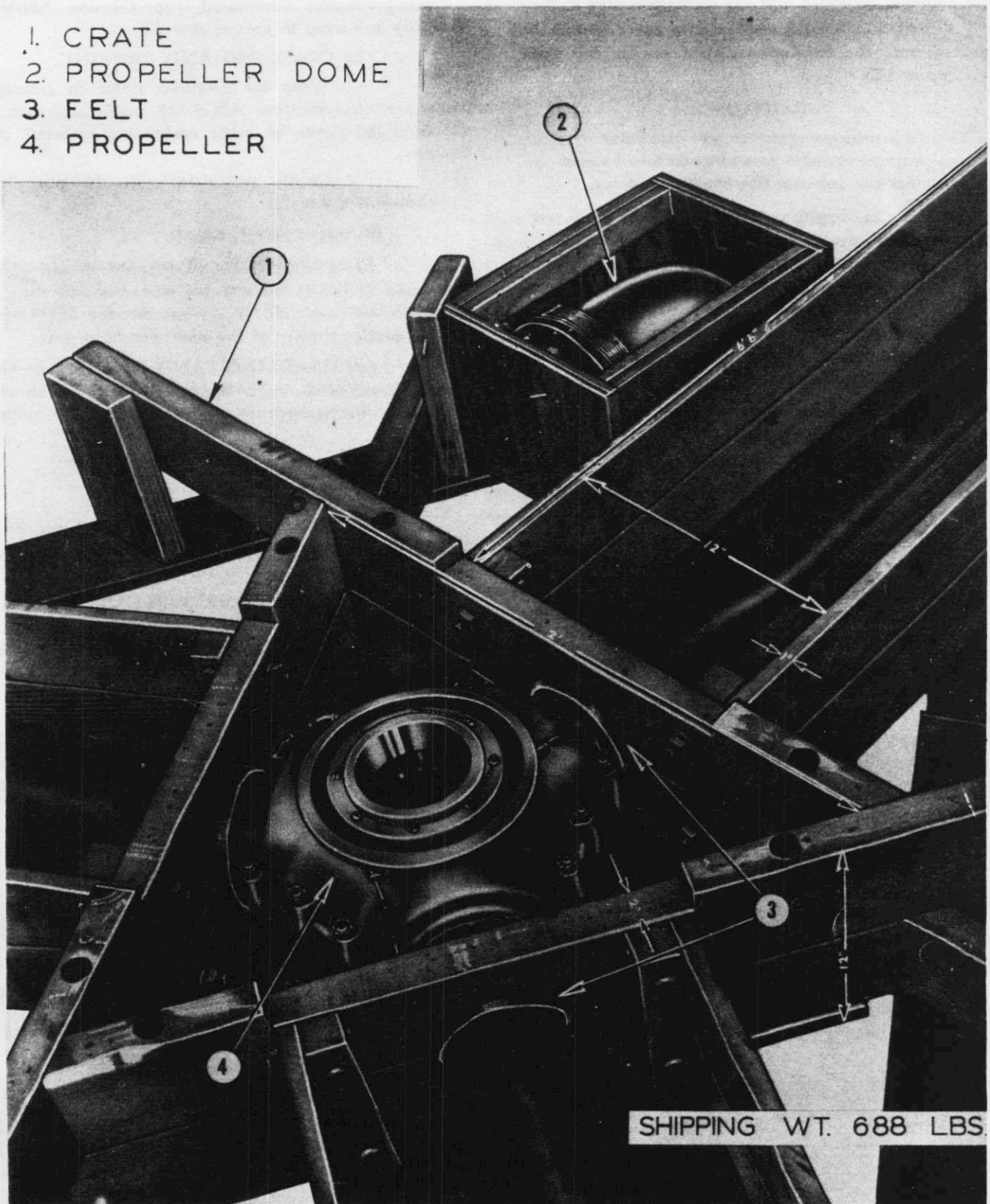


Figure 12—Cradled and Crated Propeller

more than one thickness of envelope film between the humidity indicator and the inspection port in the case.

10. Finally, the engine case cover should be lowered over the envelope-enclosed engine and then fastened in place.

CAUTION

When lowering the engine case cover over the engine, extreme care must be taken to be sure that the bag does not become ruptured.

11. Enclose all separate component parts, such as spark plugs, the carburetor, etc. in individual moisture-impervious bags (Specification AN-C-67) along with a dehydrating agent. Then, place the part enclosed by the bag in a carton with proper shock-proof material such as shredded paper or cellulose wadding. The carton may be shipped either with the engine in the engine case, or separately.

(16) PROPELLERS.

(a) PREPARATION.

1. REMOVAL OF FEATHERING MECHANISM.—Loosen locking screw and remove the dome of the propeller hub with all the feathering mechanism intact.

2. CORROSION PREVENTION. — The dome should be filled or coated with fluid (Specification AN-VV-O-366). All parts not exposed to hydraulic fluid during normal operation should be coated with corrosion-preventive compound (Specification AN-VV-C-576).

Coat the propeller hub barrel with corrosion-preventive compound (Specification AN-VV-O-576) and wrap in greaseproof paper.

(b) CRADLING AND CRATING.

1. Wrap the propeller dome in greaseproof paper (Specification AN-P-12), and then pack with shredded paper or other cushioning material into a box.

2. Cradle and then crate the propeller as shown in figure 12.

(17) BEACHING GEAR.

(a) PREPARATION.—Apply grease (Specification AN-G-3) on working surfaces, and then pour castor oil base fluid (Navy specification M574) in the hydraulic cylinder of the main beaching gear.

(b) CRADLING AND CRATING.—Cradle and crate as shown in figure 13. The crate should be lined with waterproof paper for overseas shipment, only.

(18) LANDING GEAR.

(a) PREPARATION.

1. DISASSEMBLY. — The landing gear should be disassembled into the oleo and the other struts.

2. CORROSION PREVENTION.—Fill the hydraulic jacks and oleos with fluid (Specification AN-VV-O-366). Apply corrosion-preventive compound (Specification AN-VV-C-576) to the outside surfaces

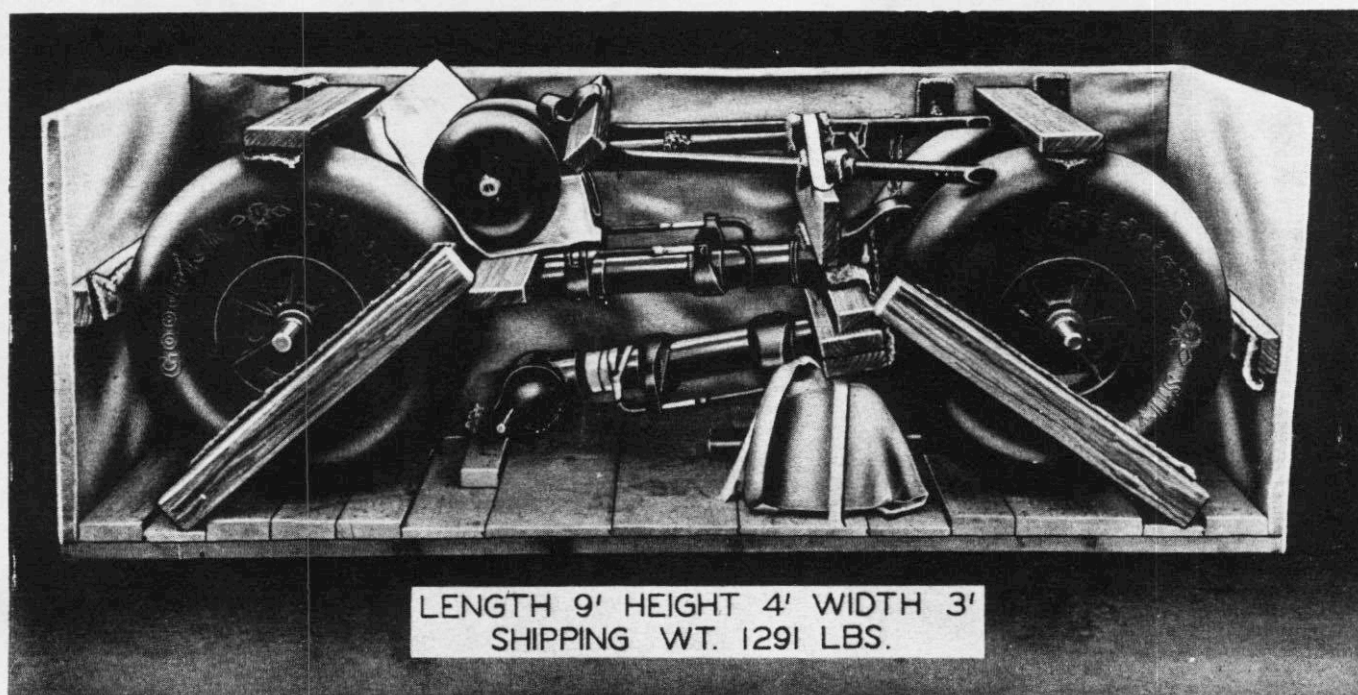


Figure 13—Cradled and Crated Beaching Gear

of oleo piston and hydraulic jacks, and then apply grease (Specification AN-G-3) to bearing and other working surfaces.

(b) CRADLING AND CRATING. — Cradle and crate in the conventional manner. For overseas shipment, use a waterproof paper-lined crate.

(19) FUEL CELLS.

(a) PREPARATION. — All cell openings should be taped shut before packing in order to keep out dust and other foreign matter.

(b) PACKING. (See figure 14.) — Care should be taken to pack the cells in a box in such a manner that all fittings will be fully protected against possible

damage. Each cell is to be placed in a cradle that will fit properly within the box. The box should be constructed according to Specification 39P16a. Fittings are not to jam against, or protrude through the box. Padded wooden supports are to be placed in the box so that jostling will be eliminated and all irregular contours will be supported.

CAUTION

Supports should be so placed that there will be no danger of damaging the fittings or the fuel cell liner. Care must be exercised, while nailing the box together, that nails do not protrude through the material or enter the cell.

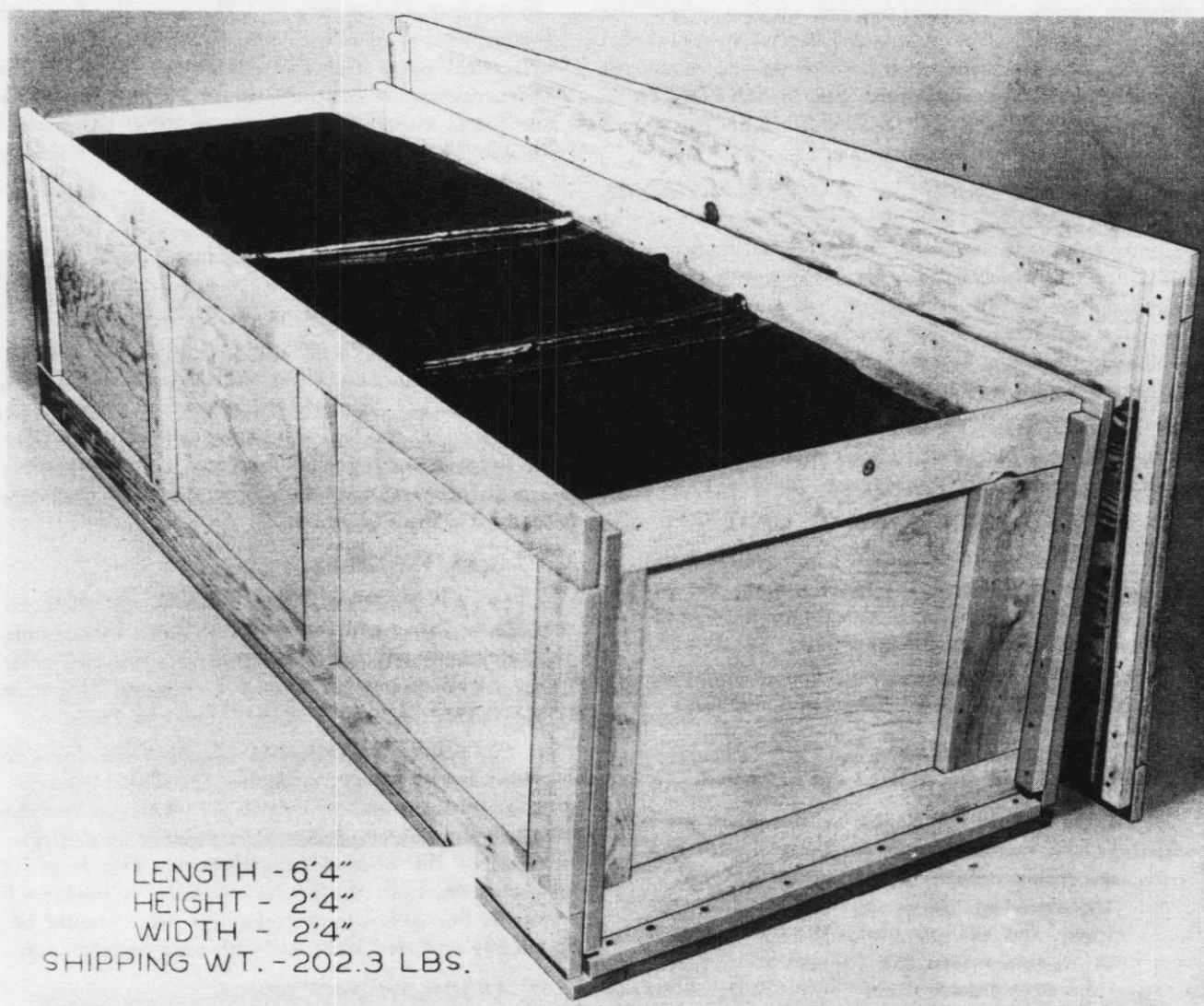


Figure 14—Cradled and Crated Fuel Cell

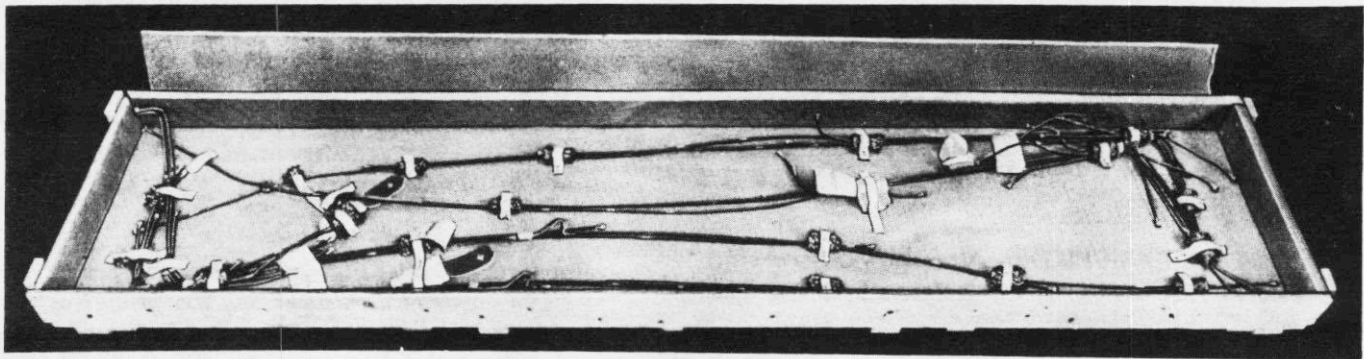


Figure 15—Cradled and Crated Tubing

The container should have the following information stencilled on the outside: part number, construction number, manufacturer and serial number. The box or crate should be plainly marked to insure careful handling, and the side which is to remain up in storage or shipment should be so indicated. Stencil "DO NOT REMOVE CELL PRIOR TO ACTUAL USE" in a conspicuous place on the box or crate.

(20) INSTRUMENTS, VALVES, ELECTRICAL EQUIPMENT, ETC.—Every individual piece of fragile equipment, such as instruments, electrical equipment, etc. for which solvent cleaning may prove costly or damaging, should be shipped in a moisture-impervious envelope along with a dehydrating agent. The envelope should then be packed in a carton with proper shockproof partitions or wadding to prevent movement.

(21) AUXILIARY POWER PLANT.—The auxiliary power plant is prepared for shipment in the same manner as the engine. (See paragraph d., (15).)

(22) QUICK ENGINE CHANGE UNIT.

(a) PREPARATION.—The unit should be completely assembled except for loose tubing, the exhaust collector ring, and electrical equipment, including flexible conduit, the junction box, etc.

Apply corrosion-preventive compound (Specification AN-C-52, type I) to all bare metal surfaces.

Note

Corrosion resistant metals need not be coated.

Tubing should be closed at the open ends with tape. The oil coolers should be sprayed with corrosive-preventive compound (Specification AN-VV-C-576). All electrical harnesses, flexible conduit, the junction box, and the vacuum pump should be placed in a moisture-impervious bag (Specification AN-C-67) along with a dehydrating agent (Specification AN-D-6) and a humidity indicator (AN7511).

(b) CRADLING AND CRATING.—The assembly of the cowl well should be blocked and crated in one box. (See figure 16.) The box must be lined with waterproof paper for overseas shipment, only. The electrical parts and the vacuum pump sealed in the moisture-impervious bags should be packed in cartons or crates with shredded paper or other shockproof material. The loose parts are wrapped in grade A paper and also packed in cartons or boxes.

(23) ARMAMENT.

(a) PREPARATION.—Remove guns as outlined in Section V, Par. 4. Preserve in accordance with Specification AN-P-13, method I or II.

(b) CRATING.—Crate and block the machine gun in a wooden box filled with shredded paper or cellulose wadding. If method I is used to preserve the gun, wrap it in greaseproof paper (Specification AN-P-12) before packing. For overseas shipment, use a waterproof paper-lined crate. For domestic shipment, the crate need not be lined.

(24) BLISTERS.

(a) PREPARATION.—Wipe all Plexiglas surfaces clean with a grit-free soft cloth or chamois, and then completely cover with paper to prevent scratching. Apply corrosion-preventive compound (Specification AN-C-52, type I) to all bare metal surfaces.

(b) CRATING.—A typical crate for domestic shipment is shown in figure 17. The blister is fitted snugly into the crate. Paper wrapped excelsior is placed in the crate in such a manner as to protect the sides of the blister from abrasion. Two bolts, one at each end, hold the blister securely in position in the crate. For overseas shipment the crate should be completely enclosed and lined with waterproof paper.

2. ERECTION PROCEDURE.

(Refer to Section IV.)

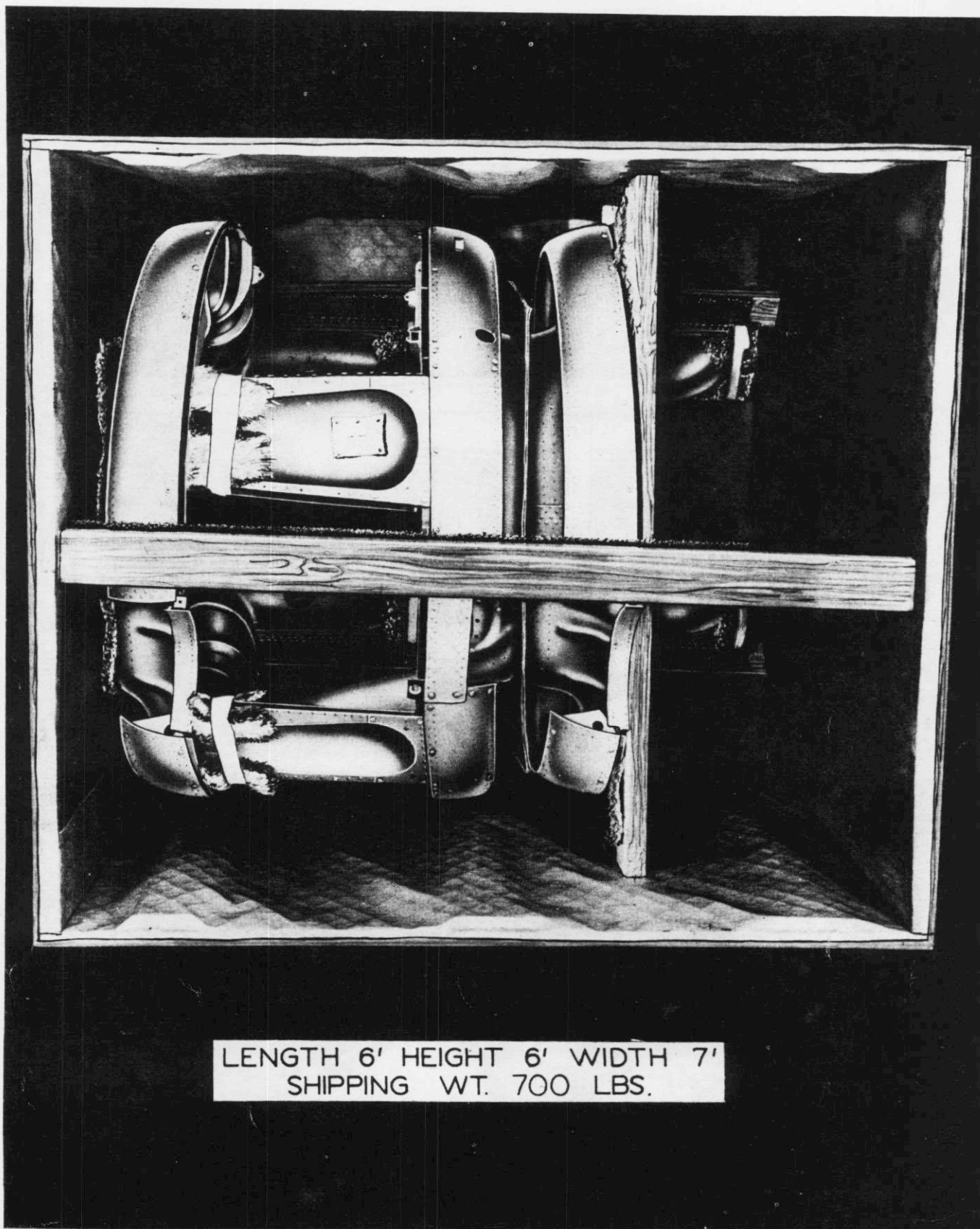
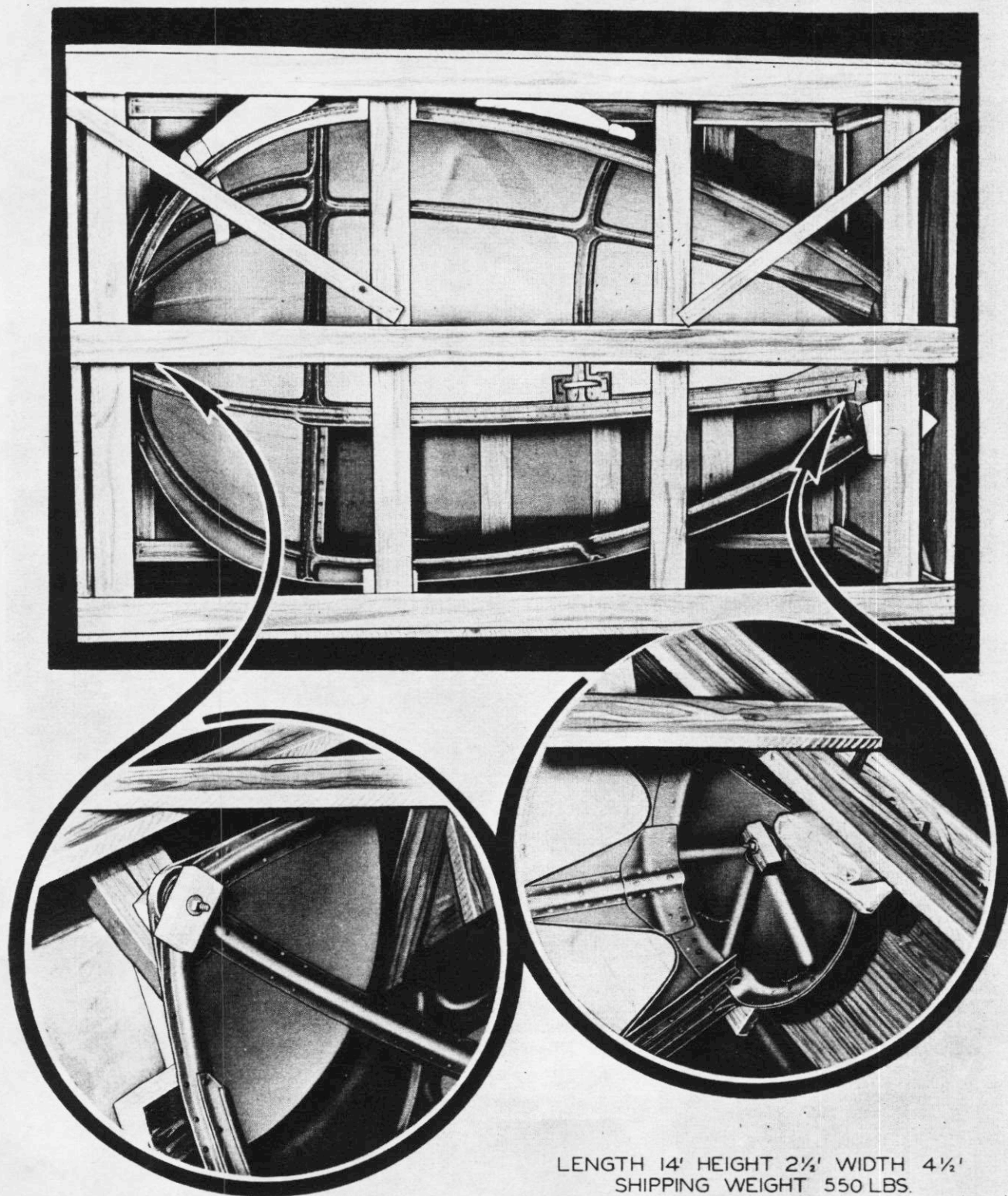


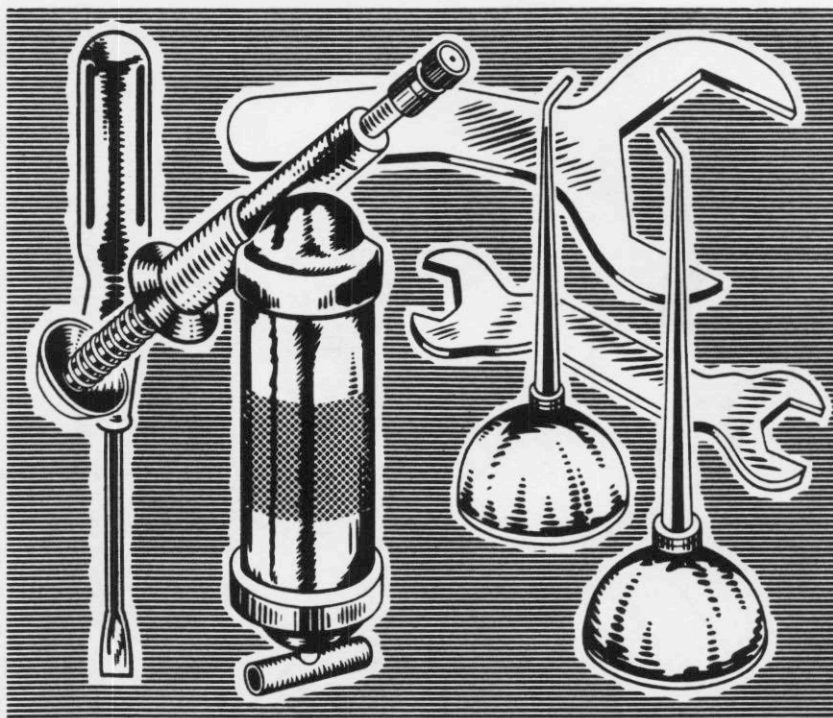
Figure 16—Crated Cowl Well Assembly

RESTRICTED
AN 01-5MA-2



LENGTH 14' HEIGHT 2½' WIDTH 4½'
SHIPPING WEIGHT 550 LBS.

Figure 17—Crated Blister



SECTION III

HANDLING AND GENERAL MAINTENANCE INSTRUCTIONS

1. ACCESS AND INSPECTION PROVISIONS.

(See figures 18, 19 and 20.)

Access doors and openings for inspection, adjustment, and repair purposes, are provided at necessary points throughout the airplane.

Zipper fasteners are used to close the openings in the fabric covered parts of the wing. All other openings, with the exception of nacelle accesses, have water-tight hinged or removable metal doors.

In figure 20 all openings shown are located on both port and starboard sides, except as noted.

2. GROUND HANDLING.

a. HOISTING.

(1) GENERAL.—For hoisting purposes, a hoisting sling is furnished with every fourth airplane. It is stowed on the forward side of bulkhead 5. The shackle on the end of the sling accommodates a hook on the lifting crane.

Lugs are provided for hoisting the entire airplane, the complete wing assembly, or center section, and the outer panels. No lugs are provided for hoisting of the empennage. It is hoisted by an improvised method.

(2) HOISTING OF COMPLETE AIRPLANE.

(a) LUGS.—The lugs are located at the front and rear spar on the upper surface of the wing at the center line of the airplane. They are designed to engage the fork fittings on the end of the hoisting sling.

(b) HOISTING SLING (28H1003-55 or 28H1003-62).—The hoisting sling for this operation is made to take a 21,000 pounds maximum service load. Under no condition should this load be exceeded. All loose gear and movable equipment should be removed from the airplane to bring its weight down to 21,000 pounds before hoisting.

(c) OPERATION. (See figure 21.)—To attach the hoisting sling to the lugs: match the holes in the lugs and the hoisting sling fork fittings; pass the pins through; and check to see that the spring loaded catches are in position. The forged rod must be attached to the forward fitting, and the cable to the aft lug on the wing. The shackle is then attached to a hook on the lifting crane.

CAUTION

Hoisting should be done in ideal weather conditions, that is, no wind, etc.

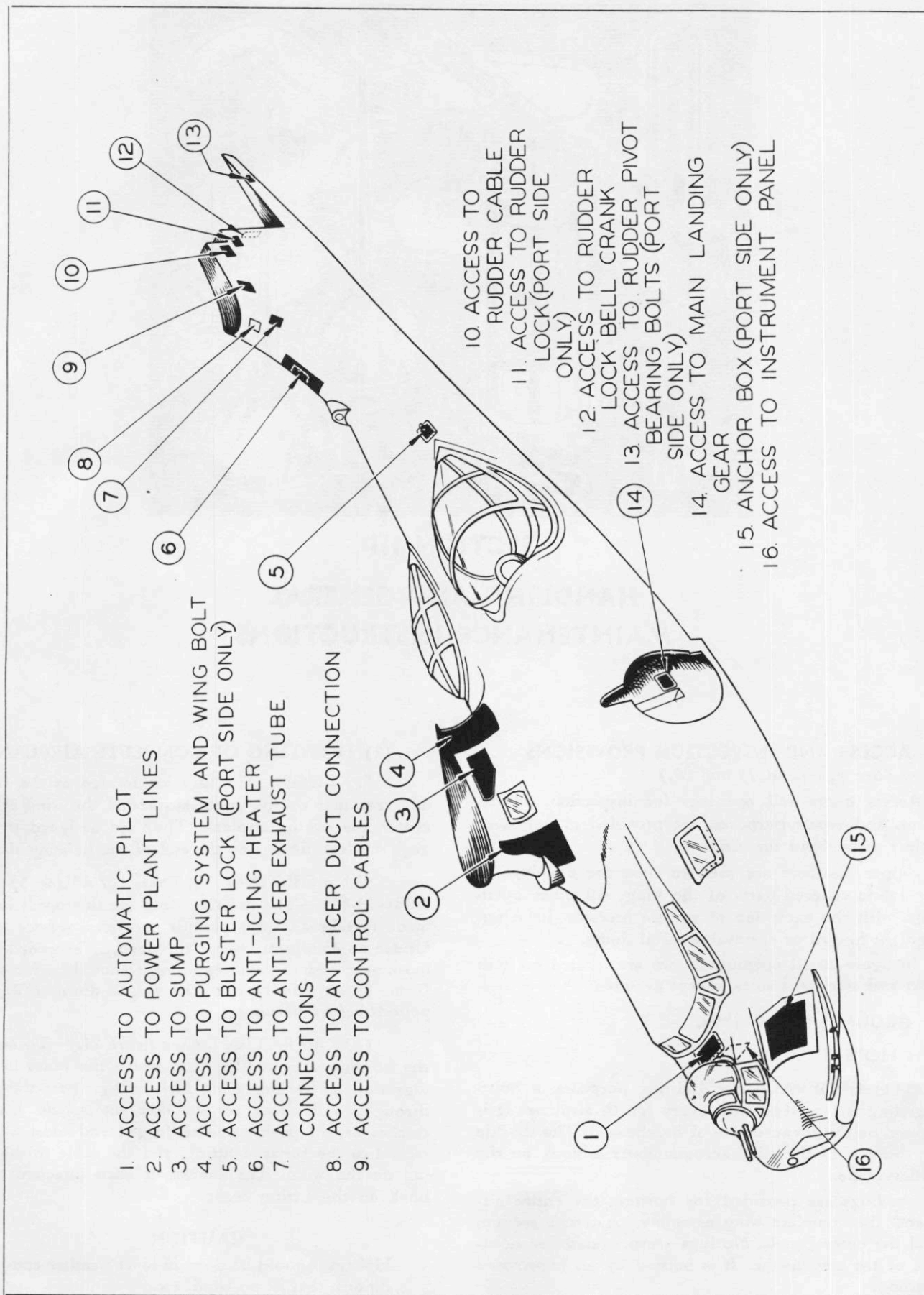


Figure 18—Hull Access Doors

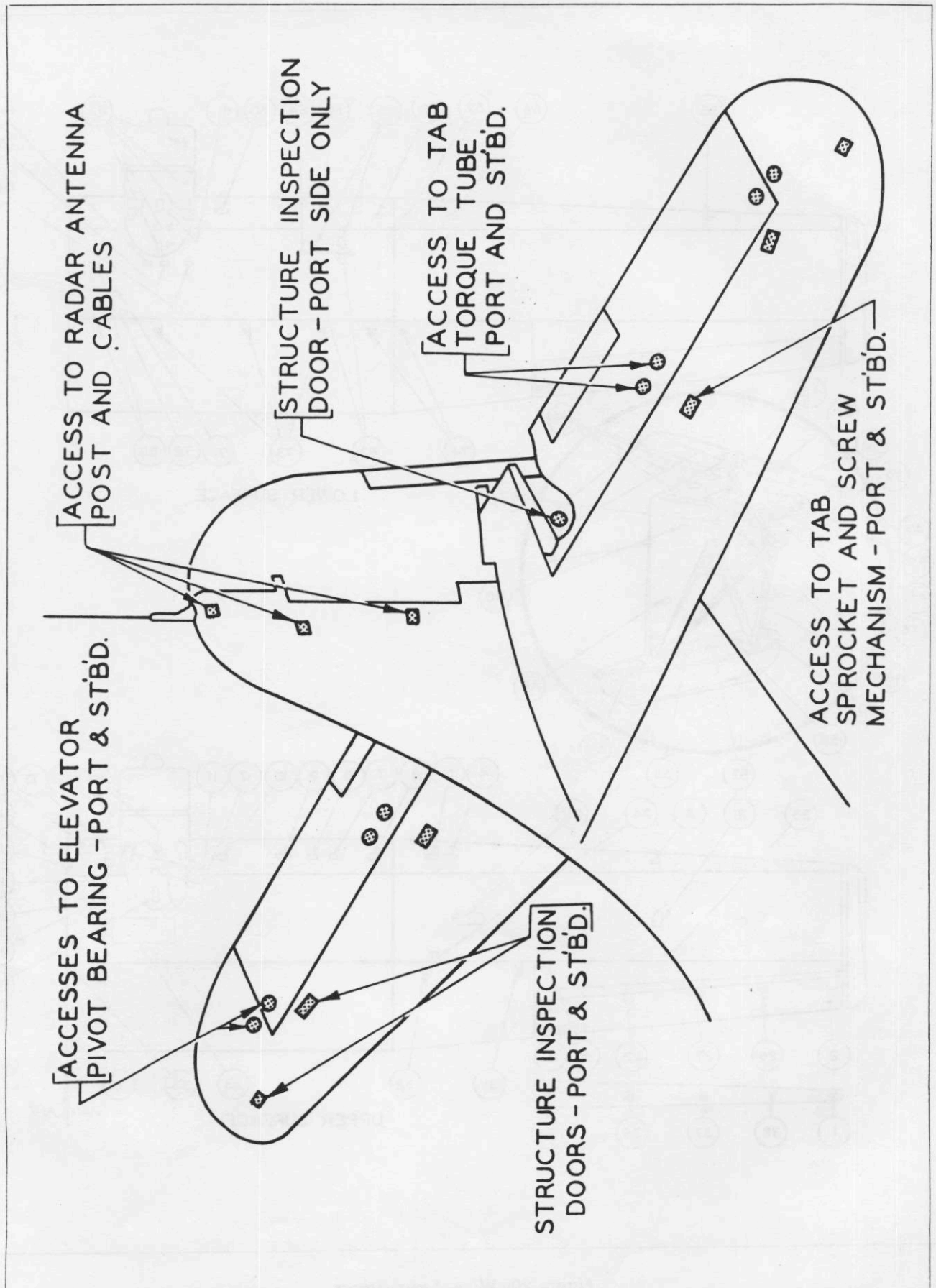


Figure 19-Tail Access Doors

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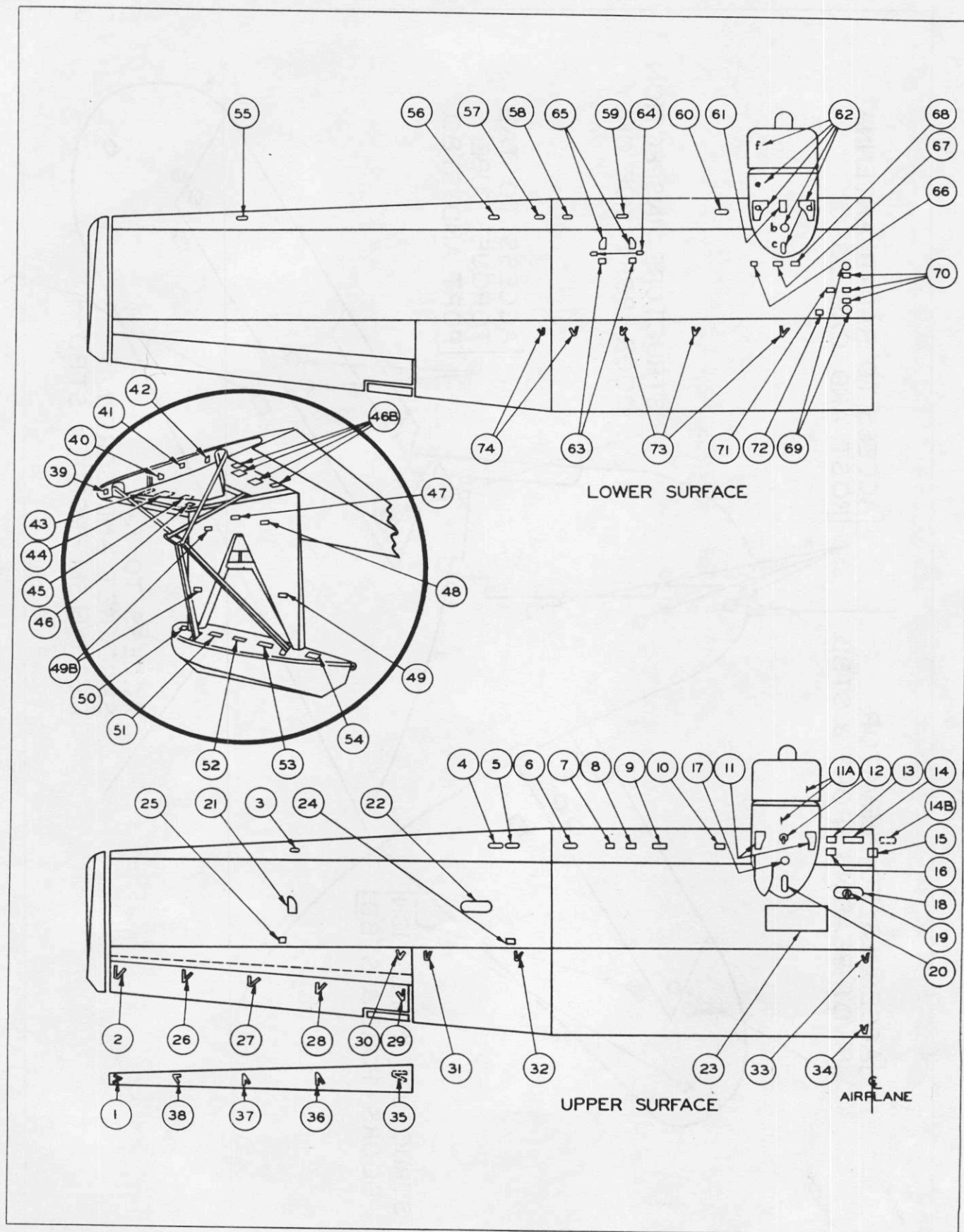


Figure 20—Wing Access Doors

RESTRICTED

1. Access to Attachments of Aileron Cut-Out.
2. Access to Aileron Hinge.
3. Access to Float Control Gear Box.
4. Access to Leading Edge.
5. Access to Leading Edge.
6. Access to Anti-Icing Splice, Wing Splice, Float Torque Tube Linkage, Pitot Static Tube Wire Attachment, and Bomb Rack Cable Pulley.
7. Access to Landing Light Wire Attachment and to Bomb Release Cable Pulleys.
8. Access to Cable Splice Plate, to Anti-Icing Duct, and to Bomb and Torpedo Control Cables.
9. Access to Cable Attachment Plate, Pulley and Fair-Leads, and to Bomb and Torpedo Controls.
10. Access to Anti-Icing Duct Connections and to Bomb and Torpedo Rack Cable Attachments.
11. Access to Engine Emergency Starter Handle, Anti-Icing Door Actuating Motor, and Anti-Icing Duct Connection.
- 11A. Nacelle Fairing Access Doors.
12. Oil Filler Neck.
13. Access to Battery.
14. Port Side Only: Access to Fuel Hose, Pipe Lines and Attachments, Cables, Fair-Leads, and Pulley Brackets at Superstructure Intersection.
- 14B. Starboard Side Only: D-C Generator Junction Box.
15. Access to Junction Box.
16. Access to Landing Light Relay Engine Terminal.
17. Access to Oil Tank Attachment Points and Structural Inspection.
18. Fuel Tank Manhole.
19. Fuel Filler Neck.
20. Structural Inspection Door.
21. Access to Float Control Gear Box, Float Lock, and Recoil Mechanism.
22. Manhole to Wing Splice.
23. Access to Fuel Tank.
24. Access to Aileron Idler and Turnbuckle.
25. Access to Aileron Bell Crank.
26. Access to Aileron Hinges.
27. Access to Aileron Hinges.
28. Access to Aileron Hinges.
29. Access to Aileron Tab Linkage, Tab Actuating Arm, and Aileron Pivot Bearing.
30. Port Side Only: Access to Aileron Tab Linkage, Tab Gear Box, and Sprocket.
31. Access to Aileron Tab Chain-to-Cable Bolt Connections.
32. Access to Connection of Aileron Push-Pull Tube to Idler.
33. Access to Aileron Controls.
34. Access to Trailing Edge Splicing.
35. Starboard Side Only: Attachment of Aileron Cut-Out to Stubby Trailing Edge.
36. Access to Attachments of Aileron Cut-Out.
37. Access to Aileron Cut-Out and Aileron Actuating Arm Attachments.
38. Access to Attachments of Aileron Cut-Out.
39. Running Light Flex Coupling and Leading Edge Inspection.
40. Port Side Only: Float Micro Switch Installation.
41. Access to Float UP Lock and Cable; on Starboard Side Only: Access to Recognition Lights Flex Couplings and Junction Box.
42. Antenna Mast Attachment.
43. Port and Starboard Sides: Junction Box for Running Light, Anchor Light, Formation Light; Starboard Side: To Recognition Lights and two Micro Switches.
44. For Conduit and Structural Inspection.
45. Port Side Only: Access to Float "Down" Micro Switch Mounts.
46. For Structural Inspection.
- 46B. Access Doors Opposite 43, 44, 45, and 46.
47. Structural Inspection Openings.
48. Structural Inspection Openings.
49. Structural Inspection Openings.
50. Structural Inspection Openings.
51. Structural Inspection Openings.
52. Structural Inspection Openings.
53. "Vee" Strut Attachment and Access to Drain Hole Pipe and Structural Inspection.
54. "Vee" Strut Attachment and Structural Inspection of Watertight Compartment.
55. Access to Float Control Gear Box.
56. Access Door to Wing Line Fitting.
57. Access to Float Torque Tube.
58. Access to Float Torque Tube.
59. Access Door to Landing Light Wires.
60. Port Side Only: Access to Pitot Tube Lines and Brackets. Port and Starboard Sides: Leading Edge and Lower Anti-Icing Duct Inspection.
61. Access to Engine Heater.
62. Nacelle Fairing.
63. Access to Bomb Release.
64. Access to Bomb Rack MK 51-7.
65. Access to Bomb Nose and Tail Fusing.
66. Fuel Cell Manifold Access Doors.
67. Fuel Cell Manifold Access Doors.
68. Fuel Cell Manifold Access Doors.
69. Sight Gage Inspection Access Doors.
70. Fuel Cell Manifold Access Doors.
71. Fuel Cell Manifold Access Doors.
72. Fuel Cell Manifold Access Doors.
73. Access to Aileron Controls. (The first from left also gives access to anti-icer exhaust duct connection.)
74. Access to Wing Splice.

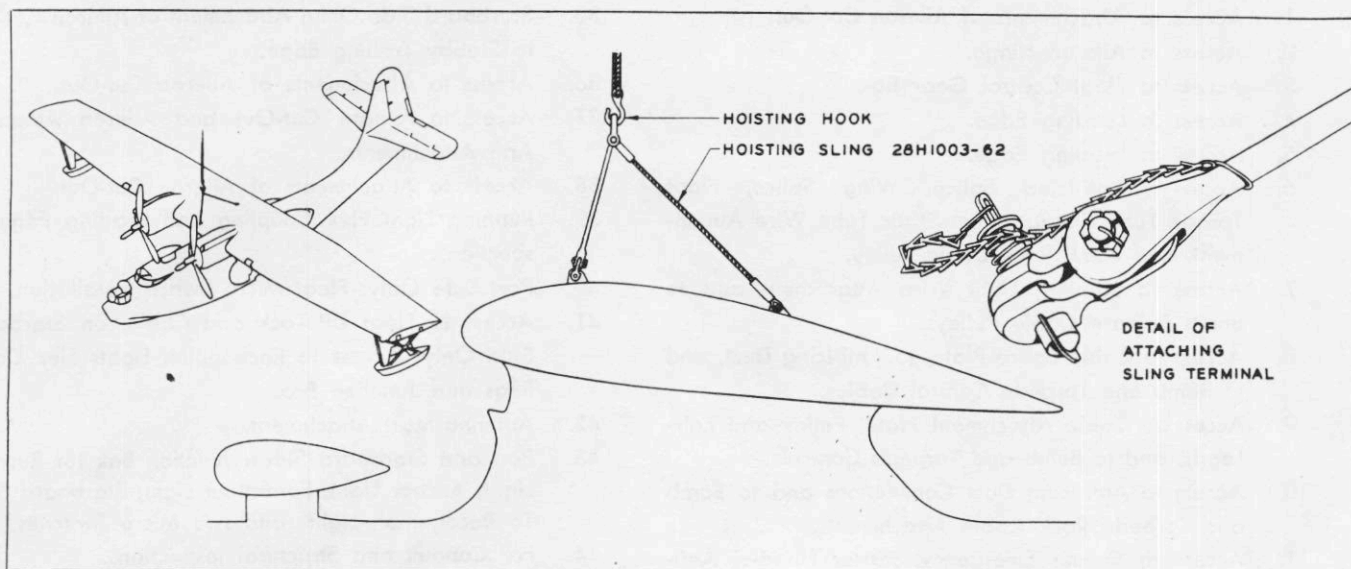


Figure 21—Hoisting of Airplane

(3) HOISTING OF THE COMPLETE WING OR CENTER SECTION.

(a) LUGS.—The lugs used to lift the entire airplane are also used to lift the wing or the wing center section.

(b) SLING.—The sling used to lift the entire airplane is also used for this operation.

(c) OPERATION.—Attach sling to lugs as explained in paragraph a, (2), (c). Handling lines should be attached to the wing at the line handling fittings or at some structural points such as strut fittings, etc. The wing or center section can be hoisted with or without engines installed.

(4) HOISTING THE OUTER PANEL.

(a) LUGS.—Lugs for hoisting the outer panel are located as follows: one at each spar near the wing splice, and a third one outboard at the access door to the float lock.

(b) SLING.—The improvised sling may be made from a $\frac{1}{8}$ inch steel cable, minimum strength of 2000 pounds, three AN 100-4 thimbles at the ends, two AN 115-32 shackles at the ends that attach to the fittings near the wing splice, and an AN 115-46 shackle at the other end.

(c) OPERATION. (See figure 22.)—The sling is attached to the proper fittings with two $\frac{1}{4}$ diameter bolts and nuts, and one $\frac{5}{16}$ diameter bolt and nut. The hoisting hook of the crane is hooked under the doubled cable at the center of gravity, and the outer panel lifted.

(5) HOISTING THE EMPENNAGE.

(a) LUGS.—There are no lugs for hoisting the empennage.

(b) SLING.—The sling may be made in two pieces from webbing, and "D" rings or equivalent.

One piece is made from 5 inch wide by $\frac{1}{8}$ webbing (Army Specification 6-185 type II) with "D" rings or equivalent on each end. A block of wood is attached to the 5 inch web at its center. The size and shape of the block is determined by the upper fin contour at the base as shown on figure 23.

(c) OPERATION. (See figure 23.)—The 5 inch web sling is threaded through the opening between the stabilizer and the fin just forward of the forward fin spar. The wood block attached to the sling is fitted into place. The two "D" rings are then attached to the hook on the lifting crane. The 3 inch web sling is passed under the upper hinge and the "D" rings attached to the hook on the lifting crane.

(6) HOISTING THE RUDDER.

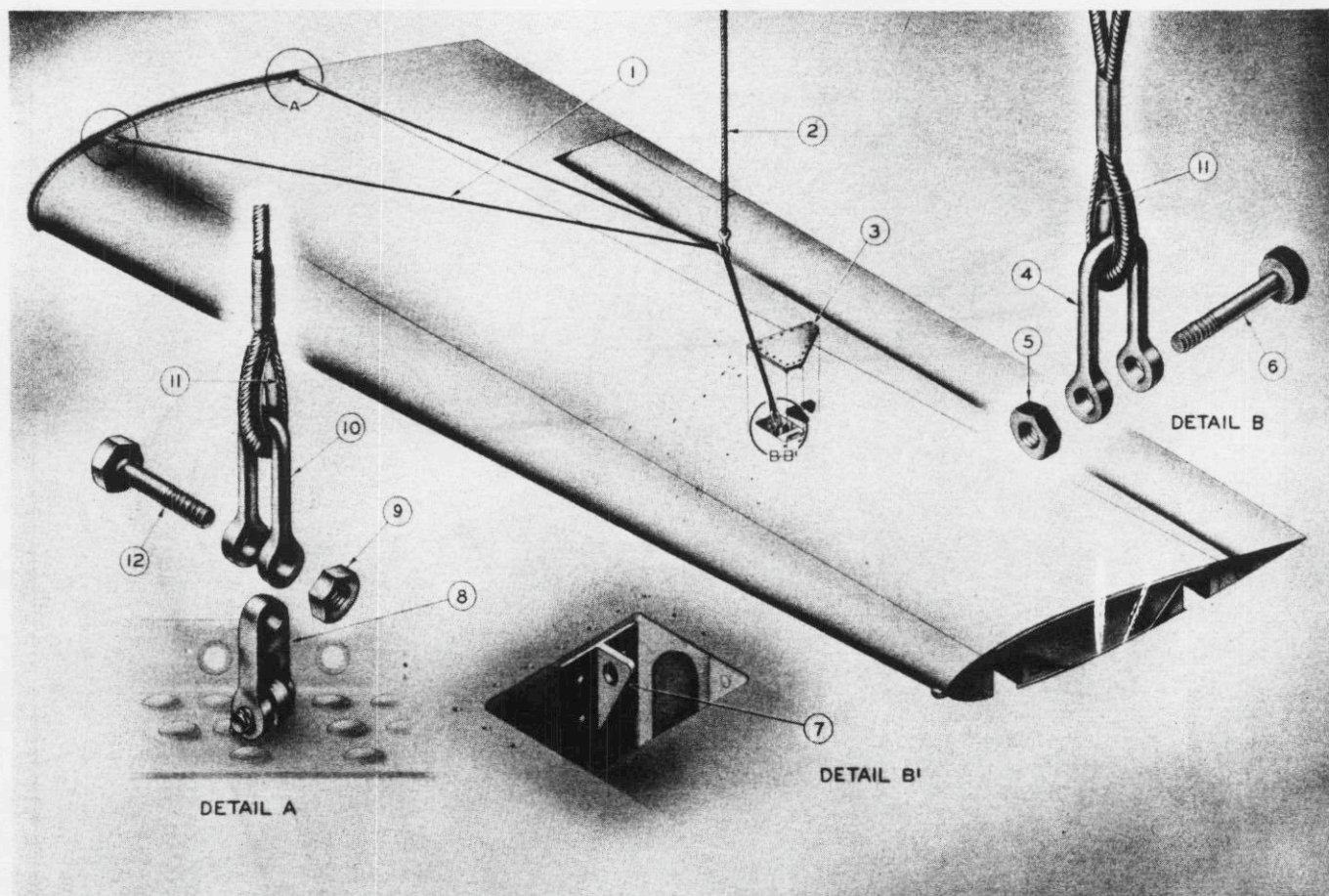
(a) LUGS.—No lugs are provided for hoisting the rudder.

(b) SLING.—The sling is made up of two pieces of 3 inch by $\frac{1}{8}$ webbing (Army Specification 6-185 type II) with a "D" ring or equivalent attached on each end.

(c) OPERATION.—The sling is used as shown on figure 23.

b. JACKING.

(1) GENERAL.—When it is necessary to raise the airplane a short distance above the ground, the operation is accomplished by jacking. This may be done while the airplane is on either landing or beaching gear. In order to raise the airplane several feet or more above the ground, the hoisting sling is required. (See paragraph a.)



No.	NAME
1	Hoisting Sling Cable ($\frac{1}{8}$ " dia. by 45 ft long)
2	Hoisting Crane Cable and Hook
3	Hoisting Fitting Access Door
4	Shackle (AN115-46)
5	$\frac{5}{16}$ " Nut
6	$\frac{5}{16}$ " Bolt

No.	NAME
7	Outboard Hoisting Fitting
8	Inboard Hoisting Fitting
9	$\frac{1}{4}$ " Nut
10	Shackle (AN115-32)
11	Thimble (AN100-4)
12	$\frac{1}{4}$ " Bolt

Figure 22—Hoisting of Wing Outer Panel

(2) JACKING MAIN LANDING GEAR.

(a) JACK PADS.—The jack pad surfaces for jacking through the main landing gear are located on the bottom sides of the shock strut pistons of the main landing gear.

(b) JACK.—A 10 ton jack or one with a higher rating may be used. Clearance between the ground and the jack pad surface will allow a 10 ton jack to be used.

(c) OPERATION. (See figure 24.)—Place the jack beneath the jack pad surface and jack up. If the clearance between jack pad and ground is insufficient for placing the jack, the wheel may be run up on a plank to increase the clearance between the jack pad surface and the ground. Be sure to have the airplane

blocked with chocks placed in front of and behind the other wheels. Do not raise the airplane higher than necessary.

(3) JACKING NOSE WHEEL GEAR.

(a) JACK PADS.—There is no satisfactory jack pad on the nose landing gear strut.

(b) In place of a jack, use a Yale & Towne "Pul-Lift" or a similar block and tackle device.

(c) OPERATION. (See figure 25.)—Place hook (1) of Pul-Lift in towing fitting aft of tunnel gun opening, then place hook (2) into a steel ring set in concrete in a convenient place on the field. Turn the pawl rod lever (3) until the marking "UP" is visible. Now turn the handwheel (4) until all slack is removed from chain. Tail end of airplane is then low-

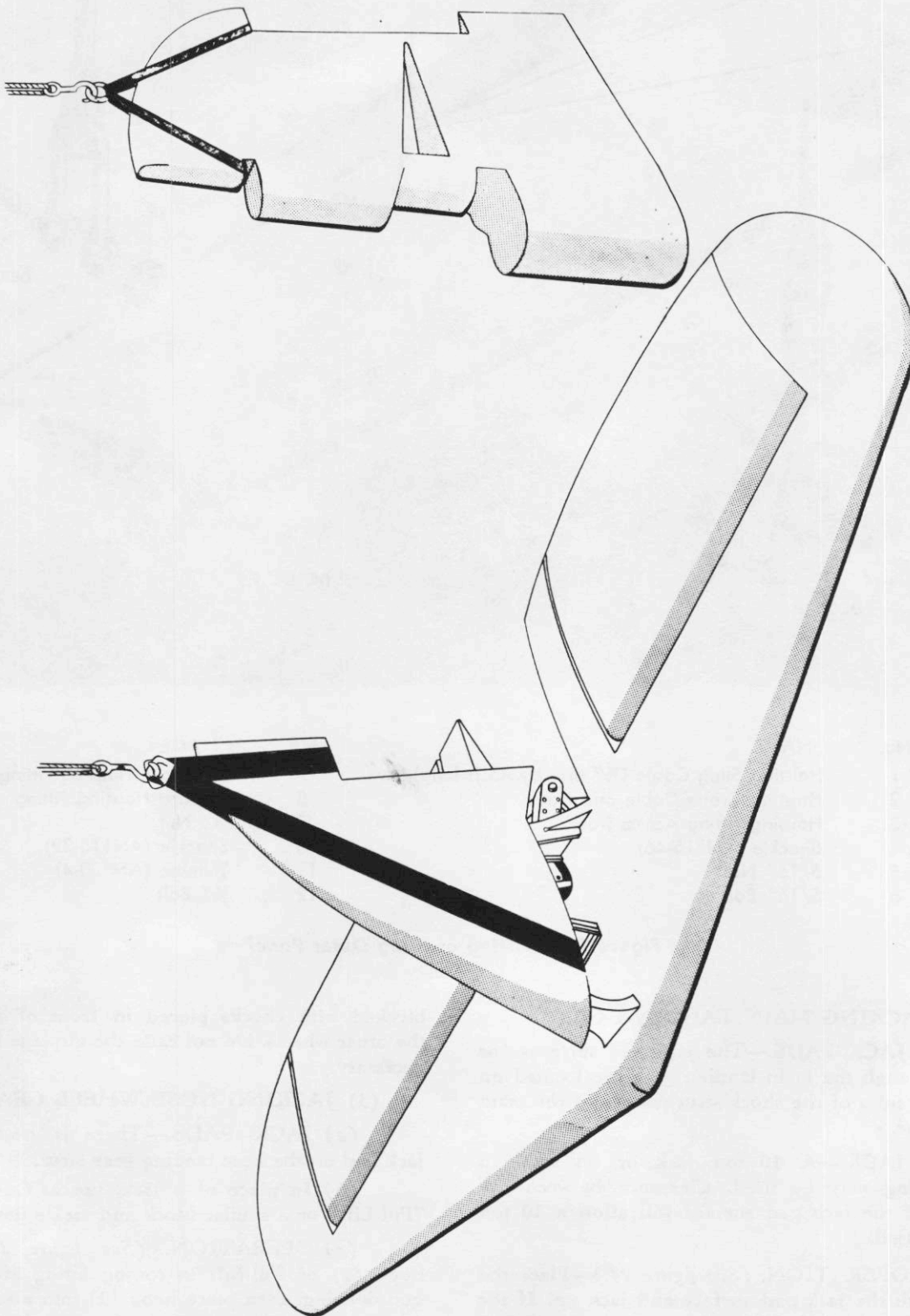


Figure 23—Hoisting Empennage

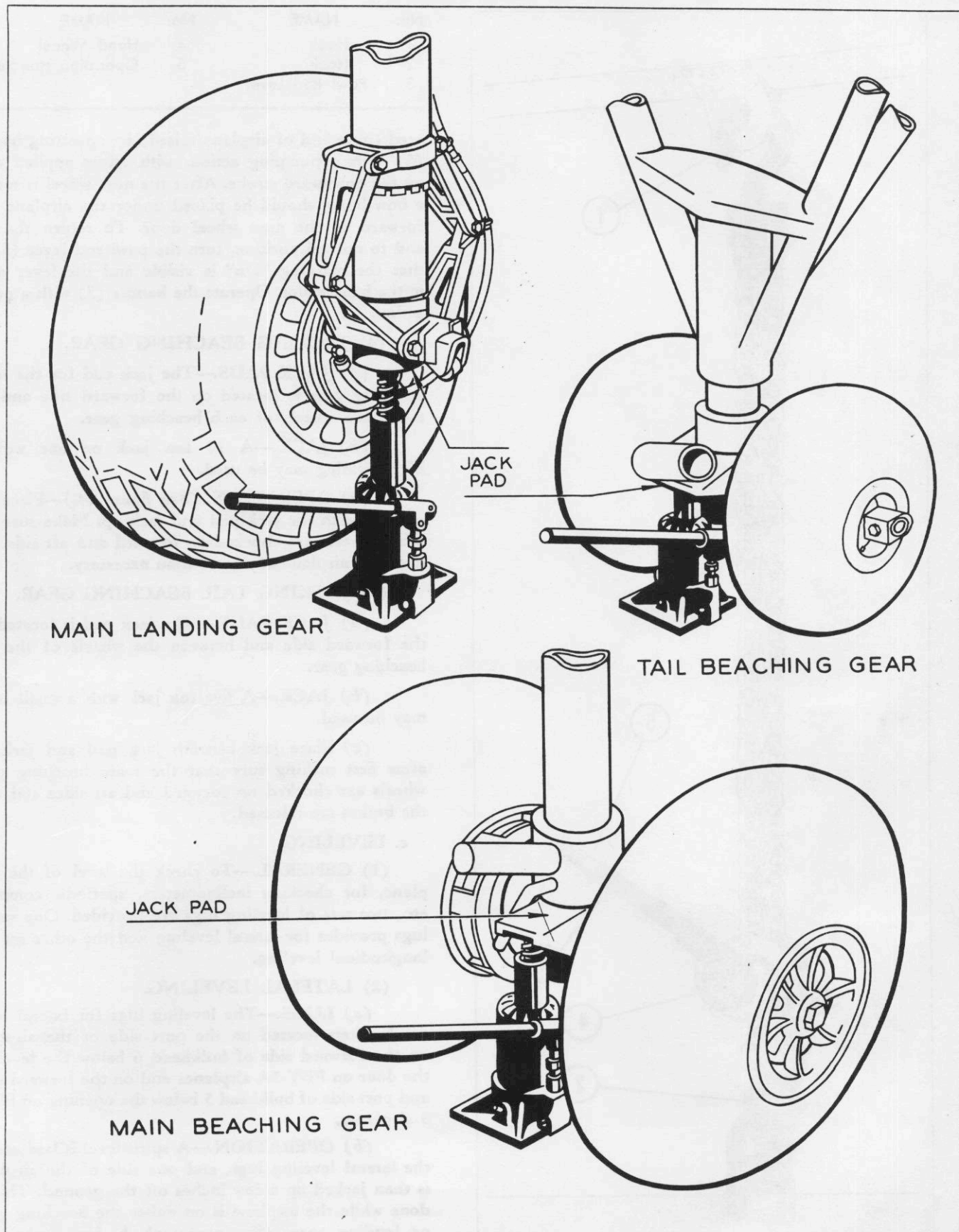


Figure 24—Jacking Main Landing Gear and Beaching Gear

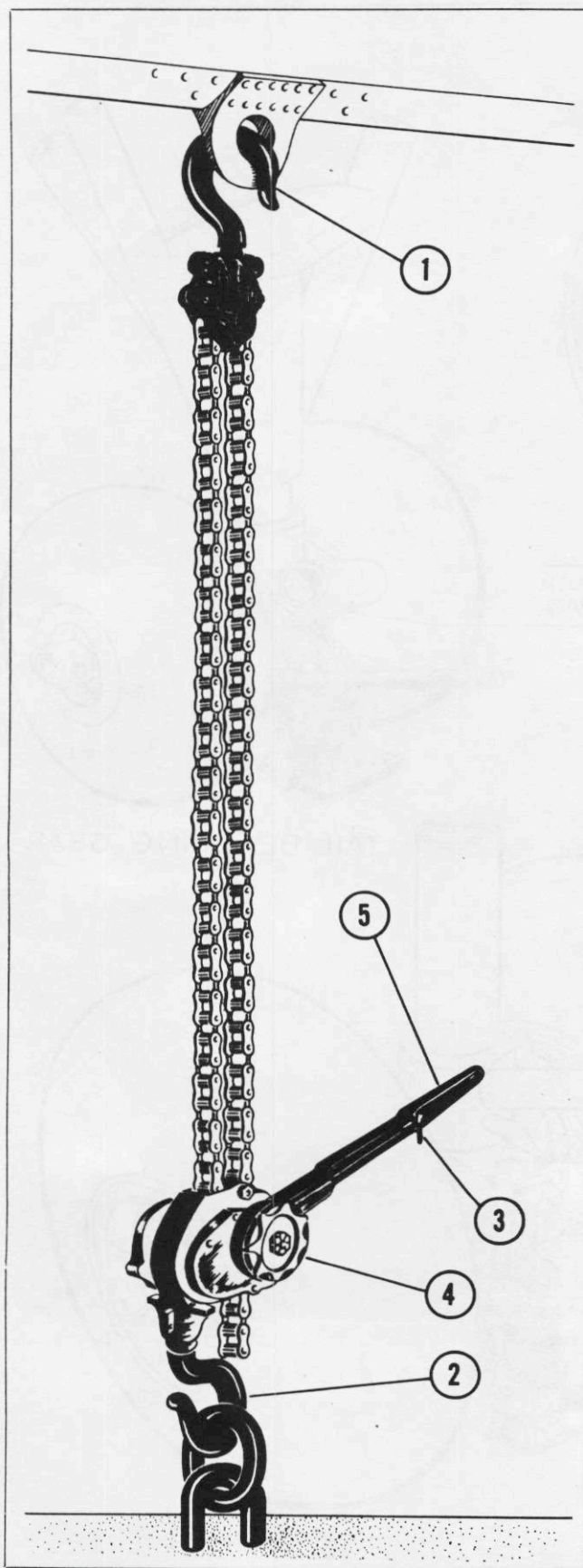


Figure 25—Pul-Lift (Yale and Towne)

No.	NAME	No.	NAME
1	Hook	4	Hand Wheel
2	Hook	5	Operating Handle
3	Pawl Rod Lever		

ered (nose end of airplane raised) by operating handle (5) with a pumping action, with effort applied only on the downward stroke. After the nose wheel is raised, a bow horse should be placed under the airplane just forward of the nose wheel door. To return the tail end to normal position, turn the pawl rod lever (3) so that the marking "Dn" is visible and the lever seats in the handle slot. Operate the handle (5) with a pump action.

(4) JACKING BEACHING GEAR.

(a) JACK PADS.—The jack pad for the main beaching gear is located on the forward side and between the wheels of each beaching gear.

(b) JACK.—A 10 ton jack or one with a higher rating may be used.

(c) OPERATION. (See figure 24.)—Place the jack beneath the jack pad and jack up. Make sure the other wheels are chocked on forward and aft side. Do not raise airplane any more than necessary.

(5) JACKING TAIL BEACHING GEAR.

(a) JACK PADS.—The jack pad is located on the forward side and between the wheels of the tail beaching gear.

(b) JACK.—A five ton jack with a small head may be used.

(c) Place jack beneath jack pad and jack up after first making sure that the main beaching gear wheels are chocked on forward and aft sides and that the brakes are released.

c. LEVELING.

(1) GENERAL.—To check the level of the airplane, for checking inclinometers, aperiodic compass, etc., two sets of leveling lugs are provided. One set of lugs provides for lateral leveling and the other set for longitudinal leveling.

(2) LATERAL LEVELING.

(a) LUGS.—The leveling lugs for lateral level are brackets located on the port side of the airplane on the forward side of bulkhead 6 below the level of the door on PBV-5A airplanes and on the forward face and port side of bulkhead 5 below the opening on PBV-5 airplanes.

(b) OPERATION.—A spirit level is laid across the lateral leveling lugs, and one side of the airplane is then jacked up a few inches off the ground. This is done while the airplane is on either the beaching gear or landing gear. (See paragraph b, for method of jacking.) The other side of the airplane is then jacked up until the spirit level indicates level position.

(3) LONGITUDINAL LEVELING.

(a) LUGS. (See figure 26.)—On PBV-5A airplanes the leveling lugs for longitudinal leveling are brackets located on the port side of the airplane and attached to beltframes 5.50 and 5.75, approximately 12 inches above the chine line. On PBV-5 airplanes the lugs are located on the port side and are attached to beltframes at stations 4.25 and 4.75 about 24 inches above the chine.

(b) OPERATION.

1. WHILE AIRPLANE IS ON LANDING GEAR.—Lay a spirit level across the longitudinal lugs, and then jack up the main landing gear on each side a few inches, and by means of the Pul-Lift or equivalent, (See paragraph b.) lower the tail end of the airplane until the spirit level indicates level position. Place a bow horse under airplane forward of nose gear door and a tail horse under airplane forward of second step. These horses are for steadying purposes and should take no appreciable load.

2. WHILE AIRPLANE IS ON BEACHING GEAR.—Lay level across the longitudinal leveling lugs; then raise tail with special hoist at the aft fitting until level position is indicated. To stabilize the airplane, place a bow and tail horse in position as shown in figure 26.

d. TYING DOWN.

(1) GENERAL.—The causes for major wind-storm losses, and sudden squall damage may be classified under the following:

(a) Inadequate mooring, or none at all, resulting in airplanes being blown from their parked position.

(b) Damage to airplanes with adequate anchorage, but improperly moored.

(c) Damage caused by loose objects and debris being blown against airplane.

(2) MAXIMUM PROTECTION.—In order to obtain maximum protection and safety, planes must be moored in a position facing into the wind with the lift of the wings reduced to approximately zero. They must be securely anchored to prevent lateral and perpendicular movement, with main wheels blocked and parking brakes on, and controls locked. The wing lift may be neutralized by the use of "spoiler board," or by placing the major axis of the plane in a horizontal position. Under unusual "Advance Base" conditions, or in the absence of mooring facilities, wing lift may be neutralized by placing the wheels in pits so that the hull will be approximately level with the wheels blocked. The use of wheel pits is preferred since the wheels are blocked and the plane brought close to the ground, thus damping out, to a great extent, the effect of strong vertical wind gusts.

(3) MINIMUM PROTECTION.—For other than severe and stormy weather, the minimum precau-

tions to be taken to protect moored planes against wind damage are outlined below:

(a) Planes moored in the open must always be spaced to permit a change of position in the least possible time, commensurate with greatest security, to meet shifting wind directions and to prepare for extremely severe weather conditions. Mooring lines of a quarter inch diameter wire cable, or one and one-half inch circumference manila rope or equivalent, should be used and secured to stakes arranged in accordance with figure 27. Attachments must be made at all times to the tie-down fittings provided on the plane or to the structural member mooring points indicated. (See figure 27.) The relative stake locations to the plane should be maintained, and the stakes set so that the mooring line from the stake to the plane will form an angle of 30° to 45° with the ground. Cable is preferred for mooring lines, and should be put only under a very slight tension. If manila rope or other material is used, careful adjustment should be made for slack to provide for shrinkage due to moisture in order to prevent excess stress on the plane fittings in rainy weather. However, excessive line slack must be avoided at all times and under all conditions to prevent lateral movement and damage from pounding of the plane in a high wind.

(b) The following details of parking and staking should be followed:

1. Locate plane with beaching gear or main landing gear wheels on level ground and headed into the prevailing, or expected wind direction. Lock tail or nose wheel in the fore-and-aft direction.

2. Lock controls in neutral position. Use external surface control locks.

3. Lock parking brakes and place wheel chocks at front and back of each wheel. Do not lock brakes in freezing weather.

4. Attach lines to the landing gear above the oleo or to the main beaching gear strut.

(4) STORM PRECAUTIONS.—The following additional precautions should be taken when storm warnings have been issued or a severe wind condition is expected:

(a) Space all planes to provide a minimum clearance around each plane equivalent to its major axis length plus ten feet, in order to reduce damage to adjacent planes by a plane being partially torn from its moorings.

(b) Stow or anchor all equipment, vehicles, tools, and materials of all kinds that may become flying debris under severe wind conditions.

(c) Install flat spoilers fabricated locally from wooden two-by-four material or equivalent, placed with long dimension vertical, along approximately 75 per cent of the wing span and located 10 per cent to 15 per cent of the average chord aft and parallel to the leading edge. Spoilers should be covered with felt, or

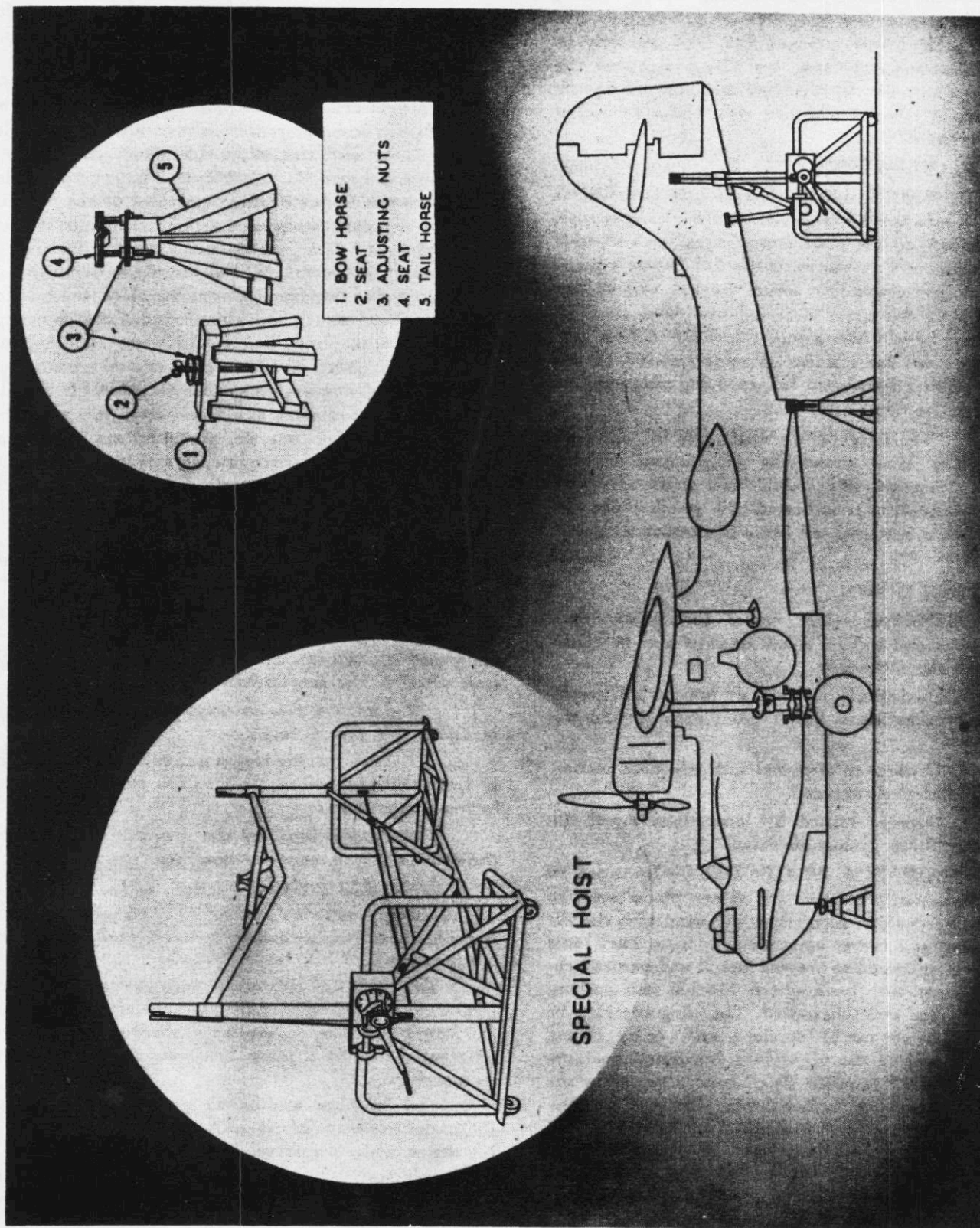


Figure 26—Longitudinal Leveling of Airplane

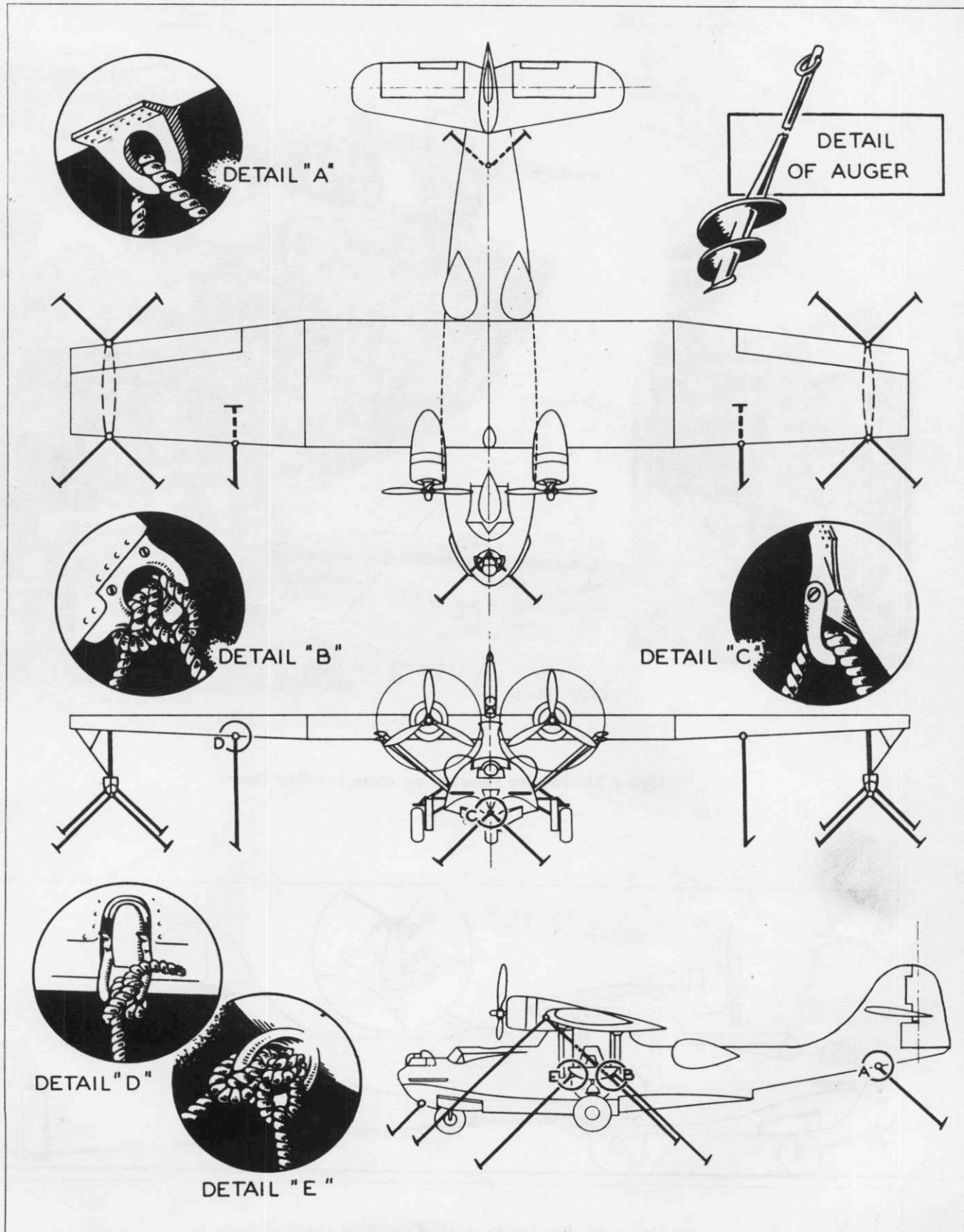


Figure 27—Airplane Tie Down Diagram

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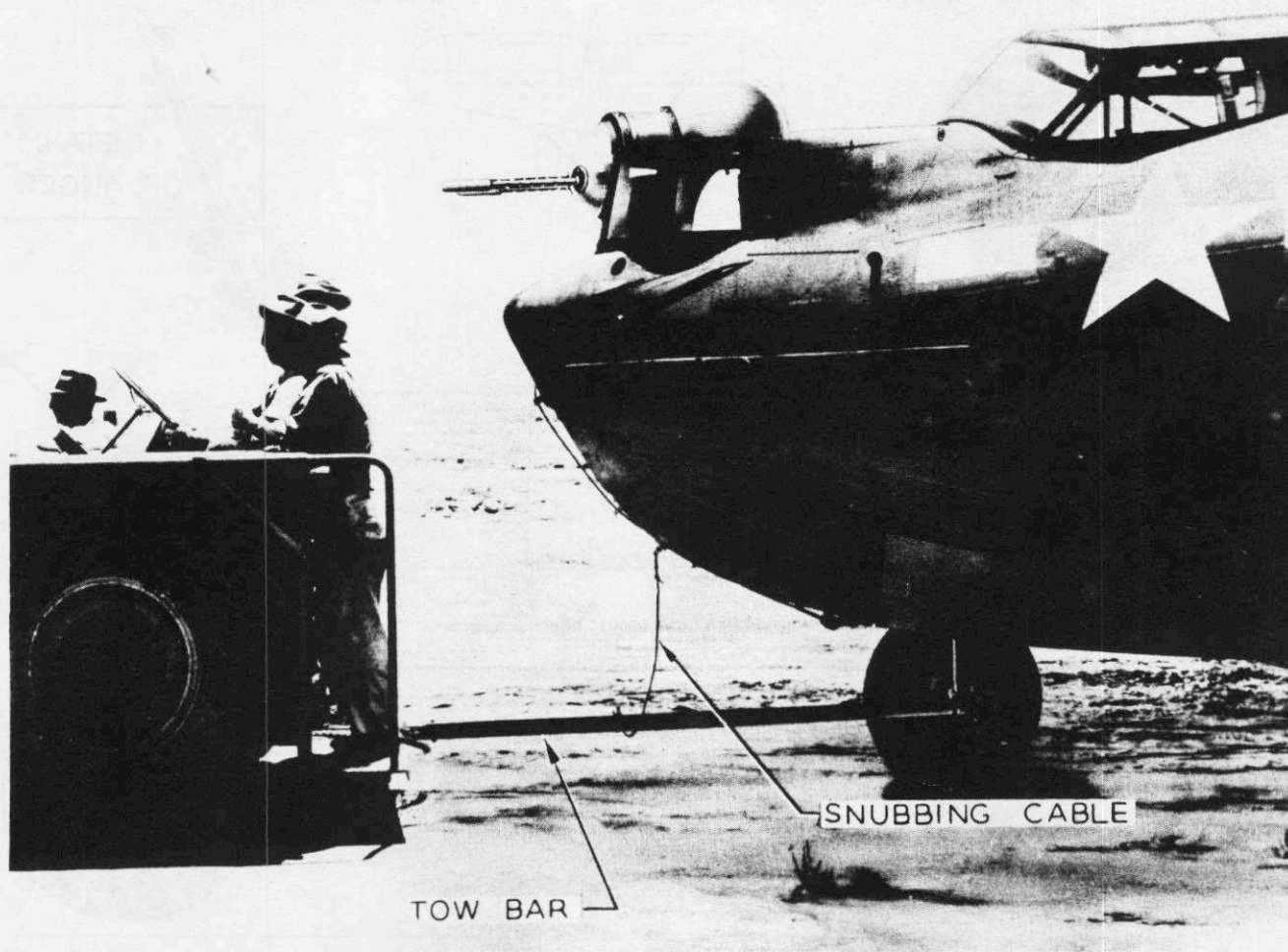


Figure 28—Towing Forward on Main Landing Gear

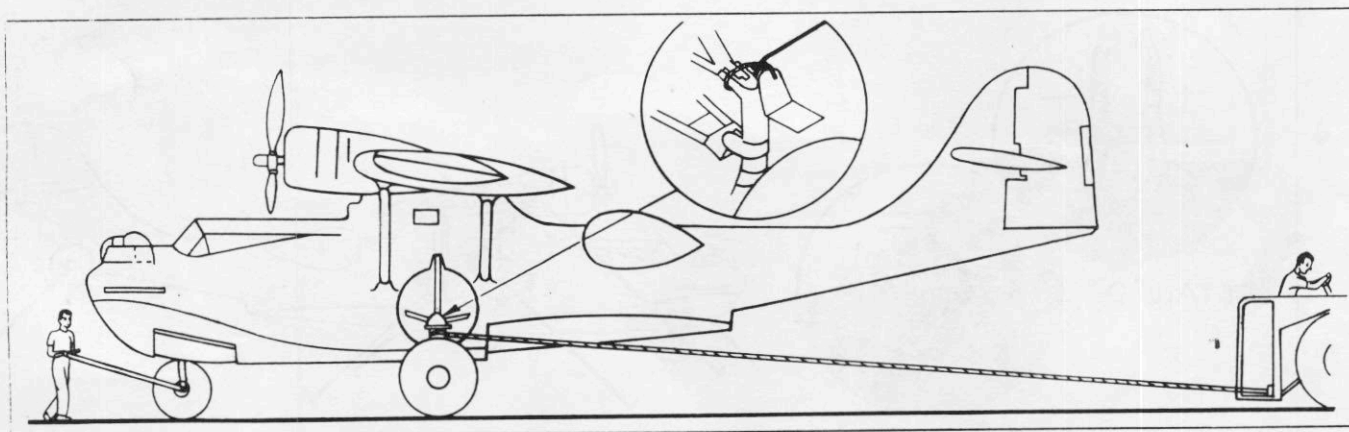


Figure 29—Towing Backward on Main Landing Gear

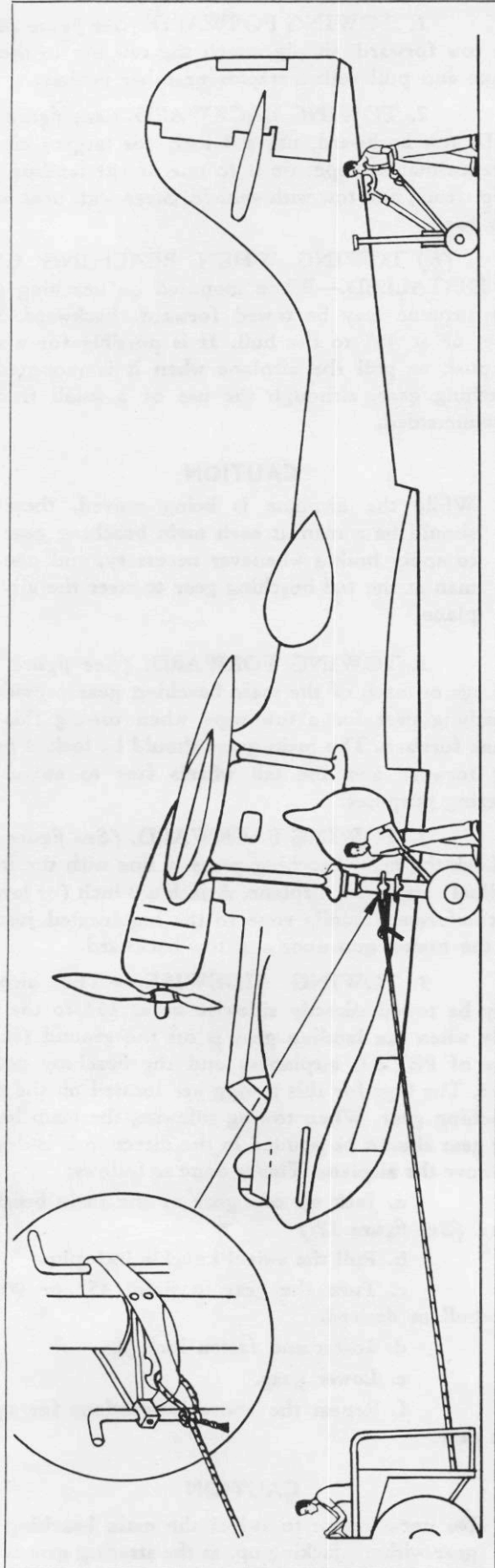


Figure 30—Towing Forward on Beaching Gear

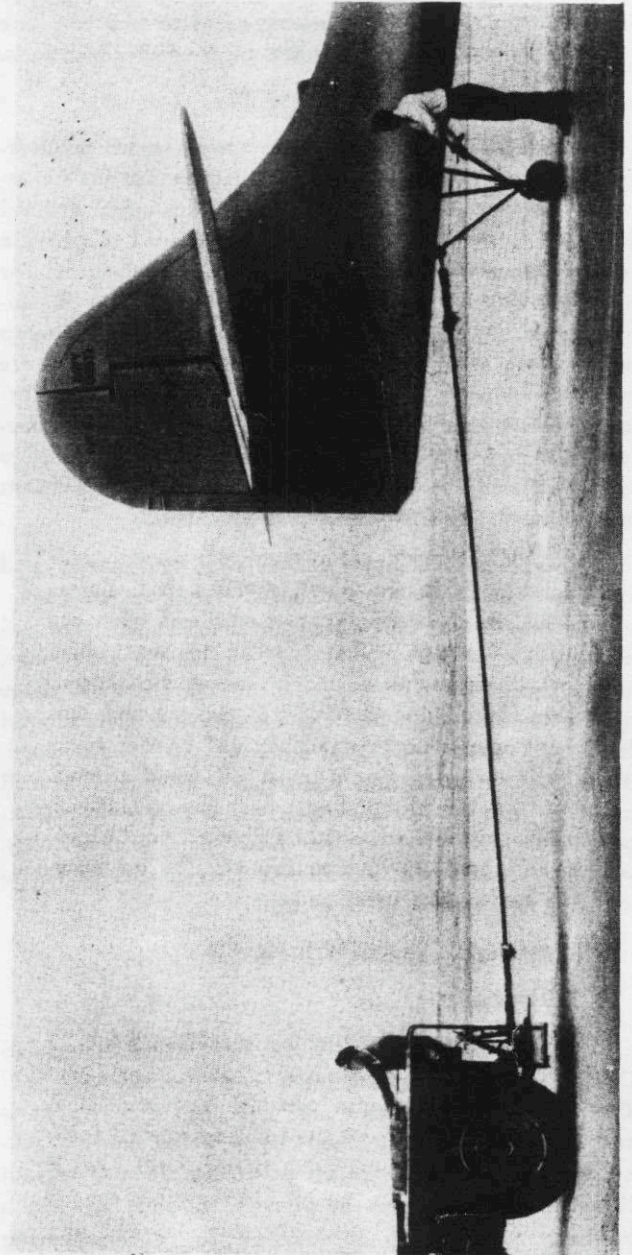


Figure 31—Towing Backward on Beaching Gear

equivalent material, along the edge in contact with the wing to avoid wing surface damage and to eliminate space between spoilers and wing surface.

(d) All movable control surfaces must be securely fastened with felt-padded wooden clamps fabricated locally. These clamps are used in addition to cockpit control locks.

(e) Wheel chocks must be securely anchored or pegged down on ground parking areas to reduce plane movement to a minimum under high wind conditions.

(5) MOORING EQUIPMENT.

(a) PERMANENT.—For permanent anchorage facilities, rings set flush in concrete aprons or attached to concrete blocks sunk in the open ground should be provided. They should be spaced to provide tie-down points as shown in figure 27 and designed for minimum tension of 2,000 pounds. The practice of running stretched steel cable or manila rope between anchor locations along the ground or on concrete aprons, to which tie-down lines from planes are attached, should be avoided since the slack in the mooring lines and the angle of pull from the anchorage cannot be satisfactorily controlled to prevent movement and pounding of the plane in a high wind.

(b) TEMPORARY.—For semi-permanent and temporary moorings in the open, metal spiral auger-type stakes or anchor fence post stakes will give excellent results. Wooden stakes similar to tent pegs, having eight square inches or more cross section, three to five feet in length and driven into the ground and slanted at an angle of approximately 30° to the vertical so that the mooring line tension will tend to pull the stake into an upright position, will prove satisfactory under most semi-hard or hard ground conditions. In soft ground, two wooden stakes should be compounded for each stake location.

e. TOWING AND ANCHOR GEAR.

(1) TOWING.

(a) TOWING WHEN LANDING GEAR IS EXTENDED (PBY-5A ONLY).—A towing bar (28U 5006) is used to control and tow the airplane. It is attached to the nosewheel axle by a spring loaded locking device. To lock in place, push handle and turn it clockwise until it snaps in place. The tow bar has a snubbing cable which is attached to the small ring fitting just below the bomber's window during the towing operation and is to be kept slack when towing and steering. This snubbing cable prevents excessive swiveling of the nose wheel.

CAUTION

All towing should be done slowly and steadily. During this operation, there should be a man inside the airplane to operate the brakes.

1. TOWING FORWARD. (See figure 28.)—

To tow forward, simply attach the tow bar to the airplane and pull with a tractor or other vehicle.

2. TOWING BACKWARD. (See figure 29.)

—To tow backward, use a 3 inch (or larger) circumference manila rope; tie it to one of the landing gear oleo struts; and tow with vehicle. Steer with nose wheel tow bar.

(b) TOWING WHEN BEACHING GEAR IS INSTALLED.—When mounted on beaching gear, the airplane may be towed forward, backward, sideways, or at 45° to the hull. It is possible for a crew to push or pull the airplane when it is mounted on beaching gear, although the use of a small truck is recommended.

CAUTION

While the airplane is being moved, there should be a man at each main beaching gear to apply brakes whenever necessary, and one man at the tail beaching gear to steer the airplane.

1. TOWING FORWARD. (See figure 30.)

—Lugs on each of the main beaching gear provide an attaching part for a tow rope when towing this airplane forward. The main gears should be locked pointing forward and the tail wheels free to swivel for steering purposes.

2. TOWING BACKWARD. (See figure 31.)

—Lock the main beaching gears in line with the longitudinal axis of the airplane. Attach a 3 inch (or larger) circumference manila rope to the lug located just aft of the tunnel gun door and tow backward.

3. TOWING SIDEWISE.—The airplane may be towed directly sidewise or at 45° to the hull only when the landing gear is off the ground (in the case of PBY-5A airplanes) and the beaching gear is used. The lugs for this towing are located on the main beaching gear. When towing sidewise, the main beaching gear should be pointed in the direction it is desired to move the airplane. This is done as follows:

- a. Jack up one gear of the main beaching gear. (See figure 32.)
- b. Pull the swivel knuckle lock pin.
- c. Turn the gear to point 45° or 90° to the hull as desired.
- d. Insert and fasten lock pin.
- e. Lower gear.
- f. Repeat the above instructions for opposite gear.

CAUTION

Do not attempt to swivel the main beaching gear without jacking up, as the steering arm is liable to break.

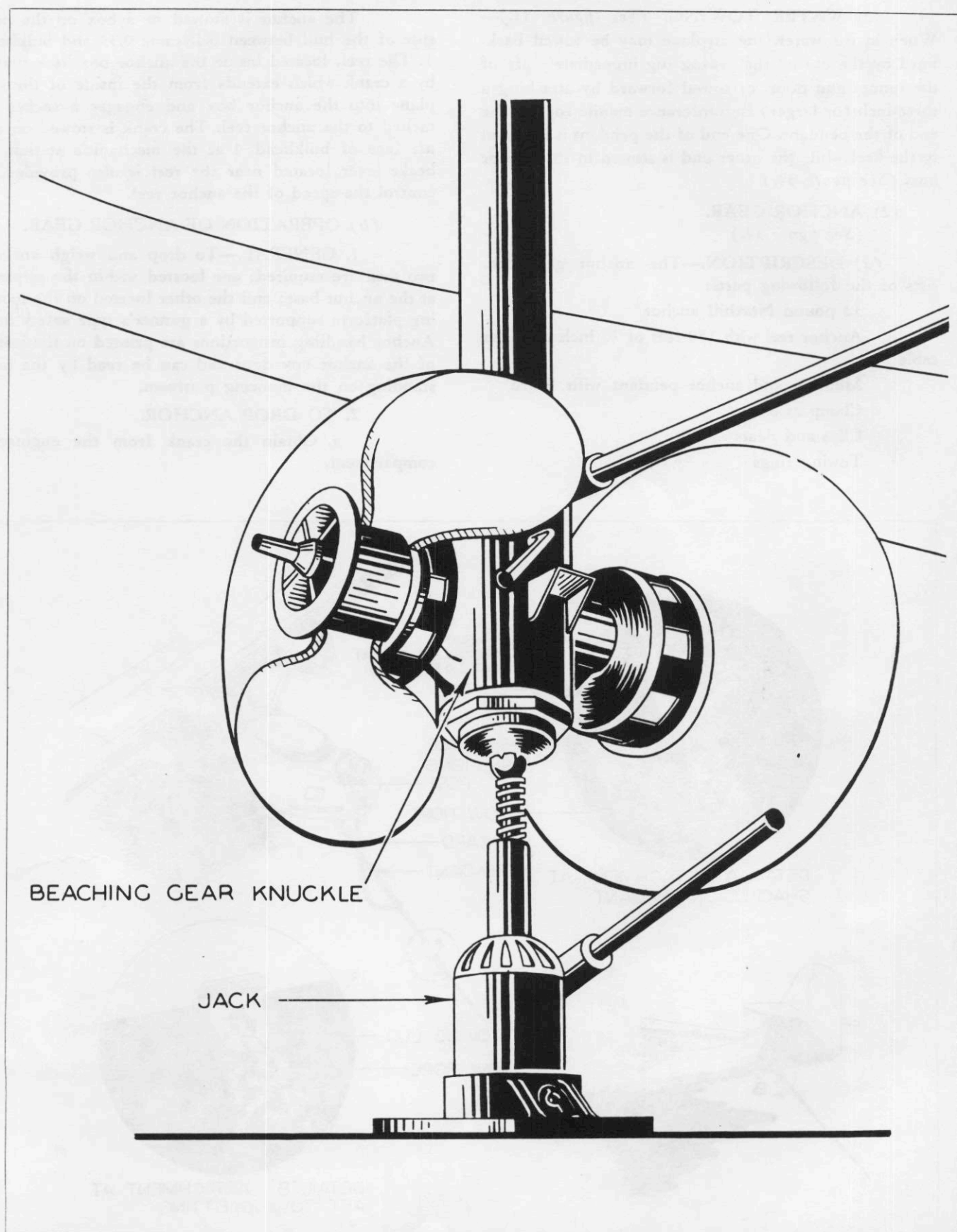


Figure 32—Jacking Beaching Gear for Turning

(c) **WATER TOWING.** (See figure 33.)—When in the water, the airplane may be towed backward by the use of the towing lug immediately aft of the tunnel gun door, or towed forward by attaching a three-inch (or larger) circumference manila rope to the end of the pendant. One end of the pendant is fastened to the keel while the other end is stowed in the anchor box. (See figure 34.)

(2) **ANCHOR GEAR.**
(See figure 34.)

(a) **DESCRIPTION.**—The anchor gear consists of the following parts:

- 32 pound Northill anchor
- Anchor reel with 150 feet of $\frac{1}{4}$ inch diameter cable
- Mooring and anchor pendant with lizard
- Clamp assembly
- Clips and cleats
- Towing rings

The anchor is stowed in a box on the port side of the hull between beltframe 0.33 and bulkhead 1. The reel, located inside the anchor box, is actuated by a crank which extends from the inside of the airplane into the anchor box and engages a socket attached to the anchor reel. The crank is stowed on the aft face of bulkhead 4 at the mechanic's station. A brake lever located near the reel is also provided to control the speed of the anchor reel.

(b) **OPERATION OF ANCHOR GEAR.**

1. **GENERAL.**—To drop and weigh anchor, two men are required; one located within the airplane at the anchor base; and the other located on the mooring platform supported by a gunner's type safety belt. Anchor handling instructions are printed on the inside of the anchor box door and can be read by the man standing on the mooring platform.

2. **TO DROP ANCHOR.**

a. Obtain the crank from the engineer's compartment.

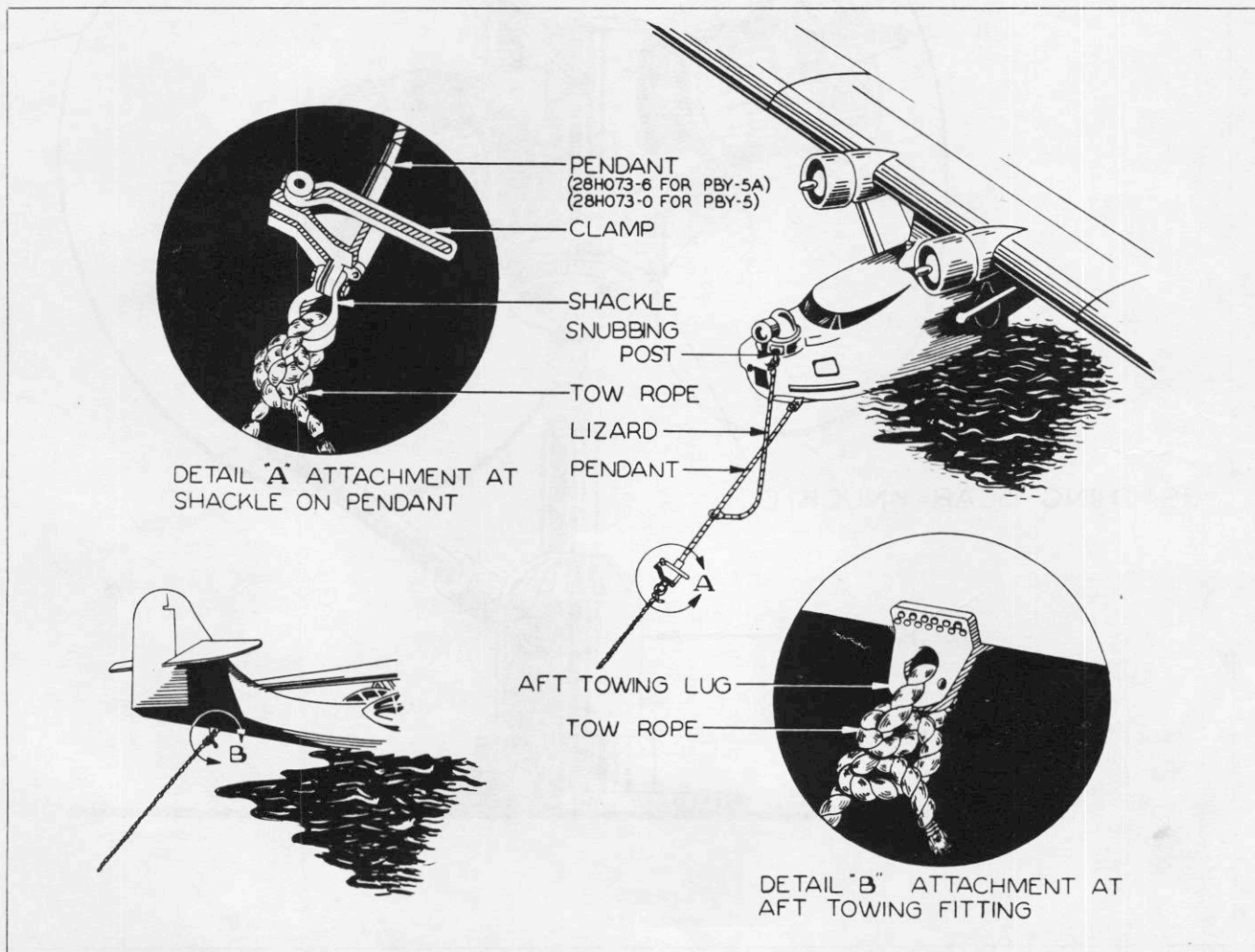


Figure 33—Water Towing

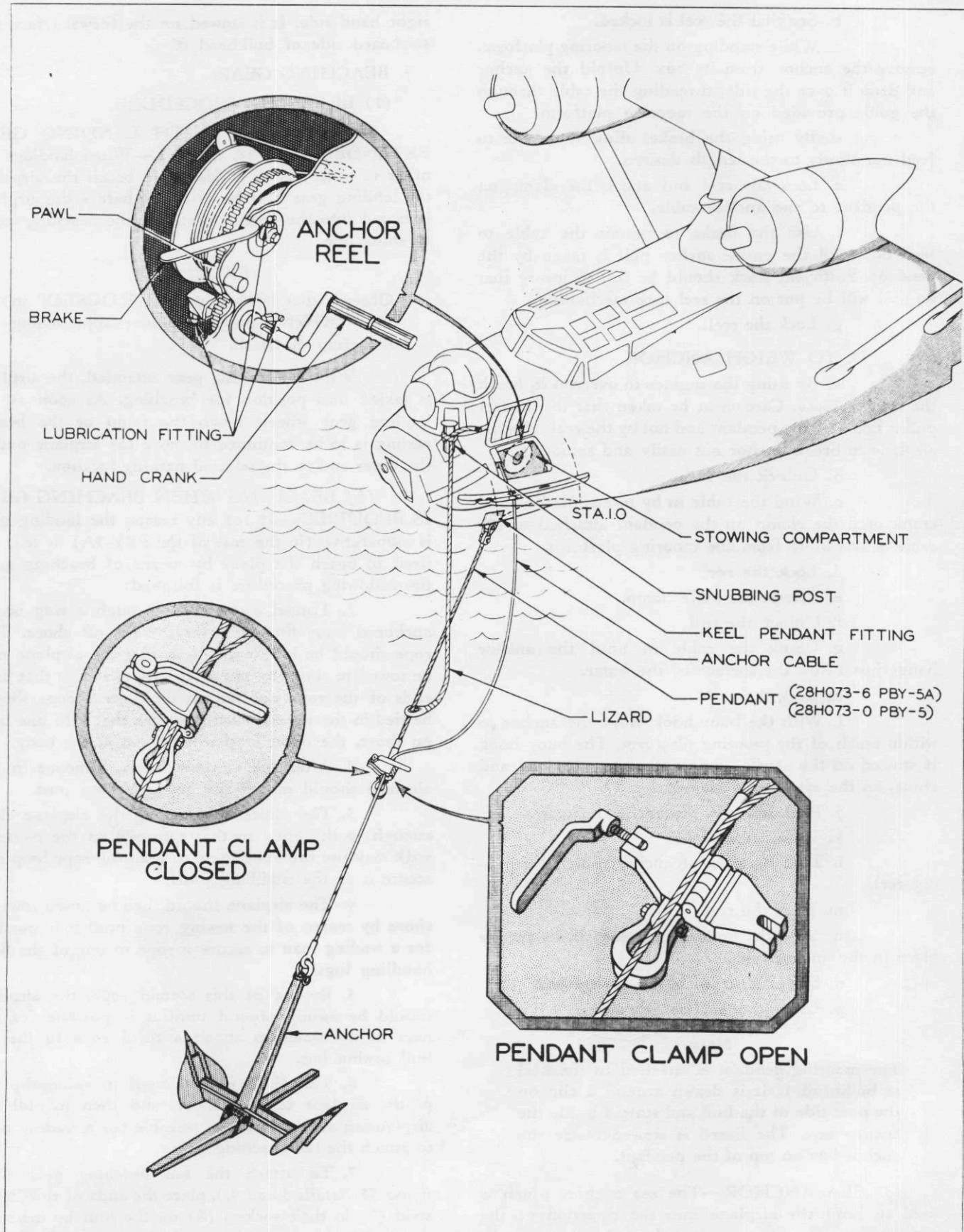


Figure 34—Anchor Gear Detail

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b. See that the reel is locked.

c. While standing on the mooring platform, remove the anchor from its box. Unfold the anchor and drop it over the side, threading the cable through the guide provided on the mooring platform.

d. By using the brake, allow the cable to feed out slowly to the length desired.

e. Lock the reel and attach the clamp on the pendant to the anchor cable.

f. Use the brake to permit the cable to feed out until the entire anchor pull is taken by the pendant. Sufficient slack should be left to insure that no pull will be put on the reel lock mechanism.

g. Lock the reel.

3. TO WEIGH ANCHOR.

a. By using the engines to overrun it, break the anchor loose. Care must be taken that the anchor pull is taken by the pendant and not by the reel. Handle airplane to break anchor out easily and smoothly.

b. Unlock the reel.

c. Wind the cable in by means of the hand crank until the clamp on the pendant attached to the cable is accessible from the mooring platform.

d. Lock the reel.

e. Release the cable clamp.

f. Unlock the reel.

g. Crank the cable in until the anchor hangs just below the surface of the water.

h. Lock the reel.

i. With the buoy hook, hoist the anchor to within reach of the mooring platform. The buoy hook is stowed on the starboard side, between the keel and chine, on the aft face of bulkhead 1.

j. Fold and stow the anchor in its box.

k. Unlock the reel.

l. Take up slack of anchor cable by cranking reel.

m. Lock the reel.

n. Stow the mooring pendant in its proper place in the anchor box.

o. Stow the lizard in the anchor box.

p. Close the anchor box door.

Note

The mooring pendant is attached to the keel at bulkhead 1. It is drawn around a clip on the port side of the hull and stowed inside the anchor box. The lizard is stowed inside the anchor box on top of the pendant.

(3) SEA ANCHOR.—The sea anchor, which is used to head the airplane into the direction of the water current, may be launched through the waist gun blister and tied to the step which is immediately aft of the blister. It can be launched from either left or

right hand side. It is stowed on the forward face and starboard side of bulkhead 6.

f. BEACHING GEAR.

(1) BEACHING PROCEDURE.

(a) BEACHING WITH LANDING GEAR EXTENDED (PBY-5A ONLY).—When landings are made in water and it is desired to beach the airplane, the landing gear is to be extended before the airplane is taxied into the shallow water at the beaching ramp or shore line.

CAUTION

Observe that landing gear is "LOCKED" in the "DOWN" position before approaching the ramp or beach.

With the landing gear extended, the airplane is taxied into position for beaching. As soon as the landing gear wheels touch the ramp or the beach, taxiing is to be continued to move the airplane out of the water and to the selected parking location.

(b) BEACHING WHEN BEACHING GEAR IS REQUIRED.—If for any reason the landing gear is inoperative (in the case of the PBY-5A) or it is desired to beach the plane by means of beaching gear, the following procedure is followed:

1. Thread a tow rope through a ring on an anchored buoy floating several yards off shore. This rope should be long enough so that the airplane may be towed to shore by use of the rope, and so that both ends of the rope will remain on shore. Loops should be tied in the rope at such positions that with one loop on shore, the other loop will be just at the buoy.

2. After the airplane lands, someone in the airplane should mount the bow snubbing post.

3. The pilot should bring the airplane close enough to the buoy so that someone on the mooring walk may use the buoy hook to grab the rope loop and secure it to the snubbing post.

4. The airplane should then be towed towards shore by means of the towing rope until it is possible for a wading man to secure a rope to one of the float handling lugs.

5. By use of this second rope, the airplane should be swung around until it is possible for the man in the water to attach a third rope to the aft hull towing lug.

6. This third rope is used to swing the tail of the airplane towards shore, and then to pull the airplane in shore until it is possible for a wading man to attach the tail beaching gear.

7. To attach the tail beaching gear (See figure 35, details 3 and 4.), place the ends of the "Vee" strut (7) in their sockets (8) on the hull by inclining the entire unit forward at a slant to the hull. As the unit is swung rearwards, the "Vee" struts automatically lock in the hull fittings. The center strut (11) is then

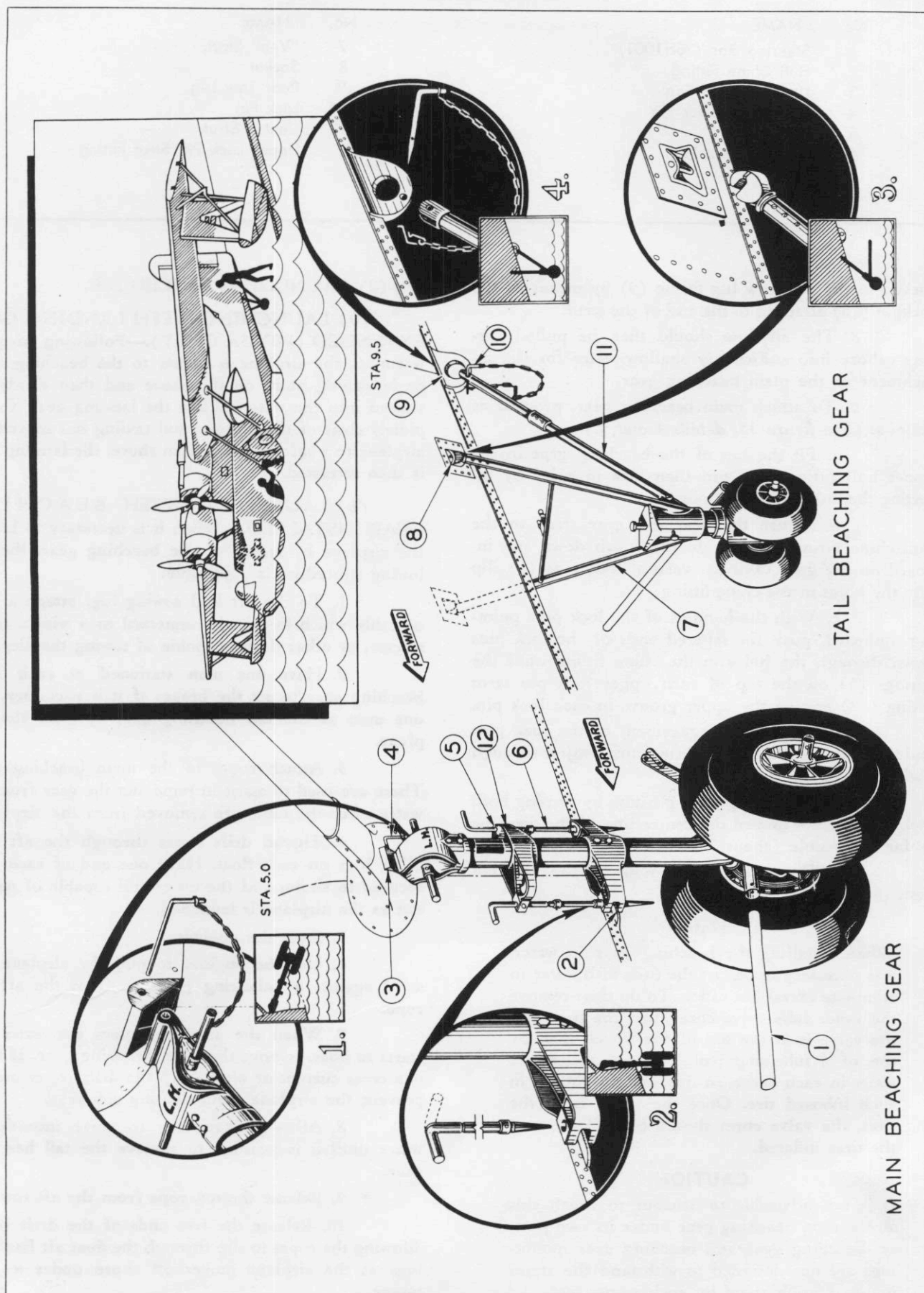


Figure 35—Attaching Beaching Gear

No.	NAME
1	Steering Bar (28H1001)
2	Hull Chine Fitting
3	Upper Hull Fitting
4	Hull Fitting Lock Pin
5	Spring
6	Vertical Lock Pin

No.	NAME
7	"Vee" Strut.
8	Socket
9	Rear Tow Lug
10	Lock Pin
11	Center Strut
12	Upper Lock Pin Strut Fitting

locked to the rear tow lug fitting (9) by means of the lockpin (10) attached to the end of the strut.

8. The airplane should then be pulled further ashore into sufficiently shallow water for the attachment of the main beaching gear.

9. To attach main beaching gear, proceed as follows: (*See figure 35, details 1 and 2.*)

a. Fit the top of the beaching gear in the upper hull fitting (3), and then lock in place by inserting the hull fitting lock pin (4).

b. Secure the beaching gear strut to the hull chine fitting (2). To do this, push down and inboard on the gear until the vertical lock pins (6) slip into the holes in the chine fitting.

c. With the handles of the lock pins pointing outboard, push the tapered ends of the lock pins down through the holes in the chine fitting until the springs (5) on the top of each upper lock pin strut fitting (12) engage the upper groove in each lock pin.

d. Check the engagement of the lock pins and the hull chine fitting. The pins must project through both holes in the chine fitting.

e. Lock the pins in position by turning both lock pin handles toward the center line of the airplane as far as possible (about 25° off center line).

10. The airplane may now be beached tail first.

Note

When installing the beaching gear in water, it is necessary to ballast the tires with water to eliminate excess buoyancy. To do this: remove the inner tube valve core; turn the tire until the valve is at the top of the wheel; then by use of a tube and pail, pour 10 gallons of water in each outboard tire, and 15 gallons in each inboard tire. Once the water is in the tires, the valve cores should be replaced and the tires inflated.

CAUTION

It is not advisable to attempt to beach this airplane on beaching gear under its own power. Beaching gear and beaching gear mountings are not designed to withstand the strain imposed upon them by such maneuvers.

(2) LAUNCHING PROCEDURE.

(a) LAUNCHING WITH LANDING GEAR EXTENDED (PBY-5A ONLY).—Following adequate warm-up, the airplane is taxied to the beaching ramp or launching point on the shore and then slowly advanced into the water. When the landing gear is completely clear of the bottom, and taxiing has moved the airplane to a safe distance from shore, the landing gear is then retracted.

(b) LAUNCHING WITH BEACHING GEAR INSTALLED.—When it is necessary to launch the airplane by means of the beaching gear, the following procedure is applicable:

1. To the aft hull towing lug, attach a rope or cable which in turn is connected to a winch, truck, tractor, or other device capable of towing the airplane.

2. Have one man stationed at each main beaching gear to set the brakes if it is necessary, and one man at the tail beaching gear to steer the airplane.

3. Attach ropes to the main beaching gear. These are used to assist in removing the gear from the water after the units are removed from the airplane.

4. Thread drift ropes through the aft handling lugs on each float. Have one end of each rope secured to shore, and the other end capable of paying out as the airplane is launched.

5. Start the engines.

6. Use the engines to pull the airplane forward against a balancing pressure from the aft tow rope.

7. When the airplane enters the water and starts to float, remove the main beaching gear. If there is a cross current or wind, keep the drift ropes snug to prevent the airplane from drifting sideways.

8. Allow the airplane to move into deeper water until it is possible to remove the tail beaching gear.

9. Release the tow rope from the aft tow lug.

10. Release the free ends of the drift ropes, allowing the ropes to slip through the float aft handling lugs as the airplane moves off shore under its own power.

(3) DISASSEMBLY AND STOWAGE.

(a) DISASSEMBLY.

(See Section IV, Par. 5.)

(b) STOWAGE.—There are no special provisions for stowage of the beaching gear in the airplane.

(4) CARE OF TIRES AND LUBRICATION.

(See Section IV, Par. 5.)

g. PARKING BRAKES AND CONTROL LOCKS.

(1) PARKING BRAKES.

(See figure 36.)

(a) LANDING GEAR (PBY-5A ONLY).—

The parking brakes must be set from the co-pilot's seat. To set the parking brakes, proceed as follows:

Apply foot pressure to both brake pedals located at the top of the copilot's rudder pedals. At the same time, turn the parking brake knob (located at the

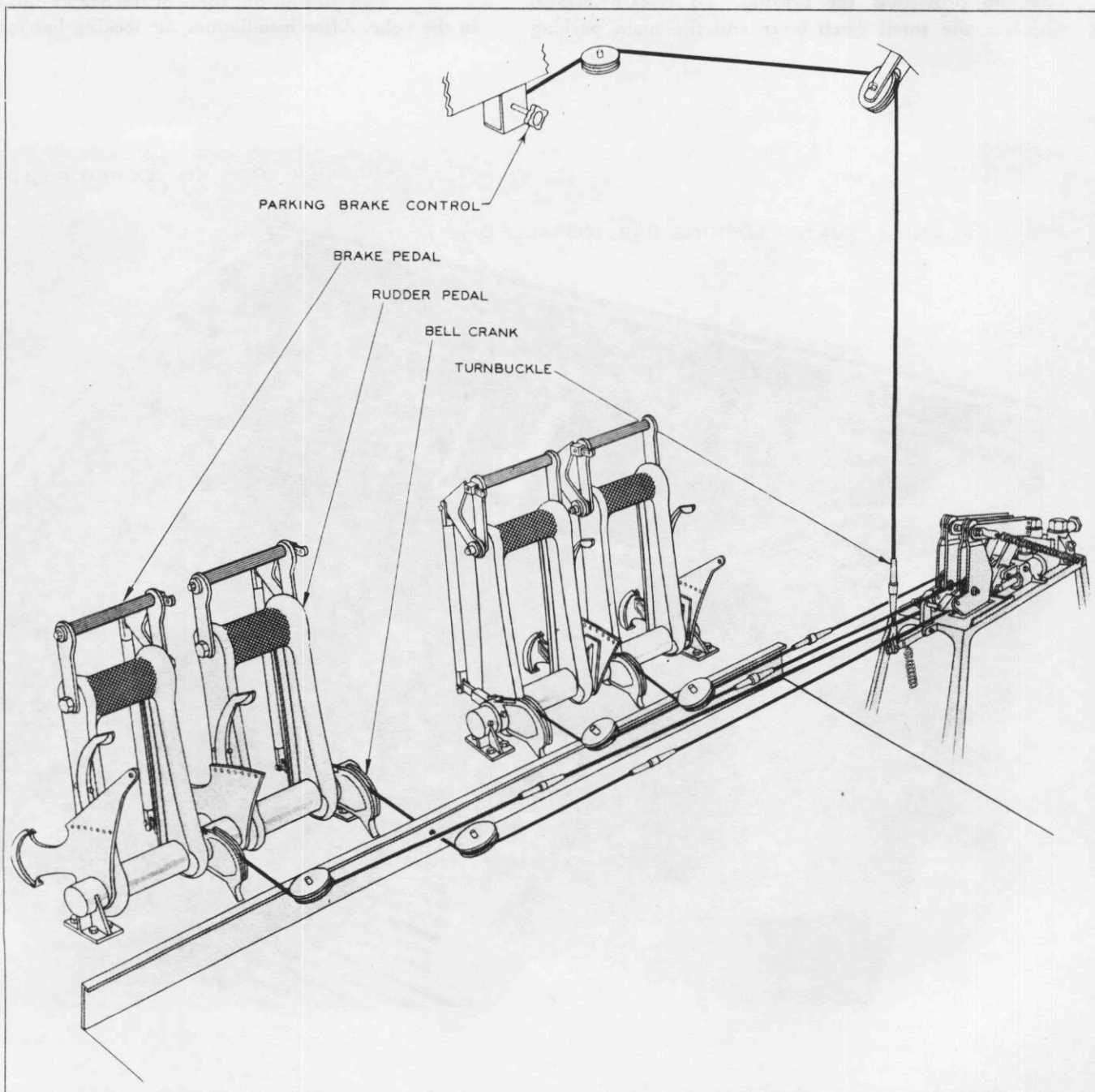


Figure 36—Parking Brakes

starboard side of the ship just below the pilot's instrument panel) to the locked position. This action locks the brake pedals and therefore the brakes on the main landing gear. To release brakes, apply heavy foot pressure to brake pedals and then remove foot pressure. This removes locking action of parking knob and releases brakes.

(b) BEACHING GEAR. (See figure 90.)—To set parking brakes on beaching gear, push downward on the handle extending aft from the beaching gear strut of the main beaching gear. The tail beaching gear has no provisions for braking. To release brakes, squeeze the small catch lever and the main parking

brake handle together and then pull upward.

(2) CONTROL LOCKS.

(See figure 37.)

(a) AILERON AND ELEVATOR.—The aileron and elevator controls may be locked by means of a detachable bar and strap. One end of this bar is inserted in a fitting near the side of the hull, aft and outboard of the pilot's seat. The forked end of the bar fits around the lower spoke in the pilot's aileron wheel when the elevator yoke is placed in a neutral position.

Two pins on the forks of the bar fit into holes in the yoke. After installation, the locking bar may be

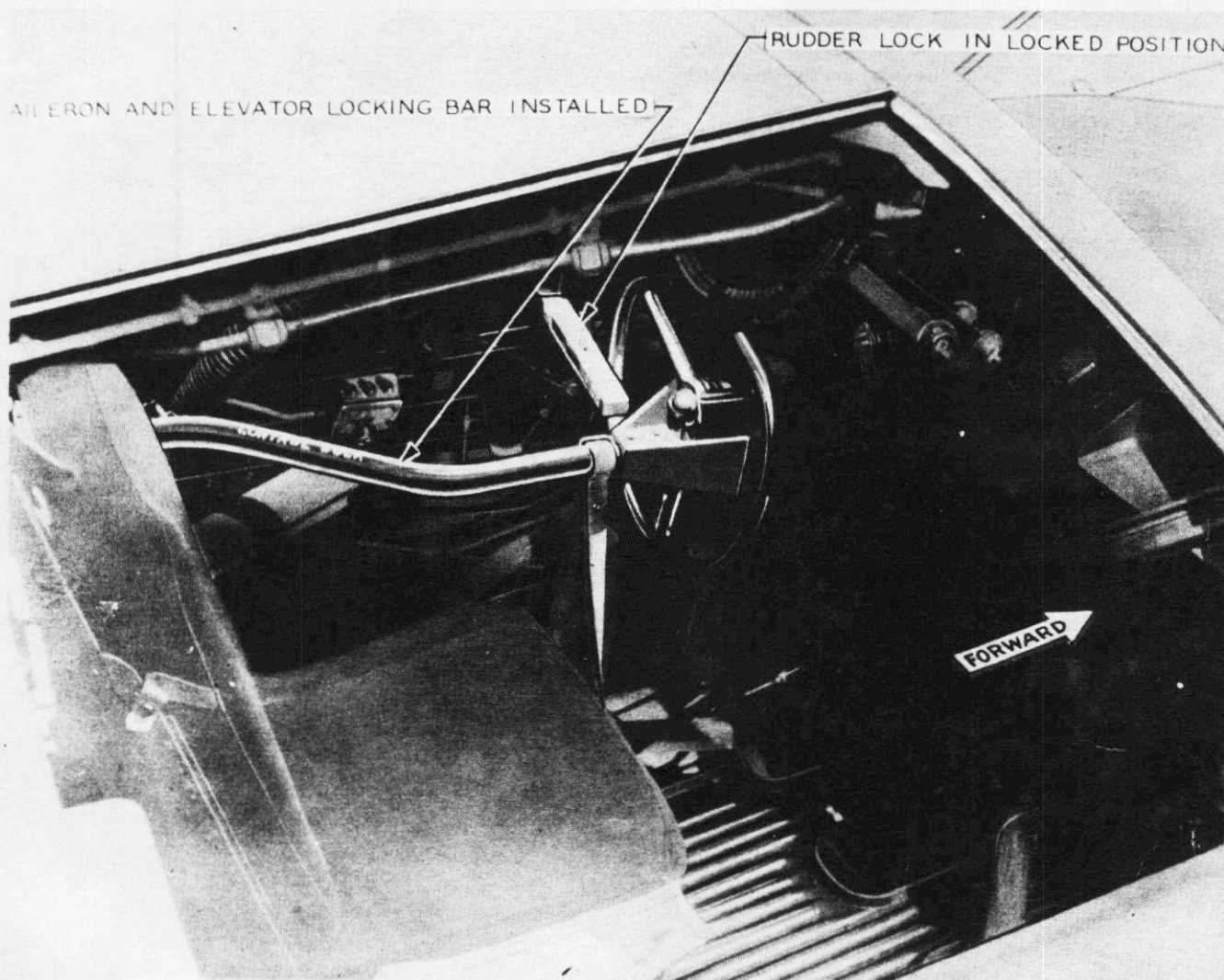


Figure 37—Control Locks

secured in place by attaching the strap to the pilot's seat.

(b) **RUDDER LOCKS.**—The rudder lock lever is located outboard of and slightly forward of the pilot's seat. To lock rudder, pull hinged rudder lock handle in from side of hull and forward. This action causes a plunger to slide into a socket in the leading edge of the rudder. This plunger is housed in the lower fin structure and is actuated through a cable and bellcrank linkage by the rudder lock handle. While pulling the rudder lock handle, in order to assist the sliding of the plunger into the socket at the rear of the plane, it will be necessary to work the rudder pedals back and forth slightly.

h. SERVICING.

(1) FUEL TANKS.

(a) DATA.

(See figure 38 for names of tanks, capacities, and filler cap locations.)

(b) GROUNDING.

1. WHEN AIRPLANE IS ON LANDING GEAR OR BEACHING GEAR.

- Connect a ground lead from nose wheel strut or tail beaching gear strut to fuel truck.
- Connect a ground wire from main landing gear or beaching gear strut to the ground.
- Connect a ground wire from fuel truck to ground.
- Ground hose nozzle to fuel tank vents or other available structure.

WARNING

All fuel delivery hose must be metal lined or otherwise bonded between discharge nozzle and fitting on opposite end of hose.

2. WHEN AIRPLANE IS IN WATER.

- Be sure fuel tanks of refueling ship are properly grounded.
- Connect ground wire from airplane beaching gear fittings to the refueling ship.
- Ground discharge nozzle to fuel tank vents or other available structure.

(c) SERVICING OPERATION.

1. Station man with fire extinguisher adjacent to fuel truck (when refueling on land) or near fuel reservoir.

2. Station man on wing to handle the fuel hose. Always have a fire extinguisher on the wing near the refueling operation. The man should rub his hands on the wing surface at a point remote from the filler opening to discharge any static charges which might have built up on his body.

3. Drain approximately 1½ pints of fuel from

each tank by turning on the fuel drain valves. This removes any accumulated water.

4. Break seal and open filler cap.

5. Insert nozzle. Do not allow nozzle to remain in filler opening without support.

6. Fill tank with proper fuel (Specification AN-F-28). Allow sufficient time for fuel to seek its level.

7. Close and seal filler covers.

8. Remove grounding wires.

(d) DRAINING OPERATION.

1. Connect a one inch pipe fitting and hose to the discharge end of the drain line. Insert other end of hose into empty container to catch draining fuel.

2. Turn drain valve on and allow fuel to drain.

(e) PRECAUTIONS.

1. Be sure that all fuel system units are suitable for the use of aromatic fuel.

2. Be sure that operators wear rubber soled and heeled shoes so that no nails will stick out and produce sparks.

3. Turn off main and auxiliary battery switches.

4. Do not charge the batteries while fueling.

5. Do not test radio or radar equipment while fueling.

6. Do not drag refueling equipment over wing surface.

7. Be sure to walk only on places marked as walkways.

8. Do not smoke or light matches while fueling.

(2) OIL TANKS.

(a) DATA.

(See figure 38 for names of tanks, capacities, and filler cap locations.)

(b) SERVICING OPERATION.

1. Break seal and open filler cap.

2. Fill tank to proper level with oil (Specification AN-VV-O-446). The volume of oil needed is approximately 7 per cent of the volume of gasoline to be used. A sounding rod is provided to ascertain the level of the oil. This rod is stowed within the opening.

3. Close with filler cap and then seal.

(c) DRAINING OPERATION.

1. **FOR TANK ONLY.**—Place container beneath drain hole and then remove plug.

2. **FOR TANK AND ENGINE.**

a. Turn selector valve to "TANK TO ENGINE."

b. Remove plug from bottom of valve and

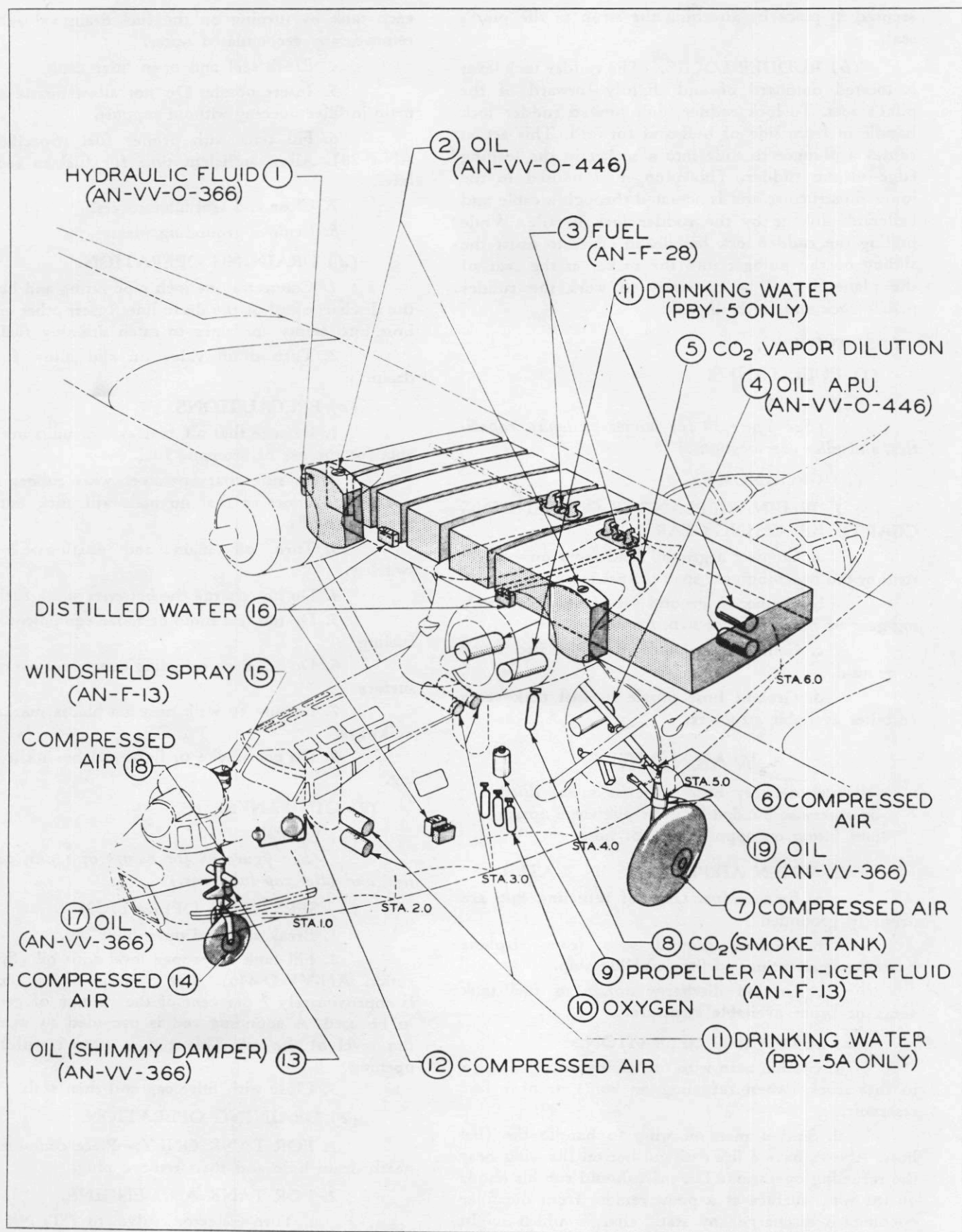


Figure 38 (Sheet 1 of 2 sheets)—Servicing Diagram

Index No.	Name of Tank	CAPACITY		Location of Reservoir and/or Filler Cap	Location of Outlets for Draining
		U. S. Gal.	Imp. Gal.		
3	Fuel Tank (Left)	Cells 622	516	Filler cap is on top of wing 13 inches from center line.	In superstructure fwd. of bulkhead 5. LH side.
		Integ. 875	728		
3	Fuel Tank (Right)	Cells 622	516	Filler cap is on top of wing 13 inches from center line.	In superstructure fwd. of bulkhead 5 RH side.
		Integ. 875	728		
2	Oil Tank (Left)	65	54	Filler cap is on center line of nacelle on top, aft of firewall.	On center line of nacelle bottom surface, aft of firewall LH side.
2	Oil Tank (Right)	65	54	Filler cap is on center line of nacelle on top, aft of firewall.	On center line of nacelle bottom surface, aft of firewall RH side.
1	Hydraulic Res.	2.4	2	Reservoir is in starboard nacelle on outboard side, aft of firewall. Filler cap is on top.	At test block below reservoir or fitting at bottom of reservoir.
9	Prop. Anti-Icing Res.	3	2.5	Reservoir is on port side aft of blkhd. 4. Filler cap is on top.	At fitting at bottom of reservoir.
15	Windshield Spray Res.	.25	.20	Reservoir is on starboard side fwd. of pilot's instr. panel.	Remove reservoir.
4	A.P.U. Oil Tank	3	2.5	Tank is on starboard side between bulkheads 4 and 5 over A.P.U. (on PBY-5), and on port side between bulkheads 4 and 5 over A.P.U. (on PBY-5A). Filler cap is on top.	Plug in "tee" at bottom of tank.
11	Drinking Water (4 Tanks)	18	15.2	PBY-5A—Two tanks are fwd. of navigator's table and two in shear web aft blkhd. 4 on starboard side. PBY-5—Two tanks are overhead between bulkheads 4 and 5—one on each side and two on fwd. port side of bulkhead 6. Filler cap is on top.	Faucet on tanks.

Figure 38 (Sheet 2 of 2 sheets)—Servicing Diagram

attach a one-inch hose fitting and hose. Place container on opposite end of hose to catch draining oil.

c. Turn valve to "TANK AND ENGINE DRAIN" and allow oil to drain into container.

(d) PRECAUTIONS.

1. Do not fill oil tank completely. Breathing space should be left for expansion and foaming.

(3) HYDRAULIC RESERVOIR.

(a) DATA.

(See figure 38 for capacity and filler cap location.)

(b) SERVICING OPERATION.

1. Remove filler cap and add fluid (Specification AN-VV-O-366) to proper level.

2. Replace filler cap.

(c) DRAINING OPERATION. — Connect hose assembly No. AC 39G1030W-10-180 to suction side of test block and allow fluid to drain into container. If hose is not available, the tubing connection below the reservoir may be loosened and fluid allowed to drain.

(4) PROPELLER ANTI-ICING RESERVOIR.

(a) DATA.

(See figure 38 for capacity and filler cap locations.)

(b) SERVICING OPERATION.

1. Remove filler cap at top of reservoir and fill with fluid (Specification AN-A-18) to desired level.

2. Replace filler cap.

(c) DRAINING OPERATION. — Remove hose from filter by loosening clamp. If more rapid drainage is required, disconnect the joint between the reservoir and the "ON-OFF" valve.

(5) WINDSHIELD SPRAY RESERVOIR.

(a) DATA.

(See figure 38 for capacity and location.)

(b) SERVICING AND DRAINING OPERATION.—To replenish or drain fluid (Specification AN-A-18) loosen clamp and unscrew jar from cover. Fill or drain as required.

(6) A.P.U. OIL TANK.

(a) DATA.

(See figure 38 for capacity and filler cap location.)

(b) SERVICING OPERATION.—Remove filter cap and fill with oil (Specification AN-VV-O-466, Gr. 1065 to 1080). Do not fill completely. Leave air space for expansion and foaming.

(c) DRAINING OPERATION.—Remove cap attached to "tee" at bottom of tank and allow fluid to drain into container.

(7) OXYGEN SYSTEM.

(a) DATA.—Three spare oxygen bottles are

located on the port side on the forward face of bulkhead 4. Two others, one each in the pilot's and copilot's rebreather unit, make up the oxygen supply. Each oxygen bottle has 96 cu in. capacity at 1800 lbs pressure. (See Section V, Par. 2.)

(b) SERVICING OPERATION.—After use, each bottle must be replaced by a filled bottle.

(8) DRINKING WATER TANKS.

(a) DATA.

(See figure 38 for capacity and filler cap locations.)

(b) SERVICING OPERATION.

1. After use, remove tank and clean thoroughly.

2. Fill with fresh water.

3. Replace in stowage.

(9) VAPOR DILUTION SYSTEM.

(a) DATA.—A bottle of compressed carbon dioxide is located in the superstructure aft of bulkhead 5. Its capacity is 9.5 pounds of liquid CO₂.

(b) SERVICING OPERATION.—This bottle must be detached and replaced with a fully charged bottle after use.

(10) SMOKE GENERATING SYSTEM.

(a) DATA.—A cylinder of CO₂, connected to the smoke tank, is located on the port side of the airplane aft of bulkhead 5 near the door. This bottle has a capacity of 12.6 pounds of liquid CO₂.

(b) SERVICING OPERATION.—This bottle should be detached and replaced with a fully charged bottle after use.

(11) ACCUMULATORS (PBY-5A ONLY).

(a) TEN INCH ACCUMULATOR.

1. DATA.—This accumulator has a total volume of 540 cu in. Its pressure outlet is at the top and connected to the hydraulic system. Just inboard of the accumulator is the compressed air connection for recharging. The location of this accumulator is just below and outboard of the copilot's seat.

2. SERVICING OPERATION.—This accumulator is charged with 600 ± 25 pounds per sq in. air pressure when there is no oil in the accumulator. Attach booster pump or other device incorporating a pressure gage and charge as required. Make sure all the oil is removed from the accumulator before charging with air.

3. DRAINING OPERATION.—To release compressed air from the accumulator, remove air valve cap, and depress valve stem.

(b) FIVE INCH ACCUMULATOR.

1. DATA.—The location of this accumulator is just below and outboard of the copilot's seat. It has

a capacity of 69 cu in. Its pressure outlet connection to the hydraulic system is at the top and the compressed air connection is adjacent to the connection of the 10 inch accumulator.

2. SERVICING OPERATION. (Similar to the 10 inch accumulator.)

3. DRAINING OPERATION. (Similar to the 10 inch accumulator.)

(12) OLEO SHOCK STRUTS (PBY-5A ONLY).

(a) MAIN LANDING GEAR.—An air valve, located at the top, is used to recharge the oleo with compressed air. The piston has a red line on it which should be 1½ inches from the gland nut, when properly inflated. The fluid level is at the height of the filler hole when the strut is fully compressed. To replenish fluid, remove air valve body from filler hole, and add fluid (Specification AN-VV-O-366).

(b) NOSE WHEEL LANDING GEAR.—Replenishing is similar to that for the main landing gear except that the red line should be 2 inches from the gland nut.

(13) SHIMMY DAMPER (PBY-5A ONLY).

(a) DATA.—The shimmy damper is located on the nose wheel shock strut above the scissors. It contains a filler plug and an indicator. (See figure 87 for location.) The indicator is ⅜ inches extended when full. The shimmy damper should be replenished when the indicator is 9/32 inches extended.

(b) SERVICING OPERATION.—To refill, remove the lockwire and the protecting cap, exposing an ordinary lubricator fitting. An ordinary pressure type lubricating gun is used. Force fluid into damper until indicator is at proper level. Do not overfill. Use fluid (Specification AN-VV-O-366).

(c) DRAINING OPERATION. — To drain fluid from damper, the unit must be taken apart. (See Section IV, Par. 4, c, (4), (c), 2.)

(14) BATTERIES.—To replenish electrolyte in the batteries, see Section IV, Par. 22, c, (3), (a).

(15) TIRES (PBY-5A ONLY).

(See Section IV, Par. 4, b, (2), (c), 2.)

i. GROUND OPERATING INSTRUCTIONS. (Refer to Pilot's Handbook of Flight Operating Instructions AN 01-5MA-1.)

j. LUBRICATION REQUIREMENTS.—Lubrication requirements of moving parts that require no lubrication whatever during the life of the airplane are listed in Table A; parts that require lubrication only at time of overhaul are listed in Table B; parts that require periodic lubrication are listed in figure 39, Sheet 1. Small moving parts that stick or squeak, for which there are no specific requirements, may be lubricated sparingly with oil (Specification AN-O-6) or grease (Specification AN-G-3 or AN-G-5).

No distinction is made between "Summer," "Winter" and "Extreme Cold" for lubrication requirements due to the fact that the lubricants used have a sufficiently wide temperature range to give reasonably satisfactory operation during extreme weather conditions. All parts requiring lubrication that are listed in figure 39 pertain to the PBY-5A and also to the PBY-5 where applicable.

TABLE A

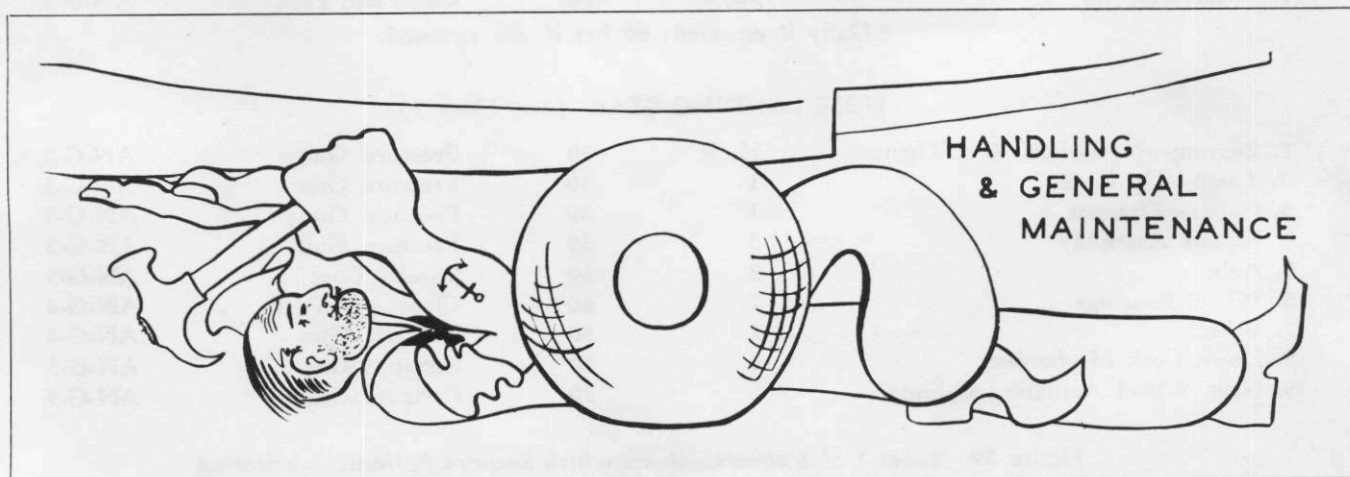
PARTS REQUIRING NO LUBRICATION
DURING LIFE OF THE AIRPLANE

- | | |
|--------------------|-------------------------|
| 1. Fuel Pumps | 3. Vacuum Pumps |
| 2. Hydraulic Pumps | 4. Anti-icer Fluid Pump |

TABLE B

PARTS REQUIRING LUBRICATION
ONLY AT TIME OF OVERHAUL

- | | |
|--------------------------|---------------|
| 1. Electric Motors | 4. Generators |
| 2. Control Cable Pulleys | 5. Hinges |
| 3. Levers | 6. Rollers |



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ITEM	NAME OF UNIT	NO. OF POINTS	PERIOD HOURS	OPERATION	LUBRICANT
FLOATS (See Sheet 2)					
1.	Strut—Lower Float Retracting	4L/R	30	Pressure Gun	AN-G-10
2.	Strut—Upper Float Retracting	2L/R	30	Pressure Gun	AN-G-10
3.	Fitting—Float Brace—Upper	2L/R	30	Pressure Gun	AN-G-10
4.	Latch—Float Lock	1L/R	30	Spread Coat	AN-G-10
5.	Operating Screw	5L/R	30	Oil Can	AN-O-6
6.	Float Lock Mechanism	3L/R	30	Oil Can	AN-O-6
7.	Gear Boxes	6	60	½ in. to ¾ in. Layer	AN-G-10
8.	Torque Tube Universal	1	30	Oil Can	AN-O-6
HULL (See Sheet 3)					
9.	Anchor Gear	3	60	Pressure Gun	AN-G-5
1.	Nose Wheel Door Lock Pins	2	30	Pressure Gun	AN-G-5
1.	Nose Wheel Door Lock Mechanism	2	30	Pressure Gun	AN-G-5
CONTROLS (See Sheet 3)					
2.	Yoke Run-Around Sprocket (Chain)	1	30	Spread Coat	AN-G-10
3.	Tab Control Units	2	60	Oil Can	AN-O-6
8.	Brake and Rudder Pedal Assembly	6L/R	60	Pressure Gun	AN-G-3
8.	Rudder Pedal Lock	2L/R	60	Oil Can	AN-O-6
7.	Rudder Lock Lever	1	60	Oil Can	AN-O-6
5.	Tab Screw Jacks	4	60	Pack	AN-G-3
6.	Rudder Lock Pin	2	60	Pressure Gun	AN-G-3
4.	Cowl Flap Screw Jacks	2	30	Spread Coat	AN-G-10
MAIN LANDING GEAR (See Sheet 4)					
1.	Bell Crank—Latch Release	2L/R	30	Pressure Gun	AN-G-5
2.	Fitting—Main Strut	2L/R	30	Pressure Gun	AN-G-5
3.	Universal—Main Strut, Operating	2L/R	30	Pressure Gun	AN-G-5
4.	Latch—Main Strut Locking	2L/R	30	Pressure Gun	AN-G-5
5.	Fork—Upper Vee	3L/R	30	Pressure Gun	AN-G-5
6.	Fitting—Lower Vee Strut, Center	2L/R	30	Pressure Gun	AN-G-5
7.	Upper and Lower Vee Strut, Front	2L/R	30	Pressure Gun	AN-G-5
8.	Upper and Lower Vee Strut, Rear	2L/R	30	Pressure Gun	AN-G-5
9.	Scissor Assembly	6L/R	30	Pressure Gun	AN-G-5
10.	Brake Torque Plate	2L/R	*	Pressure Gun	AN-G-5
11.	Wheel Bearings	2L/R	60	Clean and Pack	AN-G-4
* Daily if emersed; 60 hrs if not emersed.					
NOSE LANDING GEAR (See Sheet 5)					
1.	Bearing—Nosewheel Keel Thrust	1L/R	30	Pressure Gun	AN-G-5
2.	Latch—Up Lock	1	30	Pressure Gun	AN-G-5
3.	Collar—Damper	1	30	Pressure Gun	AN-G-5
4.	Scissor Assembly	5	30	Pressure Gun	AN-G-5
5.	Axle	2	30	Spread Coat	AN-G-5
6.	Wheel Bearings	2	60	Clean and Pack	AN-G-4
7.	Wheel	1	30	Pressure Gun	AN-G-4
8.	Down Lock Mechanism	2	30	Pressure Gun	AN-G-5
9.	Nose Wheel Actuating Cylinder	1	30	Pressure Gun	AN-G-5

Figure 39 (Sheet 1 of 5 sheets)—Items which Require Periodic Lubrication

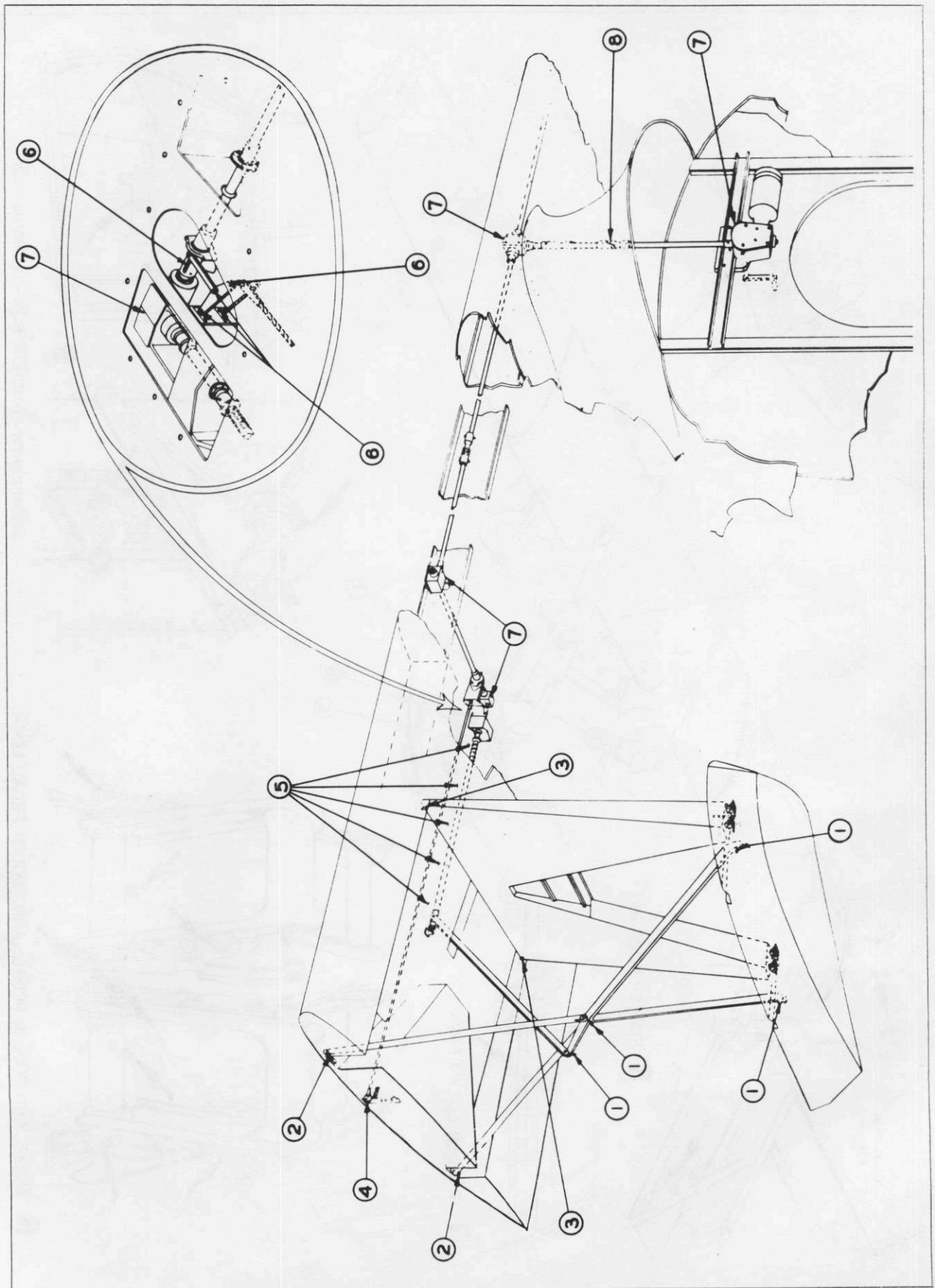
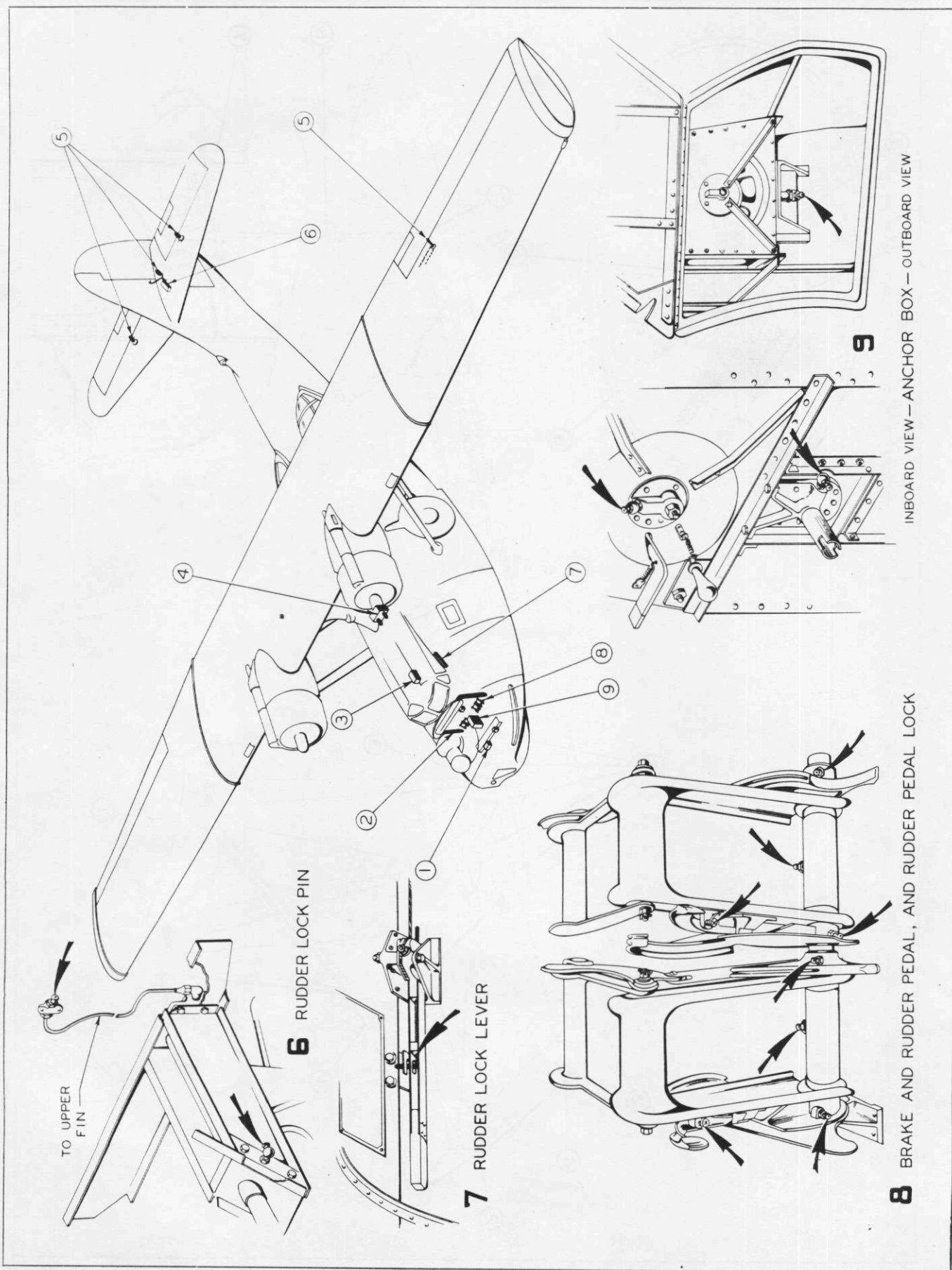
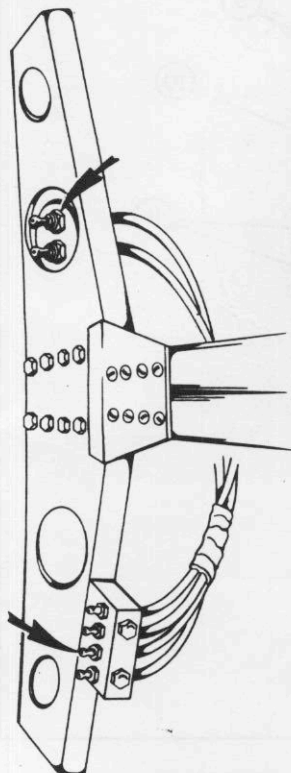
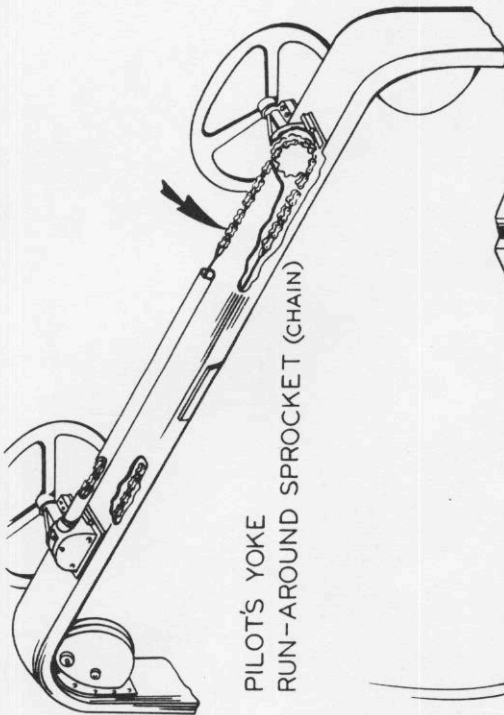


Figure 39 (Sheet 2 of 5 sheets)—Float Lubrication Chart

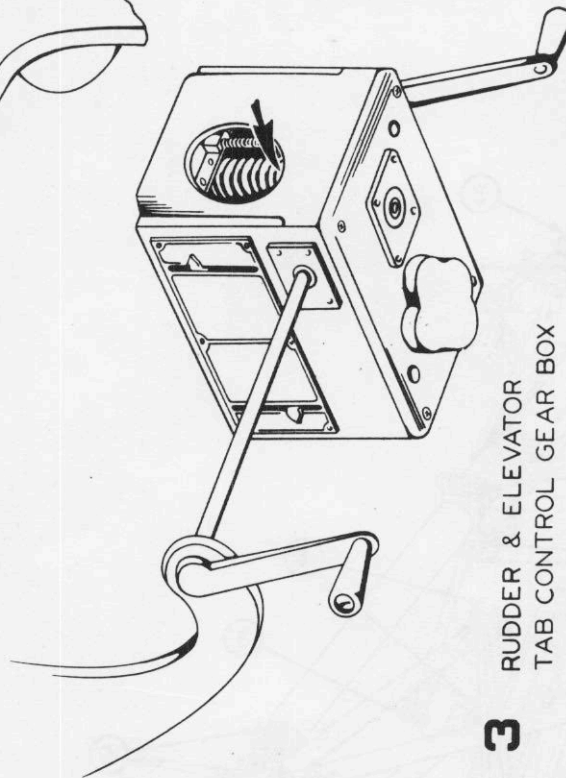




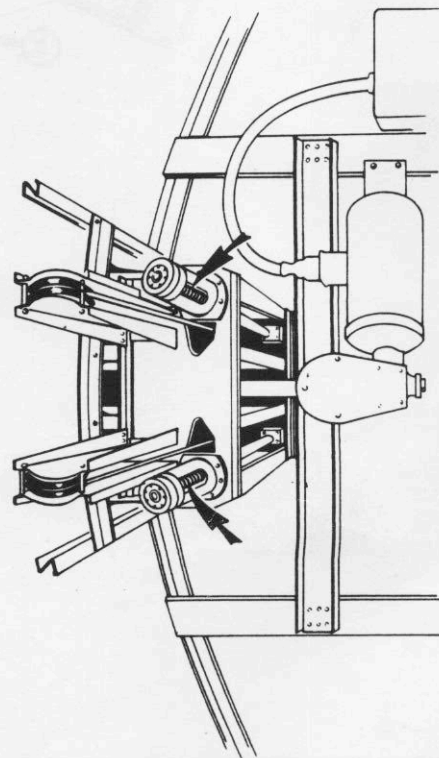
1 NOSE WHEEL DOWN LATCH
NOSE WHEEL DOOR LOCK PINS
NOSE WHEEL DOOR LOCK MECHANISM



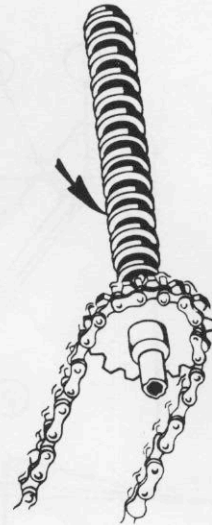
2 PILOT'S YOKE
RUN-AROUND SPROCKET (CHAIN)



3 RUDDER & ELEVATOR
TAB CONTROL GEAR BOX



4 COWL FLAP SCREW JACKS - LOOKING AFT AT BLK'D 4.0



5 ELEVATOR, RUDDER & AILERON TAB SCREW JACKS

Figure 39 (Sheet 3 of 5 sheets)—Flight Controls and Hull Lubrication Chart

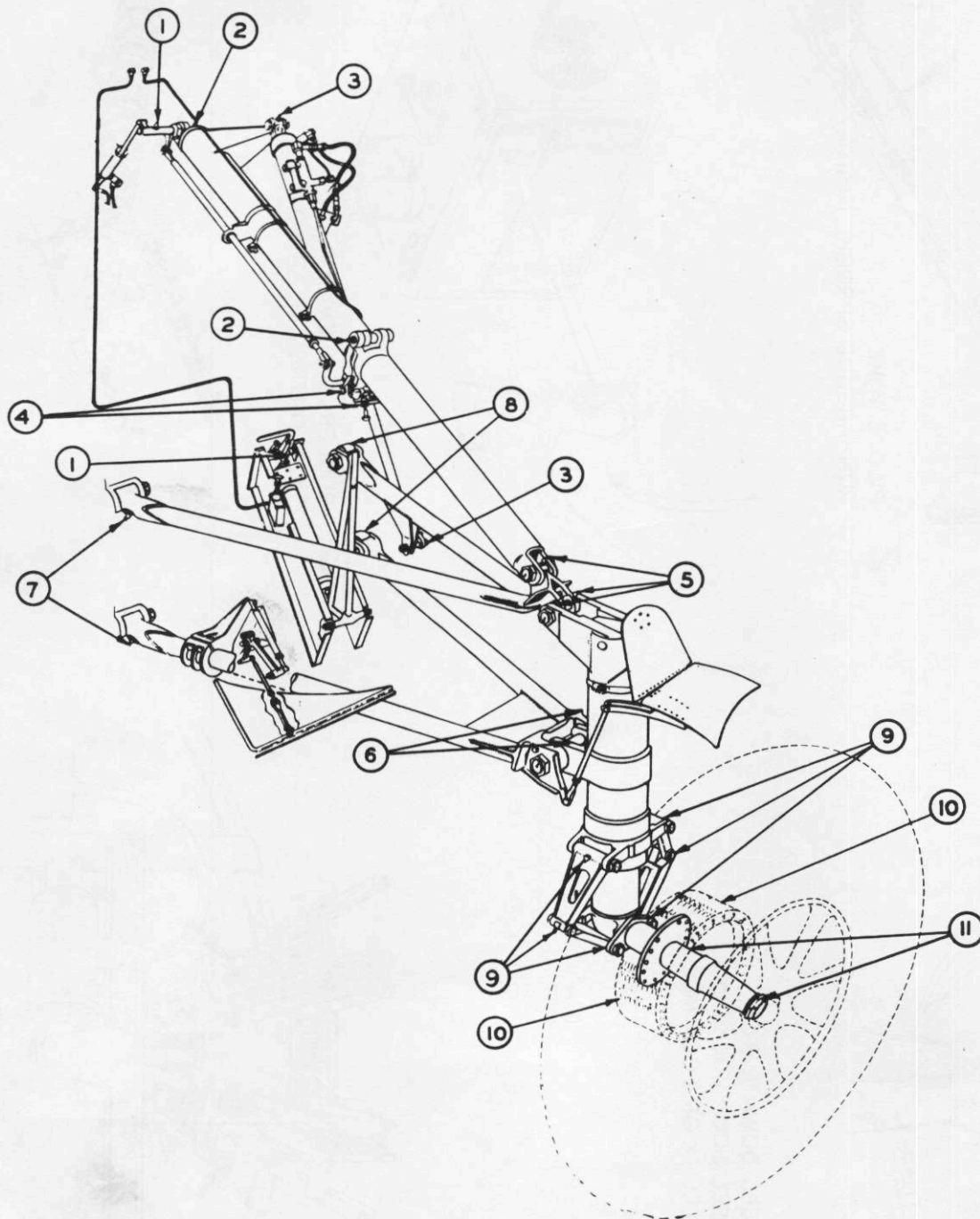


Figure 39 (Sheet 4 of 5 sheets)—Main Landing Gear Lubrication Chart (PBX-5A ONLY)

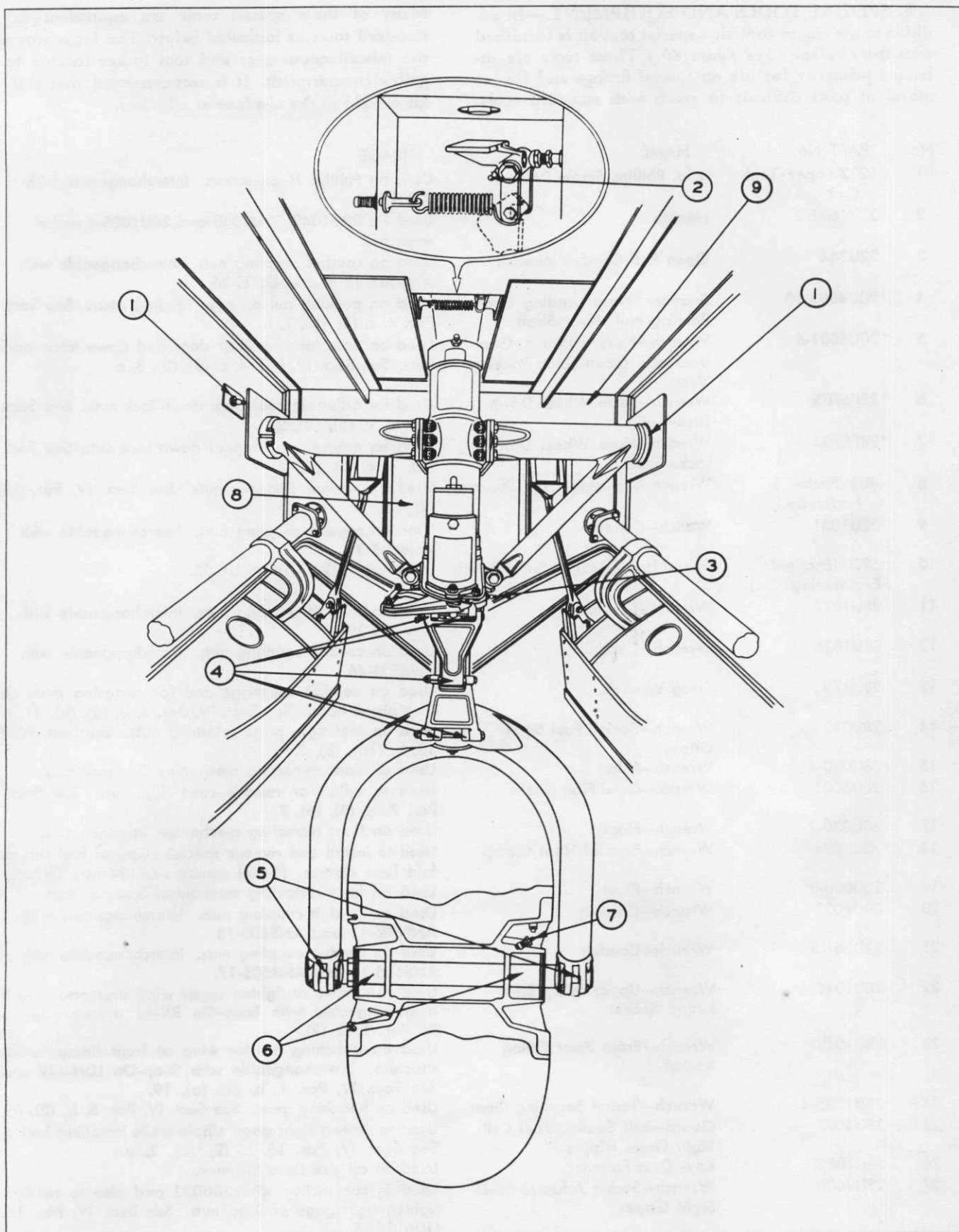


Figure 39 (Sheet 5 of 5 sheets)—Nose Landing Gear Lubrication Chart (PBY-5A ONLY)

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k. SPECIAL TOOLS AND EQUIPMENT.—In addition to the engine tool kit a special tool kit is furnished with the airplane (See figure 40.) These tools are intended primarily for use on special fittings and for removal of parts difficult to reach with standard tools.

Many of these special tools are equivalent to AN standard tools as indicated below. The kit is stowed in the miscellaneous gear and tool locker located in the galley compartment. It is recommended that this tool kit remain in the airplane at all times.

No.	PART No.	NAME	USAGE
1	1202 (Apex Tool Co.)	4 in. Phillips Screw Driver	Used on Phillips Head screws. Interchangeable with AN8503-4.
2	28U1025-2	Handle	Used for 28U1049, 28U1048 and 28U1025-4 socket wrenches.
3	22U364	Open End Conduit Wrench	Used on conduit coupling nuts. Interchangeable with AN8505-23 and AN8505-26.
4	*28U4005-10	Spanner—Nose Landing Gear Packing Nut—Pivot Shaft	Used on packing nut on nose landing gear. See Sect. IV, Par. 4, c, (3), (b), 1, h.
5	*28U5031-6	Wrench—Nose Landing Gear Door and Down Latch Packing Nuts.	Used on nose landing gear door and down latch packing nuts. See Sect. IV, Par. 4, c, (5), (b), 3, c.
6	*28F6705	Wrench—Nose Wheel Down Lock—Long	Used for adjusting nose gear down lock nuts. See Sect. IV, Par. 4, c, (5), (d), 2.
7	*28F6704	Wrench—Nose Wheel Down Lock—Short	Used for adjusting nose gear down lock nuts. See Sect. IV, Par. 4, c, (5), (d), 2.
8	482 (Fischer & Porter Co.)	Wrench—Adjustable Pin Spanner	Used on various Spanner nuts. See Sect. IV, Par. 15, b, (9), (c).
9	22U1031	Wench—Conduit	Used on conduit coupling nuts. Interchangeable with AN8505-31.
10	5280 (Scofield Engineering Co.)	Speed Handle for Socket Wrench	Used with socket wrench US-52.
11	28U1027	Wrench—Conduit	Used on conduit coupling nuts. Interchangeable with AN8505-39.
12	28U1026	Wrench—Conduit	Used on conduit coupling nuts. Interchangeable with AN8505-46.
13	22U173	Strap Wrench	Used on conduit couplings and for removing main shock strut piston head. See Sect. IV, Par. 4, b, (5), (b), 21, j.
14	28U032	Wrench—Socket Fuel Sight Gages	Used on fuel sight gage retaining nuts. See Sect. IV, Par. 15, b, (10), (b), 5.
15	28U030-4	Wrench—Float	Used on float retracting mechanism Spanner nuts.
16	28U5001	Wrench—Cowl Flap Nut	Used to adjust or remove cowl flap nuts. See Sect. IV, Par. 7, b, (3), (b), 7.
17	28U030-2	Wrench—Float	Used on float retracting mechanism Spanner nuts.
18	**28U5094	Wrench—Special Hose Clamp	Used to install and remove special elliptical fuel cell manifold hose clamps. (Serial numbers 08124 thru 08266.)
19	28U030-3	Wrench—Float	Used on float retracting mechanism Spanner nuts.
20	22U1033	Wrench—Conduit	Used on conduit coupling nuts. Interchangeable with AN8505-11 and AN8505-13.
21	22U361-3	Wrench—Conduit	Used on conduit coupling nuts. Interchangeable with AN8505-16 and AN8505-17.
22	28U1049	Wrench—Upper Wing Strut Fitting Socket	Used to remove or tighten upper wing strut attaching bolt. Interchangeable with Snap-On RX-48 wrench. See Sect. IV, Par. 1, d, (2).
23	28U1048	Wrench—Front Spar Fitting Socket	Used on attaching nut for wing at front fitting in superstructure. Interchangeable with Snap-On LDH-482 socket. See Sect. IV, Par. 1, b, (2), (a), 19.
24	28U1025-4	Wrench—Socket Beaching Gear	Used on beaching gear. See Sect. IV, Par. 5, b, (2), (c), 3.
25	28U5097	Guard—Self Sealing Fuel Cell Sight Gage Nipple	Used to protect sight gage nipple while installing fuel cells. See Sect. IV, Par. 15, b, (2), (d), 2, a.
26	28U1052	Key—Dzus Fastener	Used on all size Dzus fasteners.
27	28U3000	Wrench—Socket Adapter Fuel Sight Gages	Used in conjunction with 28U032 and also to remove or tighten sight gage packing nuts. See Sect. IV, Par. 15, b, (10), (b), 5.

*PBY-5A only.

**PBY-5 only.

No.	PART No.	NAME	USAGE
28	*28F6696	Fitting—Special Hydraulic	Used for the hydraulic test stand. See Sect. IV, Par. 21, b, (10), (a).
29	US-52 (Scofield Eng. Co.)	7/8-12 point Universal Socket	Used with speed handle 5280.
30	28U2006	Wrench—Battery Terminal	Used to remove or tighten battery wing nuts. See Sect. IV, Par. 22, c, (2), (e).
31	28U5096	Screw Driver	Used for removing or tightening brazier head screws.
32	28U5027	Wrench—Special Starter	Used to remove or tighten starter and generator attaching nuts. See Sect. IV, Par. 12, b, (2), (k).
33	28U1025-20	Tool Container	Provides location for all tools in the kit.

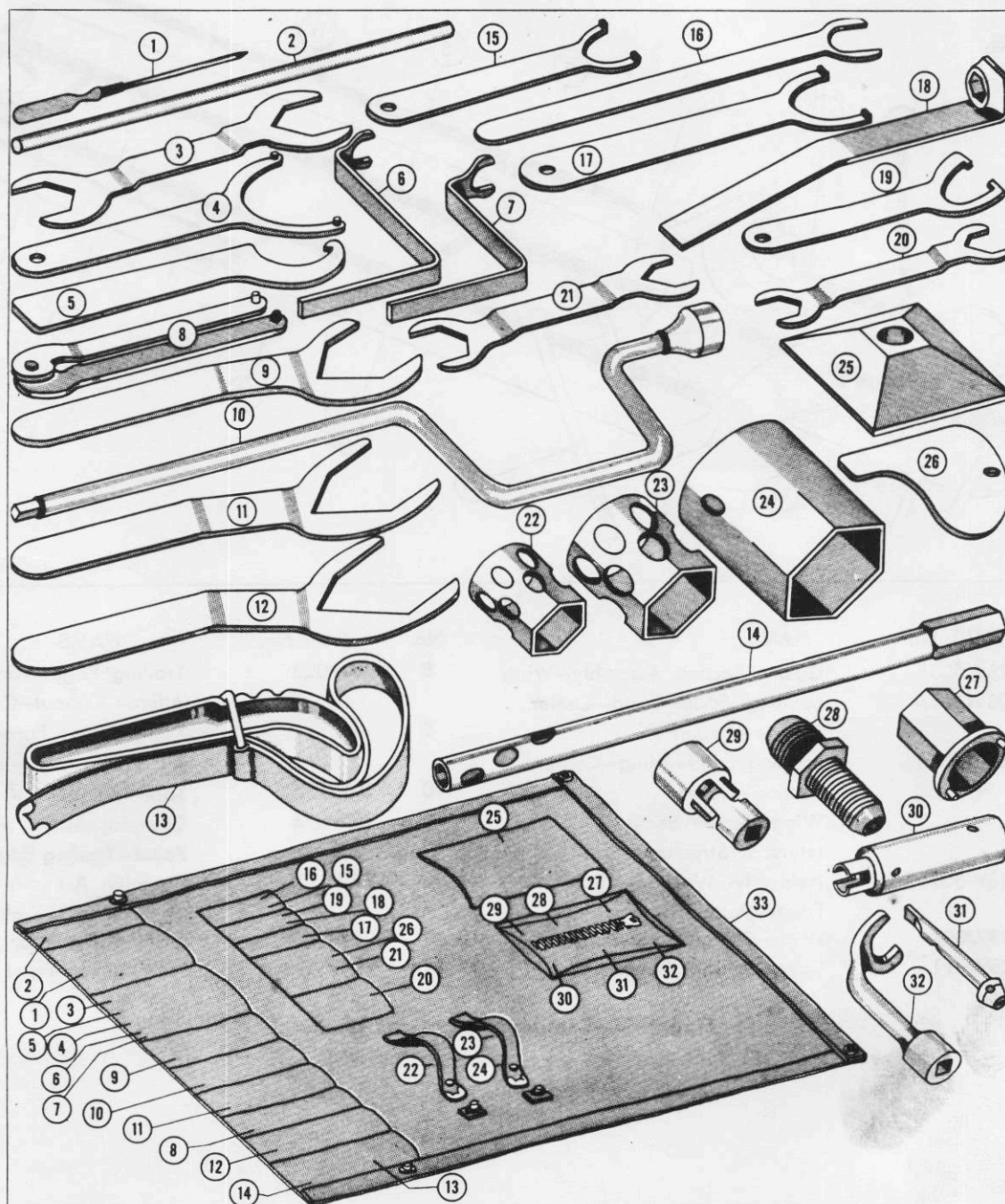
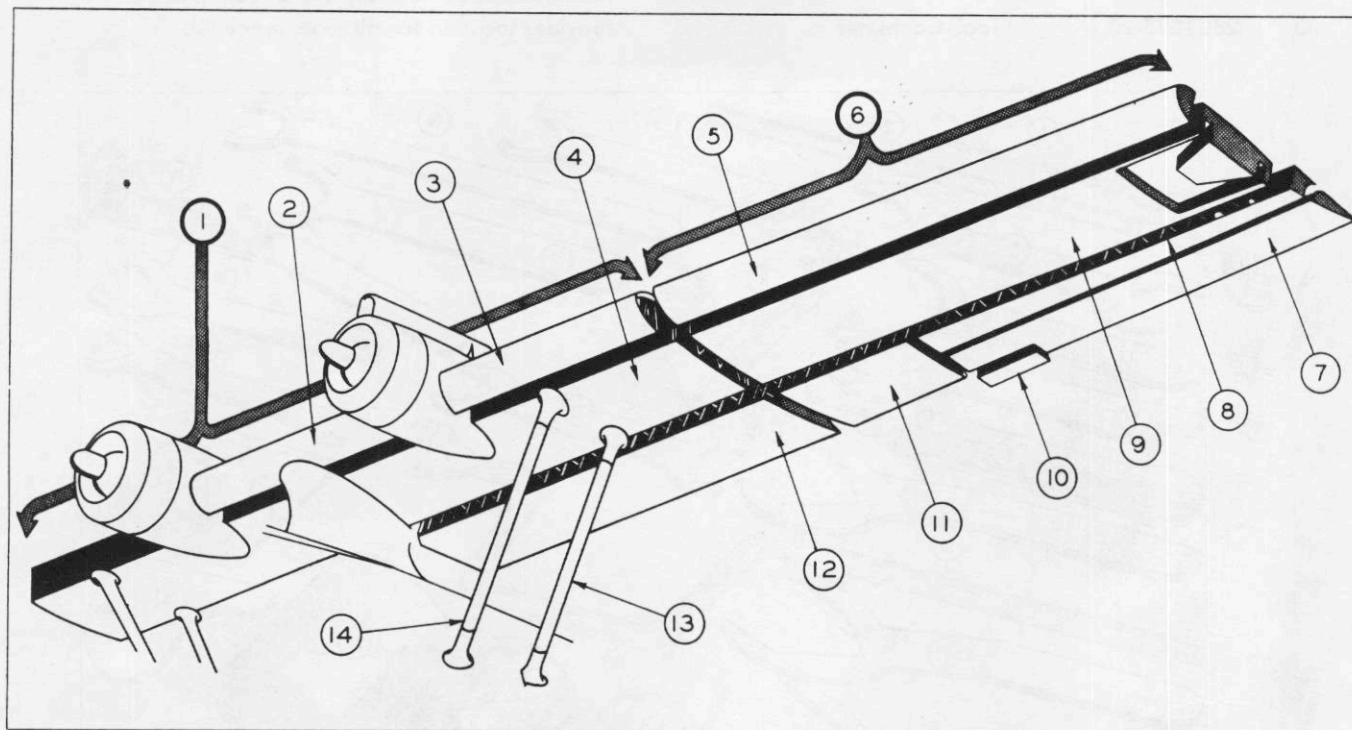


Figure 40—Special Tools



No.	PART No.	NAME	No.	PART No.	NAME
1	28W5005	Center Section Assembly—Wing	8	28W022	Trailing Edge—Wing—
2	28W3017	Leading Edge—Wing—Center			Aileron Cut-out—Covered
		Section—Center	9		Wing—Outer Panel—Interspar
3	28W5016	Leading Edge—Wing—Center			Structure
		Section—Outer	10	28W2082	Tab—Aileron
4		Wing—Center Section—	11	28W024	Covering Ass'y.—Wing—Outer
		Interspar Structure			Panel—Trailing Edge
5	28W6011	Assembly—Wing—Leading	12	28W171	Covering Ass'y.—Wing—
		Edge—Outboard Panel			Center Panel—Trailing Edge
6	28W004	Wing—Outer Panel Assembly	13	28W040	Strut—Wing—Rear
7	28W011	Covering—Wing—Aileron	14	28W039	Strut—Wing—Front

Figure 41—Component Parts of Wing

SECTION IV MAJOR COMPONENTS, SYSTEMS AND INSTALLATIONS

PARAGRAPH I.



1. WING.

a. GENERAL. (See figure 41.)—The wing consists of three major assemblies,—the center section and a right and left outer panel. Outer panels bolt to the center section, permitting removal for repair or overhaul.

The center section is composed of five units: the interspar structure, three leading edge assemblies, and a trailing edge assembly.

Each outer panel is built in six units: the interspar structure, leading edge, trailing edge, aileron cut-out trailing edge, aileron, and a wing tip which serves as a float when in the lowered position.

Leading edges, trailing edges, and ailerons are removable for repair and overhaul. Leading edges are of all metal construction, while the trailing edges are of a fabric covered, internally braced design. The ailerons are fabric covered, with dural internal structure.

The interspar structure of the center section is constructed in such a way as to provide two gas tight chambers, one on each side of the airplane center line. These interspar tank areas may contain either the gasoline itself, or rubber self-sealing cells.

Walkways are provided on the wing as follows: along the front spar across the entire span; at the airplane center line from the rear spar to the trailing edge; between the front and rear spar to the wing splice.

The entire center section forward of the rear spar, including the leading edge, is braced for walking. Hand grips are provided on each side of the wing center line. Pull up on the grips to use them.

b. CENTER SECTION.

(1) GENERAL. (See figure 41.)—The center section is composed of the interspar structure (4), center leading edge (2), left and right-hand outer leading edges (3), and left and right-hand trailing edges (12). The center section is attached to the hull by two fittings at the airplane superstructure and two struts on each side of the hull.

The interspar structure is box-shaped, and consists of front spar and rear spar, truss and web ribs, and upper and lower surface skin reinforced with extruded zee stringers.

The structure is sealed between wing station 5.0 and the center line on both port and starboard sides providing two gas tight chambers. These tanks may contain either the gasoline itself, or five self-sealing fuel cells.

A 10 x 20 inch manhole located in the wing upper surface on each side of the center line provides access for inspection and repair inside each fuel tank. A 23 x 70 inch access door is located on the upper surface on each side of the center line for installing fuel cells.

The nacelle aft of the rear face of the oil tank is an integral part of the center section interspar structure. Two hoisting fittings are located on the wing upper surface at the airplane center line for hoisting the entire airplane. (See Section III, Par. 2, a, (3).)

(2) ERECTION.—The center section may be removed or installed as a complete assembly. In some cases it may be more practical to remove the leading edges and trailing edges from the center section interspar structure, and remove the interspar structure separately. The wing may be completely assembled or disassembled on the airplane or on cradles at floor level. Hoisting provisions for the wing are such that the entire wing including engines may be handled. In any case the handling of the center section will be the same.

(a) REMOVAL.

1. Remove radio sense antenna from wing as outlined in Par. 23, h, (3), (b).

2. Remove wing outer panels as described in paragraph c, (2), (a).

3. Drain fuel tanks. Drainage procedure is

Section IV
Paragraph 1,b

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outlined in Section III, Par. 2, *h*, (1), (*d*). Drain fuel lines as outlined in Par. 15, *b*, (3), (*b*), 1.

4. Inside superstructure, remove fuel sight gages. Removal procedure is outlined in Par. 15, *b*, (10), (*b*).

5. Through access door to fuel sump, located in center superstructure, disconnect lines at twin fittings, the forward one being the main fuel line outlet, the aft one being the tank drain and refuel line connection. Removal procedure is outlined in Par. 15, *b*, (3), (*b*).

6. At forward superstructure fairing, remove access doors and removable fairing as described in Par. 3, *c*, (2), (*b*) and (*c*).

CAUTION

When making disconnections of control cables and piping, be sure to tag ends to insure proper connections at installation.

7. At airplane centerline at front spar, break the following control cables by disconnecting turnbuckles: propeller control cables (see Par. 11, *c*, (2), (*b*)), cowl flap control cables (see Par. 11, *f*, (2)), engine throttle control cables (see Par. 11, *b*, (2), (*b*)), carburetor air control cables (see Par. 11, *e*, (2), (*b*)), bomb and torpedo release cables (See Section V, Par. 4, *b*, (3), (*c*)), and cable for arming fuse for MK 42 bomb rack. (See Section V, Par. 4, *b*, (3), (*c*)). Break dump valve control cable at turnbuckle (5) in leading edge. Remove fairlead (4) and pull lower part of cable through hole in leading edge skin. (See figure 151.) Break mixture control cables (26) at turnbuckles in superstructure. (See figure 46.)

CAUTION

Before breaking any electrical connections, be sure to shut off main battery switch on main distribution panel on forward face of bulkhead 4.

Note

On PBV-5 airplanes prior to serial number 08349, a rubber boot de-icer system was installed. In these planes, detach Arens control from lever arm of distributing valve by removing clevis bolt from arm at leading edge.

8. Disconnect electrical system and piping from wing leading edge to hull superstructure as follows:

a. Remove cover to ignition junction box (4), D. C. power junction box (19), A. C. power junction box (18), and main battery junction box (3). (See figure 45.)

Note

Wires may be identified by numbers taped on wires near terminals.

b. Disconnect the four wires leading to the ignition junction box.

c. Disconnect wires 674, 677, 680, 710, 713, 718, 721, and 724 in D. C. power junction box (19).

d. Disconnect wires 538, 527, 523, 500, 542, 545, 563, and 566 in A. C. power junction box.

e. Disconnect the following wires in center wing junction box:

1035	203	586	96
997	107	582	93
991	106	581	92
985	105	532	72
915	104	529	33
914	103	528	30
662	102	568	1039
661	95	494	745
945	94	1031	654
946	73	492	534
533	28	277	191
531	27	276	189
530	1053	200	185
567	913	101	80
666	912	100	69
465	867	99	
357	878	98	
356	879	97	

f. Disconnect flex conduit (5), (15), (16), and (17) in superstructure by unscrewing conduit coupling nuts. (See figure 45.) Pull wires down allowing wires to hang free from open end of conduits in superstructure.

g. Disconnect anti-icer thermocouple wires from wing anti-icer gage at port side of engineer's seat. Disconnect engine thermocouple wires at engine temperature gages on engineer's instrument panel. Remove, up to the wing, clips holding thermocouple wires in place. Return empty clips to position as an aid in subsequent assembly. Tape wire ends and carefully pull them into wing leading edge in a coil. (See Par. 22, *s*, (3).)

Note

All fluid lines may be identified by colored bands on lines. (See Section IX, Table E.)

h. At fitting where hydraulic lines go through the skin between hull station 3.66 and 4.0, break and drain lines. After draining, reconnect lines.

Note

Tape ends of tubing after making disconnections to prevent dirt from getting in lines.

i. At lower surface of leading edge at center line of airplane, disconnect hydraulic lines (2), (3), (4) and (27), propeller anti-icer lines (12) and (16), manifold pressure lines (6) and (18), pitot lines (20) and (21), fuel vent lines (11) and (17), engine primer lines (13) and (15), and oil pressure lines (7) and (19) by unscrewing coupling nuts. By breaking hose connections, disconnect main fuel lines (9) and

(24), cross feed fuel lines (10) and (23), and fuel pressure lines (8) and (22). (See figure 46.)

Note

On PBV-5 airplanes, there are only two hydraulic lines to disconnect.

On PBV-5 airplanes prior to serial number 08349 at lower surface of leading edge at centerline of airplane, disconnect two rubber boot de-icer air lines leading into superstructure by unscrewing coupling nuts.

9. At bottom of front spar, near wing bolt, disconnect float torque tube linkage by removing bolt (11). (See figure 92.)

10. At aft superstructure fairing, remove removable panels as described in Par. 3, c, (2), (b).

11. At rear spar, break the aileron tab control cables by disconnecting turnbuckles (See Par. 18, i, (3), (b)) and the aileron cables by detaching from the aileron push-pull tube. (See Par. 18, e, (2).)

12. At rear face of bulkhead 5 in the hull, remove nut disconnecting smoke control cable from handle, and pull cable up into superstructure. Break tube to smoke tank at pipe union on rear spar near centerline.

13. Disconnect purging lines at pipe union (35). (See figure 151.)

14. Remove loop antenna, wiring and shaft as described in Par. 23, h, (4), (b).

15. Remove armor plate on aft face of hull bulkhead 5. (See Section V, Par. 4, d.)

16. To prevent tilting of wing, place a support under each side of center section. (Hand lines on each end of the wing will serve the same purpose.)

17. Remove transmission lines of IFF and radio altimeter from front struts, starboard and port, as follows:

a. Remove IFF antenna and disconnect transmission lines as outlined in Par. 23, h, (9), (b).

b. Remove radio altimeter antenna and disconnect transmission lines as outlined in Par. 23, h, (5), (b).

c. Detach three clips holding IFF line to interior wing structure.

d. Detach four clips holding radio altimeter line to bottom of interior wing structure.

e. Remove upper fairings from front struts as outlined in paragraph d, (2), (b), 1.

f. Remove lower fairings from front struts as outlined in paragraph d, (2), (b), 2.

g. Detach clips at upper and lower fairings.

h. Pull Vinolite tubing containing transmission lines down so that connector plugs are pulled through grommets at wing intersection. Coil tubing at hull intersections.

Note

On PBV-5A airplanes prior to airplane 48352 and on PBV-5 airplanes, radio altimeters are not installed. On PBV-5A airplanes prior to 48252 and PBV-5 airplanes, IFF antenna transmission lines do not run through wing or wing struts.

18. Remove wing struts as outlined in paragraph d, (2).

19. Remove wing bolts (1) and (6). (See figure 42.) These bolts may be removed by removing nut on inside of hull; to overcome tight fit, use large caliber drift punch for driving out the bolts. At front wing hull fitting, a special socket wrench (7) is to be used for removing nut.

20. Lift wing off superstructure with hoist sling as outlined in Section III, Par. 2, a, (3).

(b) INSTALLATION.

1. See that hull is leveled. (The wing hoist holds the wing at an angle of 6°. The hull must be leveled, otherwise the hull fittings will not align with the wing fittings.) On PBV-5A airplanes, the fore-and-aft leveling blocks are located between bulkheads 5 and 6 on the port side and transverse blocks on the forward port face of bulkhead 6. On PBV-5 airplanes, the fore-aft leveling blocks are located between bulkheads 4 and 5 on the port side and transverse blocks on the forward port face of bulkhead 5.

2. Hoist the wing as described in Section III, Par. 2, a, (3) into position above the hull, and lower slowly; pull flexible conduits through openings provided in lower surface of the wing leading edge.

CAUTION

Fuel sumps must not be permitted to rest on any part of hull superstructure. If power plants are attached, engine and nacelle controls must be kept clear.

3. When the wing rests against the hull and the front and rear fittings are engaged, insert the front wing bolt (6) in a fore-and-aft direction, and the aft wing bolt (1) in a forward direction. (See figure 42.) A special socket wrench (7) is provided for tightening the nut on the front wing bolt.

4. Insert Vinolite tubing containing IFF and radio altimeter transmission lines in front struts, and then install wing struts as outlined in paragraph d, (3).

5. Install IFF and radio altimeter transmission lines and antennae by reversing procedure as outlined in paragraph b, (2), (a), 17.

6. Install armor plate on aft face of hull bulkhead 5. (See Section V, Par. 4, d.)

7. Connect purging lines at pipe union (35). (See figure 151.)

8. At rear face of bulkhead 5 in hull, and rear spar, connect smoke tank control cable and tube, fol-

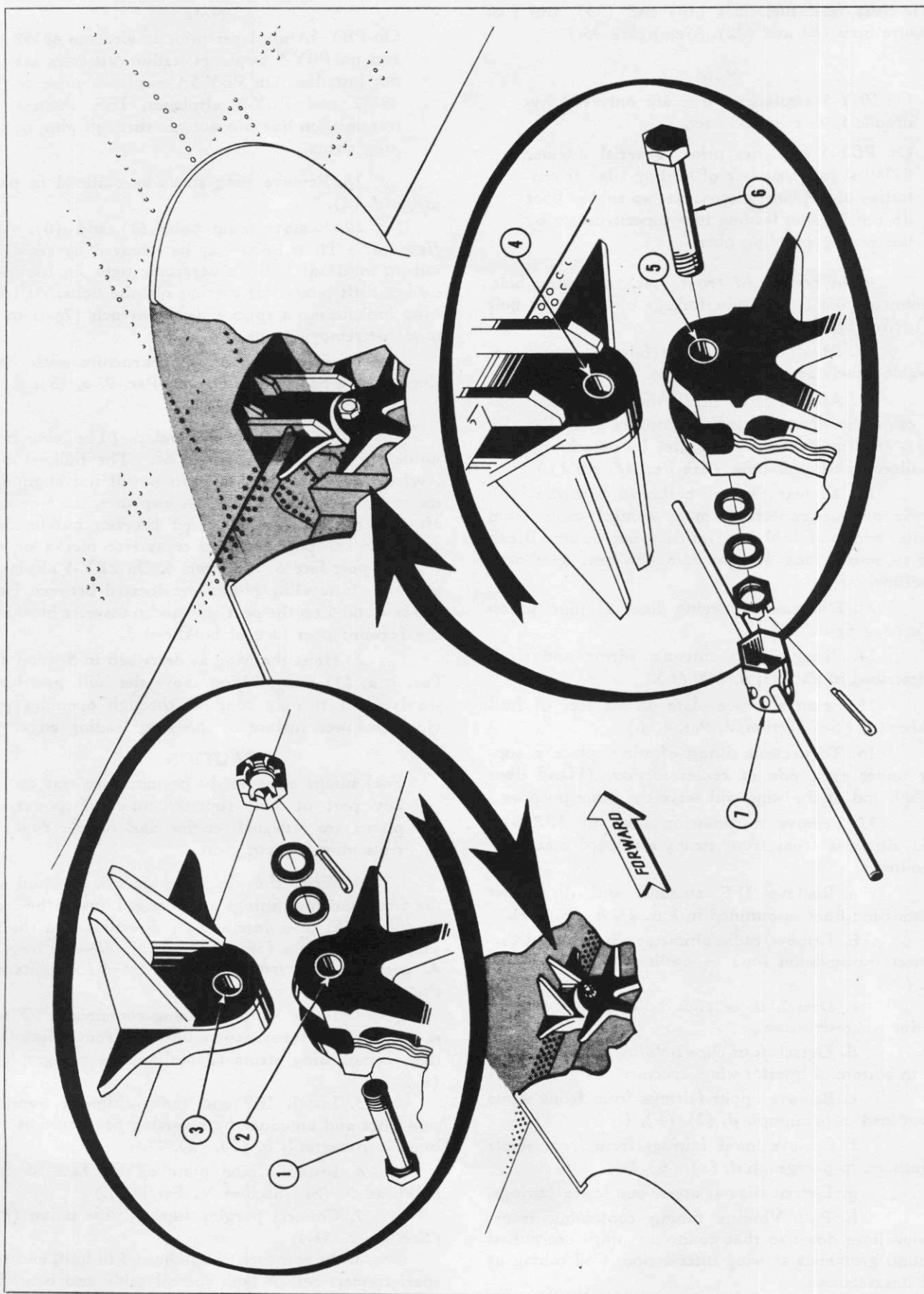


Figure 42—Wing to Hull Attachment

No.	PART No.	NAME	No.	PART No.	NAME
1	28W181	Bolt-Wing-Center Attaching Rear	5	Q636-32-28.5	Bushing-Wing-Bulkhead No. 4
	AN960-1416	Washer-Plain	6	28W182	Bolt-Wing-Center-Attaching Front
	Q7102-AL1416	Washer-Plain		AN960-1616	Washer-Plain
	AN320-14	Nut		Q7102-AL1616	Washer-Plain
	AN380-4-5	Cotter Pin		AN320-16	Nut
2	Q632-28-23	Bushing-Hull-Bulkhead No. 5		AN380-4-6	Cotter Pin
3	Q632-28-42	Bushing-Wing-Aft	7	28U1048	Wrench-Socket-Wing Attaching
4	Q632-28-44	Bushing-Wing-Front			

lowing reverse procedure to that described in paragraph a, (12).

9. At rear spar, connect the aileron tab control cables (see Par. 18, i, (3), (d)), and the aileron cables to the push-pull tube. (See Par. 18, e, (4).)

Note

Tighten all cable turnbuckles to give required tensions as outlined in Section IX, Table A. For safetying of turnbuckles, see paragraph 18, d, (4), (b), 6.

10. At bottom of front spar, near wing bolt, connect float torque tube linkage by inserting bolt (11). (See figure 92.)

Note

All control cables and piping are tagged when connections are broken. Fluid lines may be identified by colored bands on lines. (See Section IX, Table E.) A diagram is located on the inside of each junction box cover for hooking up wires.

11. String wires hanging from flex conduits (5), (15), (16) and (17) in superstructure through corresponding conduits hanging from leading edge to junction boxes (3), (4), (18), and (19) in leading edge. (See figure 45.) Connect all wires in junction boxes and connect conduits in superstructure.

12. At airplane center line connect the following control cables: propeller control cables (See Par. 11, c, (2), (d)); cowl flap control cables (See Par. 11, f, (2), (d)); engine throttle control cables (See Par. 11, b, (2), (d)); carburetor air control cables (See Par. 11, e, (2), (d)); bomb and torpedo release cables (See Section V, Par. 4, b, (3), (c), 4, a.); cables for arming fuse for MK 42 bomb rack. (See Section V, Par. 4, b, (3), (c), 4, b.)

Push dump valve control cable (3) through cut-out in lower surface leading edge skin, and connect to cable hanging loose from pulley (17). (See figure 151.) Connect mixture control cables at turnbuckles (26) in superstructure. (See figure 46.)

13. On PBY-5 airplanes prior to serial number 08349, a rubber boot de-icer system was installed. In these airplanes, attach Arens control to lever arm of distributing valve by means of clevis bolt.

14. Uncoil thermocouple wires in leading edge, carefully pull wire ends through opening in leading edge at airplane center line. Pass wires down through cut-outs on bulkhead 4 on port side of ship near the deck line. Connect engine thermocouple wires to engine temperature gages on engineer's instrument panel. Connect anti-icer thermocouple wires to wing anti-icer gage at port side of engineer's seat. Empty clips in this area are to be used to hold wires in place.

15. At lower surface of leading edge at airplane center line connect hydraulic lines (2), (3), (4), and (27); propeller anti-icer lines (12) and (16); manifold pressure lines (6), and (18); pitot lines (20) and (21); fuel vent lines (11) and (17); engine primer lines (13) and (15); oil pressure lines (7) and (19); fuel lines (9) and (24); fuel cross feed lines (23) and (10); and fuel pressure hoses (8) and (22). (See figure 46.)

Note

For compounds to be used on threads for making piping connections, see Section IX, Table F.

16. Install loop antenna by reversing procedure described in Par. 23, h, (4), (b).

17. Through access door to the fuel sump, located in center superstructure, connect fuel lines at twin fittings on sump. (See Par. 15, b, (3), (d).)

18. Install fuel sight gages as outlined in Par. 15, b, (10), (d).

19. Install wing outer panels as outlined in paragraph c, (2), (b).

20. Install radio sense antenna as outlined in Par. 23, h, (3), (d).

(c) MAINTENANCE.—If the interspar structure comprising the integral fuel tanks suffers damage, it is important that gas fumes be removed from the tank area before undertaking repairs. Adequate ventilation should be provided to eliminate any possibility of personnel being overcome by the fumes, and to preclude danger of fire. This caution is to be observed even though self-sealing fuel cells have been installed in the area to be repaired.

Provisions are made for preventing corrosion to the wing internal structure and equipment. Drain holes are placed in the lower surfaces of the leading,

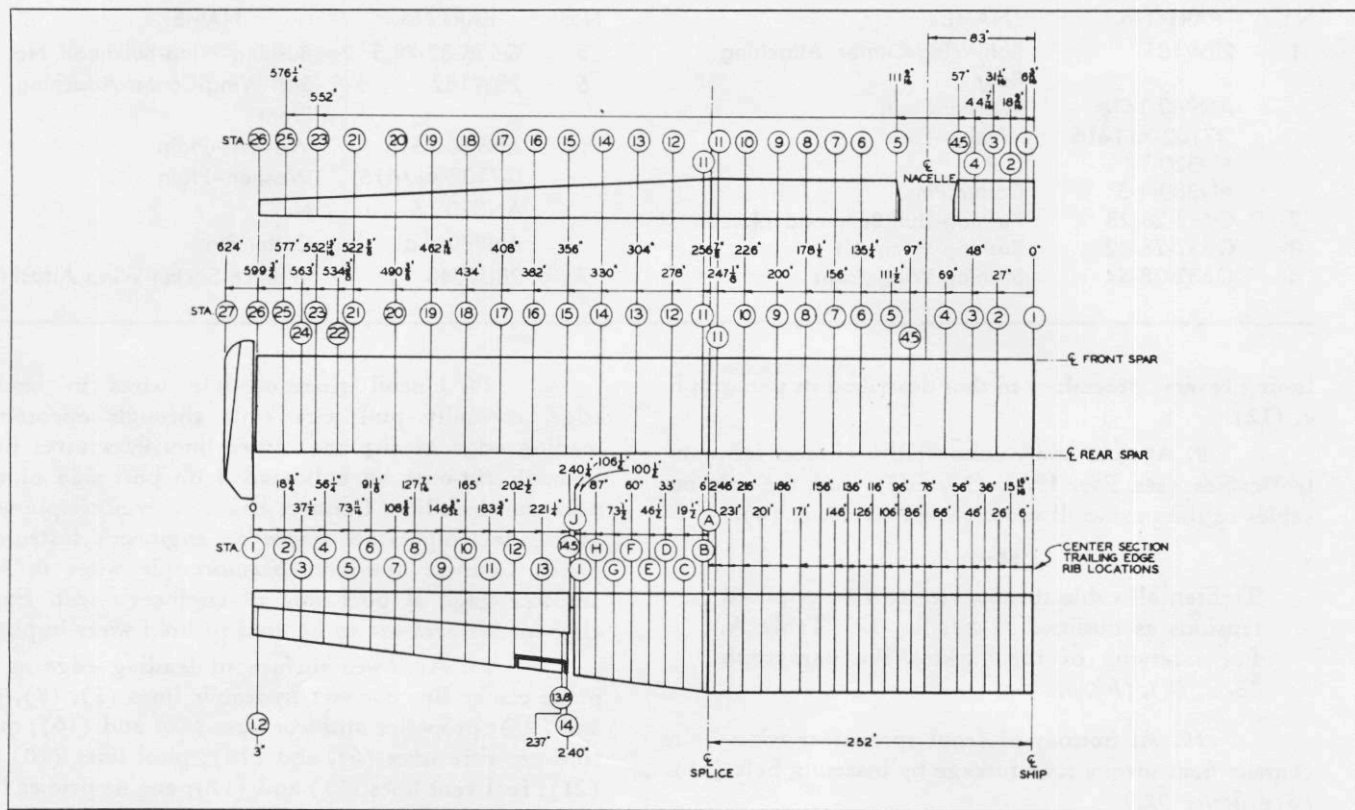


Figure 43—Wing Station Diagram

trailing edges and interspar structure. Keep the holes free of dirt and extraneous matter at all times. Rubber plugs are provided for the bomb and torpedo hoist slots in upper surface of wing, bomb release bell crank slots in lower surface of wing, torpedo hoists cable slots in lower surface of wing and work platform slots in wing leading edge.

The wing's structural strength lies primarily in the interspar structure, all failures in this section are to be repaired carefully in order to maintain original structural strength. Instructions for making repairs on the component parts of the wing are fully set forth in the Structural Repair Manual (An 01-5MA-3).

(3) CENTER SECTION LEADING EDGE (BETWEEN NACELLES).

(a) DESCRIPTION. (See figure 44.)—The leading edge is of all metal construction with aluminum alloy skin, aluminum alloy extruded zee stringers, and truss ribs. Contained in the leading edge are various functional installations such as, engine control cables, electrical wiring, junction boxes, fuel lines, hydraulic lines, various instrument lines, and other equipment. To gain access to these installations, door (2), (9), and (11) are located on the upper surface. Mounted on the upper surface at airplane center line is the loop antenna, and at the starboard side is the sense antenna mast. The leading edge is attached to the front spar and to the nacelles, with screws.

(b) REMOVAL.

1. To disconnect wires, conduits, control cables, etc., open access doors (2), (9), and (11); remove access doors (3) and (4) (See figure 64.) on both sides of forward superstructure fairing, and removable part of fairing as outlined in Par. 3, c, (2), (c). Open access doors (1), (7), (8), and (12) (See figure 44.) in nacelle cowl.

2. Disconnect the electrical system as follows: (if possible, two men should work together).

CAUTION

Before breaking any electrical connections, be sure that main battery switch on main distribution panel, forward face of bulkhead 4, is off.

Note

Wires may be identified by numbers taped on wires near terminals.

a. Remove cover of center wing junction box (3). (See figure 45.) Disconnect all wires in this box.

b. Remove cover to ignition junction box (4) and disconnect all wires.

c. Remove cover to D. C. power junction box (19) and disconnect all wires.

d. Remove cover to A. C. power junction box (18) and remove all wires.

e. Remove cover to LH engine terminal junction box (6). Disconnect all wires in this box.

f. Remove cover to RH engine terminal junction box (2). Disconnect all wires in this box.

g. Disconnect conduit (7) from outboard face of box (2) and (6) by unscrewing conduit coupling nut. Pull wires through opening in box allowing wires to hang from open end of conduit.

h. At outboard leading edge ribs on port and starboard side, disconnect conduits and flex conduits by removing conduit coupling nuts. Pull all wires through conduit couplings in ribs allowing wires to hang from open ends of conduits.

i. Disconnect flex conduits (5), (15), (16), and (17) in superstructure by unscrewing conduit coupling nuts. Pull wires to hang from open end of conduits in superstructure.

j. Remove loop antenna from leading edge

as described in Par. 23, h, (4), (b) and pull wires down into superstructure.

k. Disconnect antenna wire from top of sense antenna mast.

1. Coil all loose ends of wires and tape.

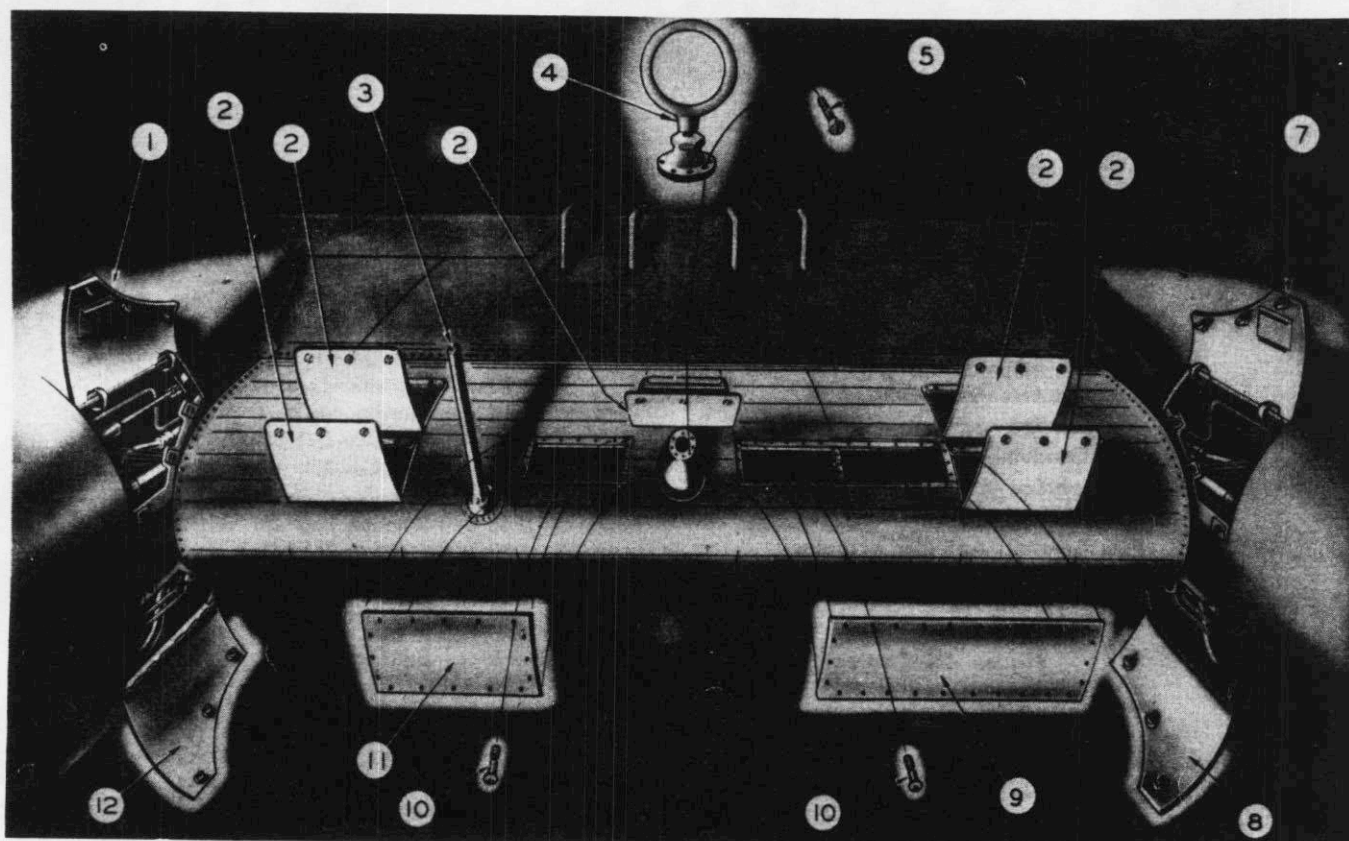
CAUTION

When breaking connections of control cables and piping, be sure to tag ends to insure proper connections at installation.

3. Break dump valve control cable at turn-buckle (5) in leading edge. (See figure 151.) Remove fairlead (4) and pull lower part of cable down into superstructure. Remove pulley (17) and pull upper cable back allowing it to hang free from spar.

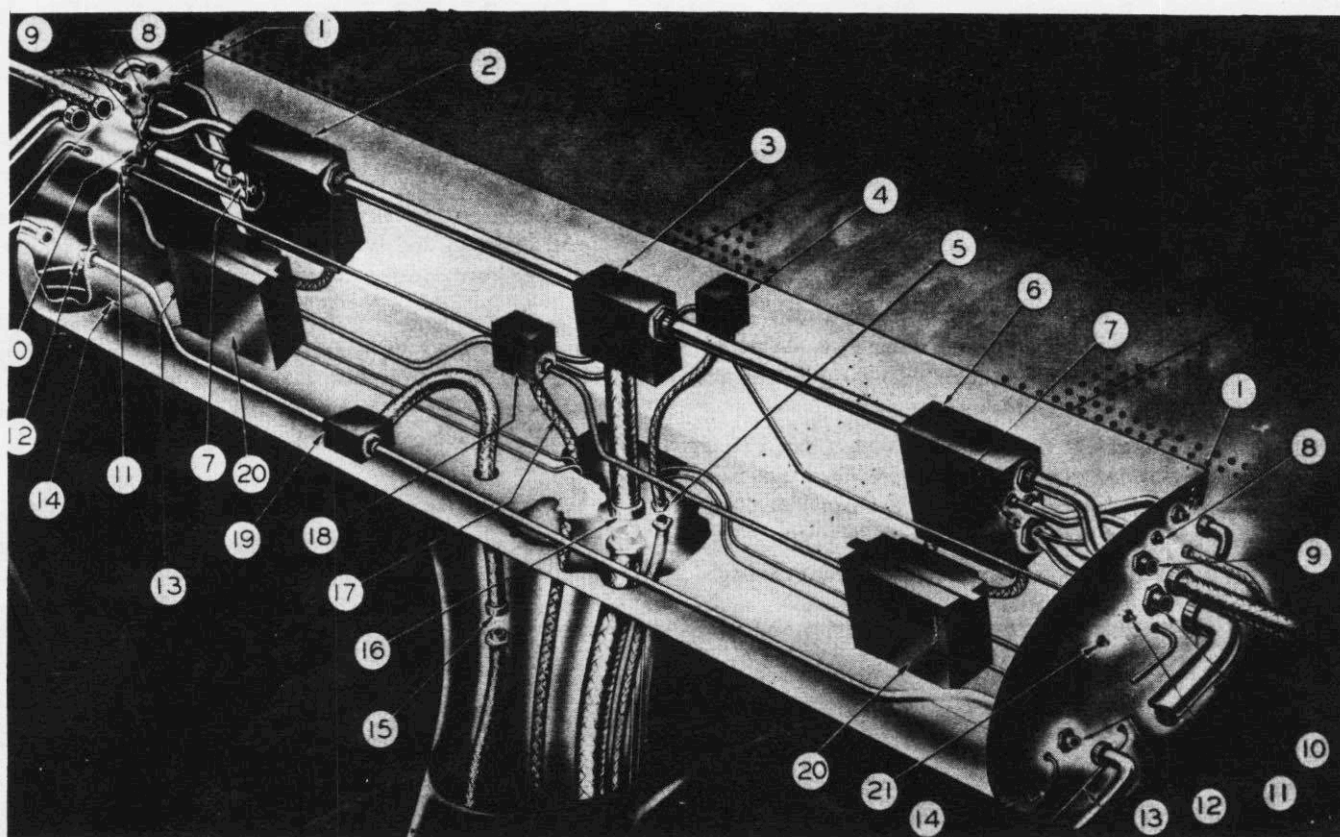
Note

On PBV-5 airplanes prior to serial number 08349, remove Arens control from distributing valve lever arm by detaching the clevis bolt.



No.	PART No.	NAME	No.	PART No.	NAME
1	28D2006-41	Nacelle Cowl Door Subassembly R.H. Inboard—Upper	8	28D2006-5	Nacelle Cowl Door Subassembly Rear Lower
2	28W173-6	Leading Edge Access Door	9	28W3017-60	Leading Edge Access Door
3	28F7096	Sense Antenna Mast	10	Q5103-3	Screw
4	CRR50053	DW-1 Loop Antenna	11	28W5010	Leading Edge Access Door
5	AN510-D10-12	Screw	12	28D2006-4	Nacelle Cowl Door Subassembly L.H. Inboard—Upper
7	28D2006-3	Nacelle Cowl Door Subassembly			Rear Lower

Figure 44—Center Section Leading Edge Access Doors



No.	NAME	No.	NAME
1	Conduit—Fast Feathering	11	Conduit—Ignition
2	Junction Box—R. H. Engine Terminal	12	Conduit—D. C. Power
3	Junction Box—Main Battery	13	Thermocouple—Anti-Icer
4	Junction Box—Ignition	14	Thermocouple—Engine
5	Flex Conduit—Ignition	15	Flex Conduit—D. C. Power
6	Junction Box—L. H. Engine Terminal	16	Flex Conduit—Main Harness
7	Conduit—Liquidometer	17	Flex Conduit—A. C. Power
8	Flex Conduit—Anti-Icer Actuator	18	Junction Box—A. C. Power
9	Flex Conduit—Outer Wing	19	Junction Box—D. C. Power
10	Conduit—General	20	Main Batteries
		21	Flex Conduit—A. C. Power

Figure 45—Center Section Leading Edge Electrical Equipment

4. Break mixture control cables at turn-buckles (1) outboard of leading edge ribs and at turn-buckles (26) in superstructure. (See figure 46.)

5. Check to see that main fuel shut off valve in superstructure is in "OFF" position, and drain lines as described in Par. 15, b, (3), (b). At fittings where hydraulic line goes through the deck skin between hull stations 3.66 and 4.0, break lines, drain, and re-connect.

6. On outboard side of leading edge ribs, on port and starboard side and at center line of ship on lower side of leading edge, make the following tubing disconnections: (See figure 46.)

a. By unscrewing bulkhead coupling, nuts disconnect hydraulic lines (2), (3), (4), and (27);

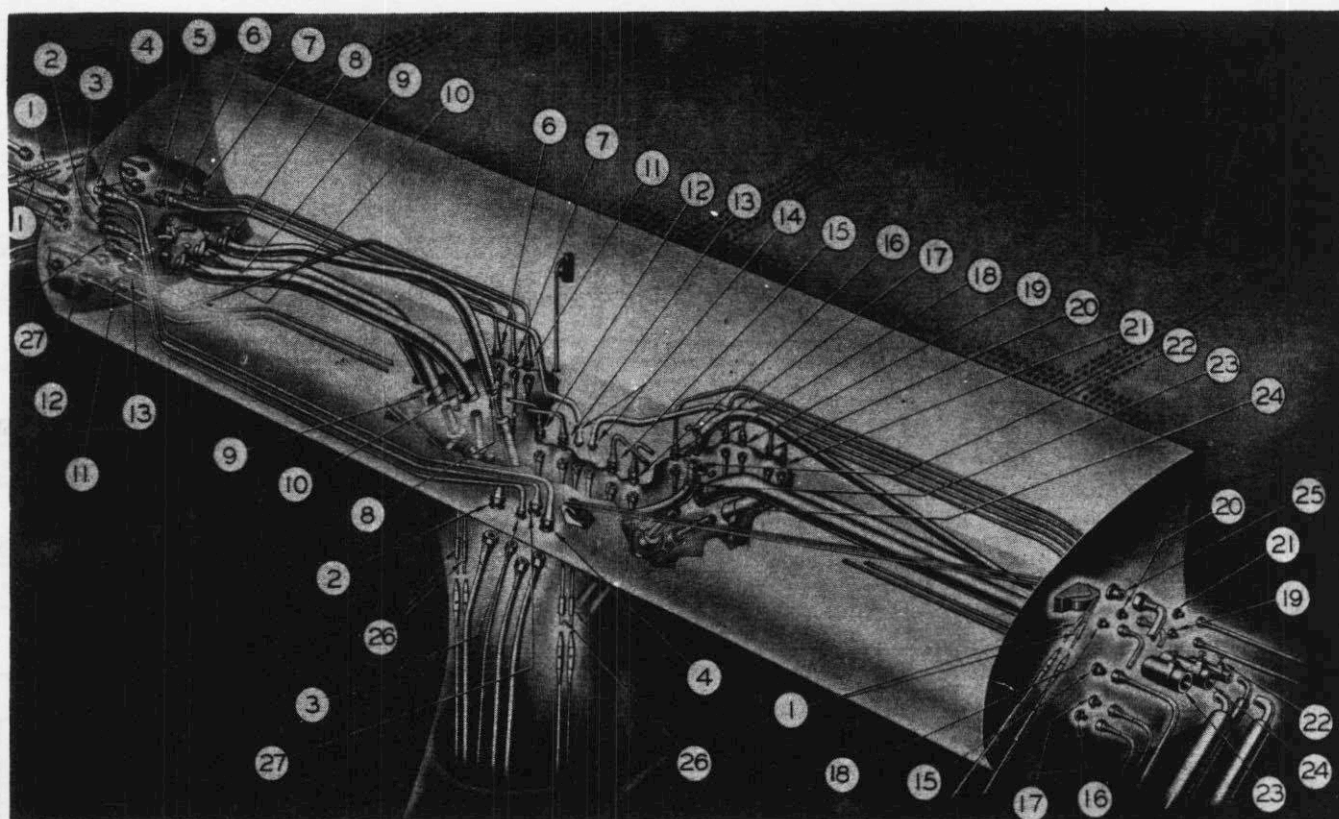
vacuum lines (5), (14), and (25); anti-icer lines (12) and (16); manifold pressure lines (6) and (18); pitot lines (20) and (21); fuel vent lines (11) and (17); engine primer lines (13) and (15); oil pressure lines (7) and (19).

Notes

On PBX-5 airplanes there are only two hydraulic lines.

On PBX-5 airplanes prior to serial number 08349, disconnect de-icer air lines by breaking connections below leading edge at center line of airplane and outboard of leading edge ribs on port and starboard sides.

b. Disconnect main fuel lines (9) and (24), cross feed fuel lines (10) and (23), and fuel pressure



No.	NAME	No.	NAME
1	Outboard Turnbuckle—Mixture Control Cables	15	Engine Primer Line (LH)
2	Hydraulic Line (RH)	16	Anti-Icer Line (LH)
3	Hydraulic Line (RH)	17	Fuel Vent Line (LH)
4	Hydraulic Line (RH)	18	Manifold Pressure Line (LH)
5	Vacuum Line (RH)	19	Oil Pressure Line (LH)
6	Manifold Pressure Line (RH)	20	Pitot Pressure Line
7	Oil Pressure Line (RH)	21	Pitot Static Line
8	Fuel Pressure Line (RH)	22	Fuel Pressure Line (LH)
9	Main Fuel Line (RH)	23	Cross Feed Fuel Line (LH)
10	Cross Feed Fuel Line (RH)	24	Main Fuel Line (LH)
11	Fuel Vent Line (RH)	25	Vacuum Line (LH)
12	Anti-Icer Line (RH)	26	Center Turnbuckles—Mixture Control Cables
13	Engine Primer Line (RH)	27	Hydraulic Line
14	Vacuum Lines—Center		

Figure 46—Center Section Leading Edge—Tubing and Cables.

lines (8) and (22) by breaking connections below leading edge at center line of airplane, and outboard of leading edge ribs on port and starboard sides.

Note

Tape ends of tubing after breaking connections to prevent dirt from getting into lines.

7. Disconnect anti-icer thermocouple wires (13) from anti-icer duct at outboard side of each nacelle, and from wing anti-icer gage at port side of engineer's seat. Disconnect engine thermocouple wires (14) at each nacelle firewall, and from engine temperature gages on engineer's instrument panel. Tape wire

ends and carefully pull them into the wing leading edge and coil. (See Par. 22, s, (3).)

8. Disconnect tubing bonding braid outboard of leading edge ribs on port and starboard sides.

9. At inboard side of each nacelle, remove screws (1) and (2) and remove flange assembly (3). (See figure 48.)

10. Remove all screws and bolts attaching leading edge to front spar except two or three screws on upper side to hold leading edge in place. At inboard side of each nacelle remove screws. (See figure 47.)

11. For removal of center leading edge, to

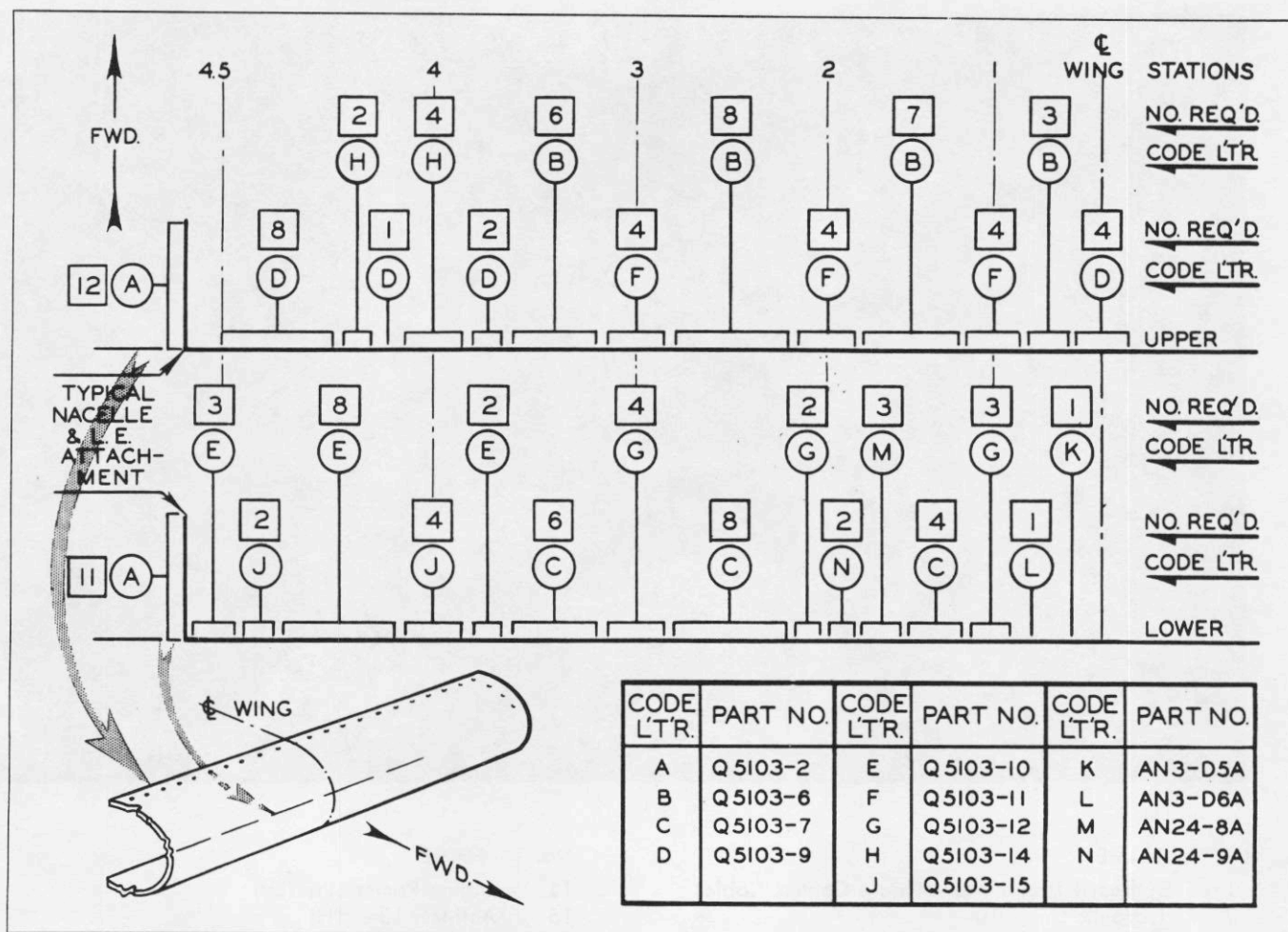


Figure 47—Center Section Leading Edge Screw Diagram

prevent damage in handling, at least four men are required. Three men should hold the leading edge while the fourth man removes the remaining screws.

(c) INSTALLATION.

1. Apply a coat of zinc chromate paste to the faces of the upper and lower attaching bars where they will contact surfaces of the front spar flanges.

2. Place leading edge in position on wing between nacelles.

3. Install leading edge attaching screws and bolts at front spar, and screws at inboard side of nacelle shown on figure 47.

4. Install nacelle flange assembly (3) at inboard side of each nacelle by putting parts into place and securing with five screws (1). Install screws (2) attaching flange assembly to leading edge. (See figure 48.)

Notes

1. Every control cable and each piece of tubing is tagged when connections are broken.
2. Fluid lines may be identified by colored

bands on lines. (See Section IX, Table E.)

3. Tighten at all turnbuckles to give required tensions as outlined in Section IX, Table A. For safetying of turnbuckle, see paragraph 18, d, (4), (b), 6.
4. All wires are taped with a number for identification.
5. A diagram is located on the inside of each junction box for hooking up wires.

5. Push dump valve control cable (3) through cut-out in lower surface leading edge skin. Thread cable (6) through pulley bracket (18), install pulley (17), and connect cable at turnbuckles (5). Install fair-lead (4). (See figure 151.)

Note

On PBY-5 airplanes prior to serial number 08349, attach Arens control to distributing valve lever arm by means of the clevis bolt.

6. Connect mixture control cables in superstructure at turnbuckles (26) and on inboard side of

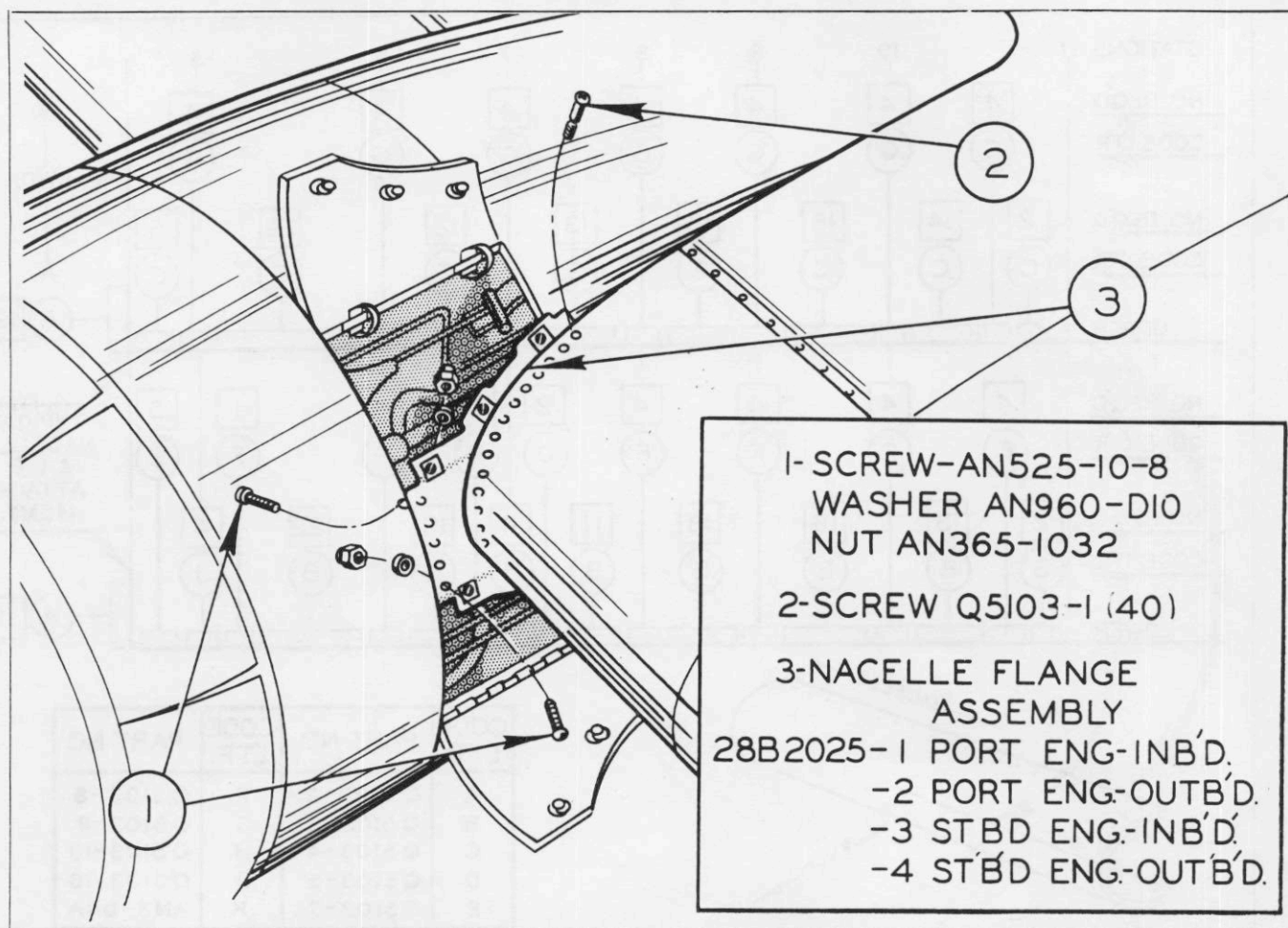


Figure 48—Screw Diagram—Leading Edge—Nacelle Flange Assembly

each nacelle aft of firewall at turnbuckles (1). (See figure 46.)

7. String wires hanging from flex conduits (5), (15), (16), and (17) in superstructure through corresponding conduits hanging from leading edge to junction boxes (4), (19), (18), and (3) in leading edge. (See figure 45.) Connect all wires in junction boxes and connect conduits in superstructure.

8. String wires hanging from conduits at nacelles through the corresponding conduits which lead inboard. Connect all wires in junction boxes (2), (3), (4), (6), (18), and (19). Connect all conduits at coupling fittings.

9. Uncoil anti-icer and engine temperature thermocouple wires in leading edge, and thread through cut-outs in leading edge ribs. Connect anti-icer wires at anti-icer ducts on outboard side of each nacelle. Connect engine thermocouple wires at each nacelle firewall. Connect ends of thermocouple wires at mechanic's station as described in paragraph b, (2), (b), 14.

Note

For compounds used on pipe threads, see Section IX, Table F.

10. At lower surface at airplane center line and at leading edge ribs adjacent to nacelles, connect hydraulic lines (2), (3), (4), and (27); propeller anti-icer lines (12) and (16); manifold pressure lines (6) and (18); pitot lines (20) and (21); fuel vent lines (11) and (17); engine primer lines (13) and (15); oil pressure lines (7) and (19); main fuel lines (9) and (24); cross feed fuel lines (10) and (23); fuel pressure lines (8) and (22) and vacuum lines (5), (14) and (25). (See figure 46.)

Note

On PBY-5 airplanes prior to serial number 08349, connect rubber boot de-icer line below leading edge at center line of airplane and outboard of leading edge ribs on port and starboard sides.

11. Connect bonding braid at tubing outboard of leading edge ribs at port and starboard sides.

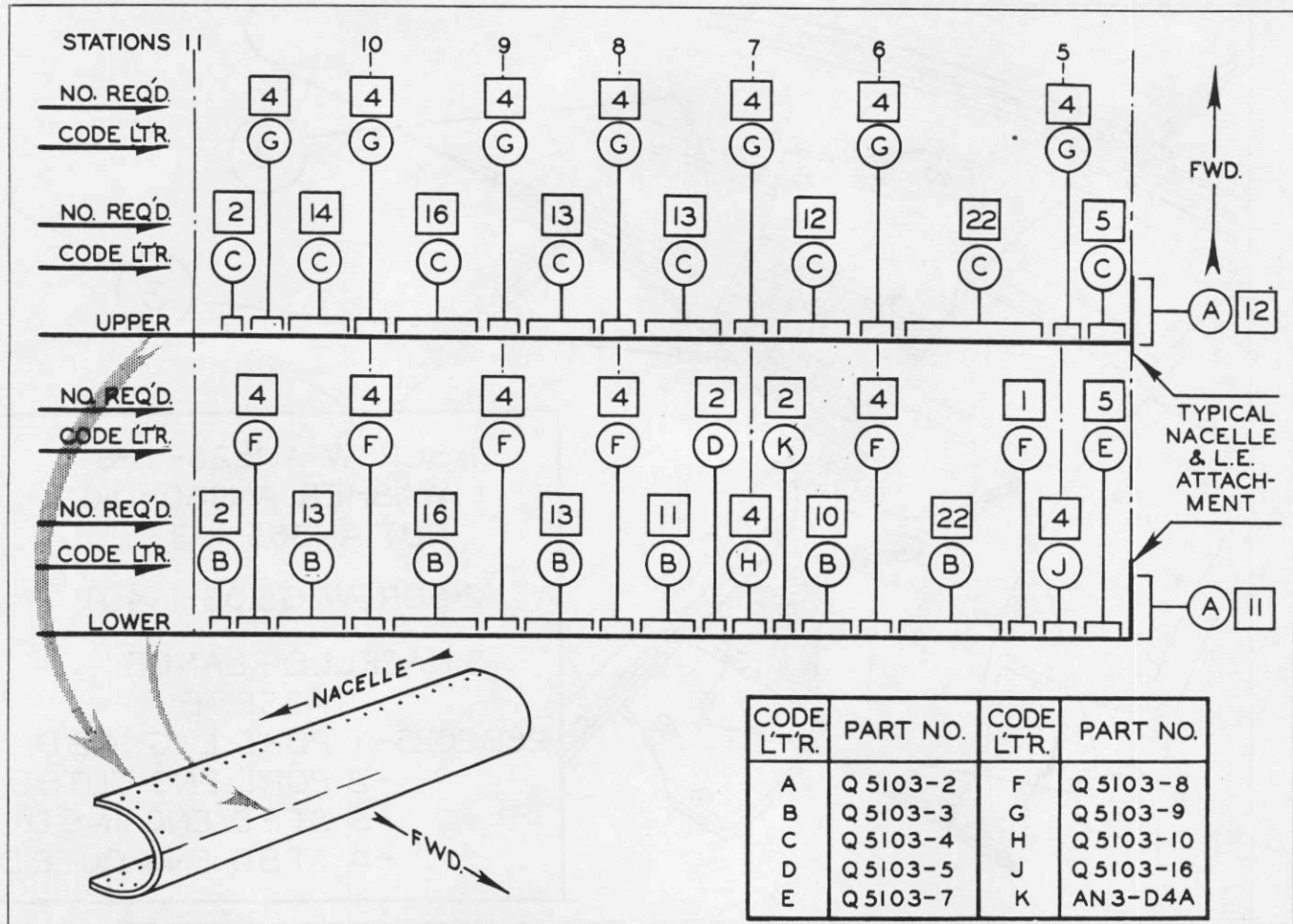


Figure 49—Screw Diagram—Center Section Leading Edge—Outer

12. Install and connect loop antenna as outlined in Par. 23, h, (4), (d).

13. Connect antenna wire to top of sense antenna mast.

(4) OUTER LEADING EDGE (CENTER SECTION).

(*) DESCRIPTION.—The leading edge is of all metal construction with aluminum alloy skin, aluminum alloy extruded zee stringers, and truss type ribs. This assembly is attached to the front spar of the wing extending from the outboard side of the nacelle to the panel splice. Enclosed in the leading edge is a heat anti-icing duct on port and starboard side, a landing light on each side, and a pitot-static mast on port side only. There are five access doors located on the upper surface and three access doors in the lower surface to provide access to equipment. (See figure 20.)

(b) REMOVAL.

1. Through outboard nacelle doors (1) and (2) (See figure 50.) break the following connections:

a. Disconnect anti-icer duct by removing screws (16).

b. At actuator motor disconnect flex conduit (18) and pull out plug.

c. Disconnect anti-icer exit door actuator arm by removing bolt (17).

d. Break capillary tube to duct connection by removing screws (13).

e. Disconnect pitot lines (15) at inboard leading edge rib on port side by unscrewing coupling nuts.

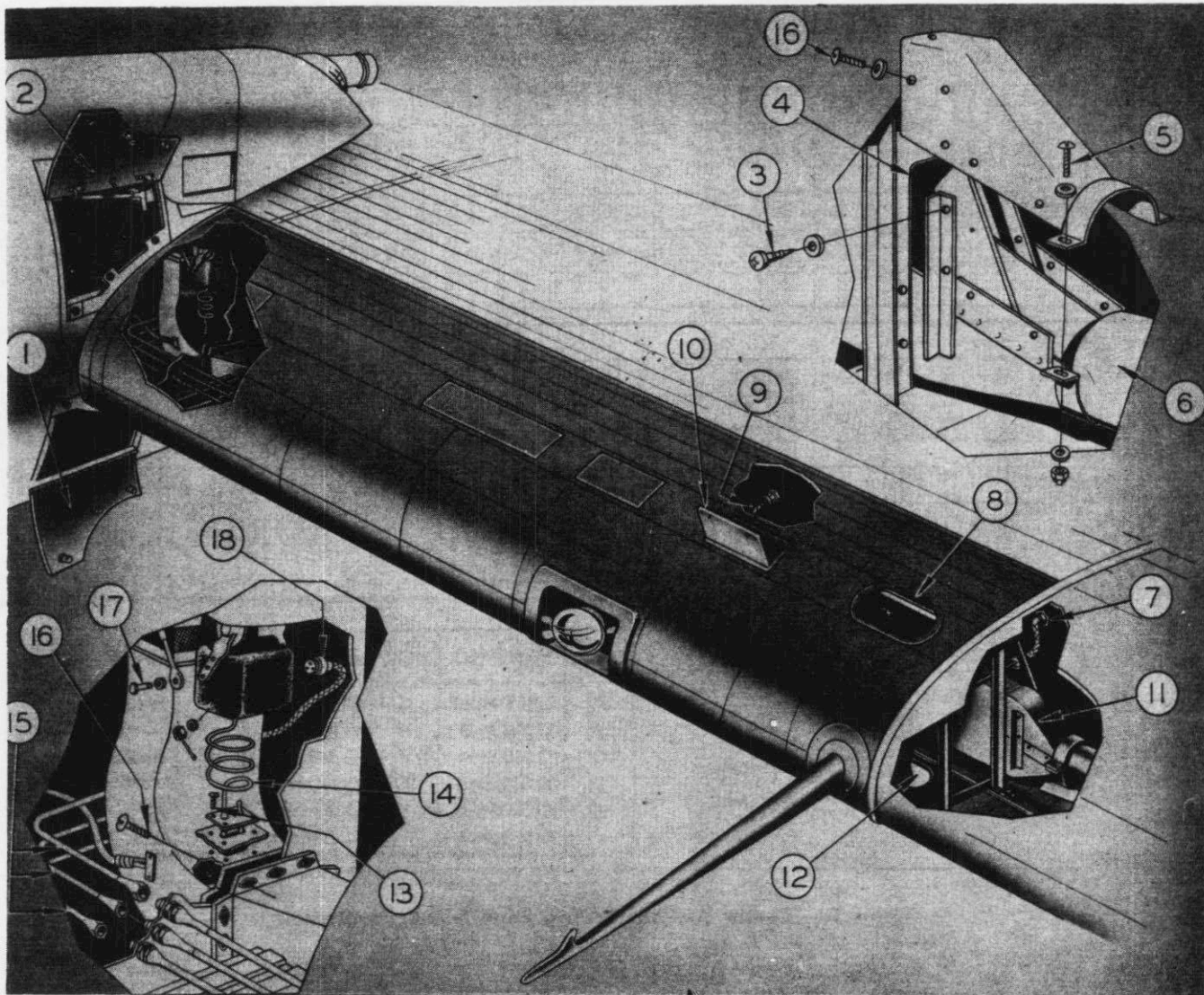
Note

PBY-5 airplanes prior to serial number 08349 contained no heat anti-icing ducting. On these airplanes, break the four de-icer hose connections outboard of each nacelle and three tube de-icer connections at each panel splice by unscrewing coupling nuts.

2. Through leading edge access doors (6), (57), and (58) (See figure 20.) remove heat anti-icer transition duct as follows: (See figure 50.)

a. Remove screws (5) disconnecting transition duct (11) from duct (6).

b. Disconnect transition duct from inboard side by removing screws (16).



No.	PART No.	NAME	NO.	PART NO.	NAME
1	28D2006-4(LH) 28D2006-5(RH)	Nacelle Door—Lower Outboard	10		Access Door
2	28D2006-31(LH) 28D2006-41(RH)	Nacelle Door—Upper Outboard	11	28F6750	Anti-Icing Transition Duct
3	AC530-10-8	Screw	12	28W016-11	Access Door
	Q7103-A10	Washer	13	AN515-D6-8	Screw
4	28F6733	Duct Installation—Center Section Leading Edge		AC372-D632	Nut
5	AN526DD1032-8	Screw	14		Capillary Tube
	AC372-D1032	Nut	15		Pitot Lines
6	28F6736	Duct Installation—Outer Panel Leading Edge	16	AN526-D1032-8	Screw
7		Pitot Heater Flex Conduit	17	AN3-5	Bolt
8	28W016-11	Access Door		AN320-3	Nut
9		Landing Light Flex Conduit		AN380-2-2	Cotter
				AN960-AL10L	Washer
				Q810-D6-10	Spacer
			18		Actuator Motor Flex Conduit

Figure 50—Center Section Leading Edge—Outer

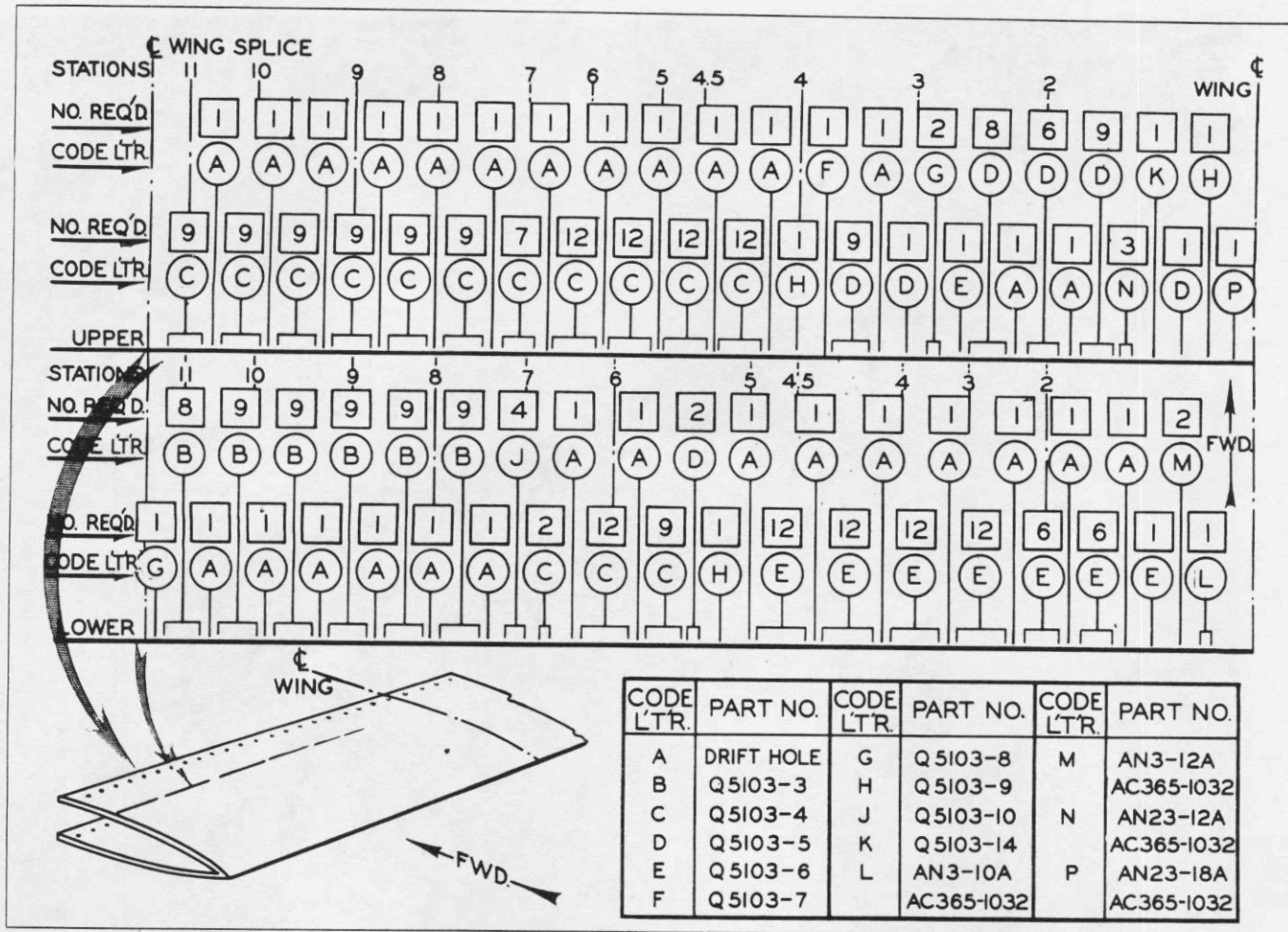


Figure 51—Center Section Trailing Edge Screw Diagram

c. Remove screws (3), split transition duct (11) in half and remove.

3. Remove splice fairing as outlined in paragraph c, (2), (a), 4, a.

4. Remove leading edge bolts (1) and (9) at panel splice. (See figure 55.)

5. Enter wing through manhole (22) (See figure 20.) and break the following connections:

Note

Wires may be identified by numbers taped on wires near terminals.

a. On port side only, remove cover to junction box mounted on upper surface of wing between stations 10 and 11, and disconnect pitot heater wires 869 and 1149.

Note

On PBV-5 airplanes, only one wire (869) leads to the pitot tube.

b. Remove cover to bomb bay junction box located on the lower surface between station 9.0 and

10.0, and disconnect landing light wires 294 and 296 on port side, and wires 374 and 376 on starboard side.

6. Through access door (8) (See figure 50.) on port side, disconnect pitot heater flex conduit (7) at front spar, and pull wires through spar leading edge.

7. Through access door (10) disconnect landing light flex conduit (9) at front spar, and pull wires through spar into leading edge.

8. Remove outboard nacelle flange assembly. At outboard side of each nacelle, remove screws (1), and (2), and remove flange assembly (3). (See figure 48.)

9. Remove screws (5) and (6) at upper front strut fairing, and slip fairing down strut. (See figure 59.)

CAUTION

Pitot-static mast must be well protected by a wooden fixture before removing leading edge.

10. Remove all screws attaching leading edge to front spar and nacelles, except two or three screws on upper side to hold leading edge in place until removal of leading edge is desired. (See figure 49.)

(c) INSTALLATION.

1. Apply a coat of zinc chromate paste to the faces of the upper and lower attaching bars where they will contact surfaces of the front spar flanges.

2. Put leading edge into place and install screws attaching leading edge to front spar and nacelles. (See figure 49.)

3. At leading edge panel splice, install bolts (1) and (9). (See figure 55.)

4. Put outboard flange assembly into place, and install screws (1) and (2). (See figure 48.)

Note

All wires are taped with a number for identification. A diagram is located on the inside of each junction box cover to show how the wires are to be hooked up.

5. The connection of the wires to the pitot-static heater, which is located on the port side of the airplane, can be more easily performed as a two man operation. By means of manhole (22), one man should be stationed within the wing at the junction box mounted on upper surface between stations 10.0 and 11.0; the other man should be stationed on the wing upper surface at leading edge access door (58). (See figure 20.) Connect wires as follows: Through leading edge access door, uncoil wires and push through conduit fitting on front spar; from inside of wing, pull wires into the junction box, and connect wires at terminals; on forward side of spar, connect flex conduit to conduit fitting.

Note

On PBY-5 airplanes, only one heater wire is connected to the pitot tube.

6. The connection of the wires to the landing lights can be more easily performed as a two man operation. By means of manhole (22), one man should be stationed within the wing at bomb bay junction box mounted on lower surface of wing between stations 9.0 and 10.0; the second man should be stationed on the wing at leading edge access door (59). Connect wires as follows: Through leading edge access door, uncoil wires and push through conduit fitting on front spar; from inside of wing pull wires into junction box; connect wires at terminals in junction box; on forward side of front spar, connect flex conduit fitting.

7. Install anti-icer transition duct (11), (See figure 50.) working through access doors (6), (57) and (58). (See figure 20.) as follows:

Note

On PBY-5 airplanes prior to serial number 08349, rubber boot de-icing was installed instead of heat anti-icing. On these airplanes, connect the three tube de-icer lines at each wing outer panel splice and the four de-icer hose lines outboard of each nacelle by means of coupling nuts.

a. Insert bottom half of transition duct into leading edge through access door (6), and place in position with the inboard end of transition duct inside of duct (4). (See figure 50.)

b. Insert top half of transition duct in leading edge through access door (6) (See figure 20.), and place in position with inboard end inside of duct (4) (See figure 50.) so that screw holes line up with corresponding screw holes in bottom half of duct.

c. Install screws (3), and (6).

d. Install screws (5) attaching transition duct to outboard duct (6).

8. Through outboard nacelle doors (1) and (2) make the following connections:

a. Connect anti-icer duct in leading edge to duct in nacelle by installing screws (16). (See figure 50.)

b. Place anti-icer exit door actuator arm in position and connect to actuator motor by installing bolt (17).

c. Plug in wires at back side of actuator motor and connect flex conduit (18).

d. Place capillary tube from actuator motor in position on anti-icer duct and install screws (13).

e. On port side, connect pitot lines (15) at inboard leading edge rib by connecting coupling nuts.

9. Place upper front strut fairing in position and install screws (5), and (6). (See figure 59.)

10. Install panel splice fairing as outlined in paragraph c, (2), (b), 6.

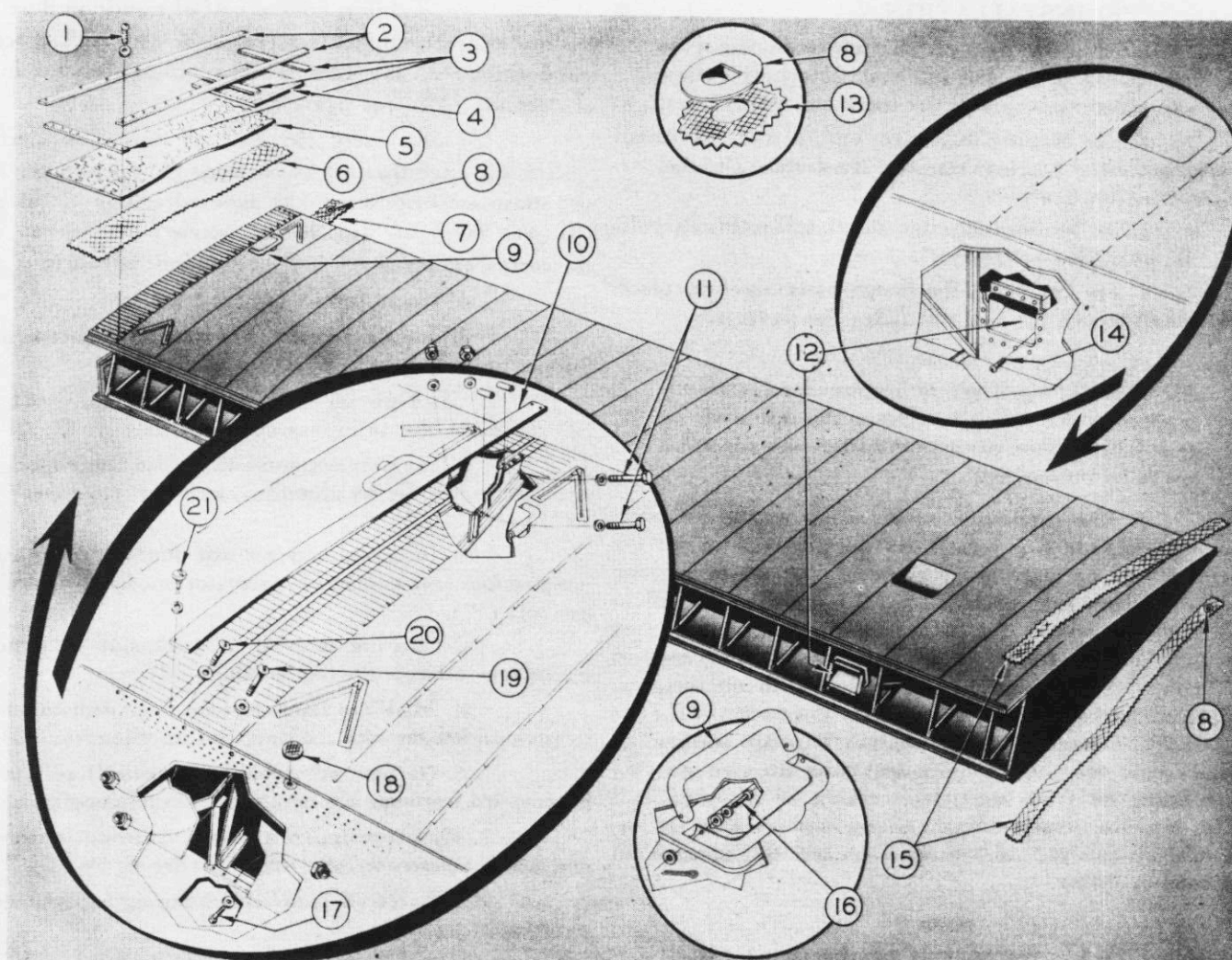
(5) CENTER SECTION TRAILING EDGE.
(See figure 52.)

(a) DESCRIPTION.—The center section trailing edge is composed of a left and right-hand assembly, joined at the center line of the airplane. Each assembly is a fabric-covered framework of aluminum alloy truss ribs, formed trailing edge section, and extruded aluminum alloy tapping strips for attachment to the rear spar flanges. Access to the interior in installed position is made through three access laps in the fabric. At the center line of the airplane, the upper surface is braced to provide a 13 inch wide walkway from rear spar aft to the trailing edge. Retractable handgrips are installed at each side of this walkway.

(b) REMOVAL.

1. Remove superstructure aft fairing. Use procedure of Par. 3, c, (2).

2. Withdraw screws (1) and remove walkway molding strips (2) and (3). (See figure 52.) Pull off matting (4) and corkprene (5) and the 5½ inch wide fabric tape doped to upper surface. Withdraw the two self-tapping screws (21) from each end of metal gap plate (10) and remove plate. From the lower surface center line, strip the 3½ inch wide fabric gap tape (7).



No.	PART No.	NAME
1	AN515-6-10	Screw
	Q7102-AL6	Washer
2	28W005-150	Molding Strip
3	28W005-170	Molding Strip
4	28W005-153	Rubber Matting
5	28W005-152	Corkprene Matting
6	28W3005-114	Gap Tape
7	28W3005-116	Gap Tape
8	NAF1093-4	Grommet
9	28W1072	Handgrip
10	28W3005-115	Gap Cover
11	AN3-12A	Bolt
	AN365-1032	Nut
	AN960-A10	Washer
	Q612-D7-32	Spacer
12	28F6798	Anti-Icer Exhaust Duct
13	28W011-29	Fabric Patch
14	AN526-D1032-10	Screw
15	28W4001-2	Gap Tape

No.	PART No.	NAME
16	AN393-41	Pin
	AN380-2-2	Cotter
	Q610-D6-1	Spacer
	Q610-D6-5	Spacer
	Q608-D3-3	Spacer
17	AN3-12A	Bolt
	AN365-1032	Nut
	AN960-A10	Washer
	Q7102-AL10	Washer
18		½ inch diameter fabric patch
19	AN23-12A	Bolt
	Q7102-AL10	Washer
	AN365-1032	Nut
20	AN23-18A	Bolt
	Q7102-AL10	Washer
	AN365-1032	Nut
21	Q5033A-6-4	Self Tapping Screw

Figure 52—Center Section Trailing Edge

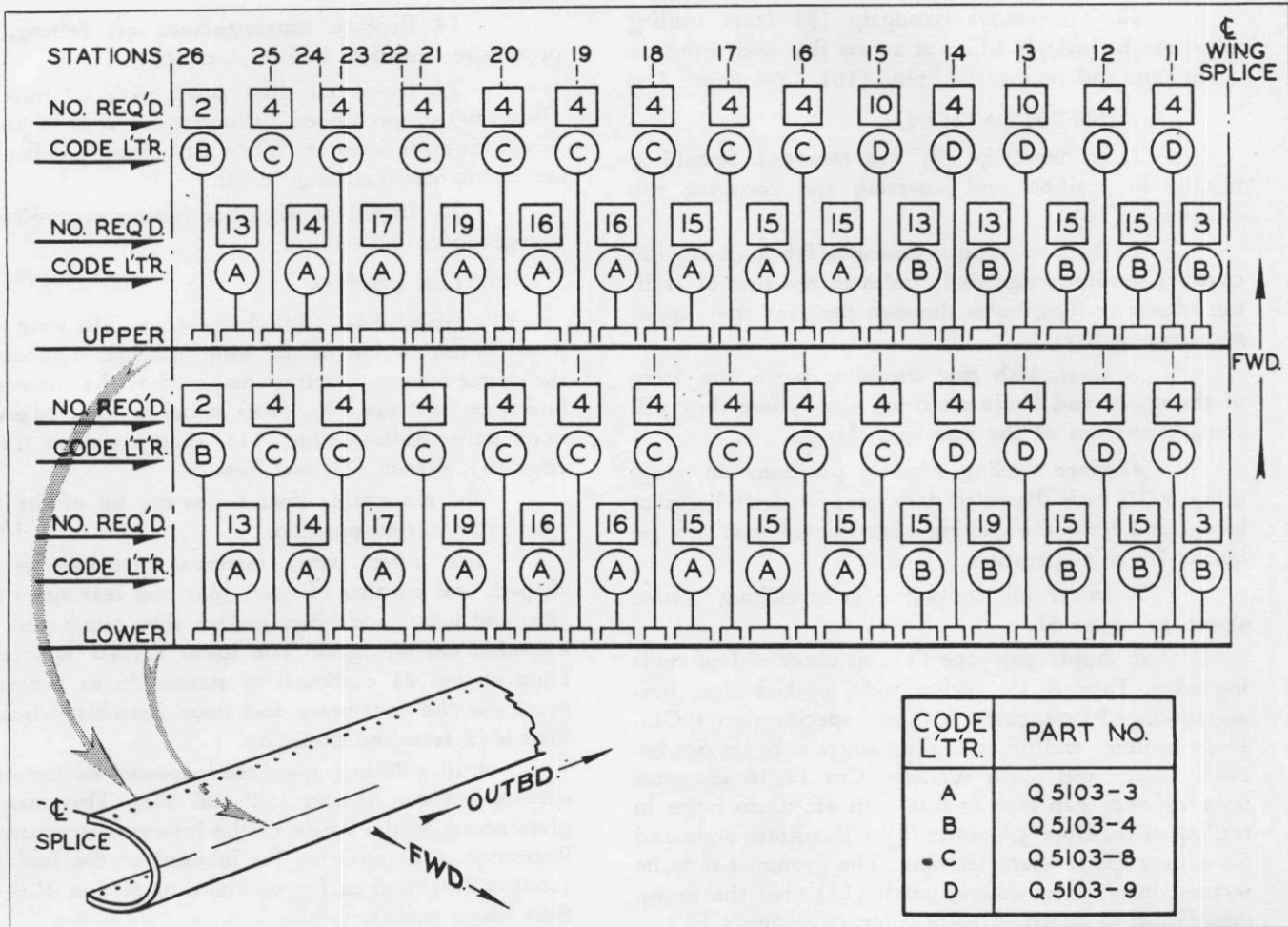


Figure 53—Outer Panel Leading Edge Screw Diagram

Note

Save the grommet (8) on gap tape for re-application on assembly.

3. Through adjacent access flap in the upper surface near the center line, remove two bolts (11) attaching left hand and right trailing edges together at aft end.

Note

Care should be taken that spacers are not lost when removing bolts (11).

4. Remove three bolts (17). Procedure: Man on upper surface of wing uses $\frac{3}{8}$ inch socket ratchet wrench, while man below wing reaches inside aft superstructure to hold bolt with $\frac{3}{8}$ inch open-end wrench.

5. Remove two clevis bolts (19), (20), by reaching through adjacent access flap to hold $\frac{3}{8}$ inch open-end wrench on nuts, and unscrewing bolt from upper surface.

6. Remove fuel dump pipe from wing lower surface. For procedure, see Par. 15, c, (2), (a).

7. Enter wing through upper surface access

door (22). (See figure 20.) and, at rear spar, remove fourteen screws (14) freeing anti-icing exhaust duct (12) from rear spar web. (See figure 52.)

Note

Heat anti-icing ducting was not installed on PBV-5 airplanes prior to serial number 08349.

8. At upper end of rear strut remove screws (8) and (9). (See figure 59.) Sliding fairing (11) down the strut.

9. Remove panel splice fairing and fairing end cap in accordance with paragraph c, (2), (a), 4, a.

10. At outer end of trailing edge, pull off gap tape (15) from upper and lower surfaces where it covers crevice between center section and outer panel trailing edges.

Note

Save the grommet (8) on gap tape for reapplication on assembly.

11. Make provision to support trailing edge, then remove all attaching screws shown in figure 51.

12. To remove handgrip (9) from trailing edge, reach through adjacent access flap and withdraw cotter pins and remove two pins (16). (See figure 52.)

(c) INSTALLATION.

1. If handgrip (9) was removed, install by placing in position and inserting and cottering two clevis pins (16).

2. Remove 1/2 inch diameter fabric discs (18) covering trailing edge drift holes in the line of trailing edge attaching holes through the rear spar upper and lower flange.

3. Coat, with zinc chromate paste, the faces of the upper and lower attaching bars where they will contact surfaces of the rear spar flanges.

4. Place trailing edge in positions on wing, using 3/16 inch diameter drift pins in drift holes to locate and hold the trailing edge. Three men are required for this operation.

5. Insert all trailing edge attaching screws shown in figure 51.

6. Apply gap tape (15) at outer end of trailing edge. Tape is 3 3/4 inches wide, pinked-edge, preacetate-doped tape, grade A fabric, specification 49C13. Dope to inner and outer trailing edges over crevice between upper and lower surfaces. Cut 11/16 diameter hole in lower gap tape in line with aft drain holes in trailing edge. Dope grommet (8) with nitrate dope and place over 11/16 diameter hole. The grommet is to be secured in place by doping patch (13) over the grommet. Finish to match adjacent color. (See figure 52.)

7. Perform, in reverse order, removal steps of paragraphs b, (5), (b), 3 through b, (5), (b), 8.

8. Place metal gap cover (10) in position and secure with two self-tapping screws (21) at each end. (See figure 52.)

9. Dope fabric tape (16) over the gap cover on upper surface.

10. Dope 3 3/4 inch wide, pinked-edge, pre-nitrate-doped tape (7) over gap on lower surface.

11. Cut 11/16 diameter hole in lower gap tape in line with aft drain holes in trailing edge. Dope grommet (8) with nitrate dope and place over 11/16 diameter hole. The grommet is to be secured in place by doping patch (13) over the grommet.

12. Cement corkprene walkway (5) to upper surface at center line, using following procedure:

a. Apply to wing one coat of Vulcalock cement, then one coat of Minnesota Mining Co. cement EC-3L.

b. Apply to corkprene walkway two coats of Minnesota Mining Co. cement EC-31.

c. When cement is tacky, smooth walkway onto prepared surface of trailing edge.

13. Place walkway molding strips (2) and (3) in position and insert hold-down screws (1).

14. Replace superstructure aft fairing. Use procedure described in Par. 3, c, (4).

15. Cover all drift holes with 1/2 inch dia. discs (18) of pre-doped balloon cloth applied to surface with clear lacquer. When dry, finish patches with lacquer to match adjacent color.

16. Install panel splice fairing as outlined in paragraph c, (2), (b), 6.

c. OUTER PANEL.

(1) GENERAL. (See figure 41.)—The wing outer panel is the section of the wing attached outboard of the center section, which is composed of the outer panel interspar structure (9), outer panel leading edge (5), outer panel trailing edge (11), aileron cut-out trailing edge (8), aileron (7), and float.

The retractable float forms the tip of the wing when in retracted position.

The outer panel interspar structure is box shaped, and consists of front spar and rear spar; truss ribs; and upper and lower surface skin, reinforced with extruded zee stringers. The lower surface is recessed from station 21 outboard to station 26 to provide a space for the float brace and strut assembly, when the float is in retracted position.

A 10 x 20 inch manhole is located on the upper surface between station 13.0 and 14.0. This manhole gives access to the inside of the interspar structure for inspection and repair as far inboard as the fuel tank (station 5.0), and as far outboard as station 21.0 (the float hinge point).

Hoisting lugs are provided for hoisting the outer panel assembly. See Section III, Par. 2, a, (4).

(2) ERECTION.

(See figure 54.)

(a) REMOVAL.—The outer panel may be removed as an assembly or the major units comprising the assembly may be removed from the interspar structure while it is still attached to the wing center section. The following description is for the removal of the outer panel as an assembly.

1. Disconnect radio antenna wire (5) by removing bolt (4) from top of "V" antenna masts at port and starboard wing tips.

2. Unhook thimble of voice antenna from hook on leading edge outboard of starboard outer panel wing splice.

3. Disconnect equipment at panel splices.

a. AILERON PUSH-PULL TUBE.

(1) Open access hole (18) on upper surface of stubby trailing edges near panel splice to give access to joints between aileron push-pull tubes (10) and bell cranks (8).

(2) Remove self-tapping screws (6) to disconnect bonding braid (7).

(3) Remove bearing bolt (9) from end of push-pull tube (10).

b. AILERON TAB CABLES.

Note

The aileron tab control cables are on the port side only.

CAUTION

Before loosening tab cables, move cable stops aft of hull bulkhead 2 to rest against bulkhead and clamp them securely to cables. Failure to heed this caution will result in a violent unwinding of cable around tab drum in control box, causing damage to cable.

(1) Open access hole on lower surface of center section trailing edge aft of port nacelle.

(2) Remove safety wire from tab cable turnbuckles and break cables by unscrewing turnbuckle barrels.

(3) Detach fairlead cap strip from tab cable fairlead at wing station 5.0 to allow tab cables to be pulled out of center section.

(4) Open access hole (22) on lower surface of stubby trailing edge near panel splice. Draw aileron tab control cables from center section trailing edge and lay it in a coil in stubby trailing edge.

c. FLOAT TORQUE TUBE.

(1) Raise float to full up position and see that it is locked.

CAUTION

Do not operate float with float torque tube splice bolt missing, as the torque tube splice connections may shift in operation and become damaged.

(2) Working through access door in upper surface of leading edge inboard of panel splice, remove clevis bolt (16) from joint in float torque tube (17).

d. ELECTRICAL CONNECTIONS.

(1) Remove screws (13) attaching manhole covers (14) on upper surface of wing outer panel near panel splices and climb into interior of wing.

(2) Remove covers from junction boxes mounted on upper surface stringers near panel splice and front spar, and disconnect the following wires from the binding posts.

(a) In box on port side of airplane, disconnect wires 298, 297, 748, 488, 485 and 1051. Disconnect conduits (27) and (29) leading to outer panel from junction box by loosening knurled nuts (28) and (30). Pull ends of wires out of junction box and lay conduit in outer panel.

(b) In box on starboard side of airplane disconnect wires 378, 377, 987, 993, 461, 999, and 749. Disconnect conduit from junction box by loosening knurled nut. Pull ends of wires out of junction box and lay conduit in outer panel.

(3) In port side of wing at station 14.0, disconnect cable (12) from magnesyn compass transmitter (11). Remove screws attaching clips to bulkhead and outer panel spar. Roll cable into a coil and lay in center section where it will not be damaged during subsequent operations.

Note

The magnesyn compass transmitter was installed in the wing on PBY-5A airplanes, serial numbers 46588 and on.

e. HEAT ANTI-ICING DUCT. (See paragraph b, (4), (b).)

4. BREAK WING AT PANEL SPLICE.

a. Remove fairings as follows:

(1) Remove screws (24) to detach upper and lower rear panel splice fairings (21).

(2) Cut safety wire and loosen set screws (23) on rear ends of panel splice fairings (32) and (26) to allow removal.

Note

The upper and lower fairings may be separated by removing screws (31) for convenience in handling.

(3) Pull pinked-edge tape (20) from both upper and lower surfaces trailing edge at panel splice.

WARNING

Before proceeding with the removal of panel splice bolts, provide a support for the outer panel.

Note

Hoisting fittings have been provided in the upper surface, two at the panel splice, and one under the access door at station 19.0 for the attachment of a hoisting sling. (See Section III, Par. 2, a, (4).)

b. Remove leading edge splice bolts as follows: (See figure 55.)

(1) Working through access doors in leading edge at panel splice remove leading edge stringer splice bolts (9).

(2) Remove leading edge skin splice bolts (1) and (9).

c. Remove bolts from interior of wing as follows:

(1) Enter wing through manhole in upper surface of outer panel near splice.

(2) Remove upper and lower stringer splice bolts (6).

(3) Remove three $\frac{3}{8}$ dia. bolts (2) from bottom of each front and rear spar splice.

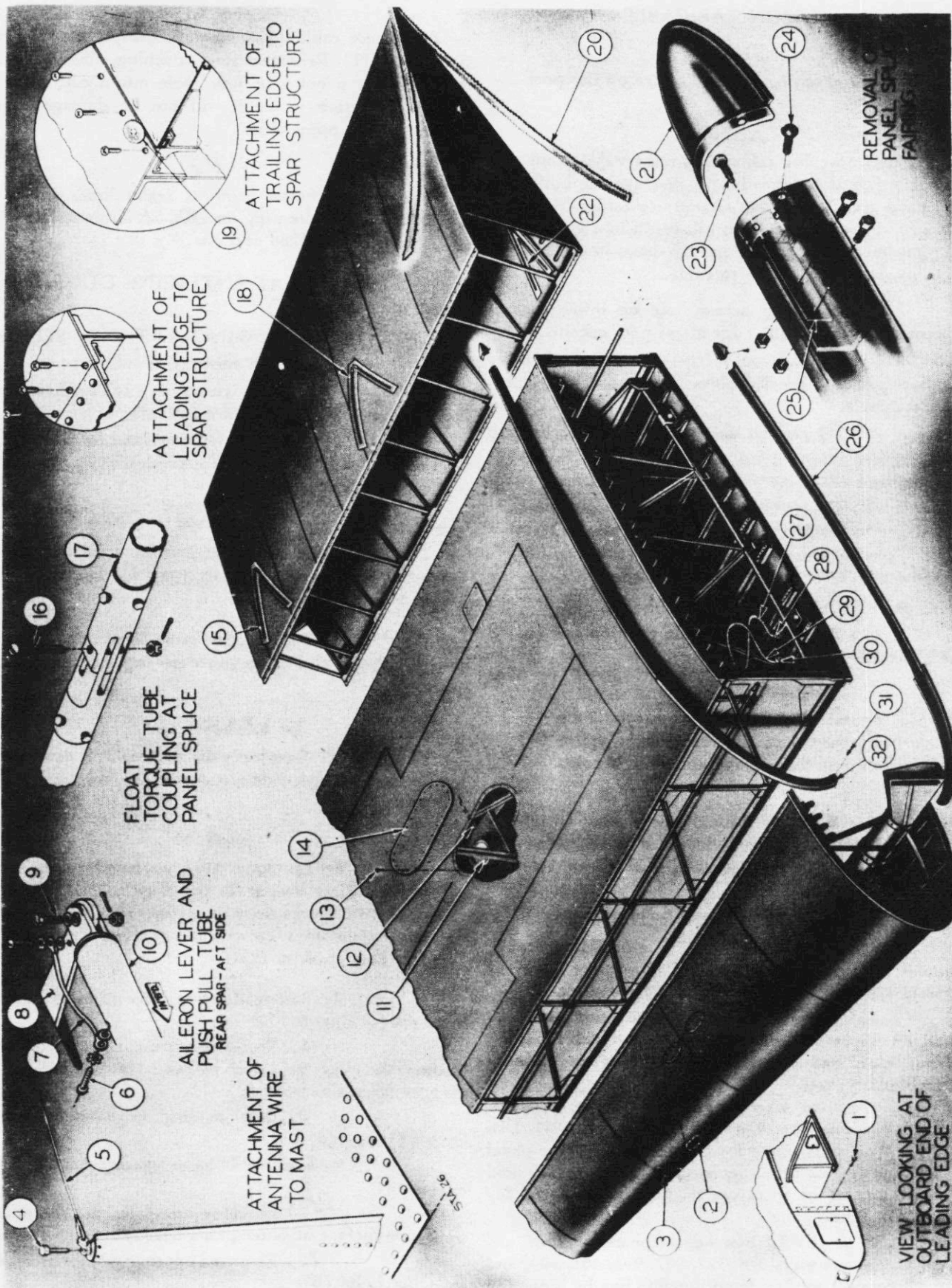


Figure 54—Outer Panel Assembly

No.	PART No.	NAME	No.	PART No.	NAME
1	AN510-D10-7	Screw	18		Access Flap
2	28W169-68	Access Door	19	28W4005-18	Patch
3	28W1012	Wing Line Fitting	20	28W4001-2	Gap Tape
4	AN73-5	Bolt	21	28W2018-10	Panel Splice Fairing—End Assembly—Lower
	AC995-40-3	Lock Wire		28W2018-43	Panel Splice Fairing—End Assembly—Upper
5	28U5004-3	Antenna	22		Access Flap
6	Q5033-A8-8	Self Tapping Screw	23	28W5042	Screw
	AN936-B8	Lock Washer		AC995-32-2	Lockwire
	AN960-A8	Washer	24	AN526-1032-7	Screw
7	Q506A-2-5	Bonding Braid	25	28W2018-20	Upper Splice Fairing Fitting
8	28C065	Aileron Control Lever		28W2018-21	Lower Splice Fairing Fitting
9	AN4-12	Bolt	26	28W2018-36	Lower Splice Fairing Assembly (Port Side)
	AN960-416	Washer		28W2018-37	Lower Splice Fairing Assembly (Starboard Side)
	AN310-4	Nut	27	NAF1150-6A	Flexible Conduit
	AN380-2-2	Cotter	28		Nut
10	28C021-50	Aileron Push Pull Tube	29	NAF1150-12A-108	Flexible Conduit
11	88-T-1950	Magnesyn Compass Transmitter Port Side Only	30		Nut
12	AN3106-14S-2S	Magnesyn Compass Cable Port Side Only	31	AN526-1032-7	Screw
13	AN520-D10-8	Screw	32	28W2018-34	Upper Splice Fairing Assembly (Port Side)
14	28W004-63	Access Door		28W2018-35	Upper Splice Fairing Assembly (Starboard Side)
15		Access Flap			
16	AN23-21	Clevis Bolt			
	AN320-3	Nut			
	AN380-2-2	Cotter			
17	28L095	Float Torque Tube			

Item number 11 is a Federal Standard Stock catalogue part number.

(4) Remove three 5/16 dia. bolts (4) from the top of each front and rear spar splice.

(5) Remove eight 1/4 dia. bolts (3) from each front and rear spar splice.

(6) Check carefully that all bolts have been removed from inside of wing splice and that no equipment or wiring is left across panel splice.

d. Remove external panel splice bolts.

(1) Working through access hole (22), (See figure 54.) in stubby trailing edge and through access hole in center section trailing edge, remove three 3/8 dia. bolts (2), three 5/16 dia. bolts (4), and eight 1/4 dia. bolts (3) from each rear spar splice. (See figure 55.)

(2) Working through access doors in outer panel and in center section leading edges, remove three 3/8 dia. bolts (2), three 5/16 dia. bolts (4), and eight 1/4 dia. bolts (3) from each front spar.

(3) Remove two 5/16 dia. bolts (8) and splice fairing fitting from lower skin splice.

(4) Remove 52 5/16 dia. skin splice bolts (4) from lower skin splice angles.

(5) Remove two 5/16 dia. bolts (5) from upper skin splice angle at front spar.

(6) Remove two 5/16 dia. bolts (2) and splice fairing fitting from upper skin splice angles.

(7) Remove 49 1/4 dia. bolts (1) from upper skin splice angle.

(8) By means of hoisting sling, swing

outer panel outboard approximately three feet to clear end of aileron push-pull tube and lower to a suitable cradle for disassembly.

(b) INSTALLATION.

1. See that all equipment is placed in the wing panels so that it will not interfere with the mounting of the outer panel. The float should be locked in the up position.

2. Attach the hoisting sling to the three fittings provided, two at the panel splice and one under the access door near the center of the interspar section at station 19.0, and hoist the outer panel to the level of the center section. (See Section III, Par. 2, a, (4).) Swing the outer panel inboard until the skin splice angles are approximately three inches apart, being careful not to bump the aileron push-pull tube.

3. Install interspar splice bolts as follows:

a. Working through the access door in the upper surface of the center section leading edge at the panel splice, turn the float inboard torque tube until the torque tube splice fittings are in alignment. Swing the outer panel into position and guide the torque tube splice fittings together.

b. Insert the upper skin splice bolts (1) and the lower skin splice bolts (4). Attach the lower splice fairing fitting with bolts (8), and the upper splice fairing fitting with bolts (2).

c. Working through access doors in outer panel and center section leading edges, install bolts (2), (3) and (4) in the front spar.

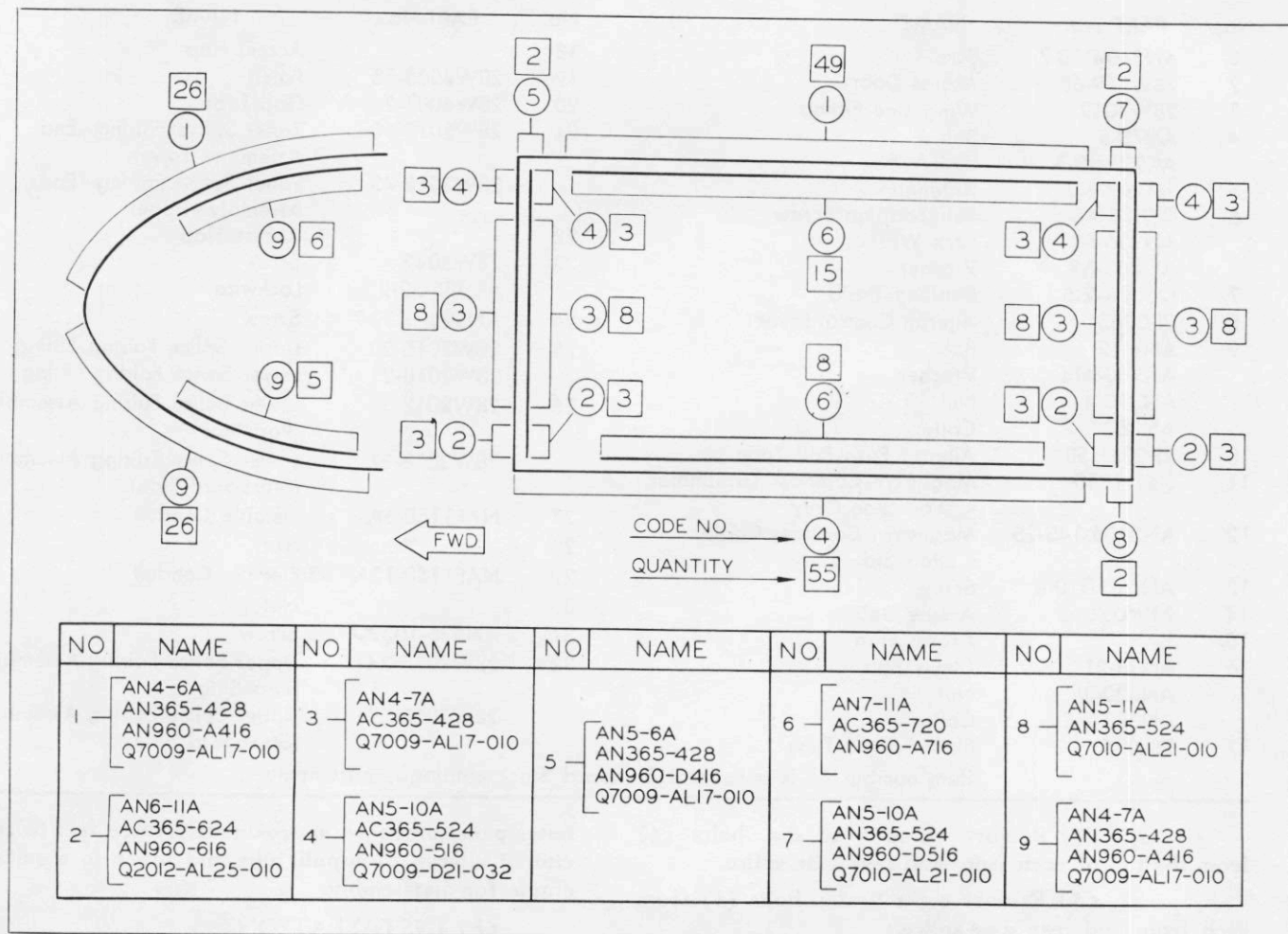


Figure 55—Panel Splice Bolt Diagram

d. Working through access openings in trailing edge at panel splice, install bolts (2), (3) and (4) in aft splice angle of rear spar.

e. Enter wing through manhole in upper surface of outer panel near panel splice and install upper and lower stringer splice bolts (6) and front and rear spar splice bolts (2), (3) and (4).

4. Install leading edge splice bolts as follows:

a. Install leading edge skin splice bolts (1) and (9) through splice angles.

b. Working through access holes in leading edge at panel splice, install leading edge stringer splice bolts (9).

5. Connect equipment crossing panel splice as follows: (See figure 54.)

a. Connect float torque tube by working through access door in upper surface of leading edge at panel splice and installing bolt (16) in torque tube fittings.

b. Attach aileron push-pull tube to bell crank as follows:

(1) Working through access opening

(18) on upper surface of stubby trailing edge, attach push-pull tube (10) to bell crank (8) with bolt (9), tighten nut and lock with cotter pin.

(2) Connect bonding braid (7) to push-pull tube (10) with self-tapping screw (6).

c. Install aileron tab cables as follows:

(1) String aileron tab cables from outer panel through center section trailing edge and attach to inboard cables with turnbuckle by working through access opening in lower surface of center section trailing edge aft of port nacelle.

(2) See that the cables are not twisted or fouled, and take up the slack by tightening the turnbuckles. Attach fairlead cap to fairlead at station 5.0.

(3) Move cable stops to their correct position aft of hull bulkhead 2 and rig trim tabs as directed in Par. 18, i, (3), (d) 6.

d. Install heat anti-icing transition duct in leading edge as directed in paragraph b, (4), (c), 7.

e. Connect electrical equipment as follows:

(1) Enter wing through manhole and connect conduits (27) and (29) to junction box on

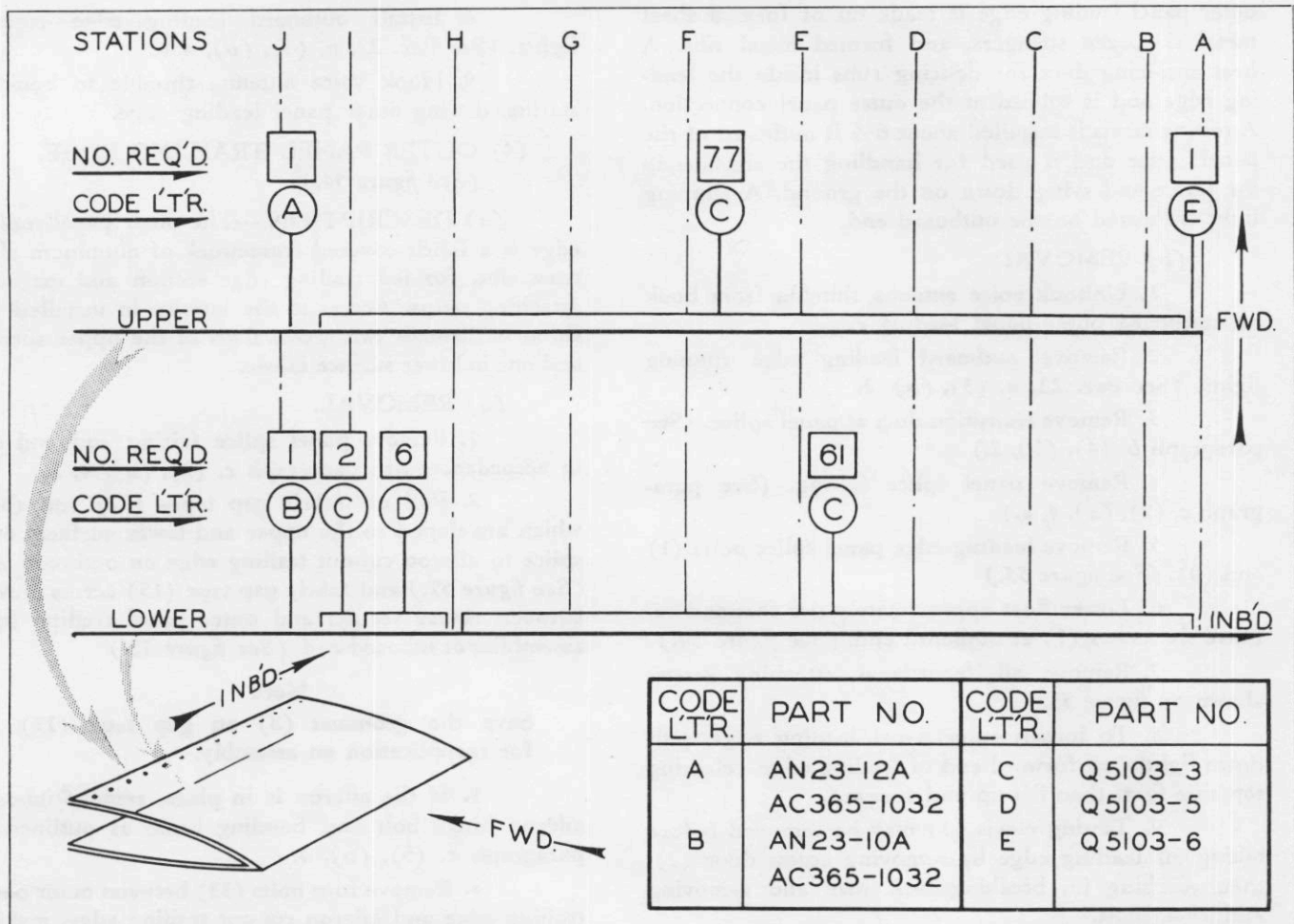


Figure 56—Outer Panel Trailing Edge Screw Diagram

port side of wing by tightening knurled nuts (28) and (30). On starboard side, connect conduit to junction box with knurled nut. Attach wires to binding posts as shown on wiring diagrams on under side of junction box covers. After checking all connections, attach junction box covers to boxes.

(2) In port side of wing, connect electrical cable (12) to magnesyn compass transmitter (11). Attach the cable to the structural members of the wing with mounting clips and screws.

Note

The magnesyn compass transmitter was installed in the wing on PBY-5A airplanes, serial numbers 46588 and on.

6. Install panel splice fairing as follows:

a. At trailing edge, dope pinked-edge tape (20) over gap between outer panel and center section trailing edges, and finish in accordance with instructions given in Section VII, Par. 7 of this manual.

b. At bolted splice, coat external splice bolts with paralketone, Specification AN-C-52.

c. Place splice fairings (26) and (32) over bolted panel splice and engage set screws (23) with fittings (25). Tighten set screws (23) until the fairing fits snugly over the bolted splice and lock set screws with lock wire.

d. Attach caps (25) to rear ends of (26) and (32) fairings with screws (24).

7. Close access openings as follows:

a. Inspect all attachments and remove debris before closing access openings.

b. Attach manhole cover (14) in upper surface of outer panel with screws (13).

c. Attach leading edge access hole covers with screws.

d. Close openings in trailing edge.

8. Attach "V" antenna (5) to masts at starboard and port wing tips with bolt (4).

9. Hook voice antenna thimble to hook on starboard outer panel leading edge.

(3) OUTER PANEL LEADING EDGE.

(a) DESCRIPTION.—The structure of the

outer panel leading edge is made up of formed sheet metal skin, zee stringers, and formed metal ribs. A heat anti-icing duct for de-icing runs inside the leading edge and is spliced at the outer panel connection. A towing clevis is installed about 6½ ft outboard of the panel splice and is used for handling the airplane in the water and tying down on the ground. A running light is located on the outboard end.

(b) REMOVAL.

1. Unhook voice antenna thimble from hook on starboard outer panel leading edge.
2. Remove outboard leading edge running lights. (See Par. 22, n, (3), (b), 2.)
3. Remove transition duct at panel splice. (See paragraph b, (4), (b), 2.)
4. Remove panel splice fairing. (See paragraph c, (2), (a), 4, a.)
5. Remove leading edge panel splice bolts (1) and (9). (See figure 55.)
6. Lower float approximately two feet and remove six screws (1) at outboard end. (See figure 54.)
7. Remove all front spar attaching screws shown on figure 53.
8. To loosen outer panel leading edge, pull down lightly on forward end of leading edge, releasing top side first; then lift up and forward.
9. Towing clevis (3) may be removed before taking off leading edge by removing access door (2), then reaching in, breaking lock wire and removing AN 74-43 bolt.

(c) INSTALLATION.

1. If towing clevis (3) has been removed, install by placing clevis in recess provided in leading edge, and through access door (2) insert AN 74-43 bolt from the outboard side. Lock bolt to angle with AC 995-47-A lock wire.

Note

Coat the faces of the upper and lower attaching bars with zinc chromate paste, where they will contact surfaces of the front spar flanges.

2. Put leading edge in place using drift pins to align screw holes.
3. Install all front spar attaching screws, top and bottom. (See figure 53.)
4. With the float lowered approximately two feet, install six screws (1) at outboard end. (See figure 54.)
5. Install leading edge panel splice bolts (1) and (9). (See figure 55.)
6. Install panel splice fairings. (See paragraph c, (2), (b), 6.)
7. Install transition duct at panel splice. (See paragraph b, (4), (c), 7.)

8. Install outboard leading edge running lights. (See Par. 22, n, (3), (b), 4.)

9. Hook voice antenna thimble to hook on starboard wing outer panel leading edge.

(4) OUTER PANEL TRAILING EDGE.

(See figure 54.)

(a) DESCRIPTION.—The outer panel trailing edge is a fabric-covered framework of aluminum alloy truss ribs, formed trailing edge section and extruded attaching strips. Access to the interior in installed position is through two access flaps in the upper surface and one in lower surface fabric.

(b) REMOVAL.

1. Remove panel splice fairing and end cap in accordance with paragraph c, (2), (a), 4, a.
2. Pull off fabric gap tapes (22) and (35), which are doped to the upper and lower surfaces over splice to aileron cut-out trailing edge on outboard end (See figure 57.) and fabric gap tape (15) across crevice between center section and outer panel trailing edge assemblies at inboard end. (See figure 52.)

Note

Save the grommet (8) on gap tape (15) for reapplication on assembly.

3. If the aileron is in place, remove inboard aileron hinge bolt and bonding braid as outlined in paragraph c, (5), (b), 4.

4. Remove four bolts (33) between outer panel trailing edge and aileron cut-out trailing edge, making provision to catch the spacer (21) on each bolt between the surfaces. Bolts and their nuts are reached through access flaps adjacent to splice in upper fabric of each of these trailing edges. (See figure 57.)

5. Make provision to support trailing edge, then remove all attaching screws shown in figure 56.

Note

The number of screws of each type may vary from the normal requirements. Repair of stripped threads in a hole is made by adding a new tapped hole and screw into the row, adjacent to the stripped hole.

(c) MAINTENANCE.

1. Clean orifice in any drain grommet which may have become plugged.
2. For repair of stripped threads on the trailing edge to spar connections, refer to the Structural Repair Manual (AN 01-5MA-3).

(d) INSTALLATION.

1. Remove fabric discs (19) along aft flange of rear spar, upper and lower, covering fourteen drift holes. (See figure 54.)
2. Coat with zinc chromate paste the faces of attachment tapping strips where they will contact surfaces of the rear spar flanges.

3. Place trailing edge in position using 3/16 inch diameter drift pins in the drift holes to locate and hold trailing edge in place.

4. Install all attaching screws shown on figure 56.

5. Withdraw all drift pins. Cover drift holes with 1/2 inch diameter discs (19) of pre-doped balloon cloth applied to surface with clear lacquer. When dry, finish patches with lacquer to match adjacent color.

6. Apply gap tapes (22) and (35) (See figure 57.) and gap strip (15) of 3 3/4 inch wide pink-edge, pre-acetate-doped tape, grade A fabric, Specification 49C13. Dope to trailing edge structures over gap at each end, on top and bottom surfaces. Cut 11/16 diameter hole in lower gap tape (15) in line with aft drain holes in trailing edge. Dope grommet (8) with nitrate dope and place over hole. The grommet is to be secured in place by doping patch (13) over the grommet. (See figure 52.) Finish to match adjacent color.

7. If the aileron is in place, install inboard aileron hinge bolt and connect bonding braid as outlined in paragraph c, (5), (c), 3.

8. Install panel splice fairing as outlined in paragraph c, (2), (b), 6.

(5) AILERONS.

(a) DESCRIPTION.—The ailerons are located in the trailing edge on the outer panel of the wing. Their structure consists of a truss type spar and ribs, and a sheet metal formed nose cover. The entire aileron is fabric covered. The left aileron contains two counter-balance weights attached on the inside of the nose section by screws and is located in the farthest bay outboard, and in the fourth bay from the inboard end. The right aileron has no counterbalance weights. The left aileron is equipped with a movable trim tab while the right aileron has a fixed trim strip which may be adjusted on the ground. The aileron is attached to the wing by means of five hinges and is actuated by a push-pull rod.

(b) REMOVAL.

(See figure 57.)

1. Through the inboard zipper (32) on the upper surface of the aileron cut-out trailing edge, unbolt (29) the aileron tab torque tube (31) and disconnect bonding braid (30). This procedure is necessary on the left-hand aileron only.

2. Disconnect the aileron push-pull rod (14) by removing bolt (16) and nut. Detach bonding braid (15).

3. Lower the tip float approximately two feet to provide access to the outboard aileron hinge and remove bolt (7) holding nut thru outboard access flap (26). Disconnect bonding braid (11).

4. Disconnect aileron at inboard hinge point. Two men are required. The head of the hinge bolt (36)

is reached through the outboard access flap (34) of the stubby trailing edge; the nut is reached through the inboard access flap of the aileron. After nut has been removed push bolt back just enough to clear the aileron. (This procedure will eliminate the difficulty of replacing the bolt in the stubby trailing edge.) Disconnect bonding braid (37) at inboard hinge.

Note

Before proceeding with balance of disassembly, support the aileron at each end and at the center to prevent damage.

5. Through the center three access flaps (3), (46) and (48) disconnect bonding braids (2) and (47) at each hinge point.

6. Complete the removal of the aileron by removing the bolts (1) attaching the aileron to the three intermediate hinges (49).

CAUTION

In removing the left-hand aileron take care that the tab control rod is free of the aileron cut-out trailing edge.

(c) INSTALLATION.

(See figure 57.)

1. Lift aileron into place, guiding tab torque tube (31) on the left-hand aileron through the hole provided in the aileron cut-out trailing edge.

2. With float lowered approximately two feet for access, connect outboard hinge by inserting bolt (7), head outboard, and tightening nut through outboard access flap (26). Connect bonding braid.

3. Make inboard hinge connection holding bolt head through access flap (34) and nut through access flap (28). Two men are required for this operation. Connect bonding braid (37).

4. Through the center access flap (48) make the center hinge connection by installing bolt (1) and connecting bonding braids (2) and (47).

Note

Supports for the aileron may be removed at this point.

5. At the mid span of the aileron connect the push-pull rod (14) by installing bolt (16). Connect bonding braid (15).

6. Make the last two hinge connections by installing bolts (1). Connect bonding braids (2), and (47).

7. Through the inboard access flap on the aileron cut-out trailing edge connect the tab control rod with bolt (29). Connect bonding braid (30).

8. Close all access flaps.

9. Through access flap (48) shim bumpers (50) to give the aileron the correct throw. See Section 1, Par. 4.

(d) MAINTENANCE.—Make a periodical

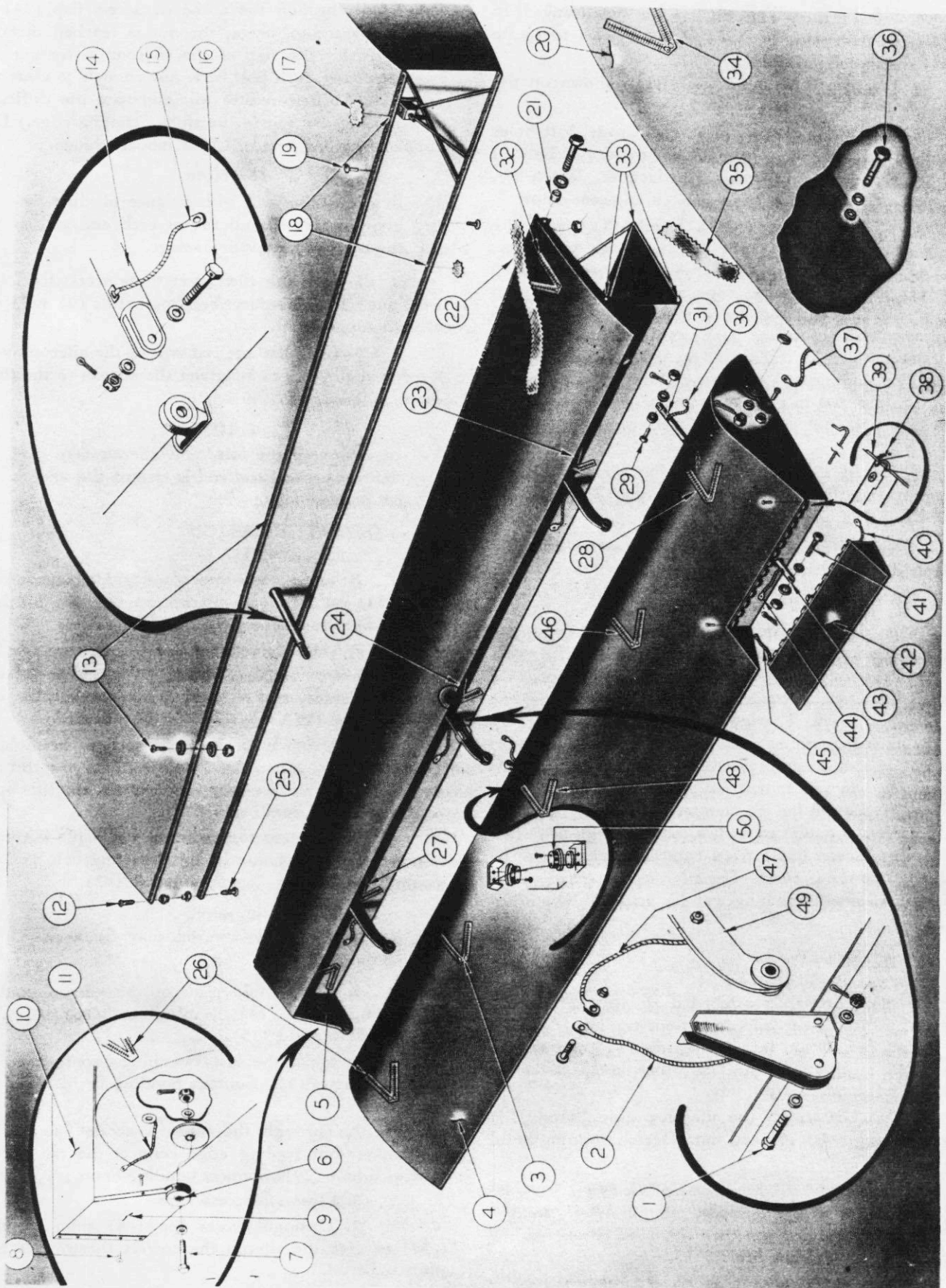


Figure 57—Aileron, Aileron Cut-out, Aileron Tab

No.	PART No.	NAME	No.	PART No.	NAME
1	AN4-12	Bolt	26		Access Flap
	AN960-416	Washer	27		Access Flap
	AN310-4	Nut	28		Access Flap
	AN380-2-2	Cotter	29	AN3-7	Bolt
2	Q506A-2-3	Bonding Braid		AN960-10	Washer
3		Access Flap		AN310-3	Nut
4	28W011	Aileron		AN380-2-2	Cotter
5		Access Flap	30	Q508A-7	Bonding Braid
6	28W021-171	Bearing—Fafnir SIK—6	31	28C2047	Tab Push-Pull Tube
7	AN4-16	Bolt	32		Access Flap
	AN960-416	Washer	33	AN3-6A	Bolt
	AN310-4	Nut		Q7102-AL10	Washer
	AN380-2-2	Cotter		AN365-1032	Nut
8	Q510-D10-8	Screw	34		Access Flap
	AN365-D1032	Nut	35	28W024-19	Fabric Gap Tape
9		Hinge—Sta. 1.0 Trailing Edge	36	AN4-17	Bolt
10	28W022	Trailing Edge—Aileron Cut-out		AN960-416	Washer
11	Q506A-2-3	Bonding Braid		AN310-4	Nut
12	Q5103-4	Screw		AN380-2-2	Cotter
	AN365-D1032	Nut	37	Q506A-2-3	Bonding Braid
13	AN24-12A	Bolt	38	AC995-47-2	Lockwire
	AN364-428	Nut	39	28W2082-8	Hinge Pin
14	28C024	Aileron Push-Pull Rod	40	Q507A-2-8	Bonding Braid
15	Q507A-2-2	Bonding Braid	41	AN3-7	Bolt
16	AN4-13	Bolt		AN960-10	Washer
	AN960-416-0156	Washer		AN310-3	Nut
	AN310-2-2	Nut		AN380-2-2	Cotter
	AN380-2-2	Cotter	42	28W2082	Aileron Tab
17	28W4005-18	Drift Hole Patch	43	28C2046	Tab Push-Pull Rod
18		Drift Hole	44	Q508A-3	Bonding Braid
19	Q5103-4	Screws	45	Q507A-2-8	Bonding Braid
20	28W024	Outer Panel Trailing Edge	46		Access Flap
21	Q812D-6-7	Spacer	47	Q508A-7	Bonding Braid
22	28W024-19	Fabric Gap Tape	48		Access Flap
23		Access Flap	49	28W176	Aileron Hinge
24		Access Flap	50	28C2021	Bumper
25	Q5103-4	Screw			
	AN365-D1032	Nut			

check of aileron for fabric tears, loose connections, and clogged drain holes.

(6) AILERON CUT-OUT TRAILING EDGE.

(a) DESCRIPTION.—The aileron cut-out is the part of the trailing edge directly forward of the aileron. Its structure consists of truss type ribs held together with angle sections, and is fabric covered. It is readily removable being assembled to the rear spar with screws, and to the outer panel inboard, trailing edge (stubby trailing edge) with four splice bolts to insure alignment with the aileron hinge arms.

(b) REMOVAL.

(See figure 57.)

1. Remove the aileron as outlined in paragraph c, (5), (b).

2. Remove the fabric gap strips, (upper and lower surface) (22) and (35) between the aileron cut-out and the stubby trailing edge.

3. Remove four bolts (33) which tie the stubby trailing edge to the aileron cut-outs. Two men are required for this operation; one working through the outboard access flap (34) on the upper surface of the stubby trailing edge, and one working through the inboard access flap (32) on the upper surface of the aileron cut-out.

Note

Care should be taken that spacers are not lost when removing bolts (33).

4. Lower float approximately two feet and remove five bolts (8) working through access flap (5) located at the outboard end of the cut-out on its forward surface. In the same manner remove 2 bolts (12) through the upper spar flange and the outboard aileron hinge bracket (9) and 2 bolts (25) through the lower spar flange and the aileron hinge bracket.

5. At each of the 3 hinge brackets on the aileron cut-out is an access flap (23), (24) and (27).

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Each of the three hinge arms is held to the rear spar with 2 bolts (13) through the upper spar flange and 2 bolts through the lower spar flange. Working through the access flaps remove four bolts at each hinge location.

6. Remove all the attaching screws (19) from the upper rear spar flange and all the attaching screws from the lower rear spar flanges.

7. Remove the aileron cut-out by pulling aft being careful to guide the aileron push-pull rod (14) through the hole in the trailing edge of the cut-out.

(c) INSTALLATION.

1. Lift aileron cut-out into place guiding aileron push-pull rod through the hole in the cut-out trailing edge.

2. Remove fabric discs (17) covering drift holes through upper and lower spar flanges.

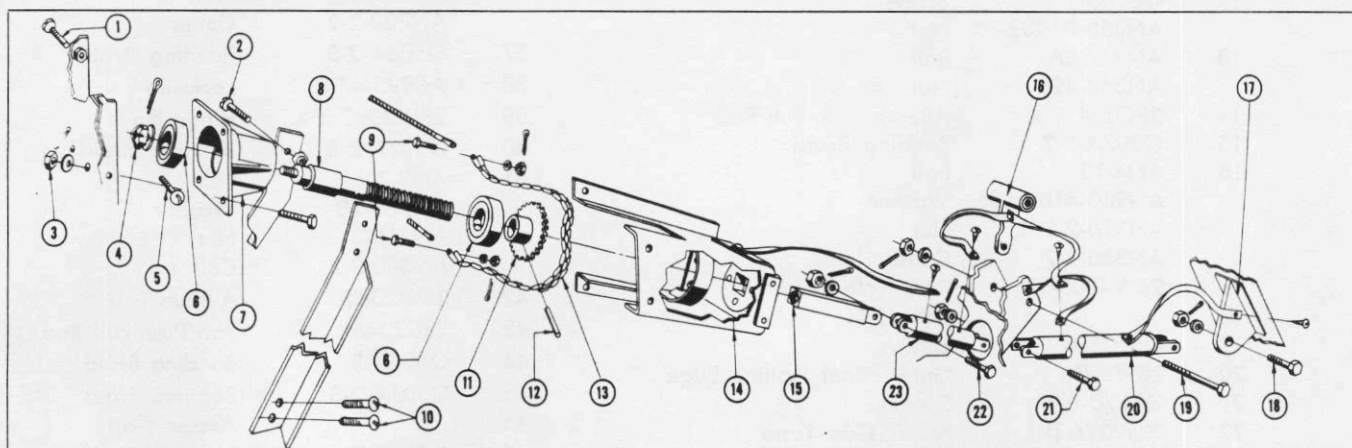
3. Locate and hold cut-out in place using pins through drift holes (18). These drift holes are identified by a painted circle at each hole. There are 10 drift holes on the lower surface and 11 drift holes on the upper surface.

4. Install screws (19) through the aileron cut-out and the upper and lower rear spar flanges.

5. Through access flaps (23), (24) and (27) install four screws (13) tying each aileron hinge to the rear spar.

6. With the float lowered approximately two feet, and working through access flap (5), install five bolts (8). Also install two bolts (12) through the upper rear spar flange and the aileron hinge brackets and two bolts (25) through the lower rear spar flange and the aileron hinge bracket.

7. Install four bolts (33) which tie the stubby



No.	PART No.	NAME	No.	PART No.	NAME
1	AN515-D8-8	Screw	12	28C2045-2	Pin
	AN365-D832	Nut	13	28C1100-6	Chain
2	AN515-D8-8	Screw	14	28C3016	Socket Guide Assembly
	AN365-D832	Nut	15	28C048-2	Tab Operating Socket
3	AN3-5	Bolt	16	28C2040	Idler Lever
	AN310-3	Nut	17	28W2081	Aileron Tab Horn
	AN380-2-2	Cotter	18	AN3-7	Bolt
	AN960-10	Washer		AN310-3	Nut
4	AN310-6	Nut		AN380-2-2	Cotter
	AN960-616	Washer		AN960-10	Washer
	AN380-3-3	Cotter	19	AN6-27	Bolt
5	AN515-D8-8	Screw		AN310-6	Nut
6	Fafnir K8-A	Bearing		AN380-3-3	Cotter
7	28C2044	Tab Control Mechanism Support (Housing)	20	28C2046	Tab Operating Rod
8	28C2042	Tab Operating Screw	21	AN3-11	Bolt
9	AN23-10	Bolt		AN310-3	Nut
	AN320-3	Nut		AN380-2-2	Cotter
	AN380-2-2	Cotter		AN960-10	Washer
	AN960-10	Washer	22	AN3-7	Bolt
10	AN515-D8-8	Screw		AN310-3	Nut
	AN365-D832	Nut		AN380-2-2	Cotter
11	Boston Gear Works H-964	Sprocket		AN960-10	Washer
			23	28C2047	Tab Operating Rod

Figure 58—Aileron Tab Control Mechanism

trailing edge to the aileron cut-out. Two men are required for this operation; one working through access flap (34) on the stubby trailing edge, and one working through access flap (32) on the upper surface of the aileron cut-out.

Note

When inserting bolts (33) be sure that spacers (21) are in position.

8. Over gap between stubby trailing edge and aileron cut-out, dope a 3 in. wide piece of fabric (22) over the upper gap and a similar piece of fabric (35) over the lower gap.

9. Close all access flaps.

10. Dope small fabric discs (17) over all drift holes on the upper and lower surface.

11. Install the aileron as outlined in paragraph c, (5), (c).

(7) AILERON TAB.

(a) DESCRIPTION.—The aileron tab, movable in flight, is located at the inboard end of the port aileron. Its structure consists of a zee-shaped spar formed from sheet stock, four formed sheet metal ribs and a formed sheet metal skin. It is hinged along its upper surface.

(b) REMOVAL.

(See figure 57.)

1. Move aileron to "full up" position.

2. Adjust tab to "full up" position. If the tab controls are connected, the tab may be moved by adjusting the tab control in the pilot's compartment. If the tab controls are not connected, move tab by manipulating the control cables through the outboard access flap (34) on the stubby trailing edge.

Note

Access for performing the operations for removing the tab is through the gap between the lower surface of the tab and the trailing edge of the aileron. If the tab is trimmed in the down position closing this gap, it must be trimmed to the neutral or up position.

3. Disconnect the tab push-pull tube (43) and bonding braid (44) at the tab.

4. Disconnect bonding wires (40) and (45) at the outboard end of the tab.

5. Break safety wire (38) which holds hinge pin (39) to the structure.

6. Withdraw hinge pin from the inboard end and remove tab.

(c) INSTALLATION.

(See figure 57.)

1. Adjust aileron and tab to the "full up" position for each.

2. Locate tab in position, aligning hinge teeth and insert hinge pin (39) from the inboard end lubri-

cating with a light oil to facilitate insertion. Wipe excess oil from hinge.

3. Safety wire (38) pin (39) to structure.

4. Connect bonding wires (40) and (45) at the outboard and inboard ends of the tabs.

5. Connect the tab push-pull tube (43) to the tab and attach bonding wire (44).

(8) AILERON TAB CONTROLS.

(a) DESCRIPTION.—The lateral trim of the airplane is secured by means of an adjustable tab on the port aileron which is operated by a control located on the pilot's panel. The knob turns a drum and operates cables that run aft, up through the superstructure, and along the rear spar to a point near the aileron. The cable is attached to a chain, routed around a sprocket. This sprocket drives a jack screw which in turn operates the tab actuating rod.

(b) REMOVAL AND DISASSEMBLY.

1. Clamp both aileron tab cables against bulkhead No. 2 in the hull by means of a cable clamp. This prevents cables, when released at turnbuckles, from raveling around drum.

Note

Clamp can consist of two metal bars with adjacent cut-out, a bolt through the center of both bars, and a wing nut for tightening.

2. Through the first access flap from airplane center line on the lower surface of center section trailing edge, disconnect tab control cables at turnbuckles.

3. Through outboard access flap (34) (See figure 57.) in outer panel trailing edge, disconnect control cables from chain (13) by removing bolts (9). (See figure 58.)

4. Through access flap (32) (See figure 57.) on the upper surface of aileron cut-out trailing edge, break the following connections:

a. Disconnect actuating rod (23) from socket (15) by removing bolt (22) and disconnecting bonding braid. (See figure 58.)

b. Disconnect bracket angle braces at bottom of rear spar by removing screws (10).

c. Remove socket guide attaching screws (1) and (5) and remove socket guide assembly. After removing the guide assembly from the wing, the angle braces may be taken off by removing screws (2).

5. To remove aileron tab control mechanism assembly is a two-man operation. One man is to work through access flap and the other man is to enter wing through manhole (22) (See figure 20.) and be stationed at rear spar between stations 15 and 16. Remove bolts and remove tab control mechanism assembly through access flap. The assembly may be further disassembled after removal from wing as follows:

a. Unscrew socket (15) and remove. (See figure 58.)

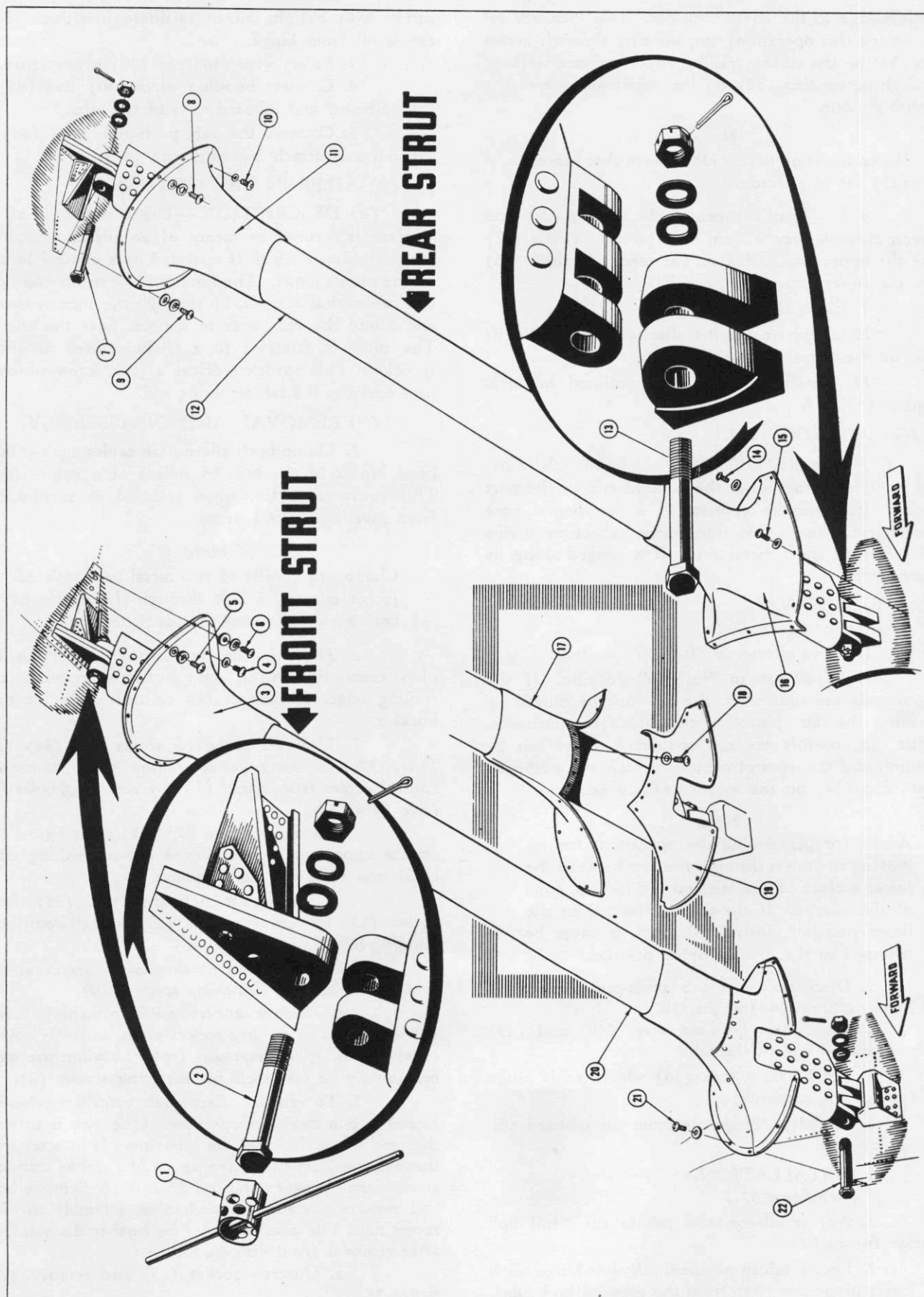


Figure 59—Wing Struts

No.	PART No.	NAME	No.	PART No.	NAME
1	28U1049	Wrench—Socket—Upper Wing Strut Fitting	10	AN526-DD1032-7	Screw
2	AN16-50	Bolt—Upper—Forward		AN960-AL10	Washer—Plain
	AN960-1616	Washer—Plain	11	28W5076	Fairing—Wing—Rear
	Q7102-AL1616	Washer—Plain	12	28W040	Strut—Wing—Rear
	AN310-16	Nut	13	AN12-54	Bolt—Lower—Rear
	AN380-4-6	Cotter Pin		AN960-1216	Washer—Plain
3	28W5075	Fairing—Wing—Front Strut		Q7102-AL1216	Washer—Plain
4	AN526-DD1032-7	Screw		AN310-12	Nut
	AN960-AL10	Washer		AN380-4-5	Cotter Pin
5	AN515-6-8	Screw	14	AN526-DD832-6	Screw
	AN960-AL6	Washer—Plain		AN960-AL8	Washer—Plain
	AN935-6	Washer—Locking	15	AN526-DD832-8	Screw
6	AN526-DD832-8	Screw		AN960-AL8	Washer—Plain
	AN960-AL8	Washer—Plain	16	28B5027	Fairing—Hull—Rear
	AN935-8	Washer—Locking	17	28B1835	Fairing—Hull—Front
7	AN14-43	Bolt—Upper—Rear	18	AN526-DD832-8	Screw
	AN960-1416	Washer—Plain		AN960-AL8	Washer—Plain
	Q7102-AL1416	Washer—Plain	19	28B1835-4-5	Fairing—Hull—Lower Front Strut
	AN310-14	Nut	20	28W039	Strut—Wing—Front
	AN380-4-5	Cotter Pin	21	AN526-DD832-8	Screw
8	AN515-6-8	Screw		AN960-AL8	Washer—Plain
	AN960-AL6	Washer—Plain	22	AN12-57	Bolt—Lower—Front
	AN935-6	Washer—Locking		AN960-1216	Washer—Plain
9	AN526-DD832-8	Screw		Q7102-AL1216	Washer—Plain
	AN960-AL8	Washer—Plain		AN310-12	Nut
	AN935-8	Washer—Locking		AN380-4-5	Cotter Pin

b. Remove nut (4) and slip operating screw (8) out of housing (7).

c. Bearings (6) may be removed from housing by punching them out.

d. Sprocket (11) may be removed from operating screw by removing pin (12) and slipping sprocket off. To remove pin, drill peened head, chisel off, and drive pin out.

6. Remove tab control rod (23) as follows: through inboard aileron access flap, remove bolt (21), disconnect bonding braid at tab control rod forward of idler lever (18), and withdraw control rod.

7. Remove tab control rod (20) as follows: move tab into up position, remove bolt (18) disconnect bonding braid at tab control horn (17); through access flap in aileron, disconnect bonding braid at forward end of control rod, and withdraw rod.

8. Through inboard access flap in aileron, remove idler lever (16) by removing bolt (19).

(c) MAINTENANCE.

1. Inspect bearings for wear and replace if necessary.

2. Every 60 hours, lubricate as follows:

a. At pin joints where bolts (18), (19), (21), and (22) are located, apply oil (Specification AN-O-6).

b. On thread of operating screw (8), and on exterior of socket (15) apply grease (Specification AN-G-3).

(d) ASSEMBLY AND INSTALLATION.

1. Through access flap in aileron, place idler lever (16) in position and install bolt (19).

2. Through access flap in aileron, place tab control rod (20) in position. Move aileron tab in up position; attach rod to tab control horn (17) with bolt (18). Connect bonding braid from control horn to rod.

3. Through access flap in aileron, place tab control rod (23) in position and install bolt (21). Connect bonding braid at forward end of rod (20) and aft end of rod (23).

4. Assemble aileron tab control mechanism as follows:

a. Install sprocket (11) on operating screw (8) by slipping sprocket on screw and installing pin (12). Peen pin on both ends.

b. If bearings (6) have been removed from housing (7), scrape stake marks smooth in housing. Insert bearings and stake adjacent to old stake marks.

c. Slip end of operating screw into housing through bearings and install nut (4).

d. Apply grease (Specification AN-G-3) to threads of operating screw and screw on socket (15).

5. Through inboard access flap in aileron cut-out trailing edge, place control mechanism assembly in position and install bolts (3). The nuts are to be tightened on the forward face of the rear spar from the inside of the wing.

6. Wrap chain (13) around sprocket (11) and connect chain to control cables by installing bolts (9) through outboard access flap in outer panel trailing edge.

Note

Prior to installing chain, dip chain in solution of one part by weight of grease (Specification AN-G-10) and 3.25 parts by weight of naphtha or other suitable solvent, allowing sufficient time for thorough saturation, remove and drain. On installation, wipe dry of grease with a cloth to prevent accumulation of dust and dirt.

7. Clamp tab control cables with an equal length of chain on each side of sprocket.

8. Adjust socket (15) on operating screw so that when control rod (23) is connected to socket, the trailing edge of the tab will line up with trailing edge of aileron and outer panel trailing edge.

9. Install angle braces on socket guide (14) by installing screws (2).

10. Through inboard access flap in aileron cut-out trailing edge, place socket guide assembly in position and install screws (1), (5), and (10).

Note

Apply grease (Specification AN-G-3) to exterior of socket (15) prior to installation of guide assembly.

11. Remove control cable clamps installed according to instructions of paragraph c, (7), (d), 7.

12. Connect control rod (23) to socket (15) by installing bolt (22), and connect bonding braid at socket guide to control rod.

13. At pin joints where bolts (18), (19), (21), and (22) are located, apply oil (Specification AN-O-6).

14. Through the first access flap from airplane center line on the lower surface of center section trailing edge, connect tab control cables at turnbuckles.

Note

Tighten turnbuckles to give required tension as outlined in Section IX, Table A. For safetying of turnbuckles, see Par. 18, d, (4), (b), 6.

15. Remove clamp from aileron tab cables at bulkhead 2 in the hull.

WARNING

Check controls to insure that cables are not crossed.

d. WING STRUTS.

(See figure 59.)

(1) DESCRIPTION.—Two struts on each side of the air plane attach the wing to the hull. The front strut extends from an attaching fitting on the front spar of the wing at station 7.0 to an attaching fitting on the side of the hull at bulkhead 4. The rear strut extends from an attaching fitting at the rear spar of the wing at station 7.0 to an attaching fitting on the side of the hull at bulkhead 5. The front strut consists of a reinforced streamlined tube with an attaching fitting riveted in each end.

(2) REMOVAL.

(a) To prevent tilting of wing, place a support under each side of center section. (Handling lines on the ends of the wing will serve the same purpose.)

(b) Remove front strut as follows:

1. Remove screws (4), (5), and (6) at upper front strut fairing (3). Split fairing at aft edge and slip off strut.

2. Remove screws (18) and (21) at lower strut fairing.

3. Remove IFF and radio altimeter wiring, encased by Vinolite tubing, from the port and starboard front strut as outlined in paragraph b, (2), (a), 17.

4. Remove top bolt (2) using wrench (1), remove bottom bolt (22), and remove strut.

(c) Remove rear strut as follows:

1. Remove screws (8), (9) and (10) at upper rear strut fairing (11). Split fairing at aft edge and slip off strut.

2. Remove screws (14) and (15) at lower rear strut fairing (16). Split fairing at aft edge and slip off strut.

3. Remove bolts (7) and (13), take off top bolts first, and remove strut.

(3) INSTALLATION.—The struts are to be installed by reversing the procedure described in removal of struts. The bolts (2), (7), (13), and (22) are to be inserted in a fore-to-aft direction, bolting the lower ends of the struts first. The lower ends of the struts are marked with numbers corresponding to the number stenciled on the side of the hull in area of strut attaching fittings. After installing bolts, apply a coat of beeswax and grease (Navy Aero. Specification C-88-2) to strut attaching fittings and bolts.



PARAGRAPH 2.



2. TAIL.

a. GENERAL. (See figure 62.)—The fixed surfaces of the tail group consist of the horizontal stabilizer and a single vertical stabilizer. The horizontal and vertical stabilizers are permanently riveted together. The movable control surfaces consist of an elevator in two sections, and a rudder. The rudder and each section of the elevator is equipped with a controllable trim tab. The tail group is not removable as a unit because the rudder must be removed before the other units. The tail assembly is attached to the hull with standard aircraft parts.

The frames and skin of the horizontal and vertical stabilizers and also the frames and skin of the rudder and elevator trim tabs are constructed of 24ST aluminum alloy. The frames of the rudder and elevator are made of 24ST aluminum alloy and covered with doped fabric. The leading edges of the horizontal and vertical stabilizers have double skins separated by neoprene strips to provide a passage for a stream of hot air supplied to prevent icing of the leading edges. The outer skin is not a structural part of the airplane.

Note

PBY-5 airplanes up to serial number 08349 are equipped with rubber boot type de-icers on the leading edges of the horizontal and vertical stabilizers instead of heat anti-icing.

b. RUDDER.

(1) DESCRIPTION.—The rudder is fabric covered with a riveted frame of spars and ribs made of formed sheets of 24ST aluminum alloy.

The rudder is attached to the vertical stabilizer by means of three hinges. The bottom hinge is a pivot bearing with a vertical adjusting screw and is attached to the tail cone beneath the rudder. The second hinge is incorporated in the rudder horn a few inches below the lower surface of the horizontal stabilizer and is attached to the tail post of the hull. The third hinge is located above the horizontal stabilizer and attached to ribs extending out from the vertical stabilizer.

The rudder contains a cut-out between the front and rear spars for the stabilizer island, a fixed section of the horizontal stabilizer located between the two elevator sections.

The rudder covering is attached to the ribs with retaining strips and sheet metal screws. The retaining strips are covered with pinked edged tape.

The rudder may be locked in the neutral position by means of a lock pin actuated by a handle located in the pilot's compartment.

The rudder lock is mounted on the tail post of the lower fin below and to the port side of the rudder tab mechanism. It consists of a plunger mounted in two bearings; one in the tail post, and the other in the aft sloping frame of the lower fin. The plunger is actuated by a bell crank which engages in a slot in the side of the plunger. In the locked position, the plunger is pushed aft into a socket in an extension of the rudder leading edge.

(2) REMOVAL. (See figure 60.)—Normally, two men are required for this operation, although any one man can do everything but remove or lift the rudder. The time required for removal of the rudder is four man-hours. (Two hours for two men working together.)

(a) Remove upper (79) and lower (76) side fairings from both sides of vertical stabilizers by removing all screws shown in figure 61.

(b) Detach rear end of top fairing (23) from stabilizer island (36) by removing two countersunk screws (31).

(c) Remove screws (28) and (32) from stabilizer island (36) and loosen island so that it will be easily removed with the rudder.

(d) Disconnect electric wire (27) leading to tail light at the tail light receptacle.

(e) Remove clevis bolt (16) from the rudder tab push-pull tube (29).

(f) Remove access hole cover (51) from tail cone by detaching screws (50).

(g) Remove lock-wire and the pivot bearing attaching bolts (49) from inside of tail cone.

(h) At rudder horn attachment fittings (30), remove the bolts (26) attaching the rudder to the rudder horn.

(i) Remove lock-wire from the upper hinge and then remove bolts (18) and (20).

(j) Lift the rudder from the airplane.

(k) Disassemble rudder as follows:

1. Remove trim tab (33). (See paragraph c, (2).)

2. Detach bottom hinge assembly and disassemble as follows:

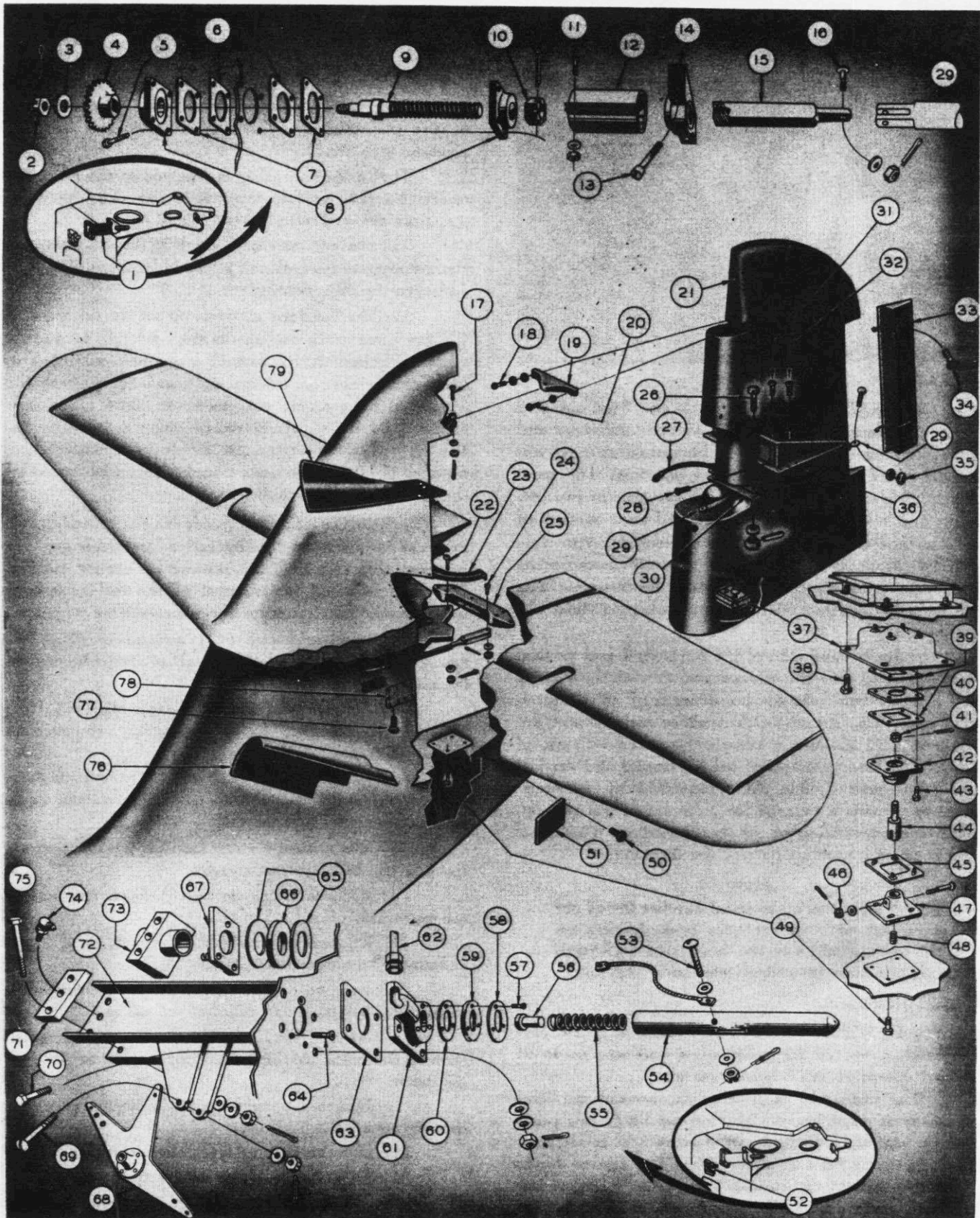


Figure 60—Rudder and Rudder Tab Assembly

RESTRICTED
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Section IV

No.	PART No.	NAME	No.	PART No.	NAME
1		Rudder Tab Mechanism	36	28T2014-101	Stabilizer Island
2	AN320-4	Sprocket Nut	37	28T5040	Rudder Lower Hinge Housing
	AN380-2-2	Cotter Pin	38	AN4DD6A	Housing Bolt
3	AN960-C416L	Washer	39	28T5096-9	Gasket
4	28T5090	Sprocket	40	28T5111	Spacer
5	AN3DD-10A	Bolt	41	AN320-4	Hinge Pin Nut
	AN365-D1032	Nut		AN380-2-2	Cotter Pin
6	28B1006-82	Shim	42	28T2050	Rudder Lower Hinge Bearing
7	28C1052	Spacer	43	AN4DD6A	Bearing Attaching Bolt
8	22C354	Bearing	44	28T2024	Bearing Pin
9	28T5081	Jack Screw	45	28T5095	Nut Plate
10	28T5082	Bearing Nut	46	AN23-24	Locking Bolt
11	AN3DD3A	Guard Bolt		AN320-3	Nut
12	28T5117	Guard		AN380-2-2	Cotter Pin
13	AN501-10-24	Support Screw	47	28T1031	Bearing Pin Housing
14	28T5084	Support	48	28T1036	Adjusting Screw
15	28T5083	Push Pull Link	49	28T5133	Bearing Pin Housing Bolt
16	AN23-13	Bolt		AC995-47-5	Lock Wire
	Q7102-AL10	Washer	50	AN520D10-10	Access Door Screw
	AN320-3	Nut	51	28B1162-62	Access Door
	AN380-2-2	Cotter Pin	52	28T5101	Rudder Lock
17	AN24-21	Rudder Hinge Bolts	53	AN23-19	Clevis Bolt
	Q7102-AL416	Washer		AN320-3	Nut
	AN320-4	Nut		AN380-2-2	Cotter Pin
	AN380-2-2	Cotter Pin	54	28T5102	Plunger
18	AN74-11	Rudder Bearing Bolt	55	28T5105	Spring
	AN960-AL416	Washer	56	28C4076	Button
	Q7102-AL416	Washer	57	AN505-6-8	Packing Screw
	AC995-47-4	Lock Wire		AN936-C-6	Washer
19	28T5035	Rudder Hinge Bearing	58	28T5104-8	Steel Washer
20	AN74-10	Rudder Bearing Bolt	59	28T5104-7	Felt Packing
	Q7102-AL416	Washer	60	Q7030-N52-015	Neoprene Washer
	AC995-47-4	Lock Wire	61	28T5104-6	Rear Bearing
21	28T5006	Rudder Assembly	62	28T5118-0,-2	Grease Tube
22	AN25-25	Rudder Horn Bearing Bolt	63	28B1006-82	Spacer
	Q7102-A516	Washer	64	AN510-DD10-16	Packing Screw
	AN320-5	Nut	65	28C4070-9	Neoprene Washer
	AN380-2-2	Cotter Pin	66	Type 430B	Garlock Packing
23	28T5067-10	Fairing		Type 430	1 3/8 O. D. x 7/8 I. D.
24	AN25-20	Clevis Bolt		Type 430T	
	AN960-D516	Washer	67	28C4070-8	Packing Nut Plate
	AN320-5	Nut		68A5-02	Nut
	AN380-2-2	Cotter Pin		(Elastic Stop Nut Corp.)	
25	28T5072	Rudder Horn		AN366DF1032	Plate Nut
26	AN4-25	Rudder Horn Bolt	68	28C4074	Bell Crank
	Q7102-AL416	Washer	69	AN24-29	Bell Crank Bolt
	AN310-4	Nut		Q7102-AL416	Washer
	AN380-2-2	Cotter Pin		AN320-4	Nut
27	NAF 1150-4A-72	Tail Light Circuit		AN380-2-2	Cotter Pin
	235	Tail Light Wire		AN3-6	Rear Bearing Bolt
28	Q5103-6	Island Screw	70	Q7102-AL10	Washer
29	28T5088-0	Push-Pull Tube, Aft		AN960-D10	Washer
	28T5085	Push-Pull Tube, F'w'd.		AN310-3	Nut
30		Rudder Horn Attachment		28C4068	Lubricator
31	AN510-D10-8	Fairing Screw	71		Rudder Lock Support
32	Q5103-4	Island Screw	72		Rudder Lock Bearing
33	28T5033	Trim Tab	73	28C4055	Grease Fitting
34	AN3-DD4A	Trim Tab Bolts	74	AN286-4	Forward Bearing Bolt
35	AN23-14	Push Pull Tube Bolt	75	AN3-24	Washer
	Q7102-AL10	Washer		Q7102-AL10	Washer
	AN320-3	Nut		AN960-D10	Washer
	AN380-2-2	Cotter Pin			

Section IV
Paragraph 2,b

RESTRICTED
AN 01-5MA-2

No.	PART No.	NAME	No.	PART No.	NAME
	AN310-3	Nut		AN515D6-7	Access Door Screw (Lower)
	AN380-2-2	Cotter Pin		Q7102-AL10	Washer
76	28T5067-7 L/R	Lower Fairing	78	28B1006-76	Rudder Pulley Access Door
77	AN505D6-7	Access Door Screw (Upper)	79	28T5067-6 L/R	Upper Fairing

a. Detach hinge assembly from bottom of rudder by removing bolts (38).

b. Remove bolts (43) attaching bearing housing (42) and spacer (40) to base (37).

c. Remove clevis bolt (46) attaching bearing pin (44) to housing (47).

d. Before removing adjusting screw (48) note its position so that it may be replaced in the same position.

e. Detach nut (41) to allow bearing pin (44) to be removed from bearing (42).

3. Detach and disassemble rudder horn (25) as follows:

a. Remove rudder control cables from horn (25).

b. Remove clevis bolt (22) attaching rudder horn to rudder hinge bracket.

4. Detach upper hinge (19) from hinge bracket by removing bolt (17).

5. Detach and disassemble rudder lock (52) as follows:

a. Access to rudder post is gained by opening hinged door on the aft side of the tail post just below the rudder lock (52).

b. Remove clevis bolt (69) and pull bell crank (68) out of plunger (54).

c. Rotate plunger (54) 90° and remove bolt (53).

d. Push plunger aft and remove through tail post.

Note

After removing bolt (53) be careful that the spring (55) and button (56) do not become lost.

e. Disconnect grease tube (62) from rear bearing assembly (61).

f. Remove bolts (70) that secure rear bearing (61).

g. Remove screws (64), thus releasing nut assembly (67), neoprene washers (65), and Garlock packing (66).

h. Remove bolts (75) that attach lubricator (71) and forward bearing (73).

i. Disassemble rear bearing (61) by removing screws (57), felt packing (59), and neoprene washer (60).

6. Detach and disassemble rudder tab control mechanism (1) as follows:

a. Remove screws (13) that secure support (14).

b. Loosen bolts (11) and then remove guard (12).

c. Remove nut (2), washer (3), and sprocket (4).

d. Remove bolts (5) that attach bearings (8), spacers (7), and shims (6) to tail post.

e. Remove link (15) and nut (10) from screw (9) and then slip screw (9) out of rear bearing (8).

(3) MAINTENANCE.

(a) CLEANING.

1. Clean the fabric with mild soap and water, or Simoniz Kleener.

2. Remove grease from metal surfaces by first rubbing with a cloth that is moistened with unleaded gasoline or carbon tetrachloride and then washing with mild soap and water.

3. Wipe metal fittings with a cloth moistened with unleaded gasoline or carbon tetrachloride.

CAUTION

Do not allow solvent to get on the sealed ball bearings.

4. Remove corrosion from corroded surfaces with sandpaper or emery paper, and then treat as directed in General Manual for Structural Repair, AN 01-1A-1, Section 14.

(b) MINOR REPAIRS.

1. Repair any damaged fabric as directed in AN 01-1A-1, Section 13.

2. Repair damage to structural members as directed in the Structural Repair Manual, AN 01-5MA-3, or replace.

3. Sealed ball bearings should run freely. If a bearing is loose, corroded, dry, or if it contains any foreign material which causes it to run roughly, it should be replaced.

Note

Do not attempt to lubricate sealed bearings.

4. Inspect all moving parts for wear or malfunctioning.

5. Replace bonding braids if they are broken or frayed.

6. Replace plate nuts if the threads are damaged or if they have lost their self-locking qualities.

7. In bottom hinge assembly, check the fit of bearing pin (44) with housing (47). It should be a close slip fit, free of any rocking motion. Replace parts if they are worn.

8. Touch up finish where it is chipped or worn.

(4) INSTALLATION.

(See figure 60.)

(a) Install rudder tab control mechanism as follows:

1. Insert threaded end of screw (9) into rear bearing (8); fasten with nut (10), and lock with cotter pin. Coat screw (9) with grease (Specification AN-G-10) and screw into link (15).

2. Mount forward bearing (8), one spacer (7), and one shim (6) on forward face of tail post; insert bolts (5); place one shim (6), one spacer (7), and rear bearing (8) on aft side of the tail post; and tighten nuts on bolts (5).

3. Attach sprocket (4) and washer (3) to screw (9) with nut (2). Lock nut with cotter pin.

4. Coat link (15) with grease (Specification AN-G-10) and turn it so that bolt in end is in vertical position.

5. Place guard (12) over end of rear bearing (8); slide support (14) over end of link (15) and into end of guard (12); and then attach with screws (13). Tighten bolts (11) in guard (12).

6. Place chain on sprocket and adjust cables as directed in rigging instructions. (See Paragraph 18, h, (3), (d).)

(b) Assemble and install rudder lock as follows:

1. Place neoprene washer (60), felt packing (59), and steel washer (58) on hub of bearing (61); align holes; attach bearing with screws (57).

2. Set forward bearing (73) in place; insert bolts (75) through lubricator (71), support (72), and bearing (73); tighten nuts on bolts (75); lock with cotter pins.

3. Place Garlock packing (66) between neoprene washers (65) with holes aligned, and then place on forward face of tail post. Insert screws (64) from rear face of tail post through washers (65) and packing (66); and then screw them into nut assembly (67). Tighten screws (64) just enough to make packing (66) sit snugly around plunger (54) and still allow the plunger to slip without binding.

4. Mount rear bearing (61) on rear face of tail post so that grease fitting is on the left side. Water-seal the joint between bearing and tail post with zinc chromate tape. Attach bearing to tail post with bolts (70) inserted from forward side of tail post. Tighten nuts and lock with cotter pins. Attach grease tube (62) to rear bearing.

5. Coat spring (55) with paralketone (Specification AN-C-52, type I); insert button (56) into end of spring; and then push both into plunger (54). Coat plunger (54) lightly with grease (Specification AN-G-10). With plunger turned so that bolt hole in center is vertical, press plunger into bearings (61) and (73). Insert bolt (53) into bolt hole through plunger and bonding braid. Tighten nut on bolt (53), taking care not to distort plunger by over tightening. Lock nut with cotter pin and then rotate plunger 90° so that slot in center of plunger faces down.

6. Insert rounded end of bell crank (68) into slot so that it rests between spring loaded button (56) and bolt (53); install clevis bolt (69); tighten nut so that bell crank rotates freely; then lock nut with cotter pin.

7. Lubricate with grease (Specification AN-G-10) at two Zerk fittings. Rudder lock should be lubricated every sixty hours.

(c) Assemble and install bottom hinge as follows:

1. Insert bearing pin (44) into bearing assembly (42).

2. Set adjusting screw (48) in bearing pin (44) in same position it occupied before disassembly. If in doubt about previous location, set hole in adjusting screw (48) three threads from end of pin (44).

3. Place nut plate (45) over hub of housing (47) with nuts placed away from flange of housing (47); insert hinge pin (44) into housing (47); and fasten with clevis bolt (46); tighten nut and lock with cotter pin.

4. Bolt the bearing housing (42) and spacer (40) to base plate (37) with bolts (43).

5. Attach hinge assembly to rudder with bolts (38).

6. Coat hinge assembly with paralketone (Specification AN-C-52, type I).

(d) Install rudder horn as follows:

1. Mount horn (25) on bearing and attach with clevis bolt (22); tighten nut; and then lock with cotter pin.

2. Attach control cables. (See Par. 18, f, (4).)

(e) Mount upper hinge (19) on bearing; attach with bolt (17); tighten nut; and then lock with cotter pin.

(f) Install rudder assembly as follows:

1. Slide stabilizer island into cut-out in rudder, making sure that the correct side is face up.

2. Lift rudder into place.

3. Check adjustment of pivot hinge (37). The pivot hinge should be adjusted so that the rudder horn attachment fittings (30) will slide over the rudder horn (25) without the rudder having to be lifted up or

forced down. If the pivot hinge (37) is out of adjustment, remove the rudder and adjust hinge as follows:

- a. Remove clevis bolt (46).
 - b. Turn adjustment screw (48) to get required adjustment.
 - c. Replace clevis bolt; tighten nut; lock with cotter pin.
 - d. Lift rudder back into place.
4. Insert bolts (26) through rudder horn attachment fitting; tighten nuts; lock with cotter pins.
 5. Insert bolts (18) and (20) through bonding jumpers into upper two hinges; tighten; lock with lock-wire.
 6. Insert bolts (49) from inside of tail cone into bottom hinge (45); tighten; lock bolts with lock-wire.
 7. Push stabilizer island (36) into place and attach with screws (28), (31), and (32).
 8. Connect tab push-pull tube (29) to link

(15) with clevis bolt (16); tighten nut so that joint works freely; lock with cotter pins.

9. Connect the tail light wire (27) to its receptacle.

10. Coat ribs and spars of stabilizer around rudder cut-out with beeswax and grease mixture (Spec. C-88-2).

11. Place upper (79) and lower (76) fairings in position and then attach with screws as shown in figure 61.

(5) OPERATIONAL CHECK. — Move rudder pedals back and forth and observe the movement of the rudders. The movement should be free of any binding, interference, or looseness. Make sure that the direction of the rudder movement has not been reversed. The rudder should have a movement of 22° both right and left. For rigging of controls see Par. 18, f, (4).

c. RUDDER TRIM TAB.

(1) DESCRIPTION. (See figure 60.)—The rudder tab is located near the center of the trailing edge of the rudder. It consists of 24ST aluminum alloy ribs and skin and is assembled with rivets. The tab is attached to the rudder by a piano type hinge located on the starboard edge of the rudder. The piano hinge is riveted to the rudder tab and is attached to the rudder by means of screws which are screwed into self-locking plate nuts mounted inside the rudder. The rudder tab may be set by the pilot while in flight. It is actuated by a push-pull tube which is connected by a clevis bolt to a horn mounted on the port side of the rudder tab.

(2) REMOVAL.

(a) Disconnect push-pull tube (29) from rudder tab (33) by removing clevis bolt (35).

(b) Detach bonding braid from rudder tab horn by removing self-tapping screw.

(c) Swing tab to starboard side and remove screws that attach bonding braids to front spar of tab.

(d) Remove bolts (34) that attach hinge to rear spar of rudder.

(e) Lift rudder tab from rudder.

(3) MAINTENANCE.

(a) Clean surfaces with castile soap and water. Thoroughly wash off soap solution.

(b) Treat corroded areas as directed in General Manual for Structural Repair (AN 01-1A-1).

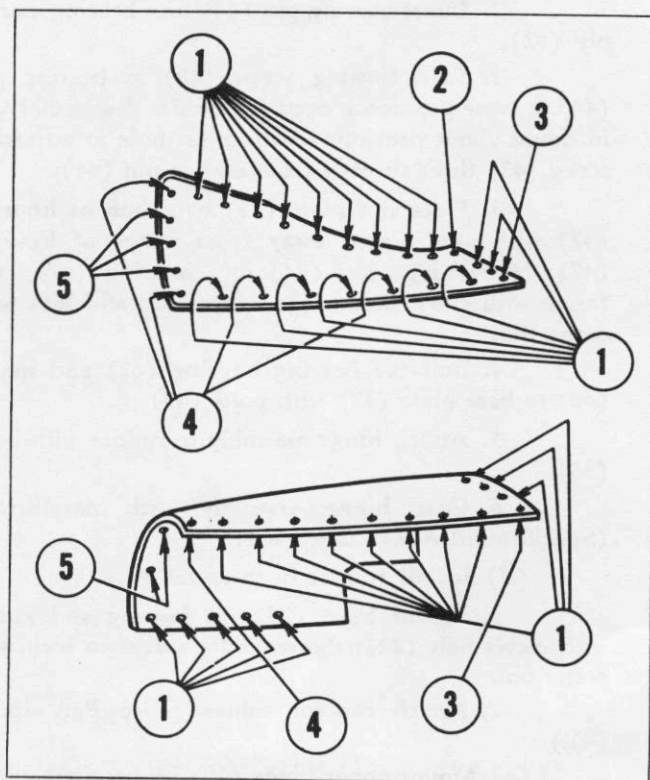
(c) For structural repairs, refer to Structural Repair Manual (AN 01-5MA-3).

(d) Refinish surfaces where finish has been chipped or worn.

(4) INSTALLATION.

(a) Place rudder tab in proper position.

(b) Attach hinge to rear spar of rudder by means of bolts (34).



No.	PART No.	NAME
1	AN515DD6-8	Screw
	AN960D6	Washer
2	AN520DD10-8	Screw
3	Q5103-2	Screw
4	AN515-DD6-10	Screw
	AN960-D6	Washer
5	AN515-DD8-8	Screw
	AN960-D8	Washer

Figure 61—Tail Fairing Screw Diagram

(c) Swing tab to starboard side and then attach bonding braids to front spar of tab with self-tapping screws.

(d) Connect push-pull tube (29) to rudder tab horn by means of clevis bolt (35). Tighten nut to allow free movement of push rod, and then lock nut with cotter pin.

(e) Attach bonding braid from push-pull tube to rudder tab horn by means of self-tapping screw.

(5) OPERATIONAL CHECK.

(a) Move tab controls inside airplane and observe movement of tab at tail. There should be no interference, binding, or looseness in the system. Note direction of movement and make sure that it is not reversed.

(b) For rigging instructions see Par. 18, h, (3), (d).

d. HORIZONTAL STABILIZER.

(1) DESCRIPTION. (See figure 62.)—The horizontal stabilizer is a cantilever structure mounted on the lower fin of the airplane. The frame consists of stringers, ribs, and spars made of 24ST aluminum alloy extrusions and formed sheet stock. It is covered with 24ST aluminum alloy skin except for the tips which are fabric covered. The leading edge is removable except for the tip sections and is protected from icing conditions by heated air which flows through a duct located within the leading edge.

Note

PBY-5 airplanes up to serial number 08349 are equipped with boot type de-icers instead of heat anti-icing. The leading edge of the horizontal stabilizer for these boot de-icer equipped airplanes is not removable.

(2) REMOVAL OF STABILIZER FROM HULL. (See figure 62.)—This is, ordinarily, a two-man job, even though one man can do any one of the following steps. The time required for removal of the stabilizer from the airplane is eight man-hours (two men working four hours together).

(a) Remove the two antenna wires from the leading edge of the vertical stabilizer (6).

(b) On all PBY-5 airplanes and on PBY-5A airplanes with serial numbers 33960 to 34059 inclusive, remove the ABK antenna mast and cable from the vertical stabilizer in the following manner:

1. Remove coaxial plug from the ABK receiver which is located aft of bulkhead 7.

2. Loosen set screw which fastens antenna conductor to the terminal of the coaxial plug and unscrew nut which holds the antenna cable in the coaxial plug.

3. Withdraw antenna cable from the coaxial plug and remove the sleeve and nut from the antenna cable.

4. Remove all clips which attach the antenna cable to the hull and stabilizer structure. Access to antenna cable clips in the vertical stabilizer is gained by removing the three access doors on the starboard side and near the aft edge of the vertical stabilizer.

Note

After freeing antenna cable from its attaching clips, fasten the clips to the hull and stabilizer structure to facilitate routing and attaching of the cable when it is reinstalled.

5. Remove the two screws and lock washers which attach the ABK antenna mast to the support on the vertical stabilizer.

6. Carefully withdraw antenna mast and transmission cable upward through the antenna mast support. Transmission cable must not be bent in less than a 10-inch radius.

(c) Remove fairings (104), (51), and (53) by detaching screws (105) and (52) that hold them between vertical and horizontal stabilizers.

(d) Remove rudder. (See paragraph b, (2).)

(e) Disconnect rudder lock lubricating tube (90) at rear spar of stabilizer.

(f) Remove access hole cover plates (26) from upper surface of horizontal stabilizer by detaching screws (4) and (5).

(g) Disconnect bonding braid (3) from push-pull tube (1) by removing self-tapping screws (7).

(h) Remove clevis bolt (11) from elevator mast (2).

(i) Disconnect elevator tab cables (85) at turn-buckles in lower fin.

(j) Remove screws (88) that attach access door covers (89) to vertical stabilizer.

(k) Remove screws (86) that attach access door covers (87) to vertical stabilizer.

(l) Disconnect heat anti-icing duct sleeve (100) by removing screws (97) and bearing plates (99). Access for this operation is obtained at access doors (87) and (89).

(m) Push sleeve (100) up into horizontal stabilizer to prevent it from becoming fouled when stabilizer is removed.

(n) PBY-5 airplanes up to serial number 08349 are equipped with rubber boot type de-icers which must be treated in the following manner before removal of the empennage:

1. Remove screws which attach the de-icer boot to the leading edge of the vertical stabilizer. These screws are engaged by rivnuts.

2. Disconnect de-icer boot lines from the boots on the leading edges of the horizontal and vertical stabilizer.

(o) Attach sling or other lifting device to stabilizer and take up slack to eliminate danger of stabilizer

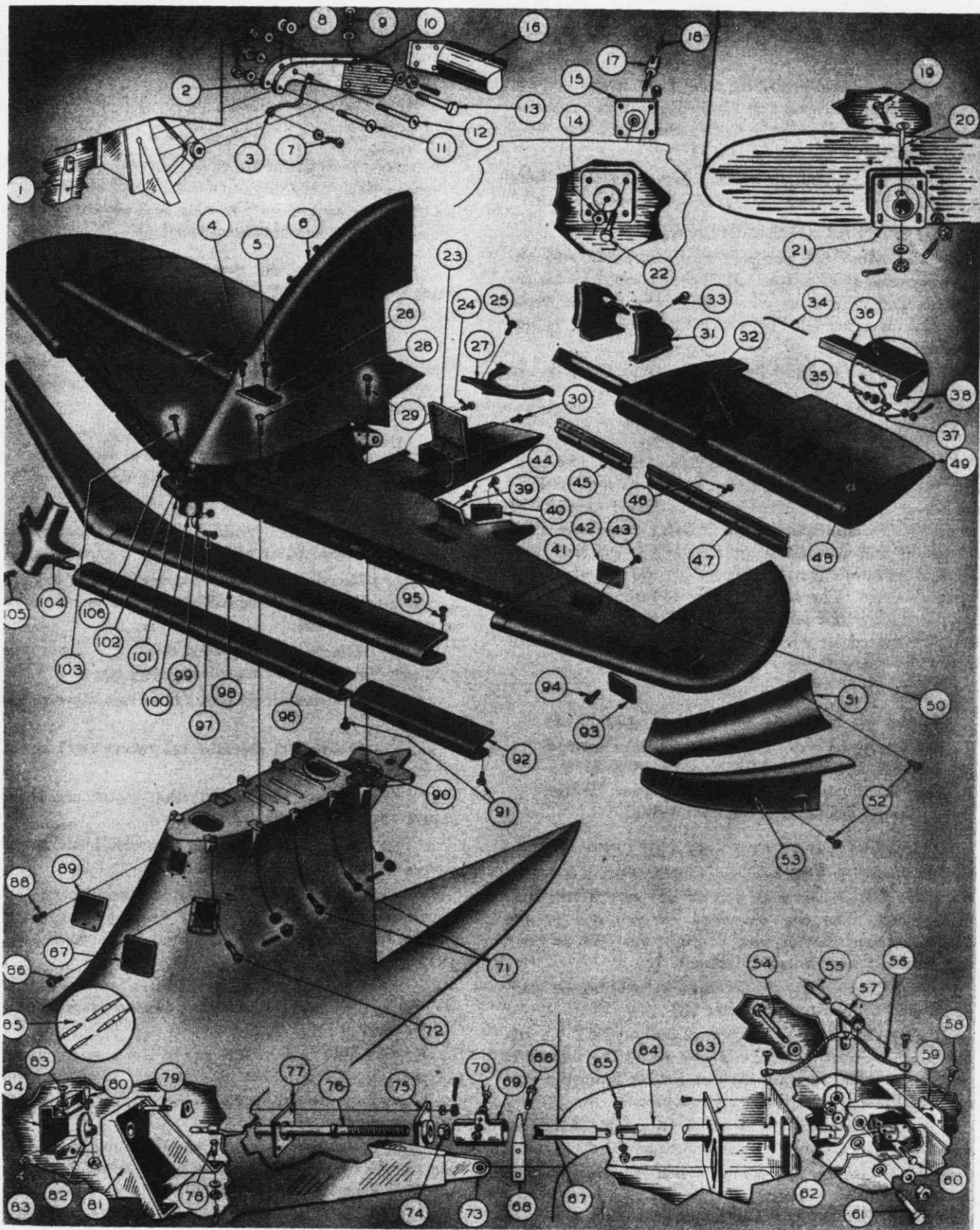


Figure 62—Horizontal Stabilizer, Elevator and Elevator Tab Assemblies

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Section IV

No.	PART No.	NAME	No.	PART No.	NAME
1	28C080	Elevator Push-Pull Tube	33	AN3-4A	Housing Bolt
2	28T5125	Elevator Mast	34	28T032-10	Tab Hinge Pin
3	Q507A-2-6	Bonding Braid	35	AN23-13	Elevator Tab Bolt
4	Q5103-7	Access Door Screw		AN320-3	Nut
5	Q5103-5	Access Door Screw		AN380-2-2	Cotter Pin
6	*28T5002-3	Vertical Stabilizer	36	28T032-L&R	Elevator Trim Tab
	**28T5002-2	Vertical Stabilizer	37	28C1078	Tab Push-Pull Tube
7	Q5033-8-8	Self Tapping Screw	38	Fafnir KC-3	Bearing
	AN960-A8	Washer	39	28T3015-2	Access Hole Cover
8	28C5135	Spacer	40	Q5103-2	Hinge Fairing Screw
9	AN24-11	Clevis Bolt	41	28T1046	Hinge Side Fairing
	AN320-4	Nut	42	28T3015-2	Access Hole Cover
	Q7102-AL416	Washer	43	Q5103-2	Access Hole Cover Screws
	AN380-2-2	Cotter Pin	44	Q5103-2	Access Hole Cover Screws
10	28T5124	Spacer	45	28T2014-23 L&R	Hinge Gap Fairing Inb'd.
11	28C5046	Push-Pull Tube Bolt	46	Q5103-2	Fairing Screws
	AN320-4	Nut	47	28T2014-22 L&R	Hinge Gap Fairing Outb'd.
	Q7102-AL416	Washer	48	29T1192	Elevator Hand Hole Cover
	AN380-2-2	Cotter Pin	49	28T2004-50 L&R	Elevator
12	28C5046	Bolt	50	28T5115	Elevator Hinge Access Door
	AN320-4	Nut	51	28T2026-57	Stabilizer Fairing, Upper Port
	Q7102-AL416	Washer		28T2026-58	Stabilizer Fairing, Upper St'b'd.
	AN380-2-2	Cotter Pin	52	AN515-D6-8	Fairing Screws
13	AN4-16	Elevator Center Hinge Bolt		AN960-D6	Washer
	Q7102-AL416	Washer	53	28T2026-2	Stabilizer Fairing, Lower Port
	AN310-4	Nut		28T2026-3	Stabilizer Fairing, Lower St'b'd.
	AN380-2-3	Cotter Pin	54	AN4-27	Idler Link Bolt
14	AN320-4	Outb'd. Hinge Pin Nut		Q7102-AL416	Washer
	AN380-2-2	Cotter Pin		AN310-4	Nut
15	28T2050	Bearing		AN380-2-2	Cotter Pin
16		Torque Tube	55	Q612-8-68	Spacer
17	28T2024	Outb'd. Hinge Pin	56	Q508-A-4	Bonding Braid
18	28T1036	Adjusting Screw	57	28C1082	Idler Link
19	AN4-DD6	Pin Housing Bolt	58	AN526-DD832-8	Cover Plate Screws
	AN960-D416	Washer	59	28T2007-65	Cover Plate, Port
	AN310-D4	Nut		28T2007-68	Cover Plate, St'b'd.
	AN380-2-2	Cotter Pin	60	AN3-12	Bolt
20	AN23-24	Clevis Bolt		AN960-10	Washer
	Q7102-AL10	Washer		AN310-3	Nut
	AN320-3	Nut		AN380-2-2	Cotter Pin
	AN380-2-2	Cotter Pin	61	AN4-14	Hinge Bolt
21	28T1031	Bearing Pin Housing		AN310-4	Nut
22	AN4-DD5	Bearing Attaching Bolts		AN380-2-3	Cotter Pin
	AN310-D4	Nut		AN960-416	Washer
	AN380-2-2	Cotter Pin	62	28C1078	Aft Push-Pull Tube
23	28T2014-67	Hinged Fairing	63	28T2004-12	Splash Shield
24	Q5103-5	Hinged Fairing Screw	64	28C5023	Forward Push-Pull Tube
25	AN3-DD4A	Fairing Bolt	65	AN3-7	Bolt
26	28T1002-10	Access Door		AN960-10	Washer
27	28T5067-10	Fairing		AN310-3	Nut
28	AN7-21	Bolt		AN380-2-2	Cotter Pin
	Q7012-D28-091	Washer	66	AN3-4	Guide Bolts
	AN310-7	Nut		AN320-3	Nut
	AN380-3-3	Cotter Pin		Q7102-AL10	Washer
29	AN8-22	Bolt		AN380-2-2	Cotter Pin
	Q7014-D32-091	Washer	67	28C048-0	Link
	AN310-8	Nut	68	28C073	Guide
	AN380-3-3	Cotter Pin	69	28C068	Guard
30	Q5103-6	Hinged Fairing Screw	70	AN520-6-5	Screw
31	28T4021-14 &-18	Elevator Mast Housing		AN345-6	Nut
32	29T1192	Elevator Hand Hole Cover		AN935-6	Lock Washer
				AN960-6	Washer

*PB5-5 (Up to serial No. 08349).

**PB5-5A and PB5-5 (Serial numbers 08349 thru 08549).

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No.	PART No.	NAME	No.	PART No.	NAME
71	AN74-12	Bolt	83	AN515-DD8-5	Guard Screw
	Q7102-AL416	Washer		AN935-8L	Lock Washer
	AC995-47-3	Lock Wire		AN960-D8	Washer
72	AN74-11	Bolt	84	28C1087 L&R	Chain Guard
	Q7102-AL416	Washer	85		Elevator Tab Cables
	AC995-47-3	Lock Wire	86	AN505-DD8-10	Access Door Screws
73	28T015-10	Hinge Bracket, Port	87	28B5275-6	Access Door, Port
	28T015-11	Hinge Bracket, St'b'd.		28B5275-9	Access Door, St'b'd.
74	22C358	Nut	88	AN526-DD1032-8	Cover Screws
	AN380-3-3	Cotter Pin	89	28B5076-28	Access Hole Cover
75	22C354	Bearing Housing	90	28T5118-O &-2	Grease Tube
76	28C1047-7	Shaft	91	AN526-6-8	Outer Skin Screws
77	28C044	Spacer		Q7102-AL6	Washer
78	AN3-4	Bolt		AN960-AL6	Washer
	Q7102-AL10	Washer	92	28F6826-45	Outb'd. Anti-Icing Skin
	AN320-3	Nut	93	28T2051-84	Inspection Door
	AN380-2-2	Cotter Pin	94	Q5103-3	Inspection Door Screws
79	AN3-6	Bolt	95	See figure 63	Leading Edge Screws
	28C1101	Spacer	96	28F6826-44	Inb'd. Anti-Icing Skin
	Q7102-AL10	Washer	97	AN526-DD1032-12	Duct Screw
	AN310-3	Nut		AN372-D1032	Nut
	AN380-2-2	Cotter Pin	98	28T5129-0	Stabilizer Leading Edge
80	28C1092-0	Taper Pin	99	28F6731-27	Duct Splice Plate
	AN365-632	Nut	100	28F7556	Transition Duct
81	28C1086 L&R	Bearing Support	101	28F6873	Plenum Chamber
82	28C1145	Sprocket	102	28F6755	Elbow Anti-Icing Duct
			103	AN526-DD1032-10	Duct Screw
			104	28T2026-50	Stabilizer Fairing
			105	AN515-D6-8	Fairing Screw
				AN960-D6	Washer

*PBY-5 (Up to serial No. 08349).

**PBY-5A and PBY-5 (Serial numbers 08349 thru 08549).

falling after attaching bolts are removed. (See figure 23.)

(p) Remove bolts (71) and (72).

(q) By working through access opening (26), remove bolt (28).

(r) Remove bolt (29) from rear spar flange.

(s) Lift stabilizer assembly from airplane a few inches to permit the tab cables to be pulled through top bulkhead of lower fin.

(t) Swing stabilizer assembly clear of airplane by means of an improvised hoisting sling. (See figure 23.)

(3) DISASSEMBLY.

(See figure 62.)

(a) Remove elevator. (See paragraph f, (2).)

(b) Remove screws (44) that hold access hole covers (39) in place.

(c) Remove screws (46) that hold elevator hinge gap fairings (45) and (47) in place.

(d) Remove leading edge (98) as follows:

1. Remove screw (103) which attaches vertical stabilizer heat anti-icing duct (102) to the leading edge of the horizontal stabilizer and push duct up into the vertical stabilizer as far as it will go.

2. At bottom of plenum chamber (101), push

fabric sleeve (100) up into plenum chamber so that it will not interfere with removal of leading edge.

3. Remove leading edge attachment screws (95), and then lift leading edge from stabilizer.

4. Remove outer skins (92) and (96) from leading edge by the removal of screws (91).

Note

The leading edge of the horizontal stabilizer is not removable on PBY-5 airplanes with serial numbers up to 08349.

(e) Remove outboard elevator hinge as follows:

1. Remove hand hole cover (50) from the upper surface of the stabilizer tip.

2. Remove bolts (22) that attach hinge assembly to the stabilizer tip.

3. Remove adjusting screw (18) from the hinge assembly.

Note

Position of adjusting screw (18) should be marked so that it may be replaced without changing the adjustment of the elevator.

4. Detach nut (14) from end of bearing pin (17) to allow bearing (15) to be removed.

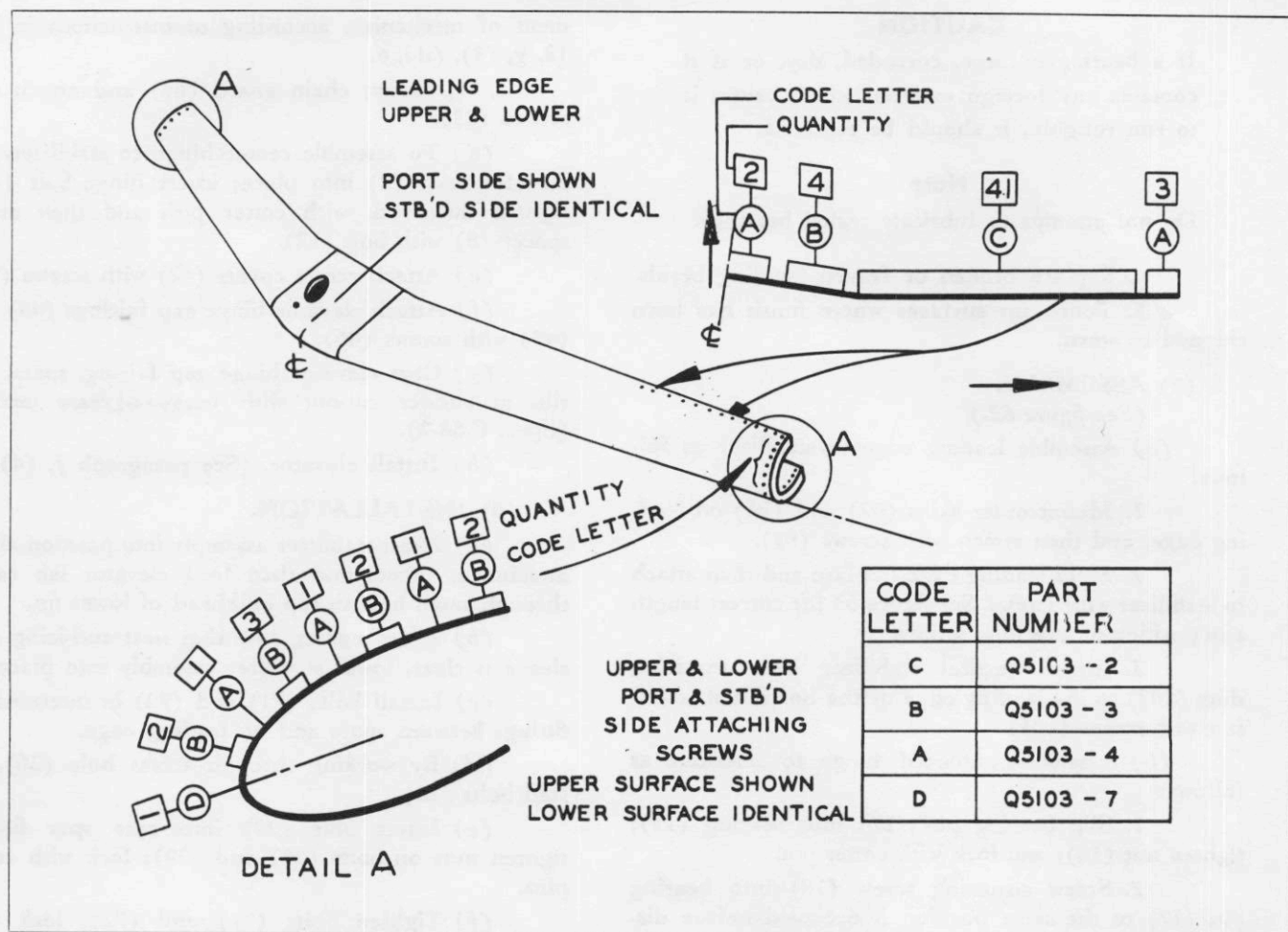


Figure 63—Horizontal Stabilizer Leading Edge Screw Diagram

(f) Remove elevator tab control mechanism as follows:

1. Detach chain guard (84) by removing screws (83).
2. Remove chain from sprocket (82).
3. Remove taper pin (80) attaching sprocket (82) to shaft (76).
4. Remove guard (69) by loosening screw (70).
5. Remove bolts (66) which attach guide (68) and then slip guide off link (67).
6. Remove bolts (79) which attach bearing housing (75) and spacer (77) to spar, and then slip screw assembly out of forward bearing.
7. Remove link (67) and nut (74) and then slip shaft (76) out of bearing housing (75).
8. Detach forward bearing by removing bolts (78).

(g) Remove center bearing by detaching bolt (12) and spacer (8) from elevator mast (2), and then removing hinge bolt (13).

(h) For removal of anti-icing or de-icing equipment, see Par. 25, c.

(4) MAINTENANCE.

(a) CLEANING.

1. Remove oil or grease with cloth dampened with unleaded gasoline or carbon tetrachloride.

CAUTION

Do not allow solvent to get on sealed bearings.

2. Wash with castile soap and water.

3. Inspect both interior and exterior for corrosion. Treat corroded areas as directed in Section 14 of the General Manual for Structural Repair (AN 01-1A-1).

(b) MINOR REPAIRS.

1. Repair damaged structure as directed in Structural Repair Manual (AN 01-5MA-3) or replace with new parts if necessary.

2. Replace all moving parts which are worn or damaged.

3. Inspect sealed bearings.

CAUTION

If a bearing is loose, corroded, dry, or if it contains any foreign material which causes it to run roughly, it should be replaced.

Note

Do not attempt to lubricate sealed bearings.

4. Replace broken or frayed bonding braids.

5. Touch up surfaces where finish has been chipped or worn.

(5) ASSEMBLY.

(See figure 62.)

(a) Assemble leading edge to stabilizer as follows:

1. Mount outer skins (92) and (96) on leading edge, and then attach with screws (91).

2. Hold leading edge in place and then attach to stabilizer with screws. See figure 63 for correct length and position of attaching screws.

3. Attach vertical stabilizer heat anti-icing duct (102) to the leading edge of the horizontal stabilizer with screws (103).

(b) Assemble outboard hinge to stabilizer as follows:

1. Slip bearing pin (17) into bearing (15); tighten nut (14); and lock with cotter pin.

2. Screw adjusting screw (18) into bearing pin (17) to the same position it occupied before disassembly.

3. Attach bearing assembly to outboard hinge bracket with bolts (22).

(c) Assemble elevator tab control mechanism to stabilizer as follows:

1. Mount forward bearing (81) and attach with bolts (78); tighten nuts and lock with cotter pin.

2. Slip bearing housing (75) over shaft (76); tighten nut (74); and lock with cotter pin.

3. Coat screw with grease (Specification AN-G-10) and then screw link (67) over jack screw (76).

4. Place spacer (77) over end of shaft and insert shaft through spar into bearing (81). Turn spacer (77) so that thick side is up, and then bolt bearing housing (75) to spar with bolts (79). Put tapered spacers on forward side of spar; tighten nuts; and lock with cotter pins. Coat link (67) lightly with grease (Specification AN-G-10) and then turn so that bolt hole is horizontal.

5. Slip guide (68) over link (67) and attach to elevator bearing bracket with bolts (66).

6. Attach guard (69) and clamp to bearings by tightening screw (70).

7. Place sprocket (82) on shaft (76) and attach with taper pin (80).

8. Mount chain on sprocket and adjust move-

ment of mechanism according to instructions in Par. 18, g, (3), (d), 6.

9. Mount chain guard (84) and attach with screws (83).

(d) To assemble center hinge to stabilizer, slip elevator mast (2) into place; insert hinge bolt (13); tighten nut; lock with cotter pin; and then attach spacer (8) with bolt (12).

(e) Attach access covers (42) with screws (43).

(f) Attach elevator hinge gap fairings (45) and (47) with screws (46).

(g) Coat elevator hinge gap fairing, spars, and ribs at rudder cut-out with beeswax-grease mixture (Spec. C-88-2).

(h) Install elevator. (See paragraph f, (4).)

(6) INSTALLATION.

(a) Hoist stabilizer assembly into position above attachment points and then feed elevator tab cables through small hole in top bulkhead of lower fin.

(b) After making sure that heat anti-icing duct sleeve is clear, lower stabilizer assembly into place.

(c) Install bolts (71) and (72) in intermediate fittings between spars and on leading edge.

(d) By working through access hole (26), install bolts (28).

(e) Insert bolt (29) into rear spar fitting; tighten nuts on bolts (28) and (29); lock with cotter pins.

(f) Tighten bolts (71) and (72); lock with lock-wire.

(g) Attach access hole covers (26) with screws (4) and (5).

(h) By working through access holes (87), and (89), pull heat anti-icing duct sleeve (100) down over lower duct and clamp in place with bearing plates (99) and screws (97).

(i) Attach access hole covers (87), and (89) with screws (86) and (88).

(j) Connect elevator push-pull tube (1) to elevator mast (2) with bolt (11). Tighten nut to allow free movement in joint and then lock with cotter pin.

(k) Attach stabilizer fairings (104), (51), and (53) with screws (105) and (52).

(l) Connect elevator tab cables (85) and rig as directed in rigging instructions. (See Par. 18, g, (3), (d), 6.)

(m) On PBY-5 airplanes up to serial number 08349, install rubber boot de-icer on the vertical stabilizer. (Refer to Par. 25, d.)

(n) On all PBY-5 airplanes and on PBY-5A airplanes with serial numbers 33960 through 34059, install the ABK antenna mast and transmission cable in the vertical stabilizer in the following manner:

1. If transmission cable has been coiled, it must be allowed to be flat for 24 hours prior to in-

stallation in the airplane so that the insulation may contract. The insulation will have stretched slightly due to coiling.

2. Carefully route transmission cable, starting at the antenna mast support on the vertical stabilizer, through the vertical stabilizer and the aft portion of the hull to the ABK receiver located aft of bulkhead 7. Routing of cable is to follow the line of mounting clips which were left attached to the airplane structure when the cable was first removed.

3. Attach transmission cable to the airplane structure with clips.

4. Insert antenna mast into its support on the vertical stabilizer and secure it with two screws (AN515-8-5) and lock washers (AN936-A8).

5. At the receiver end of the transmission cable, slide nut on cable and open braid and insert sleeve under braid. Bring nut into position on shoulder of sleeve and insert conductor of cable into well of the coaxial plug.

6. Turn plug on nut and tighten plug and nut together to obtain a tight connection.

7. Tighten set screw in well on cable firmly but do not crush conductor.

8. Attach coaxial plug to ABK receiver.

9. Replace access door covers on the starboard side of the vertical stabilizer.

(o) Install rudder. (See paragraph b, (4).)

(p) Attach antenna to two hooks on leading edge of vertical stabilizer.

(7) OPERATIONAL CHECK. — Check the movement of all control surfaces. If necessary, make adjustments as explained in Par. 18.

e. VERTICAL STABILIZER.

(1) DESCRIPTION.—The vertical stabilizer is of all metal construction. The frame is made of 24ST aluminum alloy extrusions and formed 24ST aluminum alloy sheet metal parts. The skin is 24ST aluminum alloy sheet.

The vertical stabilizer is made in two sections. The upper section is permanently riveted to the horizontal stabilizer. The lower section is an integral part of the hull and has fittings to which are attached the horizontal stabilizer.

The main structural members of the lower section are two canted bulkheads extending from the keelson to the top. Horizontal ribs of trussed construction and vertical stringers complete the frame work. Access to the structure of the lower vertical stabilizer may be gained from the inside of the hull. The leading edge of the lower section of the vertical stabilizer contains a combustion type heater which supplies hot air to the empennage anti-icing system.

The frame work of the upper section of the vertical stabilizer consists of vertical spars and hori-

zontal ribs. Heat anti-icing is provided for the leading edge of the upper section of the vertical stabilizer.

Note

PBY-5 airplanes up to serial number 08349 are equipped with rubber boot type de-icers instead of heat anti-icing.

Limited access to the interspar area of the upper section may be gained by stripping the fabric cover from the lightening holes in the rear spar.

(2) REMOVAL.—Although the vertical stabilizer is not removable as a unit, the upper portion can be removed along with the horizontal stabilizer.

(3) MAINTENANCE.

(a) CLEANING.—Remove oil or grease with cloth dampened with unleaded gasoline or carbon tetrachloride. Wash with castile soap and water.

(b) MINOR REPAIRS.—Repair damaged structure as directed in Structural Repair Manual (AN 01-5MA-3). Touch up finish where it is worn or chipped off.

f. ELEVATOR.

(1) DESCRIPTION. (See figure 62.)—The elevator is made in two sections which are connected by torque tubes to a single control point at the center line of the airplane. The elevator sections are fabric covered, the frame being made of formed 24ST aluminum alloy sheet and 24ST aluminum alloy extrusions. The elevator is attached to the horizontal stabilizer by the five following hinges: the center hinge, which is incorporated in the elevator control horn; the outboard hinges which are pivot hinges designed to give side adjustment to the elevator; the intermediate hinges which are attached to arms extending from the horizontal stabilizer spar. Both sections of the elevator are equipped with controllable trim tabs.

(2) REMOVAL. (See figure 62.)—This is ordinarily a two-man job, even though one man can do any one of the following steps alone. Time required is eight man-hours (two men working four hours each).

Note

The rudder should be removed before removing the elevator.

(a) Detach top fairing (27) of rudder to stabilizer fillet by removing bolts (25).

(b) Remove elevator crank housing (31) by removing bolts (33).

(c) Remove screws (24) and (30) and then open hinged fairing (23) on stabilizer center section.

(d) Remove intermediate hinge fairing side plate (41) by removing screws (40) and then detach push-pull tube (64) from elevator tab mechanism by removing bolt (65). Detach bond braids from front face of spar.

(e) Remove hand hole covers (32) from upper surface of elevator near intermediate hinge. Remove screws (58) attaching cover plate (59) to rear face of elevator spar and slide cover back out of way.

(f) By working through lightening hole in spar and through hole under cover plate (59), remove hinge bolt (61).

(g) Remove clevis bolt (20) from outboard elevator hinge.

CAUTION

Provide support for elevator before proceeding any further with removal.

(h) Remove bolts (9) that attach torque tube (16) to elevator mast (2).

(i) At top center line of elevator torque tube (16), (but not in bolt area, which would cause distortion or bending of the plate) drive a wedge, not over 1/4 inch thick, between plate riveted to torque tube and elevator horn for the purpose of clearing torque tube at elevator horn bearing bolt.

(j) Remove access hole cover (48) from the upper surface near the outboard elevator hinge. By working through access hole, remove bolts (19) attaching bearing pin housing (21) to elevator.

(k) Lift elevator from stabilizer, being careful that the elevator tab push-pull tube (64) clears the intermediate elevator hinge housing.

(l) Disassemble elevator as follows:

1. Remove elevator trim tab. (See paragraph g, (2).)

2. Remove elevator trim tab linkage as follows:

a. Remove rubber splash shield (63) from front face of spar.

b. By working through access holes in top of elevator and through hinge bracket slot in front face of elevator spar, remove bolt (54) that attaches idler link (57), and spacer (55) to elevator spar.

c. Pull push-pull tube assembly through opening in front face of spar and then remove bolt (60) and self-tapping bonding screw.

(3) MAINTENANCE.

(a) **CLEANING.**—Wash fabric surfaces with castile soap and water or use Simoniz Kleener. Remove oil or grease by means of cloth dampened with unleaded gasoline or carbon tetrachloride.

(b) MINOR REPAIRS.

1. Repair damaged fabric as directed in General Manual for Structural Repair (AN 01-1A-1, Section 13).

2. Repair damage to structural members as directed in Structural Repair Manual (AN-01-5MA-3) or replace.

3. Inspect all moving parts and replace those that are worn or defective.

4. Replace worn or frayed bonding cables.

(4) ASSEMBLY AND INSTALLATION.

(See figure 62.)

(a) Assemble and install trim tab linkage as follows:

1. Coat spacer (55) lightly with grease (Specification AN-G-10) and insert into idler (57). Assemble push-pull tubes (62) and (64) and idler link (57); attach with clevis bolt (60); tighten nut to allow the joint to work freely; and lock with cotter pin.

2. Connect bonding braids and push assembly into elevator and through cover plate (59).

3. Mount idler (57) in line with top holes through spar bulkhead and then attach with clevis bolt (54).

Note

The spacer should be clamped tightly between the bulkheads, and the link should swing freely about the spacer.

4. Install rubber splash shield (63) on front face of spar.

(b) Install trim tab. (See paragraph g, (4).)

(c) Check movement of elevator horn for interference and see that outboard hinge pin housings are on as far as they will go.

(d) Lift elevator into place and guide trim tab push-pull tube into housing. This may be accomplished by starting push-pull tube while elevator is held in a vertical position and then gradually rotated into horizontal position.

(e) Install bolts (9) in torque tube fittings and elevator mast.

(f) At outboard hinge, slip shims between elevator rib and hinge pin housing (21). Turn housing so that bolt hole through hub of housing is vertical, and then attach to elevator with bolts (19).

(g) At intermediate hinge, install hinge bolt (61); tighten nut; check for freedom of movement; and lock nut with cotter pin. Attach push-pull tube to jack mechanism with bolt (65); tighten nut to allow joint to work freely; and lock with cotter pin.

(h) Center elevator assembly so that elevator clears stabilizer center section and so that elevator horn has ample clearance at spar cut-out. By working through access hole (48) near outboard hinge, turn adjusting screw in hinge pin until hole in screw is in line with hole in housing. Insert clevis bolt in hole through housing; attach bonding cable; tighten nut; and lock with cotter pin. Attach access hole cover (48).

(i) At intermediate hinge, attach fairing side plate (41) with screws (40). Attach cover plate (59) to rear face of spar with screws (58). Install hand-hole covers (32).

(j) Attach elevator crank housing (31) with bolts (33).

(k) Attach top fairing (27) of rudder to stabilizer fillet with bolts (25).

(l) Close hinged fairings (23) on stabilizer center section and fasten with screws (24) and (30).

(5) OPERATIONAL CHECK.—Have the elevator moved from the pilot's station and observe the movement from the rear. The elevator should move quietly and be free of any binding, interference, or lost motion. For rigging instructions, see Par. 18, d, (4), (b).

g. ELEVATOR TRIM TAB.

(1) DESCRIPTION. (See figure 62.)—The elevator trim tab is of all metal construction, the frame and skin being made of 24ST aluminum alloy sheet stock. The tab is attached to the upper surface of the elevator by a piano type hinge with a removable hinge pin. The tab is actuated by a push-pull tube which is attached to a fitting on the tab spar.

(2) REMOVAL.

(a) Remove bolts (35) from push-pull tube (37).

(b) Disconnect bonding cables.

(c) Cut safety wire at end of hinge and then pull pin (34) out of hinge.

(3) MAINTENANCE.

(a) CLEANING.

1. Remove oil and grease by wiping with cloth dampened with unleaded gasoline or carbon tetrachloride.

CAUTION

Do not allow solvent to get on sealed bearing.

2. Wash surface with castile soap and water.

(b) CORROSION.

1. Treat corroded areas as directed in General Manual for Structural Repair, Section 14 (AN 01-1A-1).

2. Polish hinge pin with crocus cloth.

(c) MINOR REPAIRS.

1. Replace hinge pin if it is bent.

2. For repairs of structural members, see Structural Repair Manual (AN 01-5MA-3).

3. Replace bearing (38) if it is dry, corroded, worn, or if it contains any gritty material.

Note

Do not attempt to lubricate sealed bearings.

4. Replace broken or frayed bonding cables.

5. Touch up finish where it has been worn or chipped off.

(4) INSTALLATION.

(a) Coat hinge pin lightly with grease (Specification AN-G-10). With the tab in place, insert pin into hinge and fasten in place with safety wire.

(b) Connect tab to linkage with clevis bolt (35); tighten nut to allow free motion of joint; and lock nut with cotter pin.

(c) Connect bonding cables.

(5) OPERATIONAL CHECK.—Have the elevator tab controls operated from the pilot's station, and then observe the movement from the rear. The tab should have a quiet, smooth motion and should not have any looseness or lost motion. For rigging instructions, see Par. 18, g, (3), (d), 6.

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RESTRICTED
AN 01-5MA-2

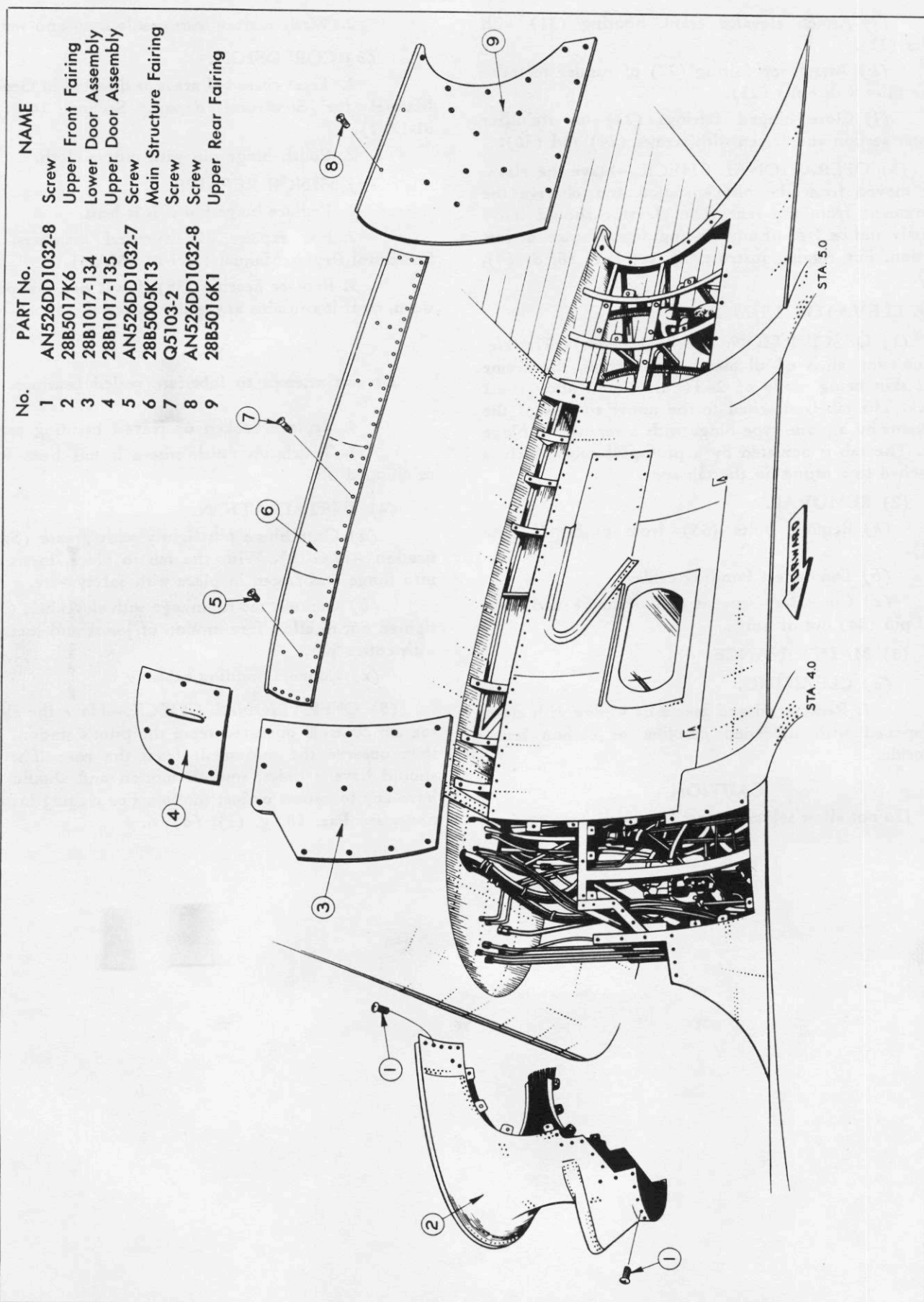


Figure 64—Superstructure

PARAGRAPH 3.



3. HULL.

a. GENERAL.—The hull is an all metal skin stressed structure built around a keel and reinforced longitudinally by stringers, and laterally by beltframes and bulkheads. It consists of a main structure and a superstructure. A pilot's enclosure, two blisters, and the landing gear wells (for PBX-5A airplanes, only) are located on the main structure.

b. HULL STRUCTURE.

(1) DESCRIPTION. (See figure 65.)—The hull is divided into seven major compartments. The bombardier's compartment is in the nose of the hull. Immediately aft of the bombardier's compartment is the pilot's compartment, which extends aft as far as bulkhead 2. The radio operator's and navigator's compartment is aft of the pilot's compartment and extends to bulkhead 4. The compartment between bulkhead 4 and station 5.0 is the galley compartment. Crew quarters are aft of the galley compartment between station 5.0 and bulkhead 6. Aft of the crew quarters, are the waist gun blister compartment between bulkheads 6 and 7, and the tail compartment located aft of bulkhead 7. These seven major compartments can be sealed into five independent hull compartments by closing watertight doors installed for security purposes at bulkheads 2, 4, 6, and 7. Flooding from serious leaks is thus confined to the compartment in which it originates, and does not seriously affect the seaworthiness of the otherwise uninjured hull. The hull structure is built over a keel that extends from bulkhead 2 to 7. The keel contains two steps, one at station 5.0 and the other at station 7.0.

Two mooring platforms, one on each side, ex-

tending from the nose to station 1.33, are installed on the outside of the airplane. These platforms have been provided to facilitate mooring and anchoring operations, and for an emergency exit from the bombardier's compartment. Clips are provided at the aft end of each waist gunner's blister for the installation of an entrance ladder. The main entrance into the airplane is by means of this ladder.

(2) MAINTENANCE.—The maintenance of the hull structure consists mainly of the prevention and removal of corrosion.

(a) PREVENTION OF CORROSION.

1. Wash down the hull thoroughly with fresh water after each flight when the airplane has been in salt water.

2. When it is necessary to wash the airplane, use castile soap (or equivalent), inside and outside. Use plenty of soap and water, and wipe dry with a soft cloth, chamois, or sponge. Never allow soapy water to dry on the surface of the airplane.

3. Inspect the inside and outside of the airplane for corrosion every 60 hours.

4. Replace potassium dichromate crystals in the bilge when the existing supply has been dissolved.

(b) REPAIR OF CORRODED AREAS.

1. When the structural strength is not impaired, but the hull shows corrosion, remove all traces of corrosion and foreign matter by rubbing with sandpaper or emery paper. Do not use a metallic abrasive. Avoid damage to non-corroded areas.

2. Cover sanded surface with a 10 per cent solution of chromic acid. The acid should be applied by spray or rubber sponge.

CAUTION

Because of its strong oxidizing action, the acid should not be allowed to come in contact with cloth, leather, wood, etc.

3. Apply one coat of zinc chromate primer and allow it to dry for at least six hours.

4. Apply two coats of exterior finish to match the surrounding area.

5. If corrosion has progressed until structural strength has been impaired, the affected area must be repaired according to "STRUCTURAL REPAIR MANUAL" (AN 01-5MA-3).

c. SUPERSTRUCTURE.

(1) DESCRIPTION. (See figure 64.)—The superstructure is built up from the main structure of the hull between stations 4.0 and 5.0. It is of aluminum alloy construction with fairings of the same material.

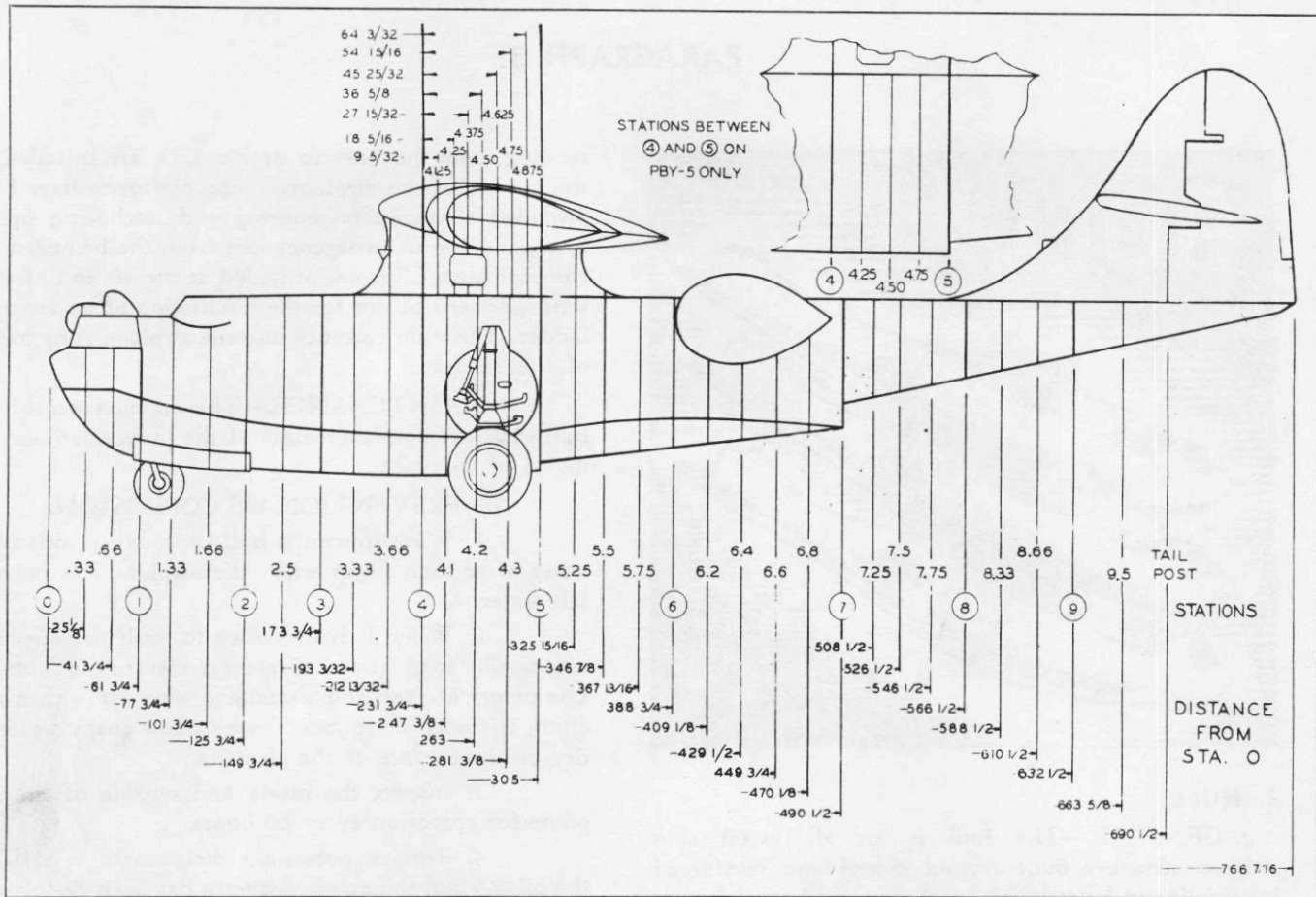


Figure 65—Hull Station Locations

Three access doors are provided on both the port and starboard sides of the superstructure to allow for inspection and repair of all wires, cables, and tubing routed to the wing from the hull. The engineer's station is in the superstructure.

(2) REMOVAL. (See figure 64.)—The main structure of the superstructure is built around the upper portion of bulkhead 4 and 5 and is not removable. The fairing between the main structure and the wing, and portions of the front and rear fairings are removable.

(a) To remove the fairing (6) between the superstructure and the wing, remove bolts (5) and (7).

(b) The upper portions (9) of the rear fairing (both port and starboard) and the two door assemblies (3) and (4) on each side of the front fairing can be removed by unfastening the Dzus fasteners. By using a screw driver to turn the top side, the Dzus fastener will become disengaged from the spring below it.

(c) To remove the upper portion (2) of the front fairing after the four doors (3) and (4) have been removed, detach the bolts (1) from all of its edges.

(3) MAINTENANCE.—The maintenance of the superstructure is the same as for the "HULL STRUCTURE." (See paragraph b., (2).)

(4) INSTALLATION.

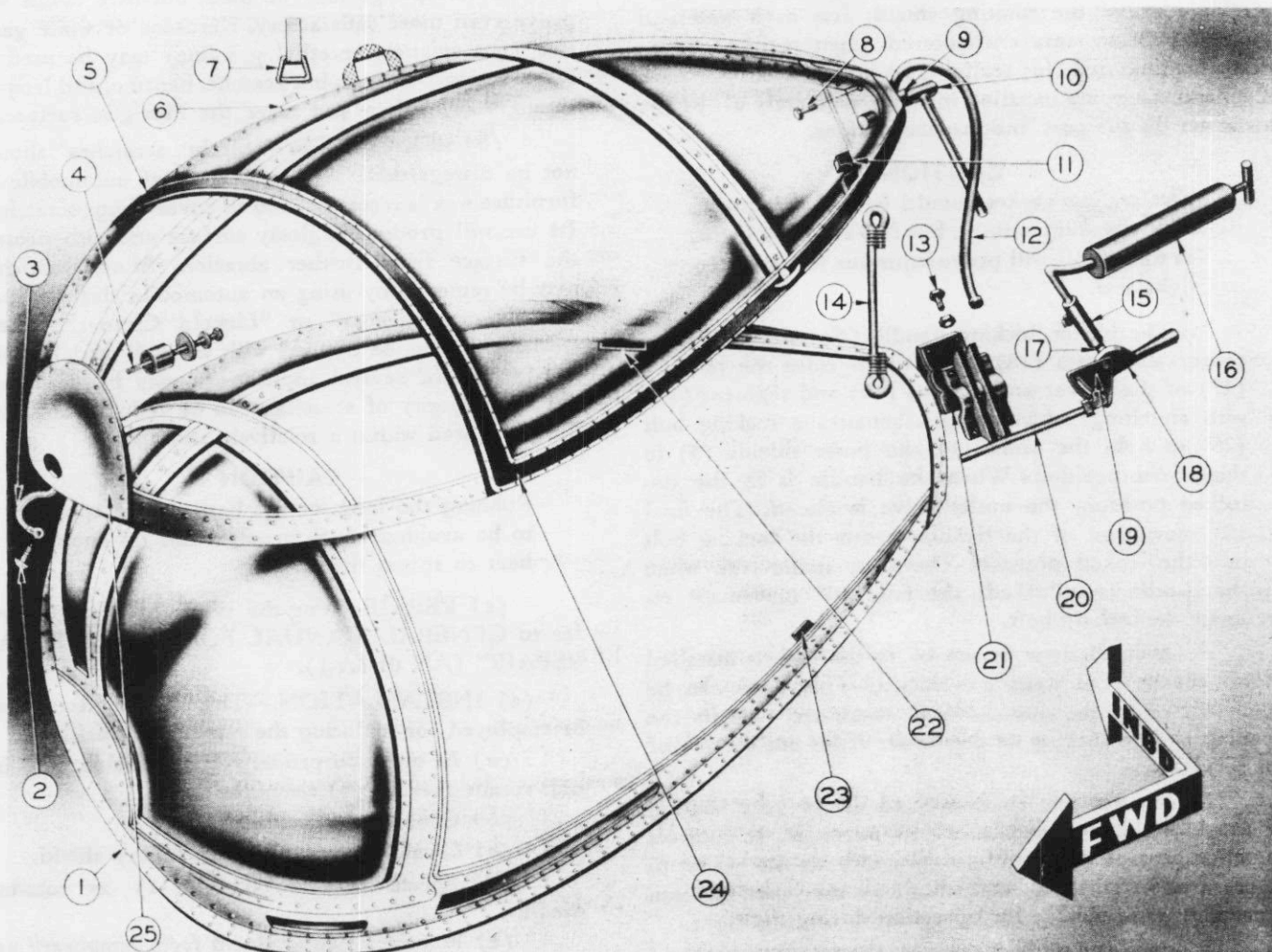
(a) To install upper portion (2) of front fairing, place it in position and attach with bolts (1) at all edges. Replace the four doors (3) and (4) by attaching with the Dzus fasteners.

(b) To install upper portions (9) of the rear fairing, hold it in position and attach with the Dzus fasteners.

(c) To install upper fairing (6) on main structure of the superstructure, hold it in position and attach bolts (5) and (7).

d. BLISTERS. (See figure 66.)

(1) DESCRIPTION.—Two side blisters of tear drop design in the aft portion of the hull between bulkheads 6 and 7 are installed to shelter machine guns mounted on a fixed post located on both port and starboard sides. Each blister is constructed of an aluminum alloy frame comprising an inner and outer shield. The inner shield rotates, while the outer remains stationary. Each frame encloses Plexiglas, which is reinforced for protection from the force of the wind.



No.	PART No.	NAME	No.	PART No.	NAME
1	28A5020-2L -2R	Stationary Shield	14	28A5161	Shock Cord
2	AN526DD832-14 AN365D832	Screw Nut	15	28A5033	Gasket Outlet Valve
3	Q508A-6	Bonding Braid	16	2049	Hand Pump
4	AN4-30A AN365-428	Bolt Nut		Noera Mfg. Co. Waterbury, Conn.	
5	28A5104-2L -2R	Rotating Shield	17	28B4050	Plunger
6	28F5266	Hook	18	28B4043	Cam
7	28F5258	Snubber Ring	19	28A4059	Segment
8	AN4-14A	Bolt	20	28A5060	Locking Bolt
9	28A4064	Locking Block	21	28A5011-9	Rear Bearing Fitting
10	28A5117	Eccentric Shaft	22	28A5020-94 28A5020-95	Steel Clip Rubber Bumper
11	28F5333	Micarta Block	23	28A5020-14L 28A5020-87L	Stops
12	28F5327	Gasket Hose			
13	AN3DD6A AN365D1032	Bolt Nut	24	28A5106	Gasket
			25	28A5031	Front Bearing Plate

Figure 66—Waist Gun Blister

A pneumatic gasket, extending around the outside edge of the rotating shield, acts as a waterseal against heavy seas encountered when taxiing, taking off, or landing. This sealing gasket is inflated by means of a hand pump installed inside immediately aft of the blister on the port and starboard sides.

CAUTION

The sealing gasket should be inflated during take-offs and landings, but NOT during flight, as the results will prove injurious to the watertight seal.

The blister locking handle (See figure 66) incorporates a cam (18) upon which rides the plunger (17) of the gasket outlet valve (15) and segment (19) with an elongated slot which actuates a locking bolt (20) to hold the outer (1) and inner shields (5) in the closed position. When the handle is in the unlocked position, the outlet valve is closed. The final 10° movement of the handle throws the locking bolt into the locked position. The same holds true when the handle is unlocked; the final 10° movement releases the locking bolt.

A small door for access to the lock is installed aft of the port waist gun blister. This door can be opened from the outside. This, therefore, permits the opening and locking of the blister from the outside of the airplane.

An eccentric shaft, located at the rear bearing of the blister, accomplishes two purposes. It controls the alignment of the rotating shield with the gasket to insure a watertight seal, and allows clearance between inner and outer shields for operation during flight.

A pneumatic snubber prevents the rotating shield from snapping open too rapidly, and, when open, is held in position by a shock cord.

(2) REMOVAL.—Removal of the inner rotating shield from the outer stationary shield is accomplished by disengaging the parts as follows:

(a) Unhook shock cord (14) by removing bolt (8) from the bottom of the aft bearing plate.

(b) Unhook gasket hose (12) connected to locking device.

(c) Unhook snubber strap ring (7) from rotating shield.

(d) Detach bonding wire (3) by removing bolt.

(e) Remove center bolt (4) from front bearing plate (25), and four bolts (13) from the rear bearing fitting (21). Pull the forward end of the shield from bearing; this will allow the aft end of the shield to drop down, and therefore permit removal of rotating shield from airplane.

(3) MAINTENANCE.—The maintenance of the waist gun blister consists mainly of the care of Plexiglas.

(a) CLEANING.—Wash the Plexiglas with mild soap and cold water. A clean grit-free cloth,

chamois, or sponge may be used, but bare hands will prove even more satisfactory. Kerosene or white gasoline (not aviation or ethyl gasoline) may be used to remove grease and oil, but acetone, benzine, and lacquer thinners will soften and craze the Plexiglas surface.

(b) SCRATCHES.—Slight scratches should not be disregarded. The application of automobile or furniture wax is recommended to cover minor scratches. Its use will produce a glossy surface and also protect the surface from further abrasion. Minor scratches may be removed by using an automobile cleanser such as "Simoniz Kleener" or "Lincoln Cleaner." These cleaners should be applied with a small pad of soft, grit-free cloth. Several applications may be necessary, but the majority of scratches can be reduced and visibility restored within a relatively short time.

CAUTION

Rubbing too long, or too hard at one spot is to be avoided, since it may build up enough heat to soften the plastic.

(c) REPAIR.—For the repair of Plexiglas, refer to GENERAL MANUAL FOR "STRUCTURAL REPAIR" (AN 01-1A-1).

(4) INSTALLATION.—The following steps may be employed for replacing the removable shield:

(a) In order to properly align shields, first install rotating shield (5) temporarily.

(b) Contour the bulb angles.

(c) Locate stops (23) on stationary shield.

(d) Locate micarta blocks (11) on rotating shield.

(e) Remove rotating shield from temporary position, and install locking blocks (9).

(f) Install steel clips (22) and rubber bumper.

Note

It is important that the steel clip be installed as it serves to prevent the removable shield from being forced away from the stationary shield when air is being pumped into the gasket.

(g) Attach shock cord (14) to shield (5) with ¼ inch bolt (8) before installing in ship. Bolt will not go in after installation.

(h) Reinstall rotating shield to proper position.

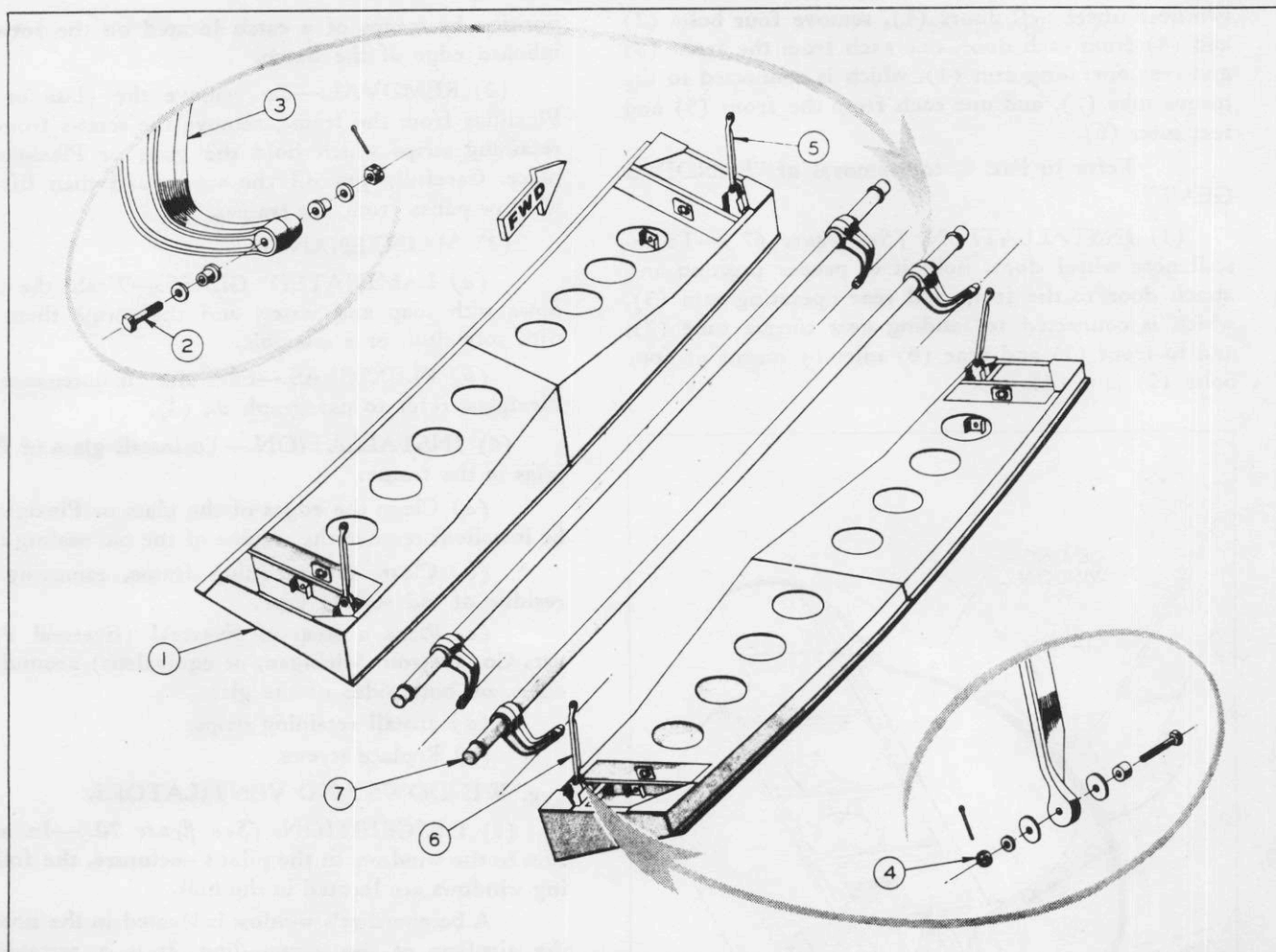
(i) Attach bonding wire (3) to forward bearing plate (25) with one bolt (4).

(j) Connect gasket hose (12) to locking devices.

(k) Install steel hook (6) on rotating shield (5).

Note

When leathers become loose on snubber, tighten the adjustable screw on end of cylinder. The shock cord may be adjusted, when it loses its elasticity, by advancing it to the succeeding hole on the shock cord link.



No.	PART No.	NAME	No.	PART No.	NAME
1	28B5606-L -R	Nose Wheel Well Doors	4	AN4D11 AN320D4	Bolt Nut
2	AN6DD37 AN310D6 AN380C3-3 Q7010AL25-.063	Bolt Nut Cotter Pin Washer	5	28B5577	Front Idler
3	28B5515	Operating Arm	6	28B5578	Rear Idler
			7	28B4028	Torque Tube

Figure 67—Nose Landing Gear Doors (PBY-5A Only)

(l) Install center bolt (4) to front bearing plate (25).

(m) Installation is completed by attaching the four bolts (13) to rear bearing fitting (21).

Note

A thin layer of neoprene should be used to separate two dissimilar metal parts (steel or alclad).

e. LANDING GEAR WELLS. (PBY-5A ONLY).
(See figures 67 and 68.)

(1) DESCRIPTION.—Three wells in the outer shell of the hull enclose landing gear and retraction mechanism when landing gear is in the retracted po-

sition. The forward, or nose wheel well, is located in a recess in the bottom of the hull and extends from stations 1.0 to 2.0. Two doors close over this well, when the nose gear is retracted, to form an unbroken hull line. Access openings for the gear "UP" and gear "DOWN" locks, and a view plate are provided in the ceiling of the well.

Two wells, one on each side of the hull, house the main landing gear when retracted. These wells extend from stations 4.1 to 5.0 and have no doors or cover for the retracted gear, but remain open at all times. A small view plate and an access door are located on the inboard wall of each well.

(2) REMOVAL. (See figure 67.)—To remove the

two nose wheel well doors (1), remove four bolts (2) and (4) from each door, one each from the front (3) and rear operating arm (3), which is connected to the torque tube (7), and one each from the front (5) and rear idler (6).

Refer to Par. 4, for removal of "LANDING GEAR."

(3) INSTALLATION. (See figure 67.)—To install nose wheel door, hold it in proper position and attach door to the front and rear operating arm (3), which is connected to landing gear torque tube (7), and to front (5) and rear (6) idler by means of four bolts (2) and (4).

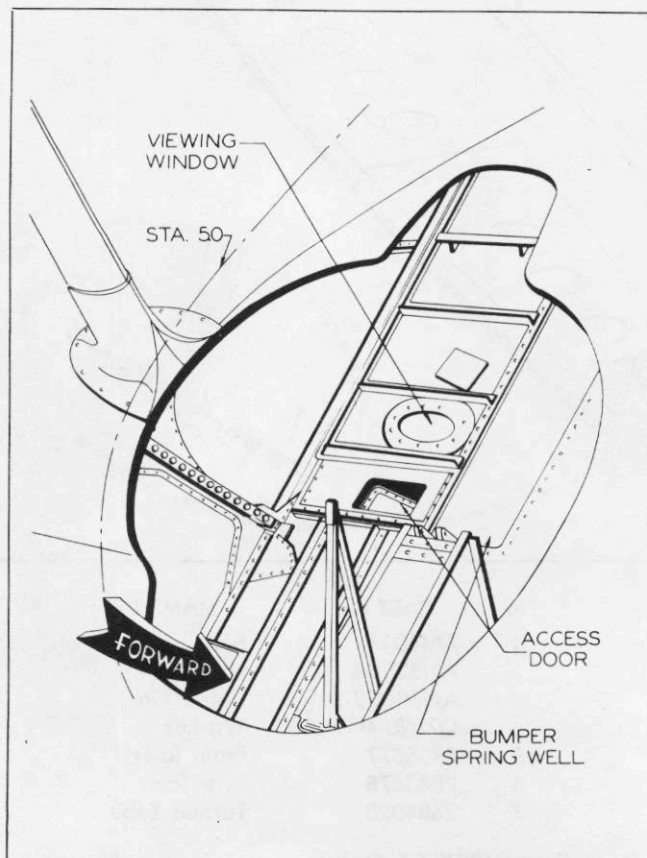


Figure 68—Main Landing Gear Well (PBY-5A Only)

f. PILOT'S ENCLOSURE.

(1) DESCRIPTION.—The pilot's enclosure is a framework covered with glass or Plexiglas, and located at the top of the hull beginning aft of station 1.0 and extending to station 2.5. The frames of the pilot's enclosure are aluminum alloy. The windshield glasses, side glasses, and the two forward glasses on top of the enclosure are of laminated glass. The windows on the sliding hatch, and those on the fixed ports located on the deck aft of station 2.0 are of Plexiglas. The sliding window can be locked in the open or closed position by means of an arm which fastens to a knob on the window. The sliding hatch can be locked in open or closed

position by means of a catch located on the forward, inboard edge of the hatch.

(2) REMOVAL.—To remove the glass or the Plexiglas from the frame, remove the screws from the retaining strips which hold the glass or Plexiglas in place. Carefully pry off the strips, and then lift the window panes from the frames.

(3) MAINTENANCE.

(a) LAMINATED GLASS.—Wash the windows with soap and water, and then wipe them dry with soft cloth or a chamois.

(b) PLEXIGLAS.—For the maintenance of Plexiglas, refer to paragraph d., (3).

(4) INSTALLATION.—To install glass or Plexiglas in the frame:

(a) Clean the edges of the glass or Plexiglas to be installed; remove the residue of the old sealing tape.

(b) Clean the retaining frame, removing the residue of old sealing tape.

(c) Place a strip of Everseal (Everseal Products Co., Detroit, Michigan, or equivalent) around the edges on both sides of the glass.

(d) Install retaining strips.

(e) Replace screws.

g. WINDOWS AND VENTILATORS.

(1) DESCRIPTION. (See figure 70.)—In addition to the windows in the pilot's enclosure, the following windows are located in the hull.

A bombardier's window is located in the nose of the airplane at the center line. It is a rectangular shaped, fixed window, and is constructed of semi-tempered laminated glass. The window is provided with two metal covers. On the outside is a sliding cover which is retracted into the nose by operating a crank located inside the airplane at the top of the window. The inside cover is an aluminum alloy cover which may be stowed when not in use. (See Par. 24, h, (10).) PBY-5A airplanes with serial numbers 46596 and on are equipped with a triangular shaped fixed window that is provided with a metal cover on the inside only. A hand hole is located immediately to the right of the window to permit the bombardier to clean the outside of the window during flight.

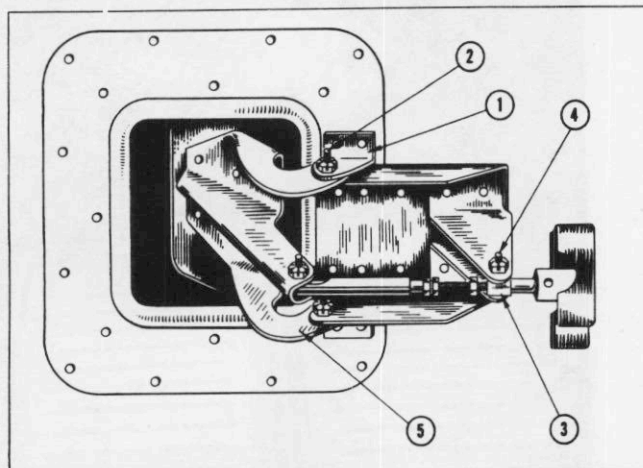
In the navigator's compartment, there are two fixed windows. These windows, constructed of Plexiglas, are located between stations 2.5 and 3.0; the larger one is on the port side, and the other on the starboard side.

Two Plexiglas windows are located in the engineer's compartment, one on each side in the superstructure. These windows slide up and down and may be locked by means of a latch located at the bottom of each window.

One fixed Plexiglas window is located on each side of the galley compartment. These windows are located above the small access doors to the wheel well.

There are two fixed Plexiglas windows installed in the living quarters, one on the port wall and one on the starboard wall; these are located between stations 5.0 and 5.5.

The tunnel gun compartment has a rectangular Plexiglas window located on the starboard wall forward of station 7.5.



No.	PART No.	NAME
1	28B1270	Hinge
2	AN23-8	Clevis Bolt
	AN320-3	Nut
	AN380-2-2	Cotter Pin
3	28B5148	Shaft Nut
4	AN23-15	Clevis Bolt
	AN320-3	Nut
	AN380-2-2	Cotter Pin
5	28B1265	Ventilator Flap

Figure 69—Compartment Ventilator

Also installed in the hull are five small, hinged ventilators. (See figure 69.) Two of these ventilators are in the pilot's compartment aft of station 1.33, one being on the port wall, and the other on the starboard wall; one is in the starboard ceiling of the navigator's compartment aft of station 3.0, and the other two are in the ceiling of the living compartment, one on each side of the center line forward of station 5.5. Knobs for controlling the opening, closing, and locking of the ventilators are installed on the two in the pilot's compartment and the one in the navigator's compartment. The ventilators in the living compartment are of the hinged door type with a toggle hinge latch.

(2) REMOVAL.

(a) To remove the bombardier's window, remove bolts and retaining strips, or blocks, and then remove the glass with its frame.

(b) To remove engineer's window, unscrew the corner pieces at bottom of window, unscrew the two side tracks, and then remove window and frame. Remove Plexiglas from frame.

(c) To remove Plexiglas from frame or from fixed windows, remove screws and retaining strips, or cover plates, from the inside of the windows; carefully pry off retaining strips, or cover plates, and remove neoprene, or cork gaskets. Plexiglas can then be lifted from frame.

(d) To remove ventilators, remove the two hinge bolts and the screws holding the control knobs, or toggle latches, to the side wall of the airplane.

(3) MAINTENANCE.

(a) LAMINATED GLASS.—Wash the win-

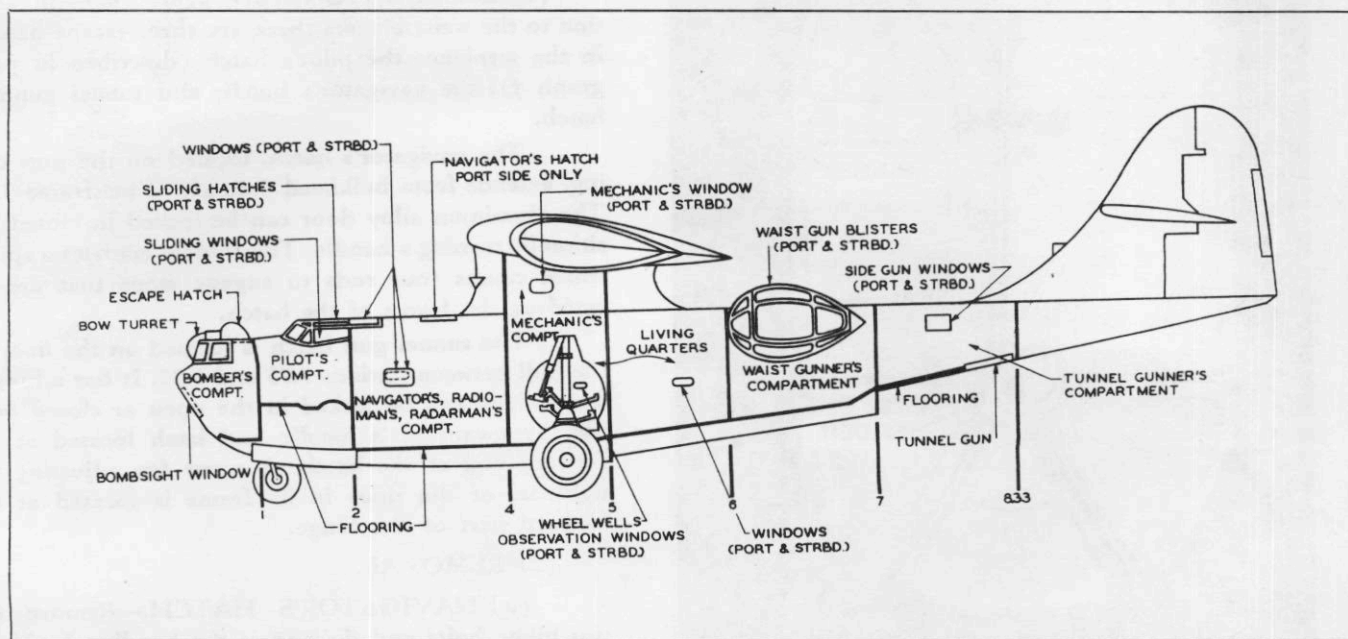


Figure 70—Compartments, Windows, and Flooring

dows with soap and water and wipe them clean with a soft cloth or chamois.

(b) PLEXIGLAS.—For the maintenance of Plexiglas, refer to paragraph d., (3).

(c) HINGES AND LOCKS.—Lubricate hinge points and locks. A light oil (Specification AN-O-6) should be used for this purpose.

(4) INSTALLATION.

(a) To install bombardier's window, replace glass assembly and the retainer strips, or blocks. Bolt these in position.

(b) To install engineer's window, insert Plexiglas in its frame; slide the frame into its tracks, and then bolt tracks into position. Bolt the two corner pieces into position at bottom of each window.

(c) To install Plexiglas in frames, or fixed windows, place neoprene or cork gaskets on both sides of the Plexiglas; install retaining strips, and then fasten in place with screws.

(d) To install ventilators in pilot's and navigator's compartments, connect hinges by means of two hinge bolts, and then install control knob shaft nut to bracket on side wall by means of clevis bolt. (See figure 69.)

(e) To install ventilators in the living compartment, connect hinges by means of two hinge bolts, and

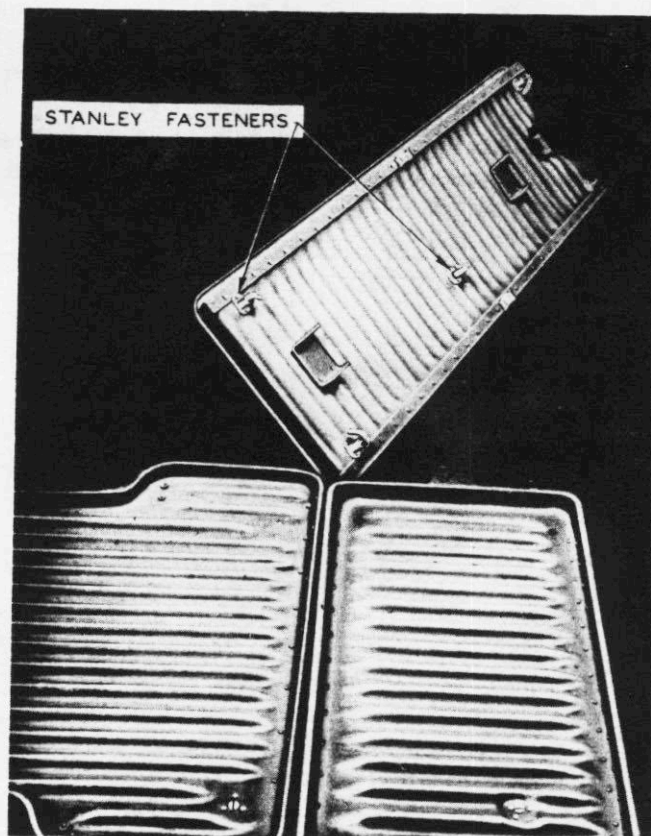


Figure 72—Typical Floor

then fasten toggle latch to angle on side wall by means of bolt.

h. ESCAPE HATCHES.

(1) DESCRIPTION. (See figure 70.)—In addition to the waist blisters there are three escape hatches in the airplane; the pilot's hatch (described in paragraph f); the navigator's hatch; and tunnel gunner's hatch.

The navigator's hatch, located on the port ceiling, extends from bulkhead 3 to aft of beltframe 3.33. The aluminum alloy door can be locked in closed position by turning a handle. This handle actuates a spider which causes four rods to engage stops that are located on the frame of the hatch.

The tunnel gun hatch is located on the floor of the hull between stations 7.75 and 8.33. It has a hinged door which can be locked in the open or closed position by means of a handle and latch located at the forward end of the hatch. A screw for adjusting the tightness of the door in its frame is located at the forward part of the hinge.

(2) REMOVAL.

(a) NAVIGATOR'S HATCH.—Remove the two hinge bolts and disconnect the bonding braid located at the hinges. Unlatch the door and remove it.

(b) TUNNEL GUNNER'S HATCH.—Dis-

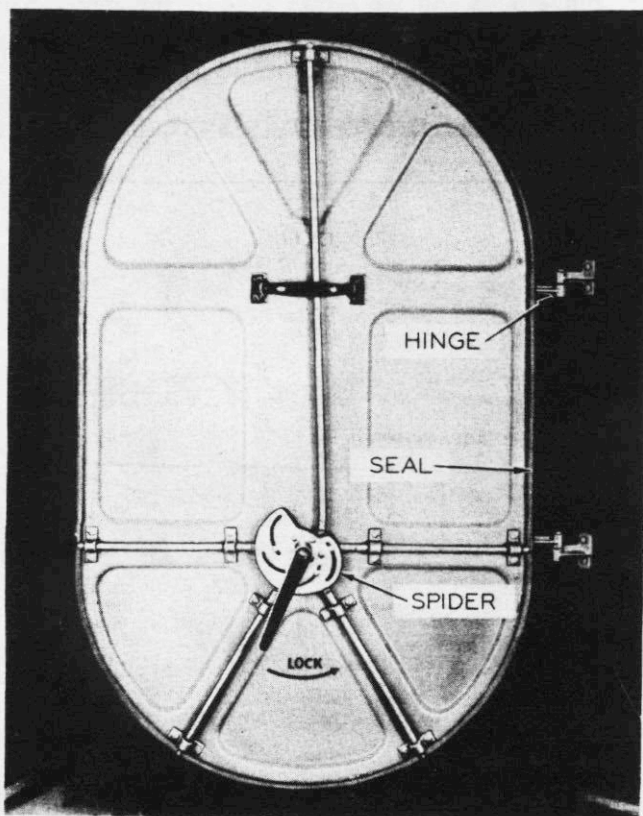


Figure 71—Bulkhead Door

connect the hinges by removing the bolt and nut at the aft portion of each hinge.

(3) MAINTENANCE.—Lubricate hinge points and locks with a light oil (Specification AN-O-6).

(4) INSTALLATION.

(a) NAVIGATOR'S HATCH.—Place the navigator's hatch in position and install the hinge bolts. Connect the bonding braid.

(b) TUNNEL GUNNER'S HATCH.—Hold the door in position, and then connect the hinges by means of the hinge bolts.

i. BULKHEAD DOORS.

(See figure 71.)

(1) DESCRIPTION.—Watertight, hinged doors are installed on bulkheads 2, 4, 6, and 7. These are constructed of aluminum alloy. Each door has a handle to lock it in closed position. This handle activates a spider consisting of five rods which fit over stops located on the door frame. The doors are held in open position by means of hooks installed at the top of each door.

(2) REMOVAL. (See figure 71.)—Remove the hinge pins from the two hinges in each door.

(3) MAINTENANCE.—Lubricate hinge points and locks with a light oil (Specification AN-O-6).

(4) INSTALLATION.—To install doors, hold in position, and then attach hinges by means of hinge pins.

j. FLOORS.

(See figure 72.)

(1) DESCRIPTION.—The floors in the hull are drop hammer parts constructed of aluminum alloy. They are held in place by Stanley type fasteners. Pads, designed to prevent rattling and chafing of parts, are attached to the clips or supports below the flooring.

(2) REMOVAL.—To remove flooring, use a screw driver. Push down and slightly turn the top side of the Stanley fastener several degrees until it clears the clip on the reverse side. This releases the fastener and the floor can then be lifted out.

(3) INSTALLATION.—Before installing the floors, see that supporting angles have not been torn loose from bulkheads and stringers to which they are attached, and that floor clips and fasteners are in correct alignment with each other. Push down and turn the top of each fastener several degrees until the floors are held taut by the fasteners.

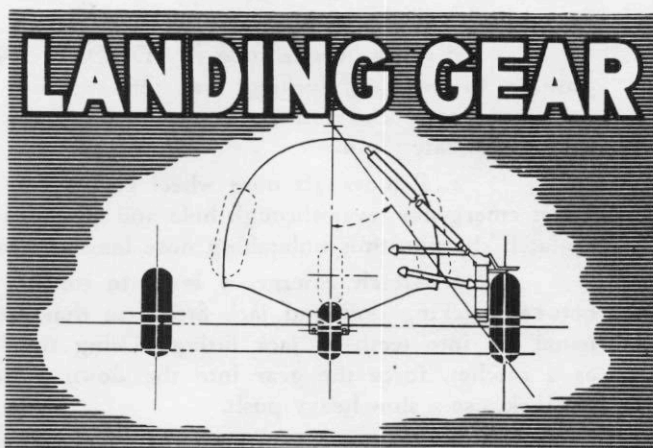
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PARAGRAPH 4.



4. LANDING GEAR AND BRAKES.

a. GENERAL.

(1) DESCRIPTION.—The PBY-5A airplane only is equipped with a tricycle landing gear consisting of two main gears and one nose gear.

The entire landing gear is retractable, being activated by hydraulically operated cylinders which are controlled by a selector valve and handle located under the pilot's panel. The two main gears retract into wheel wells in the side of the hull. The nose gear retracts into a wheel well in the bow of the hull. Doors close over the nose wheel well after the gear is retracted and opens before the gear is extended.

All three units are provided with up and down locks which engage automatically when the gear reaches the fully extended position or retracted position, and release automatically at the beginning of retraction or extension.

Each main unit is equipped with a hydraulic pneumatic shock strut mounting a water tight wheel and brake assembly and a pneumatic tire.

Brakes are of the disc type and are operated by means of hydraulic pressure supplied by the main hydraulic system through a brake control valve which in turn is operated from extensions on the rudder pedals.

The nose landing gear is equipped with a hydraulic pneumatic shock strut which mounts a wheel and tire assembly and a shimmy damper.

A signal light on the pilot's instrument panel indicates "WHEELS DOWN" when both main landing gear wheels and the nose wheel are locked in landing position. Signal lights indicate "WHEELS UP" when the main landing gear unit has been raised, and "WHEEL DOORS LOCKED" when the nose wheel has been retracted and the door closed and latched. The position of the gear may be determined at any time by placing the indicator switch in the "INDICATION LIGHTS" position and observing

which lights are illuminated. At all other times, the switch should remain in the "WARNING LIGHTS" position. With the switch in this position, no indication can be obtained unless the throttles are cut, whereupon the lights will register as though the switch were in the "INDICATION LIGHTS" position.

(2) OPERATION.—The landing gear may be extended by either of the three following methods: Normal hydraulic extension; emergency manual hydraulic extension; and manual emergency extension.

The landing gear may be retracted by either the normal hydraulic method or the manual hydraulic method.

External safety locks are provided and are installed on the three landing gear down locks when the weight of the airplane is resting on the gear to prevent the gear from being retracted.

WARNING

External safety locks must be removed before a land take-off or before launching the airplane on the landing gear.

(a) NORMAL HYDRAULIC RETRACTION AND EXTENSION.—The selector valve, locking knob, and name plates for operation of the landing gear units are located below the pilot's instrument panel slightly to port of the airplane center line. Complete operating instructions appear on the instruction plate. (See figure 73.) To extend or retract the landing gear by this method, the starboard engine must be operating.

(b) EMERGENCY HYDRAULIC EXTENSION AND RETRACTION.—The manual hydraulic system should be used in case of failure of the engine driven pump. Proceed as follows:

1. Rotate landing gear selector valve to the desired position.

2. Actuate the gear by building up hydraulic pressure with the emergency hand pump. This pump is located just inboard of the co-pilot's seat.

(c) EMERGENCY MANUAL EXTENSION.—In case of failure of the hydraulic system, the landing gear may be lowered manually as follows:

1. MAIN LANDING GEAR.

(See figure 74.)

- a. Rotate landing gear selector valve to "DOWN" position.

- b. Release the "UP" locks by pulling out and turning "Tee" handles at the main wheel wells $\frac{1}{4}$ turn. (See figure 75.)

- c. Work gear down by rocking airplane approximately 14° to each side.

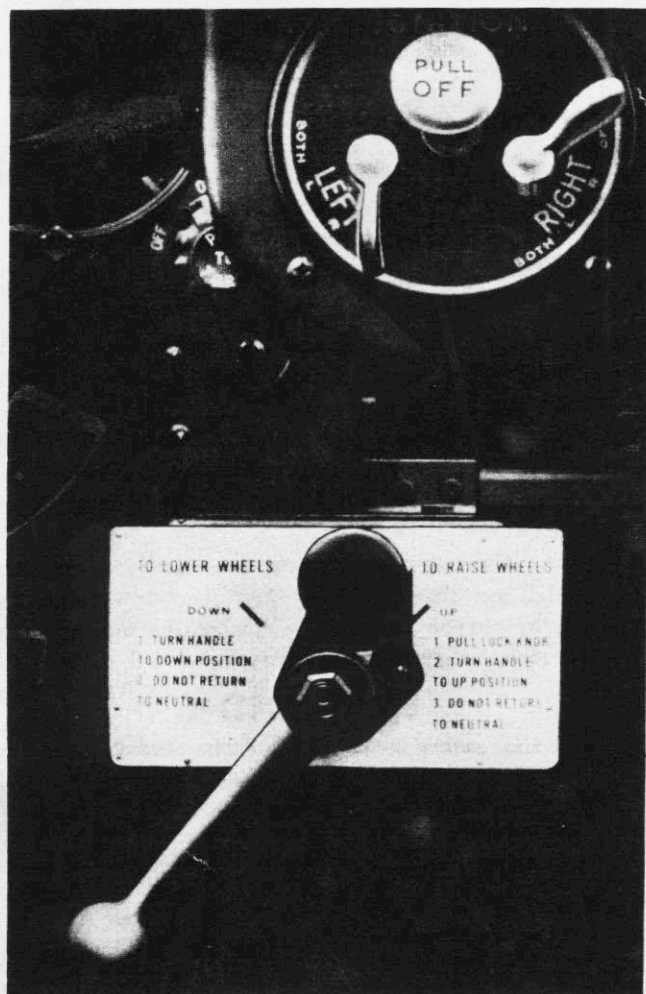


Figure 73—Landing Gear Selector Valve

d. Use the "down latch" rod, stowed on port side shear web aft of main wheel well, to straighten out and "latch down" the main support struts of the main landing gear. This is done by inserting the emergency down latching rod through the door and operating as follows:

(1) Engage the short end of the lever over the bolt provided on the auxiliary keel.

(2) Guide the outside end of the rod into the strut socket located just above the pivot point in the strut.

(3) Pushing firmly on the lever will straighten out the struts and the gear will lock down.

2. NOSE WHEEL GEAR.

(See figure 76.)

a. Turn landing gear valve to "DOWN" position.

b. Unlock the nose wheel doors by pushing door lock handle (located on the starboard side forward of bulkhead 1.) aft, thus releasing door lock pins.

c. Insert hydraulic hand pump handle or

emergency lever handle (stowed aft of bulkhead 2 on port side) in aft end of starboard door torque tube (located aft of bulkhead 2) and push inboard (counter-clockwise), rotating torque tube and thus opening nose wheel well doors.

d. Lock torque tube in "DOORS OPEN" position by swinging locking link inboard over lug on torque tube end fitting. Insert locking pin and retain with safety pin.

e. Remove aft nose wheel cover plug and insert emergency lever through hole and strike end of up-latch sharply, thus unlatching nose landing gear.

f. Attach emergency lever to torque tube between packing unit and jack fitting so that ratchet panel fits into teeth of jack fitting. Using the lever as a ratchet, force the gear into the down position. To lock, use a slow heavy push.

g. Remove forward plug of wheel unit cover to examine down-lock and use emergency lever to determine if down-latch is locked. If it is locked, the red collar on the lever will not extend above hole and oleo strut will be vertical and against down bumper. When the top of the collar is even with the hole, the down latch is locked.

CAUTION

Before operating gear again, be certain to release the emergency door locking link.

The above procedure for the emergency hydraulic and manual lowering of the landing gear is based on the assumption of an actual failure of the power hydraulic system and should be followed for an actual emergency drop. However, if a check or practice emergency drop is to be made, it is necessary first to shut off the starboard engine and feather the propeller; and then work the pressure out of the accumulator by operating the selector valve from the up to the down position and back again several times very rapidly. After this is done, proceed with the emergency manual extension as outlined.

b. MAIN LANDING GEAR.

(1) GENERAL. (See figure 80.)—Each side unit consists of a 47-inch 10-ply smooth contour tire; a Goodyear wheel and watertight brake assembly No. 530126; an Aerol shock strut (Cleveland Pneumatic Tool Co. Drawing No. 8103-L and-R or No. 8251-L and-R) including oleo scissors and axle; a strut assembly; and hydraulic retraction mechanism.

(2) WHEEL AND TIRE ASSEMBLY.

(a) DESCRIPTION.—The main landing gear wheels are of the drop center type. They are of all cast construction made either from Dow metal or aluminum alloy. The wheels are machined to be fitted with drive spline inserts in the brake cavity. The brake cavity is fitted with a drain cock in order to determine if water is present in the brake cavity without necessitating removal of the wheel.

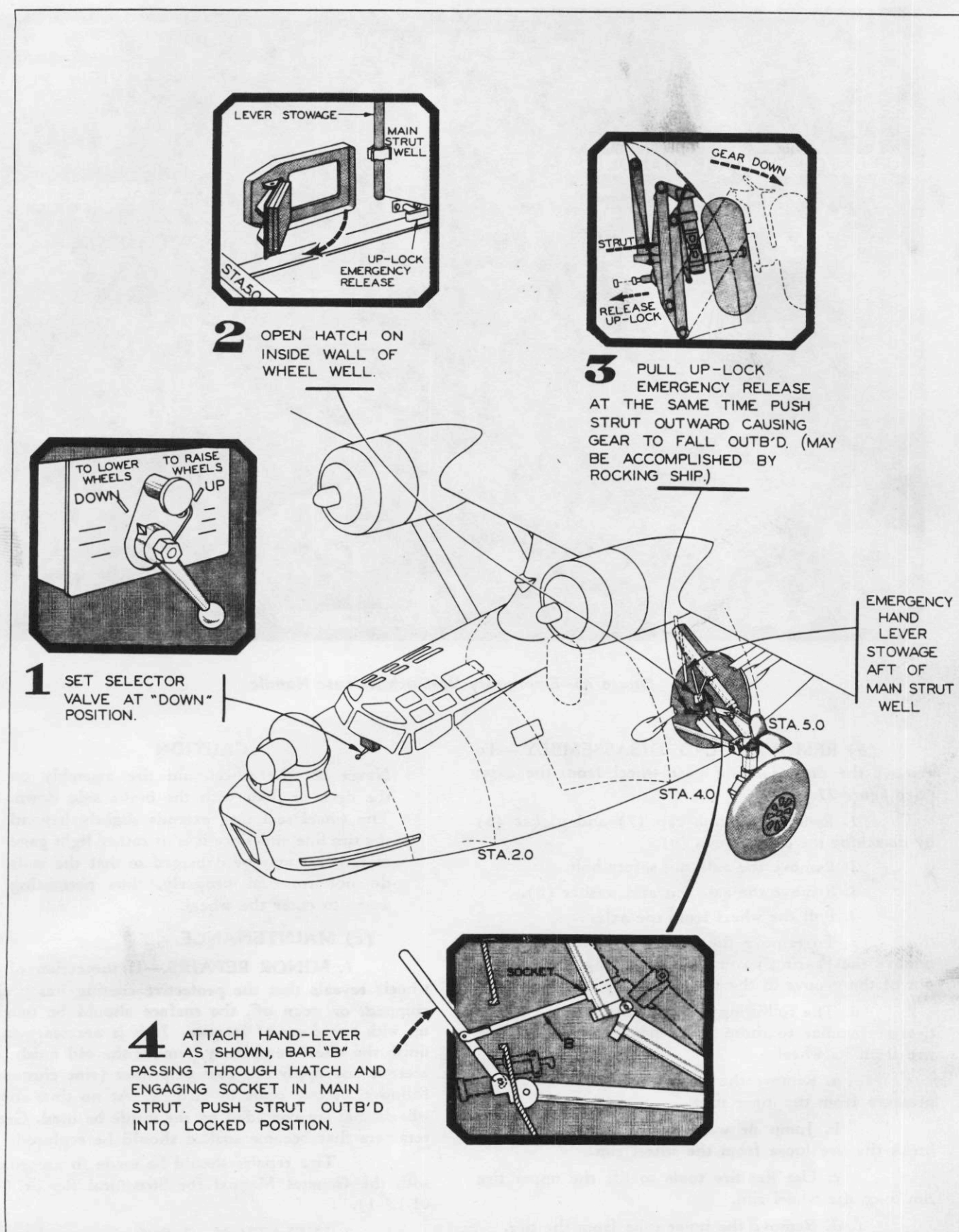


Figure 74—Emergency Lowering—Main Landing Gear

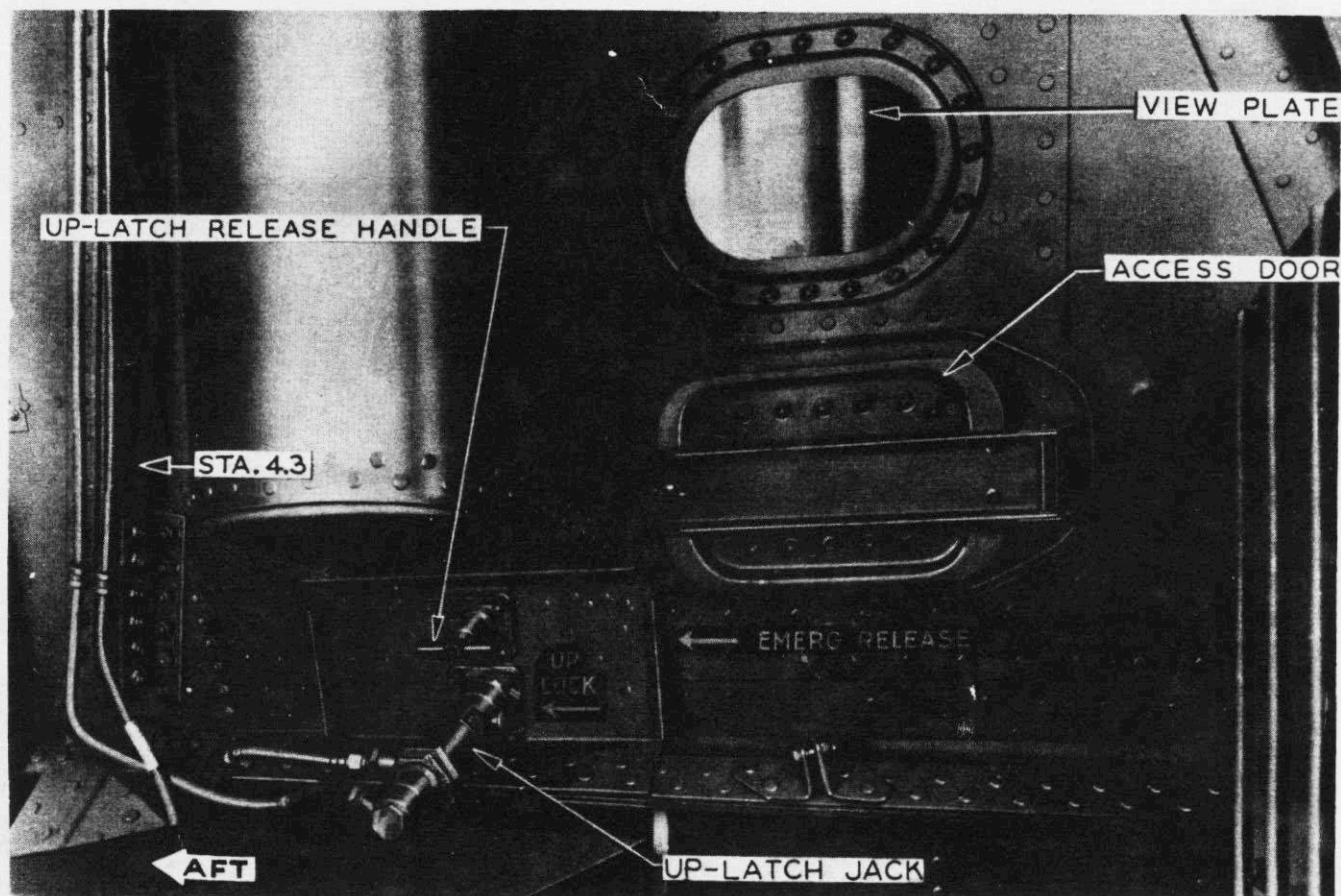


Figure 75—Emergency Up-Latch Release Handle

(b) REMOVAL AND DISASSEMBLY.—To remove the main landing gear wheel from the axle: (See figure 77.)

1. Remove the hub cap (7) and gasket (5) by detaching the eight screws (6).
2. Remove the axle nut safety bolt.
3. Remove the axle nut and washer (8).
4. Pull the wheel from the axle.
5. To remove the inboard bearing (2), first remove the bearing cover (1) by prying the tongues out of the groove in the wheel and tap out bearing.
6. The following steps for the removal of the tires are similar to those for removing an automobile tire from its wheel:
 - a. Remove the valve core to release all air pressure from the inner tube.
 - b. Jump or walk on the tire side wall to break the tire loose from the wheel rim.
 - c. Use flat tire tools to lift the upper tire rim over the wheel rim.
 - d. Remove the inner tube from the tire.
 - e. Pry the lower tire rim over the upper wheel rim.

CAUTION

Never lay the wheel and tire assembly on the deck or floor with the brake side down. The wheel seal ring extends slightly beyond the tire line and since it is of rather light gage material, it may be damaged so that the seals do not function properly, thus permitting water to enter the wheel.

(c) MAINTENANCE.

1. MINOR REPAIRS.—If inspection of the wheels reveals that the protective coating has peeled, chipped, or worn off, the surface should be touched up with two coats of lacquer. If it is necessary to re-finish the wheel completely, remove the old finish with acetone and apply one coat of primer (zinc chromate) followed by two coats of lacquer. At no time should wheels that are corroded on the inside be used. Grease retainers that become soaked should be replaced.

Tire repairs should be made in accordance with the General Manual for Structural Repair (AN 01-1A-1).

2. INFLATION.—Inflate tires to the pressure which is correct for the weight of the airplane. (See figure 78.)

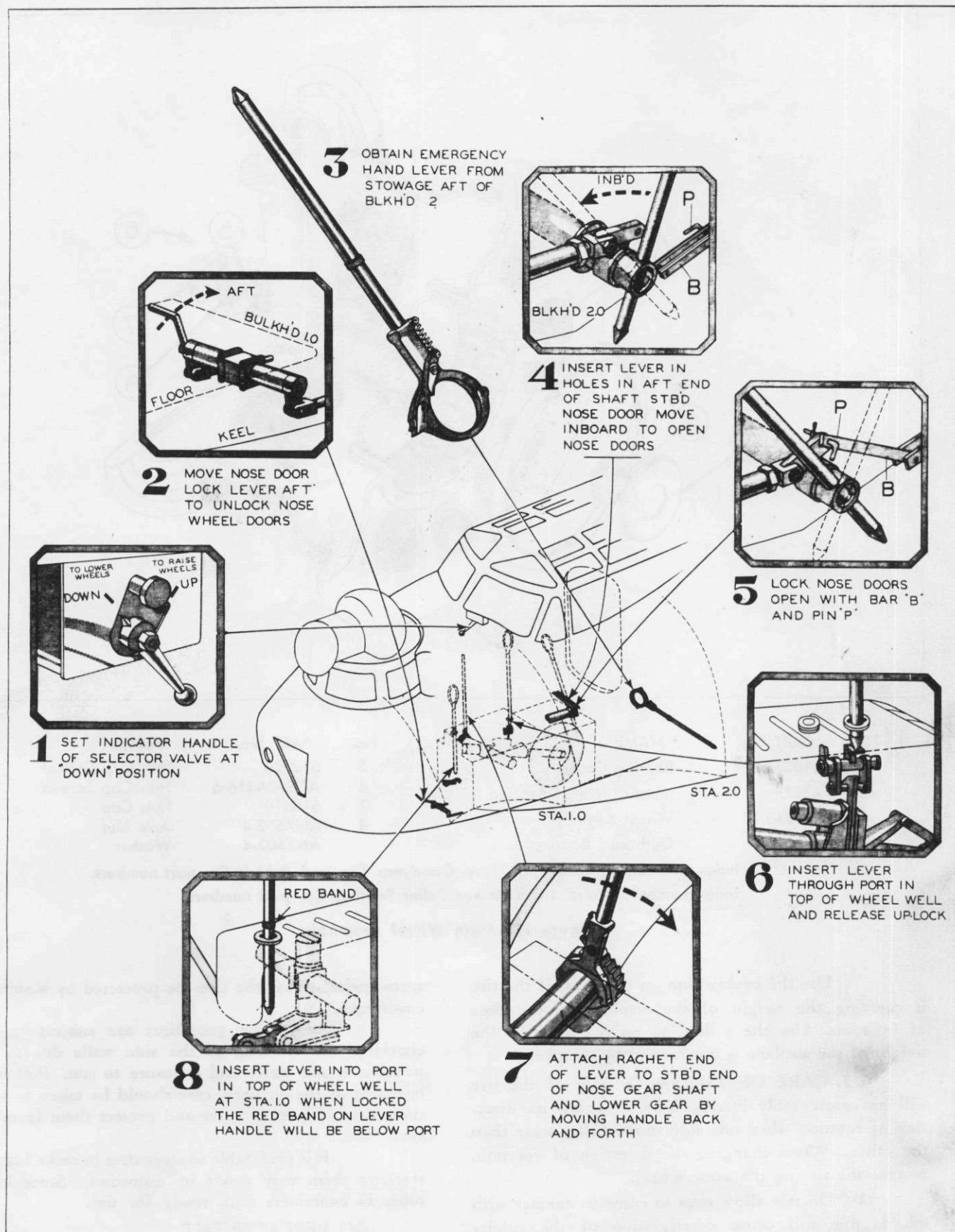
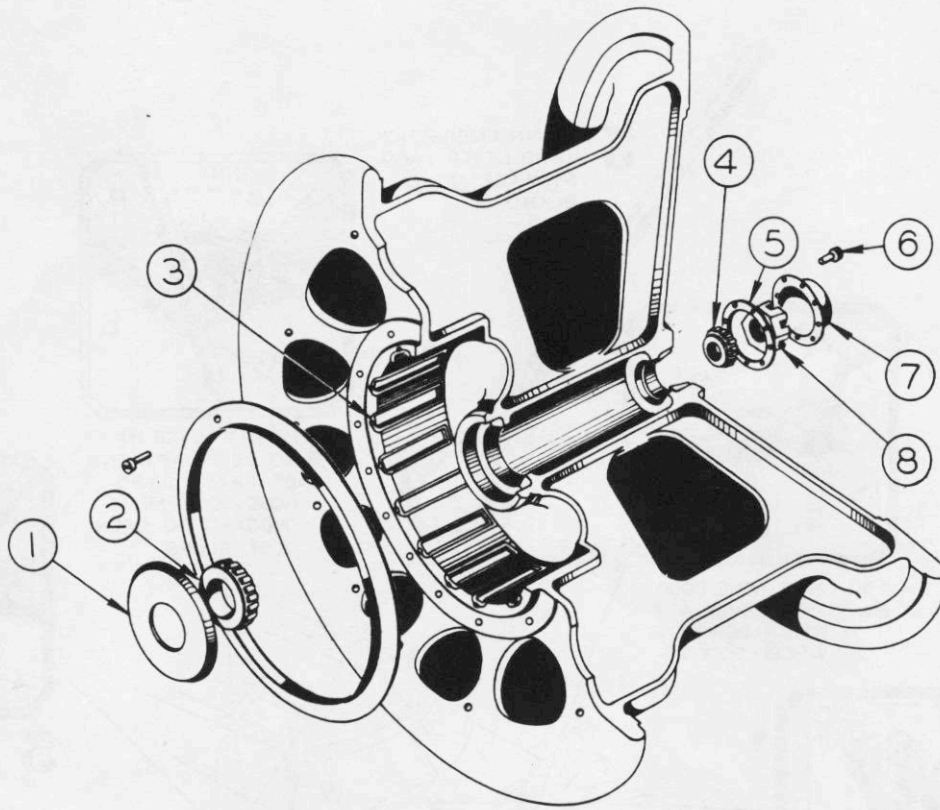


Figure 76—Emergency Lowering—Nose Landing Gear



No.	PART No.	NAME	No.	PART No.	NAME
1	510084-3	Bearing Cover	5	510926	Hub Cap Gasket
2	42375	Inboard Wheel Bearing	6	AC500A416-6	Hub Cap Screws
3	218340-13	Wheel Keyways	7	510619	Hub Cap
4	34300	Outboard Bearing	8	AN7502-4	Axle Nut
				AN7503-4	Washer

Index numbers 1, 3, 5 and 7 are Goodyear Tire and Rubber Co. part numbers.
Index numbers 2 and 4 are Timken Roller Bearing Co. part numbers.

Figure 77—Main Wheel Assembly

Use the broken line on the chart if the tire is carrying the weight of the airplane at the time of inflation. Use the solid line on the chart if the weight of the airplane is not carried by the tires.

3. CARE OF TIRES.—The life of the tire will be considerably increased by changing its direction of rotation when one side shows faster wear than the other. When changing the direction of rotation, reverse the tire on the same wheel.

Do not allow tires to come in contact with oil, as this will cause deterioration of the rubber and result in rapid wear and weakening of the tire construction. When the engines are changed, it is

recommended that the tires be protected by a suitable covering.

Amphibian gear tires are subject to sun checking and cracking of the side walls due to immersion in salt water and exposure to sun. Following beaching of the airplane, care should be taken to wash these tires with fresh water and protect them from the sun.

It is preferable to store tires in racks because stacking them may result in distortion. Store inner tubes in containers until ready for use.

(d) REPLACEMENT.

1. Replace leaking valve cores. Use Dill 302D or Schrader 2300 type cores.

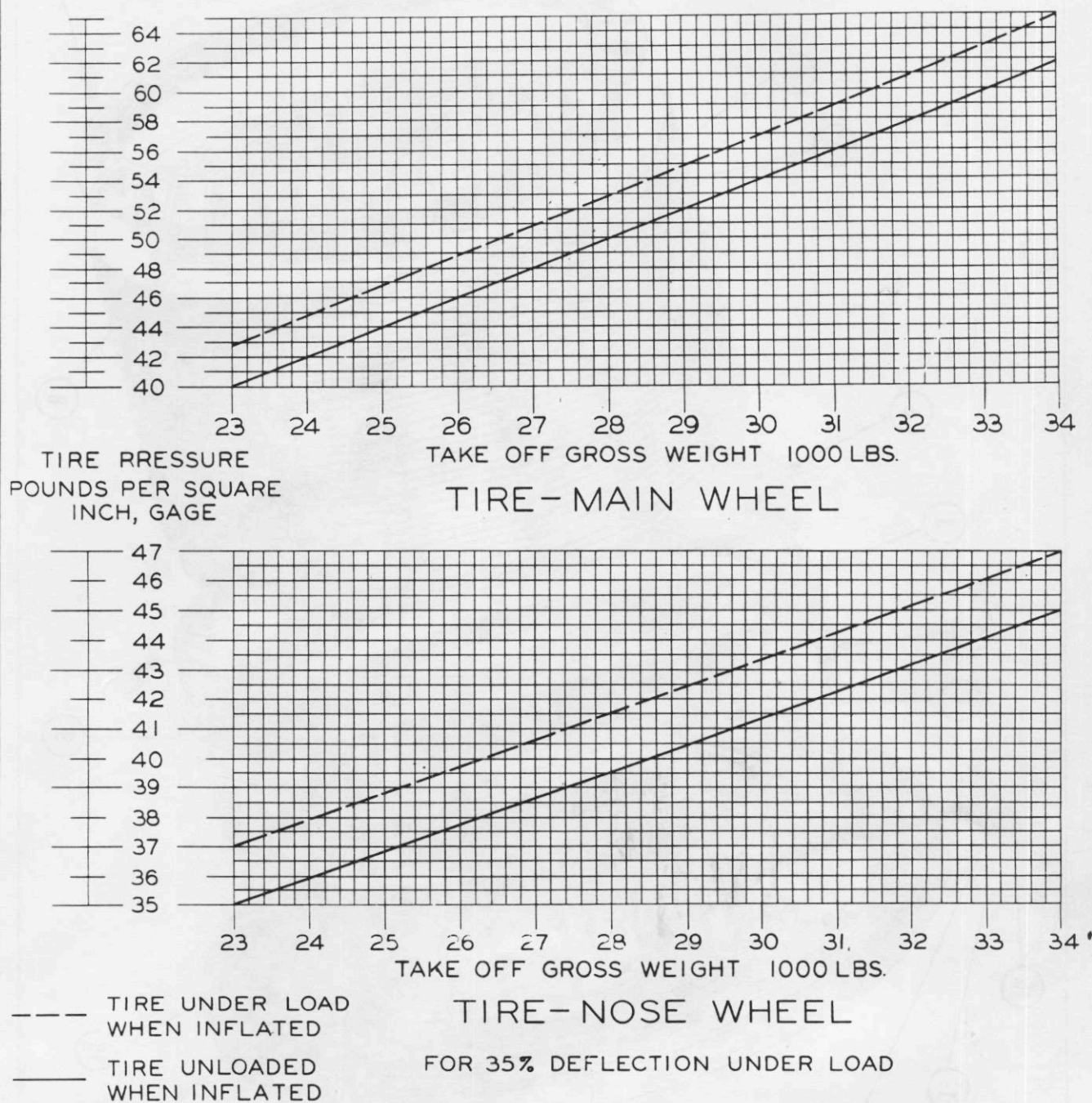


Figure 78—Tire Inflation Diagram

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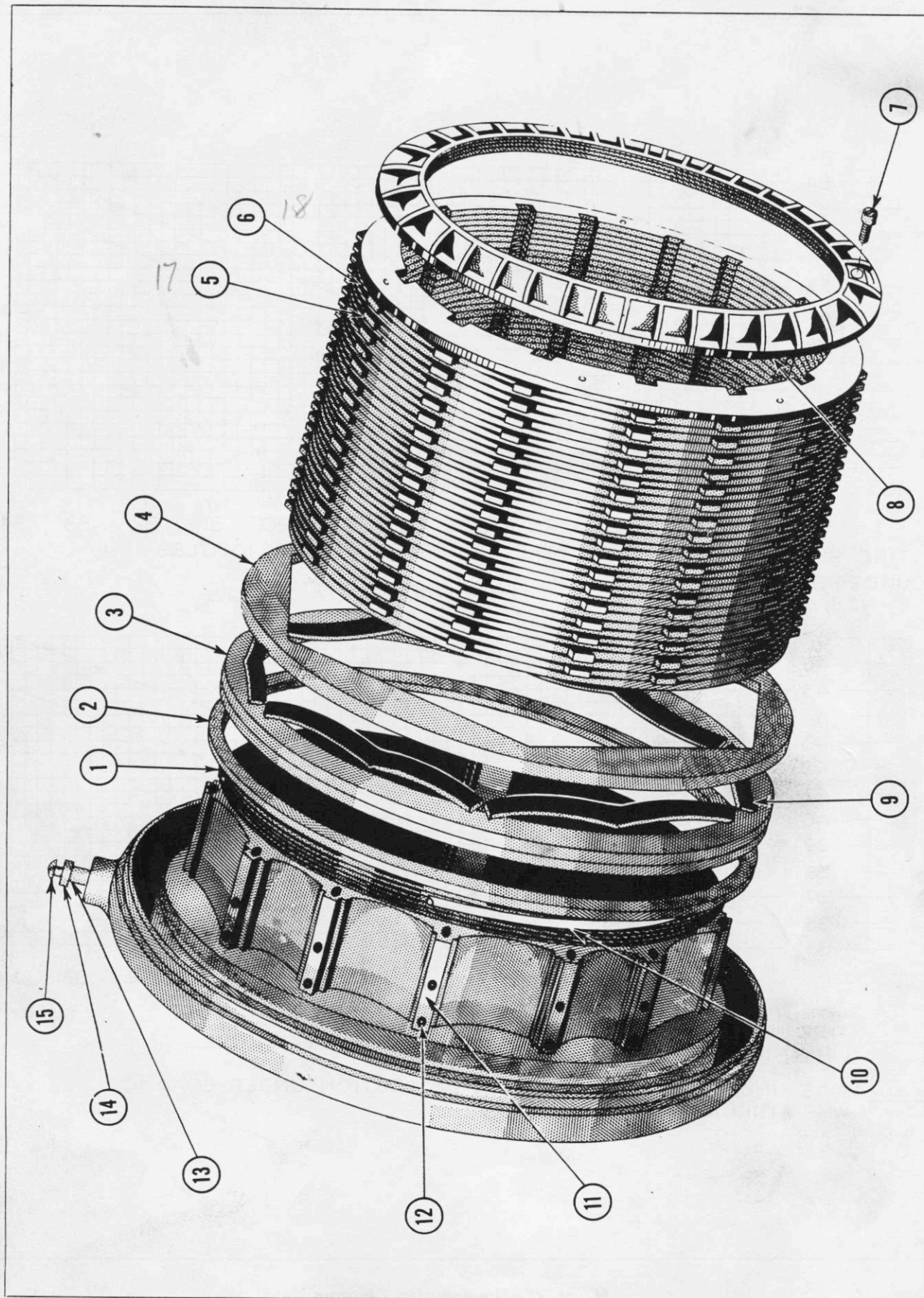


Figure 79—Brake Assembly

No.	PART No.	NAME	No.	PART No.	NAME
1	530152-A	Anchor Bracket	9	218608	Piston Return Spring
2	214048	Piston Gasket	10	217967	Piston Gasket Expander
3	218610-A	Piston Assembly	11	218274-7	Anchor Key
4	218609	Insulating Disc	12	217244-4	Anchor Key Screw
5	530031	Rotating Disc	13	218613	Bleeder Plug
6	530030	Stationary Disc	14	AN960-10	Bleeder Plug Washer
7	510534	Screw	15	AN520-10-6	Bleeder Screw
8	731631	Disc Retaining Nut			

Index numbers 1-13, inclusive, are Goodyear Tire and Rubber Co. part numbers.

2. Replace inner tubes if the valve body is damaged or if the tube has a large hole, cut, or tear.

3. Replace tires if the fabric is torn or broken or if the fabric is exposed at any point due to chafing, a cut, or tread wear.

4. Replace the bearing if the inner races or rollers are worn, chipped, or broken, or if the roller retaining ring is damaged. However, if the bearing cup is damaged, the entire wheel must be replaced. The bearing cups are shrink-fitted to the wheel. Do not attempt to press or drive them out.

5. If brake keyways are damaged, replace the entire wheel. These are likewise shrink-fitted to the wheel.

6. Replace the wheel if it is cracked, bent, or otherwise damaged.

7. Replace threaded parts if threads are damaged.

8. Replace brake water seal wiper ring if it is in any way damaged.

(e) ASSEMBLY AND INSTALLATION.

1. Mount the tire to the wheel in much the same manner as mounting an automobile tire on its wheel.

2. When inserting tubes having balance marks into the tire, place the tube so that the balance mark is adjacent to the red dot on the tire in order to balance the assembly.

Note

Balance marks appear on certain aircraft tubes to indicate the heavy portion of the tube. These marks are approximately 1/2 inch wide by 2 inches long.

3. When inserting tubes having no balance marks, place the valve at the red dot on the casing.

CAUTION

The above method of inserting the inner tube is important because a heavy spot in a wheel assembly will have the tendency to be always at the bottom when landing, and therefore to strike the ground first. This results in severe wear in one spot on the tire tread and possible early failure.

4. To assemble and mount the wheel, proceed as follows: (See figure 77.)

a. Insert the inboard wheel bearing (2) in the wheel. Pack bearing with grease (Specification AN-G-4) before insertion in wheel.

b. Assemble inboard bearing cover (1) to wheel and lock in place by bending tongues down into the groove in the wheel.

c. Line up keys on all bronze brake discs with a straight edge and apply the brake to hold the discs in position.

d. Line up disc keys with wheel keyways (3) and slide the wheel over the brake, being sure that the wheel engages the last disc.

e. Release the brake and then insert the outboard bearing (4). Pack bearing with grease (Specification AN-G-4) before insertion in wheel.

f. Install axle nut (8).

CAUTION

It is important that the axle nut be properly tightened to give the desired load on the tapered roller bearings of the wheel assembly. To do this, tighten the axle nut sufficiently to seat the bearing in the bearing cup and then tighten to the next lock position, not to exceed one-sixth of a turn. The wheel should be turned during this operation to move the grease so that the bearing is allowed to contact the bearing cup.

g. Assemble gaskets (5) and hub cap (7) to wheel with the eight screws (6), being careful not to tighten so much as to squeeze the gasket out from under the hub cap. Lock-wire the screws.

(f) OPERATIONAL CHECK.—Rotate and shake the wheel by hand. It should show no perceptible binding or side play. Rotate the wheel again and apply and release the brakes several times. The wheel should stop quickly when the brake is applied, and should again be free to rotate as soon as the brake is released.

(3) BRAKE ASSEMBLY.

(a) DESCRIPTION. (See figure 79.)—The brake assembly consists of an anchor bracket, rotating and stationary discs, an adjusting nut, and an annular ring piston. The anchor bracket is bolted to

a torque plate on the axle. Steel keys are bolted to the anchor bracket and the non-rotating discs are keyed to these. Rotating discs are keyed into splines in the wheel. These rotating discs have steel cores with bronze friction material deposited on both sides. The frictional material bears against the non-rotating steel discs. These discs are held in position on the anchor bracket by the steel disc retaining nut. Proper clearances between the discs are obtained by adjusting the position of this nut, the nut being held in position by a lock screw when the proper total clearance is obtained. The annular ring piston presses the discs together to furnish the desired braking effect. This piston is activated by fluid from the 10 inch accumulator of the hydraulic system delivered by the brake valve through the brake booster. A circular leaf type piston gasket expander spring holds the piston gasket against the cylinder wall. An insulator disc located between the brake piston and the first steel disc prevents excessive heating of the piston and vaporization of the brake fluid. Cut-outs in the insulator disc permit the piston return springs to bear directly against the piston.

(b) REMOVAL AND DISASSEMBLY.

(See figure 79.)

1. Remove the wheel. (See paragraph b, (2), (b).)
2. Remove cotter pin and locking screw (7) and then unscrew disc retaining nut (8) by using both hands.
3. Remove stationary discs (6) and rotating discs (5) by sliding them out along the anchor bracket keys and over the axle.
4. Carefully remove the asbestos insulator disc (4).

CAUTION

Extreme care must be used in removing the insulator disc, as it is fragile and easily damaged.

5. By using a prying motion with an ordinary screw driver, remove all piston return springs (9) from the anchor bracket casting (1).
6. Lift the piston out of the piston cavity and off the anchor bracket casting. If the piston sticks, air pressure by means of a hand pump or pressure hose applied through the inlet port will release it.
7. Remove the piston seal gasket (2) by using air pressure through the inlet port to release it from the piston cavity.

(c) MAINTENANCE.

1. MINOR REPAIRS.

- a. Worn discs should be replaced. If discs

are found to be warped or dished, remove and flatten them by tapping them on a flat plate until they return to a flat condition. If dished, tap on outer circumference, and if warped, tap on inner circumference. "Deposits" or "pick-up" on discs can be removed by soaking for one day in a 20% solution of sodium cyanide. Rinse and polish lightly, using No. 600 emery paper and water. Discs that have a small amount of "deposit" can be cleaned by buffing on a cloth wheel with buffing compound, or by hand polishing with No. 600 emery paper and water.

CAUTION

Any disc that has been cleaned with emery cloth or compound should be thoroughly washed and cleaned with unleaded gasoline before using to prevent any of the grit or compound from damaging the disc.

- b. If gasket is found to be worn or shrunk or in any way damaged, replace with new gasket.
- c. Broken or weak return springs should be replaced with new springs.
- d. Insulator discs in poor condition from oil saturation, distortion from compression, etc., should be replaced.

2. BLEEDING.

- a. Hold a wrench on the bleeding fitting (13) and remove screw (15) and washer (14) from the end of the fitting. This fitting is located on the inboard side of each wheel near the top of the brake.
- b. With the accumulator pressure between 850 psi and 1050 psi, insert the bleeder hose in end of fitting and insert other end of hose in a container of clean hydraulic fluid (Specification AN-VV-O-366).
- c. Depress brake pedal and open bleeder valve one or two turns.
- d. By keeping end of bleeder tube under oil, bleed brakes until all air bubbles are out of the system and fluid runs clear.
- e. In the process of bleeding the brake, release the brake pedal at intervals.
- f. Release the brake with the bleeder tube still under the oil.
- g. After all air has been expelled, remove bleeder hose and re-install screw and washer in the end of the bleeder fitting.

Note

Never allow the hydraulic reservoir to become dry or dangerously low of fluid, or the entire system must be bled.

- h. Upon completion of the bleeding operation, refill the hydraulic reservoir to the desired level.



3. TROUBLES AND REMEDIES.

TROUBLE	CAUSE	REMEDY
a. Excessive pedal travel or insufficient braking action.	(1) Normal wear of bronze discs or improper adjustment of clearance between discs.	(1) Adjust brake discs. If brake discs are worn to such an extent that the retaining nut cannot be tightened up to the clearance specified in paragraph b, (3), (d), a stationary steel disc should be inserted next to the retaining nut and the brake then adjusted to the proper clearance. If discs are worn excessively, replace with a new set.
	(2) Leakage in the system.	(2) If piston seal is worn, shrunk, or damaged, replace with new seal. If dirt is present in the system, flush system out thoroughly and refill with clean fluid (Specification AN-VV-O-366). Replace damaged fittings, tubes, or hose assemblies.
	(3) Air in the system.	(3) Bleed the system as outlined in paragraph b, (3), (c), 2.
	(4) Malfunctioning of hydraulic system.	(4) See Par. 21 for troubles and remedies pertaining to units of the hydraulic system.
b. Dragging brakes.	(1) Improper adjustment of clearance between discs.	(1) Adjust clearance as outlined in paragraph b, (3), (d).
	(2) Dirt in system.	(2) Flush the system thoroughly and disassemble the brake valve, the deboosters, and brake piston. Clean all parts in industrial alcohol; reassemble; and fill the system with clean fluid (Specification AN-VV-O-366).
	(3) Use of improper fluid.	(3) If seals have swelled, replace with new seals. Flush system thoroughly with industrial alcohol and refill with oil (Specification AN-VV-O-366).
	(4) Weak or broken brake piston return springs.	(4) Replace with new springs.
	(5) Malfunctioning of brake valve or deboosters cylinder.	(5) See Par. 21 for troubles and remedies pertaining to units of the hydraulic system.
	(6) Dished or warped bronze or steel discs.	(6) Rework as outlined in paragraph b, (3), (c), 1.
	(7) Brake pedal linkage binding.	(7) Check and repair any defects in mechanical linkage.

TROUBLE

CAUSE

REMEDY

c. Water seepage.

(1) Piston Gasket Seal Assembly.

(1) Remove seal assembly from the brakes and coat contacting surface on brake casting with Permatex No. 1 sealing compound. Heat the seal assembly in water near the boiling point and chill the brake casting in ice for at least an hour. Then, quickly slip the seal assembly into place, being careful to locate the lubricating holes to match the brake casting. Let dry and harden for 24 hours without disturbing the joint.

(2) Other Permatex sealed joints such as axle torque plate and brake casting, anchor key screws, and etc.

(2) The old sealing compound should be cleaned away and a new thin layer of Permatex spread evenly on the surfaces. Each bolt should be coated with Permatex when it is installed.

(3) Vent fitting in the lower half of the brake leaking.

(3) A swivel bolt connection which is used for the fitting may become loosened by vibration. Place an aluminum washer under this fitting and coat with Permatex No. 1 sealing compound. As an additional precaution, safety-wire the bolt to prevent loosening.

(d) ADJUSTMENTS.—To adjust brake disc clearance, proceed as follows:

1. Screw the disc retaining nut up tight and back off until a feeler gage can be inserted between the discs. The clearance should be .119 inches for the entire unit, not for each disc. Back off disc retaining nut to next lock position and then safety in place.

2. In case a feeler gage is not available, another satisfactory method of adjusting disc clearance is as follows: Screw disc retaining nut up tight and then back off until proper clearance is obtained on the basis that each complete turn of the retaining nut gives .060 inches clearance.

(e) ASSEMBLY AND INSTALLATION.

(See figure 79.)

1. In re-assembling a brake which has been completely disassembled, first install the two expander spring halves (10) in the brake piston gasket (2). These expander springs have a series of notches on both sides, the notches on one side being wider than on the other. Install the two expander spring halves in the gasket with lips up and the wide notches toward the inside and the narrow notches toward the outside. First locate the ends of the two springs in the gasket

making certain they meet but do not overlap, and then work the rest of the springs into the gasket. Both springs must be completely inside the lips of the gasket. The insertion of the expander springs can be facilitated if the gasket is lubricated with brake fluid (Specification AN-VV-O-366), thereby permitting the springs to become adjusted.

2. After thoroughly cleaning the brake fluid cavity, cover gasket with brake fluid (Specification AN-VV-O-366), and insert gasket and spring assembly with lips inward being careful to feed the gasket into the cavity progressively so as not to cut the lips or force the spring from under the lips. After gasket is in place, check by running finger around the gasket; any hard raised spot or comparatively soft spots in the gasket will indicate that the lips of the expander spring are not properly installed in the gasket. In this case, the gasket should be removed and re-installed after the lips of the expander spring have been properly seated in the gasket.

3. Next, insert piston (3) in the piston cavity.

4. Install piston return springs (9). The springs are inserted by hand so that they center under

the anchor keys. They can be pushed into place if first compressed near the center point with the thumbs, pressure being applied by grasping the anchor bracket with the fingers of both hands. Care should be taken to prevent scratching of the piston near the spring bearing surfaces. It is recommended that small thin protective steel sheets be used at spring ends during application. These thin plates can be pulled out when springs are placed in position.

5. Replace the insulator disc (4) and then slip on a stationary steel disc. Next add a rotating bronze disc. Then alternate steel and bronze discs until the proper number of discs are in place. (18 stationary steel, and 17 rotating bronze discs.)

CAUTION

Be sure that steel discs are next to both the retaining nut and the insulator disc.

6. Screw the disc retaining nut (8) up tight and then back off until the proper clearance is obtained. (See paragraph *b*, (3), (d).)

7. Brakes are interchangeable; any brake can be used on either the right or left side. When ready to install on the axle, put a thin layer of Permatex No. 1 sealing compound on the axle torque plate and the contacting surface of the brake.

8. Bolt the brake unit to corresponding holes in the torque plate and safety. See that the bleeder port (13) is at the top and on the vertical center line when the ship is in normal landing position. If bleeder port varies more than 15° from this position, it will be difficult or even impossible to properly bleed the system.

9. Connect the line provided to the vent connection in the lower half of the brake. The fitting should be given a thin coat of Permatex No. 1 sealing compound and then securely tightened.

10. Connect brake pressure supply line to the brake.

11. Fill the system with fluid (Specification AN-VV-O-366) and bleed as outlined in paragraph *b*, (3), (c), 2.

(f) OPERATIONAL CHECK.—To check the brakes, the airplane should be taxied. Apply both right and left brakes individually and then together. Apply brakes with a light but steady push to check for smooth braking action. Depress both brake pedals fully and set the throttle at 2700 rpm or 35 inches of mercury. The brakes should be capable of holding the airplane against the thrust produced.

(4) BRAKE CONTROLS. (See Par. 21, *f*, (5).)

(5) MAIN STRUT ASSEMBLY.

(a) DESCRIPTION. (See figure 80.)—The strut assembly consists of two pairs of "Vee" struts forming a parallelogram linkage from the oleo to hull fittings at stations 4.2 and 5.0 and a main strut from

the oleo to the upper inner portion of the wheel well. The main strut is broken near its center so that it may fold inward during retraction. (The main strut is automatically latched into a rigid position when extended.)

Retraction of each side unit is accomplished by the operation of two actuating cylinders. The small actuating cylinder near the upper hinge point of the main strut actuates a rod outside the strut by means of a bell crank. This rod releases the spring loaded strut latch, allowing the main strut to be folded inward by the action of the main actuating cylinder. The main actuating cylinder floats between a bracket near the upper end of the main strut and a bracket on the forward leg of the upper "Vee" strut. By piston retraction, this actuating cylinder applies torque to the strut system, folding the main strut inward and pulling the gear upward and into the well. As the side gear approaches its retracted position, it has a tendency to fall into the well. On the inboard end of the wheel axle is a fitting equipped with a roller which, upon coming in contact with a spring bumper arm assembly in the well, cushions the shock of the fall as the gear reaches full retraction. This fitting at the same time is caught by a spring latch (in the well) which holds the unit in the retracted position.

When the side unit is to be extended, another small hydraulic actuating cylinder releases the "retracted position" latch (up lock); the main actuating cylinder extends, forcing the unit out into the extended position; and the main strut automatically latches in a rigid position.

(b) REMOVAL AND DISASSEMBLY. (See figure 80.)—Before any attempt is made to remove the landing gear or any portion of it, the airplane shall be jacked up, cradled, or mounted on beaching gear.

1. Remove wheel. (See paragraph *b*, (2), (b).)

2. Support lower "Vee" strut so that it will not fall against and damage the hull.

3. Disconnect brake pressure (22) and vent (21) lines and remove.

4. Remove brake assembly. (See paragraph *b*, (3), (b).)

5. Disconnect the upper and lower wheel well door operating links (1) and (6).

6. Remove the bolt (2) attaching lower "Vee" struts to shock strut and the bolt (20) attaching upper "Vee" struts (3) to shock strut. This permits removal of the shock strut.

7. Disconnect the two hydraulic lines from the actuating cylinder (14).

8. Remove bolt (13) attaching cylinder to universal fittings at upper part of main strut.

9. Remove bolt (18) attaching piston of cylinder to upper "Vee" strut (3) and then remove cylinder.

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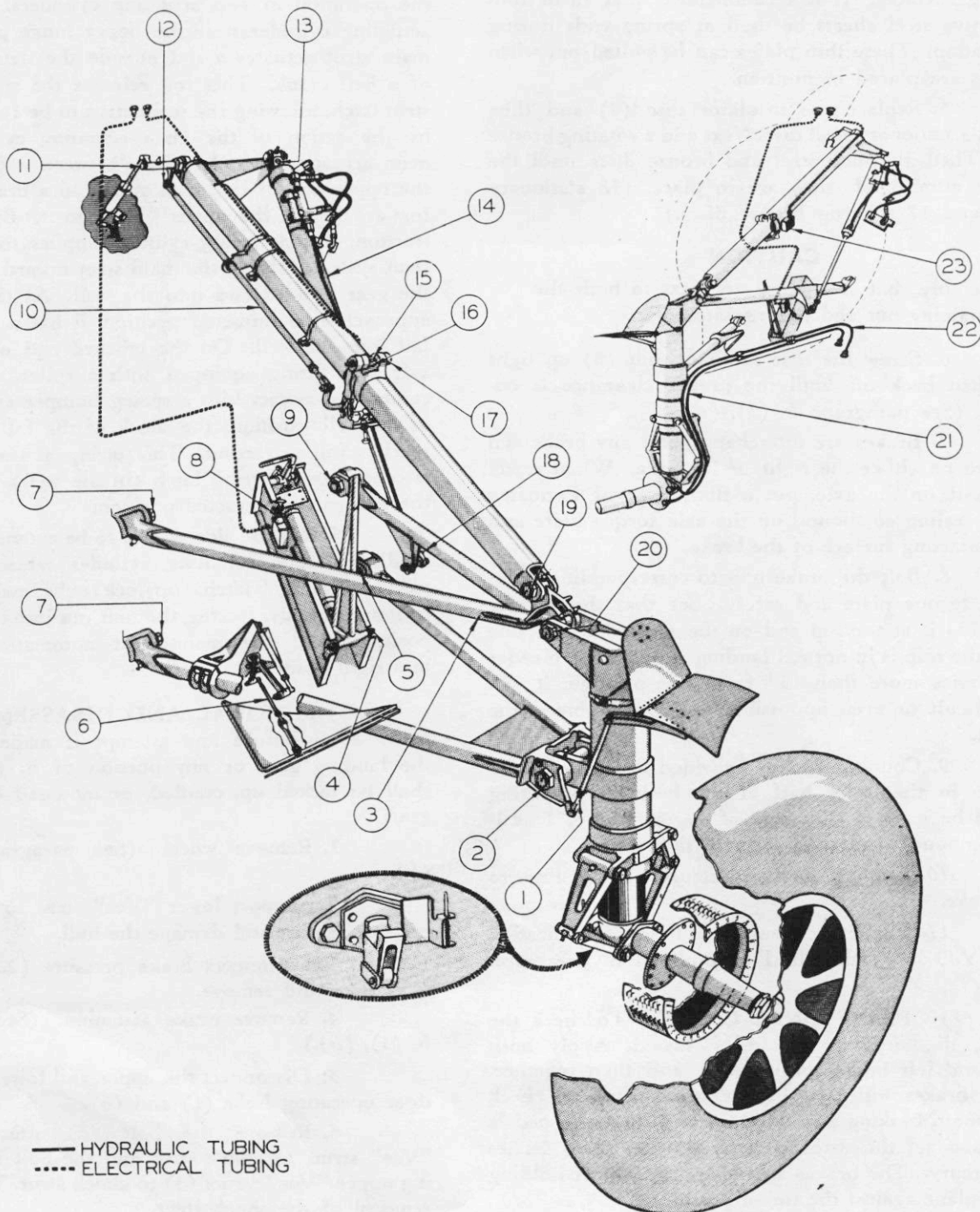


Figure 80—Main Strut Assembly

No.	PART No.	NAME	No.	PART No.	NAME
1	28L5115	Upper Wheel Well Door Link		AN380C3-3	Cotter
2	28L4056-7	Attaching Bolt		AN960-816	Washer
	Q7040-97-125	Washer	12	AN24-13	Bolt
	28L4057	Nut		AN320-4	Nut
	AN380C4-10	Cotter		AN380C2-2	Cotter
3	28L5023	Upper "Vee" Strut		AN960-416	Washer
4	AN5-45	Bolt	13	AN26-32	Bolt
	AN310-5	Nut		AN960-616	Washer
	AN380C2-2	Cotter		AN320-6	Nut
	AN960-516	Washer		AN380C3-3	Cotter
5	28L4067-7	Bolt	14	41522	Actuating Cylinder
	Q7032-73-064	Washer	15	AN24-25	Bolt
	28L4085	Nut		AN320-4	Nut
	AN380C4-8	Cotter		AN380-2-2	Cotter
6	28B4238-4	Lower Wheel Well Door Link		AN960-416	Washer
7	28L4067-7	Bolt	16	Q840-32-40	Spacer
	Q7032-73-125	Washer	17	28L5019	Hinge Pin
	28L4085	Nut	18	AN26-30	Bolt
	AN380C4-8	Cotter		AN320-6	Nut
8	AN4-45	Bolt		AN960-616	Washer
	AN310-4	Nut		AN380C3-3	Cotter
	AN380C2-2	Cotter	19	28L4055-6	Bolt
9	28L5058	Bolt		Q7032-81-125	Washer
	Q7024-57-064	Washer		AN320-20	Nut
	AN320-14	Nut		AN380C4-10	Cotter
	AN380C4-5	Cotter	20	28L4055-7	Bolt
10	28L5069	Rod Assembly		Q7032-81-125	Washer
11	28L5068	Bolt		AN320-20	Nut
	Q7032-81-125	Washer		AN380C4-10	Cotter
	AN320-20	Nut	21	28F7592-10	Brake Vent Line
	AN380C4-10	Cotter	22	28F7592-6	Brake Pressure Line
	AN320-8	Nut	23	28E5869	Micro-Switch

Index number 14 is a United Aircraft Products part number.

10. At the upper main strut, disconnect and remove electrical connections to the down lock indicating micro-switch (23).

11. Remove the bolt (12) attaching down lock operating rod (10) to bell crank at upper end of main strut.

12. Remove the bolt (19) attaching the main strut to the upper "Vee" strut.

13. Remove the bell crank and bolt (11) attaching main strut to hull fitting, allowing the removal of the main strut.

14. Remove the upper and lower "Vee" struts by removing bolts (5), (7), (9) attaching struts to hull.

15. Remove the bumper spring assembly by detaching upper (8) and lower (4) bolts from the bumper supports.

16. The up-latch is removed by detaching the bolt (1) from the bumper supports and the bolt (2) from the up-latch jack plunger. (See figure 81.)

17. Loosen the stop nut and unscrew the up latch spring cylinder assembly from the end of the up latch jack piston.

18. Unscrew the cap from the cylinder carefully so that no damage is caused by the compressed spring inside the cylinder.

19. To remove the manual up lock release mechanism; loosen the lock nut on the inboard end of the fork fitting and unscrew fork fitting and lock nut. To remove handle and slide assembly, detach the four bolts from the hull shear web. (See figure 75.)

20. Disassemble the main strut by removing the bolt (15) through the spacer (16) and the center of the hinge pin (17) and slide the hinge pin out of the fittings. (See figure 80.)

21. To disassemble the main shock strut proceed as follows: (See figure 82.)

a. Release all air pressure by depressing valve (1) at top of shock strut.

b. Remove air valve body (2) and empty out the oil.

c. Remove the torque arm (3).

d. Remove lock wire and screw (5).

e. Unscrew gland nut (4) about half way.

f. Replace the air valve body and inflate

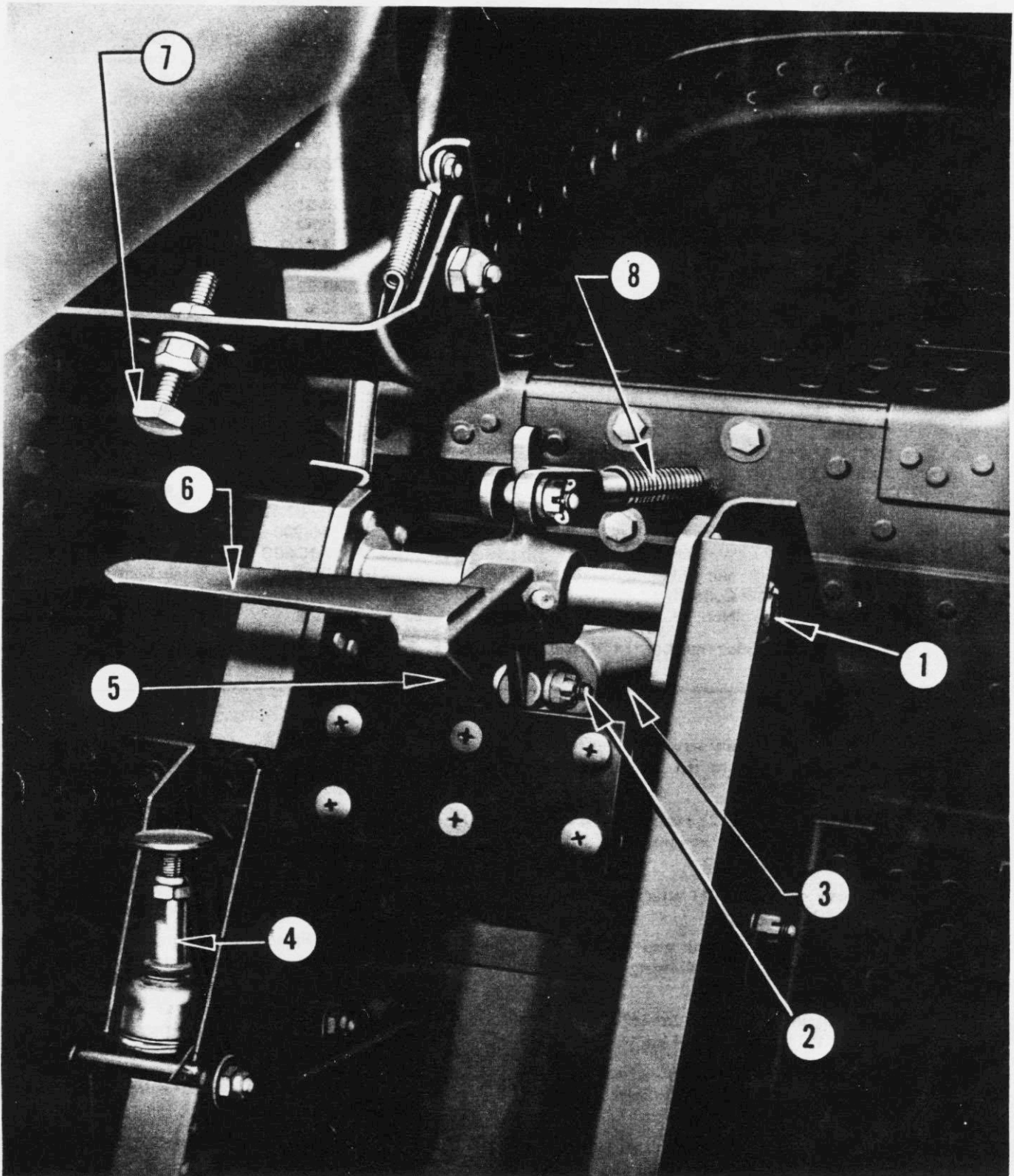


Figure 81—Main Landing Gear Up-Latch

No.	PART No.	NAME
1	AN8-47	Bolt
	AN310-8	Nut
	AN380-C3-3	Cotter
	Q820-16-40	Spacer
	AN960-AL816L	Washer
2	AN960-AL816	Washer
	AN23-15	Bolt
	AN320-3	Nut

No.	PART No.	NAME
	AN380-C2-2	Cotter
	AN960-C10	Washer
3	28L5103	Up-Latch Spring Cylinder
4	28E5629	Up-Lock Micro-Switch
5	28L5119-2	Up-Latch
6	28L5119-8	Contact Plate
7	28E5604	Down Latch Actuating Contact
8	28L5108	Emergency Release Handle

strut slowly with air until the piston extends itself and the follower (12) and bearing (7) are loosened in the cylinder. Release all air pressure.

g. Unscrew the gland nut (4) from the cylinder.

h. Remove the piston assembly (14) from the cylinder assembly (17).

i. The plunger head ring (11) may be replaced without removing the plunger tube (13) from the cylinder.

j. When replacing the piston head (16), packings (9), bearings, etc., remove the three $\frac{1}{8}$ in.

pipe plugs (15) which lock the piston head in place and unscrew the head, using a strap wrench (22 U 173-1). (See figure 40.)

k. Pull the piston parts from the piston tube.

(c) MAINTENANCE.

1. Inspect the surfaces of all pistons for scores, scratches, or dents which, if evident, should be lapped out and the part thoroughly cleaned. Corroded pistons should be properly cleaned up and restored to a serviceable condition. In the event this involves grinding and replating, the following table dimensions should be strictly adhered to:

Part Name	Part No.	Original Diam. of Basic Metal Before Factory Plating	Minimum Permissible Diameter After Grinding and Before Replating. (Inches)	Dia. After Replating and Finish Grinding. (Inches)
Main Landing Gear Oleo Piston.	Cleveland Pneumatic No. 8103-4	5.487 + .000 - .002	5.4687	5.495 + .000 - .002
Main Landing Gear Retractable Cylinder Piston.	United Aircraft Products No. 41522.		1.2187	+ .000 1.250 - .001

Any existing chromium plating should be completely removed in the event grinding and replating is necessary. Pistons which cannot be restored to a serviceable condition in accordance with the above instructions must be replaced.

2. If there is an indication of loss of air pressure from the shock strut, check the air valve core and the gasket. Replace either or both parts, if necessary. For substitutes, use only Shrader valve core No. 2300 or Dill valve core No. 302D. These are special valve cores made for this purpose; substitutes such as tire valve cores are unsatisfactory.

3. When there is an indication of oil leakage past the gland nut of the actuating cylinder, or the shock strut cylinder, re-adjust the packing.

a. Re-adjust the packing in the actuating cylinder as follows:

(1) Loosen the gland nut one or two turns and operate the cylinder through several cycles.

(2) Tighten the gland nut snug but not tight enough to bind.

(3) Safety wire in place.

b. Re-adjust the packing in the shock strut as follows:

(1) Remove the air valve cap.

(2) Depress air valve until all air pressure has been released.

(3) Remove lock wire and screw.

(4) Loosen gland nut about one or two turns and work strut up and down allowing the packing to re-adjust itself.

(5) Tighten the gland nut snug (but not too tight) lining up one of the slots in the nut with tapped hole in the cylinder.

(6) Replace lock screw.

(7) Inflate to proper length. (See paragraph b, (5), (d).) If after re-adjusting packing, leakage is still present, the packing must be replaced.

Note

Taxiing the airplane will often stop leakage in the shock strut particularly when the struts have been standing idle in one position for some time.

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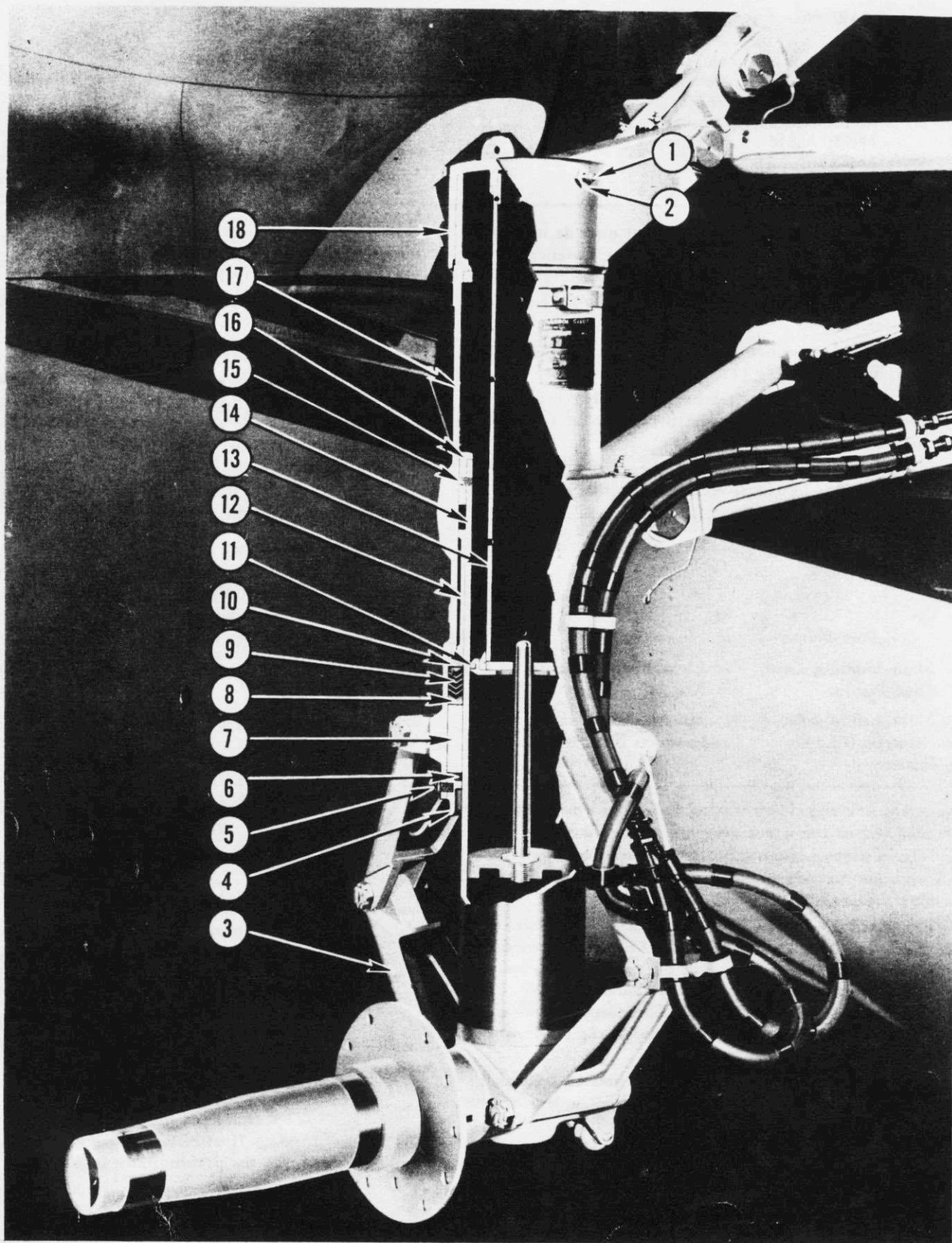


Figure 82—Main Shock Strut

No.	PART No.	NAME	No.	PART No.	NAME
1	CV18D	Air Valve Core	10	AN6229-55	Male Packing Adapter
2	A16	Air Valve Body	11	8103-270	Plunger Head Ring
3	8103-46	Torque Arm	12	8251-10	Follower
4	8251-48	Gland Nut	13	8103-126	Plunger Tube
5	501A416-5	Screw	14	8103-104	Piston Assembly
6	AN6231-49	Packing Gland Wiper Ring	15		Piston Head Plug
7	8251-9	Bearing	16	8103-3	Piston Head
8	AN6228-55	Female Packing Adapter	17	8251-2	Cylinder Assembly
9	AN6225-55	Packing	18	8251-L-R	Shock Strut Assembly

All items except 6, 8, 9 and 10 are Cleveland Pneumatic Tool Co. part numbers.

(d) ADJUSTMENT.

1. **DOWN LATCH JACK.**—A $\frac{1}{8}$ inch dimension should be held between the down latch jack plunger and the bell crank. Landing gear must be in the down and locked position when this adjustment is made.

2. **ACTUATING CYLINDER.**—The adjustment is made after the cylinder is completely bottomed, with the check nut drawn up against the piston shaft. Screw piston shaft clockwise so that it enters the cylinder $\frac{1}{4}$ inch, measured by the distance between the check nut and the end of the piston shaft. Tighten check nut.

3. **UP AND DOWN INDICATING SWITCHES.**—With the gear locked in the up position, loosen the lock nut on the plunger of the "up indicating" switch, located on the bumper support. Screw the end of the plunger into the plunger shaft, then screw it back out of the shaft until the plunger end contacts the actuating pin and the switch "clicks." Screw it out two more turns and tighten the lock nut.

With the gear locked in the down position, use the same method of adjusting the "down indicating" switch as was used for adjusting the "up indicating" switch.

4. **SHOCK STRUT.**—The proper inflation of the strut is measured by the distance the piston tube extends from its fully compressed position. For convenience of the Field Service, there is a red line around the piston tube that is flush with the lower edge of the gland nut when the strut is fully compressed. The distance from the gland nut to the red line, when the strut is inflated, should be $1\frac{1}{2}$ inches. While inflating the strut, it is advisable to move the airplane forward and backward several feet to overcome the friction, thus preventing over-inflation. It is not necessary to re-adjust for minor changes which may be due to changes in position of the plane. Over-inflation causes hard taxiing and should be avoided.

After inflating, be sure to check the air valve and valve body gasket so that there is no leakage at these points.

(e) ASSEMBLY AND INSTALLATION.

1. MAIN GEAR SHOCK STRUT.

a. Replace parts on the piston (14) in order shown in figure 82.

b. Line up the tapped holes in the piston (14) and the piston head (16). Screw pipe plugs into tapped holes and then stake the plugs to secure head to piston.

c. Insert the piston assembly (14) into the cylinder (17), using caution not to damage the plunger ring (11) when entering it into the bore of the piston tube.

CAUTION

When installing packing inside sharp threads or similar projections, the packing lips must be protected by the use of a flared sleeve or similar means as shown in figure 83. Do not use screw drivers or other sharp tools to install or remove packing rings. Do not install packing rings in sets.

d. Push the follower (12) and the male packing adapter (10) up against shoulder on inside of cylinder (17).

e. Push the five packing rings (9) up against adapter (10).

f. Push the female packing adapter (8), the bearing (7), and the packing gland wiper ring (6) into position behind packing rings (9).

g. Tighten the gland nut (4) until the packing ring stack is set together securely, and then loosen the gland nut to the first lock point (not to exceed one-sixth of a turn).

h. Lock gland nut with lock screw (5) and lockwire.

i. Replace torque arm (3).

j. With strut fully compressed, fill with fluid (Specification AN-VV-O-366) to the level of the filler hole. To insure that no air has been trapped within the strut, it is advisable to work with piston up and down several strokes and then check the oil level with the piston fully compressed.

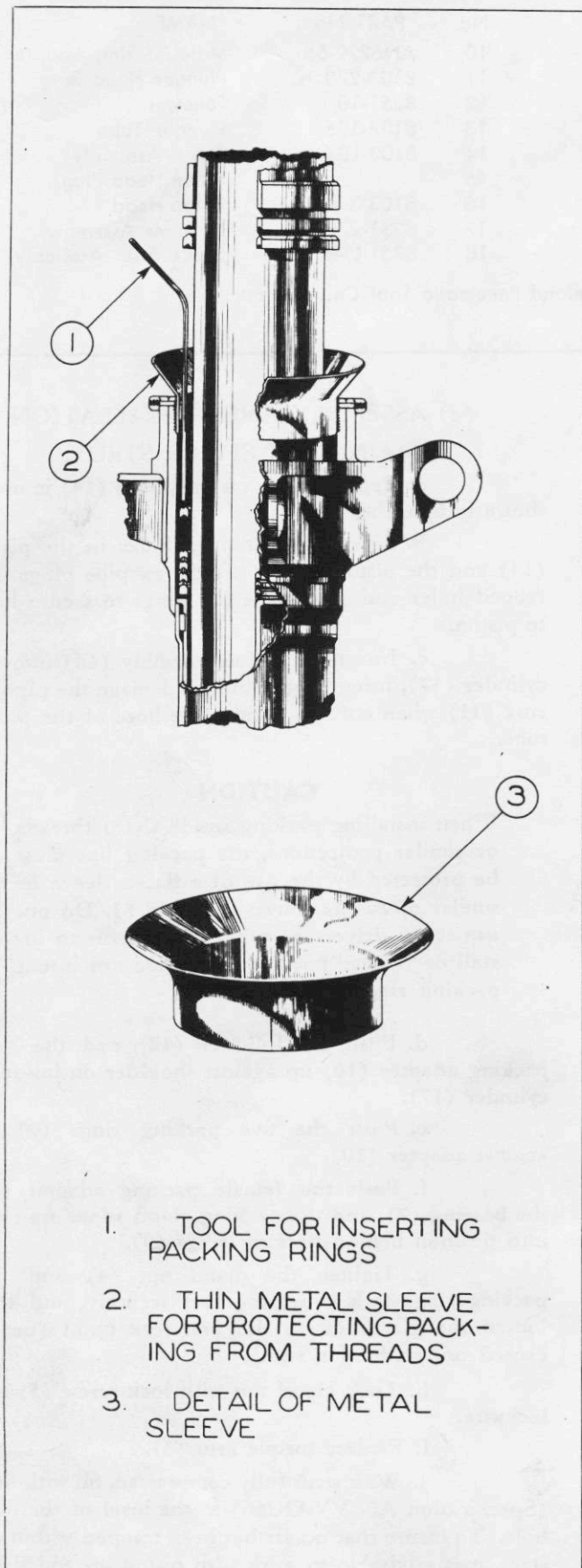


Figure 83—Packing Ring Installation

k. Assemble the air valve body and gasket, tightening securely.

2. STRUT ASSEMBLY.—When installing the strut assembly, locks, linkages, etc., follow in a general manner the reverse of the procedure for removal and disassembly as outlined in paragraph b, (5), (b).

a. When installing bolts which are used as hinge pins, draw the nuts or bolts up tight and then back off until no binding is present (usually one and a half to two turns).

b. With the up-latch in the locked position, maintain $3/32$ in. overtravel in the spring cylinder between the up-latch and the unlatching jack.

c. Maintain a $2\frac{3}{4}$ in. dimension from the center of the hole in the eye bolt plunger of the down latch spring cylinder to the center of the spring top.

d. A $1/8$ in. dimension should be maintained between the plunger of the down lock unlatching jack and the contact surface of the bell crank.

e. Maintain $3/32$ in. overtravel of the yoke on the manual up lock release when the latch is in the locked position.

f. For adjustment of the actuating cylinder, see paragraph b, (5), (d).

g. Lubricate all moving parts not supplied with Zerk fitting with a light oil (Specification AN-O-6).

c. NOSE LANDING GEAR.

(1) GENERAL. (See figure 85.)—The nose wheel unit consists of a single 30 inch, 8-ply smooth contour tail wheel type tire; wheel and axle; an Aerol shock strut; a fork extending from the axle to the shock strut; a shimmy damper; a strut assembly; and hydraulic retracting mechanism.

Retraction of the nose unit is accomplished by the operation of two hydraulic actuating cylinders. The small actuating cylinder releases the spring latch which locks the unit in the extended position, allowing the main actuating cylinder to pull the unit up into the well. When fully retracted, a hook on the damper support plate is engaged by an automatic spring latch in the well, holding the unit in the retracted position.

When extending the unit, another small actuating cylinder releases the "retracted position" latch (up lock), and the main actuating cylinder rotates the unit to the fully extended position, where the down lock latch engages a fitting on the forward side of the oleo.

It is possible to observe the position and operation of the nose wheel through a small window in the floor of the pilot's compartment. A plugged hole is located in the compartment floor at the forward end of the nose wheel well and a rod is supplied which, in an emergency, may be inserted through this hole far enough to contact the down lock latch. If the red collar on the rod extends above the top of the

hole, the latch has not fully engaged. Striking with the end of the rod will push the latch into place. This should be used if the indicator lights do not operate, or if there is any doubt as to the nose gear being locked down. In checking for the gear down position, it is important to observe through the sounding rod hole that the oleo strut is vertical and resting against the down bumper. Then insert the emergency lever through this hole and through the hole in the down bumper bracket until it rests on the top of the down-latch. When the latch is engaged, the top end of the red collar on the emergency rod should be just even with the top of the hole. If the gear is not locked, try another hydraulic operation, and if this does not lock the gear, proceed according to instructions for emergency lowering of the landing gear.

Doors which cover the nose wheel well operate hydraulically in sequence with the nose wheel. In retracting the nose wheel, a sequence valve is opened at the end of the travel and directs fluid to the nose wheel door cylinder to close the doors. The sequence valve is on the starboard side of the starboard auxiliary keel in such a position that a small extension on the main retracting crank engages the plunger in the valve. The valve has a snap action and is so adjusted that the nose gear is all the way up and latched before the valve is opened. Similarly, there is a valve on the door cylinder which directs fluid to the retracting cylinder when the gear is being lowered. This valve is closed at all times, except when the doors are open.

(2) WHEEL AND TIRE ASSEMBLY.

(a) DESCRIPTION.—The wheel (Hayes Industries No. G-3-96) is a drop center rim type incorporating a demountable flange on the valve side. The rim flange is held in place by a lock ring and two anchor pins. The wheel hub is equipped with two Timken tapered roller bearings. The wheel mounts a 30 inch smooth contour eight ply auxiliary wheel casing and "Dual Seal" inner tube (Goodrich Rubber Company or equivalent). A 30 inch smooth contour 10 ply auxiliary casing (Specification AN-C-55) may be used as an alternate for the 30 inch, eight ply casing.

(b) REMOVAL AND DISASSEMBLY.

1. To remove the nose wheel from the nose wheel strut assembly:

a. Elevate the nose of the ship until the nose wheel clears the ground. This may be done by jacking, or by pulling the tail of the airplane down. (See Section III, Par. 1, b.)

b. Remove the bolts (2) from the spindle clamp (12). (See figure 84.)

c. Pull the wheel (11) and axle (14) free from the clamps and strut (1).

2. To disassemble the wheel and axle:

a. Remove the axle nut lock bolt (13).

b. Remove the axle nut (8).

c. Pull the axle from the wheel.

d. Remove the lock rings (9) on either side.

e. Remove the grease retainers (5).

f. Slide the bearings (10) from the wheel.

3. To dismount the tire:

a. Remove the inner tube valve core and loosen body to completely deflate the inner tube. (See paragraph c, (2), (c).)

b. Lay the tire and the wheel so that the solid side of the wheel is down.

c. Remove the cotter pins (3) from the two anchor pins (4).

d. Depress the upper tire rim until the anchor pin holes are exposed and then remove anchor pins.

e. Push downward on the wheel flange (6) until it is possible to remove the flange lock ring (7).

f. Remove lock ring and wheel flange.

g. Lift the tire and inner tube from the wheel.

(c) MAINTENANCE.—Maintenance of the nose wheel is essentially the same as that outlined under paragraph b, (2), (c) for the main wheels.

1. Tire repair should be in accordance with the General Manual for Structural Repair (AN 01 1A-1).

2. To inflate the dual seal inner tube:

a. Unscrew the valve core housing five full turns from the seated position; inflate with air; wait 30 seconds to allow pressure in both portions of inner tube to equalize; check inflation pressure with gage; if inflation pressure is insufficient, repeat procedure until correct gage reading is obtained; then retighten valve core housing by screwing rubber barrel lock tight and twisting 180° by hand to seat securely.

CAUTION

Do not use pliers on valve core housing.

b. Remove valve core and use saliva test on valve tip to check for leakage.

c. Re-install valve core and cap.

d. To deflate the dual seal tube: remove the valve core and unscrew the valve core housing five full turns.

Note

Removal of core housing before tube is completely deflated will cause inner compartment to collapse, preventing further deflation. In the event that the inner compartment of the inner tube is collapsed at any time, follow inflation procedure and then resume deflation.

(d) INSTALLATION.

1. To install the tire and tube on the wheel:

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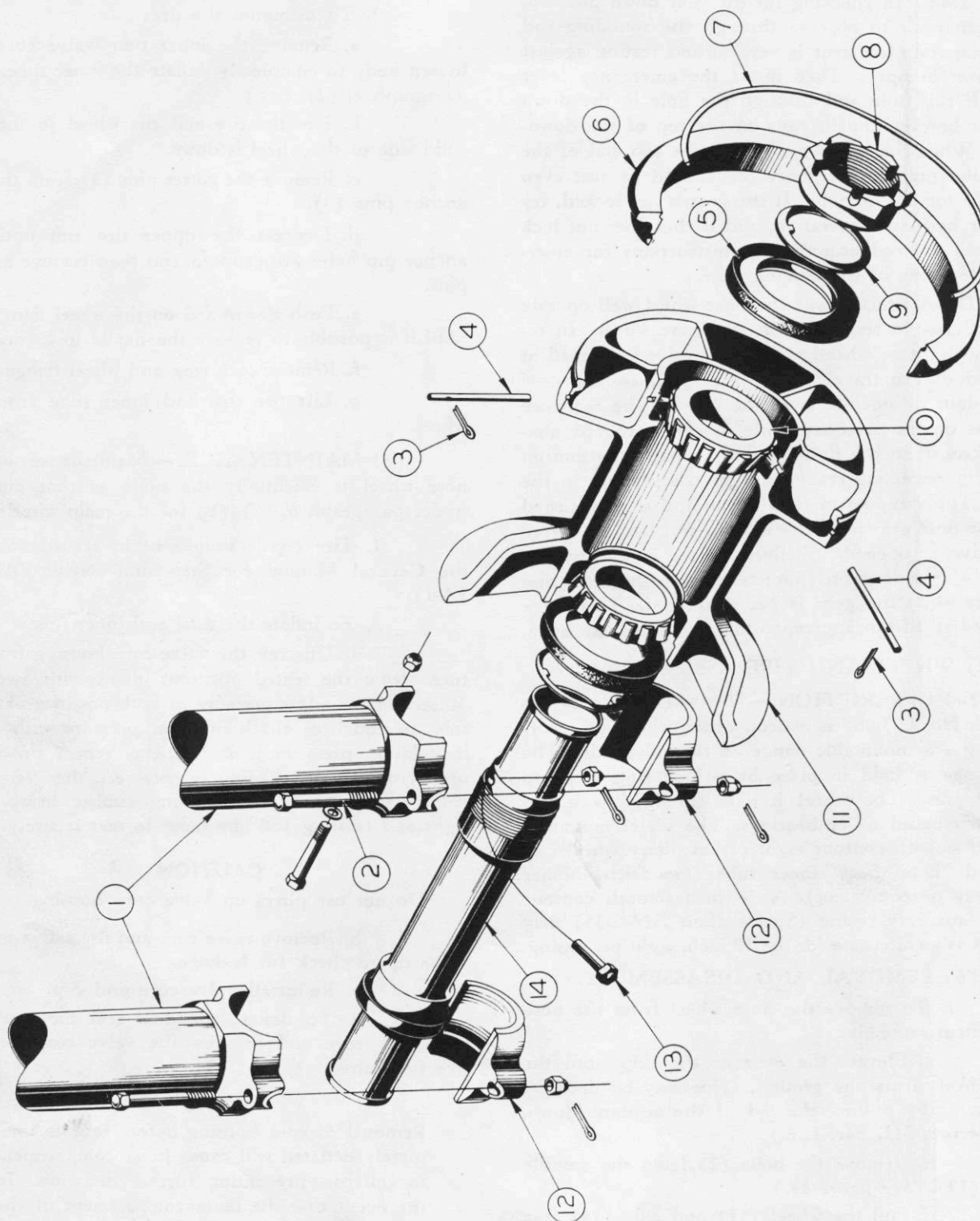


Figure 84—Nose Wheel Assembly

No.	PART No.	NAME	No.	PART No.	NAME
1	8104-160	Strut	8	8104-65	Axle Nut
2	AN8-25	Bolt		8104-64	Retaining Washer
	AN310-8	Nut	9	A-85-61-S	Lock Ring
	AN380C-3-3	Cotter	10	3982 (Timken)	Bearing
3	A-67-1	Cotter Pin	11	G-3-96	Wheel
4	A-20-50	Anchor Pin	12	8104-62	Spindle Clamp
5	A-56-28	Grease Retaining Disc	13	AN3-33	Axle Nut Lock Bolt
	E-50024-68	Grease Retainer		AN310-3	Nut
6	G-11-27	Wheel Flange		AN380C2-2	Cotter
7	B-85-114	Flange Lock Ring	14	8104-85	Axle

Index numbers 1, 8, 12, and 14 are Cleveland Pneumatic Tool Co. part numbers.

Index number 3, 4, 5, 6, 7, 9, and 11 are Hayes Industries Inc. part numbers.

a. Work deflated tube into the tire, making sure that the red balance marks on the tire and tube are in line.

b. Inflate the tube enough to fill it out, and force the tire and tube onto the wheel.

c. Deflate the tube sufficiently to work stem through valve hole in the wheel and carefully line the valve up with the hole.

d. Replace the wheel flange (6) and install the lock ring (7) and anchor pins (4).

Note

Two marks are provided, one on the main body of the wheel and the other on the wheel flange, for lining up the anchor pin holes.

e. Inflate tire to proper pressure as shown in figure 78.

2. To assemble and install the wheel assembly on the strut, reverse the procedure outlined in paragraph c, (2), (b), 1.

Pack the wheel bearings with grease (Specification AN-G-4) before installation.

CAUTION

It is important that the axle nut be properly tighten to give the desired load on the tapered roller bearings of the wheel assembly. To do this, tighten the axle nut sufficiently to seat the bearing in the bearing cup and then tighten to the next lock position, not to exceed 1/6 of a turn. The wheel should be turned during this operation to move the grease so that the bearing is allowed to contact the bearing cup.

(3) STRUT ASSEMBLY.

(a) DESCRIPTION. (See figure 85.)—The strut assembly consists of a pair of cross tubes bolted to the top of an oleo strut. The outer ends of the cross tubes fits into pivot bearings installed on the double keels. The lower end of the oleo strut is

braced by two diagonal struts whose upper ends attach to the outer ends of the cross tubes. The cross tubes serve as the axis of rotation when the nose wheel is retracted or extended. The shock strut (Cleveland Pneumatic Tool Co. No. 8104) consists of an oleo strut mounting a fork assembly to which the wheel axle is attached. The wheel can swivel 45° each side of center (fore-and-aft) position, but is automatically centered fore-and-aft by an internal cam in the shock strut when the strut is fully extended. The fork is attached to a rotating collar on the oleo strut by means of a scissors assembly. A lever extending from this collar is linked to an arm on a hydraulic damper. (Houdaille Corp. No. 10689). This mechanism dampens any tendency of the nose wheel to "shimmy."

(b) REMOVAL AND DISASSEMBLY.

1. To remove the strut assembly from the airplane:

a. Remove the wheel. (See paragraph c, (2), (b).)

b. Disconnect the nose wheel cylinder (20) from the actuating arm (22) on the starboard end of the cross tube (9), by detaching bolt (21). (See figure 85.)

c. Remove the bolt locking the actuating arm to the cross tube (9) and remove the arm.

d. Remove the two bolts (11) attaching the diagonal struts (10) to the oleo strut (7).

e. Remove the twelve bolts (8) attaching the cross tubes to the oleo strut, allowing the oleo strut and fork assembly to be removed from the airplane.

f. Remove the split collar (46) from the port cross tube keel bearing by removing the two bolts (45) attaching the halves of the collar.

g. Slide the port cross tube out of the bearing.

h. Loosen the packing gland nut (26) on the starboard cross tube bearing and slide the cross tube out of the bearing. Use wrench 28 U 4005-10. (See figure 40.)

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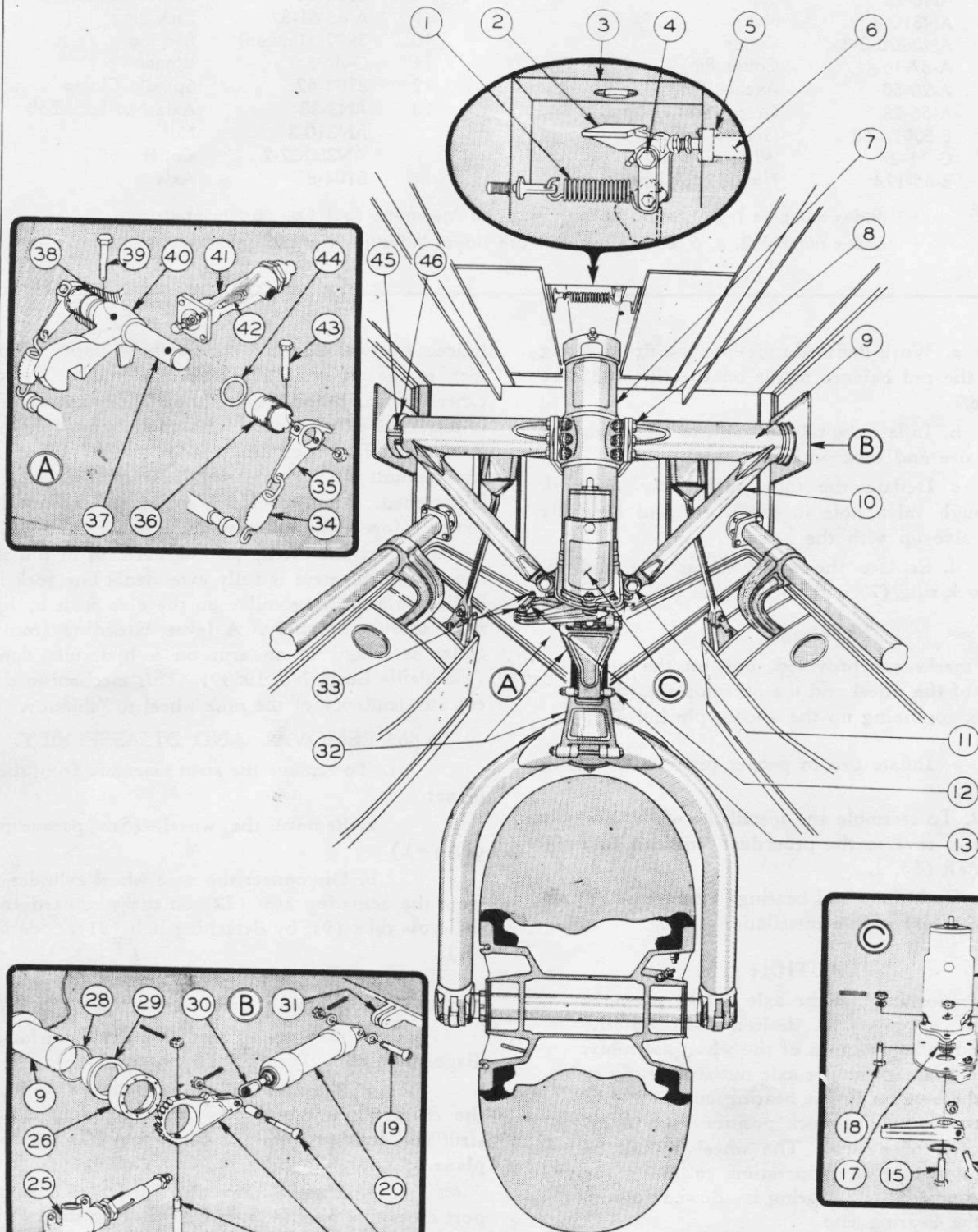


Figure 85—Nose Wheel Strut Assembly

No.	PART No.	NAME	No	PART No.	NAME
1	28L5123	Spring	20	51518	Actuating Cylinder
2	28L5076	Latch-Up Lock	21	AN25-25	Bolt
3	28B5533	Up-Lock Bracket		AN320-5	Nut
4	AN75-37	Bolt (Latch Pivot)		AN380-2-2	Cotter
5	AN4-11A	Bolt	22	28L5049	Arm
	AN365-428	Nut	23	AN29-28	Bolt
6	523	Up-Lock Jack		AN320-9	Nut
7	8104	Nose Landing Gear Shock Strut		AN380-4-4	Cotter
8	AN10-14	Bolt	24	AN3-6A	Bolt
	AN310-10	Nut		AN960-A10	Washer
	AN380-C4-4	Cotter	25	41531	Snap Action Valve
	AN960-1016	Washer	26	28L4047-7	Packing Nut
9	28L5053	Cross Tube	28	28L5138	Seal
10		Diagonal Struts	29	28L4048	Packing Ring
11	AN12-21	Bolt	30	21572-1	Clevis End
	AN310-12	Nut	31	28L5054	Retracting Fitting
	AN380-C4-5	Cotter	32		Scissor Assembly
12	28L4045	Damper Link	33	AN4-12	Bolt
13	NAS156-41	Bolt	34	28L5122	Spring
	AN310-6	Nut	35	28L5047	Lever
	AN380-C3-3	Cotter	36	28L5046	Gland Nut
14	A-10689	Shimmy Damper	37	28L5045	Latch Pin
15	AN5-12	Bolt	38	28B5212	Drag Fitting
	AN310-5	Nut	39	AN4-23A	Bolt
	AN380-C2-2	Cotter		AN365-428	Nut
	AN960-516	Washer	40	28L5029	Latch
16	AN5-21A	Bolt	41	523A	Down-Lock Jack
	AN365-524	Nut	42	AN4-11A	Bolt
	AN960-516	Washer		AN365-428	Nut
17	17026	Damper Shaft	43	AN4-17A	Bolt
18	AN5-10	Bolt		AN365-428	Nut
	AN310-5	Nut	44	AN6227-21	Seal Ring
	AN380-C2-2	Cotter	45	AN4-12A	Bolt
19	AN25-36	Bolt		AN365-428	Nut
	AN320-5	Nut		AN960-416	Washer
	AN380-C2-2	Cotter	46	28L5035-7	Split Collar
	AN960-516L	Washer			

Index number 7 is a Cleveland Pneumatic Tool Co. part number.

Index numbers 6 and 41 are Weston Aerodraulics Co. part numbers.

Index numbers 14 and 17 are Houdaille Hershey Corp. part numbers.

Index numbers 20, 25 and 30 are United Aircraft Products Corp. part numbers.

i. Remove the packing gland nut, the packing ring (29) and the seal (28).

2. To disassemble the oleo strut and fork assembly:

a. Remove the bolt (13) attaching the upper and lower scissors (32) to each other. (See figure 85.)

b. Disconnect the shimmy damper (14) as follows:

(1) Detach the two bolts (33) through the damper link (12) and then remove link.

(2) Remove the nut and bolt (16) which secure the split arm to the damper shaft (17). Remove the snap ring holding the arm in place. Tap off the arm with a hammer.

(3) Remove the damper (14) by detach-

ing the two bolts (15) and the one bolt (18) from the bottom lugs on the damper.

c. Remove the cap (9) from the lower end of the strut (1) by removing the nut (11) and sliding the cap and gasket (10) off the stud (8). (See figure 86.)

d. Remove the bolt (7) locking the fork (12) to the piston tube (16).

e. Loosen the four bolts (14) of the expansion plug assembly in the piston tube and tap the heads of the bolts until the top plug (15) is free.

f. Remove the four bolts and insert four bolts in the lower plug (13). Rap the fork fitting just above the expansion plug with a rawhide mallet to facilitate removal of the lower plug.

g. Withdraw the entire expansion plug assembly from the piston and unscrew the fork assembly.

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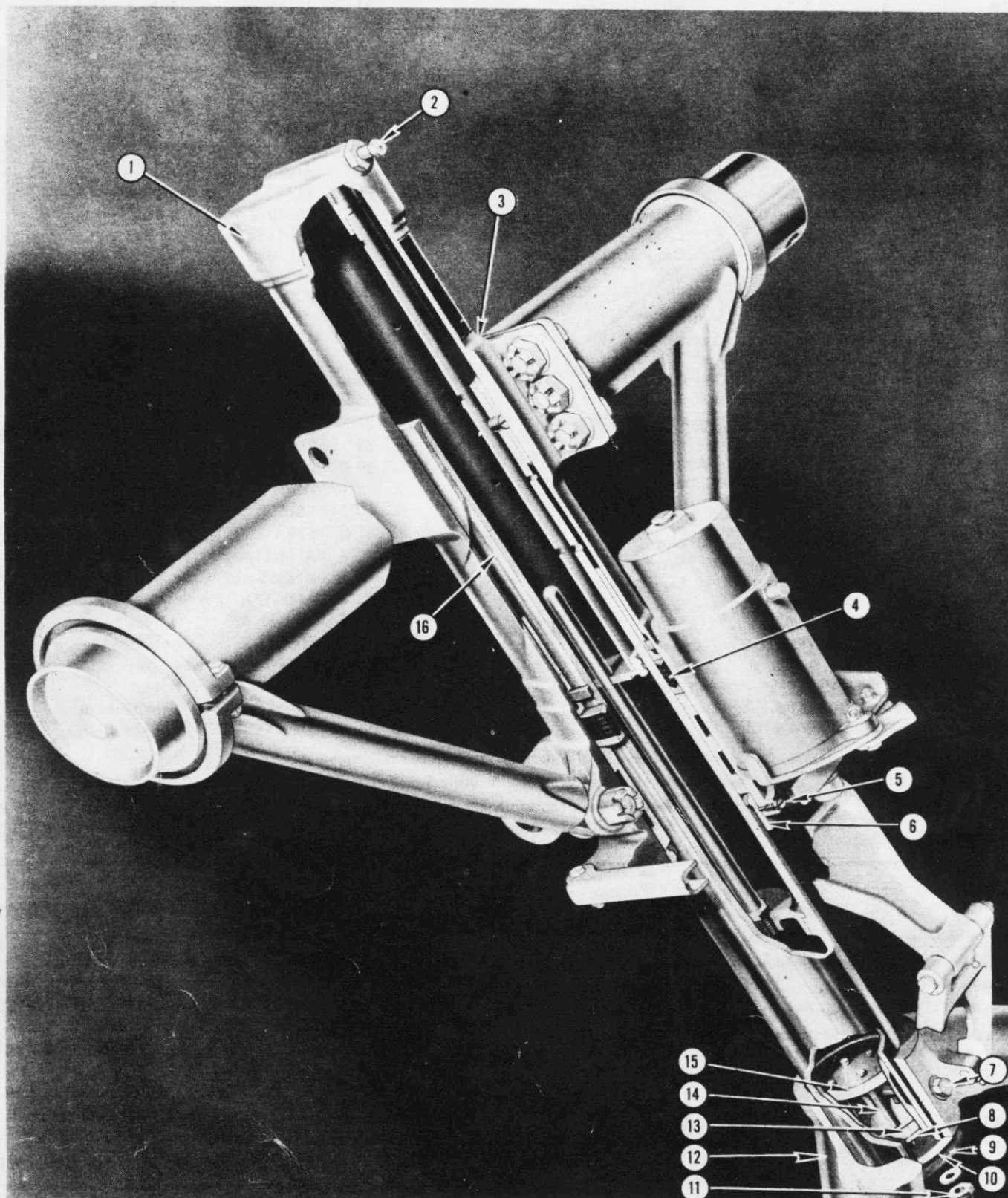


Figure 86—Nose Wheel Shock Strut

No.	PART No.	NAME	No.	PART No.	NAME
1	8104	Strut	9	28L5142-6	Cap
2	A-16	Air Valve Body	10	28L5145	Gasket
3	8104-2	Cylinder	11	AN364-428	Nut
4		Packing Gland		Q7102-AL416	Washer
5	7813-43	Screw	12	8104-60	Fork
6	7813-48	Gland Nut	13	8104-97	Lower Plug
7	AN5-42	Bolt	14	8104-99	Bolt
	AN310-5	Nut		AN960-716	Washer
	AN380C2-2	Cotter	15	8104-98	Tap Plug
8	28L5146	Stud and Plate Assembly	16	8104-4	Piston Tube

Index numbers 1, 2, 3, 4, 5, 6, 12, 13, 14 and 15 are Cleveland Pneumatic Tool Co. part numbers.

h. Release all air pressure from the shock strut. Remove air valve body (2) and empty the oil.

i. Remove gland nut lock screws (5) and unscrew gland nut (6) approximately half way.

j. Replace the air valve (2) and inflate slowly to loosen the packing gland (4). When this is done release all air pressure.

k. Unscrew the gland nut (6) from the cylinder (3).

l. Remove the piston assembly from the cylinder and slide the parts off the tube (16).

(c) MAINTENANCE.—Inspect the surfaces of the pistons for scores, scratches, or dents which, if evident, should be lapped out and the part thoroughly cleaned. Corroded pistons should be properly cleaned up and restored to a serviceable condition. In the event this involves grinding and replating, the following table of dimensions shall be strictly adhered to.

Part	Part No.	Original Diam. of Basic Metal Before Factory Plating (Inches)	Minimum Permissible Dia. After Grinding and Before Replating (Inches)	Diameter After Replating and Finish Grinding (Inches)
Nose Landing Gear Retracting Cylinder Piston	United Aircraft Products No. 51518	0.9687	1.000 + .000 — .001
Nose Landing Gear Oleo Piston	Cleveland Pneumatic No. 8104-4	3.489 + .0000 — .0015	3.4875	3.4965 + .000 — .001

Any existing chromium plating should be completely removed in the event grinding and replating is necessary.

Pistons which cannot be restored to a serviceable condition in accordance with the above instructions must be replaced.

If air or oil leakage is indicated, a procedure similar to that outlined in paragraph b, (5), (c) should be followed.

(d) ADJUSTMENTS.

1. SHOCK STRUT.—General instructions for inflation of the main landing gear struts also apply to this unit. The proper inflation of the nose strut measured from the red line to the lower edge of the gland nut is two inches.

2. CROSS TUBE.—Maintain 19/32 in. between the packing nut on the starboard cross tube bearing and the actuating arm on the cross tube.

(e) INSTALLATION.—To install the nose wheel strut assembly, follow in a general manner the

reverse of the procedure as outlined in paragraph c, (3), (b), except that the starboard cross tube should be inserted in the bearing before the seal, packing ring, and gland nut are installed.

(4) SHIMMY DAMPER.

(a) DESCRIPTION. (See figure 87.)—The Houdaille shimmy damper is a vane type damper which consists of an oscillatory pair of vanes connected to a shaft, and a stationary pair of vanes connected to the housing. This combination forms two pairs of diametrically opposite pressure chambers. Displacement of fluid and consequent resistance is obtained by the movable vanes turning toward or in relation to the stationary vanes. This vane movement decreases and increases the size of the respective chambers as the fluid passes through a valve opening from one to the other, the delivery chamber decreasing as the receiving chamber increases in size.

The control valve is externally adjustable, the adjusting element being protected by a removable cap in the end of the damper shaft. A bi-metal heli-

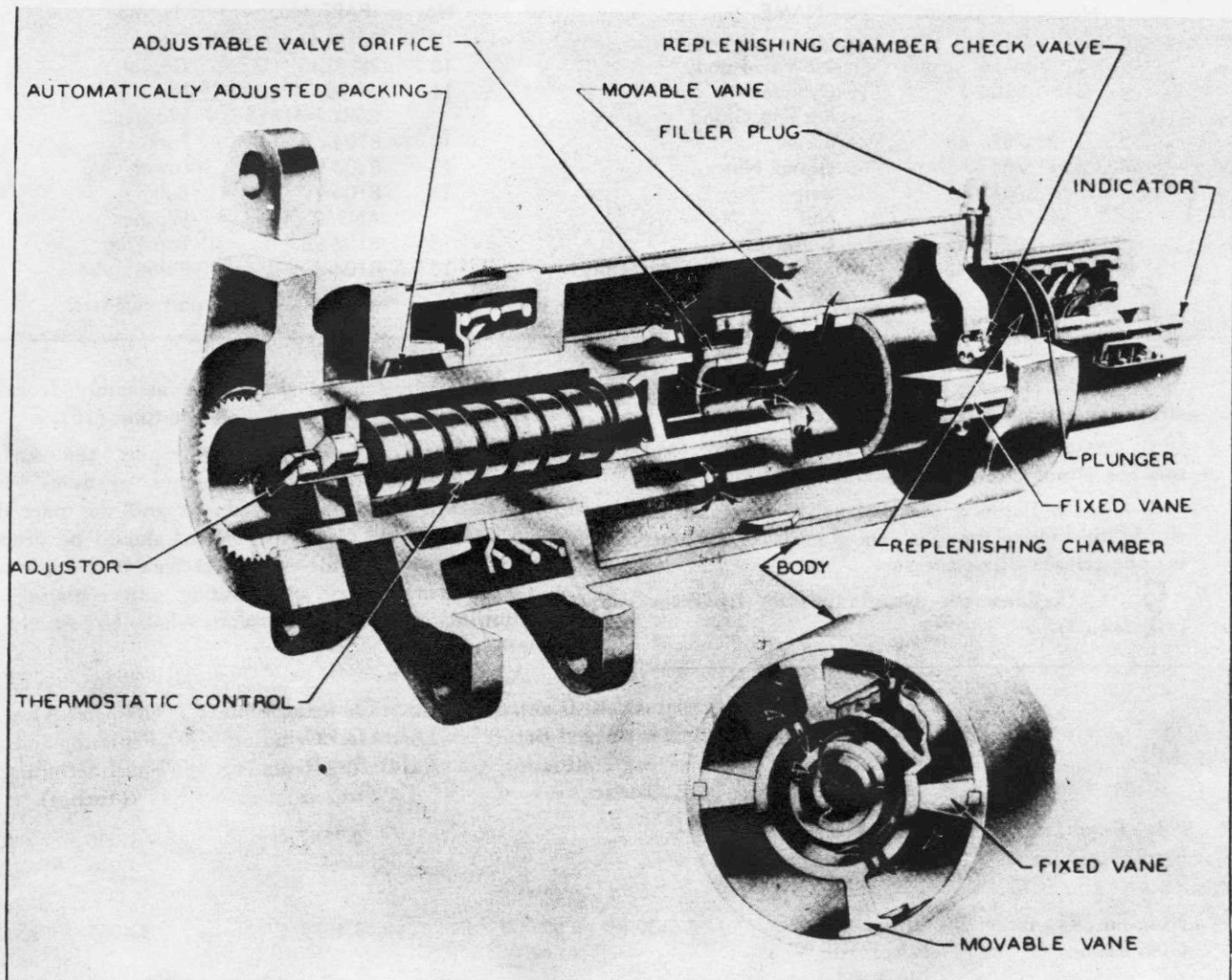


Figure 87—Shimmy Damper

cal thermostat is employed to automatically adjust for temperature changes.

The dampers have a fluid replenishing chamber which is connected to the working chambers by means of one-way, spring loaded valves, and which serves as a reservoir to compensate for changes in fluid volume due to temperature changes.

The addition of fluid is accomplished through a pressure lubricator fitting on the replenishing chamber. An ordinary pressure type lubricating gun is used. An exterior and readily visible fluid level indicator is provided.

The working chambers are vented to the replenishing chamber by means of small slots which allow air and only a small amount of fluid to escape. The fluid which is lost is immediately replaced through the replenishing valves. Air is not taken back into the working chambers because it collects at a point remote from these valves. The proper technique of filling also allows for escape of air from the replenishing chamber.

The packing assembly is self-compensating for wear by reason of a spring which pushes it into the gland and against the shaft. The gland is not subjected to high pressure because it is connected to the replenishing chamber by means of a hole through one of the stationary vanes.

(b) REMOVAL.

(See paragraph c, (3), (b), 2, b.)

(c) MAINTENANCE.

1. The shimmy damper must be kept filled with fluid (Specification AN-VV-O-366) to the proper level. The unit is properly filled at a temperature of 16° to 27°C (60° to 80°F) when the protruding rod at the top of the unit extends $\frac{3}{8}$ inch above the cover. If it extends less than $\frac{9}{32}$ inch above the top, the addition of more fluid is imperative.

2. To add fluid to the shimmy damper: remove the lock wire and protecting cap to expose the lubricator fitting; and then by means of a pressure lu-

bricating gun, add fluid (AN-VV-O-366) until proper amount is added.

CAUTION

Avoid over-filling as this will force the replenishing chamber plunger assembly against the upper stop and bend it out of shape.

3. If shimmy occurs, although the fluid level is correct or has been properly corrected, inspect the damper for inclusion of air in the working chambers as follows: Inspection for air pockets is accomplished by disconnecting the link between the damper and slip ring. The damper lever should then be used to operate the shimmy damper by hand. If on reversals of motion by hand operation, the damper offers immediate resistance, there is no air in the working chamber. If, on the other hand, there is a feeling of lost motion before resistance is offered, or if a loss of resistance is noted, air has been trapped in the working chamber. Air that is trapped is removed by operating the damper by hand through its full stroke for a number of oscillations until resistance is immediate and uniform.

This operation serves to remove air from the working chamber, but air thus removed finds its way into the upper reserve chamber and lodges under the piston. It is, therefore, wise in such instances to remove the damper from the airplane and place it on a bench so that the filler fitting points vertically upward. The area around the filler fitting should be thoroughly cleaned, and the filler fitting should then be removed from the damper. Removal of the fitting will allow the replenishing piston to return to its lowest level and thus expel air from the filling hole. Fluid should then be poured into the filling hole. As it overflows, the unit should be pumped through its full travel to ascertain there are no air pockets. The filler fitting should then be re-inserted and properly tightened. The fluid level should be brought to its proper point by using a clean Zerk lubricating gun as previously directed.

(d) ADJUSTMENTS.—The adjustment for normal conditions of use has been made by the manufacturer. The following instructions should be used for determination of the valve adjustment or re-adjustment, if such becomes necessary:

1. At bottom of shimmy damper, remove the weld of nut to splined shaft by filing. Unscrew the nut. This will reveal a screw driver slot with an arrow on its end, which is in line with a chisel mark on the end of the shaft. This mark lies between the letters "O" and "S" on the face of the shaft end and represents the valve setting as determined by the manufacturer. Clockwise rotation of the valve toward "S" closes the valve. Counterclockwise rotation toward "O" opens the valve.

2. When taxiing the airplane, if the wheel has a tendency to shimmy, the adjusting needle must be turned toward the closed position, that is clockwise, by increments of 1/32 inch at a time until shimmy is eliminated.

3. While this valve setting is adequate to stop shimmy during normal taxiing, additional adjustment may be necessary to prevent shimmy when maximum decelerating loads are imposed on the nose wheel. Make several taxiing runs at a speed of approximately 70 miles per hour and during each run apply the brakes with increasing pressure until full deceleration is reached. If shimmying occurs, close the valve further until there is no indication of shimmy when the maximum braking effort is applied.

4. It is desirable to use the damper with its valve open as far as possible so that damping is effected with a minimum stiffening of steering and with a minimum damper pressure.

5. Replace the cap nut. If possible, tackweld in place at one point.

(e) INSTALLATION.—Follow the reverse of the removal procedure as outlined in paragraph c, (3), (b), 2, b.

(5) NOSE WHEEL RETRACTING MECHANISM.

(a) DESCRIPTION. (See figure 85.)—The actuating cylinder for the nose landing gear is attached to the hull structure outboard of the starboard double keel by means of a hinge fitting incorporated in the end cap of the cylinder. The piston is attached to an operating lever on the cross tube of the strut assembly. The cylinder, as it extends, applies torque to the cross tube retracting the nose wheel and, as it retracts, extends the nose wheel.

The up lock located in the floor between the double keel consists of a spring loaded latch which is engaged by a hook attached to the nose wheel strut just below the shimmy damper when the gear reaches the retracted position. The up lock is disengaged by means of an unlatching jack which extends and rotates the latch, disengaging the latch pin from the hook.

The down lock latch is also a spring loaded latch located in the nose landing gear drag fitting in the lower forward end of the wheel well. The latch, which extends out into the well, engages a lock pin on the forward side of the oleo strut as the gear reaches the extended position.

Unlatching is accomplished by an unlatching jack in the same manner in which the up lock is disengaged.

(b) REMOVAL.

(See figure 85.)

1. To remove the nose wheel actuating cylinder proceed as follows:

a. Disconnect the hydraulic lines from the cylinder (20).

b. Remove the bolts (19) and (21) attaching the cylinder to the hull structure and to the actuating lever on the strut cross tube (9) and withdraw the cylinder from the airplane.

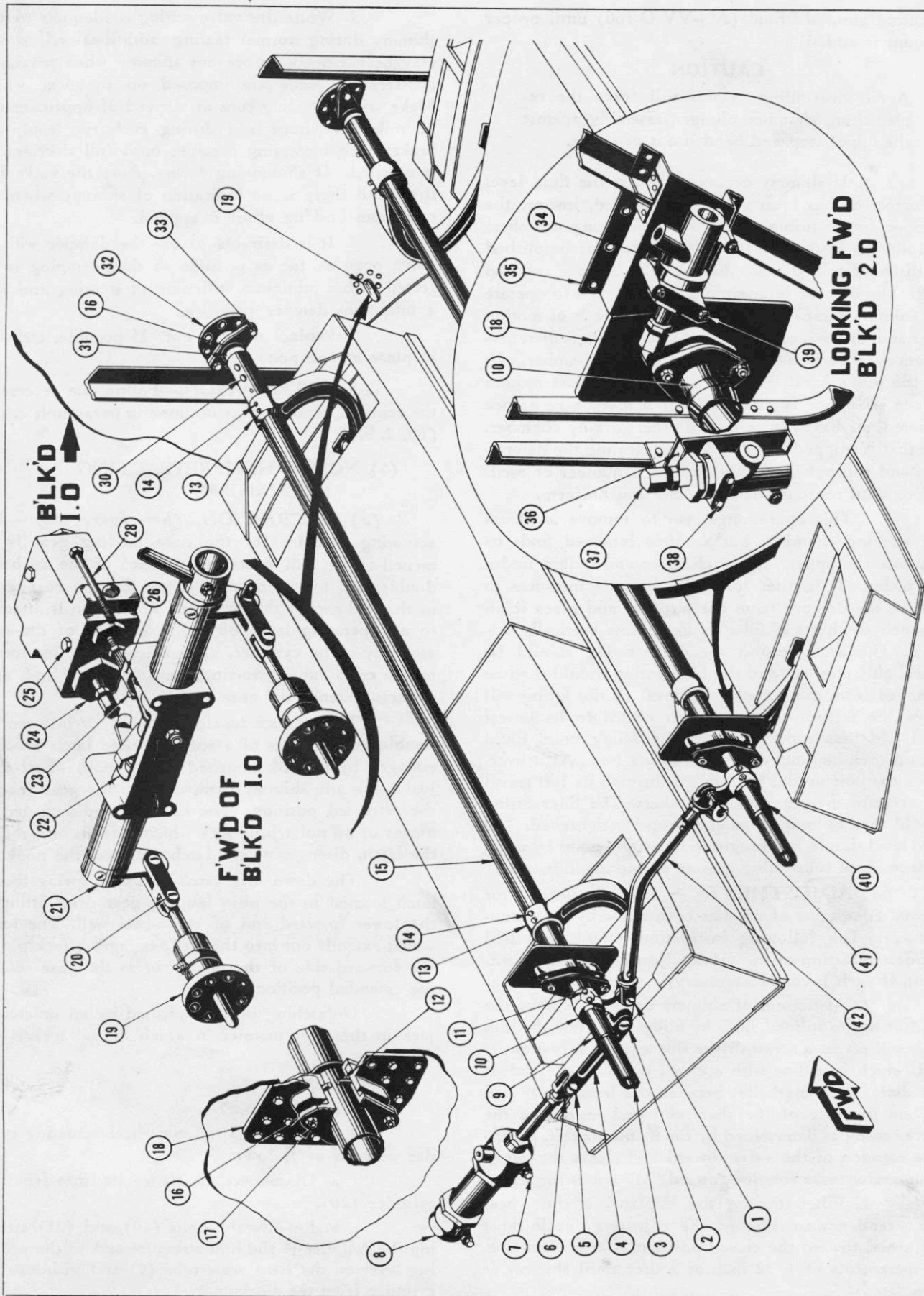


Figure 88—Nose Wheel Door Control Mechanism

No.	PART No.	NAME	No.	PART No.	NAME
1	AN25-23	Bolt	20	AN23-12	Bolt
	AN320-5	Nut		AN320-3	Nut
	Q7014-21-063	Washer		AN380-2-2	Cotter
	28B5586-6	Bearing	21	28F6615	Lock Mechanism Assembly
	AN380C2-2	Cotter	22	28F6617	Link
	Q7102-A516	Washer	23	AN23-13	Bolt
2	AN25-31	Bolt		AN320-3	Nut
	AN320-5	Nut		AN380-2-2	Cotter
	Q7014-21-063	Washer	24	28F6619	Nose Wheel Door Lock and Seq.
	28B5586-6	Bearing			Valve
	Q7102-A516	Washer	25	AN4-2-2	Bolt
	AN380-C2-2	Cotter		AN310-4	Nut
3	28B5672	Adapter Tube (Aft)		AN380-2-2	Cotter
4	28B5576	Link	26	28F6627	Clevis
5	AN25-31	Bolt	28	AN3-30A	Bolt
	AN320-5	Nut		AN365-720	Nut
	Q7012-21-091	Washer	30	AN386-2-18A	Pin
	AN380-C2-2	Cotter		AN365-1032	Nut
	Q7102-A516	Washer		AN975-3	Washer
6	0310H	Clevis End	31	31B222-3	Adapter Tube (Forward)
7	AN4-35A	Bolt	32	28B5584	Hull Fitting Bulkhead 1
	AN365-428	Nut	33	AN4-DD6A	Bolt
	Q7102-A416	Washer		AN365-D428	Nut
8	0625H	Actuating Cylinder	34	28F6501	Nose Wheel Door Lock Seq.
9	28B5600	Torque Tube Extension (Port)			Valve
10	28B5510-2	Torque Tube Fitting	35	28F6611	Mounting Bracket
11	AN386-2-19A	Pin	36	28F6532-2	Bracket
	AN365-1032	Nut	37	28F6501	Nose Wheel Seq. Valve
	AN975-3	Washer	38	AN4-21A	Bolt
12	33V219-26	Seal		AN960-416A	Washer
13	28B5515	Arm	39	AN4-D20A	Bolt
14	AN386-2-21A	Pin		AN365-D428	Nut
	AN365-1032	Nut	40	28B5600-2	Torque Tube Extension (Stb'd.)
	AN975-3	Washer	41	28F6610	Bolt
15	28B4028	Torque Tube		AN320-5	Nut
16	28B5585	Bearing		AN380-C2-2	Cotter
17	28B5614	Bolt		Q7014-21-063	Washer
	AN365-D428	Nut		28B5586-6	Bearing
	Q7102-A416	Washer		Q7102-A516	Washer
18	28B5579	Hull Fitting Bulkhead 2	42	28B5573	Link
19	28F6578	Lock Pin Assembly			

Index numbers 6 and 8 are Interstate Aircraft and Engineering Corporation part numbers.

2. To remove the up lock latch (2) from the airplane, disengage the spring (1); and then remove the bolt (4) thru the up lock bracket and latch (2), allowing the latch to be withdrawn.

3. Remove the down lock latch as follows:

a. Disengage the two springs (34) attached to the levers (35) in the outboard end of the latch pin (37).

b. Remove the locking bolts (43) from the levers and slide them off the pin.

c. Unscrew the gland nuts immediately inboard of the levers. Use wrench 28 U 5031-6. (See figure 40.)

d. Remove the bolt (39) locking the latch (40) to the latch pin (37) and slide the pin out of the assembly allowing the latch to be removed.

e. Remove the two seal rings (44) from the drag fitting.

(c) MAINTENANCE.

(See paragraph c, (3), (c) for maintenance of the actuating cylinder piston.)

1. Replace worn or damaged parts such as pins, bushings, springs, seals, etc.

2. Lubricate all moving parts not supplied by Zerk fittings with a light oil (Specification AN-0-6).

(d) ADJUSTMENTS.

1. Adjust piston of actuating cylinder so that, with the piston fully extended, (that is wheel fully retracted) the strut hook overtravels the up latch by $\frac{1}{8}$ inch. The piston should also be a minimum of $\frac{1}{8}$ inch from being bottomed with the gear down and locked.

2. Adjust the unlatching plungers so that a $\frac{1}{32}$ inch clearance between the plunger and the latch is maintained when the latches are in the locked position.

tion. Use wrenches 28 F 6704 and 28 F 6705 on the down-lock. (See figure 40.)

3. Adjust indicating micro-switches so that indicator lights are illuminated when the gear is locked in the respective positions.

(e) INSTALLATION.—To install the nose wheel actuating cylinder, the up lock latch and the down lock latch, reverse the removal procedure outlined in paragraph c, (5), (b).

(6) NOSE WHEEL DOOR CONTROL MECHANISM.

(a) DESCRIPTION. (See figure 88.)—Nose wheel door operation is obtained by means of two torque tubes linked together and operated by a hydraulic cylinder.

Each torque tube rotates in bearings on bulkheads No. 1 and No. 2 and is fitted with two arms which transmit the motion to the doors. Idler links, attached to the doors at both the fore and aft ends and to the bulkheads, are used to maintain a definite position of the doors relative to the hull.

The hydraulic cylinder is attached to a fitting on the aft end of the port torque tube and rotates the tube when the cylinder extends or retracts. The fitting on the aft end of the port torque tube is attached to a fitting on the aft end of the starboard torque tube by means of a link, thus synchronizing the two doors.

The doors are locked in the closed position by pins which extend aft out of bulkhead No. 1 (forward end of the well) and fit into sockets in the forward end of the doors. The pins may be operated either hydraulically or manually.

(b) REMOVAL.

1. Remove the doors. (See Par. 3, e, (2).)

2. Detach the two bolts (2) and (5) from the link (4) between the hydraulic cylinder (8) and the port torque tube fitting (10) and remove the link.

3. Detach the two bolts (1) and (41) from the link (42) between the torque tube fittings (10) and remove the link (42).

4. Remove the taper pins (14) and (11) from the two arms (13) and the two aft fittings (10) on the torque tubes (15). Pull the adapter tube (3) out of the aft end of the port torque tube.

5. The torque tube can then be telescoped on the extension at the aft end of the tube, allowing the removal of both the torque tube and the aft fittings.

6. To remove the adapter tube (31) in the forward end of the torque tube, remove the two taper pins (30) and pull the adapter out of the torque tube.

7. Slide the arms (13) off the torque tubes.

8. The bearings (16) may be removed from the hull fittings (18) and (32) by removing the bolts (17) and (33) through the flanges of the bearings.

9. Remove the seal from the aft hull fittings (18).

(c) MAINTENANCE.—For maintenance of the nose wheel door actuating cylinder, see Par. 21, d, (2), (c).

1. Lubricate all moving parts that are not supplied with Zerk fittings with light oil (Specification AN-O-6).

2. Replace any damaged or worn parts.

3. Replace the seal in the aft torque tube bearings if water leakage is present.

(d) ADJUSTMENTS.

(See Par. 21, d, (2), (d) for adjustment of nose wheel door actuating cylinder.)

(e) INSTALLATION—Install the nose wheel door control mechanism as follows:

1. Insert the adapter tube (31) in the forward end of the torque tubes (15) and install the two taper pins (30).

2. Slide the arms (13) on the torque tube and insert the aft extensions (9) and (40) into the torque tubes.

3. Slide the forward half of the rear bearings (16) on the extensions (9) and (40).

4. Install the forward bearings (16).

5. Telescope the tube assembly and install it in the well forward end first.

6. Install the seal (12) and the aft half of the bearing loosely at the aft end of the torque tubes.

7. Slide aft torque tube fittings (10) on the extensions (9) and (40).

8. Insert the aft adapter tube (3) in the port torque assembly.

9. Install all remaining taper pins and tighten bearing assemblies.

10. Install linkages on the aft torque tube fittings and attach to actuating cylinder (8).

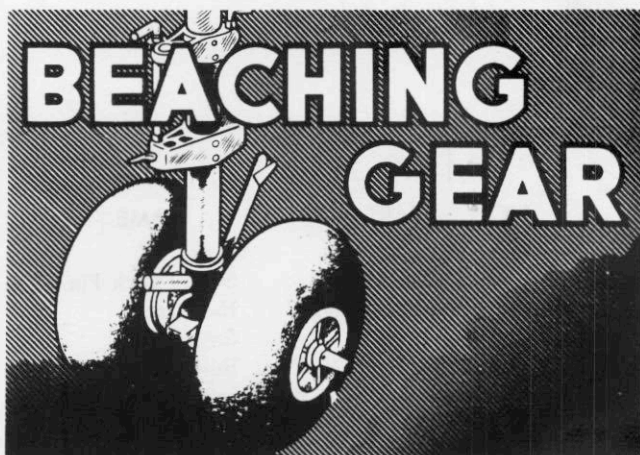
11. Fill the torque tubes with Paralketone (Specification AN-C-52, type I) until it overflows from the top vent hole and drain.

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PARAGRAPH 5.



5. BEACHING GEAR.

a. GENERAL.—For ground handling purposes, these airplanes may be equipped with a three-unit beaching gear. The two main units are mounted on either side of the hull just below the forward wing struts. The third unit mounts on the bottom of the hull immediately aft of the tunnel gunner's hatch.

Wheels of all three units swivel for steering purposes and can be locked in position. A steering pole is provided and can be installed on either the main beaching gear or the tail beaching gear.

The main beaching gear is equipped with self-contained expander type brakes.

b. MAIN BEACHING GEAR.

(1) DESCRIPTION. (See figure 89.)—Each main beaching gear is a tubular strut mounting two 11.00 x 12 Hayes wheels and a brake assembly on a swivel knuckle at the lower end. The wheels are equipped with 11.00 x 12 eight-ply smooth Goodrich low pressure tires and Goodrich tubes.

Attaching fittings are provided at the top and approximately at the halfway point of the strut. The upper fitting is secured immediately under the forward wing strut by means of a lock pin (10) which passes through both the hull fitting (9) and the beaching gear fitting (8). The lower attaching fitting (11) is fastened by two lock pins (6) to the hull chine fitting (5). These lockpins (6) are held in line and locked in place by a strut fitting (7) above the lower attaching fitting (11).

The swivel knuckle (14) at the base of the main strut (13) is equipped with a hand operated hydraulic brake system, a jack pad (1), a swivel arm (4), and a swivel lock pin (2). Jack pad and swivel arm are stationary items at the front of the swivel fitting. The swivel lock pin (2) must be removed to allow the swivel fitting to turn. The steering pole fits into the swivel arm (4).

Brakes are of the Hayes expander type. One brake is mounted in each wheel, and both brakes are

controlled by the brake handle (12) located on the aft side of the swivel knuckle (14). Moving the brake handle (12) downward depresses a piston in a hydraulic cylinder. This causes hydraulic fluid to flow into the brake expander, causing the brakes to expand against the brake drums, providing a frictional drag against movement of the wheel.

(2) REMOVAL AND DISASSEMBLY.

(See figure 89.)

(a) MAIN BEACHING GEAR FROM AIRPLANE.—To remove beaching gear from airplane:

1. Turn both lock pin (6) handles outboard.
2. Remove these lock pins (6) from the attaching fittings (5) and (7).
3. Remove the hull fitting lock pin (10) from the top of the beaching gear.

(b) TIRES.—The wheels for the main beaching gear are of the drop center type used on most modern automobiles. To remove a tire from this type of wheel, proceed as follows:

1. Deflate tire and remove the valve core to release all air pressure from the inner tube.
2. Break the tire loose from the wheel rim.
3. Use flat tire tools to pry the outside tire rim over the wheel rim.
4. Remove the inner tube from the tire.
5. Pry the inner tire rim over the wheel rim.

CAUTION

Do not attempt to remove a tire while the gear is on the airplane. If the gear is mounted and a tire needs changing, jack the gear up, remove the tire and wheel as a unit, and then remove the tire and tube.

(c) WHEELS.—To remove the main beaching gear wheels:

1. Release the hand brake (12).
2. Remove hub caps (3) and (15).
3. Remove the hub cotter pin, nut, and washer (17) with special wrench 28U1025-4. (See figure 40.)
4. Slide the wheel from the axle (16). The brake drum (2) will come off with the wheel. (See figure 90.)
5. Remove the eight bolts (1) and insulation attaching the brake drum (2) to the wheel.

(d) BRAKES. (See figure 90.)—With main wheels removed:

1. Disconnect brake hose assemblies (6) and (8).
2. Remove the six bolts (3) holding the brake to the swivel knuckle (10).

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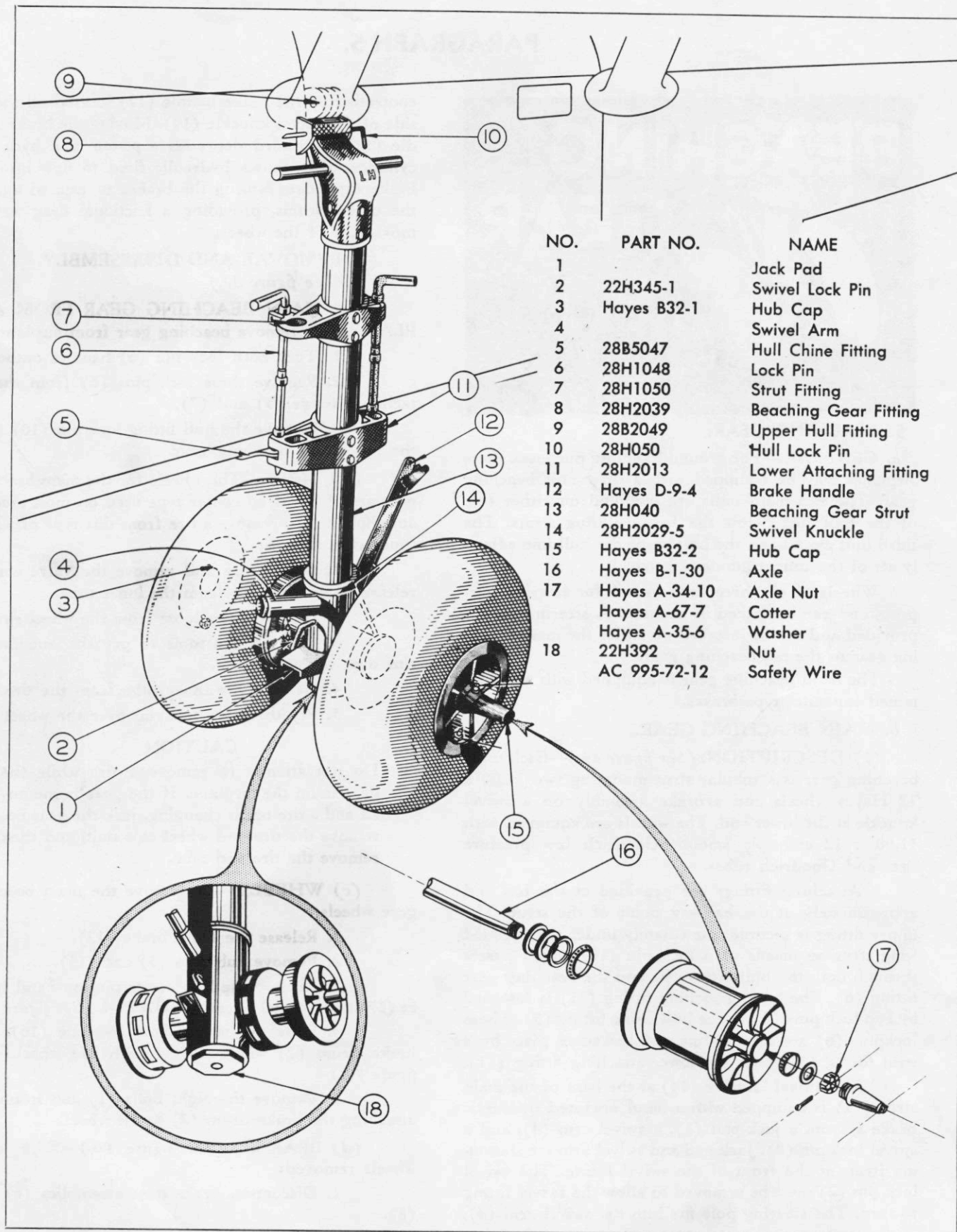
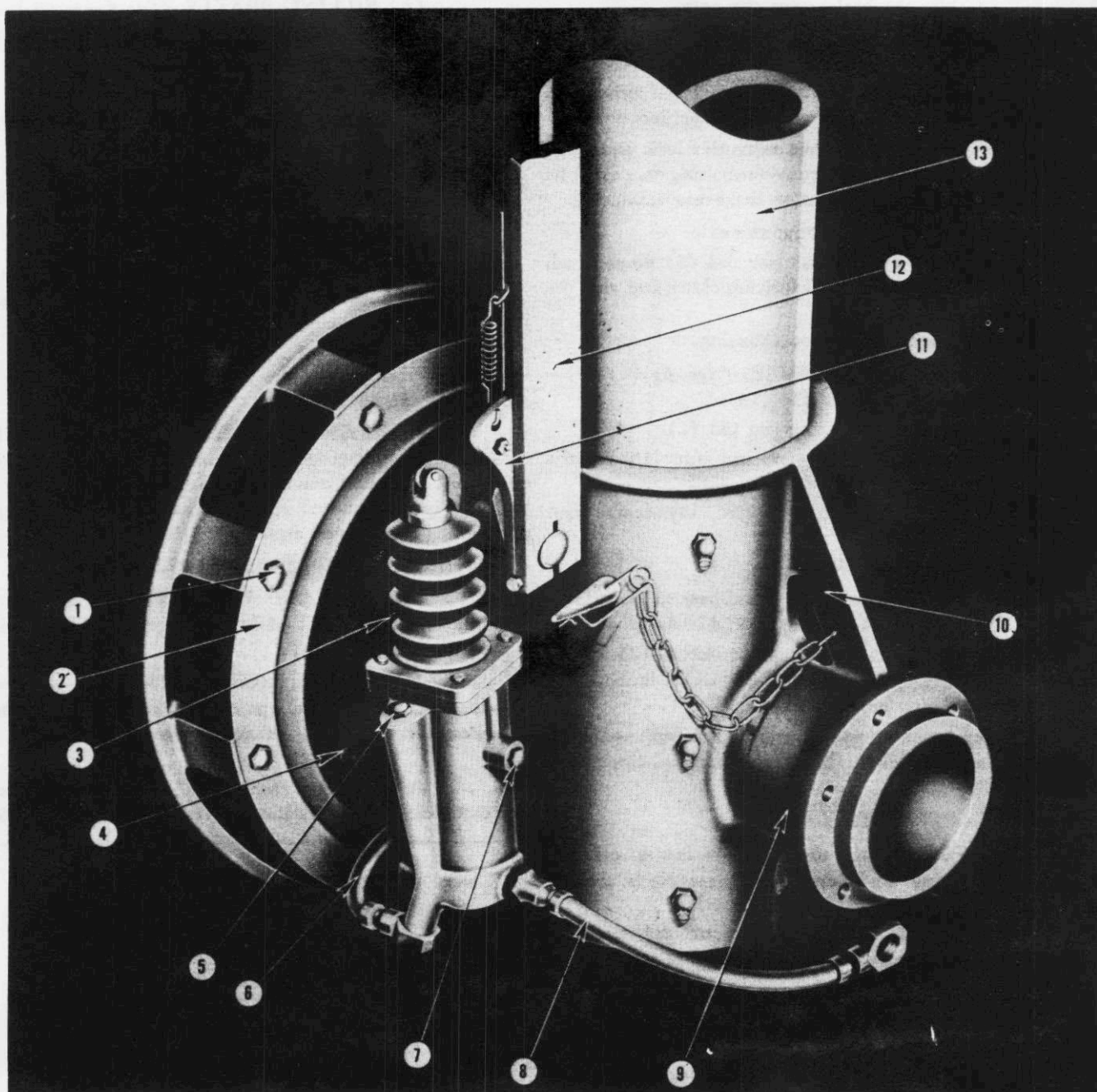


Figure 89—Main Beaching Gear Assembly



No.	PART No.	NAME
1	Hayes A-43-6	Bolt
2	Hayes D13-7	Brake Drum
3	Hayes A-43-14-7	Bolt
	Hayes A-67-1	Cotter
	Hayes A-63-14	Nut
4	Hayes A-43-5	Bolt
	Hayes A-63-9	Nut
	Hayes A-67-1	Cotter
5	Hayes A-43-24	Fluid Vent Plug
6	Hayes B-91-3	Hose Assembly

No.	PART No.	NAME
7	Hayes A-43-24	Fluid Filler Plug
8	Hayes B-91-4	Hose Assembly
9	AN 6-35	Bolt
	AN 310-6	Nut
	AN 380-3-3	Cotter Pin
10	28H2029-5	Swivel Knuckle
11	A-66-1	Brake Locking Pawl
12	Hayes D9-4	Brake Handle
13	28H040	Beaching Gear Strut

Figure 90—Main Beaching Gear Details

3. Slip the brake over the axle.
4. Remove bolt attaching brake mechanism to swivel knuckle (10).
5. Disconnect brake handle (12) from swivel knuckle (10) by removing the two attaching bolts.
6. Should the brake expander leak and need replacing, it may be removed by unbolting the six bolts (4) attaching the two halves of the brake mounting.

(e) AXLE.—To remove the axle:

1. With brake hoses (6) and (8) disengaged, remove bolts (9) through swivel knuckle (10) and the axle.

2. Remove axle from housing.

(f) SWIVEL KNUCKLE. (See figure 89).—To remove the swivel knuckle (14):

1. Remove swivel locking pin (2).
2. Remove safety wire and nut (18) at the base of the swivel knuckle (14).
3. Remove swivel knuckle (14) from strut (13).

(3) MAINTENANCE.

(a) For repair of tires and tubes, refer to General Manual for Structural Repairs (AN-01-1A-1).

(b) Apply grease (Specification AN-G-10) at Zerk fittings and at moving parts of brake locking mechanism at intervals noted in Section X.

(c) Keep beaching gear fitting on hull well coated with beeswax and grease (Navy Aeronautical Specification C-88-2).

(4) REPLACEMENTS.

(a) TIRES.—Replace tires if there is any evidence of rim cutting, or if cracks or loose cords are found on the inside of the casing.

Surface checking or cracking of the tires should not be considered as sufficient cause for replacement.

(b) INNER TUBES.—Replacement of inner tubes should be made at the discretion of the officer in charge of maintenance.

(5) ADJUSTMENTS.—The brakes should be adjusted by removing or adding castor oil base fluid (Navy Aeronautical Specification M-574). The following procedure is used:

(a) FLUID REMOVAL. (See figure 90).—If the brakes drag when the brake handle is fully released, fluid may be removed from the system by removing the fluid vent plug (5) and allowing a small amount of hydraulic fluid to flow from the system.

If there is no fluid flow, move the brake handle (12) toward locking position to stimulate fluid flow.

CAUTION

Care should be taken to ascertain whether or not the brakes are responsible for the drag, before this is attempted.

(b) FILLING BRAKES. (See figure 90).—The following procedure is used to refill the brake hydraulic system:

1. Completely release brakes.
2. Remove the fluid vent plug (5) and the fluid filler plug (7).
3. Using a fluid pump, pump fluid into the filler opening until the fluid flowing from the vent opening is free from all air bubbles.
4. Plug the fluid vent opening.
5. Continue to pump fluid into the system until the brake handle (12) may be moved only three or four notches downward on the brake locking pawl (11).
6. Leaving the brake handle (12) in the locked position, detach the fluid pump and plug the fluid filler opening.

(c) BLEEDING BRAKES.—If the brake handle has a springy feel and the brakes do not hold firmly, bleed and then refill the brake hydraulic system by following the procedure described in foregoing paragraphs b, (5), (a) and b, (5), (b).

(6) ASSEMBLY AND INSTALLATION.

(a) MAIN BEACHING GEAR.—For instructions on attachment of beaching gear to the airplane, see Section III, Par. 2, f.

(b) SWIVEL KNUCKLE.—To install swivel knuckle on the beaching gear strut, reverse removal procedure outlined in foregoing paragraph b, (2), (f).

(c) AXLE. (See figure 90).—Install axle in swivel knuckle (10) and hold in place with bolts (9).

NO.	PART NO.	NAME
1	AN 4-25	Bolt
	AN 310-4	Nut
	AN 380B2-2	Cotter
	AN 960-416	Washer
2	28H1058-2	Tire
3	AN 4-17	Bolt
	AN 310-4	Nut
	AN 380B2-2	Cotter
	AN 960-416	Washer
4	28H1060	Nut
5	28H1059	Axle
6	28H1058	Wheel Assembly
7	28H1001	Steering Bar
8	AN 27-27	Clevis Bolt
	AN 960-716	Washer
	AN 320-7	Nut
	AN 380-3-3	Cotter Pin
9	28H1014	Spring
10	28H1016	Bolt
11	28H1005	Forward Strut
12	28H1009	Aft Strut
13	28B1578	Hull Attaching Fitting
14	28B1572	Hull Towing Lug
15	28H1011	Lock Pin
	Q 115	Pin

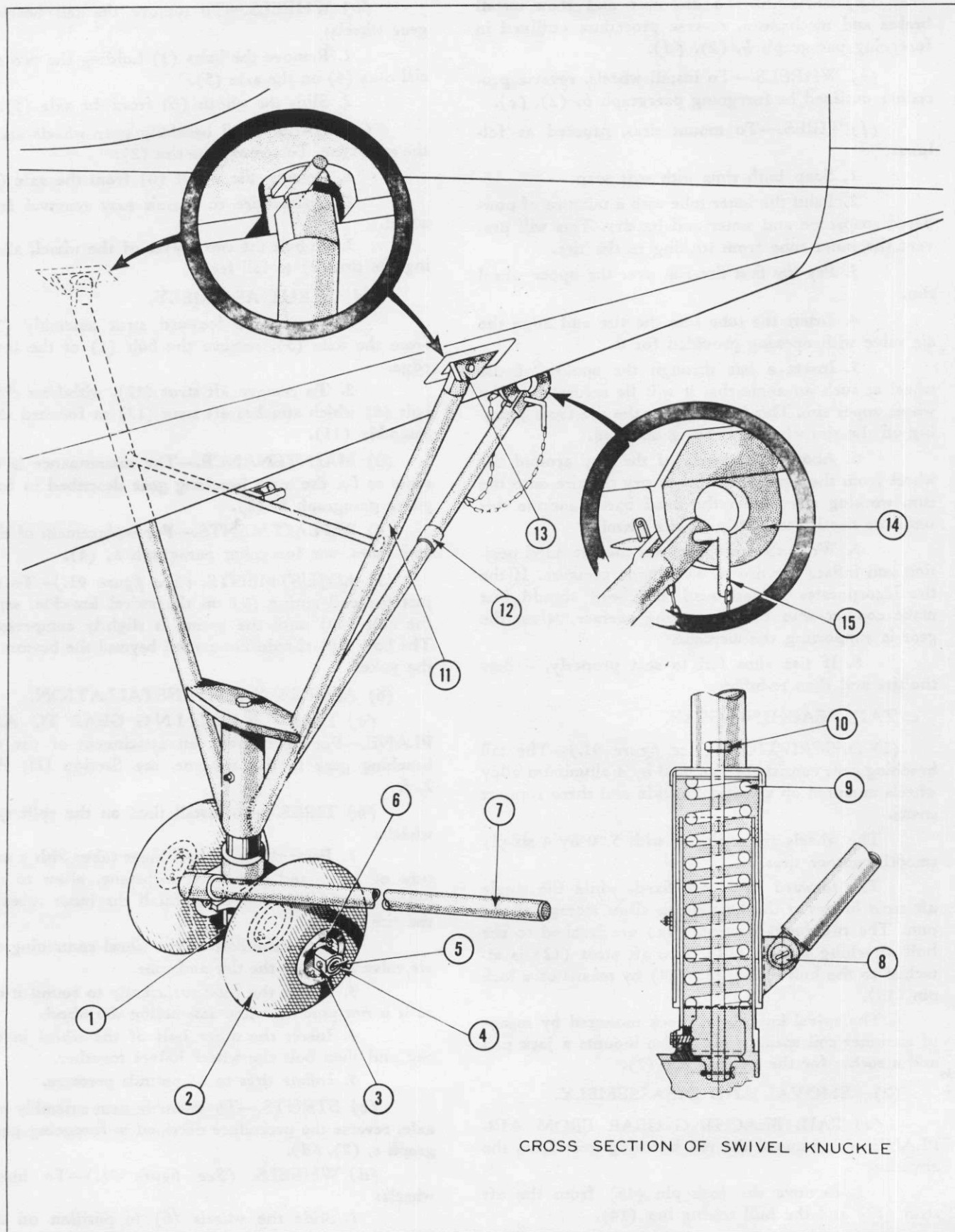


Figure 91—Tail Beaching Gear

(d) BRAKES.—To assemble and then install brakes and mechanism, reverse procedure outlined in foregoing paragraph b, (2), (d).

(e) WHEELS.—To install wheels, reverse procedure outlined in foregoing paragraph b, (2), (c).

(f) TIRES.—To mount tires, proceed as follows:

1. Soap both rims with soft soap.
2. Paint the inner tube with a mixture of powdered soapstone and water and let dry. This will prevent the inner tube from sticking to the tire.
3. Pry the first tire rim over the upper wheel rim.
4. Insert the tube into the tire and align the air valve with opening provided for it.
5. Insert a bar through the spokes of the wheel at such an angle that it will lie securely on the wheel upper rim. This is to prevent the tire from jumping off the rim while it is being installed.
6. About one-quarter of the way around the wheel from the fixed bar, start to pry the tire onto the rim, working away from the fixed bar. Continue this until the tire is completely on the wheel.
7. Work the air valve into the extended position and inflate the tire to 55 pounds pressure. If the tire incorporates a load bead, the bead should just make contact with the supporting surface, when the gear is supporting the airplane.
8. If tire rims fail to seat properly, deflate the tire and then re-inflate.

c. TAIL BEACHING GEAR.

(1) DESCRIPTION. (See figure 91.)—The tail beaching gear consists of two 5.00 by 4 aluminum alloy wheels mounted on a swivel knuckle and three support struts.

The wheels are equipped with 5.00 by 4 six-ply smooth contour tires.

The forward struts are fixed, while the single aft strut hinges at the knuckle to allow storage of the unit. The two forward struts (11) are hooked to the hull attaching fittings (13). The aft strut (12) is attached to the hull towing lug (14) by means of a lock pin (15).

The swivel knuckle is shock mounted by means of an inner coil spring (9). It also mounts a jack pad and a socket for the steering bar (7).

(2) REMOVAL AND DISASSEMBLY.

(a) TAIL BEACHING GEAR FROM AIRPLANE.—To remove the tail beaching gear from the airplane:

1. Remove the lock pin (15) from the aft strut (12) and the hull towing lug (14).
2. Unhook the two forward struts (11) from the hull attaching fittings (13).

(b) WHEELS.—To remove the tail beaching gear wheels:

1. Remove the bolts (3) holding the two special nuts (4) on the axle (5).
2. Slide the wheels (6) from the axle (5).

(c) TIRES.—Tail beaching gear wheels are of the split type. To remove the tire (2):

1. Remove the wheel (6) from the axle (5).
2. Deflate tire to permit easy removal from wheel.
3. Unbolt the two halves of the wheel, allowing the tire (2) to fall free.

(d) STRUT ASSEMBLY.

1. To remove forward strut assembly (11) from the axle (5), remove the bolt (1) at the lower edge.

2. To remove aft strut (12), withdraw clevis bolt (8) which attaches aft strut (12) to forward strut assembly (11).

(3) MAINTENANCE.—The maintenance is the same as for the main beaching gear described in foregoing paragraph b, (3).

(4) REPLACEMENTS.—For replacement of tires and tubes, see foregoing paragraph b, (4).

(5) ADJUSTMENTS. (See figure 91.)—To adjust the coil spring (9) on the swivel knuckle, screw the bolt (10) until the spring is slightly compressed. The bolt (10) should not extend beyond the bottom of the yoke.

(6) ASSEMBLY AND INSTALLATION.

(a) TAIL BEACHING GEAR TO AIRPLANE.—For instructions on attachment of the tail beaching gear to the airplane, see Section III, Par. 2, f.

(b) TIRES.—To install tires on the split type wheels:

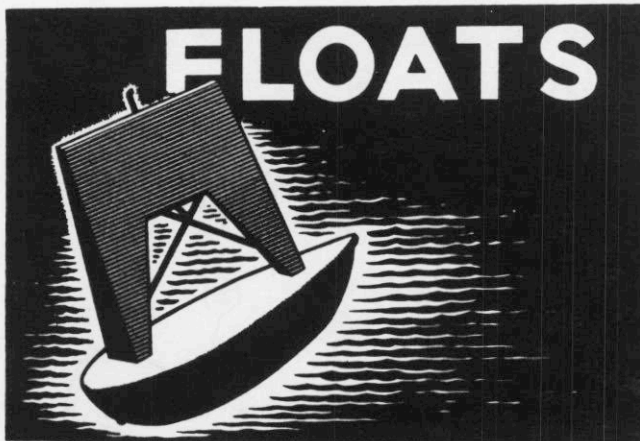
1. Paint the tail wheel inner tubes with a mixture of water and powdered soapstone, allow to dry before assembling, and then install the inner tubes in the tire casings.
2. Insert the half of the wheel containing the air valve hole into the tire and tube.
3. Inflate the tube sufficiently to round it out so it is not pinched when assembling the wheel.
4. Insert the other half of the wheel in the tire and then bolt the wheel halves together.
5. Inflate tires to 65 pounds pressure.

(c) STRUTS.—To assemble strut assembly and axle, reverse the procedure described in foregoing paragraph c, (2), (d).

(d) WHEELS. (See figure 91.)—To install wheels:

1. Slide the wheels (6) in position on the axle (5).
2. Bolt the two special nuts (4) on the axle.

PARAGRAPH 6.



6. FLOATS.

a. GENERAL. (See figure 92.)—Retractable wing floats are provided to give the airplane lateral stability when on the water. In the retracted position, the floats form the wing tips, and the drag panel (the main float supporting structural member) is retracted completely in the wing to form a continuous lower wing surface to reduce drag and increase the overall efficiency of the airplane. The wing floats system can be divided into three major components: The floats proper, the drag panel and "Vee" struts, and the retracting mechanism.

b. FLOATS.

(1) DESCRIPTION.—Each float structure is of a stressed skin, all metal aluminum alloy construction, consisting of six transverse frames and bulkheads, and longitudinal stringers. Each float contains three water tight compartments, which are vented by tubing into the drag panel. The vent lines should be kept unobstructed at all times to prevent possible rupturing of the float skin due to differences of pressure within the float and the atmospheric air at high altitude.

To give access to the interior of the float for periodic inspection or repair, five doors are provided on the upper surface of the float. These doors are a structural part of the float and must be securely fastened to the deck with screws to prevent possible buckling of the float skin and leakage of water into the water tight compartments of the float.

(2) REMOVAL AND DISASSEMBLY. (See figure 93.)—The float should be removed by three men, one at the aft end, one at the forward end, while the third man removes the attaching bolts in the following order:

(a) Remove end of bonding braids (2) and (3) by detaching screw in drag panel.

(b) Loosen vent tube coupling at the float to prevent bending of the tubing when removing the float.

(c) Remove forward and aft access doors by removing attaching screws. (See figure 94.)

(d) Loosen hinged "Vee" strut fairings (11) by removing screws. (See figure 93.)

(e) Inside float, remove hinge bolt locking clevis (5), and then completely disconnect "Vee" strut from float by detaching hinge bolts (6).

(f) Remove the two bolts that attach the drag panel at each end of the float. Floats will now be free of attaching members.

CAUTION

Do not allow the float to hang by the fitting at one end of the drag panel, as this can cause damage to the fitting or to the internal structure of the float.

(3) MAINTENANCE.—The chief maintenance problem on the float is the prevention of corrosion. After every flight when a landing or take-off is made in salt water, the float should be washed down with clear water. At every 30 hours, check, and remove the access doors to allow float to completely dry. At this time, a check should be made to see that an ample supply of potassium chromate crystals (dehydrated crystals) are still available. These crystals are in bags which are wired to the keelson of the float. If the potassium chromate crystals have been dissolved, replace with a new supply. (See figure 94.)

At every 120 hour inspection, remove the float access doors and wash the float interior with a mild castile soap solution; rinse with clear water; and allow to dry completely. The potassium chromate crystals should be replaced at this time. If evidence of corrosion is found, treat as detailed in Par. 3, b, (2).

Structural maintenance and repair to damaged floats should be in accordance with the MANUAL OF STRUCTURAL REPAIRS (AN 01-5MA-3). If during periodic inspection, there is evidence of leakage, the location of the leak may be found by filling the float with water and inspecting seams and rivets on the outside.

(4) INSTALLATION.—The float may be installed by reversing order of removal. (See paragraph b, (2).)

c. DRAG PANEL AND STRUTS.

(1) DESCRIPTION.—The drag panel is the main load carrying structural member of the float bracing structure. It is of aluminum alloy construction and designed to carry the drag and vertical loads imposed upon it by the float. The plating and internal structure are load carrying members and for maintenance and repair must be treated as such. The upper and lower "Vee" struts are of welded steel construction.

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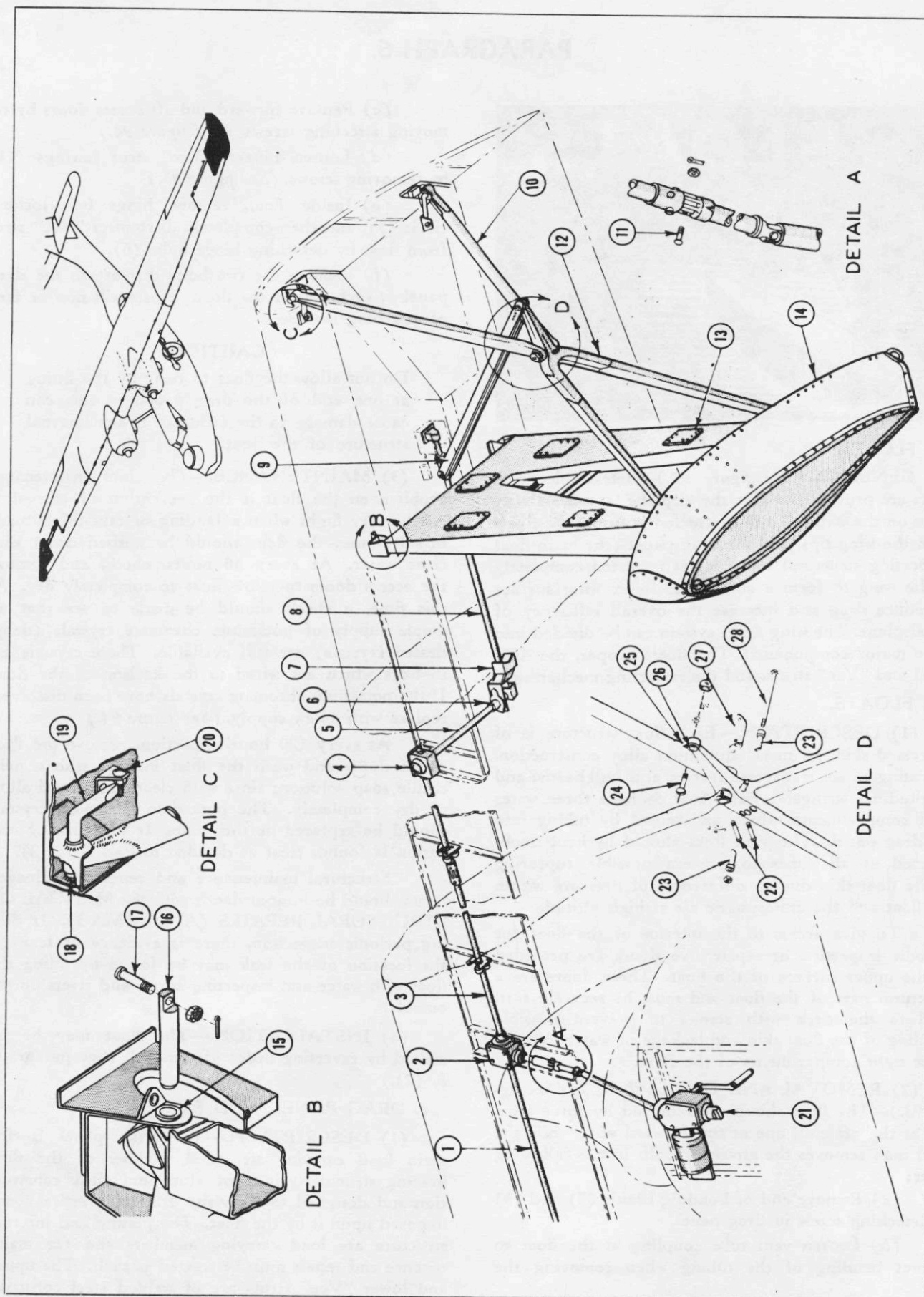


Figure 92—Float Installation

No.	PART No.	NAME	No.	PART No.	NAME
1	28L095L	Torque Tube	17	AN23-14	Clevis Bolt
2	28L049	Three Way Gear Box		AN320-3	Nut
3	28L095R	Torque Tube		AN380-2-2	Cotter Pin
4	28L044L/R	Outer Panel Gear Box	18	Q618-14-46.5	Bushing
5	28L104-2	Torque Tube	19	28L140-6	Hinge Pin—Forward
6	28L1040L/R	Lock and Recoil Mech.		28L140-7	Hinge Pin—Aft
7	28L032L/R	Screw Jack Gear Box	20	28L1045	Screw—Special
8	28L144L/R	Screw Jack		AN935-8	Lock Washer
9	28L081	"U" Strut		AN345-8	Nut
10	28L028	Strut	21	28L057	Power Gear Box
11	AN23-21	Clevis Bolt	22	AN26-34	Clevis Bolt
	AN320-3	Nut		AN320-6	Nut
	AN380-B2-2	Cotter Pin		AN380-B3-3	Cotter Pin
12	28L029-2	"Vee" Strut—Port	23	28L1046	Bushing
	28L029-3	"Vee" Strut—Starboard	24	AN28-42	Clevis Bolt
13	28L2000L/R	Drag Panel		AN320-8	Nut
14	28L2001L/R	Float Assembly	25	1708 (Alemite)	Fitting
15	Q618-14-40	Bushing—Upper	26	28L109	Spacer
	Q618-14-20	Bushing—Lower	27	28L031	Pin
16	28L110	Hinge Pin	28	28L1054	Bolt—Special
				AN315-4	Nut

tion and are designed to carry the loads imposed on the float. The "Vee" struts also serve as the mechanical linkage for retraction and extension of the float.

(2) REMOVAL.

(See figure 92.)

(a) DRAG PANEL.

1. Remove float as detailed in paragraph b, (2).
2. Remove wing to drag panel bonding braid by detaching the two bonding screws in the drag panel.
3. After removing hinge pin locking bolts (17), hinge pin (16) may be rotated down and pulled out of wing hanger bearing and drag panel bearings.

Note

The drag panel may easily be removed by two men as the weight is only approximately 40 pounds.

(b) "VEE" STRUTS.

1. The lower "Vee" strut (12) may be removed by detaching from float as outlined in paragraphs b, (2). Lower "Vee" strut can be disconnected from "U" strut by removing "U" strut attaching bolt (24). Lower "Vee" strut can then be removed from upper "Vee" strut by removing hinge pins locking bolts (20) and hinge pin (27).

2. The upper "Vee" struts are removed in two sections in the following order:

- a. Remove hinge pin at bottom of upper strut as described in paragraph c, (2), (b), 1 above.
- b. Remove bonding braid at upper end of

strut by removing attaching screw in wing skin.

c. Remove upper hinge pins (19) by detaching hinge pin bolts (20). Hinge pins may now be removed by rotating down and pulling them out of wing bearing hanger and strut bearing.

(3) MAINTENANCE.—Maintenance of the drag panel is similar to that required for the float. Five access doors are provided on the outboard face of the drag panel for inspection and repair. These doors are accessible only when the float is in the extended position. Drain plugs are provided at the bottom inboard edge of the panel, one forward and one aft. These plugs should be removed after every flight to insure drainage of moisture.

The only maintenance required on the "Vee" strut is to prevent corrosion by keeping ends well protected with an application of Paralketone. (Specification AN-C-52, type I.) All bearings are lubricated through Zerk fittings. The location and type of grease used is given in Section III, Par. 2, j.

(4) INSTALLATION.—The installation of the drag panel and "Vee" struts can be accomplished by reversing removal order given in paragraph c, (2), (b).

It is important after installing new parts or installing parts after repair to apply a coating of Paralketone (Specification AN-C-52, type I) to the ends of the drag panels and "Vee" struts after the attaching bolts have been installed.

d. RETRACTING MECHANISM.

(See figure 92.)

(1) GENERAL.—Retraction and extension of the

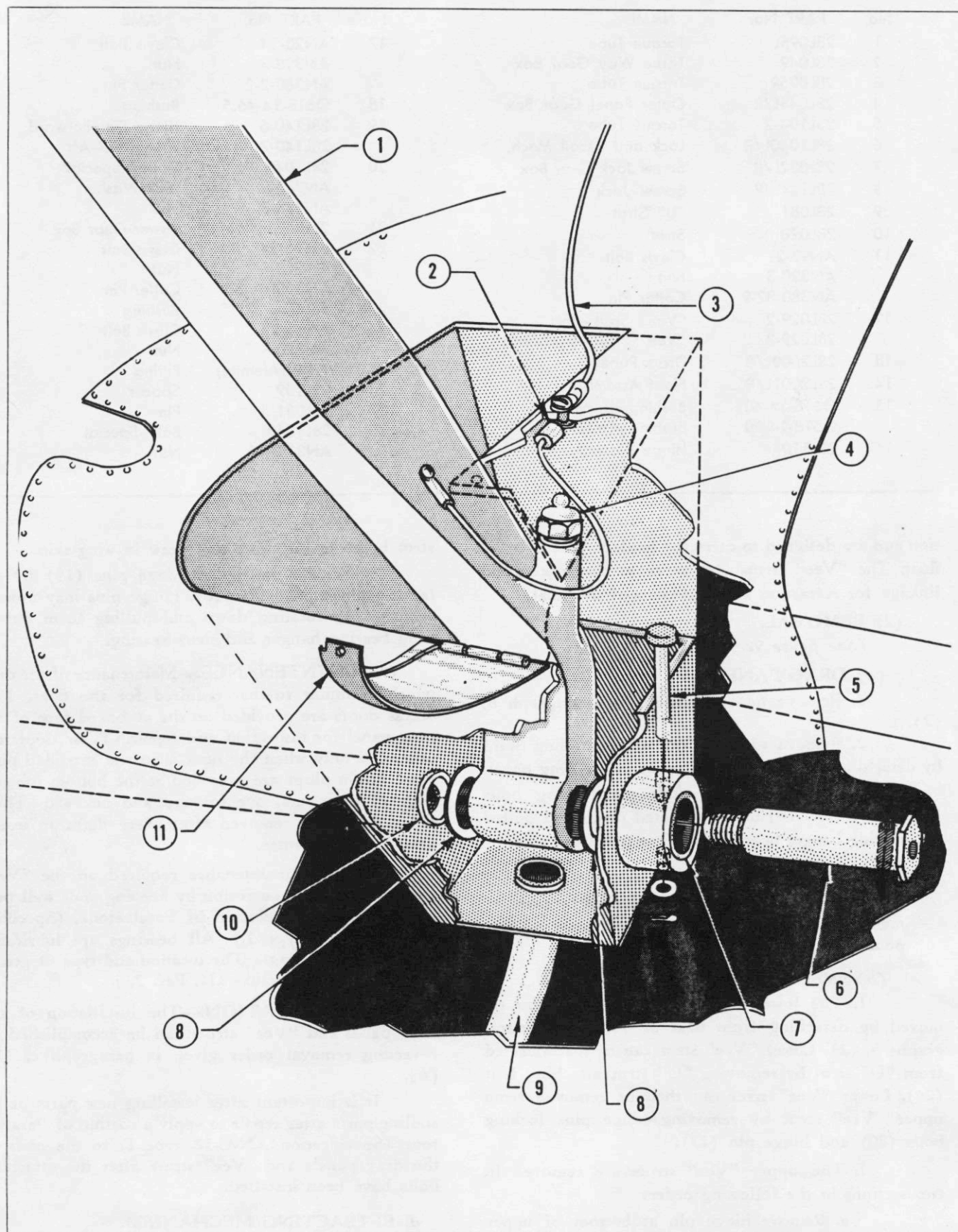


Figure 93—Connection of "Vee" Strut to Floats

No.	PART No.	NAME	No.	PART No.	NAME
1	28L029	"Vee" Strut	6	28L020	Hinge Bolt
2		Bonding Braid	7	28L2011	Bushing
3		Bonding Braid	8	Q7017-C41-.016	Washer
4	AN286-1	"Zerk" Fitting	9	28L2001-45	Drain Tube—Fwd.
5	AN393-37	Flathead Pin		28L2001-46	Drain Tube—Aft.
	AN960-10	Washer	10	28L2017	Bushing
	AN380-2-2	Cotter Pin	11	28L2001-11	Fairing Door—Fwd.
				28L2001-9	Fairing Door—Aft.

floats is powered by an electric motor or hand crank working through the gear box (21) on the forward face of bulkhead 4. This gear box couples the motor or hand crank to the float retracting mechanism through a series of gears which provide the necessary gear reduction to the vertical torque tube. There are two speeds for emergency float operation, a slow speed for heavy loads on the retracting system, and a fast speed when light loads are imposed on the retracting system. The hand crank for emergency float operation is stowed on the aft starboard face of the bulkhead 4 where it is readily available to the flight engineer in the event that manual operation of the floats is required.

A vertical tube extends upward from the gear train to a three-way gear box (2) on the forward side of the front spar. The section of tubing is joined at the junction of the wing and hull to facilitate removal or attachment of the wing. Torque tubes from the three-way gear box extend to port and starboard along the face of the spar to wing station 19, at either side. The torque tubes are joined at the wing outer panel splice to facilitate removal of the outer panel. There, torque tubes ride in bearing assemblies located at each wing station. The gear box which is mounted at wing station 19 transmits the torque tube motion to a fore-and-aft torque tube which extends directly aft to the locking and recoil mechanism. It is this mechanism which actuates the jack screw (8) which drives a trunnion inboard and outboard. Motion of this trunnion, which is coupled to the "U" strut (9), operates the strut linkage system which retracts or lowers the float.

A locking mechanism is provided to hold the floats in a retracted position. It consists of a spring loaded pawl at the outer end of each wing. (See figure 95.) These pawls are actuated by toggle arms on the float recoil mechanism and engage recesses in the float in the up locked position. The pawls engage automatically when the floats are raised, and are disengaged by a cable connected to the recoil mechanism before the floats are lowered.

The inboard end of the pawl cable is attached to a toggle linkage on the recoil mechanism. When the toggle links are folded, the cable is slack and the pawl is held outboard by a coil spring. When the toggle links straighten, the cable tightens, pulling the pawl

inboard against spring pressure. One of the toggle links is fixed to the wing structure, while the other link travels with a sliding collar attached to a traveling nut on the recoil mechanism. This nut moves along the short threaded recoil mechanism screw, and engages with the mating nut on either end.

The forward mating nut can be engaged only when the mechanism is turning to lower the floats. Before the traveling nut reaches the forward mating nut, through which the operating screw is positively driven, the toggle links straighten sufficiently to release the float lock pawls from engagement with the floats.

When the direction of turning is reversed to raise the floats, the first six turns (11 turns of the hand crank in "low speed") of the mechanism are idle as far as the float retracting screw is concerned. The traveling nut on the screw must first travel to the aft mating nut, to establish driving contact. During this travel the toggle links are closing, and this action slackens the cable and permits the locking panels to move outboard. The pawls are then ready for automatic engagement when the float is raised to the retracted position.

The additional six turns of the locking mechanism also fulfill the purpose of absorbing the recoil due to the inertia in the driving system. Recoil after the pawls are engaged cannot disengage the pawls, because the traveling nut must travel approximately three turns forward along the screw and cover the black strip painted on the outside of the recoil mechanism drive cylinder before the cable becomes taut and pulls on the lock pawls.

No mechanical lock is provided for the floats in the down position as the folding "Vee" struts attain locked position just past dead center.

(2) POWER GEAR BOX.

(a) DESCRIPTION. (See figure 92.)—The power gear box is located on the forward face of bulkhead 4. It consists of a vertical shaft which is coupled to the vertical torque tube. On this shaft are mounted two gears, one of these gears meshing with the gear driven by the electric motor, the other gear meshing with the gear driven by the hand crank. The entire mechanism is contained in a cast aluminum box.

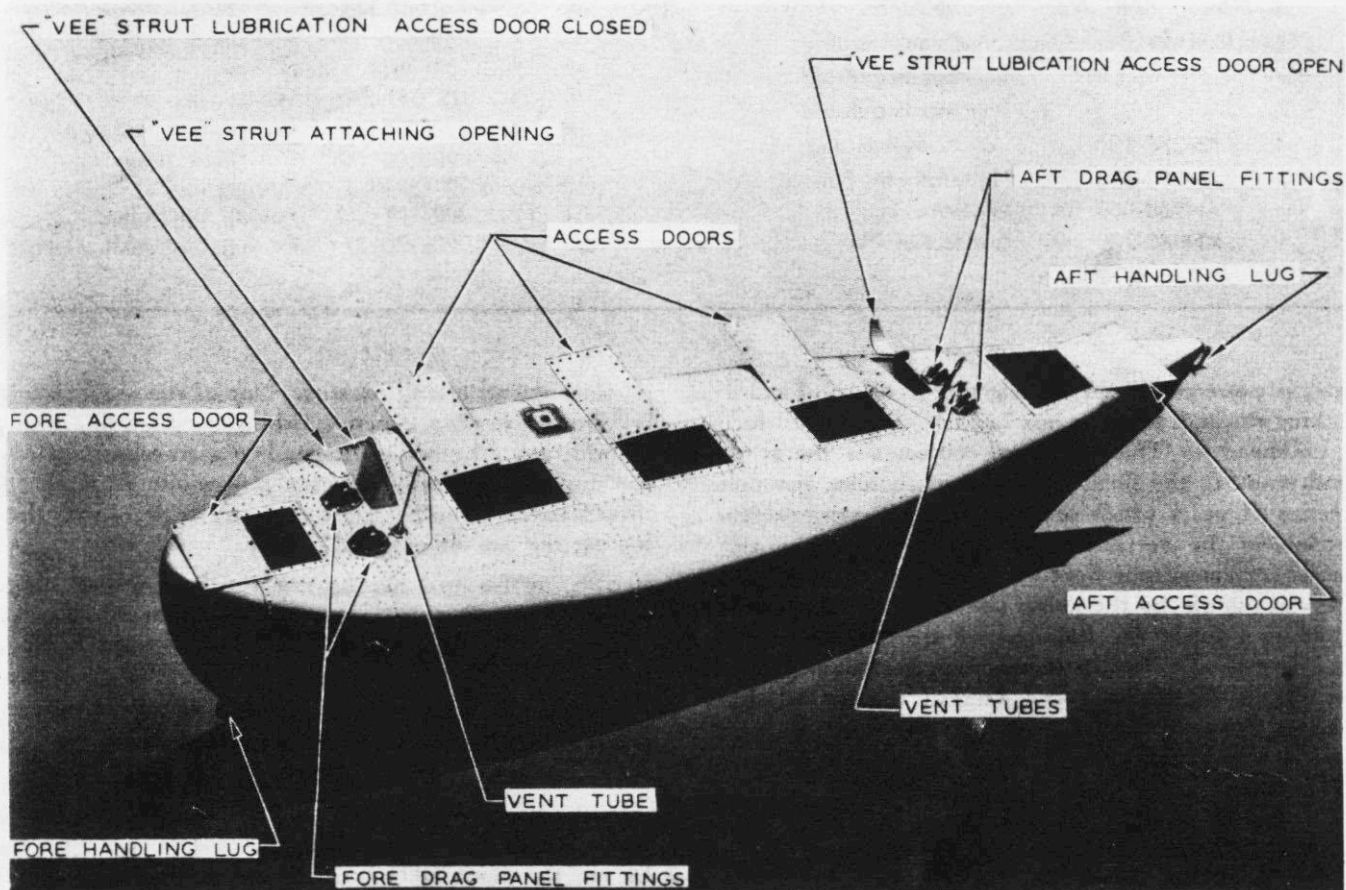


Figure 94—Float Details

(b) REMOVAL. (See figure 96.)—The power gear box may be removed in the following manner:

1. Remove guard (7) from the vertical torque tube in the superstructure and disconnect the torque tube at the splice connection.

2. Detach guard (18) from the gear box and disconnect the torque tube from the gear box by removing the two taper pins (20). Lift torque tube clear of the gear box.

3. Remove electrical connection to float motor by disconnecting it at the Cannon type plug on the motor.

4. Remove float motor by detaching the single bolt at the gear box end of the motor and by detaching the two bolts which fasten the opposite end to the airplane structure.

5. Remove backing channel (21) by detaching the six screws (15) and (22) at its ends and by detaching the four bolts (23) which fasten it to the gear box.

6. Remove the gear box by loosening the four bolts which attach it to the bulkhead structure.

(c) MAINTENANCE.—No maintenance is required on the gear box other than greasing. Disassem-

bly of the gear boxes should not be attempted except at main repair bases, as the tolerances on the gears must be held to a minimum to prevent excessive gear wear. The gear box mechanism may be greased by detaching seven screws to remove the front cover plate and filling the upper and lower sections of the gear box with approximately $\frac{1}{2}$ inch of grease (Specification AN-G-10) on the bottom of each section of the box. Remove the upper gear box cover by removing four screws, and fill this section of the gear box with grease (Specification AN-G-10) up to the bottom of the lower gear shaft.

(d) INSTALLATION.—The power gear box may be re-installed by reversing the order of removal outlined in paragraph c, (2), (b).

(3) THREE-WAY GEAR BOX.

(a) DESCRIPTION.—The three-way gear box is located on the center line of the wing at the front spar. It consists of a vertical shaft which couples to the vertical torque tube in the superstructure, and a horizontal shaft which drives the leading edge torque tubes. The internal mechanism consists of two bevel gears mounted on the shafts mentioned above, all of which is housed in a cast aluminum alloy box.

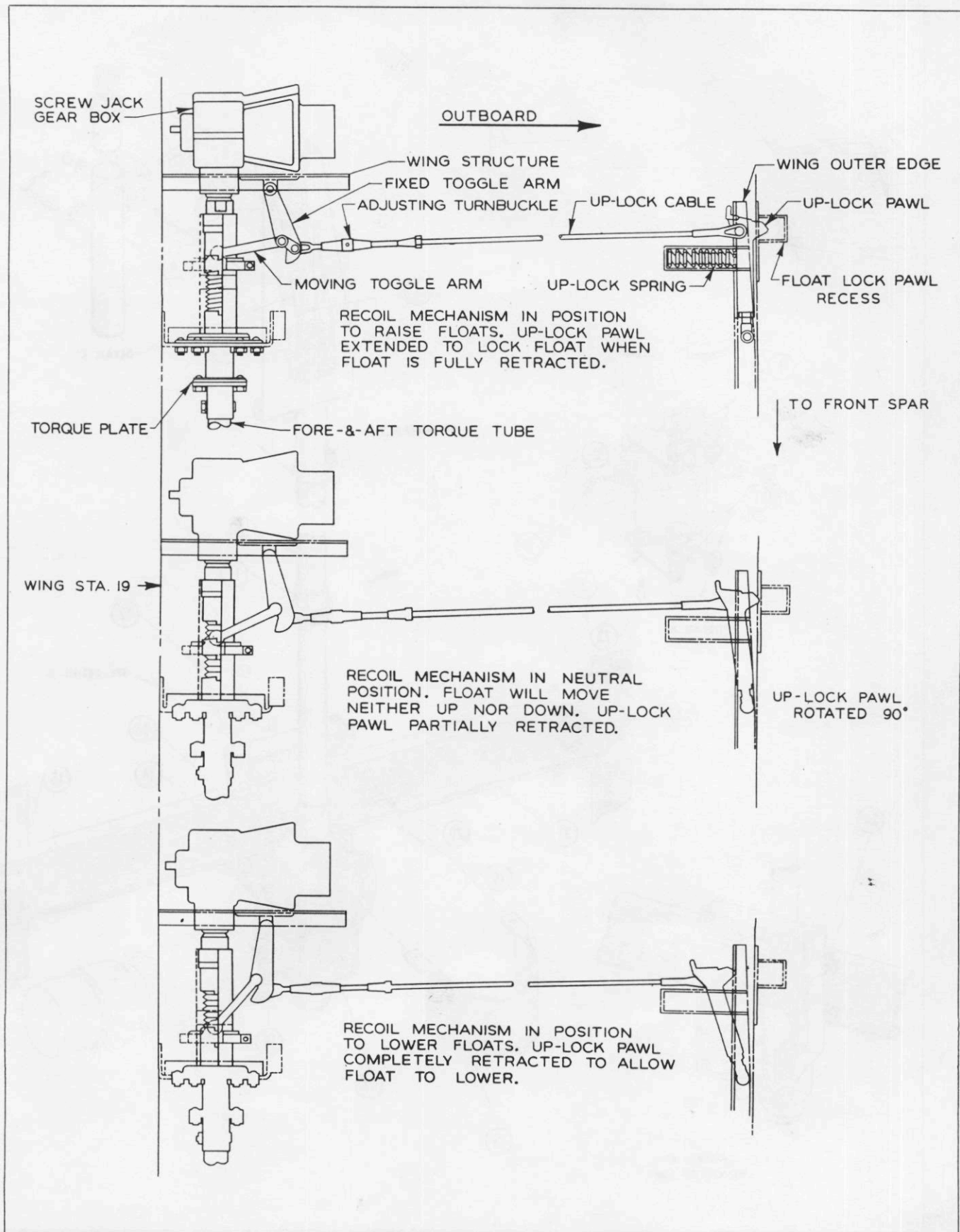


Figure 95—Float Lock and Recoil Mechanism

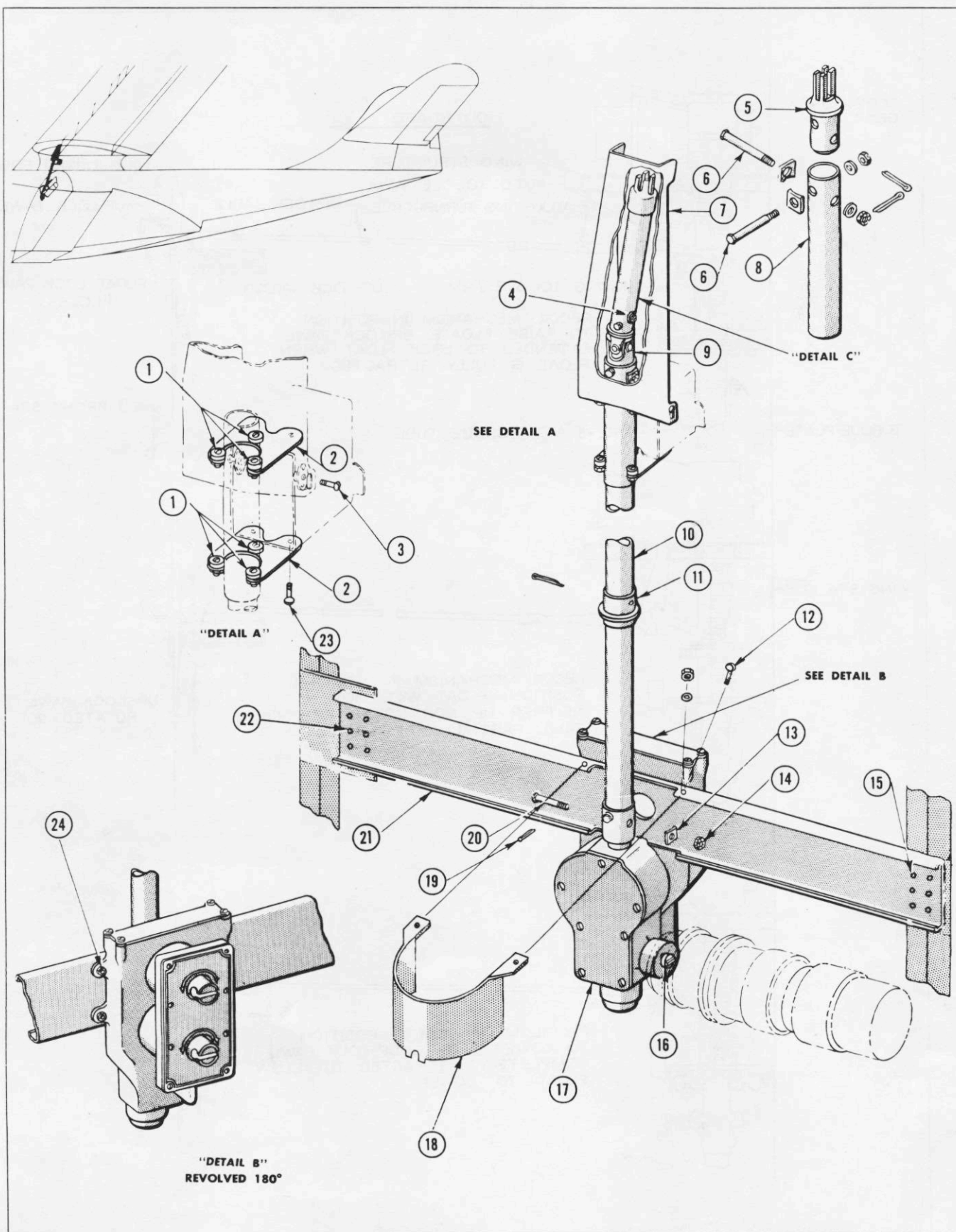


Figure 96—Float Control Installation—Bulkhead 4

No.	PART No.	NAME	No.	PART No.	NAME
1	34DD-4 (Fafnir)	Bearing	12	AN520-5-8	Screw
	AN520-6-9	Screw		AN345-5	Nut
	AN345-6	Nut		22F191-2	Lock Washer
	AN936-B6	Lock Washer	13	28L083	Washer—Special
2	28L5011	Bracket	14	AN320-3	Nut
3	AN520-10-8	Screw	15	AN520-6-8	Screw
4	28L082	Taper Bolt		AN345-6	Nut
	28L083	Washer—Special		AN936-A6	Lock Washer
	AN960-D10	Washer	16	28L088-6	Motor Coupling
	AN320-3	Nut	17	28L057	Power Gear Box
	AN380-B2-2	Cotter Pin	18	28L1042	Guard
5	28L091-6	Fitting	19	AN380-2-2	Cotter Pin
6	28L082	Taper Bolt	20	28L082	Taper Bolt
	28L083	Washer—Special	21	28L089-6	Channel Support
	AN960-D10	Washer	22	AN520-6-8	Screw
	AN320-3	Nut		AN345-6	Nut
	AN380-B2-2	Cotter Pin		AN936-A6	Lock Washer
7	28L1044	Guard	23	AN23-8A	Clevis Bolt
8	28L091-2	Torque Tube		AN365-1032	Nut
9	28L043	Universal Joint	24	AN3-5	Bolt
10	28L104-3	Torque Tube		AN310-3	Nut
11	28L097	Sleeve		AN960-D10	Washer
	AN380-2-5	Cotter Pin		AN380-2-2	Cotter Pin

(b) REMOVAL.

(See figure 97.)

1. Open wing access door (15). (See figure 20.)
2. Remove superstructure access door (3). (See figure 64.)
3. Remove upper torque tube guard (7) by removing four attaching screws through superstructure access door. (See figure 96.)
4. Remove coupling bolt (20) which connects upper vertical torque tube (16) to center vertical torque tube. (See figure 97.)
5. Remove wing access door (6) (See figure 20.) at outer panel splice.
6. Disconnect leading edge torque tube at outer panel splice by removing attaching bolt (3). (See figure 97.)
7. At gear box, remove taper pins (2) through the leading edge torque tubes, two through each torque tube.
8. Slide torque tubes outboard until torque tubes have been completely disengaged from gear box coupling. It may be necessary to put a block clamp on the torque tube and tap to loosen torque tube from gear box coupling.
9. Remove the four bolts (1) attaching the gear box to the wing structure and lift gear box and upper torque tube out of wing.
10. Upper vertical torque tube may be removed from gear box by removing the two taper pins (21) and sliding torque tube out of gear box coupling.

(c) MAINTENANCE.—No maintenance is required other than checking at every 60 hour check to see that there is an ample supply of grease (Specification AN-G-10). This may be accomplished by detaching the four cover plate retaining screws to remove the cover plate. The grease line should be maintained at approximately $\frac{1}{4}$ inch above the bottom of the gear box.

(d) INSTALLATION.—The gear box may be installed by reversing order of removal outlined in paragraph d, (3), (b).

(4) OUTER PANEL GEAR BOX.

(a) DESCRIPTION.—The outer panel gear box is located at wing station 19 on the front spar. It connects the leading edge torque tube to the fore-and-aft torque tube through two bevel gears mounted on shafts at right angles. The complete mechanism is contained in a cast aluminum alloy gear box.

(b) REMOVAL.

(See figure 97.)

1. Remove wing access door (3) (See figure 20.) in leading edge of wing (at gear box).
2. Disconnect leading edge torque tube at outer panel splice as outlined in paragraph d, (9), (b).
3. Remove the two taper pins (8) which connect the leading edge torque tube to the gear box coupling. Using a block clamp around the torque tube, tap inboard until end of leading edge torque tube has become completely disengaged from gear box coupling.

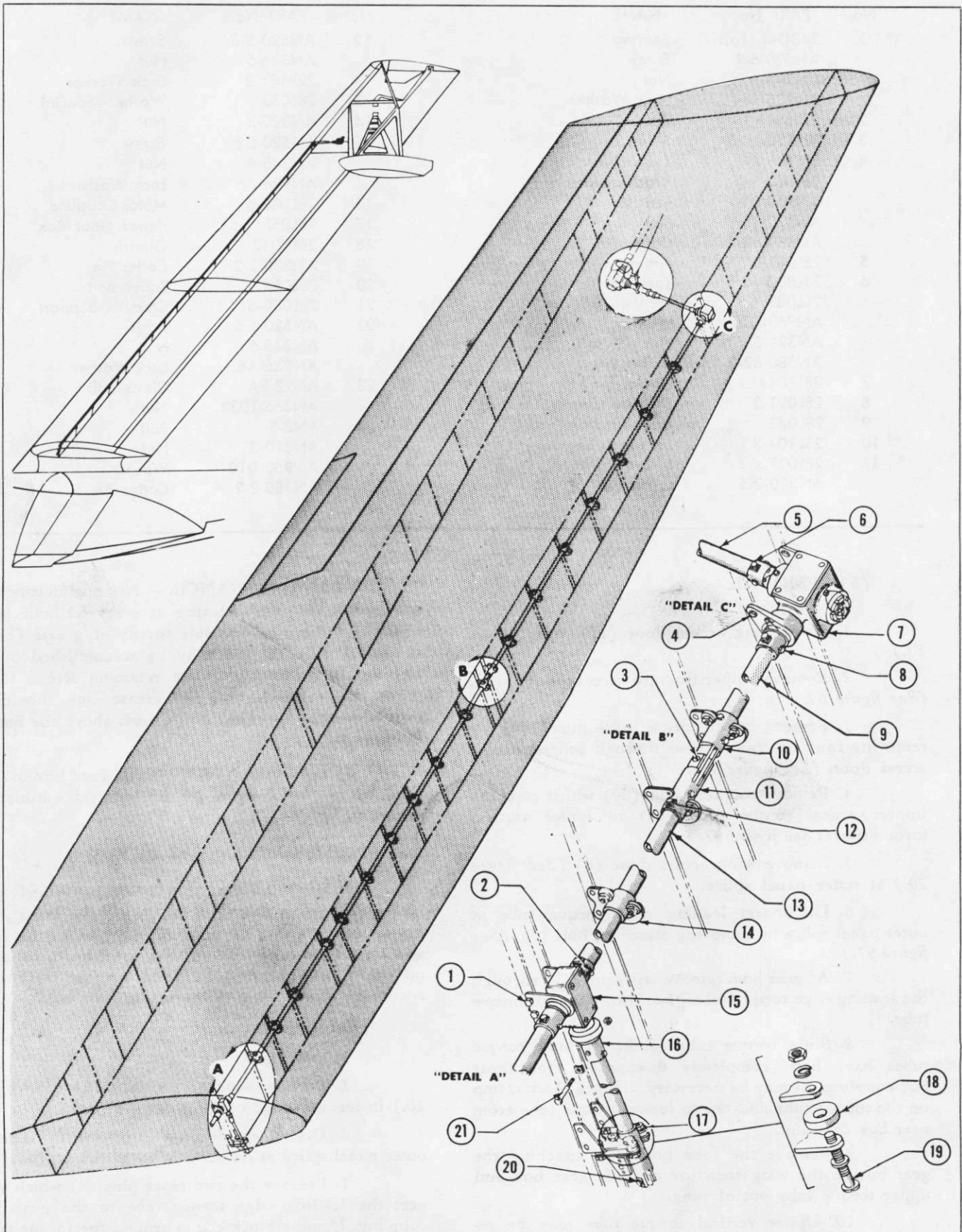


Figure 97—Float Retracting Mechanism

No.	PART No.	NAME	No.	PART No.	NAME
1	AN3-5	Bolt	12	28L082	Taper Bolt
	AN960-D10	Washer		28L083	Washer—Special
	AN320-3	Nut		AN320-3	Nut
	AN380-B2-2	Cotter Pin		AN380-B2-2	Cotter Pin
2	28L082	Taper Bolt	13	28L096	Torque Tube
	28L083	Washer—Special	14	34DD-4 (Fafnir)	Bearing
	AN320-3	Nut		AN515-6-10	Screw
	AN380-B2-2	Cotter Pin		22F191-2	Lock Washer
3	AN23-21	Clevis Bolt		AN340-6	Nut
	AN320-3	Nut		AN960-D6	Washer
	AN380-B2-2	Cotter Pin	15	28L049	Three-Way Gear Box
4	AN23-9	Clevis Bolt	16	28L094	Torque Tube
	AN960-D10	Washer	17	28L5011	Bracket
	AN320-3	Nut		AN23-17A	Clevis Bolt
	AN380-B2-2	Cotter Pin		Q810-D6-6	Spacer
5	28L104-2	Torque Tube		Q7102-AL10	Washer
6	28L082	Taper Bolt		AN365-1032	Nut
	28L083	Washer—Special	18	34DD-4 (Fafnir)	Bearing
	AN320-3	Nut	19	AN515-6-12	Screw
	AN380-B2-2	Cotter Pin		AN960-A6	Washer
7	28L044L/R	Outer Panel Gear Box		AN365-632	Nut
8	28L082	Taper Bolt	20	AN23-21	Clevis Bolt
	28L083	Washer—Special		AN320-3	Nut
	AN320-3	Nut	20	AN380-B2-2	Cotter Pin
	AN380-B2-2	Cotter Pin	21	28L082	Taper Bolt
9	28L096	Torque Tube		28L083	Washer—Special
10	28L090	Coupling		AN320-3	Nut
11	28L098	Coupling		AN380-B2-2	Cotter Pin

4. Remove two taper pins (6) which connect fore-and-aft torque tube to gear box coupling.

5. Remove the four bolts (4) which attach gear box to wing structure. Gear box may now be removed by pulling forward until gear box coupling has been completely disengaged from fore-and-aft torque tube.

(c) MAINTENANCE.—No maintenance is required on the gear box other than greasing. At every 60 hour check, the gear box cover plate should be removed and grease (Specification AN-G-10) added if necessary. There should be approximately 1/4 inch of grease above the bottom of the gear box.

Disassembly should only be attempted at a main repair base due to the close tolerances required between the component parts of the mechanism.

(5) RECOIL MECHANISM.

(a) DESCRIPTION.—The recoil mechanism is located at wing station 19 on both sides of the wing. It consists of a screw which drives a traveling nut fore-and-aft to operate the float up latch pawl. It also prevents the float from moving after the electric motor has stopped, due to recoil in the retracting system. The forward end of the recoil mechanism is coupled to the

fore-and-aft torque tube, and the aft end is connected directly to the screw jack gear box.

(b) REMOVAL.

(See figure 98.)

1. Remove wing access door (21). (See figure 20.)

2. Remove bolt (13) that connects recoil mechanism (5) to screw jack gear box.

3. Remove the two screws (4) that attach float lock link to recoil mechanism.

4. Remove two bolts (1) which attach recoil mechanism to fore-and-aft torque tube coupling.

5. Remove four bolts (3) which attach recoil mechanism to wing structure. The recoil mechanism may now be removed by moving down, rotating, and lifting it out of wing.

(c) MAINTENANCE.—No maintenance is required on the recoil mechanism other than lubricating the screw with oil (Specification AN-O-6) through the slot in the outer barrel at every 60 hour check. Disassembly and replacement of parts should not be attempted except at a main repair base.

(d) INSTALLATION.—The recoil mechanism may be installed by reversing order of removal. (See paragraph d, (5), (b).)

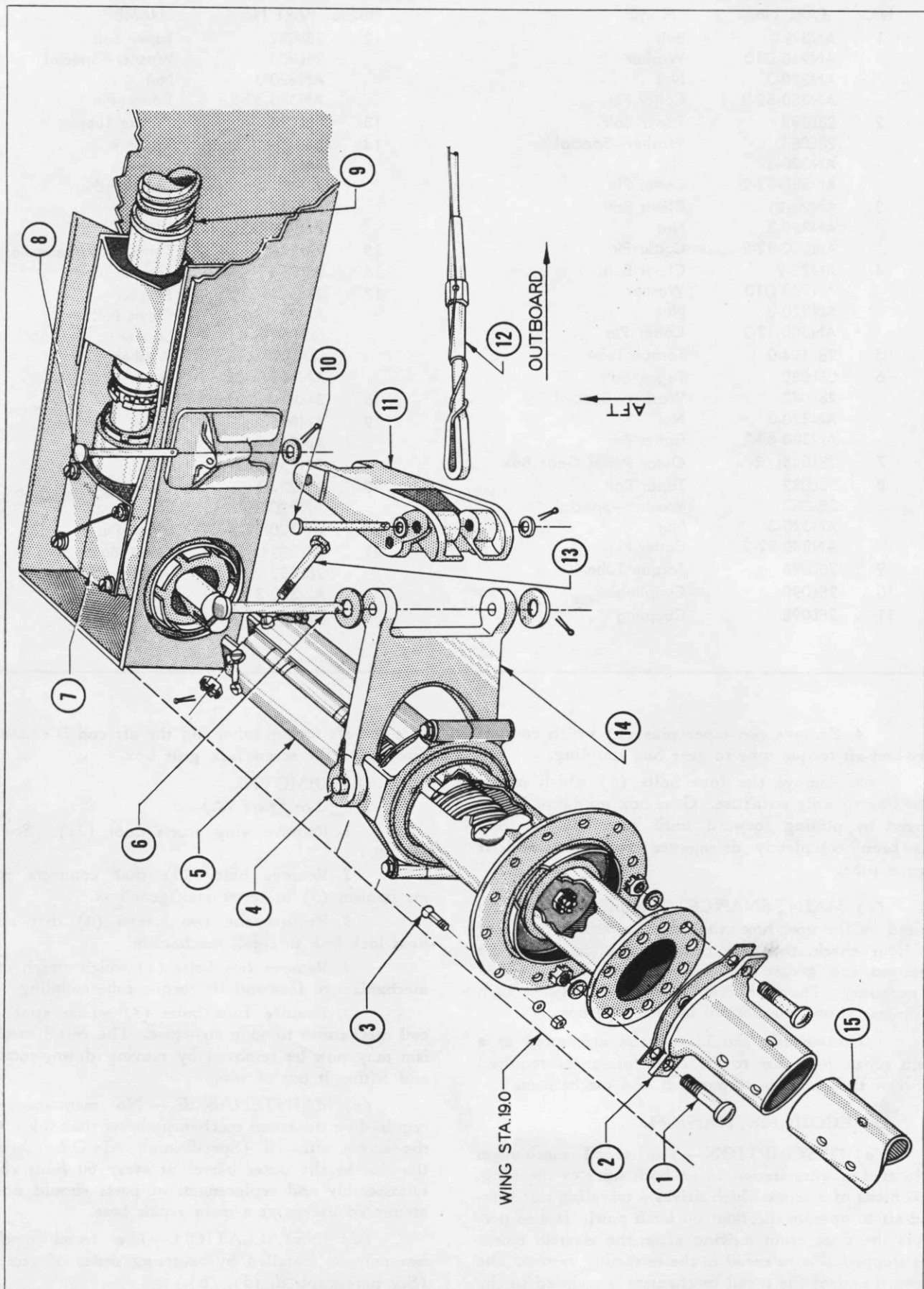


Figure 98—Locking and Recoil Mechanism

No.	PART No.	NAME	No.	PART No.	NAME
1	AN24-11	Clevis Bolt	8	AN393-64	Flathead Pin
	AN960-416	Washer		AN960-10	Washer
	AN320-4	Nut		AN380-2-2	Cotter Pin
	AN380-2-2	Cotter Pin	9	28L144L/R	Screw Jack Assembly
2	28L1032	Torque Tube Connector	10	AN393-64	Flathead Pin
3	AN23-8	Clevis Bolt		AN960-10	Washer
	AN960-10	Washer		AN380-2-2	Cotter Pin
	AN320-3	Nut	11	28L1015	Fixed Toggle Arm
4	28L1031-2	Screw—Special	12	28L1039	Cable Assembly
5	28L1010-L/R	Recoil Mechanism Assembly	13	AN23-21	Clevis Bolt
6	AN393-78	Flathead Pin		AN320-3	Nut
	AN960-10	Washer		AN380-2-2	Cotter Pin
	AN380-2-2	Cotter Pin	14	28L1014	Moving Toggle Arm
7	28L032L/R	Screw Jack Gear Box	15	28L104-2	Torque Tube

(6) SCREW JACK GEAR BOX.

(a) DESCRIPTION.—The screw jack gear box, which is located at wing station 19, couples the recoil mechanism to the screw jack. It consists of two bevel gears contained in a cast aluminum alloy box.

(b) REMOVAL.

(See figure 98.)

1. Remove wing access door (21). (See figure 20.)
2. Remove screw jack as detailed in paragraph d, (7), (b).
3. Remove the six bolts which attach gear box to wing structure at outboard end of gear box.
4. Remove bolt (13) which connects screw jack gear box shaft to recoil mechanism coupling. The gear box may now be removed from the wing.

(c) MAINTENANCE.—No maintenance is required other than lubricating. Check level of grease (Specification AN-G-10) in gear box by removing cover plate which is fastened to gear box with four screws. At every 60 hour check, the gear box should be inspected and refilled if necessary so as to maintain a grease level of approximately $\frac{1}{4}$ inch above the bottom of the box.

Disassembly or replacement of parts should not be attempted except at a main repair base.

(d) INSTALLATION.—The screw jack gear box may be installed by reversing order of removal outlined in paragraph d, (6), (b).

(7) SCREW JACK AND "U" STRUT.

(a) DESCRIPTION.—The screw jack is a screw which is mounted in a trough in the wing structure and is supported at the outboard end of the wing. The inboard end is coupled to and driven by the screw jack gear box at wing station 19. A threaded trunnion is mounted on the screw jack and is connected to the upper end of the "U" strut, which is an aluminum al-

loy extrusion. The outboard end of the "U" strut is connected to the upper end of the lower "Vee" strut.

(b) REMOVAL AND DISASSEMBLY.

(See figure 99.)

1. Run float to down position until trunnion nut (5) and "U" strut (19) are approximately 14 inches from the outboard end of the screw jack.
2. Remove wing access door (21). (See figure 20.)
3. Remove bonding braid from "U" strut by detaching screw.
4. Remove hold-washer lip (10) from locknut (9) on inboard end of jack screw (12) and completely loosen locknut.
5. Disconnect lower end of "U" strut from "Vee" strut assembly by removing attaching bolt.
6. Remove four bolts (6) from outboard screw jack bearing and pull "U" strut outboard until inboard end of jack screw has disengaged from screw jack gear box, and jack screw "U" strut assembly may be removed from the wing.
7. Locknut (9), felt oil ring retainer (15), and felt oil ring will be free of screw jack and should be removed from screw jack gear box.
8. The "U" strut may now be removed from the screw jack after removal of the screw jack "U" strut assembly from the wing in the following order:
 - a. Remove two cotter pins (4) from the trunnion (5) and unscrew the two ball bearing retaining screws (2). Ball bearings may now be slipped off the trunnion.
 - b. Remove ten bolts (18) from upper "U" strut fitting (five on each side) and slide fitting off trunnion.
 - c. To remove trunnion from screw jack, remove hold washer lip (10) from locknut (9) on out-

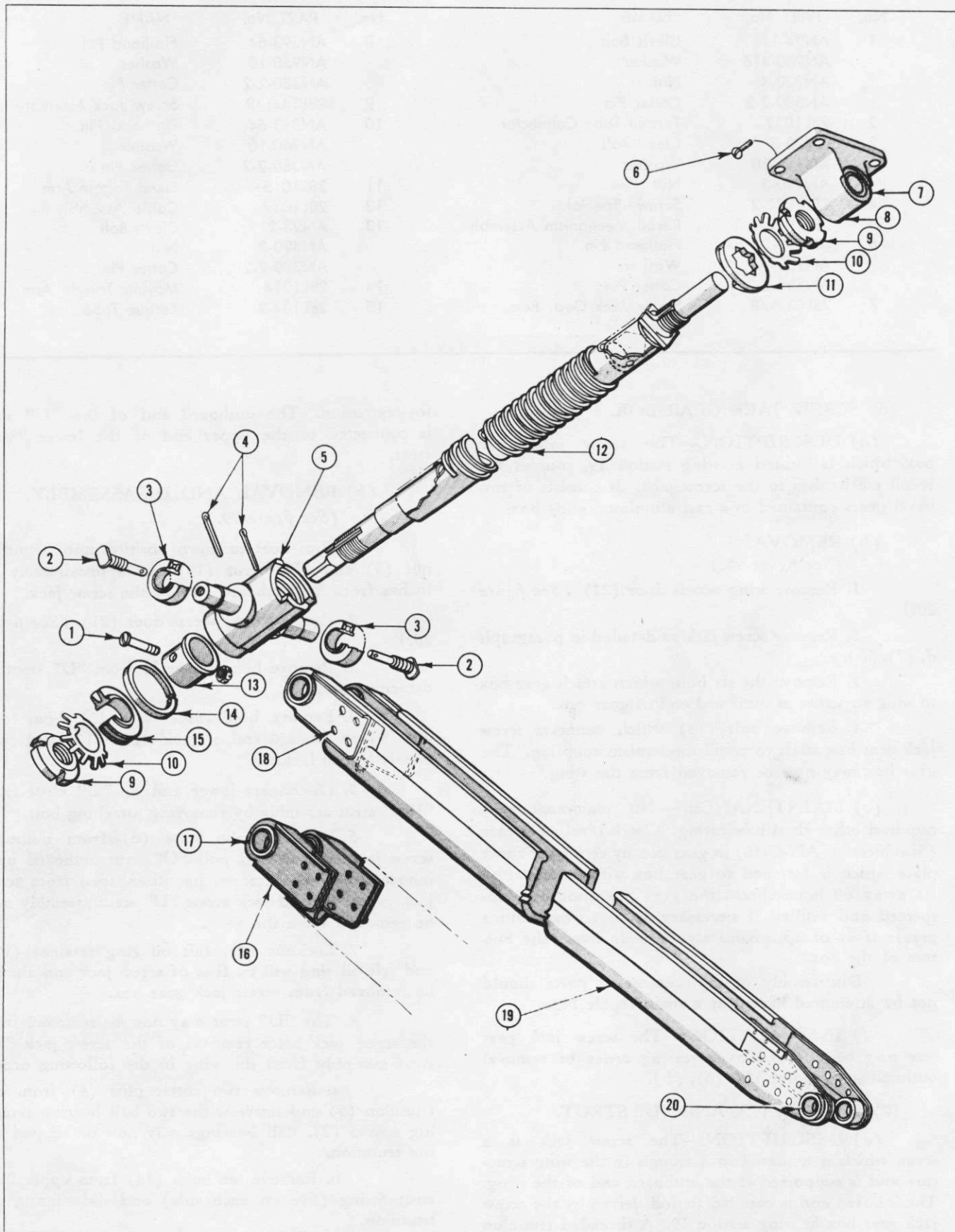


Figure 99—Screw Jack Assembly

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No.	PART No.	NAME	No.	PART No.	NAME
1	AN23-22	Clevis Bolt	11	28L118L/R	Trunnion Stop
	AN320-3	Nut	12	28L144L/R	Screw Jack Assembly
	AN380-B2-2	Cotter Pin	13	28L077	Collar
2	28L075	Trunnion Screw	14	28L056-2	Felt-Grease Retainer
3	28L078-5	Bearing	15	28L055	Grease Retainer
4	AN380-B2-2	Cotter Pin	16	28L080L/R	Fitting
5	28L119L/R	Trunnion	17	Q624-20-15	Bushing
6	28L1045	Screw	18	AN24-8A	Clevis Bolt
7	Q600B-16-28	Bushing		AN364-428	Nut
8	28L054	Bearing Assembly	19	28L081	"U" Strut Assembly
9	28L078-3	Locknut	20	Q620-16-22.5	Bushing
10	28L078-4	Lock Washer			

board end of jack screw and slide nut washer and clutch stop (11) off jack screw. The trunnion may now be turned and screwed off outboard end of jack screw.

(c) MAINTENANCE.—The screw jack should be checked and lubricated every 60 hours. Four lubricators are provided on the upper surface of the wing for lubrication of the screw jack with machine oil (Specification AN-O-6).

(d) INSTALLATION.—The screw jack gear box may be installed by reversing order of removal outlined in paragraph d, (7), (b).

(8) UP-LOCK.

(a) DESCRIPTION.—The float up lock pawl is located at the extreme outboard end of the wing on either side. It is actuated by a flexible cable which is operated through two toggle arms located at wing station 19 and connected to the wing structure and the recoil mechanism.

(b) REMOVAL.

(See figure 95.)

1. Remove wing access door (21). (See figure 20.)
2. Run floats to down position.
3. Disconnect turnbuckle and inboard end of flexible cable by removing pin (10). (See figure 98.)
4. Disconnect lower end of locking pawl by removing one bolt. Remove pawl by pulling lower end down and outboard. The cable attached to the upper end of the pawl may now be pulled out of the wing with the pawl. The spring will also be loose and may be removed from the barrel of the mechanism. Care should be taken in this operation as spring is compressed.
5. The toggle arms may be removed from the wing by removing the pin connecting the arms to the wing structure and the two bolts attaching link to the recoil mechanism.

(c) MAINTENANCE.—No maintenance is required other than an application of oil (Specification AN-O-6) on the hinge bolts of the toggle arms and the hinge bolt of the locking pawl.

(d) INSTALLATION.—The up-lock mechanism may be installed by reversing order of removal outlined in paragraph d, (8), (b). When re-installing any part of the mechanism the following adjustments are required.

1. Turn float mechanism until traveling trunnion on recoil mechanism covers the black line on the recoil mechanism barrel.

2. Tighten cable turnbuckle until cable is taut, but not tight enough to pull locking pawl inboard away from stop provided on upper end.

(9) TORQUE TUBES.

(a) DESCRIPTION.—The torque tubes are aluminum alloy tubes which are connected to the gear box couplings to transmit the power of the motor or the hand crank in torque to the screw jack. There are three main torque tube systems: the vertical torque tube which connects the power gear box to the three-way gear box; the leading edge torque tube which connects the three-way gear box to the outer panel gear box; and the fore-and-aft torque tube which connects the outer panel gear box to the recoil mechanism.

(b) REMOVAL.

(See figure 97.)

1. The upper vertical torque tube is removed with the three-way gear box as detailed in paragraph d, (3), (b).

2. The center vertical torque tube and lower vertical torque tube may be removed in the following order:

a. Remove three-way gear box and upper vertical torque tube. (See paragraph d, (3), (b).)

b. Remove guard (18) on power gear box by removing three attaching screws (12). (See figure 96.)

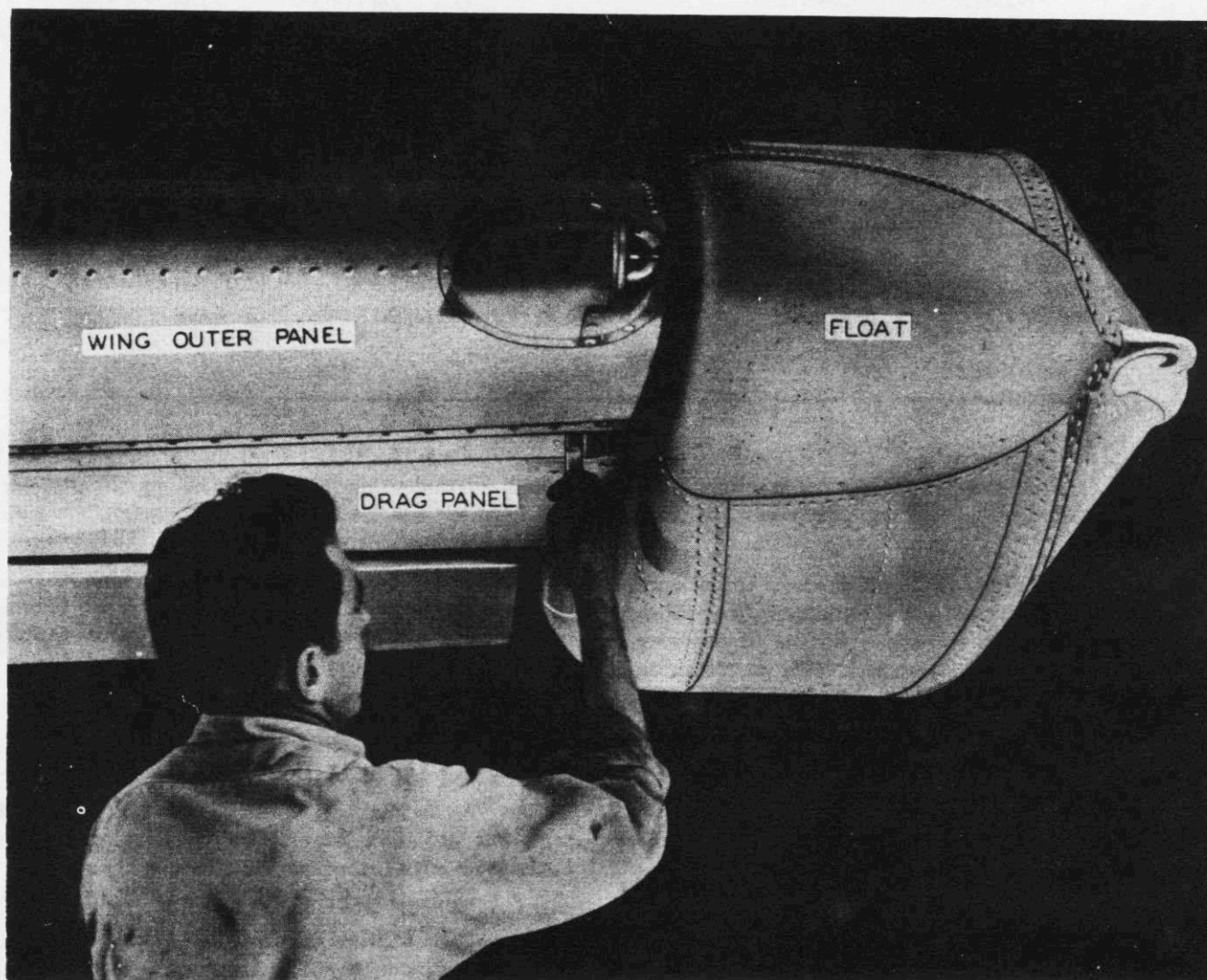


Figure 100—Drag Panel Clearance for Synchronizing Floats

c. Remove the two taper bolts (20) which connect the vertical torque tube to the power gear box coupling.

d. Remove the two roller brackets (1) at the upper end of the lower vertical torque tube, by removing the four attaching bolts (23), two in each bracket.

e. Pull the torque tube through the wing access door directly above the torque tube.

3. The inboard leading edge torque tube may be removed in the following order:

a. Disconnect leading edge torque tube at the outer panel splice through wing access door (6) (See figure 20.) by removing one bolt in the torque tube splice.

b. Disconnect leading edge torque tube from three-way gear box through the wing access door (15) (See figure 20.) by removing the two taper pins (2) which connect the torque tube to the three-way gear box coupling. Pull outboard on torque tube until torque tube is completely disengaged from gear box coupling. It may be necessary to put a block clamp around the torque tube and tap away from gear box to loosen. (See figure 97.)

c. Pull outboard on torque tube by hand, allowing the tube to settle to the bottom of the outer panel leading edge until the tube is completely free of bearings.

d. The torque tube may then be pulled through an upper or lower leading edge access door.

4. The outboard section of the leading edge torque tube may be removed in a manner similar to that detailed above and in the following order:

a. Disconnect torque tube splice at outer panel.

b. Disconnect outboard end of torque tube from outer panel gear box by removing the two taper pins (8) which connect torque tube to outer panel gear box.

c. Pull inboard on torque tube allowing torque tube to settle to bottom of center section leading edge.

d. Remove torque tube through upper or lower wing leading edge access door.

5. The fore-and-aft torque tube may be removed in the following order:

a. Remove wing access door (21) (See figure 20.) over recoil mechanism.

b. Disconnect fore-and-aft torque tube coupling from recoil mechanism by removing the two attaching bolts (1). (See figure 98.)

c. Remove wing access door (3) (See figure 20.) over outer panel gear box.

d. Disconnect outer panel gear box by removing the four attaching bolts (4). (See figure 97.)

e. Disconnect the two taper pins (6) which connect the fore-and-aft torque tube to the outer panel gear box coupling.

f. Pull up on aft end of fore-and-aft torque tube until it clears the torque plate mounted on the recoil mechanism.

g. Pull aft and up to remove torque tube from the wing. It may be necessary to put a block clamp on the torque tube and tap away from leading edge gear box to free torque tube from gear box coupling.

(c) MAINTENANCE.—No maintenance is required other than a periodic inspection to check for corrosion. If evidence of corrosion is found, treat as detailed in Par. 3, b, (2).

(d) INSTALLATION.—All torque tubes may be installed by reversing order of removal outlined in paragraph d, (9), (b) above. If a torque tube has been removed, check synchronization of floats as detailed in paragraph e.

e. ADJUSTMENTS AND TESTS.

(1) FLOAT DRIVE SYNCHRONIZATION.—When reinstalling or replacing any portion of the float retracting mechanism, the following procedure is used to synchronize the drive:

(a) Run floats toward "UP" position until the drag panels are within one or two inches of fairing with the lower wing surface.

(b) At the outboard end of the drag panel, measure the distance from the drag panel surface to the wing lower surface. (See figure 100.) The port panel is allowed to lag up to $\frac{1}{4}$ inch lower than the starboard panel, but under no circumstances shall the starboard panel lag below the port panel.

(c) If the panels need adjusting, disengage the fore-and-aft torque tube of the upper float at the torque plate. (See figure 98.) Back the locking and recoil mechanism toward the float down position. Each adjustment hole on the torque plate represents $\frac{1}{8}$ to $\frac{1}{4}$ in. of float rise.

(d) Partially lower floats, then raise to checking position again.

(e) If floats are still not in synchronized position, repeat steps (c) and (d) until synchronization is obtained.

(2) UP-LOCK PAWL.—With the float in the retracted position, the lock pawl has a top clearance of $\frac{1}{16}$ inch in the float lock recess. This clearance is adjusted by a screw and lock nut which form the base of the pawl.

(3) "VEE" STRUT BUMPERS.—The "Vee" brace bumper is so adjusted, that when the float is in the retracted position, the drag panel fairs with the wing lower surface. The bumpers are adjusted by the insertion or removal of shims beneath the rubber pad.

(4) CHECKING FOR FRICTION AND BINDING.—A simple check for excessive friction follows: (This is not used under heavy wind conditions as the crank loads will be affected.)

(a) Place the floats in full down position.

(b) Insert the crank in the low speed socket and start turning to the "UP" position. For 10 or 11 turns the operating screws will not move, due to idle turns in the recoil mechanism. Thus, during these turns, only three gear boxes and all the torque tubes are operating. Therefore, the load on the eight inch low speed crank should not be more than three to five pounds.

(c) After cranking beyond 10 turns in the "UP" direction, the screw jacks will be turning, but because of the dead point of the struts, no great additional load should be felt on the crank for approximately 20 turns. From the tenth to the twentieth turn, the load on the crank should not exceed five to ten pounds.

(d) Change the crank to the "HIGH" speed

drive and crank "UP" until the load becomes heavy. Then switch back to "LOW" speed to finish the float retraction. When the floats are near the "UP" position, the crank load should not exceed 25 to 30 pounds. If excess crank load occurs, check for the following causes:

1. INTERFERENCE.—In this case, the crank load will increase suddenly. Stop where increase in load is felt and check for interference, especially near tip of the wing.

2. DISTORTION.—The influence of distortion is negligible near the full "DOWN" dead point of the struts, but becomes increasingly noticeable as float and struts are brought toward the "UP", or retracted position. Distortion may be caused by bent

or damaged parts, or by fittings misaligned by excessive loads. To check for such a condition, disconnect the float link at the "Vee" strut and recheck the system for one side alone. By this means, it may be established which side is giving trouble. Once this is determined, disconnect float and move it up and down by hand to determine the exact point at which the trouble arises, and what correction is necessary.

3. INTERMITTENT BINDING.—If an intermittent binding occurs, especially when the motion of the float is downward, the cause may be one of several. The ends of the screw-jack may have become loose; the screw may need lubrication; too heavy a lubricant may have been used (check the lubrication chart); or the screw-jack may have some sand or dirt in the threads.



PARAGRAPH 7.



7. NACELLE AND COWLING.

a. GENERAL. (See figure 101.)—The cowling consists of the outer skin panels which form a fairing for the engine, for the accessory compartment, and for the oil tank. The cowling is divided into two sections; the engine cowling, which lies forward of the engine mounting ring, and the nacelle cowling which lies over the accessories from the cowl well to the rear of the oil tank. In addition to the cowl panels, the exit fairing, the cowl well, and the oil cooler radiator air scoop will be included in the discussion.

b. ENGINE COWLING. (See figure 103.)—The engine cowling comprises the nose cowl ring, the intermediate cowl panels, the cowl flaps, and the rear former assembly.

(1) NOSE COWL RING.

(a) DESCRIPTION. (See figure 102.)—The nose cowl ring is made of 24ST alclad sheet and is assembled as one complete section. The alclad sheet is tack riveted and spotwelded to former angles which extend from the bulb angle on the rear of the nose cowl to the bead on the front.

The nose cowl is held in place by 14 shock mounts which are attached by means of brackets to the rocker boxes on the forward row of cylinders of the engine. The shock mounts are riveted to the fore and aft former angles on the nose cowl.

The nose cowl is bonded to the engine in two places through bonding braid which forms a positive ground.

The forward section of the carburetor intake is riveted to the top of the nose cowl.

(b) REMOVAL.

1. Remove propeller. (Refer to Par. 13.)
2. Remove intermediate cowl panels. (Refer to paragraph b, (2), (b).)
3. Disconnect the forward ends of the two channels from the nose cowl by removing the four screws in each channel.
4. Remove the pulleys (7) from the propeller governor control pulley bracket on the upper inboard side of each nose cowl.
5. Remove the nuts and washers from the forward ends of the seven tie rods (10) that extend from the nose cowl to the rear former.
6. Detach bonding braid (8).
7. Loosen, but do not remove, the two bolts (12) which fasten the mounting brackets to the rocker boxes. Then remove the 14 bolts (11) which attach the nose cowl ring to the brackets. The nose cowl may then be removed.

(c) MAINTENANCE.

1. Keep all nuts, screws, and fasteners tight.
2. Check the rubber bushings in the shock mounts; if they appear worn or damaged, replace them.
3. Watch for cracks or loosened welds. (For structural repairs, refer to Structural Repair Manual, AN 01-5MA-3.)
4. Clean the nose cowl with a brush dipped in Castile soap solution. Remove grease spots with a clean cloth dipped in white gasoline. Be sure to remove all cleaning solution from surfaces.

(d) INSTALLATION.

(See figure 102.)

1. Hold the nose cowl in place and insert the uppermost two bolts which attach the shock mounts to the rocker box brackets, and then insert the remaining bolts.
2. Connect the bonding braid (8).
3. Fasten the two upper channels and tie rods (10) to the nose cowl and install the pulleys (7) in the upper pulley bracket after the propeller pitch control cable is in place.
4. Install intermediate cowl panels. (Refer to paragraph b, (2), (d).)
5. Install propeller. (Refer to Par. 13.)

(2) INTERMEDIATE COWL PANELS.

(a) DESCRIPTION.—The cowling over the cylinders consists of the upper panel and the wrap cowl. The wrap cowl is supported by the nose cowl and the rear engine former and is composed of two sections, a

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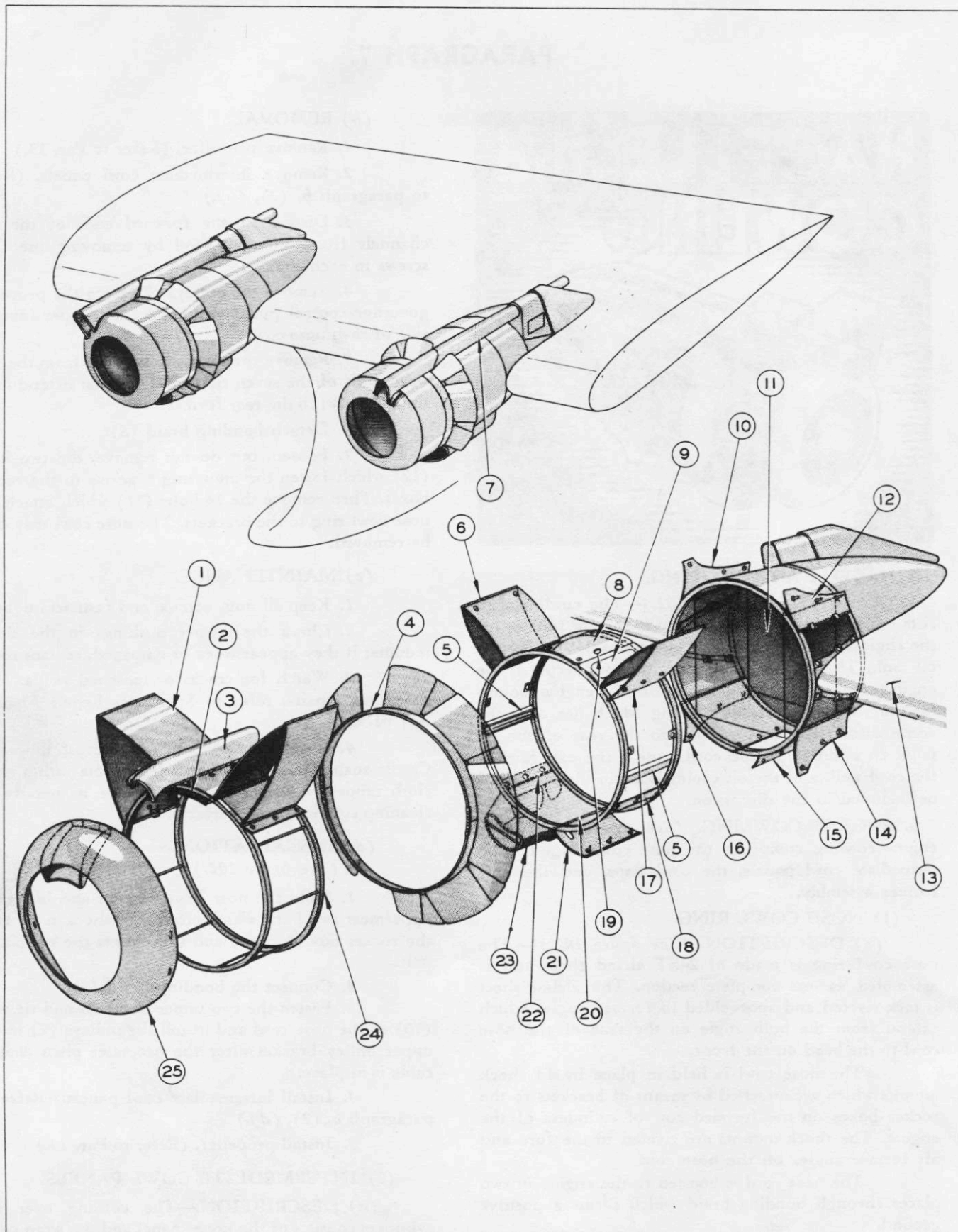


Figure 101—Engine and Nacelle Cowling

NO.	PART NO.	NAME	NO.	PART NO.	NAME
1		Wrap Cowl	13		Wing Leading Edge
2		Middle Sect. Carb. Air Duct	14	28D2006-4	Access Door
3		Heat Exchanger Duct		28D1049-17	Hinge Pin
4		Cowl Flap Assembly	15		Access Door
5	28D3000-8	Channel	16	28D2006-5	Access Door
6	28D5017	Hinged Panel		28D1049-17	Hinge Pin
	28D1049-15	Hinge Pin	17	28D5016-0	Hinged Panels
7		Heat Exch. Duct (Mid. Sect.)		28D1049-15	Hinge Pin
8	*28D5015-2	Panel	18	28D3011	Channel
	**28D5015-0		19		Starter Crank Socket
9		Cowl Well Trough	20	28D5014-2	Support
10	*28D2006-41	Door—Outboard R.H. Nacelle	21	28D5018	Access Door
	**28D2006-3	Door—Outboard R.H. Nacelle		32D044-2	Hinge Pin
	28D2006-3	Door—Inb'd. L. H. Nacelle	22	28D5020	Support
	28D1049-17	Hinge Pin	23		Oil Cooler Air Scoop
11		Oil Tank	24		Rear Engine Former
12	28D2006-31	Access Door	25		Nose Cowl
	28D1049-17	Hinge Pin			

*PB5-5A only
**PB5-5 only

right hand wrap and a left hand wrap. The right hand wrap consists of two hinged panels; the left hand wrap consists of three hinged panels. The upper panel of each section is hinged from a horizontal support channel. The left-hand wrap overlaps the right-hand wrap and is fastened to it by Dzus fasteners and draw bolts at the bottom of the nacelle.

The heat exchanger air duct is bolted to the outboard wrap on each engine and is secured to the nose cowl by Dzus fasteners. The intermediate section of the carburetor air intake duct serves as a cowl panel between the wrap cowls at the top of the nacelle.

(b) REMOVAL.

(See figure 103.)

1. Detach the heat exchanger air intake duct from the nose cowl by means of the six Dzus fasteners.
2. Open small panel (42) at the bottom of the nacelle in order to gain access to draw bolts (43).
3. Detach panels (4) and (7) of wrap cowl by loosening draw bolts (43).
4. Detach bonding braid at upper hinge.
5. Remove the two sections (4) and (7) of the wrap cowl by withdrawing hinge pins (5) from the upper hinges of the two sections.
6. Remove the intermediate section (6) of the carburetor air duct by removing the ten screws that hold it in place.
7. The heat exchanger duct may be removed from the outboard wrap by removing the nine bolts that fasten it to the wrap.

(c) MAINTENANCE.

1. Tighten all loose screws.
2. If the neoprene seals on the stiffeners are torn, burned, or brittle, replace the seals.

3. Clean the cowl panels with a brush dipped in soap solution. Remove grease spots with a clean cloth dipped in white gasoline. Use scouring powder only if the gasoline and soap fail.

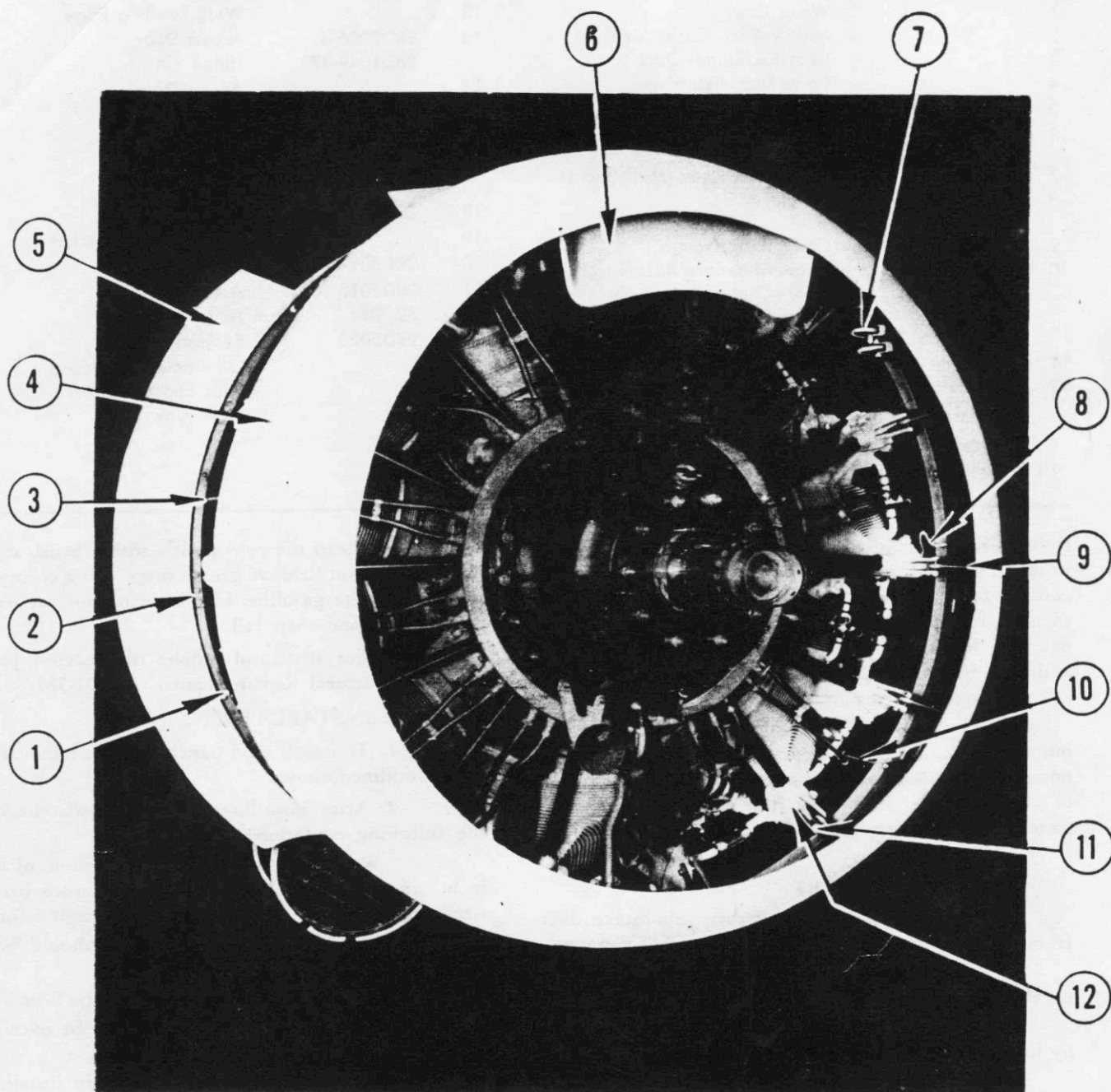
4. For structural repairs to the cowl panels, refer to Structural Repair Manual, AN 01-5MA-3.

(d) INSTALLATION.

1. To install cowl panels, reverse removal procedure outlined above.
2. After installing the wrap cowl, check for the following conditions:
 - a. There should be a minimum of 1/16 inch and a maximum of 1/8 inch clearance between wrap sections and nose cowl and rear engine former.
 - b. Neoprene chafing strips should be secured and kept free of metal shavings.
 - c. Bonding connections must be firm.
 - d. Edge of wraps should not be over 3/64 inch above adjoining edge of nose cowl.
 - e. Padding should be properly installed.
3. Connect draw bolts at bottom of nacelle and draw wrap cowl up tightly.
4. Securely lock all Dzus fasteners.

(3) COWL FLAPS.

(a) DESCRIPTION.—The cowl flaps affect proper cooling of the engine by controlling the volume of air which flows over the cylinders. The cowl flap assembly consists of a shock mounted former ring and eight movable flaps. The flaps extend completely around the nacelle, being cut away only at the heat exchanger air intake duct and at the oil cooler air scoop. Flap hinges are attached to the former ring by screws. The flap operating mechanism is composed of push-pull



No.	NAME
1	Cowl Flap Former Ring
2	Form Ring Splice Plate
3	Horizontal Support Rod
4	Nose Cowl
5	Cowl Flap
6	Carburetor Air Scoop

No.	NAME
7	Propeller Cable Pulleys
8	Bonding Braid
9	Mounting Hinge
10	Tie Rods
11	Shock Mount Bolts
12	Rocker Box Bracket Bolts

Figure 102—Nose Cowl Installation

rods and linkages which are actuated by a cable system. (Refer to Par. 11, f, for arrangement of the cable system.) The push-pull rods are attached to the second flap from the top of each side, and the linkage is mounted to the rear face of the cowl well. The flaps are connected together by plungers so that they operate as a unit. Seven horizontal support rods and two channel sections connect the engine former ring with the nose cowl.

(b) REMOVAL.

(See figure 103.)

1. Remove intermediate cowl panels. (Refer to paragraph b, (2), (b).)
2. Remove oil cooler air scoop. (Refer to paragraph e, (2), (b).)
3. Detach bonding braid from flaps.
4. Detach actuating rod from side flaps.
5. Remove plunger bolts (45).
6. Disconnect push rod (20) and hinge (33) to remove top flap (19).
7. By using special wrench, 28U5001 (See figure 40), loosen hinge bolt nuts (48) and remove hinge bolts (44) to remove remaining flaps.
8. Detach hinges (21) and (29) and the hinge connecting tubes (22) and (30) from flaps (23) and (14) by removing the three taper pins in each tube.

(c) MAINTENANCE.

1. At time of disassembly, lubricate hinge bolts and plungers with grease (Specification AN-G-5).
2. Tighten all loose screws.
3. If hinge or plunger bearings are worn, replace them.
4. Clean the cowl flaps with a brush dipped in soap solution. Remove grease spots with a clean cloth dipped in white gasoline. Use scouring powder only if the gasoline and soap fail.

5. For structural repairs to the cowl flaps, refer to Structural Repair Manual, AN 01-5MA-3.

(d) INSTALLATION.

1. To install cowl flaps, reverse removal procedure outlined above.
2. Adjust position of flaps as outlined in Par. 11, f, (2), (d).
3. Check installation for the following:
 - a. Cowl flaps should operate smoothly.
 - b. There should be a clearance of 1/8 inch in all positions between cowl flaps and former ring skirt.
 - c. Cowl flaps should have a snug fit where they overlap each other.
 - d. The hinge bolts should be tightened only enough to permit washer underneath head to be rotated. (The locknut should be tight on the star washer.)

- e. The plunger bolts should not be so tight that free movement of the cowl flaps is prevented.

- f. Bonding connections between flaps and former ring should be tight.

- g. The top flap spring clip should be adjusted to make contact on the fibre bearing surface of the adjoining flap.

(4) REAR ENGINE FORMER.

(a) DESCRIPTION.—The former consists of two angles placed back to back, spotwelded, and riveted together. Incorporated into the former at the top, is a carburetor air duct adapter. The former is made in two sections that are bolted together at the sides thru a splice plate. The assembly is shock mounted to the rocker boxes on the rear bank of cylinders. The former ring serves as a support for the intermediate cowl panels and for the cowl flaps.

(b) REMOVAL.

(See figure 103.)

1. Remove intermediate cowling. (Refer to paragraph b, (2), (b).)
2. Remove oil cooler air scoop. (Refer to paragraph e, (2), (b).)
3. Disconnect the two sections of former (11) and (13) at the splice plates (10).
4. Detach cowl flap actuating rod from bracket on cowl flap.
5. Remove plunger bolt (45) and hinge bolt (44) from the upper hinges of the side flaps. Remove only these two bolts from each of the side flaps. (Refer to paragraph b, (3), (b), 7.)
6. Remove fair-lead on inboard side of former ring.
7. Detach bonding braid that is fastened to former ring.
8. Disconnect carburetor air door return spring (5) from former ring. (See figure 130.)
9. Loosen, but do not remove, all bolts which fasten the former ring mounting brackets to the rocker boxes, except the outer bolt in each of the four angle type brackets. Remove these four outer bolts. Remove the nuts from the eye bolts which attach the above four angle type brackets to the former ring. Then disengage eye bolts from former and allow the eye bolts and brackets to swing about the loosened inner bolts thru the rocker box lugs.
10. Detach channels (9) by removing screws from both ends. (See figure 103.)
11. Remove the seven horizontal tie rods (8) by first disengaging the nuts and washers from both ends, and then backing the nut on the aft side of the nose cowl former angle as far along rod as it will go. If the tie rod is not yet free, force the rear engine former aft slightly so that the tie rod may be removed.

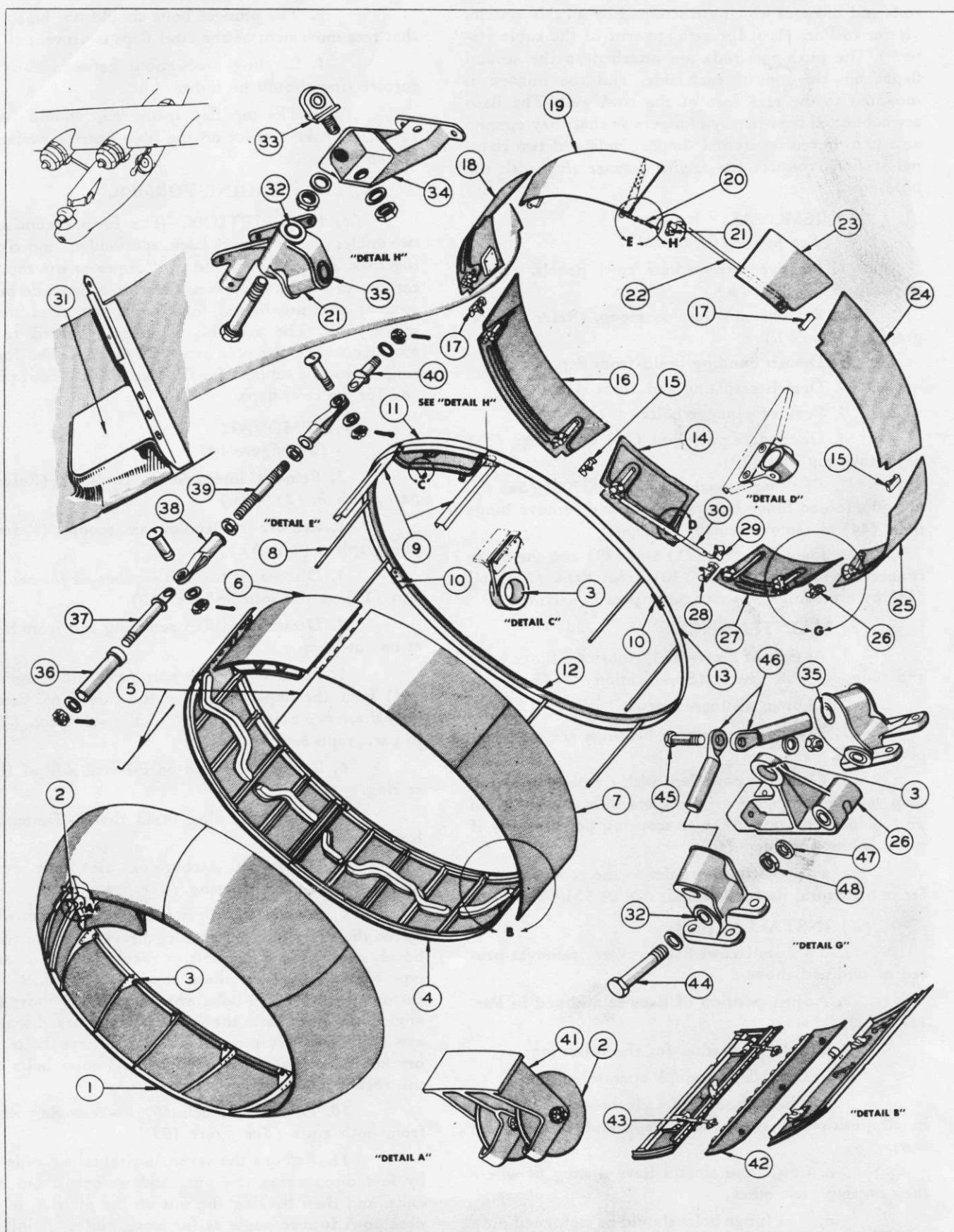


Figure 103—Engine Cowl Installation

No.	PART No.	NAME	No.	PART No.	NAME
1	32D005-70 L/R	Nose Cowl Assembly	28	28D5010-3R	Cowl Flap Support
2	AN210-2A	Pulleys	29	28D3005-3	Bearing Assembly
3	28D1029	Rubber Bushing	30	28D5002-8	Tube
4	32D022-2 L/R	Wrap Cowl	31	28D5019 L/R	Spring
5	32D044	Hinge Pin	32	28D2013	Bushing
6	32D024-2	Middle Sect. Carb. Air Duct	33	32D031-0	Hinge
7	32D021-2 L/R	Wrap Cowl	34	28D5013 L/R	Cowl Flap Support
8	32D5011	Tie Rods	35	28D2014	Bushing
9	32D019-2 L/R	Channels	36	28D5055	Spacer
10		Splice Plate	37	AN43-16	Eye Bolt
11		Upper Portion Former		AN960-C416L	Washer
12	*32D029-4	Former Assembly		AN320-4	Nut
	**32D029-2			AN380-2-2	Cotter Pin
13		Lower Portion Former	38	AN486-4	Fork Fitting
14	28D5002	Cowl Flap	39	28D5052	Rod
15	28D5010-0	Cowl Flap Support		AN316-4R	Nut
16	28D5005-R	Cowl Flap	40	AN43-5	Eye Bolt
17	28D5010-2 L/R	Cowl Flap Support		AN310-4	Nut
18	28D5004-L/R	Cowl Flap		AN960-C416	Washer
19	28D5054-L/R	Cowl Flap		AN380-2-2	Cotter Pin
20	28D5051-6	Push Rod Assembly	41	28P5034	Pulley Bracket
21	28D3005-6	Bearing Assembly	42	32D023-0	Access Door
22	28D5053-8	Tube	43		Draw Bolt
23	28D5053-L/R	Cowl Flap	44	28D3013	Bolt—Cowl Flap
24	28D5005-L	Cowl Flap	45	AN4-7A	Bolt
25	28D5006	Cowl Flap		AN310-4	Nut
26	28D5010-3L	Cowl Flap Support		AN960-416	Washer
27	28D5007	Cowl Flap	46	28D2010	Plunger
			47	22F191-7	Washer
			48	28D3015	Nut

*PBY-5A only

**PBY-5 only

12. Remove the upper four of the eight remaining shock mount bolts. The upper half of the former ring (11), including the three top flaps (18), (19), and (23), and the rear section (3) of the carburetor air duct (See figure 130.) may now be removed by pulling it forward far enough to disengage the rear section of the carburetor air duct from the carburetor air scoop elbow. After disengaging the carburetor air duct, lift former ring section from the nacelle.

13. Remove the lower portion (13) of the former ring, including the five remaining flaps (14), (16), (24), (25), and (27) by taking out the remaining four shock mount bolts.

14. To remove cowl flaps from the former, refer to paragraph b, (3), (b).

15. Detach rear section of the carburetor air duct by removing the four screws that fasten it to the adapter on the former ring.

(c) MAINTENANCE.

1. Keep all nuts, screws, and fasteners tight.
2. Check the rubber bushings (3) in the shock mounts, and if they appear worn or damaged, replace them.

3. Watch for cracks or loosened welds. For structural repairs, refer to Structural Repair Manual, AN 01-5MA-3.

(d) INSTALLATION.

(See figure 103.)

1. Place upper half (11) of former ring in position and insert the top two shock mount bolts.

2. Place lower half (13) of former ring in position and hold in place by inserting the two upper bolts.

3. Insert the seven horizontal tie rods (8), and then install the two upper channels (9).

4. Insert remaining shock mount bolts, and then attach the four eye bolt shock mounts to the former assembly.

5. Attach the two portions of the former ring at the splices by replacing the bolts.

6. Adjust and tighten the seven tie rods.

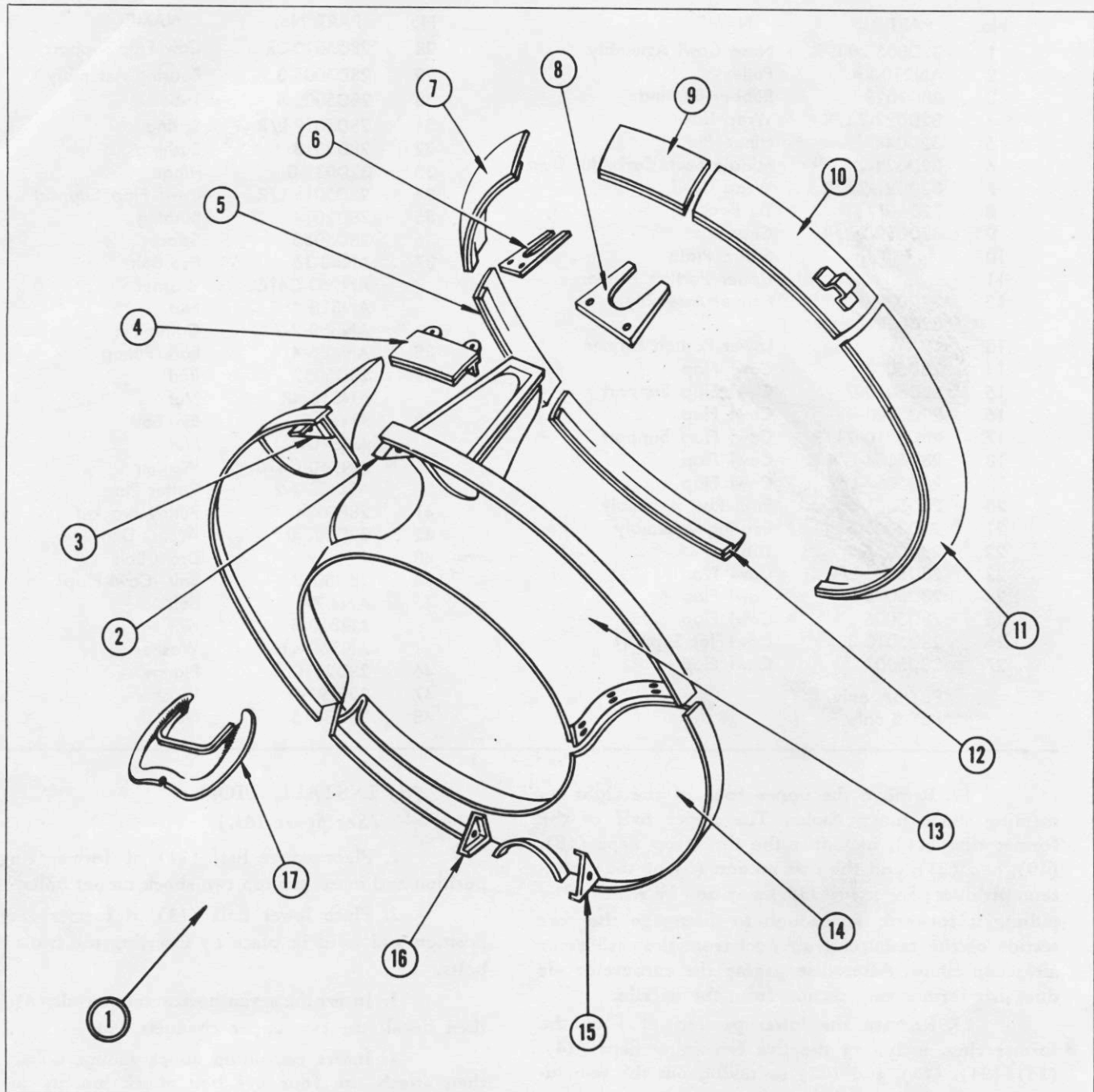
7. Attach bonding braid.

8. Tighten rocker box bracket bolts, and then insert and tighten the four bolts that were removed. Tighten all shock mount bolts.

9. Replace cowl flap hinge and plunger bolts. (Refer to paragraph b, (3), (d).)

10. Attach cowl flap actuating rod.

11. Attach fair-lead to former and install cowling that was removed.



No.	PART No.	NAME	No.	PART No.	NAME
1	28P5003-3	Cowl Well Assembly	10	28P5003-12	Exit Fairing
2	28P5097-R	End Closing Bracket	11	28P5003-13	Exit Fairing
3	28P5097-L	End Closing Bracket	12	28P5003-14	Exit Fairing
4	28P5003-10	Exit Fairing	13	28P5003-250	Upper Section Cowl Well
5	28P5003-8	Exit Fairing	14	28P5003-6	Lower Section Cowl Well
6	28P5144-8	Trough Cover Assembly	15	28P5097-2R	End Closing Bracket
7	28P5003-9	Exit Fairing	16	28P5097-2L	End Closing Bracket
8	28P5098-9	Trough Cover Assembly	17	28P5003-17	Carburetor Seal
9	28P5003-11	Exit Fairing			

Figure 104—Cowl Well and Exit Fairing

c. EXIT FAIRING.

(1) DESCRIPTION. — The exit fairings are formed of stainless steel sheet (Specification AN-QQ-S-757). They lie over the exhaust collector ring on each side of the nacelle and are attached to the cowl ring by means of screws. Their purpose is to protect the collector ring and to smooth the flow of air thru the cowl flap openings.

(2) REMOVAL.

(See figure 104.)

(a) Open the cowl flaps to the full open position.

(b) Remove oil cooler air scoop. (Refer to paragraph e, (2), (b).)

(c) Disconnect propeller governor cables aft of the cowl well, and then remove pulleys from bracket on rear face of the cowl well.

(d) Remove exit fairing sections in the following order:

1. Top section (4) by removing six screws, four on the top, and two on the rear face of the cowl well under the Dzus spring adapter.

2. Upper side sections (7) and (9), by removing nine screws in section (9), and nine screws in section (7).

3. Intermediate side sections (5) and (10), by removing eight screws in section (10), and nine screws in section (5).

4. The lower sections (11) and (12), by removing nine screws in section (12), and five screws in section (11).

(3) MAINTENANCE.

(a) Dress down all gouges with a burnishing tool.

(b) Clean the exit fairing with a brush dipped in soap solution. Remove grease spots with a clean cloth dipped in white gasoline.

(c) For structural repairs, refer to Structural Repair Manual, AN 01-5MA-3.

(4) INSTALLATION.—To install the exit fairing, reverse the removal procedure outlined above.

d. COWL WELL.

(1) DESCRIPTION.—The cowl well is formed of stainless steel sheet (Specification AN-QQ-S-757). It is made in two sections joined together at the sides by screws thru a splice plate. The two sections may be removed independently. The cowl well is attached to the engine mount ring by means of five clamps. Its purpose is to protect the carburetor and accessory compartment from the heat of the exhaust collector ring, and to form a support for the accessory panels and the exit fairing.

(2) REMOVAL.

(See figure 104.)

(a) Remove accessory cowl panels. (Refer to paragraph e, (1), (b).)

(b) Remove cowl flaps. (Refer to paragraph b, (3), (b).)

(c) Remove exit fairing. (Refer to paragraph c, (2).)

(d) Remove rear section (3) of the carburetor air duct by removing the four screws which attach it to the rear engine former, then lift the forward end slightly, and at the same time pull it forward until it is disengaged from the carburetor air scoop elbow. (See figure 130.)

(e) Remove cowl flap control bell cranks from the aft side of the cowl well.

(f) Detach intermediate heat exchanger duct by removing screws along its base, and then remove the duct support angles from the cowl well trough.

(g) Remove cowl well trough covers (6) and (8) by removing attaching screws, and then detach the troughs from the oil tank flange by loosening the two Dzus fasteners in the aft flange of each trough.

(h) Remove the exhaust manifold. (Refer to Par. 8, c, (2), (b).)

(i) Remove oil cooler. (Refer to Par. 16, c, (2).)

(j) Remove the three horizontal channel supports (5) and (18), and the two angle supports (20) and (22).

Note

The two upper channels (5), at their forward ends, attach to the rear of the cowl well by means of two screws engaging nut plates on the forward side of the cowl well. At their aft ends, they are attached to the firewall flange by means of two countersunk screws. The bottom channel (18) is attached by countersunk screws to the cowl well angle and to the firewall flange. The two angle supports (20) and (22) are attached at their forward ends by screws fastening thru the cowl well and the cowl well angle, and at their aft ends, by screws fastening thru the firewall flange. (See figure 101.)

(k) Remove carburetor air scoop seal (17) from the cowl well by removing the six bolts that hold it in place. (See figure 104.)

(l) Detach the two cowl well sections (13) and (14) by removing the screws at the splices on both sides of the cowl well.

(m) Detach cowl well from the five clamps that attach it to the engine mount ring by removing the clamp bolts. The two sections of the cowl well may now be removed.

(3) MAINTENANCE.

(a) Watch for cracks or loosened welds. For structural repairs, refer to Structural Repair Manual, AN 01-5MA-3.

(4) INSTALLATION.

(See figure 104.)

(a) Place upper half of cowl well in position and attach it loosely to the engine mount ring by means of the clamps.

(b) Place lower half of cowl well in position and attach it loosely to the engine mounting ring by means of the clamps.

(c) Assemble the two portions of the cowl well at the splices by means of screws.

(d) Install the three horizontal channel supports (5) and (18), and the two angle supports (20) and (22). (See figure 101.)

(e) Attach aft end of troughs to oil tank flange by means of the Dzus fasteners.

(f) Tighten the five clamps that fasten cowl well to engine mount ring. (See figure 104.)

(g) Install carburetor air scoop seal (17).

(h) Install exhaust manifold. (Refer to Par. 8, c, (2), (d).)

(i) Install oil cooler. (Refer to Par. 16, c, (4).)

(j) Replace cowl well trough covers (6) and (8).

(k) Install intermediate heat exchanger duct and duct support angles.

(l) Install cowl flap control bell cranks on the aft side of the cowl well.

(m) Install rear section of the carburetor air duct.

(n) Install exit fairing. (Refer to paragraph c, (4).)

(o) Install cowl flaps. (Refer to paragraph b, (3), (d).)

(p) Replace accessory cowl panels. (Refer to paragraph e, (1), (d).)

e. NACELLE COWLING.—The nacelle cowling comprises the accessory panels and the access doors on the sides and bottom of the oil tank.

(1) ACCESSORY PANELS.

(a) DESCRIPTION.—The accessory compartment is enclosed by means of a removable top panel (which contains a mounting for the starter crank socket), a hinged bottom panel, and two hinged side panels on each side. The top panel is attached to the cowl well former angle and the oil tank flange by Dzus fasteners. The upper edge of each side panel is hinged to the cowl well trough. The lower panel is hinged to a horizontal angle near the oil cooler, and attached by Dzus fasteners to a horizontal channel.

(b) REMOVAL.

(See figure 101.)

1. Detach panel (8) by loosening four Dzus fasteners and removing one screw in the forward edge.

2. Remove side panels (6) and (17) and lower panel (21) by loosening Dzus fasteners, detaching bonding braid, and then withdrawing the hinge pins.

(c) MAINTENANCE.

1. Check for loosened or broken Dzus springs.

2. Watch for cracks or loosened welds. For structural repairs, refer to Structural Repair Manual, AN 01-5MA-3.

3. If neoprene seals on panel supports are torn, burned, or brittle, replace the seals.

4. Clean the cowl panels with a brush dipped in soap solution. Remove grease spots with a clean cloth dipped in white gasoline.

(d) INSTALLATION.—For installation of the accessory panels, reverse the removal procedure outlined above.

(2) OIL COOLER AIR SCOOP.

(a) DESCRIPTION.—The oil cooler air scoop is formed of 24ST alclad sheet. It is attached to the cowl well and to horizontal angles on both sides of the oil cooler. The oil cooler's purpose is to provide ram air pressure for the oil cooling system and the accessory compartment, and also to support a blast tube to the generator.

(b) REMOVAL.

(See figure 130.)

1. Disconnect flexible generator blast tube (40) from the oil cooler air scoop. Access to generator blast tube is gained by opening cowl panel (6). (See figure 101.)

2. Remove scoop by detaching screws that fasten it to the horizontal angles on either side of the oil cooler and the three bolts which fasten it to the cowl well. These three bolts are accessible thru the forward end of the scoop.

(c) MAINTENANCE.

1. Watch for cracks or loosened welds. For structural repairs, refer to Structural Repair Manual, AN 01-5MA-3.

2. Clean the scoop with a brush dipped in soap solution. Remove grease spots with a clean cloth dipped in white gasoline.

(d) INSTALLATION.—To install the oil cooler air scoop, reverse the removal procedure outlined above.

(3) REAR ACCESS DOORS.

(a) DESCRIPTION.—The rear access doors, which are hinged to the top and bottom of the oil tank,

provide an opening between the wing and the top of the oil tank, and between the wing and the bottom of the oil tank on both sides of the nacelle. A step is provided at each top access door. A hinged access door is also provided in the bottom of the oil tank assembly.

(b) REMOVAL. (See figure 101.)—Remove rear access doors (10), (12), (14), (15), and (16) by loosening Dzus fasteners, detaching bonding braid, and withdrawing hinge pins.

(c) MAINTENANCE.

1. Check for loosened or broken Dzus springs.

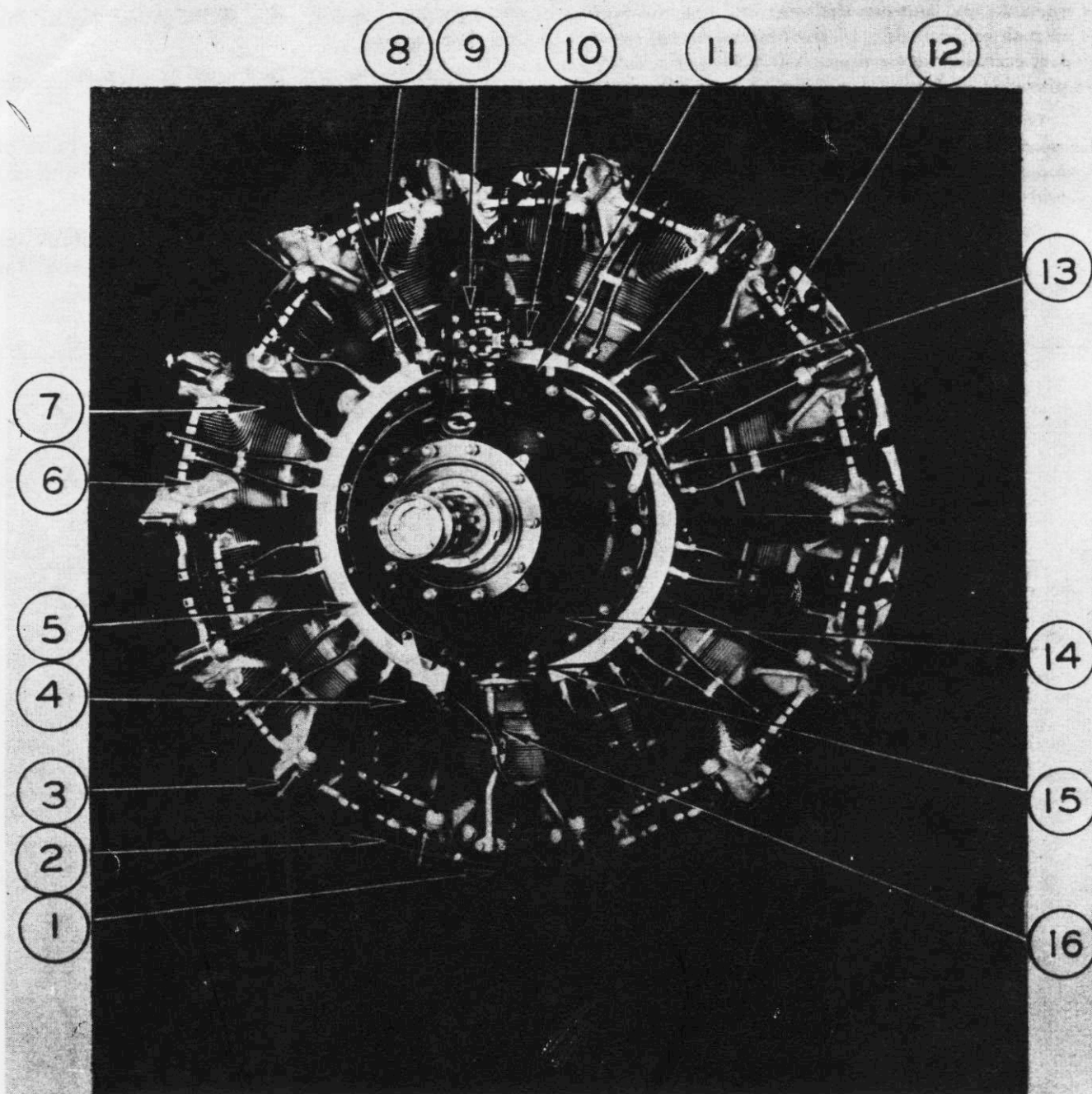
2. Watch for cracks or loosened welds. For structural repairs, refer to Structural Repair Manual, AN 01-5MA-3.

3. If neoprene seals on panel supports are torn, burned, or brittle, replace the seal.

4. Clean the cowl panels with a brush dipped in soap solution. Remove grease spots with a clean cloth dipped in white gasoline.

(d) INSTALLATION.—To install the rear access doors, reverse the removal procedure outlined above.

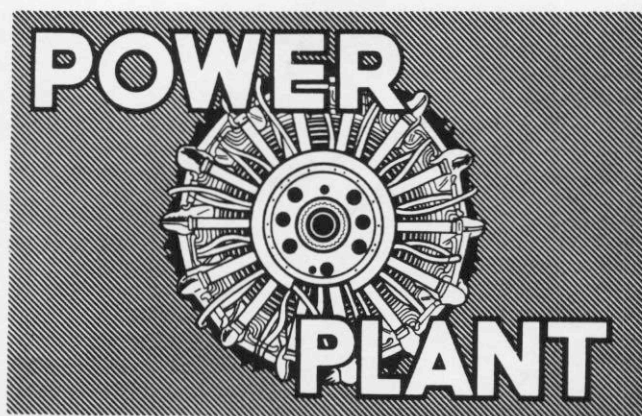




No.	NAME	No.	NAME
1	Rocker Sump	9	Propeller Governor
2	Oil Cooler	10	Pressure Switch Electrical Cable
3	Nose Cowl Mounting Bracket	11	Fast Feathering Line
4	Magneto Blast Tube Air Scoop	12	Inter-cylinder Oil Drain Pipes
5	Ignition Shielding	13	Magneto Flex
6	Rocker Box	14	Data Plate
7	Push Rod	15	Propeller Anti-Icer Line
8	Spark Plug Cable	16	Oil Scavenge and Breather Pipe Assembly

Figure 105—Engine—Three-Quarter Front View

PARAGRAPH 8.



8. POWER PLANT.

a. GENERAL.—The two power plant installations are comprised of Pratt and Whitney R1830-92 engines, three bladed Hamilton Standard quick feathering propellers, tubular steel engine mounts, engine accessories, aluminum alloy firewalls, and nacelle cowling. The power plant installations are removable at the firewall, (front of the oil tank) but are not interchangeable.

b. ENGINES.

(1) DESCRIPTION.

(a) GENERAL.—The Pratt and Whitney R 1830-92 is a 14 cylinder, two row radial, air cooled engine with a 16:9 propeller reduction gear ratio. The propeller shaft has a S.A.E. No. 50 spline and the rotation is clockwise when viewed from the anti-propeller end. An 11 inch diameter gear driven impeller, with a gear ratio of 7.15:1 provides the single stage, single speed supercharging. The piston compression ratio is 6.7:1. The bore is 5.50 in. and the stroke 5.50 in. The piston displacement is 1830 cu inches. The cylinders are numbered consecutively in the direction of normal shaft rotation starting with the top cylinder in the rear row as number one.

(b) ACCESSORY DRIVES.—The oil pump drive gear shaft accommodates a coupling for driving the fuel pump. The gear ratio of each accessory drive to the engine crankshaft and the direction of rotation (when looking at the end of the accessory drive shaft in the engine) is listed as follows:

ACCESSORY DRIVE	SPLINE DRIVE	DIRECTION OF ROTATION	RATIO TO CRANKSHAFT
Starter	3 tooth jaw	Clockwise	1.000:1
Generator	16 Internal Involute	Clockwise	1.400:1
Vacuum Pump	12 Internal Involute	Clockwise	1.400:1
Fuel Pump	11 Internal Involute	Counterclockwise	0.875:1
Tachometer	7/8-18 NS-3	RH Clockwise LH Counterclockwise	0.500:1
Prop. Governor	12 Internal Involute	Clockwise	0.958:1
Hydraulic Pump	12 Internal Involute	Clockwise	1.000:1

(c) CARBURETORS.—The engines are equipped with Stromberg injection carburetors (Model PD12H4-B8) which mount on the top of the intermediate rear section. Fuel is delivered to the carburetors at about 15 lb/sq in. pressure and first enters the regulator and control unit where it is metered proportionally to the mass flow of air as registered through venturi tubes and the automatic mixture control unit. The metered fuel from the fuel control unit is then discharged into the entering air stream through a discharge nozzle in the bottom of the carburetor. No fuel

is delivered to the engine at pressures less than 4 lb/sq in. The automatic mixture control compensates for variations in air pressure and temperature and maintains a correct fuel air mixture ratio. The carburetors are provided with a manual mixture control which may be set at full rich, automatic rich, automatic lean, and idle cut-off.

Note

PBY-5 airplanes up to serial number 08349 are equipped with model PD12H1 carburetors.

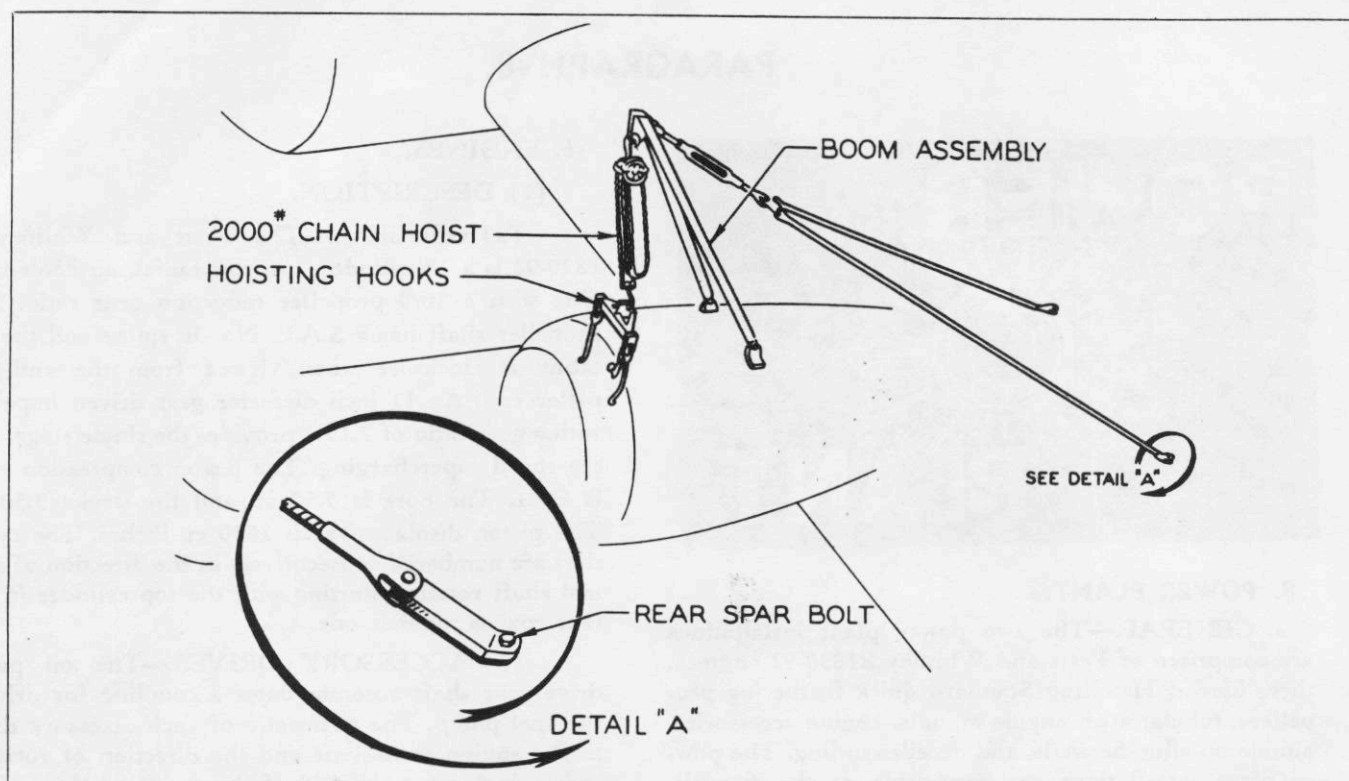


Figure 106—Portable Engine Hoist

(d) **MAGNETOS.**—Two independent sources of ignition are furnished each engine by two American Bosch SF14LU-7 or SF14LU-6 magnetos. The magnetos are mounted on the rear engine section. The magneto's accessory drive rotation is clockwise when viewed at the end of the drive in the engine, and the ratio to crankshaft speed is 0.875:1. The SF14LU-7 and SF14LU-6 magnetos are similar in design but not identical. Their functional operation in this installation is, however, the same. The right and left magnetos are interchangeable. The right magneto fires the front spark plugs of all cylinders in both banks, and the left magneto fires the rear spark plugs of all cylinders in both banks.

The firing order of the magnetos, which are completely radio shielded, is 1-10-5-14-9-4-13-8-3-12-7-2-11-6.

(e) **IGNITION SHIELDING.**—Each engine is equipped with a Pratt & Whitney ignition shielding assembly which is installed directly in front of the front bank of cylinders. This shielding assembly has 28 ignition wires. Fourteen are connected to the right-hand magneto and the spark plugs in the front of the cylinders, while the remaining 14 are connected to the left-hand magneto and the spark plugs in the rear of the cylinders.

(f) **SPARK PLUGS.**—Twenty-eight Champion, Model C-34-S, spark plugs are installed in the cylinders of each engine. Other spark plugs acceptable for use

in these engines are Bendix 6S9-A, BG-LS-321A, BG-LS-514, Aero-LS-4AD1 and AC Model LS-86.

(2) **ENGINE STARTING, OPERATION, AND STOPPING.**—Refer to "PILOT'S HANDBOOK OF FLIGHT OPERATING INSTRUCTIONS, AN 01-5MA-1."

(3) REMOVAL.

(a) **GENERAL.**—The following precautions should be observed when removing any portion or all of the power plant.

1. Before disconnecting or removing electrical leads, cables, magnetos, etc., it should be determined that all generator switches and battery switches have been turned off, and that no external source of power is connected to the airplane.

2. Before disconnecting or removing fuel lines, fuel pumps, etc., adequate precautions should be taken to insure against fire.

3. Locations of clamps holding equipment to the mount should be marked on the mount prior to disassembly to insure proper alignment when re-assembling. If possible, keep port and starboard engine parts separate so that, if parts happen to be specially fitted on the original installation, there will be less re-assembly trouble due to parts not fitting.

(b) **REMOVAL OF ENGINE AND MOUNT ASSEMBLY.**—It is necessary when any lines or ports are opened that they be covered or plugged immediately to prevent the entrance of foreign matter. If

ports are threaded, use a threaded plug; if not threaded, use tapered wooden plugs of a size that cannot enter the opening more than half the length of the plug. Nipples, ends of tubing, etc., should have a piece of heavy cloth placed over the end and then taped securely with adhesive or scotch tape. In no case should rags, corks, or the like be forced into the ends of the nipples, tubes or ports.

To remove engine and mount, proceed as follows:

1. Remove propeller. (Refer to Par. 13, b, (2).)

2. If the airplane is equipped with heat anti-icing, remove the intermediate section of the heat exchanger air scoop by detaching the screws along its base, and then removing the duct support angles from the cowl well trough.

3. Remove the accessory bay panels. (Refer to Par. 7, e, (1), (b).)

4. Remove the flexible ball joint between the exhaust collector and the heat exchanger by detaching the clamp at each end of the ball joint and then collapsing it slightly.

5. Disconnect the generator cooling blast tube from the oil cooler scoop by loosening the hose clamp.

6. Remove the oil cooler scoop by detaching screws that fasten it to the horizontal angles on either side of the oil cooler and the three bolts which fasten it to the cowl well. These three bolts are accessible through the forward end of the scoop.

7. Remove the horizontal support members between the firewall and the exhaust collector ring shroud. (Refer to Par. 7, d, (2), (j).)

8. Loosen Dzus fasteners which secure exhaust outlet shrouds to firewall.

9. Drain oil from the engine and leave oil drain valve in "DRAIN ENGINE" position. Safety wire it in this position until the engine has been reinstalled. Also drain the oil cooler through the plug in the bottom of the oil cooler.

10. Shut off the fuel to the engine by means of the shut-off valve in the superstructure.

11. Open the four nacelle fairing access doors on both sides of the oil tank.

12. Disconnect the following controls, electrical wiring, tubing, and hoses at the firewall: (See figures 108 and 109.)

- a. Generator D.C. plug.
- b. Generator A.C. Plug.
- c. Main electrical plug.
- d. Ignition plug.
- e. Tachometer generator plug at fast-feathering relay junction box.
- f. Mixture push-pull control rod.
- g. Throttle push-pull control rod.
- h. Carburetor vapor vent line (red band).
- i. Primer line (red band).

j. Anti-icer line (white and red band).

k. Fuel pressure gage vent line to carburetor (red band).

l. Oil pressure line (yellow band).

m. Manifold pressure line (white and light blue band).

n. Fuel pressure line (red band).

o. Fuel line to fuel pump (red band).

p. Cross-feed fuel line to fuel pump (red band).

q. Vacuum line (white and light green band).

r. Oil tank vent line (yellow band).

s. Thermocouple lead.

13. Disconnect the following at the locations indicated:

a. Cowl flap control cables (inboard and outboard) at the quick-disconnect fittings at the exhaust collector ring shroud.

b. Propeller control cables at the turnbuckles forward of the firewall.

c. Carburetor alternate air door control cable at the clevis fitting aft of the carburetor air scoop.

d. Starter push-pull rod at the manual meshing lever.

e. The propeller governor oil line from the fast-feathering pump.

f. Engine "oil in" line from drain valve.

g. Engine "oil out" line from automatic temperature control unit.

h. Oil line between oil cooler and automatic temperature control unit from the automatic temperature control unit.

i. Oil return line from aft port of cooler.

j. Air pressure line from oil separator.

k. Hydraulic oil lines from hydraulic pump (starboard engine only).

l. Fuel line from carburetor to oil dilution solenoid at the solenoid.

14. Remove the intermediate engine cowl panels. (Refer to Par. 7, b, (2), (b).)

15. Using the portable engine hoist (28H 5504) and a chain hoist of at least 2000 pounds capacity, lift the engine just enough to relieve the airplane structure of the engine weight. (See figure 106.)

16. Remove the two lower engine mount bolts.

17. Check to make sure that all tubing, cables, hoses, electrical wiring, bonding, etc., are free and then remove the two top engine mount bolts and guide the assembly from the airplane. Care must be exercised that no portion of the rear section or accessories strike structural members of the airplane or any portion of the stand to which the assembly is lowered.

CAUTION

There should be at least three men for the lowering operation, one at each side to see that all is clear and a third to operate the hoist.

(c) REMOVAL OF ENGINE FROM MOUNT.—Whenever it is necessary to remove the engine for overhaul or replacement, it is advisable to remove the complete engine and mount assembly from the airplane as outlined in paragraph b, (3), (b) and then complete the disassembly on a suitable work stand. The engine may, however, be removed in the following manner without removing the mount assembly from the airplane:

1. Turn both shut-off valves in the superstructure to the "OFF" position.
2. Remove the propeller. (Refer to Par. 13, b, (2).)
3. Remove the heat exchanger front air duct by loosening the six Dzus fasteners which attach it to the nose cowl, and by detaching the nine nuts and bolts which fasten it to the wrap cowl.
4. Remove the intermediate section of the heat exchanger air duct by detaching the screws through its base.
5. Remove the oil cooler duct by detaching screws that fasten it to the horizontal angles on either side of the oil cooler, and the three bolts which fasten it to the cowl. These three bolts are accessible through the forward end of the duct.
6. Remove the intermediate engine cowling. (Refer to Par. 7, b, (2), (b).)
7. Remove the accessory bay panels. (Refer to Par. 7, e, (1), (b).)
8. Remove the flexible exhaust ball joint between the heat exchanger and the exhaust collector by detaching the clamp at each end of the ball joint and then collapsing it slightly.
9. Remove the propeller governor control cables by disconnecting them at the turnbuckles forward of the firewall and by loosening the cable lock on the governor pulley.
10. Remove the nose cowl. (Refer to Par. 7, b, (1), (b).)
11. Remove the rear section of the carburetor air duct from the carburetor scoop by removing the four screws which attach it to the rear engine former, and then lift the forward end slightly, and at the same time pull it forward until it is disengaged from the carburetor air scoop elbow.
12. Disconnect the cowl flap push-pull rods from the flaps (outboard and inboard) and detach the cowl flap assembly from the rocker boxes. (Refer to Par. 7, b, (4), (b).)
13. Drain oil from the engine and leave oil drain valve in "DRAIN ENGINE" position. Safety wire it in this position until the engine has been re-installed.
14. Remove carburetor. (See following paragraph b, (3), (d).)
15. Disconnect all electrical cables from generator, starter, and magnetos.

Note

Ignition cable may be disconnected from the firewall and left attached to magnetos to avoid removing clips.

16. Remove hydraulic pump. This is on the starboard engine only. (Refer to Par. 21, b, (2), (b).)

17. Remove vacuum pump, suction relief valve, and support bracket. (Refer to Par. 19, e, (2), (b).)

18. Remove fuel pump. (Refer to Par. 15, b, (8), (b), 1.)

19. Disconnect bonding braids between the engine and engine mount.

20. Disconnect the following as indicated: (See figure 107.)

- a. Oil separator line from engine crankcase.
- b. Oil pressure gage line from the engine crankcase.
- c. Electrical cable from tachometer generator.
- d. Oil temperature gage wires at crankcase.
- e. Engine "oil in" line from engine crankcase.
- f. Engine "oil return" line from engine crankcase.
- g. Fast-feathering line to governor at the fitting on the aft side of the engine diaphragm.
- h. Manifold pressure line at connection between the flexible hose and the aluminum alloy tube on the engine mount.
- i. Starter bonding braid from starter junction box.
- j. Primer line at firewall and then unclip from engine mount and adjacent lines.
- k. Thermocouple lead at firewall and then unclip from engine mount.

l. Blower case drain line at crankcase.

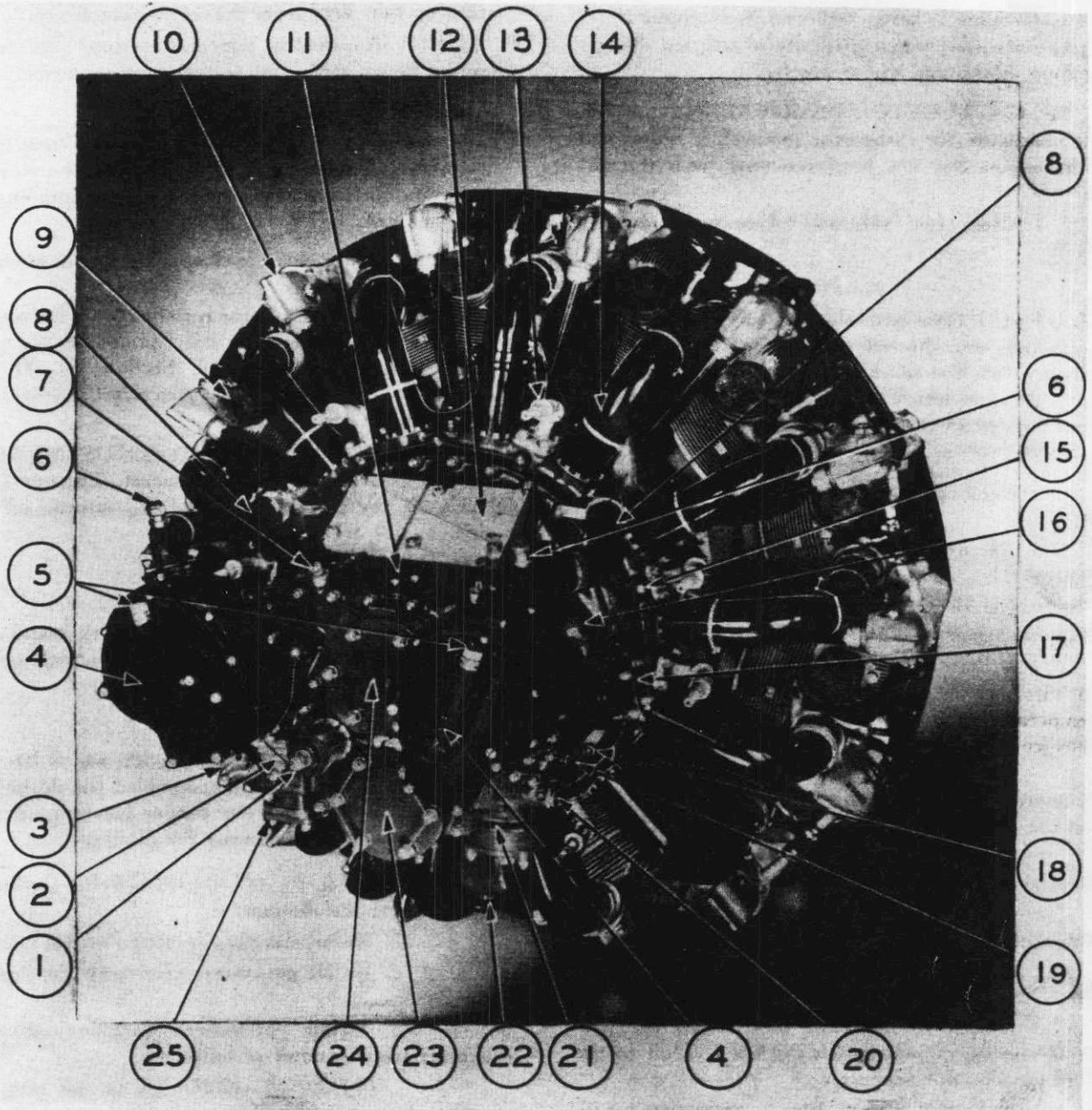
21. Remove the following as indicated:

- a. Oil breather line section from crankcase to hose which connects it to the drain gang.
- b. Oil tank vent line between crankcase and oil tank.

22. Attach hoisting hooks (28H5505) and hoist capable of supporting 2000 pounds to lifting lugs on engine. (See figure 106.)

23. Take up weight of engine with hoist and remove nuts from the engine mount studs on aft side of diaphragm.

24. When all mounting studs are free, move the engine forward until exhaust collector ring, diaphragm, engine accessory section, magnetos, starter and generator are clear of the engine mount and the exhaust collector shroud, then lower to engine work stand.



No.	NAME
1	Oil Pressure Relief Valve
2	Oil Outlet Flange
3	Oil Inlet Flange
4	Magneto
5	Magneto Ground Connection
6	Magneto Booster Connection
7	Oil Tank Vent Connection
8	Magneto Flex Tube
9	Exhaust Port
10	Rocker Box
11	Rear Crankcase Breather Connection
12	Carburetor Mounting Flange

No.	NAME
13	Engine Mount Pedestal
14	Intake Pipe
15	Manifold Pressure Fitting
16	Tachometer Drive
17	Hydraulic Pump Drive
18	Oil Pressure Gage Connection
19	Oil Temperature Connection
20	Oil Strainer By-pass Relief Valve
21	Oil Strainer Screen Chamber
22	Oil Sump Drain Plug
23	Generator Drive
24	Starter Drive
25	Fuel Pump Drive

Figure 107—Engine—Three-Quarter Rear View
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RESTRICTED

CAUTION

While engine is being removed from mount, personnel must watch carefully to see that all tubing, hoses, and wiring are free.

(d) CARBURETOR REMOVAL.—In the following procedure for carburetor removal, it is assumed that the engine has not been removed from the airplane.

1. Close fuel shut-off valves in superstructure.

Note

It is best to close both shut-off valves because with only one shut-off valve closed there is a chance that the selector valves will be turned to a position which will allow cross flow from one tank to an engine on the other side of the airplane.

2. Remove carburetor air scoop. (See Par. 14, b, (2).)

3. Remove the oil tank vent tube (for working clearance).

4. Remove starter junction box, booster coil, and support assembly as follows:

a. Remove lid from starter junction box and loosen wires for the general engine flexible conduit, the oil temperature conduit, and the propeller feathering pressure cut-out switch conduit.

b. Disconnect general engine conduit, oil temperature conduit, and pressure cut-out switch conduit at the junction box by loosening the conduit nuts.

c. Uncouple the flexible conduit disconnect plug at the starter.

d. Disconnect the booster coil flexible conduit at either the booster coil or at the magneto.

e. Disconnect the ground braid at the starter.

f. Remove the clips that fasten the propeller feathering cut-out switch flexible conduit to the forward junction box support.

g. Loosen the junction box supports by removing the bolts at each of the four clamps.

h. Lift out junction box, booster coil, and support assembly.

5. Disconnect the throttle and mixture control rods from the carburetor. (See figure 110.)

6. Disconnect the fuel inlet hose from the carburetor fitting (16) and remove the short section of dural tubing from the fuel inlet line under the carburetor.

7. Disconnect the fuel pressure (15), vapor vent (11), and oil dilution lines (13) from the carburetor.

8. Remove exhaust collector struts (for working clearance).

9. Remove the carburetor brace by removing

lockwire and two bolts from the carburetor and three elastic stop nuts from the engine crankcase.

10. Detach the elastic stop nuts from the mounting flange studs and remove carburetor.

Note

Remove loose articles as pencils, etc., from shirt pockets before removing carburetor to prevent such articles from falling into engine blower case.

11. Install cover over opening in engine blower case immediately.

12. If the carburetor is to be out of service for a period exceeding ten days, it should be prepared for storage in accordance with Section III, Par. 3, a, (17) of Service Instructions-Aircraft Engines (AN 02-10CC-2).

(4) MAINTENANCE AND ADJUSTMENT.—Refer to Service Instructions—Aircraft Engines (AN 02-10CC-2) for maintenance and adjustment of the engine.

(5) INSTALLATION.

(a) ENGINE.

1. Mount the engine on a work stand and make the following installations before attaching the engine to the mounts. (See figure 105.)

Note

If available, an engine installation which has not been removed and disassembled should be used as a guide for the proper location and positioning of the various installations.

a. Refer to AN 02-10CC-2 for preparing the engine for installation.

b. Install starter. (Refer to Par. 12, b, (5).)

c. Install generator. (Refer to Par. 22, b, (5).)

d. Install propeller governor pressure switch electrical conduit as follows:

(1) Attach conduit to the plug on the propeller governor.

(2) Clip conduit to the ignition harness forward of cylinder No. 14.

(3) Thread conduit along the left-hand magneto flex and attach it to the magneto flex between cylinders No. 12 and No. 14 and aft of the rear bank of cylinders.

e. Install the two steel tubing sections of the fast feathering oil line from diaphragm to propeller governor.

f. Install propeller anti-icer tubing section from diaphragm to propeller governor. (Reverse removal procedure as outlined in Par. 25, d, (3), (b), 15 through Par. 25, d, (3), (b), 23.)

g. Install support bracket and forward section of magneto blast tube. (Refer to Par. 14, c, (3).)

h. Install front crankcase breather line forward of the engine mount.

i. Install blower section drain fitting and hose.

j. Install oil tank vent fitting to crankcase. (See figure 107.)

k. Install manifold pressure fitting in the engine, and the flexible rubber portion of the line to the fitting.

l. Install oil pressure gage line to crankcase.

m. Install oil separator drain line fitting and rubber hose connection for drain line to engine crankcase.

n. Install tachometer generator. (Refer to Par. 22, s, (1), (e).)

o. Install fuel primer line to priming spider.

p. Install spark plugs.

q. Install thermocouple lead to rear spark plug of No. 1 cylinder.

r. Install engine oil inlet and outlet flanged fittings to engine.

s. Install engine diaphragm by slipping it over the pedestal mount studs.

t. Install the fast feathering oil line bracket immediately aft of the diaphragm.

u. Install magneto ignition conduit assembly. "T" fitting in conduit clips to the inboard magneto in both nacelles.

v. Install exhaust collector ring. (Refer to paragraph c, (2), (d).)

w. Install cowl flaps and former ring. (Refer to Par. 7, b, (4), (d).)

x. Clip front crankcase breather outlet to cowl flap former ring bracket.

y. Add four propeller hoist nuts.

2. Bolt the engine mount to a support stand capable of supporting the engine and mount assembly and install the following parts on it: (See figure 116.)

a. Attach the cowl well to the engine mount ring. (Refer to Par. 7, d.)

Note

Remove top section of cowl well before installing engine to mount.

b. Install oil cooler on engine mount. (Refer to Par. 16, c, (4).)

c. Install oil drain scupper.

d. Install drain gang assembly.

3. Attach hoisting hooks (28H5505) to the lifting lugs on the engine and with a hoist capable of hoisting 2000 pounds, raise the engine to the proper position on the mount, and secure to mount by installing nuts on the pedestal studs. (See figure 106.) Apply torque of from 400 to 800 in-lb to these nuts and in-

stall cotter keys. (See figure 112.) Then proceed as follows:

a. Install rear crankcase breather. (See figure 107.)

b. Install nose cowl ring and braces from nose cowl ring to cowl flap former ring. (Refer to Par. 7, b, (1), (d).)

c. Install fuel pump and fittings. (Refer to Par. 15, b, (8), (d).)

d. Install hydraulic pump on the starboard engine only. (Refer to Par. 21, b, (2), (d).)

e. Install vacuum pump, relief valve, and bracket assembly. (Refer to Par. 19, e, (2), (d).)

f. Install oil separator. (Refer to Par. 19, e, (3), (d).)

g. Install carburetor. (Refer to paragraph b, (5), (b).)

h. Install top section of cowl well. (Refer to Par. 7, d, (4).)

i. Install fuel line from fuel pump to carburetor and connect fuel inlet line to the fuel pump. On starboard engine connect crossfeed line to fuel pump.

j. Add oil separator drain tube from oil separator to crankcase and vacuum system pressure line from vacuum pump to oil separator. Also connect vacuum suction line to vacuum pump.

k. Connect hydraulic suction and pressure hose assemblies to hydraulic pump.

l. Connect tachometer generator flexible conduit to tachometer generator.

m. Install oil temperature resistance bulb.

n. Install starter junction box, booster coil, and support assembly as follows:

(1) Make certain that the general engine conduit, the oil temperature conduit, the starter conduit, and the booster coil to magneto conduit is attached to the starter junction box and that all wires in the above conduits are attached to the proper terminals inside the junction box. A wiring diagram is provided under the cover of the box.

Note

The propeller pressure cut-out switch conduit is attached to the propeller governor before installation of the engine and mount assembly.

(2) Place the junction box assembly under the top two engine mount tubes with the rear support angle approximately 3½ inches forward of the rear face of the engine mounting lugs. Secure it to the tubes by means of the four clamps. (See figure 116.)

(3) Clip the general engine conduit to the upper engine mount tube in three places.

o. Connect the fast feathering pressure cut-out switch conduit to the starter junction box, and clip it to the upper engine mount tube in two places and to the forward junction box support in two places.

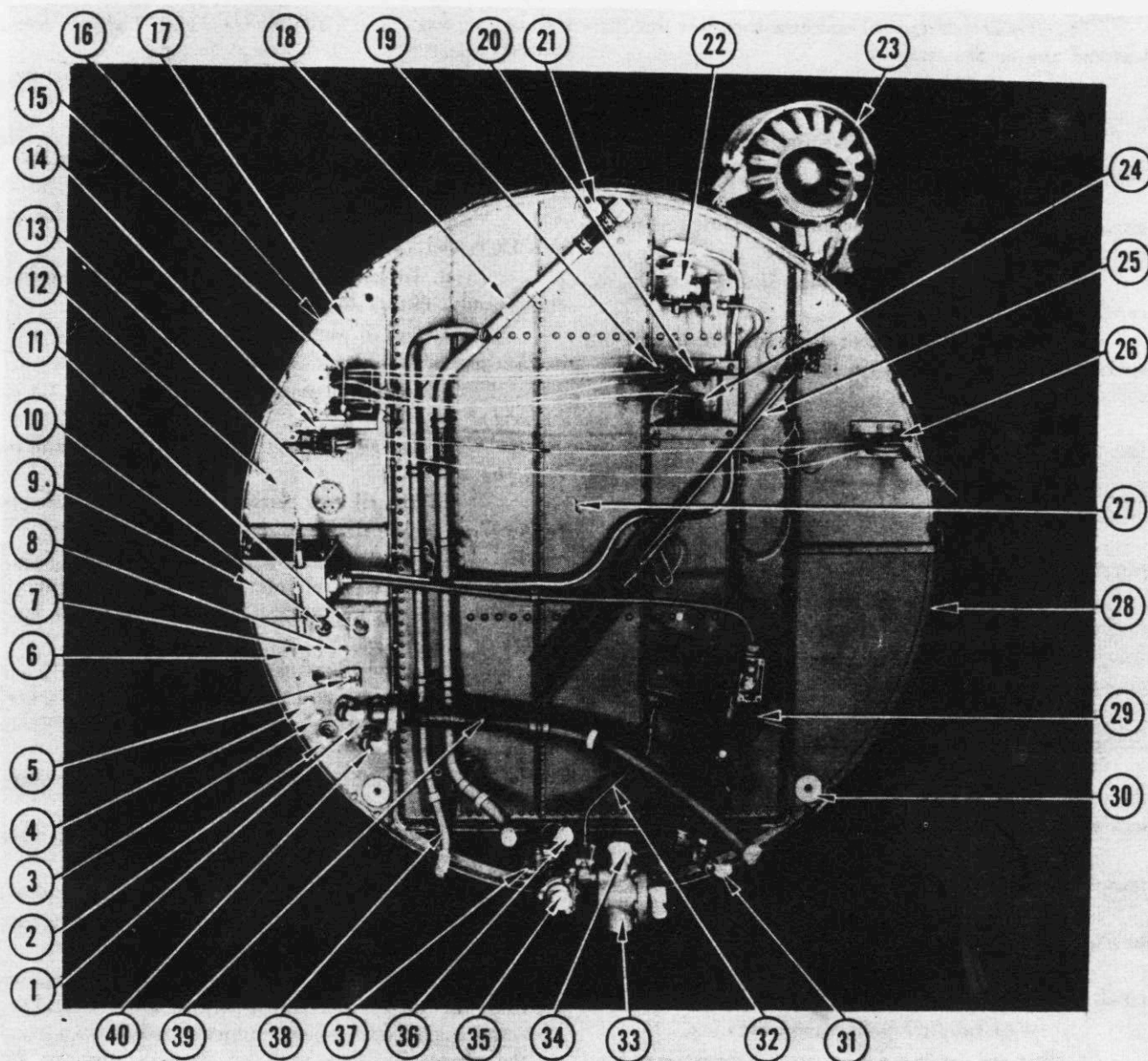


Figure 108—Firewall—Port Engine

p. Connect the oil temperature flexible conduit to the oil temperature resistance bulb on the rear of the engine.

q. Connect flexible conduit from the junction box to the plug on the starter.

r. Attach the ground braid fastened to the junction box to the aft end of the starter.

s. Attach conduit from the booster coil to the right magneto.

t. Install drain tube from fuel pump and crankcase breather line to drain gang. Connect blower section drain hose to drain gang. (See figure 116.)

u. Connect oil tank vent line and fitting to engine.

v. Install exhaust collector ring struts. Check to make sure there is ample clearance between strut bolt and engine mount tube so they will not rub when engine is in motion. (Refer to paragraph c, (2), (d), 5.)

w. Install propeller control cables (Refer to Par. 11, c, (2), (d).)

x. Complete the installation of the magneto blast tubes. (Refer to Par. 14, c, (3).)

y. Connect push-pull control rods to mixture and throttle control levers on carburetor and install cowl flap control bell crank and push-pull control rods on bracket on exhaust collector shroud.

z. Install bonding. (See figure 246.)

No.	PART No.	NAME	No.	PART No.	NAME
1	28G2030-2	Fuel to Fuel Pump Fitting	22	U1070-M	Oil Dilution Solenoid
	NAF213830-12D	Nut, Bulkhead Fitting		(United Aircraft	
	AN844-12D	45° Fitting		Products Co.)	
2	28P5166-4D	Fuel Pressure Fitting	23		Heat Exchanger
	AN840-6D	Hose Fitting	24	28P5038-O	Throttle Control Bell Crank
3	AN832-4D	Oil Pressure Fitting	25	*28P5149	Starter Meshing Control
	AN924-4D	Nut, Bulkhead Fitting		**28P5041	Starter Meshing Control
4	AN832-3D	Manifold Pressure Fitting	26		Outboard Cowl Flap Controls
	AN924-3D	Nut, Bulkhead Fitting	27	*28-O-3039-850	Oil Tank
5	88-C-1300	Thermocouple Connector		**28-O-3039-900	Oil Tank
	(F.S.S.C. No.)		28	*28P5035-38	Outboard Firewall
	AN931-4-7	Rubber Grommet		**28P5035-6	Outboard Firewall
6	AN832-4D	Primer Line Fitting	29	R-280-BH	Fast Feathering Pump
	AN924-4D	Nut, Bulkhead Fitting		(Pesco Products	
7	AN832-4D	Propeller Anti-Icing Fitting		Co.)	
	AN924-4D	Nut, Bulkhead Fitting	30		Engine Mounting Lugs
8	AN832-4D	Fuel Pressure Vent Fitting	31	AN912-7D	Fitting—Pump to Governor
	AN924-4D	Nut, Bulkhead Fitting		AN914-4D	90° Elbow
9	28E5014-3L	Fast Feathering Relay Box		AN823-10D	45° Elbow
10	28E5847-K33L	Gen. D.C. Harness and Plug	32		Oil Dilution Line
11	28E5847-K34L	Gen. A.C. Harness and Plug	33	114153 (Aero	Oil Drain Valve
12	28E5847-K35L	Ignition Harness and Plug		Supply Mfg.	
13	28E5847-K32L	Main Electrical Plug		Co., Inc.)	
14		Inboard Cowl Flap Controls	34		Oil to Engine Connection
15		Power Plant Controls	35	32-O-046	Oil from Engine Fitting
16	28P5035-7	Inboard Firewall	36	28-O-5025	Oil to Cooler Fitting
17	AN832-4D	Carburetor Vapor Vent Fitting	37	B25016 (Pratt &	Oil Temperature Control Unit
	AN924-4D	Nut, Bulkhead Fitting		Whitney)	
18	28-O-5000-32	Oil Line From Oil Cooler	38	28-O-3012-64	Oil Separator Air Exit Line
19	AN210-2A	Carburetor Air Control Pulley	39	Q2202-12-29	Cross-Feed Line
20	28P5037-O	Mixture Control Bell Crank		28G2030-2	Bulkhead Fitting
21		Engine to Tank Vent		NAF213830-12D	Nut, Bulkhead Fitting
				AN842-12D	90° Fitting
			40	NAF213827-12D	Vacuum Line Fitting
				NAF213830-12D	Nut, Bulkhead Fitting
				AN844-12D	45° Fitting

*PBY-5A only
**PBY-5 only

Note

All metal tubes must be bonded to the airplane structure at approximately 17 inch intervals. Also the following should be bonded: oil cooler (1 place); nose cowl (4 places); cowl flaps (each flap); wrap cowling (across each hinge); oil separator (1 place); carburetor control push-pull rods (1 place, each rod); engine (2 places; bond engine to mount). All support clips must make good contact with structure.

4. Using the portable engine hoist (28 H 5504) and a chain hoist of at least 2000 pounds capacity, hoist the engine and mount assembly to the proper position on the airplane. (See figure 106.) At this stage, the firewall with all its fittings, brackets, etc., should be completely installed. (Refer to paragraph e, (4).)

Apply a thin coat of engine oil to the engine mount contact surfaces. Use all new mounting bolts and nuts. Install the bolts with the heads aft. One washer should be used under each bolt head and nut. Nuts must be torqued to from 850 to 1300 in-lb and

cotter keys installed. Do not back off nuts to permit installation of cotter keys. (See figure 112.) Then proceed as follows:

a. Fasten the Dzus fasteners that connect the exhaust outlet shrouds to the oil tank.

b. Install the propeller governor flexible oil line between the fast feathering pump and the steel oil line previously installed.

c. Install the "oil in" line between the engine and the oil drain valve. (See figure 154.)

d. Install the "oil out" line between the engine and the automatic temperature control unit.

e. Install fuel line from carburetor to oil dilution solenoid.

f. Make connection between oil separator and air pressure line.

g. Add oil line between oil cooler and automatic temperature valve.

h. Connect oil return line to aft port of oil cooler.

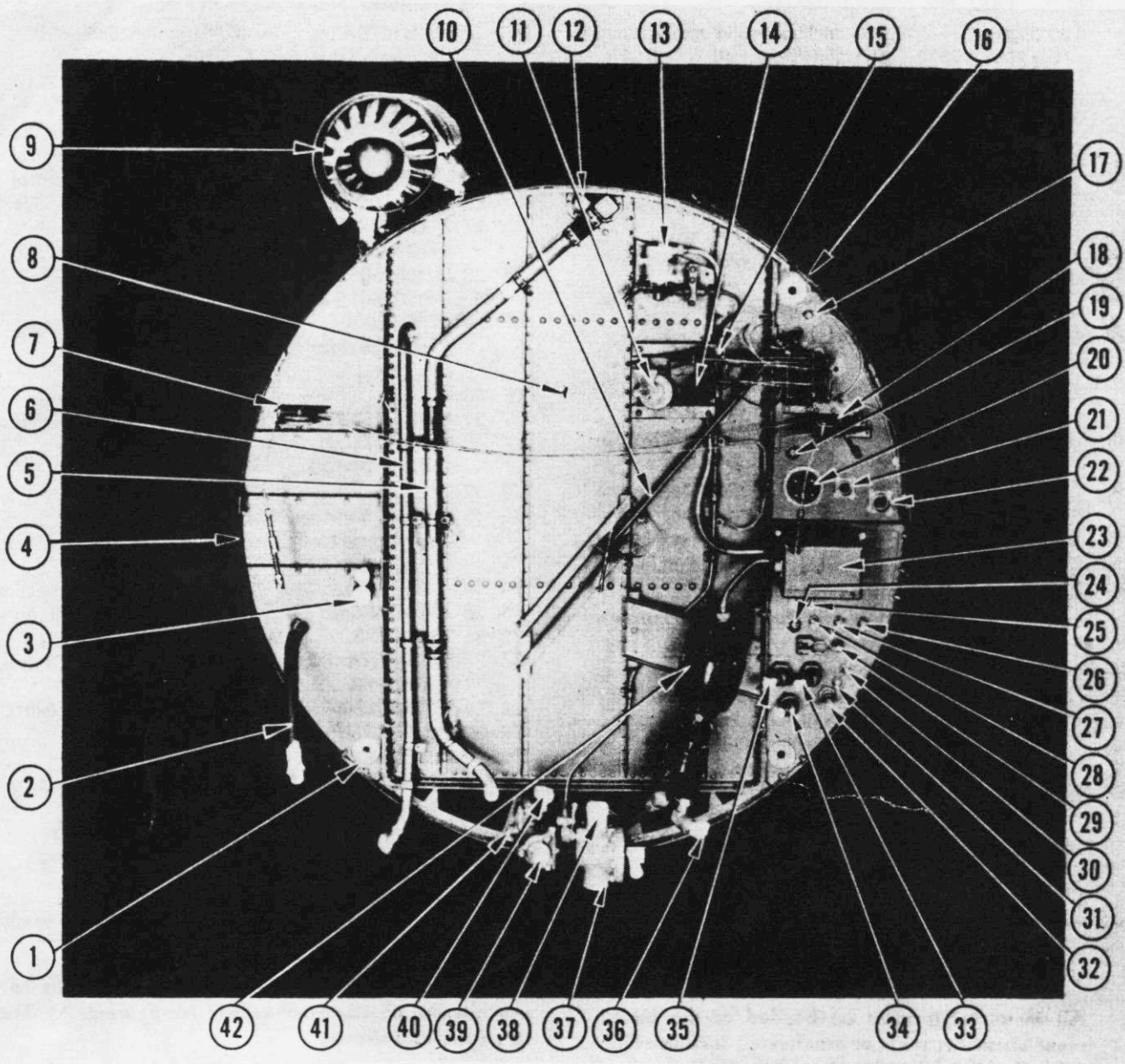


Figure 109—Firewall—Starboard Engine

i. Connect hydraulic pressure line to hydraulic pump and install hydraulic suction line between hydraulic reservoir (starboard engine only).

j. Connect starter push-pull rod at the starter manual meshing lever.

k. Connect the carburetor alternate air door control cable at the clevis fitting aft of the carburetor air scoop.

l. Connect the propeller control cables at the turnbuckles forward of the firewall.

m. Connect the cowl flap control cables at the quick disconnect fittings on the aft side of the exhaust collector shroud.

n. Connect the thermocouple lead at the firewall.

o. Connect the crossfeed fuel line (red band). On the port side engine it is connected at the fuel pump; on the starboard engine it is connected at the firewall.

p. Connect the following lines at the firewall. (See figures 108 and 109.)

(1) Oil tank vent line (yellow band).

(2) Vacuum line (white and light green band).

(3) Fuel line to fuel pump (red band).

(4) Fuel pressure line (red band).

No.	PART No.	NAME	No.	PART No.	NAME
1		Engine Mounting Lug	25	28E5847-K33R	Gen. D.C. Harness and Plug
2	*28F7592-12	Hydraulic Pressure Line	26	AN832-4D	Primer Line Fitting
3	*	Hydraulic Suction Line		AN924-4D	Nut, Bulkhead Fitting
4	*28P5035-53	Outboard Firewall	27	AN832-4D	Propeller Anti-Icer Fitting
	***28P5035-55	Outboard Firewall		AN924-4D	Nut, Bulkhead Fitting
	****28P5035-9	Outboard Firewall	28	AN832-4D	Fuel Pressure Vent Fitting
5	28-O-5000-32	Oil Line from Oil Cooler		AN924-4D	Nut, Bulkhead Fitting
6	28-O-3012-64	Oil Separator Air Exit Line	29	88-C-1300	Thermocouple Connector
7		Outboard Cowl Flap Controls		(F.S.S.C. No.)	
8	*28-O-3039-850	Oil Tank		AN931-4-7	Rubber Grommet
	**28-O-3039-900	Oil Tank	30	AN832-3D	Manifold Pressure Fitting
9		Heat Exchanger		AN924-4D	Nut, Bulkhead Fitting
10	*28P5149	Starter Meshing Control	31	AN832-4D	Oil Pressure Fitting
	**28P5041	Starter Meshing Control		AN924-4D	Nut, Bulkhead Fitting
11	AN210-2A	Carburetor Air Control Pulley	32	28P5166-4D	Fuel Pressure Fitting
12		Engine to Tank Vent		AN840-6D	Hose Fitting
13	U-1070-M	Oil Dilution Solenoid	33	28G2030-2	Fuel to Fuel Pump Fitting
	(United Aircraft Products)			NAF213830-12D	Nut, Bulkhead Fitting
14	28P5038-2	Throttle Control Bell Crank		AN844-12D	45° Fitting
15	28P5037-2	Mixture Control Bell Crank	34	NAF213827-12D	Vacuum Line Fitting
16	*28P5035-32	Inboard Firewall		NAF213830-12D	Nut, Bulkhead Fitting
	**28P5035-8	Inboard Firewall		AN844-12D	45° Fitting
17	AN832-4D	Carburetor Vapor Vent Fitting	35	28G2030-2	Cross-Feed Line Fitting
	AN924-4D	Nut, Bulkhead Fitting		NAF213830-12D	Nut, Bulkhead Fitting
18		Inboard Cowl Flap Control		AN844-12D	45° Fitting
19	**NAF213827-8D	Hydraulic Return Line Fitting	36	AN912-7D	Fitting—Pump to Governor
	**AN924-8D	Nut, Bulkhead Fitting		AN914-4D	90° Elbow
20	28E5847-K32R	Main Electrical Plug		AN823-10D	45° Elbow
21	28E5847-K35R	Ignition Harness and Plug	37	114153 (Aero Supply Mfg. Co., Inc.)	Oil Drain Valve
22	28E5847-K34R	Gen. A.C. Harness and Plug			
23	28E5014-3R	Fast-Feathering Relay Box	38		Oil to Engine Fitting
24	**NAF213827-8D	Hydraulic Pressure Line Fitting	39	32-O-046	Oil from Engine Fitting
	**AN924-8D	Nut, Bulkhead Fitting	40	28-O-5025	Oil to Cooler Fitting
	*PB5-5A only		41	B25016 (Pratt & Whitney)	Oil Temperature Control Unit
	**PB5-5 only		42	R-280-BH (Pesco Products Co.)	Fast-Feathering Pump
	***PB5-5 (Serial numbers 08349 thru 08549)				
	****PB5-5 (Serial numbers 08124 thru 08348)				

(5) Manifold pressure line (white and light blue band).

(6) Oil pressure line (yellow band).

(7) Fuel pressure gage vent line to carburetor (red band).

(8) Anti-icer line (white and red band).

(9) Primer line (red band).

(10) Carburetor vapor vent return line (red band).

q. Connect the throttle and mixture control push-pull rods to bell cranks at firewall.

r. Connect the generator D.C. plug, the generator A.C. plug, the main electrical plug, and the ignition plug to the firewall.

s. Connect the tachometer generator plug to the fast feathering relay junction box.

t. Install the horizontal support members

between the firewall and the exhaust collector ring shroud. (Refer to Par. 7, d, (4), (d).)

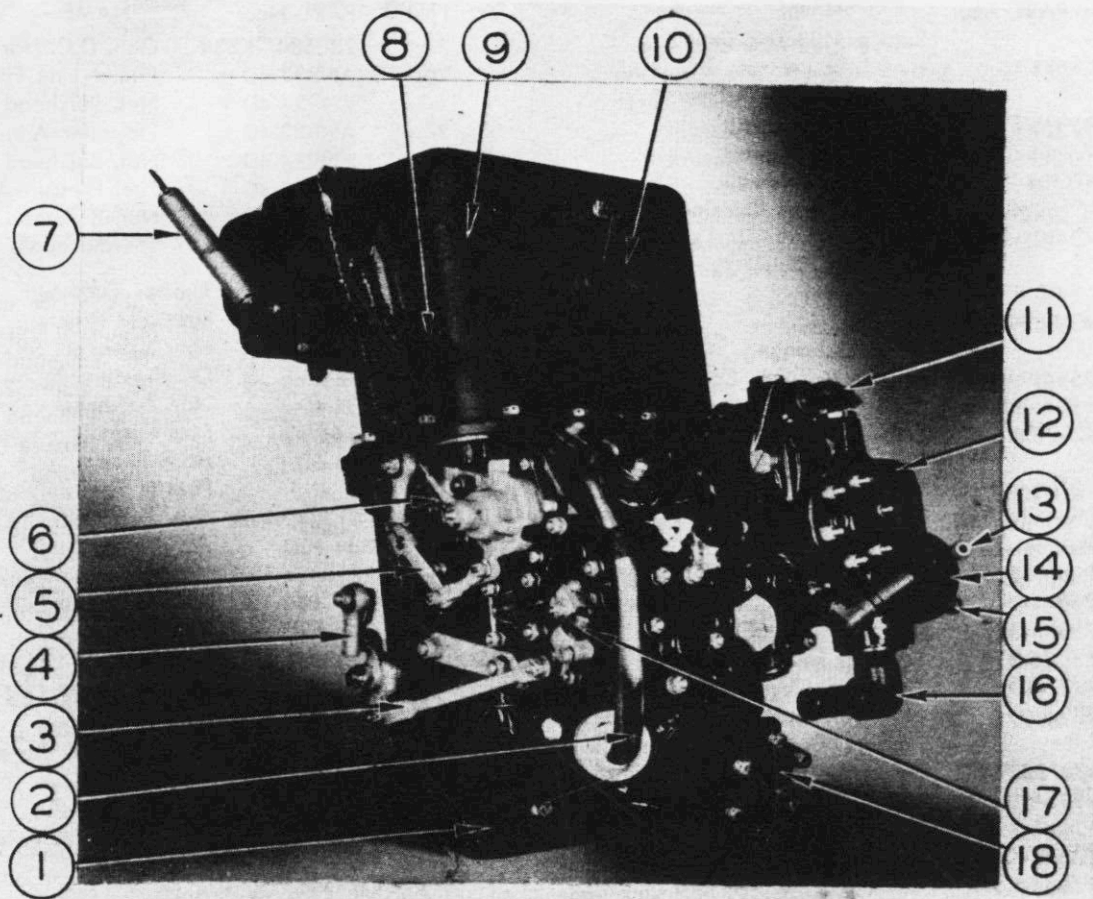
u. Install the oil cooler air scoop by attaching it to the horizontal support angle on either side of the oil cooler with screws and to the exhaust collector shroud by means of three bolts through its forward end.

v. Install the accessory bay cowl panels. (Refer to Par. 7, e, (1), (d).)

w. Install the generator blast tube and secure it to the oil cooler and the generator by means of hose clamps.

x. If the airplane is equipped with heat anti-icing, install the flexible ball joint between the exhaust collector and the heat exchanger. Also install the heat exchanger and fairing. (Refer to Par. 25, b, (2), (d).)

y. Install the propeller. (Refer to Par. 13, b, (4).)



No.	NAME
1	Adapter
2	Line From Fuel Control Unit To Spray
3	Idle Link
4	Throttle Lever
5	Manual Mixture Control Link
6	Manual Mixture Control Lever
7	Alternate Air Door Spring
8	Alternate Air Door Cable Control
9	Air Intake Elbow

No.	NAME
10	Fuel Pressure Balance Line Fitting
11	Vapor Vent Fitting
12	Regulator Unit
13	Oil Dilution Fitting
14	Fuel Stainer Cover
15	Fuel Pressure Fitting
16	Fuel Inlet Fitting
17	Idling Adjustment
18	Accelerating Pump

Figure 110—Carburetor and Intake Elbow

z. With the installation completed, check as follows:

- (1) Fill the oil tank and check for leaks.
- (2) Turn on the fuel shut-off valves in the superstructure and check for leaks.
- (3) Check all power plant control cable tensions. (Refer to Par. 11.)
- (4) Check the electrical system for proper operation. (Refer to Par. 22.)

Note

If a new or overhauled engine has been installed, carry out ground run-in test as outlined in Service Instructions-Aircraft Engines (AN 02-10CC-2.)

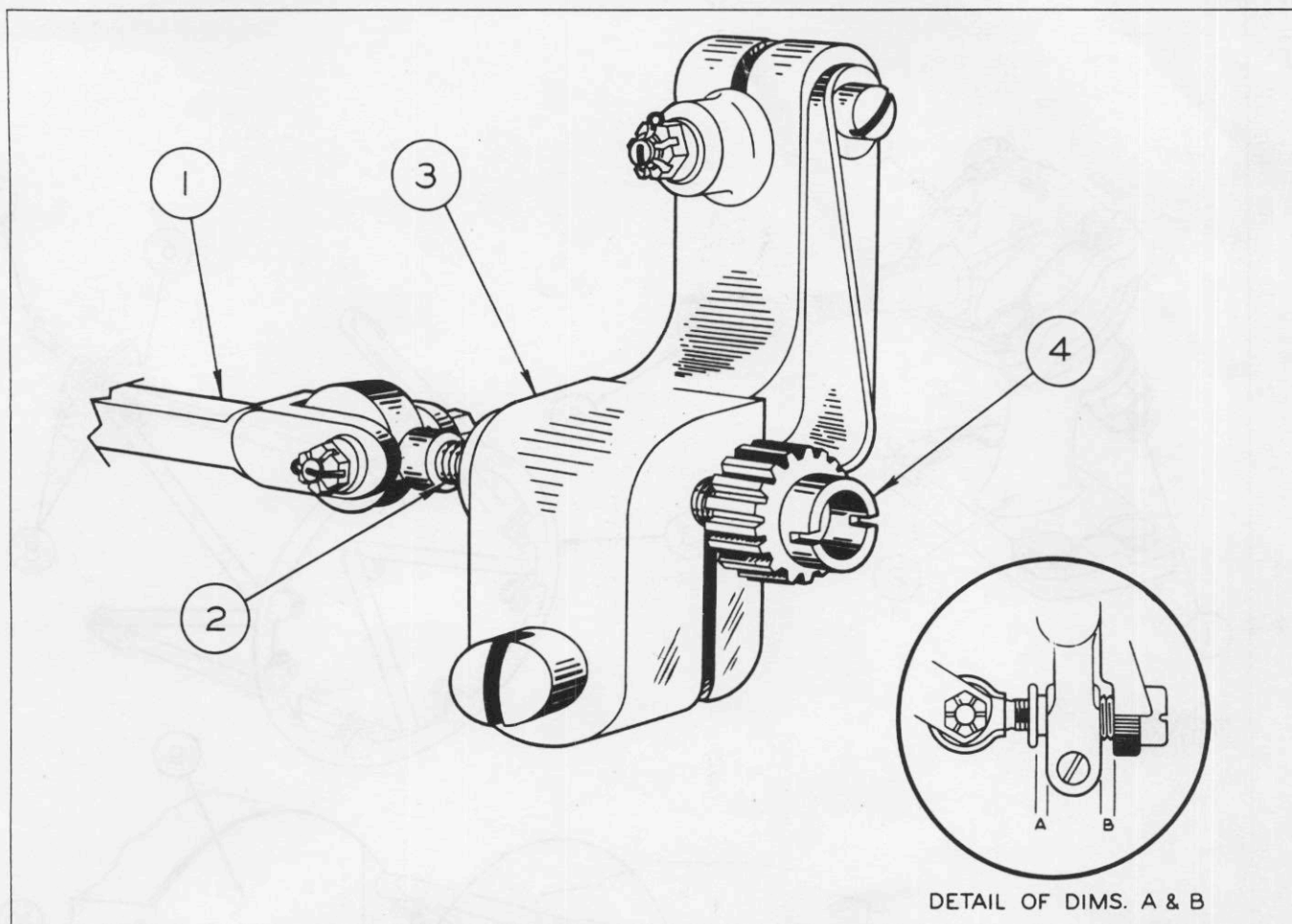
(b) CARBURETOR.

1. PREPARATION FOR INSTALLATION.

(See figure 110.)

a. Remove plugs from metered and unmetered fuel chambers and flush carburetor with gasoline of the type to be used in service. Drain out the gasoline used for flushing. (See figure 11.)

b. Then fill all fuel chambers of the carburetor with gasoline again, replacing all necessary plugs. Let the carburetor soak with the chambers filled with fuel for an absolute minimum of eight hours.



No.	PART No.	NAME	No.	PART No.	NAME
1	P70784	Link	3	P70694	Idle Lever
2	P70686	Link Connection Screw	4	P70680	Idle Adjusting Screw

All numbers listed above are Pratt and Whitney Part Numbers.

Figure 111—Carburetor Idling Adjustment

Note

This soaking period is very important as the carburetor was originally calibrated with all its fuel diaphragms thoroughly soaked with gasoline, and these diaphragms must be restored to this condition before the carburetor can be expected to function properly.

c. After draining the carburetor, wipe carefully to remove any oil, dust, or dirt that may have accumulated on its outer surface, or on the contours of its main or boost venturi.

d. Replace and lockwire the drain plugs and lubricate all joints in the control linkages with oil (Specification AN-VV-O-446).

e. Install fuel inlet fitting, oil dilution and

fuel pressure fittings, and vapor vent fitting. Parker "SEALUBE" or equivalent should be used on the male-threads of these fittings. Refer to figure 110, for location and position of these fittings. This illustration shows an installation for a port engine. The vapor vent fitting and oil dilution and fuel pressure fitting should be turned in the opposite direction for installation on a starboard engine.

f. See that all the nuts on the carburetor are tight to insure against leaks and that the carburetor (except the idle, throttle, and mixture adjustments) is completely lockwired before installation. The idle, throttle, and mixture adjustments are to be lockwired after necessary adjustments are made after the engine run.

g. Set idling adjustment screw so that from

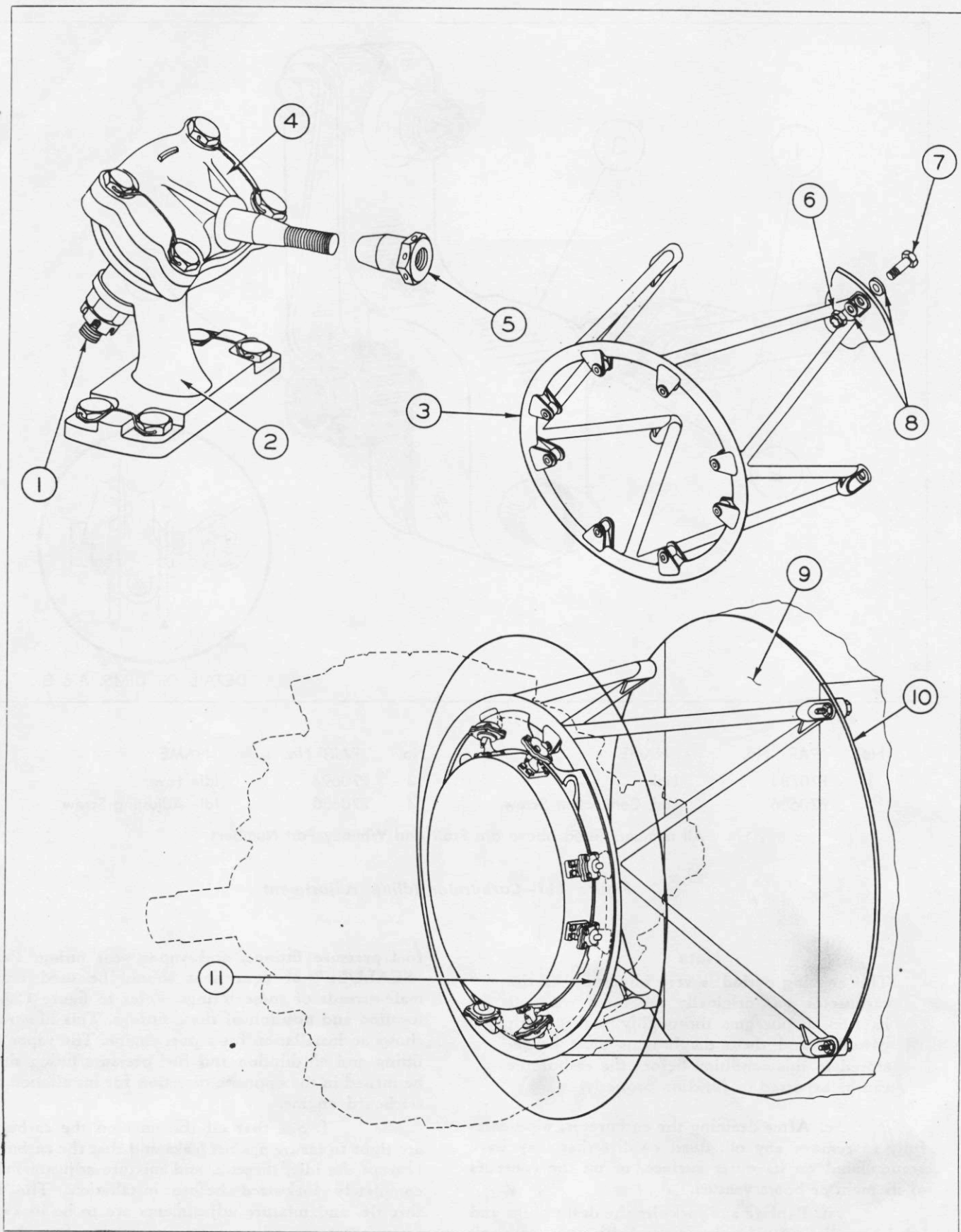


Figure 112—Engine Mount and Flexible Pedestal Mount Fitting

No.	PART No.	NAME	No.	PART No.	NAME
1	A-43785	Nut—Flexible Mount	8	28P1143	Washer
2	B-41574	Complete Assembly	9	*28-O-3039-850	Oil Tank
3	28B5000	Engine Mount		**28-O-3039-900	Oil Tank
4	B-42399	Flexible Pedestal Mount	10		Firewall
5	A-33957	Nut—Pedestal Stud	11	28P5001-11L	Diaphragm—Upper—Port Eng.
6	AN310-10	Nut		28P5001-11R	Diaphragm—Upper—Stb'd Eng.
7	1Q531-7	Bolt		28P5001-12	Diaphragm—Lower—Engine

Items 1, 2, 4 and 5 are Pratt and Whitney Part Numbers.

*PBV-5A only

**PBV-5 only

one to three threads are visible on the link connecting screw and the distance "A" and "B" are the same (See figure 111.)

h. Make certain that the throttle stops are set so that the throttle butterflies can be completely closed.

i. See that the manual mixture control lever is positioned so that it is directly over the boss opposite "IDLE CUT-OFF" on the mixture control latch cover. If adjustment is needed, remove the cotter pin and nut from the lever shaft and move serrated lever to obtain alignment.

j. Install intake screen and intake air scoop on carburetor. Two gaskets are shipped with the carburetor. One is to be installed between the carburetor intake flange and screen, and the second between the screen and the intake air scoop. Install the fuel pressure gage vent fitting to the intake air scoop.

2. INSTALLATION.

a. See that the carburetor to engine contact surfaces are smooth and clean. Do not use sandpaper or similar abrasive to smooth these surfaces. Paint surfaces with engine oil. No gasket is used between engine and carburetor.

b. Place carburetor in position on the engine and start elastic stop nuts on mounting studs.

c. Tighten the mounting nuts evenly with a torque of 200 to 225 in.-lb.

d. Attach the fuel inlet line, vapor vent line, fuel pressure line, and oil dilution line to their respective fittings. (See figure 110.)

e. Attach mixture and throttle control rods to their respective levers and add nuts and cotter keys.

f. Attach alternate air control cable to carburetor air intake scoop.

g. Install air intake duct sections to carburetor air intake scoop as follows:

(1) Insert aft end of aft duct section into mouth of elbow scoop; place in position against

engine cowl former ring; and secure by inserting four screws.

(2) Place the forward section in position between the nose cowl and the rear engine former, and secure it with ten screws.

h. Check throttle and mixture control levers for full travel.

i. Adjust cable tensions in accordance with the instructions for each control given in Par. 11.

j. Turn on fuel supply, start engine, and check carburetor and fuel connections for leaks.

k. Make final idling adjustment, throttle adjustment, and mixture adjustment after engine is warmed to operating temperature, and then lockwire after adjustments.

c. ENGINE EXHAUST SYSTEM.

(1) GENERAL.—The engine exhaust from the cylinders enters a steel collector ring which runs around the intermediate section of the engine, aft of the rear cylinder row. The collector ring has two outlets on the top of the nacelle along either side of the carburetor air duct elbow. The inboard outlets exhaust directly into the atmosphere while the outboard outlets connect, by means of a ball joint, to clover-leaf type heat exchangers, through which the exhaust gases pass to warm the air for the wing anti-icing system. A tail pipe, welded to the heat exchanger, carries the exhaust gases from the heat exchangers to the atmosphere. The inboard outlet is supported by means of a strut attached to the accessory case of the engine.

Note

PBV-5 airplanes up to serial number 08349 do not have heat exchangers because they are equipped with rubber boot type de-icers instead of the heat anti-icing.

Four flame dampers with attaching clamps, nuts, and bolts are delivered with each airplane as special equipment.

(2) EXHAUST COLLECTOR RING.

(a) DESCRIPTION.—The collector ring is formed from stainless steel (Specification AN-QQ-S-757, Cond. A), and is made up of six segments. The segments are joined to each other by expansion joint clamps which allow the entire collector ring to expand and contract, thereby avoiding undue stresses or strains. The exhaust port of each cylinder is connected to the collector ring by means of stacks and beaded clamps. The outboard outlet is connected to the ball joint by a beaded clamp. The cylinder stacks are attached to the cylinders by one nut which engages a stud projecting from the cylinder. Water drains are incorporated into the bottom nipple of the two lower segments of the collector ring.

(b) REMOVAL.

1. Remove forward section (3) of the heat exchanger air duct by loosening the six Dzus fasteners which attach it to the nose cowl and by removing the nine nuts and bolts which attach it to the wrap cowl. (See figure 101.)

2. Detach the intermediate section (7) of the heat exchanger air duct by removing the screws which fasten it to the two fore-and-aft support angles.

3. Remove the two fore-and-aft heat exchanger air duct support angles from the cowl well trough by detaching the bolts which fasten them to the cowl well trough. Bolts are engaged by nut plates on the trough.

4. Open accessory cowl panels (6) and (17). (See figure 101.)

5. Remove all exit fairing except the top section (4). (Refer to Par. 7, c, (2).)

6. Remove the short channel sections at each of the exit fairing splices.

7. Disconnect the cowl flap actuating rods from the bell cranks on the aft side of the cowl well.

8. Remove cowl flaps (18) and (23) as follows: (See figure 103.)

a. Detach top flap actuating rod (20) from hinge (21) by removing cotter pin, nut, washer, and clevis bolt.

b. Detach bonding braid from the two cowl flaps.

c. Remove plunger bolts (35) from cowl flap hinges at flap support (17).

d. To remove the flaps, loosen locknut (48) by using special wrench 28U5001, (See figure 40.) and then detach hinge bolt (44) from the lower hinges of the flaps.

9. To remove ball joint (2), detach bolts from clamps (1) and spread the clamps open far

enough to slide them off of the ball joint. Telescope ball joint slightly and remove it. (See figure 118.)

10. Detach cowl well trough covers from the forward end of the trough by removing the attaching screws. Screws are engaged by nut plates on the trough.

11. Remove the former angle bridge which lies across the forward end of the cowl well troughs by detaching the one screw at each end of the angle. The screws attach the vertical leg of the angle to the cowl well.

12. Loosen bolt through the collar at the junction of the upper (6) and lower (7) segments of the outlet assembly support strut.

Note

Airplanes which are not equipped with heat exchangers have each exhaust outlet supported by means of a strut.

13. Detach upper segment (6) of the strut from the outlet assembly by removing the clevis bolt. Raise outlet assembly sufficiently so that clevis bolt can slip between the engine mount tube and the cowl well trough.

14. To remove the strut assembly, detach the nut from the stud on the accessory case of the engine and slip strut from the stud.

15. Remove nuts and bolts from exhaust collector segment clamps (10), (12), and (15). Spread clamps until they can be slipped from the beaded ends of the segments.

16. To remove the six segments of the exhaust collector ring, detach nuts and bolts from the exhaust stack clamps (5) and (9), and spread clamps until they can be slipped forward on the stacks freeing the segment from the stacks.

17. Remove exhaust stacks from the cylinders by detaching the nut which fastens each stack to the stud projecting from the cylinder.

(c) MAINTENANCE.

1. Keep all clamps snug but not too tight. The clamps should be loose enough so that they can be rotated by hand. If the bosses on a clamp touch and the clamp is too loose, remove clamp and file or grind off enough of the bosses so that the clamp may be tightened.

2. Tighten nuts which fasten the exhaust stacks to the exhaust ports in the cylinders.

3. Repair cracks, puncture holes, and loosened welds. (Refer to STRUCTURAL REPAIR MANUAL, AN 01-5MA-3).

4. If struts are cracked or damaged, or if rubber bushing is worn or damaged, replace them.

(d) INSTALLATION.

(See figure 118.)

1. Insert exhaust stacks into cylinders and attach them to the projecting stud with a nut. Note carefully on the illustration the correct stacks used with each cylinder.

2. Slip double beaded clamps (5) over the beaded stacks and single beaded clamps (9) over the smooth stacks.

3. Place segment clamps (10), (12), and (15) on the smooth ends of the segments.

4. Install segments and fasten them in place by means of the clamps.

Note

Clamps must be snug but still loose enough so that they can be rotated by hand. This applies to all clamps in the exhaust system.

5. Attach the strut assembly to the accessory case stud and to the exhaust collector outlet assembly. Raise outlet assembly slightly in order to slip clevis bolt between the engine mount tube and the cowl well trough and into the upper strut attachment.

6. Tighten collar bolt at the junction of the upper and lower portions of the outlet assembly strut.

7. Install former angle bridge across the forward end of the cowl well trough. Secure bridge by means of a screw at each end.

8. Attach cowl well trough covers to the forward end of the troughs with screws.

9. Attach ball joint (2) to the exhaust collector outlet (3) and to the heat exchanger inlet by means of clamps (1).

10. Install cowl flaps (18) and (23) as follows: (See figure 103.)

a. Reverse removal procedure as outlined in paragraph c, (2), (b), 8.

b. Check cowl flaps as outlined in Par. 7, b, (3), (d), 3.

11. Attach cowl flap actuating rods to the bell cranks on the aft side of the cowl well.

12. Install the short channel sections at each of the exit fairing splices by means of two screws through the cowl well.

13. Install the exit fairing. (Refer to Par. 7, c, (4).)

14. Close accessory cowl panels (6) and (17). (See figure 101.)

15. Attach the two fore-and-aft heat exchanger air duct support angles to the cowl well trough with bolts. Bolts are engaged by nut plates fastened to the trough.

16. Install the intermediate section (7) of the heat exchanger air duct on the two fore-and-aft support angles by means of screws.

17. Attach the forward section (3) of the heat exchanger air duct to the wrap cowl with nine nuts and bolts, and to the nose cowl by means of the six Dzus fasteners.

(3) FLAME DAMPERS.

(a) DESCRIPTION.—The flame dampers are of two types; one is the fishtail type which connects to the inboard exhaust collector outlets and the other is the elbow type and it attaches to the heat exchanger tailpipe. Both types of dampers are formed of stainless steel. (Specification AN-QQ-S-757, Cond. A). Their purpose is to eliminate a visible exhaust flame by receiving the exhaust gases and cooling them below the temperature at which they are visible before mixing them with the air stream. The flame dampers are not installed at all times but are used only on special occasions when it is essential that the exhaust gases be invisible.

Note

Four fishtail type flame dampers are furnished on airplanes which do not have heat exchangers.

(b) REMOVAL. (See figure 118.)—To detach the flame dampers, remove the two bolts from the clamp and spread the clamp until it will slip from the beads on the outlet and on the flame damper.

(c) MAINTENANCE.

1. Keep clamps snug but not too tight. The clamps should be loose enough so that they can be rotated by hand.

2. For the repair of any damage such as cracks, puncture holes, or loosened welds, refer to the STRUCTURAL REPAIR MANUAL (AN 01-5MA-3).

(d) INSTALLATION.

(See figure 118.)

1. Slip clamp over the outlet of the exhaust collector with the small diameter of the clamp pointing forward.

2. Place flame damper in position at the outlet. Flame damper is positioned by means of a plug welded to the flame damper and a notch in the exhaust collector outlet.

3. Insert bolts in clamp and tighten them until the clamp is snug but not so tight that it cannot be rotated by hand.

d. ENGINE MOUNT.

(1) DESCRIPTION.—The engine mount is a welded tubular steel structure made of triangular elements which provide four points of support at the fire-

wall end and carry the engine support ring at the forward end. There are eight lugs welded to the support ring which hold the engine mounting bolts.

(2) REMOVAL.—It is assumed that the engine has been removed as described in paragraph b, (3), (c).

(a) Disconnect the couplings on the plumbing which is clipped to the support structure.

(b) Remove oil cooler. (Refer to Par. 16, c, (2).)

(c) Remove the cowl well from the engine support ring. (Refer to Par. 7, d, (2), (i) through Par. 7, d, (2), (m).)

(d) Remove the four bolts (7) which hold the mount to the mounting lugs on the oil tank, taking the lower bolts out first. (See figure 112.)

(e) To facilitate repair work on the mount, remove the oil separator and any lines which are attached to the mount tubes. This may be done after the mount is removed.

(3) MAINTENANCE.

(a) Keep the engine mount clean at all times.

(b) Keep the bolts at the firewall lugs tightened to a torque of 850 to 1300 inch pounds and be sure the nuts are locked with cotter pins.

(c) Keep the surface covered with primer (Specification AN-TT-P-656) to which two ounces of tinting (Navy Specification M-542) have been added for each gallon of primer.

(d) Repair all cracks, holes, or loosened welds. Refer to GENERAL MANUAL FOR STRUCTURAL REPAIR (AN 01-1A-1).

(4) INSTALLATION.

(a) Apply a thin coat of engine oil to the engine mount contact surfaces.

(b) Hold the engine mount in place and insert the bolts with their heads aft through the lugs on the oil tank. Insert the upper bolts first.

Note

Use all new mounting bolts and nuts. Washers

(8) must be used at each bolt head and nut.

(c) Tighten nuts (6) with a torque of 850 to 1300 in.-lb. Do not back off nuts to permit installation of cotter pins.

(d) Attach oil separator and lines to the engine mount tubes.

(e) Install cowl well. (Refer to Par. 7, d, (4), (a) through Par. 7, d, (4), (f).)

(f) Install oil cooler. (Refer to Par. 16, c, (4).)

(g) Attach coupling on the plumbing which is clipped to the support structure.

e. FIREWALL.

(See figure 108.)

(1) DESCRIPTION.—The complete firewall is made up of the forward face of the oil tank and two segments, formed of 24ST alclad, which are attached to sides of the forward face of the oil tank. The function of the firewall is to protect the wing center section from damage in case the engine catches fire during flight. The firewall serves as a support for the aft side of the accessory cowl panels.

(2) REMOVAL.—The assumption is made that the engine and engine mount have been removed.

(a) Open access doors (1), (2), (7), (8), and (12) and remove access panels (9) and (11). (See figure 44.)

Note

All wires are marked with their numbers near their terminals and a wiring diagram is attached to the inside of all junction box covers.

(b) Remove cover from port engine junction box (6) and disconnect wires 274 and 275 from the terminals in the box. (See figure 45.)

(c) Remove cover from the ignition junction box (4) and disconnect the following wires from the terminals in the box: LR1, LL1, RL1, and RR1.

(d) Remove cover from the center wing junction box (3) and disconnect the following wires from the terminals in the box: 917, 244, 243, 34, 51, 83, 323, 919, 324 and 52.

(e) Remove cover from the D.C. junction box (19) and disconnect the following wires from the terminals in the box: 675, 678, 689, 711, 714, 719, 722 and 725.

(f) Remove cover from the A.C. junction box (18) and disconnect the following wires from the terminals in the box: 505, 525, 535, 540, 543, 548, 564 and 569.

(g) Remove cover from the starboard engine junction box (2) and disconnect the following wires from the terminals in the box: 354 and 355.

(h) Remove cover from the port fast-feathering relay junction box (9) and disconnect wires 923 and 916 from the terminals in the box. Unsolder wires 1189, 579, and 580 from the tachometer generator plug located on the side of the box. (See figure 108.)

Note

Wire 1189 is installed only on PBY-5A airplanes with serial numbers 46624 through 46638.

(i) Remove cover from the starboard fast-feathering relay junction box (23) and disconnect wires 922 and 918 from the terminals in the box. Unsolder wires 1190, 659, and 660 from the tachometer generator plug located on the side of the box. (See figure 109.)

Note

Wire 1190 is installed only on PBY-5A airplanes with serial numbers 46624 through 46638.

(j) Disconnect plumbing from the fittings on the aft side of the firewall.

(k) Disconnect power plant control cables at their turnbuckles aft of the firewall. The propeller governor control cables will have to be drawn aft through the firewall; to accomplish this, remove a portion of the fairlead on the aft side of the firewall through which these cables pass.

(l) Disconnect the cowl flap control cables at the turnbuckles near the center of the oil tank.

(m) Remove cover from terminal box on the fast-feathering pump (29) and disconnect the wire from the terminal. (See figure 108.)

(n) Detach flex conduit from fast-feathering pump by loosening the knurled nut and from the oil tank by removing the supporting clip.

(o) Remove cover from the oil dilution solenoid and disconnect the wire from the terminal under the cap.

(p) Detach conduit from the oil dilution solenoid cap by loosening the knurled nut and from the oil tank by removing supporting clips.

(q) Disconnect electrical conduit aft of the firewall from the Cannon type plugs by loosening the conduit nuts.

(r) Remove the four nuts and screws which fasten the Cannon type plugs to the firewall and carefully withdraw plug and wires.

(s) Disconnect the thermocouple wires from the terminal block (5) on the forward face of the firewall and pull them aft through the firewall.

(t) Detach throttle and mixture control cable from the bell cranks (24) and (20) on the oil tank and remove the pulley (19) attached to the bell crank bracket in order to free the carburetor alternate air control cable.

(u) Disconnect the manual starter meshing control handle and actuating rod (25) from the upper bell crank by removing the attaching screws.

(v) Disconnect hydraulic lines from the hydraulic oil reservoir on the starboard outboard firewall. Cover or plug the open ends of all tubes and the openings in the reservoir.

Note

On all PBY-5 airplanes, the hydraulic oil reservoir is mounted on the aft side of the firewall and on all PBY-5 airplanes, it is mounted on the forward side of the firewall.

(w) On all PBY-5 airplanes, remove the two hydraulic lines which lead from the reservoir to the inboard firewall by disconnecting them at the inboard

firewall and by removing clips which attach them to the oil tank.

(x) Remove screws which attach the firewall to the leading edge nacelle adapter. Some of the screws are through the firewall flange and the others are through the web of the firewall.

(y) Detach screws which fasten the firewall to the oil tank and remove the firewall.

(3) MAINTENANCE.

(a) Clean the firewall of any oil, grease, or dirt. Use a soap solution, applying it with a brush or a soft cloth. Rinse thoroughly and dry.

(b) If the neoprene strips along the outer flange are hard, damaged, or missing, replace them.

(c) If the metal surfaces are exposed, apply two coats of primer (Specification AN-TT-P-656) to which two ounces of tinting (Navy Specification M-542) have been added for each gallon of primer. Do not use paint on the firewall.

(d) Repair all cracks, punctures, or holes from gunfire. (Refer to GENERAL MANUAL FOR STRUCTURAL REPAIR (AN 01-1A-1).)

(4) INSTALLATION.

(See figures 108 and 109.)

(a) Place firewall in position and attach it to the oil tank by means of screws and nuts.

(b) Attach firewall to the leading edge nacelle adapter. Use screws and nuts.

(c) Remove covers or plugs from the hydraulic lines and from the openings in the hydraulic reservoir and attach the lines to the reservoir.

(d) Connect the manual starter meshing control handle and actuating rod to the upper bell crank with clevis bolts and nuts.

(e) Attach throttle and mixture control cables to the bell cranks (24) and (20) on the oil tank and install carburetor alternate air control cable and pulley (19). (Refer to Par. 11.)

(f) Insert thermocouple wires through the grommet in the firewall and attach them to the terminal block (5) on the forward side of the firewall.

(g) Clip oil dilution solenoid conduit to the oil tank. Insert wire in conduit through the solenoid cap and attach it to the terminal on the solenoid. Attach cap to solenoid and fasten the conduit to the cap by means of the knurled conduit nut.

(h) Clip fast-feathering pump conduit to the oil tank. Insert wire in the conduit through the terminal box on the pump and attach it to terminal. Attach conduit to the terminal box and replace cover on the box.

(i) Connect the cowl flap control cables at the turnbuckles near the center of the oil tank.

(j) Connect power plant control cables at their turnbuckles aft of the firewall. (Refer to Par. 11.)

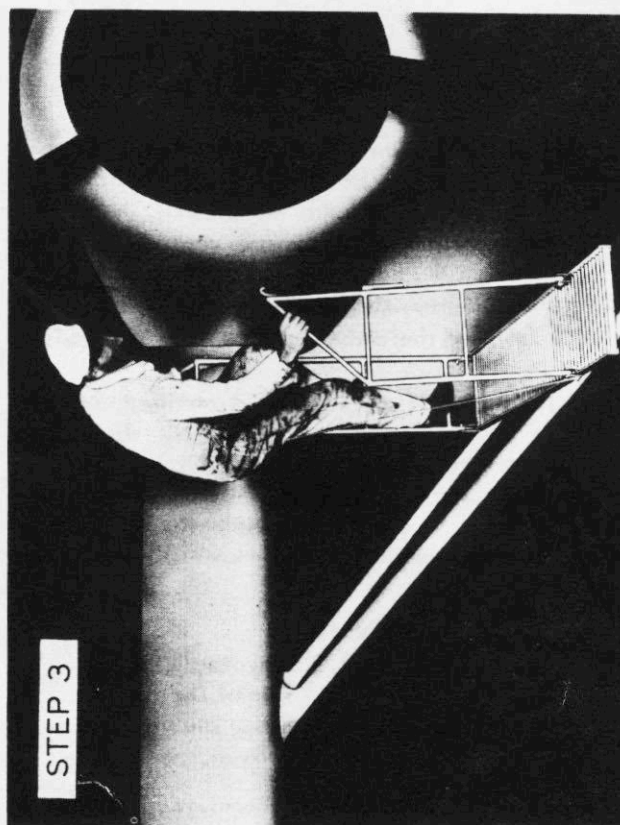
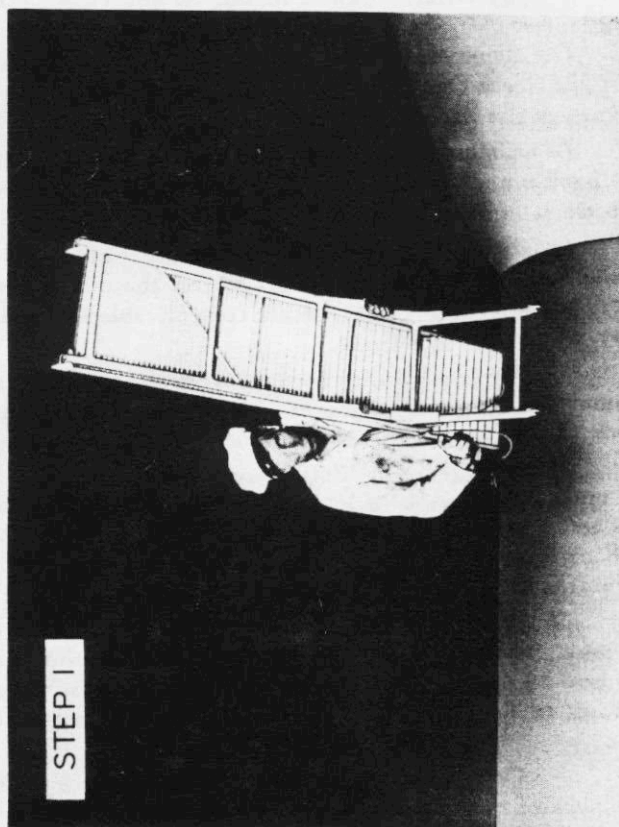
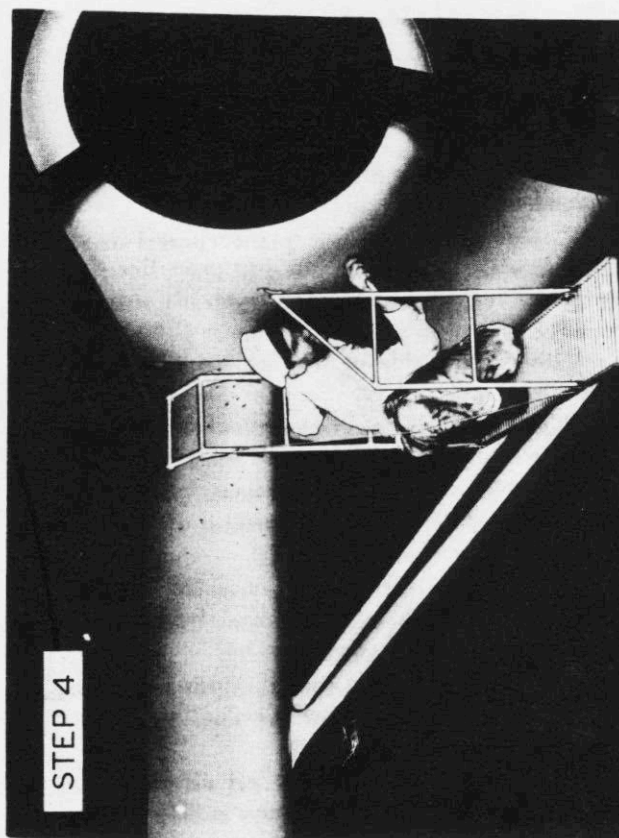
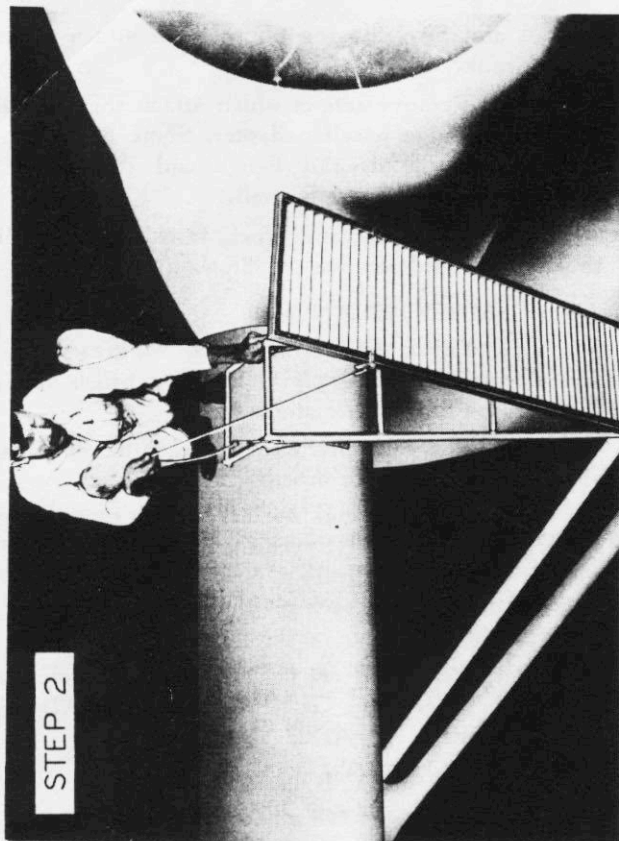


Figure 113—Work Platform Installation Procedure

(k) Connect plumbing to fittings on the aft side of the firewall.

(l) Insert wires through the firewall into the fast-feathering relay junction box and attach conduit to the fitting on the aft side of the firewall. (See figures 108 and 109.)

Note

All wires are marked with their numbers near their terminals and a wiring diagram is attached to the inside of all junction box covers.

(m) In the port fast-feathering relay junction box, connect wires 923 and 916 to their proper terminals and solder wires 1189, 579, and 580 to the tachometer generator plug located on the side of the box.

Note

Wire 1189 is installed only on PBV-5A airplanes with serial numbers 46624 through 46638.

(n) In the starboard fast-feathering relay junction box, connect wires 922 and 918 to their proper terminals and solder wires 1190, 659, and 660 to the tachometer generator plug located on the side of the box.

Note

Wire 1190 is installed only on PBV-5A airplanes with serial numbers 46624 through 46638.

(o) Thread the wires attached to the main electrical plug through their conduit and attach them to the proper terminals in the junction boxes in the leading edge of the wing.

1. The following wires, attached to the starboard plug, connect to terminals in the starboard engine junction box (2): 354 and 355. (See figure 45.)

2. The following wires, attached to the port plug, connect to terminals in the port engine junction box (6): 274 and 275.

3. The following wires from both the port and starboard plugs are connected to terminals in the center wing junction box (3): from the port plug, wires 244, 917, 34, 51, and 243; from the starboard plug, wires 324, 919, 52, 83 and 323.

(p) Thread the wires attached to the generator D.C. plug through their conduit and connect them to the proper terminals in the D.C. power junction box (19). The following wires from both the port and starboard plugs connect in this box: from the port plug, wires 675, 678, 689 and 711; from the starboard plug, wires 714, 719, 722 and 725.

(q) Thread wires attached to the generator A.C. plug through their conduit and connect them to the proper terminals in the A.C. power junction box (18). The following wires from both the port and starboard plugs connect in this box: from the port plug, wires

505, 525, 535, and 540; from the starboard plug, wires 543, 548, 564, and 569.

(r) Thread the wires attached to the ignition plug through their conduit and connect them to the proper terminals in the ignition junction box (4). The following wires from both the port and starboard plugs connect in this box: from the port plug, wires LR1 and LL1; from the starboard plug, wires RL1 and RR1.

(s) Attach all Cannon type plugs to the firewall by means of screws and nuts through their flanges.

(t) Connect conduit to the aft ends of the Cannon type plugs by means of the conduit nuts.

(u) Install covers on all of the junction boxes and close the access doors.

f. ENGINE DIAPHRAGM.

(1) DESCRIPTION.—The engine diaphragm is formed of stainless steel sheet (Specification AN-QQ-S-757). It is made in two sections joined together at the sides by screws where the two sections overlap. The engine diaphragm is held in place by the flexible pedestal mount studs. Its purpose, when used with the cowl well, is to protect the carburetor and accessory compartment from the heat of the exhaust collector ring.

(2) REMOVAL.

(See figure 112.)

(a) Remove engine from engine mount. (Refer to paragraph b, (3), (c).)

(b) Slip engine diaphragm from the pedestal mount studs. The diaphragm may be removed in one piece or the two sections of which it is composed may be separated at their joints and each section removed separately.

(3) MAINTENANCE.

(a) Clean the diaphragm of any oil, grease, or dirt. Use a soap solution and apply it with a brush or soft cloth. Rinse thoroughly and dry.

(b) Repair all cracks, punctures or holes from gunfire (Refer to STRUCTURAL REPAIR MANUAL (AN 01-5MA-3).)

(4) INSTALLATION.—Reverse the removal procedure as outlined in paragraph f, (2).

g. ENGINE WORK PLATFORM.

(1) DESCRIPTION.—The work platform is composed of two steel tube trussed frames connected across the bottom with an aluminum alloy corrugated platform riveted to two aluminum alloy bulb angles, one on each side. The assembly is hinged at the bottom of the two trussed frames and is collapsible. A flexible steel cable on the outside of the work platform connects the forward end of the platform with the top of the rear frame. Another cable is provided on the inside of the platform to be connected to the top of the rear truss in the same manner as the outside cable in case the work platform is used without the nose cowl in place. Ordinarily the front trussed frame hooks into a slot provided in the

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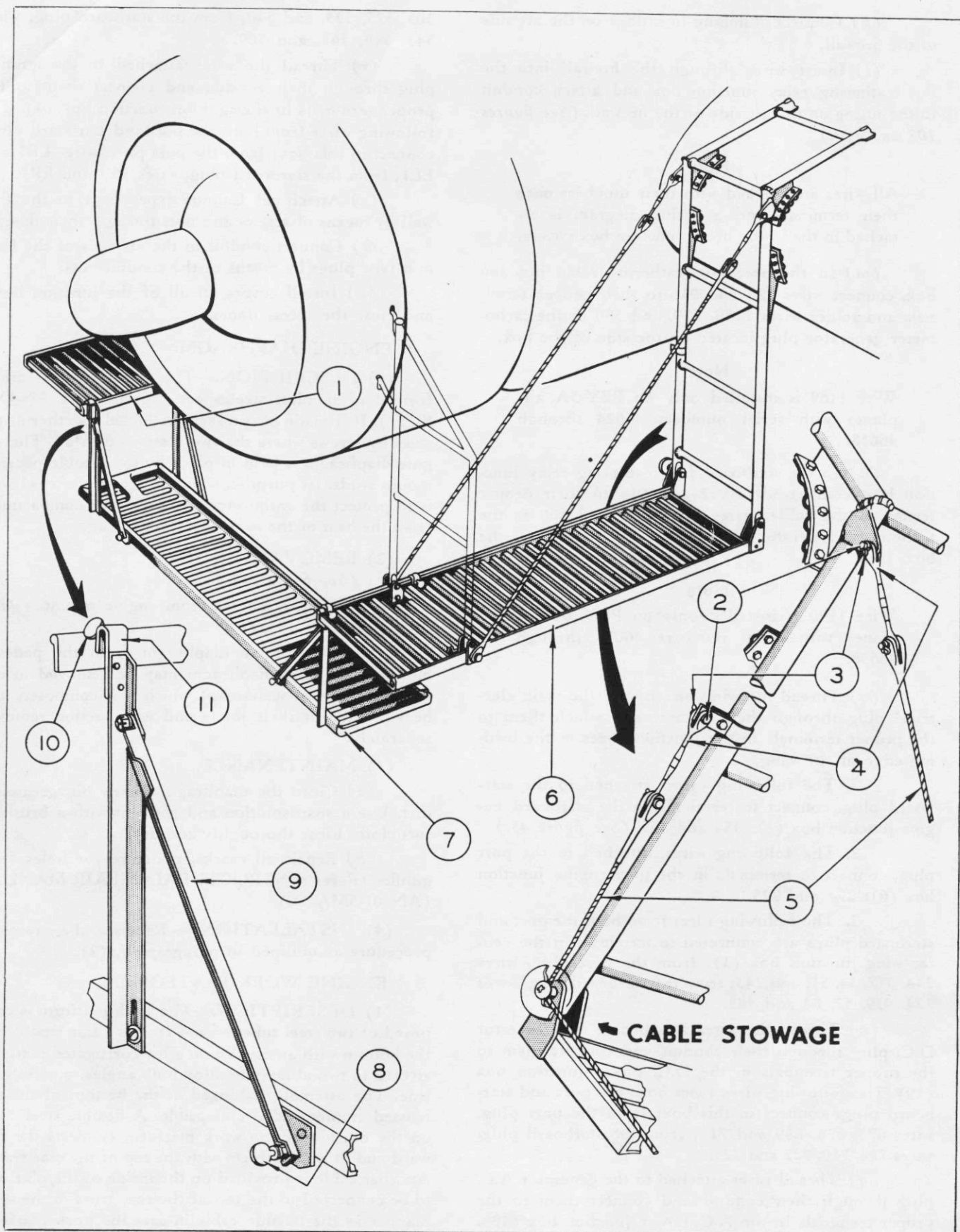


Figure 114—Engine Work Platform

No.	PART No.	NAME	No.	PART No.	NAME
1	28F1370-60R	Work Platform Assembly	6	28F1370-60L	Work Platform Assembly
2	AN393-11	Flathead Pin	7	28B2219-0	Cross Platform
3	AN380-2-2	Cotter Pin	8	28F1495-8	Thumbscrew
4	AN130-16S	Turnbuckle Assembly	9		Brace
5	28F1370-29	Cable Assembly	10	28F1495-7	Thumbscrew
			11		Hook

former of the nose cowl. An adjustable brace from the front truss also attaches to another slot in the former of the nose cowl. The assemblies are left and right hand parts and are used on their respective sides of the nacelle. The section of the hull walkway between stations 6.00 and 6.60 is used as a cross platform to connect the two work platforms on either side of the nacelle.

(2) INSTALLATION.

(See figure 113.)

(a) SIDE PLATFORMS.—The procedure outlined below applies to either the right or left-hand work platform.

1. To install the side platforms, walk out on the wing with the platform folded and place the hooks on the end of the longer trussed frames into the hook sockets in the leading edge on either side of the nacelle. (See step 1 in figure 113.)

2. With the forward trussed frame still folded, lower the platform by means of the cable by hand till the platform is in a horizontal position. (See step 2 in figure 113.)

3. Climb down to platform and raise front section and hook the hook into the slot provided for it in the former ring of the nose cowl. (See step 3 in figure 113.)

4. Place the locking link into the lower slot provided for it in the former ring of the nose cowl. With the lock in the slot, turn it 90 degrees to lock. Adjust the link to the required length. (See step 4 in figure 113.)

Note

If the nose cowl is to be removed or is not in place when the work platforms are installed, the hook and connecting link on the front trussed frame cannot be used. In this case, remove the inside cable (5) (the cable closest to the engine) from its stowed position (See figure 114.) by removing cotter key (3) and flat head pin (2).

Then connect the forked end of the turnbuckle assembly to the lug provided for it at the top of the inside member of the rear trussed frame. With the inside cable connected as shown in figure 114, there will be two cables supporting the front end of the platform.

(b) CROSS PLATFORM. (See figure 114.)—

If the cross platform is desired, hang it between the side platforms by means of the hooks (11) provided for that purpose. Screw the thumbscrews (10) down to hold the cross platform firmly. Also hook braces (9) in position as shown and tighten thumbscrews (8). The cross platform can be slid fore and aft.

(3) REMOVAL AND STOWAGE.

(a) To remove the work platforms, reverse the operations outlined in paragraph g, (2).

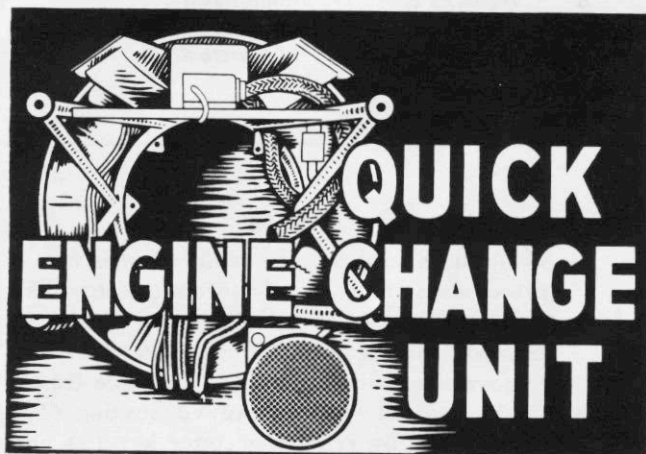
(b) Replace the cross platform in its place as a hull walkway between bulkhead 6 and station 6.60.

(c) Stow the side work platforms in their stowage positions next to the bunks between bulkheads 5 and 6.

(d) Each platform is strapped in its stowage position by three straps.



PARAGRAPH 9.



consists of all items or parts mounted in or attached to the engine mounts and all parts forward of the oil tank and firewall which are removed with the engine and engine mounts. Included with the unit is a canvas engine cover.

The parts are formed into several assemblies which can be rapidly installed on the airplane after removing a minimum number of parts from each assembly.

Figure 116 shows the assembly of the engine mount, exhaust collector shroud, oil cooler, electrical conduit and junction box and several other parts. On this assembly the exit fairing must be removed from the exhaust collector shroud before complete installation of the power plant can be attained.

Figure 115 shows loose parts which cannot be installed until the engine and its accessories have been installed and the engine mount and shroud assem-

9. QUICK ENGINE CHANGE UNIT.

a. DESCRIPTION.—The quick engine change unit

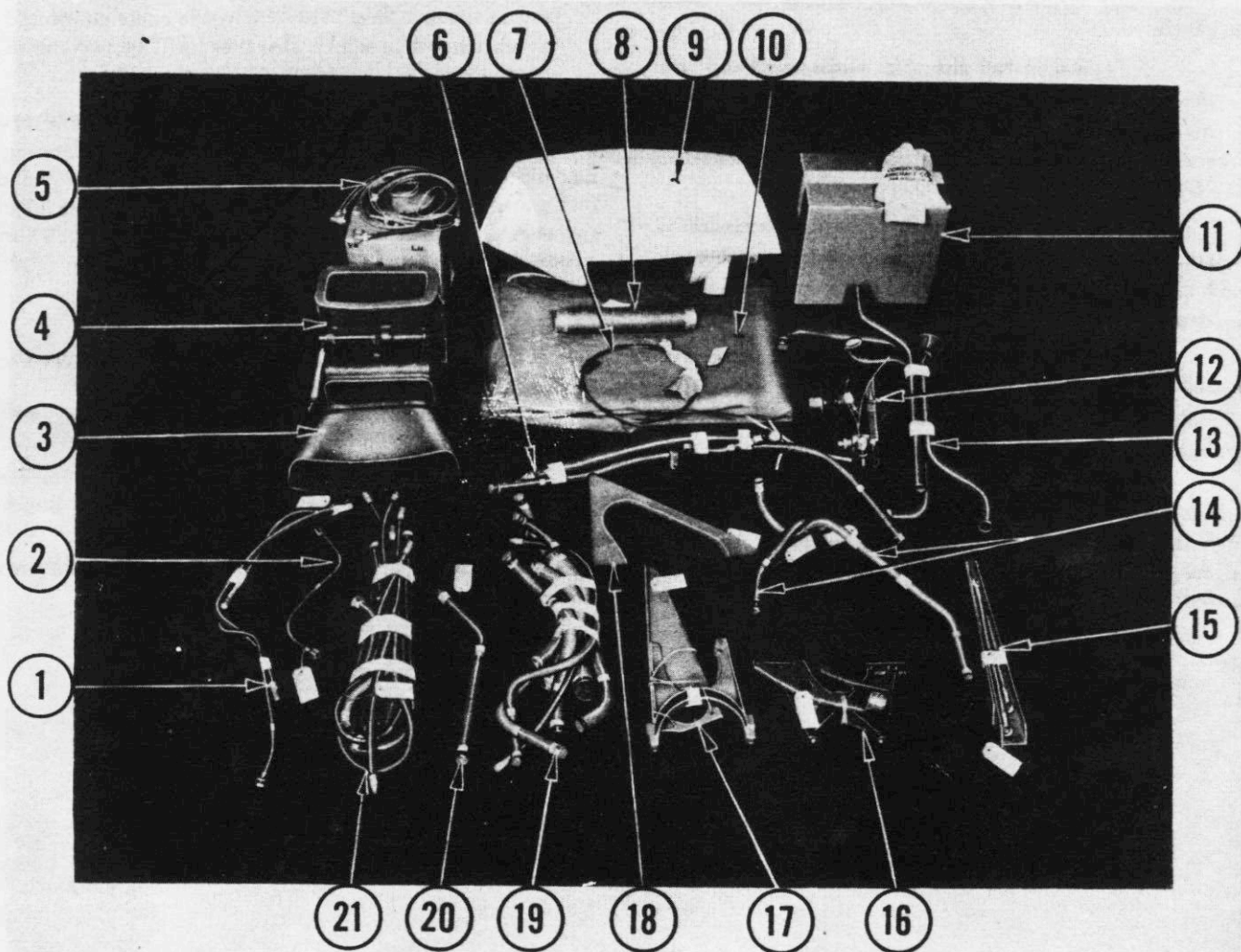


Figure 115—Quick Engine Change Unit—Parts and Installation Units

bly have been attached to the oil tank and firewalls.

The engine cowling shown on figure 117 must be partially disassembled before final installation on the power plant.

Figure 118 shows all parts (in their correct rela-

tionship to each other) that make up a complete exhaust collector ring assembly.

b. INSTALLATION.—For installation of the several assemblies and various parts which make up the quick engine change unit, refer to Par. 8.

No.	PART No.	NAME	No.	PART No.	NAME
1	*28P5539-16	Tube—Prop. Anti-Icer—Port		28P5105-6R	Brace—Outb'd. Stb'd.
	*28P5539-17	Tube—Prop. Anti-Icer—Stb'd.		28P5104-L	Brace—Inb'd. Port
	**28P5060-29	Tube—Prop. Anti-Icer—Port		28P5104-R	Brace—Inb'd. Stb'd.
	**28P5060-30	Tube—Prop. Anti-Icer—Stb'd.	16	**28P5110	Brace—Starter
	28G3014-8	Hose Assembly—Short		**28P5071	Bearing—Starter
	32P079-9	Hose Assembly—Long	17	*28P5529-6	Bracket—Generator
2	**28P5168-2	Starter Drain Line		**28P5170-10	Bracket—Generator
3	28P5007	Duct—Carburetor Air Intake		28P5170-11	Strap—Generator
4	28P5008-K2	Elbow—Carburetor Air		28P5169	Brace—Generator
5		Electrical Wiring	18	28-0-5014	Bracket—Oil Cooler
6	28P5000-9	Tube—Prop. Feathering	19	28-0-5000-10	Line—"Hot" Oil
	28P5000-12	Tube Assembly		28-0-5000-17	Line—Accessory Breather
	28P5146	Hose Assembly		28-0-5000-19	Line—Power Breather
7	28P1137-44	Cable—Prop. Control—Port		28-0-5000-27	Line—Oil Return
	28P1137-45	Cable—Prop. Control—Stb'd.		28-0-5000-28	Line—Oil to Engine
8	32P1409-7	Generator Blast Tube		28-0-5000-30	Line—Engine to Tank Vent
9	28-0-5015-5	Oil Cooler Air Scoop		29-0-1028-3	Line—Oil Pressure—Port
10	28J3000	Engine Cover		29-0-1028-4	Line—Oil Pressure—Stb'd.
11		Bolts, Nuts, Screws, Etc.		32-0-001-21	Line—Power Breather
12	3P-207-JA (Pescor Products Co.)	Vacuum Pump	20	*28F3076-40	Line—Vacuum Pump—Port
	28F4120	Nipple—Pump to Valve		**28F3076-65	Line—Vacuum Pump—Port
	AN913-1D	Plug—Nipple		28F3076-41	Line—Vacuum Pump—Stb'd.
	3V-216 (Pescor Products Co.)	Vacuum Relief Valve	21	28G5142-13	Tube—Fuel to Pump—Stb'd.
	28-0-5032	Bracket—Relief Valve		28G5142-54	Tube—Fuel to Pump—Port
	AN842-12D	90° Fitting—Relief Valve		28G5142-58	Tube—Carburetor Fuel
	AN842-10D	90° Fitting—Pump		28G3014-6	Hose—Engine Primer
13	32P281	Magneto Blast Tube		22Q180-6-3	Chafing Hose—Stb'd. Fuel Line
	28P5127-6	Magneto Blast Tube		29G1087-7	Hose—Engine Gage Vent
	28P5127-10	Magneto Blast Tube		32P079-9	Hose—Carburetor Vent
14	28-0-3012-8	Tube—Pump to Separator		AN878-6-156	Hose—Fuel Pressure—Port
	28-0-3012-62	Tube—Separator to Engine		AN878-6-171	Hose—Fuel Pressure—Stb'd.
15	32P089-10	Rod—Cowl Flap—L. H.		AN878-12-13	Hose—Fuel to Pump
	32P089-11	Rod—Cowl Flap—R. H.		Q2202-12-3.5	Hose—Carburetor Fuel
	28P5105-L	Brace—Outb'd Port		Q2202-12-14.25	Hose—Cross-Feed—Stb'd.
				Q2202-12-19	Hose—Fuel to Pump—Stb'd.
				Q2202-12-21.75	Hose—Carburetor Fuel

*PBY-5A only.

**PBY-5 only.

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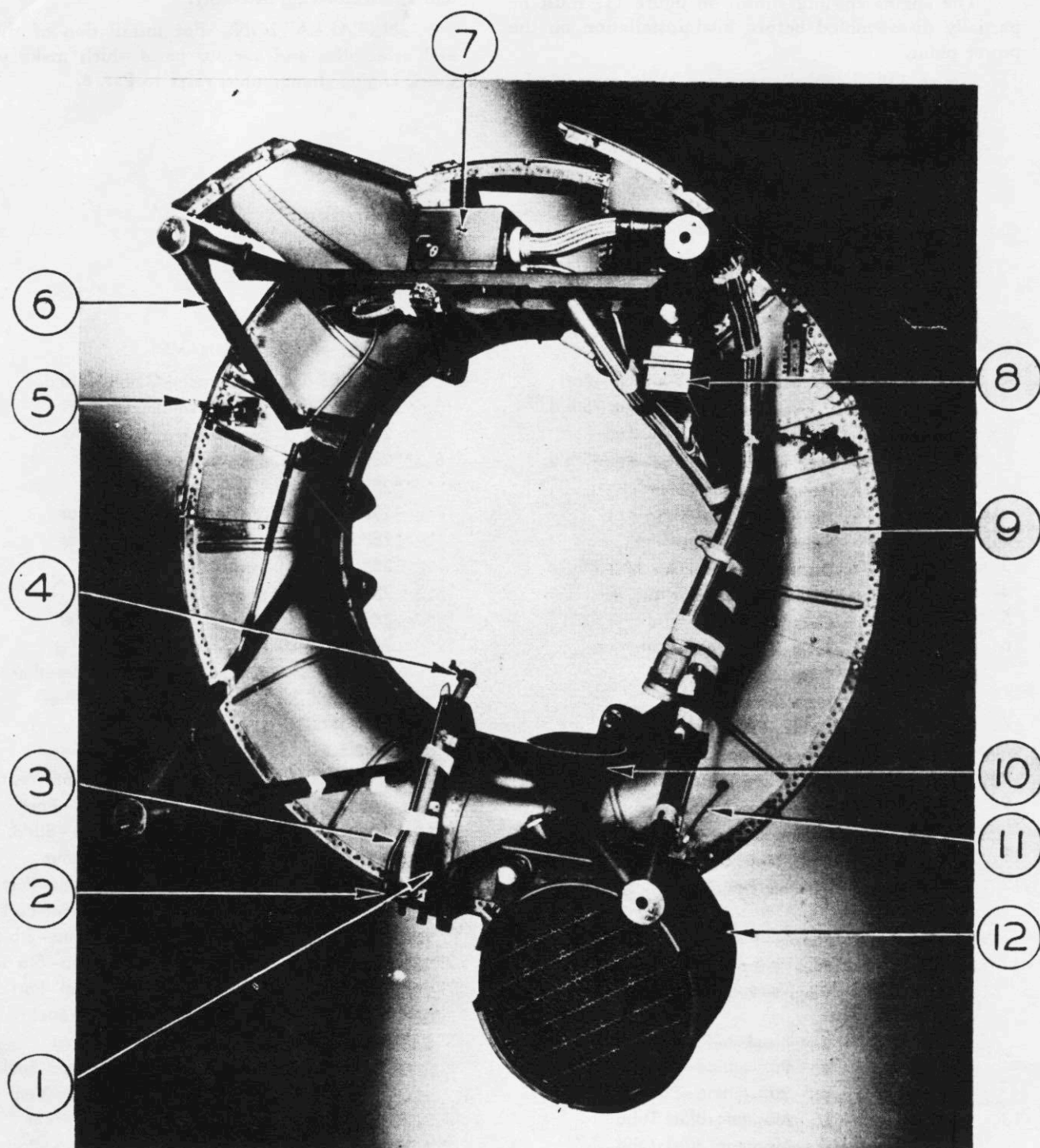


Figure 116—Quick Engine Change Unit—Engine Mount and Shroud Assembly

See Page 213 for Index Numbers

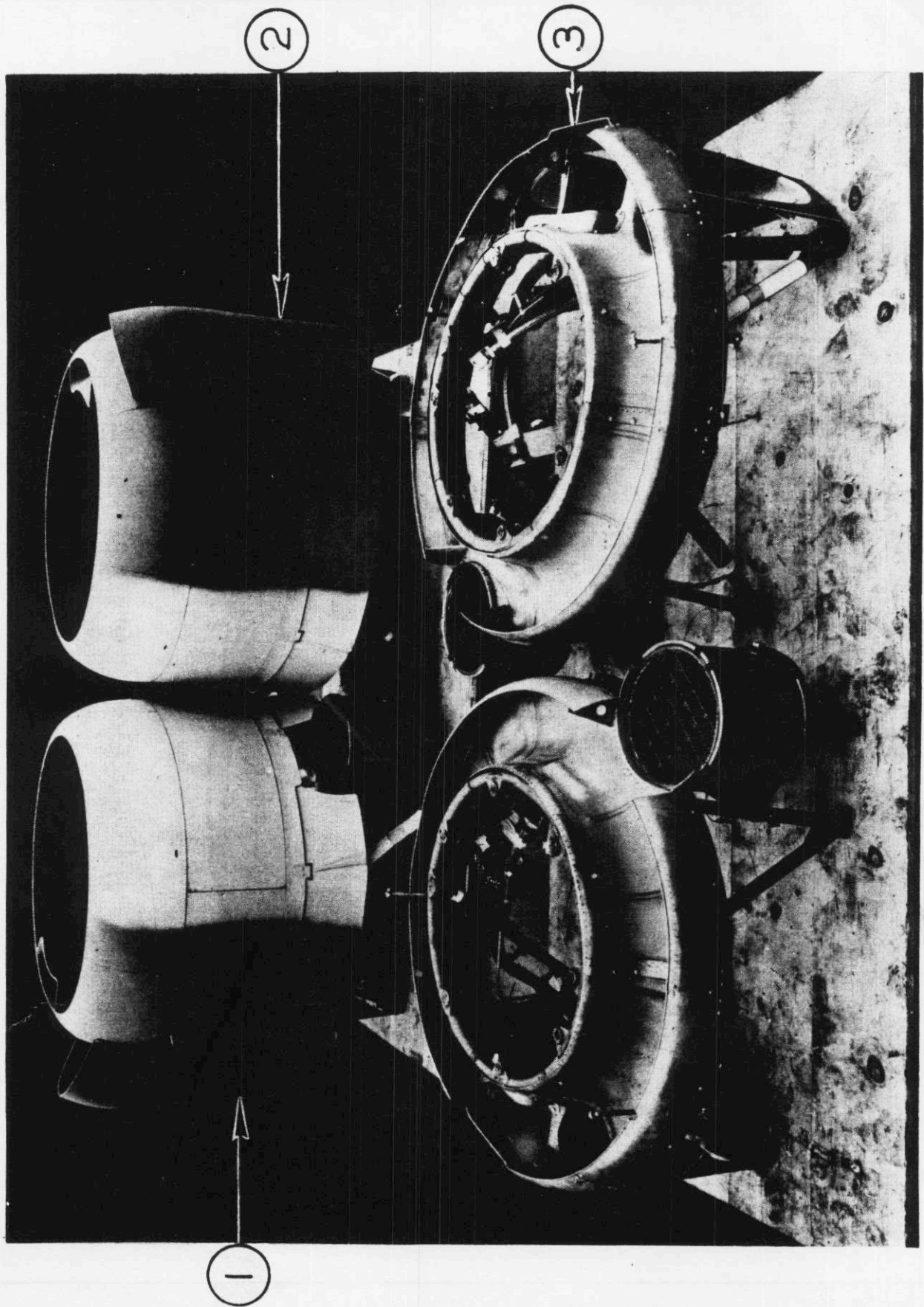


Figure 117—Quick Engine Change Unit—Cowling and Mount Assembly (See Page 213 for Index Numbers)

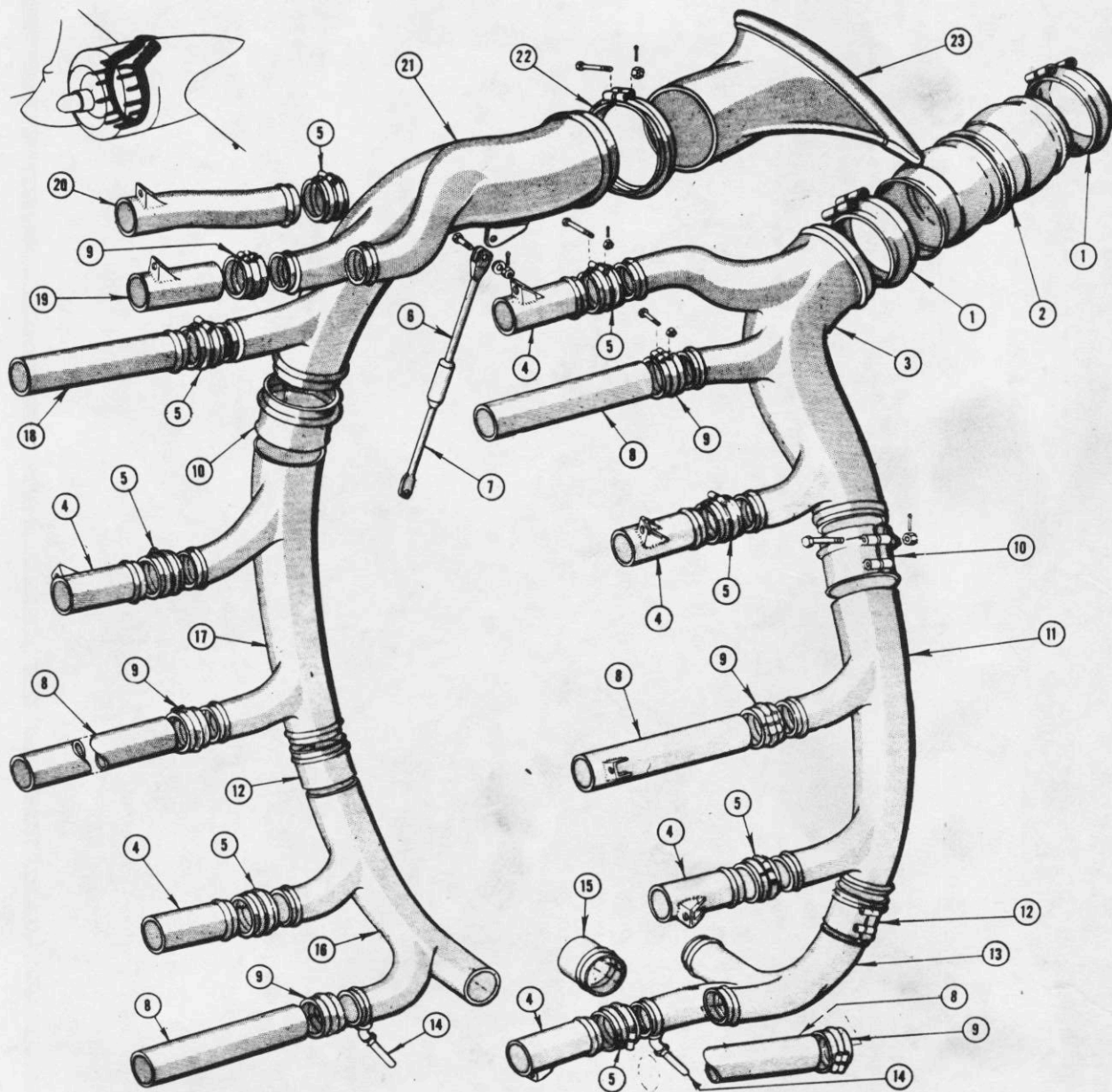


Figure 118—Quick Engine Change Unit—Exhaust Collector Ring

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Section IV

No.	PART No.	NAME	No.	PART No.	NAME
1	28-O-5000-18	Hose—Breather Line	7	*28E5053-50	Electrical Install.—Port
2	28P5080	Drain Gang		*28E5053-60	Electrical Install.—Stb'd.
3	28G5050	Hose—Fuel Pump Drain		**28E5053-96	Electrical Install.—Port
4	28G5142-83	Hose—Blower Case Drain		**28E5053-97	Electrical Install.—Stb'd.
5	28P5045-2R	Bell Crank—Outb'd R. H. Nac.	8	Type 561 Model 2	Oil Separator
	28P5045-2L	Bell Crank—Outb'd L. H. Nac.		(Eclipse Aviation Corp.)	
	28P5045-R	Bell Crank—Inb'd R. H. Nac.	9	28P5003-3	Exhaust Collector Shroud
	28P5045-L	Bell Crank—Inb'd L. H. Nac.	10	28P3082-5	Scupper—Oil Strainer
6	28B5000	Engine Mount	11	28F3076-35	Tube—Manifold Pressure—Port
	1Q531-7	Bolt—Engine Mount		28F3076-34	Tube—Manifold Pressure—Stb'd.
	AN310-10	Nut	12	U6012C-S-130	Oil Cooler
	28P1143	Washer		(United Aircraft Products)	
	AN380-C4-6	Cotter Pin			

*PB5-5A only.

**PB5-5 only.

Index Numbers for Figure 116

No.	PART No.	NAME
1	*28D5000-4R	Engine Cowl Assem.—Stb'd.
	**28D5000-3R	
2	*28D5000-4L	Engine Cowl Assem.—Port
	**28D5000-3L	
3	(See figure 116)	Engine Mount & Shroud Ass'y.
	*PB5-5A and PB5-5 (Serial numbers 08349 and on).	
	**PB5-5 (up to serial number 08349).	

Index Numbers for Figure 117

No.	PART No.	NAME	No.	PART No.	NAME
1	***3-1056-51	Clamp—Ball Joint		AN310-4	Nut
	AN4-14	Bolt		AN380-C2-2	Cotter Pin
	AN310-4	Nut	11	28P5048-38	Section Assembly
	AN380-C2-2	Cotter Pin	12	28P5048-44	Clamp—Section Assem.
2	***3-1169	Ball Joint		AN4-14	Bolt
3	***12-1111-13-14-1	Outlet Assembly—Port		AN310-4	Nut
	***12-1112-2-3-4	Outlet Assembly—Stb'd.		AN380-C2-2	Cotter Pin
4	28P5142-11	Exhaust Stack—Rear Cyl.	13	28P5048-10	Section Assembly
5	28P5048-47	Clamp—Exhaust Stack	14	28P5029-10	Drain Tube
6	1-2692	Strut—Stb'd. Side of Nacelle		AC811-FT-6	Nipple—Drain Tube
	1-2637	Strut—Port Side of Nacelle		AC811-BT-6	Nut—Drain Tube
	AN24-8	Clevis Bolt		AC811-T-6	Sleeve—Drain Tube
	AN310-4	Nut	15	28P5048-48	Clamp—Section Assem.
	AN380-C2-2	Cotter Pin		AN4-14	Bolt
	AN960-416L	Washer		AN310-4	Nut
7	*3-1178	Strut—Stb'd. Side of Nacelle		AN380-C2-2	Cotter Pin
	**1-2691	Strut—Stb'd. Side of Nacelle	16	28P5048-9	Section Assembly
	1-2635	Strut—Port Side of Nacelle	17	28P5048-37	Section Assembly
	AN4-12	Bolt—Strut Collar	18	28P5142-9	Exhaust Stack—Front Cyl.
	AN310-4	Nut	19	28P5142-10	Exhaust Stack—Rear Cyl.
	AN380-C2-2	Cotter Pin	20	28P5142-6	Exhaust Stack—Front Cyl.
8	28P5048-11	Exhaust Stack—Front Cyl.	21	12-1096-2-3-4	Outlet Assembly
9	28P5048-6	Clamp—Exhaust Stack		12-1096-13-14-1	Outlet Assembly
	AN3-14	Bolt	22	3-1002-51	Clamp—Flame Damper
	AN310-3	Nut		AN4-20	Bolt
	AN380-C2-2	Cotter Pin		AN310-4	Nut
10	28P5048-45	Clamp—Section Assem.		AN380-C2-2	Cotter Pin
	AN4-14	Bolt	23	9-247	Flame Damper

*PB5-5A only.

**PB5-5 only.

***PB5-5A and PB5-5 (Serial number 08349 and on).

Items 22 and 23 are not furnished with the Quick Engine Change Unit.

Items 1, 2, 3, 6, 7, 21, 22, and 23 are Solar Aircraft part numbers.

Index Numbers for Figure 118

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PARAGRAPH 10.

ENGINE ACCESSORIES.

a. GENERAL.—All the engine accessories are discussed under the various paragraphs of Section IV dealing with the subject with which each accessory is most intimately connected.

b. FUEL PUMP.

(See Par. 15, b, (8).)

c. GENERATOR.

(See Par. 22, b.)

d. VACUUM PUMP.

(See Par. 19, e, (2).)

e. HYDRAULIC PUMP.

(See Par. 21, b, (2).)

f. TACHOMETER GENERATOR.

(See Par. 22, s, (1).)

g. STARTER.

(See Par. 12, b.)

PARAGRAPH 11.



11. POWER PLANT CONTROLS.

a. GENERAL.—The following power plant controls are operated and controlled from the pilot's compartment: the throttle, the propeller governor, the propeller fast feathering pump, and the ignition.

The following power plant controls are operated and controlled from the engineer's compartment: the mixture, the cowl flaps, the carburetor alternate air door, the primer pump, the emergency fuel pump, the fuel selector valves, the starter, and the oil dilution solenoid.

b. THROTTLE CONTROL.

(1) THROTTLE AND PROPELLER CONTROL UNIT.

(a) DESCRIPTION.—The control unit is located above and between the pilot and copilot in the pilot's compartment. It consists of two pairs of levers; one pair for the throttle, and the other for the propeller rpm. Also incorporated into the unit are four idler pulleys and sufficient spacers to obtain the correct alignment of pulleys and control levers. The levers are so arranged that both throttle or propeller levers can be operated either simultaneously or individually.

(b) REMOVAL.

(See figure 119.)

1. Remove cables from unit. (See paragraph b., (2), (b), 5.)

2. Remove unit (20) from the airplane by removing the ten bolts (19) that attach it to the bracket in the ceiling of the pilot's compartment.

3. Detach taper pin (21) from frame (11) by removing nut and cotter pin, and then tapping taper pin out.

4. Detach frame assembly bolts and the axle bolt (25), and then remove the four pulleys (4).

5. Remove the wing nuts (18) from the lever shaft (9), and then remove shaft from the assembly. All spacers, washers, and pulleys may then be removed.

(c) MAINTENANCE.—At time of disassembly, oil shaft with light oil (Specification AN-O-6).

(d) INSTALLATION.

(See figure 119.)

1. Assemble spacers, washers, pulleys, and lever shaft to frames by reversing removal procedure outlined in paragraphs 3 through 5 above.

2. Attach all cables, and then install the guard bolts.

3. Install the control lever assembly (20) in the airplane by means of the ten bolts (19).

4. After connecting the cables by means of the turnbuckles in the navigator's compartment, tighten the wing nuts (18) to obtain desired friction for control levers.

(2) THROTTLE CONTROL CABLE SYSTEM.

(a) DESCRIPTION. (See figure 120.)—The throttle controls are connected to the control levers (located above and between the pilot and copilot) by means of a system of cables, pulleys, and actuating rods. The cables are routed from the control levers aft, through fair-leads at stations 2.0 and 3.0, over pulleys on the forward face of bulkhead 4, and then up the superstructure to another bank of pulleys on the front spar. From there, the cables proceed outboard along the front spar to a bank of pulleys on the front spar in each of the nacelles. From these pulleys, the cables run forward through the firewall, and over a bank of pulleys on the firewall to bell cranks and actuating rod assemblies which directly operate the throttle control lever on the carburetor. These bell cranks are attached to the forward face of the oil tank. All throttle control cables are identified by a $\frac{3}{8}$ inch wide green band near each terminal.

(b) REMOVAL.

1. By removing screws and loosening Dzus fasteners, open panels (14), (14 B), (15), and (16) in center section leading edge for access to pulleys in the leading edge. (See figure 20.)

2. Remove cable guard bolts from pulleys (24), (34), (41), (59), and (65). At pulleys (41) and (59), guard bolts are held in place by nutplates. Access to pulleys in the nacelle is gained by opening the inboard panel over the leading edge and by raising the inboard aft short wrap cowl. (See figure 120.)

3. Remove the following fair-leads: (62) on the aft face of bulkhead 2, the two fair-leads (61) for-

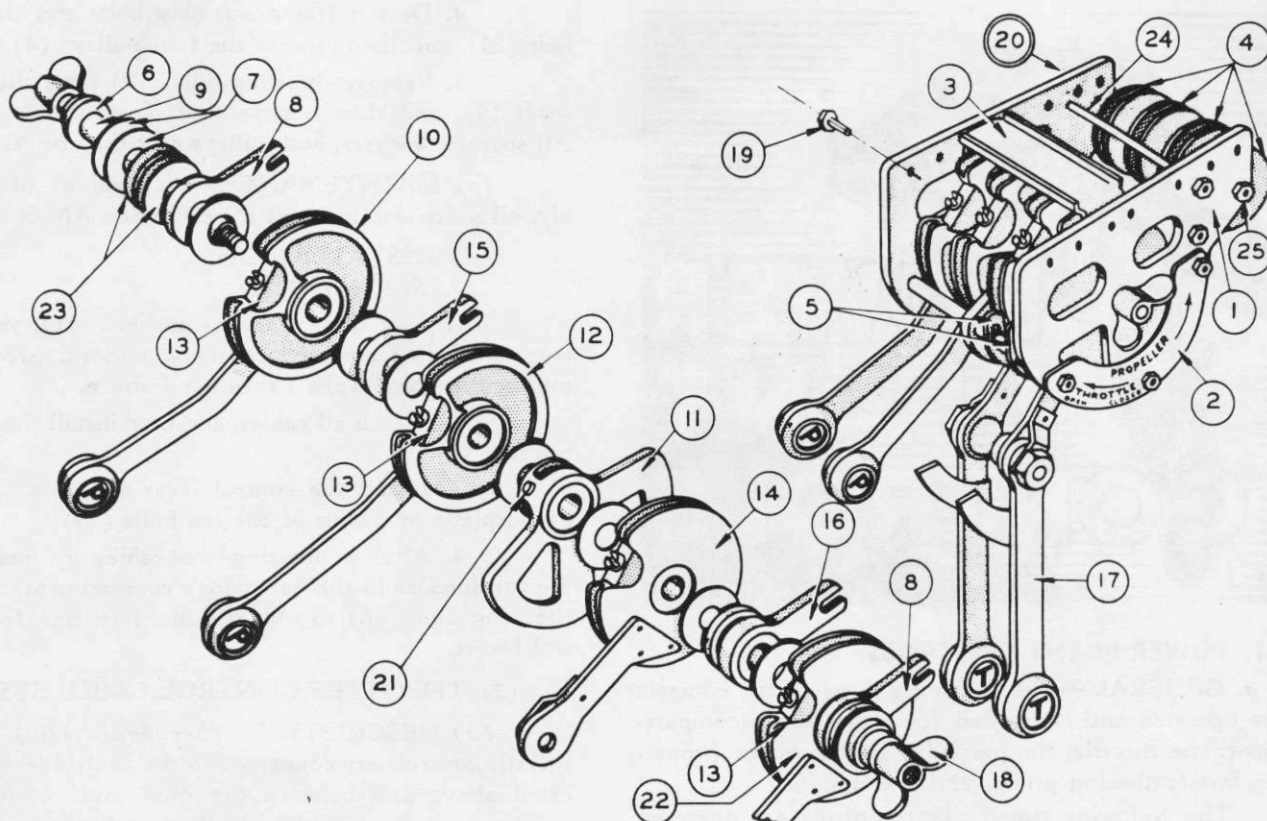


Figure 119—Trottle and Propeller Control Unit

No.	PART No.	NAME	No.	PART No.	NAME
1	28P1046 L/R	Frame	18	AN350-7	Wing Nut
2	28P1044 L/R	Nameplate	19	AN3DD5A	Bolts
3		Guard		AN365-D1032	Nuts
4	AN210-2A	Pulleys	20	28P1050-5	Control Unit Assembly
5	28P3063 L/R	Stops	21	AC386-1-11	Taper Pin
6	28P1038	Bushing		AN960-10	Washer
7	28P1161	Steel Friction Disc		AN380-B2-2	Cotter Pin
8	28P1039-3	Spacer		AN320-3	Nut
9	28P1047	Shaft Assembly	22	28P1072-2	Lever
10	28P1041-3	Lever	23	Q7024-N41-091	Rubber Friction Washers
11	28P1042	Center Frame	24	AN3-51	Bolt
12	28P1041-2	Lever		AN320-3	Nut
13	22P076	Cable Lock		AN380-B2-2	Cotter Pin
14	28P1072-3	Lever	25	AN3-51	Bolt
15	28P1039-4	Spacer		AN320-3	Nut
16	28P1040	Spacer		AN380-B2-2	Cotter Pin
17	28P1043 L/R	Extension			

ward of bulkhead 4, fair-leads (45) and (52) located in the superstructure, and the fair-lead (25) on the rear face of the firewall. Each of these fair-leads is split along several lines. Remove only the portions of the fair-lead necessary for withdrawal of the throttle cables. Access to fair-leads (45) and (52) in the superstructure may be attained by removing panels (3) and (4) on each side of the forward face of the superstructure. (See figure 64.)

4. Disconnect bonding braid attached to cables forward of firewall.

5. After breaking the safety wiring and disconnecting the turnbuckles aft of station 3.0, remove the throttle cables from the control lever assemblies (14) and (22) by detaching cable locks (13) and prying back cable guard (3) to permit withdrawal of cables. (See figure 119.)

6. Remove the two arms (57) from the throttle warning switch (58) by loosening the nut which fastens them to the plunger. Slide arms off cables. (See figure 120.)

7. Detach connecting rods (10) by removing the bolt at each end.

8. Remove the short lengths of cables (22) and (27) by withdrawing them forward through the firewall after detaching them from bell cranks (16).

9. Remove the remaining cables (53) and (54) from the superstructure by withdrawing these cables forward through the bank of pulleys on bulkhead 4. Before withdrawing these cables, attach guide wires to their ends at the firewall. The guide wires should be longer than the length of cable to be removed. The guide wires are attached to simplify the installation of the cables.

(c) MAINTENANCE.—For maintenance of cables and pulleys, see Par. 18, b., (3).

(d) INSTALLATION.
(See figure 119.)

1. Reverse removal procedure of paragraph b., (2), (b).

2. Check position of control lever at the carburetor against position of the control handle in the pilot's compartment. Watch for reversed controls. Control lever at the carburetor moves forward to open throttle.

3. Set control handle so that there is $\frac{1}{4}$ inch cushion both in the "OPEN" and "CLOSED" positions when the carburetor lever is against the open and closed stops. Synchronize the control handles in the "CLOSED" position (aft). Adjustment to gain the desired cushion may be obtained by loosening the cable locks (13) on the control lever assemblies (14) and (22), slipping the control handle, and then retightening the cable locks when adjustment is correct.

4. Tighten at all turnbuckles to give required tensions as outlined in Section IX, Table A.

5. For safetying of turnbuckles, see Par. 18, d., (4), (b), 6.

6. Adjust throttle warning switch actuating stops to operate the warning switch when the throttles are set for 15 inches of mercury manifold pressure.

c. PROPELLER RPM CONTROL.

(1) THROTTLE AND PROPELLER CONTROL UNIT.

(See paragraph b., (1).)

(2) PROPELLER RPM CONTROL CABLE SYSTEM.

(a) DESCRIPTION. (See figure 120.)—The propeller rpm control levers, located above and between the pilot and copilot, are connected to the propeller governor by means of a system of cables and pulleys. The cables are routed from the control levers aft through fair-leads at stations 2.0 and 3.0, over pulleys on the forward face of bulkhead 4, and then up the superstructure to another bank of pulleys on the front spar. The cables proceed outboard along the front spar to a bank of pulleys on the front spar in each of the nacelles. From these pulleys, the cables run forward through the firewall, over pulleys on the aft side of the exhaust collector shroud, and then through the exhaust collector shroud. They then pass through fair-leads on the engine cowl former and over a pair of pulleys in the nose cowl to the pulley on the propeller governor. These cables are identified by a $\frac{3}{8}$ inch wide black band near each turnbuckle fitting.

(b) REMOVAL.

1. By removing screws and loosening Dzus fasteners, open panels (14), (14 B), (15), and (16) in center section leading edge to gain access to pulleys and fair-leads in leading edge. (See figure 20.)

2. Access to cables, turnbuckles, pulleys, and fair-leads in the nacelle is gained by opening the forward and aft wrap cowls (1) and (17) and the door (12) over the leading edge on the inboard side of the nacelles. (See figure 101.)

3. Remove the following fair-leads: fair-lead (62) on the aft face of bulkhead 2; the two fair-leads (61) forward of bulkhead 4; fair-leads (45) and (52) located in the superstructure; fair-lead (38) in the leading edge; fair-lead (25) on the rear face of the firewall; and fair-lead (13) on the rear engine cowl former. Each of these fair-leads is split along several lines. Remove only the portions of the fair-lead necessary for withdrawal of the propeller rpm cables. Access to fair-leads (45) and (52) in the superstructure may be attained by removing panels (3) and (4) on each side of the forward face of the superstructure. (See figure 120.)

4. Disconnect bonding braid attached to cables forward of the firewall.

5. After breaking the safety wiring and disconnecting the turnbuckles aft of station 3.0, remove

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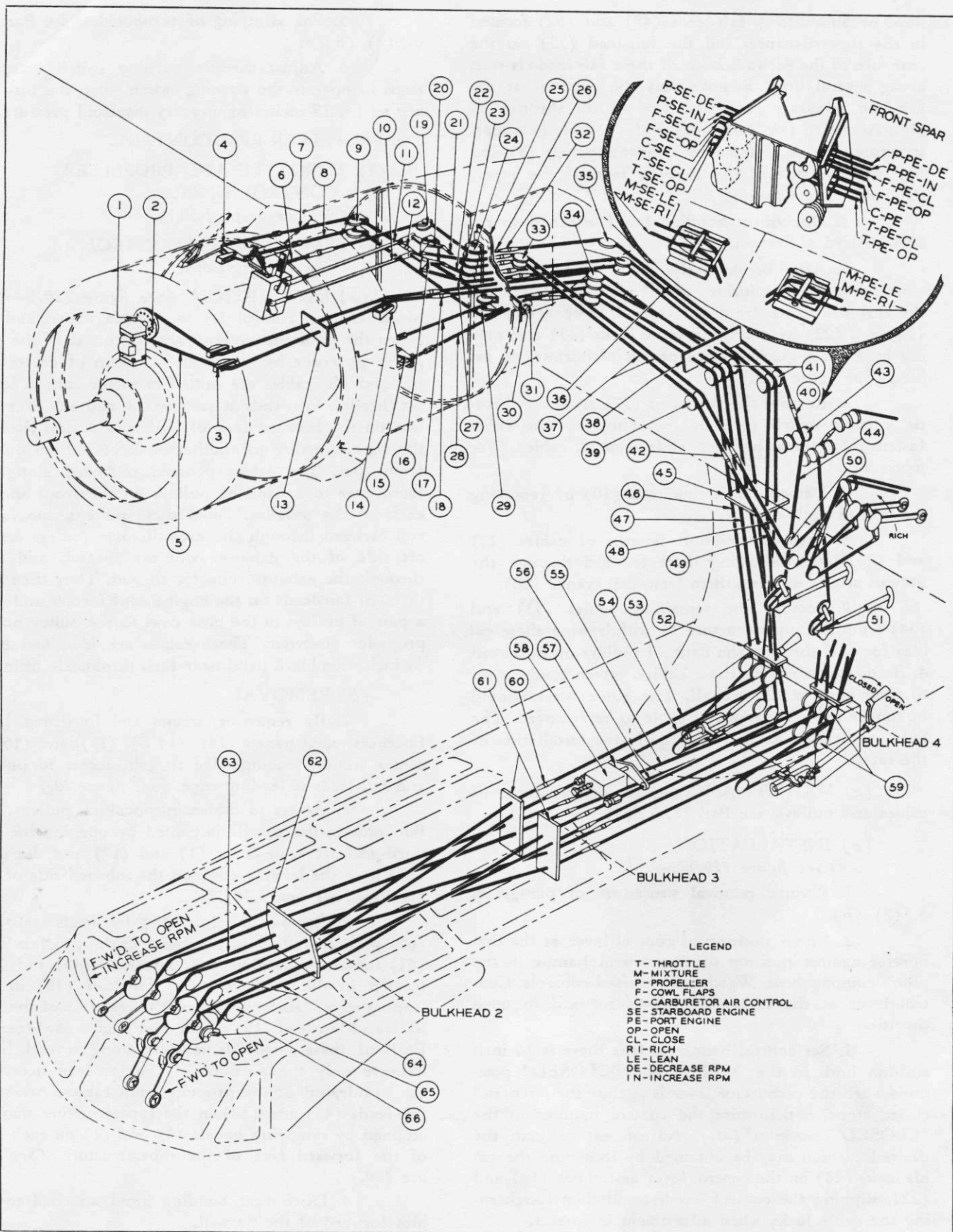


Figure 120—Power Plant Control System

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No.	PART No.	NAME	No.	PART No.	NAME
1		Pulley	28	28P5046-15	Cable
2		Stop Pin	29	AN210-2A	Pulleys
3	AN210-2A	Pulleys	30	28P5117	Fair-lead
4	28P5045-2R	Bellcrank—R. H. Nacelle	31	AN210-1A	Pulleys
	28P5045-2L	Bellcrank—L. H. Nacelle	32	AN155-8S	Turnbuckle
5	28P1137-45	Cable—R. H. Nacelle	33	AN210-2A	Pulleys
	28P1137-44	Cable—L. H. Nacelle	34	AN210-2A	Pulleys
6	28P5138-6	Cable	35	AN210-2A	Pulleys
7	*28P5118-10	Cable	36	28P5138-8	Cable
	**28P5118-8		37	28P3045-50	Cable
8	*28P5046-17	Cable—R. H. Nacelle	38	28P3054	Fair-lead
	*28P5046-16	Cable—L. H. Nacelle	39	AN210-2A	Pulleys
	**28P5046-13	Cable—Both Nacelles	40	AN155-8S	Turnbuckle
9	AN210-2A	Pulleys	41	AN210-2A	Pulleys
10	28P1200-20	Rod Assembly	42	AN155-8S	Turnbuckle
11	28P1200-5	Rod Assembly	43	AN210-1A	Pulleys
12	AN155-8S	Turnbuckle	44	28P5138-16	Cable—R. H. Nacelle
13	28P5106-6	Fair-lead		28P5138-9	Cable—L. H. Nacelle
	28P5106-7		45	28P1268-R	Fair-lead—R. H. Side
14	28P2093	Pulleys		28P1268-L	Fair-lead—L. H. Side
15	28P5045-R	Bell Crank—R. H. Nacelle	46	28P5046-12	Cable
	28P5045-L	Bell Crank—L. H. Nacelle	47	*28P5046-14	Cable
16	28P5038-2	Bell Crank—R. H. Nacelle		**28P5046-12	
	28P5038-0	Bell Crank—L. H. Nacelle	48	28P3045-51	Cable
17	AN155-8S	Turnbuckle	49	28P3045-52	Cable
18	28P5118-9	Cable	50	AN210-2A	Pulleys
19	AN210-2A	Pulley	51	AN210-2A	Pulley
20	28P5037-2	Bell Crank—R. H. Nacelle		AN210-1A	Pulley
	28P5037-0	Bell Crank—L. H. Nacelle	52	28P1266	Fair-lead
21	28P3045-27	Cable—R. H. Nacelle	53	28P3042-33	Cable—R. H. Nacelle
	28P-3045-25	Cable—L. H. Nacelle		28P3042-34	Cable—L. H. Nacelle
22	28P3042-31	Cable—R. H. Nacelle	54	28P3042-37	Cable—R. H. Nacelle
	28P3042-32	Cable—L. H. Nacelle		29P3042-36	Cable—L. H. Nacelle
23	28P3045-28	Cable—R. H. Nacelle	55	28P1137-36	Cable
	28P3045-26	Cable—L. H. Nacelle	56	28P1137-37	Cable
24	AN210-2A	Pulleys	57		Warning Switch Arms
25	28P3052-2	Fair-lead—R. H. Nacelle	58		Warning Switch
	28P3035-2	Fair-lead—L. H. Nacelle	59	AN210-2A	Pulleys
26	*28P5138-10	Cable—R. H. Nacelle	60	AN155-8S	Turnbuckle
	*28P5138-7	Cable—L. H. Nacelle	61	28P1090	Fair-lead
	**28P5138-20	Cable—R. H. Nacelle	62	28P1089	Fair-lead
	**28P5138-19	Cable—L. H. Nacelle	63	28P1137-27	Cable
27	28P3042-41	Cable—R. H. Nacelle	64	28P3042-35	Cable
	28P3042-42	Cable—L. H. Nacelle	65	AN210-2A	Pulleys
		*PBY-5A only.	66		Control Unit Assembly
		**PBY-5 only.			

the propeller rpm cables (63, figure 120) from the control lever assemblies (10) and (12) by detaching cable locks (13), removing guard bolt (24), and prying back cable guard (3) to permit withdrawal of cables. (See figure 119.)

6. Remove cable guard bolts from pulleys (34), (41), and (59). At pulleys (41) and (59), guard bolts are held in place by nutplates.

7. Remove pulleys (3) and (14) by removing axle bolts.

8. Loosen cable lock on propeller governor pulley (1).

9. After breaking safety wire and disconnecting the turnbuckles forward of the firewall, remove cables (5) by pulling the two free ends aft through the exhaust collector shroud.

10. Remove the remaining cables (55) and (56) from the superstructure and leading edge by withdrawing these cables forward through the bank of pulleys on bulkhead 4. Before withdrawing these cables, attach guide wires to their ends at the firewall. The guide wires should be longer than the length of cable to be removed.

(c) MAINTENANCE.
(See Par. 18, b., (3).)

(d) INSTALLATION.

(See figure 120.)

1. To install cables, reverse removal procedure outlined in paragraph c., (2), (b).

2. Tighten at all turnbuckles to give required tensions as outlined in Section IX, Table A.

3. Turn the pulley (1) on propeller governor until the pulley stop pin (2), the cable lock bolt, and the pulley shaft are in a horizontal line. The pulley stop pin is then in a position half way between the high and low pitch position of the governor, and the turnbuckles (17) in the nacelle should now be directly opposite each other. If they are not, the cable lock bolt on the governor should be loosened, and the cable slipped around the pulley until the turnbuckles are aligned.

4. Make certain that the pulley stop pin (2) hits the high and low pitch governor stops in correct relation with the position of the control quadrant handle. Watch for reversed controls.

Note

Both propeller governor pulleys rotate clockwise (when viewed looking aft) to increase rpm.

5. Adjust control handles so that they have approximately a $\frac{1}{4}$ inch cushion in both high and low pitch position. Synchronize the control handles in the low pitch position. Adjustment to gain the desired cushion may be obtained by loosening the cable locks (13) on the control lever assemblies (10) and (12), slipping the control handle, and then retightening when adjustment is correct. (See figure 119.)

6. For safetying of turnbuckles, see Par. 18, d., (4), (b), 6.

d. MIXTURE CONTROL.

(1) MIXTURE CONTROL UNIT.

(a) DESCRIPTION.—The control unit is located above the flight engineer's instrument panel between the fuel flowmeters. This unit consists of one pair of levers. One lever regulates the fuel mixture leading into the carburetor on the left-hand engine; the other regulates the fuel mixture leading into the carburetor on the right-hand engine. The control levers are pivoted on a bracket which is mounted to the aft face of bulkhead 4. The cables are attached to the control lever arms by means of clevis bolts. The control levers are held in any desired position by means of a rack on the bracket and a pawl on the control lever.

(b) REMOVAL AND DISASSEMBLY.

(See figure 121.)

1. Disconnect cables at turnbuckles in superstructure, and then remove pulleys in superstructure. (See paragraph d., (2), (b), 3.)

2. Withdraw unit (16) from airplane by removing the eight screws that attach it to the stringers

on the aft side of bulkhead 4. Screws are engaged by nutplates in the stringers.

3. Remove cables from control levers (7) and (12).

4. Detach nut (14) from stud (5) and remove control levers (7) and (12), spacers (1), (2), (3), and (4), spring (13), and hub (6) from unit.

(c) MAINTENANCE.—At time of disassembly, lubricate axle bolt with light oil. (Specification AN-O-6.)

(d) INSTALLATION.

(See figure 121.)

1. Assemble spacers, spring, hub, stud, control levers and nut by reversing removal procedure outlined in paragraph d, (1), (b), 4.

2. Attach cables to control levers.

3. Install the control unit (16) in the airplane by means of the eight screws.

4. Replace pulleys and connect cables in the superstructure.

(2) MIXTURE CONTROL CABLE SYSTEM.

(a) DESCRIPTION. (See figure 120.)—The mixture controls are connected to the control levers by means of a system of cables, pulleys, and actuating rods. The cables are routed from the control levers forward thru bulkhead 4, over pulleys on the forward face of bulkhead 4 in the superstructure, and then up the superstructure to a set of pulleys inside the leading edge on the lower surface. From there, the cables run outboard thru the leading edge bulkhead on the inboard side of each nacelle, over a set of pulleys on the bulkhead, and then thru fair-leads on the aft side of the firewall to another set of pulleys on the forward face of the firewall. From these pulleys, the cables proceed to a bell crank and actuating rod assembly, mounted on the forward face of each oil tank, which directly operates the mixture control on the carburetor. These cables are identified by two $\frac{3}{8}$ inch wide red bands near each turnbuckle.

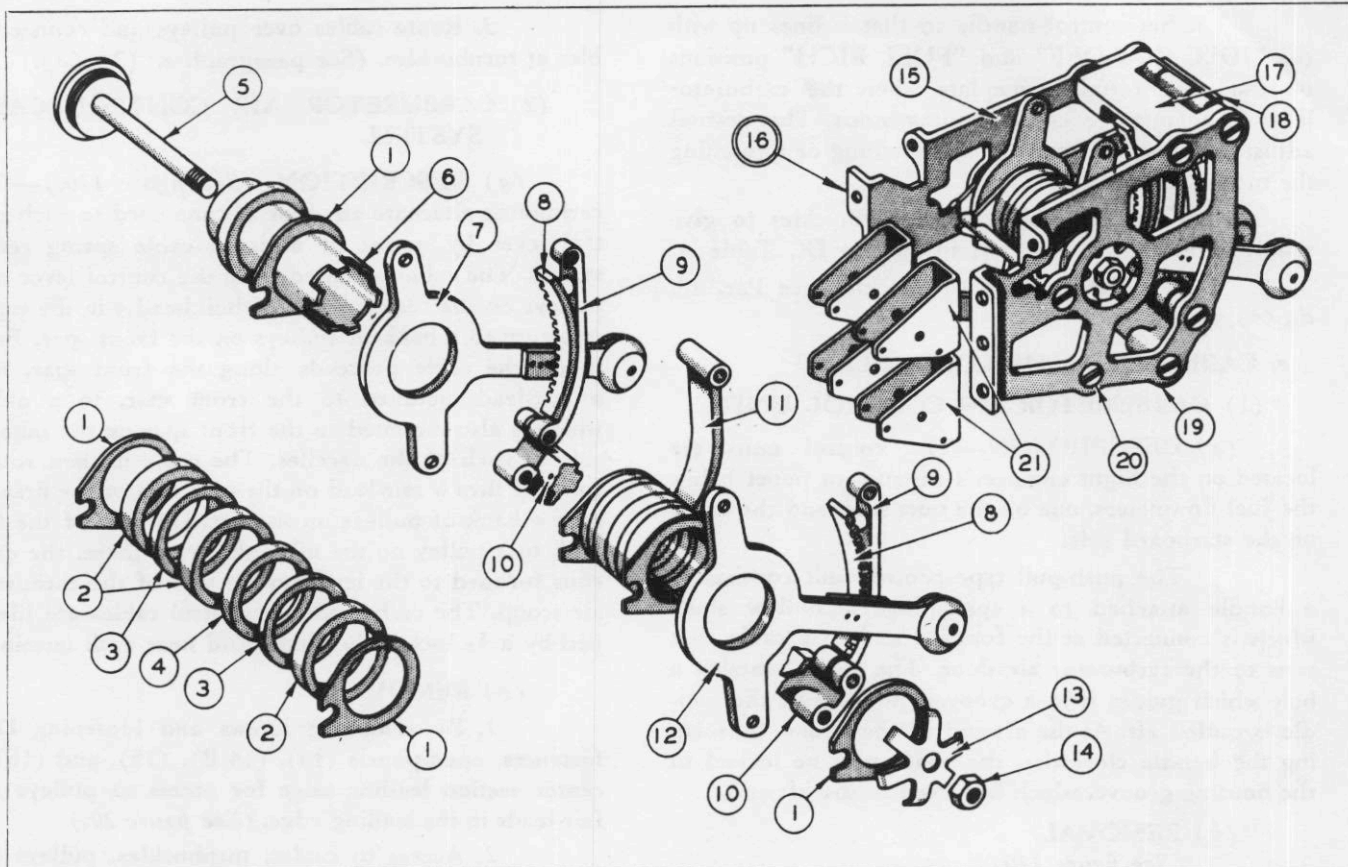
(b) REMOVAL.

1. By removing screws and loosening Dzus fasteners, open panels (14) and (14 B) in center section leading edge in order to gain access to pulleys in the leading edge. (See figure 20.)

2. Remove fair-lead (25) from the aft side of firewall. Access to firewall is gained by opening the panel over the leading edge and raising the aft wrap cowl panels on the inboard side of the nacelles. (See figure 120.)

3. Remove pulleys (50) on forward side of bulkhead 4 in the superstructure. (See figure 120.) Access to pulleys in the superstructure is attained by removing panels (3) and (4) on each side of the forward face of the superstructure. (See figure 64.)

4. Remove guard bolts from pulleys (24), (33), and (39). (See figure 120.)



No.	PART No.	NAME
1	28P1242-2	Spacer
2	28P1245-3	Spacer
3	28P1245-2	Spacer
4	28P1245-4	Spacer
5	28P1232	Stud Assem.
6	28P1231	Hub
7	28P5179-R	Lever Assem.
8	28P1298	Rack
	AN510-6-6	Screw
9	28P1218	Guide
10	28P1217	Spacer
11	28P1219	Guide

No.	PART No.	NAME
12	28P5179-L	Lever Assem.
13	AC068707	Spring
14	AN320-4	Nut
15	28P3006	Plate
16	28P5002-0	Mixture Control Unit Assem.
17	28P1216	Spacer
18	NNP018	Nameplate
	AN535-00-2	Screw
19	28P3005	Plate
20	AN505-10-10	Screw
21		Pulley Bracket

Figure 121—Mixture Control Unit

5. Disconnect bonding braid attached to cables forward of the firewall.

6. Remove the short lengths of cable (21) and (23) by withdrawing them forward thru the firewall after first loosening turnbuckles (32) aft of firewall, and then detaching the cables from the bell cranks (20).

7. Remove cables (37) from the leading edge, after breaking safety wire and loosening turnbuckles in the superstructure, by withdrawing them from either the firewall or the superstructure end. Before withdrawing these cables, attach guide wires to their ends. The guide wires should be longer than the length of cable to be removed.

8. Remove control unit from engineer's com-

partment. (For removal procedure, see paragraph d., (1), (b).) After removing control unit, detach cables (48) and (49) from control lever arms.

(c) MAINTENANCE.—For maintenance of cables and pulleys, see Par. 18, b., (3).

(d) INSTALLATION.

(See figure 120.)

1. Reverse removal procedure of paragraph d., (2), (b).

2. Check position of control lever at the carburetor against position of the control handle in the flight engineer's compartment. Watch for reversed controls. Control lever at the carburetor moves aft to "RICH" position.

3. Set control handle so that it lines up with the "IDLE CUT-OFF" and "FULL RICH" positions on the control unit nameplate when the carburetor lever is against the corresponding stops. The desired adjustment may be obtained by loosening or tightening the turnbuckle barrels.

4. Tighten cables at all turnbuckles to give required tensions as outlined in Section IX, Table A.

5. For safetying of turnbuckles, see Par. 18, d., (4), (b), 6.

e. CARBURETOR AIR CONTROL.

(1) CARBURETOR AIR CONTROL UNIT.

(a) DESCRIPTION.—The control units are located on the flight engineer's instrument panel below the fuel flowmeters, one on the port side, and the other on the starboard side.

The push-pull type control unit consists of a handle attached to a spring-loaded hollow shaft which is connected at the forward end to a cable that runs to the carburetor air door. The shaft contains a bolt which guides it in a grooved housing as the handle is pulled aft. At the aft end of the stroke, by turning the handle clockwise, the shaft may be locked in the housing groove, which is curved at the aft end.

(b) REMOVAL.

(See figure 120.)

1. Disconnect turnbuckle and remove cable guard bolts from pulleys in superstructure. (See paragraph e., (2), (b).)

2. Disconnect outside air temperature indicator from the engineer's instrument panel by removing the four screws that hold it in place. Remove instrument panel sections (12) and (14) by removing screws that attach them to the instrument panel structure. Carburetor air control units are attached to these panel sections. (See figure 175.)

3. To disassemble control unit, remove guide bolt (9) from sleeve (33) and then remove handle, sleeve, and cable from housing (8). Housing may be removed from panel by removing the two screws thru the housing flange.

4. To disassemble control handle assembly, drill out the two flush rivets near the handle and remove handle (19) from sleeve (33). Cable (10) and spring (32) may then be removed from the sleeve.

(c) MAINTENANCE—At time of disassembly, lubricate sleeve with light oil. (Specification AN-O-6).

(d) INSTALLATION.

(See figure 175.)

1. Assemble and install control unit on panel by reversing removal procedure outlined in paragraph e., (1), (b), 4., and paragraph e., (1), (b), 3.

2. Install panel sections on instrument panel and attach outside air temperature indicator to panel.

3. Route cables over pulleys and connect cables at turnbuckles. (See paragraph e., (2), (d).)

(2) CARBURETOR AIR CONTROL CABLE SYSTEM.

(a) DESCRIPTION. (See figure 120.)—The carburetor alternate air door is connected to each control lever by means of a single cable spring return system. The cable is routed from the control lever over pulleys on the forward face of bulkhead 4 in the superstructure to a bank of pulleys on the front spar. From there, the cable proceeds along the front spar, thru a fair-lead mounted to the front spar, to a pulley which is also mounted to the front spar on the inboard side of each of the nacelles. The cable is then routed forward thru a fair-lead on the rear face of the firewall, over a bank of pulleys on the forward side of the firewall, to a pulley on the oil tank. From there, the cable runs forward to the lever on the side of the carburetor air scoop. The carburetor air control cables are identified by a $\frac{3}{8}$ inch wide white band near each terminal.

(b) REMOVAL.

1. By removing screws and loosening Dzus fasteners, open panels (14), (14 B), (15), and (16) in center section leading edge for access to pulleys and fair-leads in the leading edge. (See figure 20.)

2. Access to cables, turnbuckles, pulleys and fair-leads in the nacelle is gained by opening the wrap cowl (1), short wrap (17), removable plate (8), and the upper inboard access door (12). (See figure 101.)

3. Remove fair-leads (38) in the leading edge and fair-lead (25) on the rear face of the firewall. Each of these fair-leads is split along several lines. Remove only the portions of the fair-lead necessary for withdrawal of the carburetor air cable. (See figure 120.)

4. Disconnect bonding braid attached to cable forward of the firewall.

5. Remove cable guard bolts and pins from pulleys (19), (24), (35), (41), (43) and (51). At pulleys (41), guard bolts are held in place by nutplates. Access to pulleys (43) and (51) in the superstructure is gained by removing the panels (3) and (4) on each side of the forward face of the superstructure. (See figure 64.)

6. After breaking safety wire and disconnecting turnbuckle (32) aft of the firewall, disconnect cable (6) from cable (26) by removing the nut, bolt, washer and cotter pin from the fork and eye which is aft of the carburetor air scoop. Cable (26) may be removed by pulling fork end forward. To remove cable (6), disconnect it from carburetor air door lever by removing nut, bolt, washer and cotter pin.

7. Remove cable (36) from leading edge, after breaking safety wire and loosening turnbuckle in the superstructure, by withdrawing it from either the firewall or the superstructure end. Before withdrawing this cable, attach a guide wire to one of its ends. The

guide wire should be longer than the length of cable to be removed.

8. To remove cable (44), see paragraph e., (1), (b), 2 thru paragraph e., (1), (b), 4.

(c) MAINTENANCE. — For maintenance of cables and pulleys, see Par. 18, b., (3).

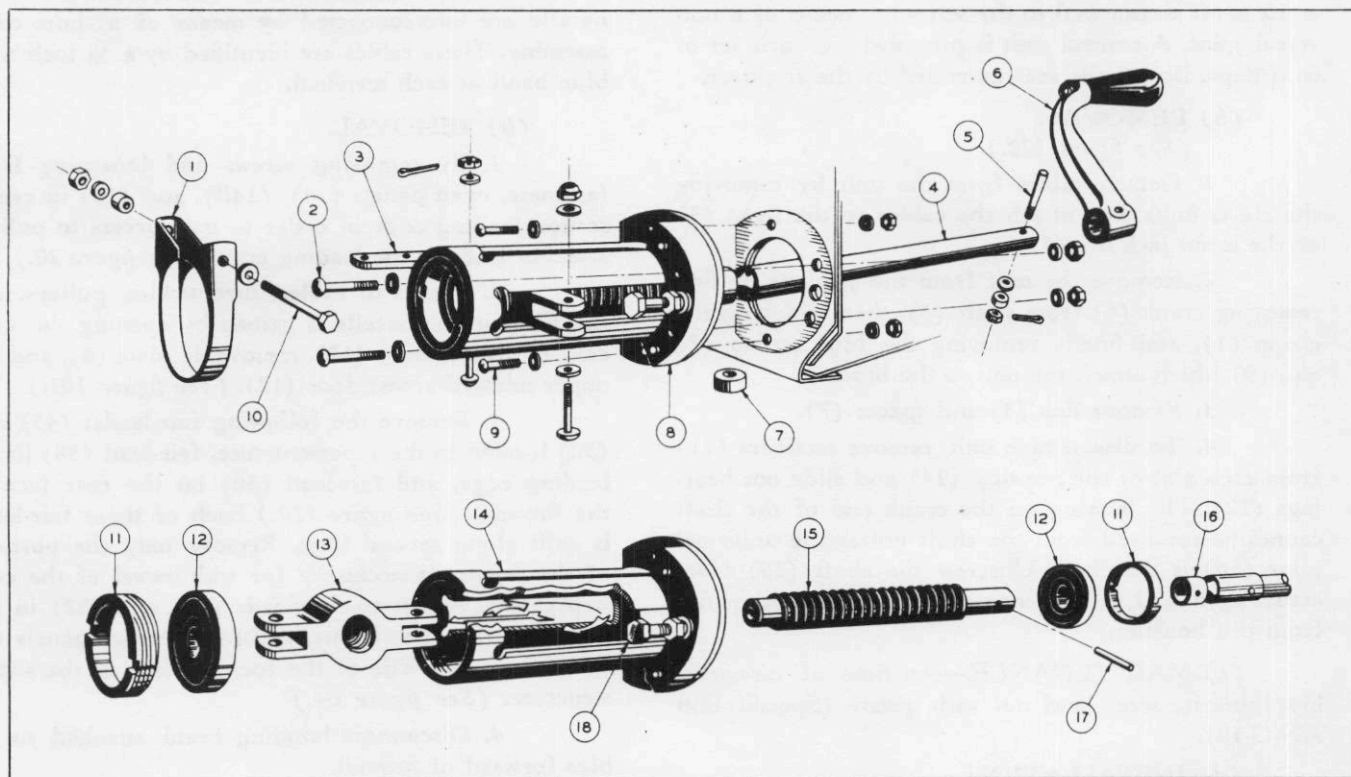
(d) INSTALLATION.
(See figure 120.)

1. Reverse removal procedure of paragraph e., (2), (b).

2. Adjust turnbuckles to give cable tension as noted in Section IX, Table A.

3. Check to see that door clicks against hot and cold stops when control is operated.

4. For safetying of turnbuckles, see Par. 18, d., (4), (b), 6.



No.	PART No.	NAME	No.	PART No.	NAME
1	Q901A24	Clamp	8	28P5004-8	Stop Bolt Retainer
2	AN526-1032-16	Screw	9	AN515-6-10	Screw
	AN960-A10	Washer		AN960-A6	Washer
	AN365-1032	Nut		AN365-632	Nut
3	28P5032	Clip	10	AN3-23A	Bolt
	Q7007-AL13-.030	Washer		Q810-D6-11.5	Spacer
	AN23-11	Clevis Bolt		AN960-A10	Washer
	AN310-3	Nut		AN365-1032	Nut
	AN380-C2-2	Cotter Pin	11	28P1099	Bearing Retainer
	Q7007-AL13-.064	Washer	12	Fafnir K8A	Bearing
4	28P5022	Shaft	13	28P1097-2	Actuating Nut
5	AC386-1-7	Taper Pin	14	28P1096-2	Housing
	AN320-3	Nut	15	28P5114	Shaft
	AC975-3	Washer	16	AC270-B10	Universal Joint
	AN380-C2-2	Cotter Pin	17	28P5004-6	Pin
6	28P1016	Crank	18	28P5119	Stop Bolt
7	Q814-D6-6	Spacer		AN315-3R	Nut
	AN526-DD1032-10	Screw		AN935-10L	Lock Washer
	AN960-A10	Washer		AN960-A10	Washer
	AN364-D1032	Nut			

Figure 122—Cowl Flap Control Unit

f. COWL FLAP CONTROL.

(1) COWL FLAP CONTROL UNIT.

(See figure 122.)

(a) DESCRIPTION.—The control unit is mounted to the pulley bracket on the forward side of bulkhead 4 above the door. The unit is a screw jack type mechanism consisting of a housing, jack screw and nut, ball bearings, and retainer nuts. The screw is rotated by means of a crank on a shaft which extends aft from the end of the screw thru bulkhead 4. The crank shaft is attached to the screw by means of a universal joint. A control unit is provided for each set of cowl flaps. Both units are controlled by the engineer.

(b) REMOVAL.

(See figure 122.)

1. Detach cables from the unit by removing the clevis bolts that attach the cables to the links (3) on the screw jack nut (13).

2. Remove the unit from the airplane by first removing crank (6) from shaft (4), then removing the clamp (1), and finally removing the four screws (2) and (9) which attach the unit to the bracket.

3. Remove link (3) and spacer (7).

4. To disassemble unit, remove retainers (11) from each end of the housing (14) and slide out bearings (12). The bearing on the crank end of the shaft cannot be removed from the shaft unless the universal joint (16) is detached. Unscrew the shaft (15) from actuating nut (13), and then remove the actuating nut from the housing.

(c) MAINTENANCE.—At time of disassembly, lubricate screw and nut with grease (Specification AN-G-10).

(d) INSTALLATION.

(See figure 122.)

1. Assemble housing, actuating nut, screw shaft, bearings, and retainers by reversing removal procedure outlined in paragraph f., (1), (b), 4.

2. Install control unit in airplane by attaching the four screws (2) and (9) and clamp (1) to the bracket assembly. Attach crank (6) to shaft (4) by means of the taper pin (5).

3. Attach cables to arm of actuating nut (13) by means of clevis bolts.

(2) COWL FLAP CONTROL CABLE SYSTEM.

(a) DESCRIPTION. (See figure 120.)—The cowl flap control cable system consists of a dual system of cables, pulleys, bell cranks, and actuating rods that connect the cowl flaps and each cowl flap control unit.

The cables are connected to the screw jack nut on each control unit and then are routed over pulleys located on the control unit bracket. From here, the cables run up the superstructure to a bank of pulleys on the front spar. From these pulleys, the cables

proceed outboard along the front spar over a set of pulleys mounted to the front spar on the inboard side of each nacelle, and then forward to a pair of pulleys on the aft face of the firewall. The cables run thru the inboard section of the firewall; one cable runs forward to a bell crank on the rear face of the exhaust collector shroud, while the other runs over a pulley on the firewall and outboard to another pulley on the outboard firewall. From this pulley, the second cable proceeds forward and is attached to a bell crank on the rear face of the exhaust collector shroud. The bell cranks in the nacelle are interconnected by means of a short cable assembly. These cables are identified by a $\frac{3}{8}$ inch wide blue band at each terminal.

(b) REMOVAL.

1. By removing screws and loosening Dzus fasteners, open panels (14), (14B), and (15) in center section leading edge in order to gain access to pulleys and fair-leads in the leading edge. (See figure 20.)

2. Access to cables, turnbuckles, pulleys, and fair-leads in the nacelle is gained by opening the wrap cowl (1), short wrap (17), removable plate (8), and the upper inboard access door (12). (See figure 101.)

3. Remove the following fair-leads: (45) and (52) located in the superstructure, fair-lead (38) in the leading edge, and fair-lead (30) on the rear face of the firewall. (See figure 120.) Each of these fair-leads is split along several lines. Remove only the portions of the fair-leads necessary for withdrawal of the cowl flap cables. Access to fair-leads (45) and (52) in the superstructure may be attained by removing panels (3) and (4) in each side of the forward face of the superstructure. (See figure 64.)

4. Disconnect bonding braid attached to cables forward of firewall.

5. Remove cable guard bolts from pulleys (9), (29), (31), (34), (41), and (59). On pulley brackets (41) and (59), the guard bolts are held in place by nutplates. (See figure 120.)

6. After breaking the safety wire and disconnecting the turnbuckle on the forward face of the oil tank, remove the two sections of cable (7) and (18) by disconnecting them at the quick disconnect couplings near bell cranks (4) and (15), and then withdraw them from the pulleys.

7. Remove cables (8) and (28) by withdrawing them forward thru the firewall, after breaking safety wire and disconnecting the turnbuckles aft of the firewall.

8. After detaching cables (46) and (47) from the cowl flap control unit, remove these cables from the leading edge and the superstructure by withdrawing them forward thru the bank of pulleys on bulkhead 4. Before withdrawing these cables, attach guide wires to their ends at the firewall. The guide wires (used to simplify installation) should be longer than the length of cable to be removed.

(c) MAINTENANCE. — For maintenance of cables and pulleys, see Par. 18, b., (3).

(d) INSTALLATION.
(See figure 120.)

1. Reverse removal procedure of paragraph f., (2), (b), to install the cables.

2. Turn cowl flap cranks to full closed position and check to see that both outboard and inboard cowl flaps are seated firmly against the stops on the exit fairing.

3. Turn cowl flap control cranks until either the outboard or inboard cowl flaps are opened $\frac{1}{2}$ inch from the stop. Adjust opposite cowl flaps to an opening of $\frac{1}{2}$ inch by lengthening or shortening the flap control rod. Both outboard and inboard cowl flaps of a nacelle must be open $\frac{1}{2}$ inch at the same time.

4. Turn cowl flap crank to the full open position. Flaps should be open $3\frac{1}{2}$ inches, but both sides of nacelle may not have the same opening. A difference in the amount of opening is permissible provided that neither side is more than $3\frac{3}{4}$ inches, nor less than $3\frac{3}{8}$ inches open. Adjust stop on side of control unit to

prevent further turning of crank when flaps are in closed position.

5. Tighten at all turnbuckles to give required tensions as outlined in Section IX, Table A.

6. For safetying of turnbuckles, see Par. 18, d., (4), (b), 6.

g. PROPELLER FAST FEATHERING CONTROL.

(See Par. 13, d.)

h. IGNITION CONTROL.

(See Par. 22, j.)

i. PRIMER PUMP.

(See Par. 15, e.)

j. EMERGENCY FUEL PUMP.

(See Par. 15, b., (6).)

k. FUEL SELECTOR VALVES.

(See Par. 15, b., (4).)

l. OIL DILUTION CONTROL.

(See Par. 22, h.)

m. STARTER CONTROL.

(See Par. 22, i.)



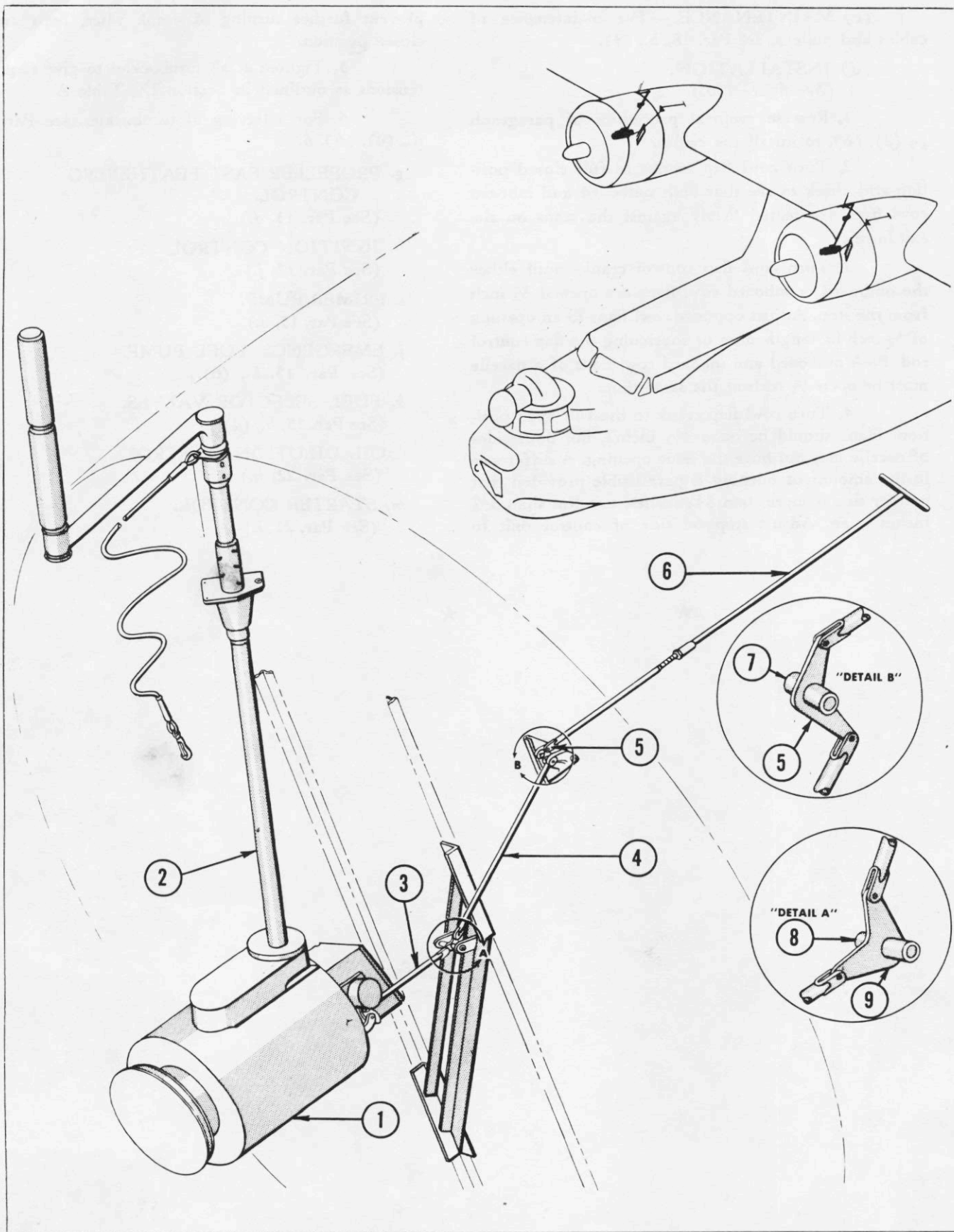


Figure 123—Starter—Manual Cranking Provision

PARAGRAPH 12.



12. STARTING SYSTEM.

a. GENERAL.—The starting system consists of an electric and hand cranking starter bolted to the accessory case of the engine, a 24 volt D.C. circuit incorporating a booster coil for the electrical operation of the starter, and a hand crank and manual meshing control for hand operation of the starter.

b. ENGINE STARTER.

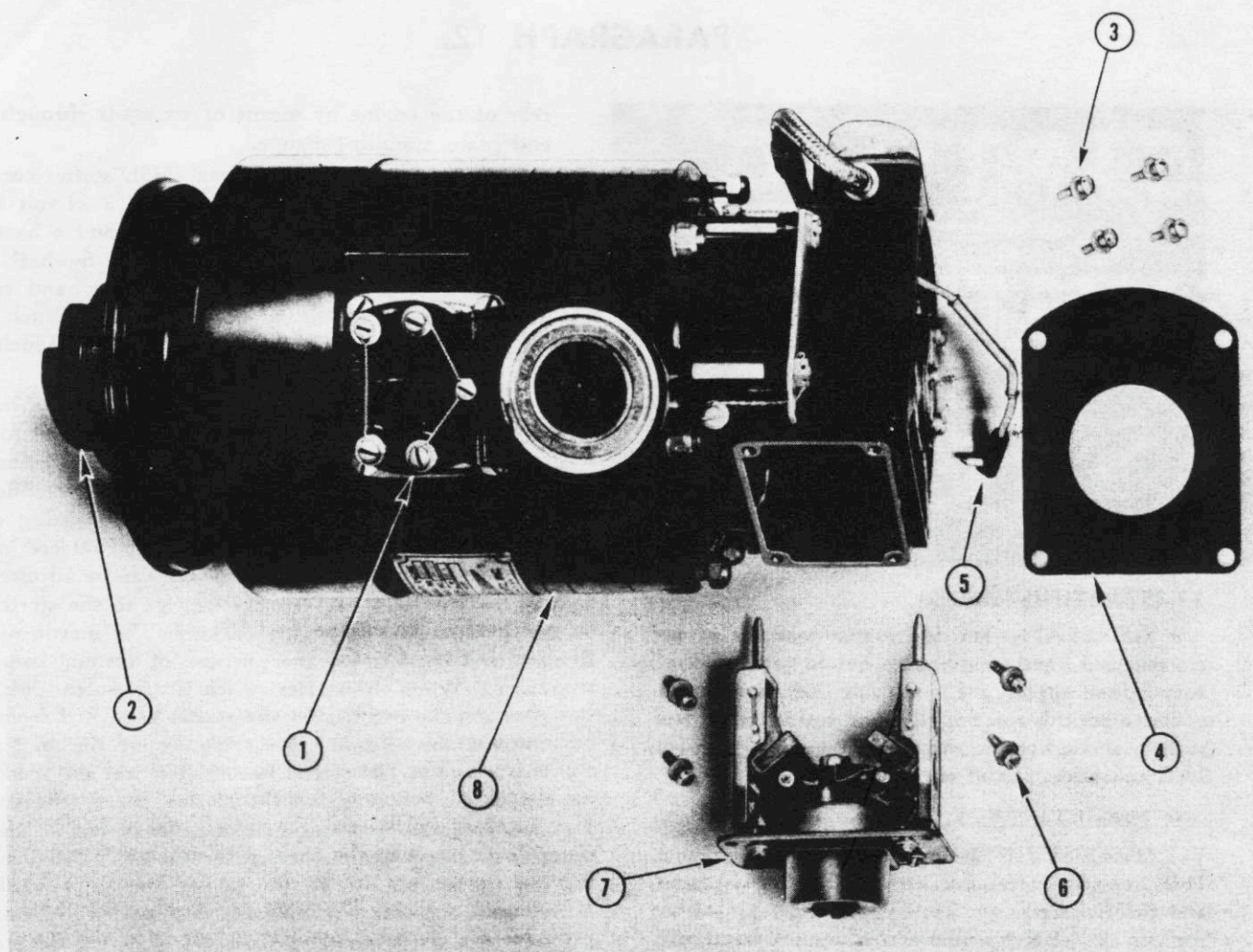
(1) DESCRIPTION.—Both the Jack and Heintz JH5D engine starter installed on the PBV-5A airplanes and the Eclipse Series 40, Type 950, Model 12 starter used on the PBV-5 airplanes are combination hand and electric inertia starters. Either starter is secured to the

rear of the engine by means of six studs through the end plate mounting flange.

(a) The Jack and Heintz JH5D starter consists of three rigidly connected assemblies; a 24-volt D.C. motor assembly, a gear case assembly, and a base assembly. The motor assembly includes the flywheel, and the gear case assembly mounts the offset hand crank adapter. The base unit, which contains the clutch and the reduction gearing, transmits the power and includes a safety release for overloads.

After the flywheel contained within the motor is electrically or manually accelerated, its momentum is transmitted to the engaging jaw through the reduction gearing. Integral with the last stage of the reduction gearing is a torque overload release consisting of a multiple gear clutch with a pre-adjusted release mechanism. The slip point of this clutch can be adjusted to control the load and prevent damage to the starter by an overload or an engine backfire. The inertia of the flywheel is used for the purpose of turning over the engine. When the starter switch is thrown to "MESH" position, the brushes on the starter are lifted from the commutator allowing the armature of the motor to rotate freely. The starter has an electrical and mechanical means of engaging the starter jaw to the engine jaw. Internal mechanical linkage connected to the external lever provides the mechanical method for engaging the starter jaw to the engine for hand cranking. A solenoid working through the mechanical linkage provides the electrical method of engaging the starter jaw.

No.	PART No.	NAME	No.	PART No.	NAME
1	*JH5D (Jack & Heintz)	Starter		*AN3-14	Bolt
	**Eclipse Series 40, Type 950, Model 12			**AN3-16	
2	*28P5532	Hand Crank		AN310-3	Nut
	**28P1190-5			AN380C2-2	Cotter Pin
3	*28P5150	Rod Assembly		Q7102-A10	Washer
	**28P5025-4			AN960-10	Washer
	AN23-8	Clevis Bolt	6	*28P3041	Rod Assembly
	AN320-3	Nut		**28P1192-2	
	AN380-C2-2	Cotter Pin		AN23-8	Clevis Bolt
	AN960-10L	Washer		AN320-3	Nut
4	*28P5149	Rod Assembly		AN380C2-2	Cotter Pin
	**28P5041			AN960-10L	Washer
	AN23-8	Clevis Bolt	7	*28P2019-2	Bushing
	AN320-3	Nut		**28P2019-3	
	AN380C2-2	Cotter Pin	8	28P2019-3	Bushing
	AN960-10L	Washer	9	*28P5521	Bell Crank
5	*28P5151	Bell Crank		**28P2025	
	**28P5036			AN3-14	Bolt
	*PBV-5A only.			AN310-3	Nut
	**PBV-5 only.			AN380C2-2	Cotter Pin
				Q7102-A10	Washer
				AN960-A10	Washer



No.	PART No.	NAME	No.	PART No.	NAME
1	556R	Offset Hand Crank Adapter	5		Electrical Connection
2	237-R3	Starter Jaw	6		Brush Assembly Screws
3		Cover Plate Screws	7	660	Brush and Solenoid Assembly
4		Cover Plate	8	JH-5D	Engine Starter Assembly

All part numbers listed above are Jack and Heintz part numbers.

Figure 124—Engine Starter (PBY-5A Only)

(b) The Eclipse Series 40, type 950, Model 12 starter consists principally of a flywheel, gear reduction, multiple-disc clutch, engaging and disengaging mechanism, baffle plate oil seal, mounting flange, driving jaw, an integral accelerating motor, and a solenoid meshing device.

The motor is attached to the starter intermediate housing and is used to energize the starter flywheel. Motor torque is transmitted to the starter flywheel by an automatic engaging and disengaging device and its momentum in turn is transmitted to the driving jaw and then to the engine crankshaft. The starter incorporates a protective clutch designed with alternate drilled steel and bronze discs. The purpose of this clutch is to protect the starter during backfire of the

engine or under excessive load. A solenoid meshing device is mounted on the starter and provides the electrical method of engaging the starter jaw.

(2) REMOVAL.

(a) Open accessory cowl panels (6), (17), and (21), and remove top panel (8). (See figure 101.)

(b) Remove vacuum lines which connect vacuum pump to firewall and pump to oil separator.

(c) Disconnect fuel line to fuel pump at the end of the self-sealing hose nearest the pump and swing it out of the way.

(d) Disconnect "oil to" and "oil from" lines at their connections to the engine.

(e) Using Pratt and Whitney special wrench,

PWA-1541, remove the compensating relief valve which is on the port side of the engine near the starter and generator.

(f) Remove the aft portion of the magneto blast tube which is fastened to the starter and the magnetoes.

(g) Remove the generator blast tube.

(h) Disconnect electrical conduit and bonding cable from the starter and the generator.

(i) Remove the generator from the engine. (Refer to Par. 22, b, (2), (a) and (b).)

(j) Disconnect manual meshing control rod from the bell crank on the starter.

(k) Loosen the starter mounting stud nuts, and remove all but the top nut.

Note

Most of the mounting stud nuts on the starter flange are not accessible by means of conventional wrenches. A special 9/16 inch crow-foot type wrench (28U5027) is provided in the special tool kit for this purpose. (See figure 40.) Considerable time and patience will be required to remove the mounting stud nuts.

(l) Lower a rope or web strap sling through the top of the nacelle in order to support the weight of the starter while removing it from the airplane. The starter weighs approximately 45 pounds.

(m) After sling is in place, remove the top nut and carefully pull starter aft until it clears the mounting studs.

(n) Lower starter carefully by means of the sling and swing it out of the nacelle between the oil cooler and the engine mount tube on the starboard side.

(o) Cover or plug all openings in the engine and lines which were exposed due to the removal of the starter.

(3) MAINTENANCE.

(a) JACK & HEINTZ STARTER (PBY-5A).

1. Remove all traces of dirt and moisture from the electrical connector plug with a clean cloth.

2. After every 60 hours of engine operation, remove brush rigging by the following method: (See figure 124.)

a. Remove aft cover plate (4) by breaking safety wire and loosening the four screws (3).

b. Disconnect wire (5) by withdrawing plug from brush assembly (7).

c. Loosen nuts which hold the brush assembly contact points. A $\frac{3}{8}$ inch socket wrench will be required.

d. Break safety wire and remove the four screws (6) which hold the brush assembly in place.

e. Remove brush assembly from the starter.

3. Inspect all wiring under aft cover plate for loose or faulty connections. Clean and tighten them.

4. Replace all defective wiring.

5. If brush holders do not move freely, use a little light oil (Specification AN-O-6) on the brush pivots.

6. Replace brushes if their exposed length beyond the holder is less than $\frac{3}{32}$ inch.

7. If commutator is rough and pitted, use Jack and Heintz honing kit No. 807 in accordance with instructions inside cover of carrying case.

CAUTION

Do not use coarse sandpaper, emery paper, or other abrasive in re-conditioning a commutator. Do not use brushes other than those specified, as poor commutation will shorten commutator and brush life.

8. If sufficient torque to start the engine is not developed, and the indications are that the clutch discs are worn or scored, the starter should be forwarded to an overhaul depot for repairs.

9. Should the starter jaw fail to engage with the engine jaw when using electric inertia starting, either the solenoid meshing device or the control switch is inoperative and replacement should be made.

(b) ECLIPSE STARTER (PBY-5).

1. Remove all traces of dirt and moisture from the electrical connector plug with a clean cloth.

2. After every 60 hours of engine operation remove brush assemblies as follows:

a. Remove motor housing cover by breaking safety wire and loosening the four screws.

b. Detach lead connections from the terminals, together with the nuts and washers, noting positions of insulating washers for correct position at re-assembly.

c. Remove bearing cap and armature shaft nut at commutator end of motor.

d. Detach window strap and disconnect and lift out brush assemblies and springs.

3. Clean and tighten all connections.

4. Replace all defective wiring.

5. Worn brushes should be replaced before their maximum wear limit is reached. The maximum permissible wear of the brushes is $\frac{3}{16}$ inch from a new serviceable length of $\frac{1}{2}$ inch.

6. If commutator is rough or pitted, smooth with No. 0000 sandpaper.

CAUTION

Do not use coarse sandpaper or emery cloth. After sanding thoroughly, clean commutator to remove all sand particles, otherwise excessive wear will result.

7. Check brush spring tension and replace springs if necessary. Brush spring tension should measure 40 to 44 ounces when spring is compressed to a length of 7/16 inch.

8. If sufficient torque to start the engine is not developed and the indications are that the clutch discs are worn or scored, the starter should be forwarded to an overhaul depot for repairs.

(4) TEST BEFORE INSTALLATION.—This test is to be performed if the starter has been in storage for a period of six months or more.

(a) Accelerate the starter by the motor or by hand to full speed. If accelerated by the motor, allow approximately 15 seconds for it to come up to speed. If accelerated by hand, a crank speed of approximately 75 rpm is necessary before starter is up to speed. Check run-down time of the starter after it has been brought up to speed. If run-down period is less than four minutes, the starter should be sent to an overhaul base, or returned to the manufacturer for cleaning and lubrication.

(b) On the PBV-5 airplanes, manually or electrically accelerate the flywheel to 12000 rpm. At 12000 rpm, remove the hand crank or open the starting switch (if electrically operated) and record the time required for the flywheel to come to a stop while running free. The minimum free run-down time should not be less than seven minutes after not more than two trials.

Note

This test is extremely important; failure to perform it will permit dried out lubricant to remain in the starter, making hand cranking difficult and free run-down time low, with resulting loss in starter performance.

(5) INSTALLATION.

(a) Remove covers from the mounting pads on the engine.

(b) Lower rope or web strap sling through the top of the nacelle.

(c) Insert starter into the nacelle between the oil cooler and engine mount tube on the starboard side.

(d) Support the weight of the starter with the rope sling and swing starter into position, and then raise it until it is lined up with its mounting pad.

(e) Mount the starter on the engine so that the starting motor electrical connection is on the starboard side and 15 degrees below the horizontal center line of the engine mounting pad.

Note

A gasket must be installed between the starter mounting flange and the engine mounting pad.

(f) Tighten the nuts on the mounting studs by means of the special wrench 28 U 5027. (See figure 40.)

(g) Connect the manual meshing control rod to the bell crank on the starter.

(h) Install the generator. (Refer to Par. 22, b, (5).)

(i) Connect electrical conduit and bonding cable to the starter and the generator.

(j) Connect generator blast tube to the generator by means of the hose clamp.

(k) Attach the aft portion of the magneto blast tube to the starter and the magnetos.

(l) Using Pratt and Whitney special spanner wrench No. PWA-1541, install the compensating relief valve to the port on the port side of the engine near the starter and generator.

(m) Attach fittings to the "OIL IN" and "OIL OUT" ports on the port side of the engine and connect the lines to the fittings with hose clamps.

(n) Connect fuel line to fuel pump.

(o) Install vacuum line between firewall and vacuum pump and oil separator.

(p) Close the accessory cowl panels and install the top panel.

(6) OPERATIONAL CHECK.—After the engine starter is installed, turn it through two or three cycles both electrically and manually to ascertain that all electrical connections are tight, and that the solenoid and manual meshing controls are operating properly.

Note

Do not operate the starter either electrically or manually while the jaws are engaged. If the jaws do not disengage, turn the propeller by hand (ignition "OFF") about 1/3 to 1/2 of a revolution in its proper direction of rotation.

c. BOOSTER COIL.

(1) DESCRIPTION.—An Eclipse type 513 booster coil is mounted on the bottom of the electrical junction box in each engine accessory compartment. The booster coil primary is connected to the starter meshing circuit and power is applied to the coil only when the starter switch is thrown to "MESH." The booster coil is not energized by operation of the manual meshing control. A high voltage lead from the booster coil is connected to the high voltage terminal of the right magneto.

(2) REMOVAL.

(a) Open accessory cowl panels (6) and (17) and remove panel (8). (See figure 101.)

(b) Remove the cover from the engine junction box which is mounted on the top of two engine mount tubes.

(c) Disconnect high voltage line from the booster coil to the right magneto at the magneto by detaching the knurled nut and pulling out finger plug.

(d) Disconnect wire No. 560 in the port junction box and wire number 561 in the starboard junction box from its terminal. This is the input line to the coil.

(e) Disconnect the input line conduit from the junction box.

(f) Detach the four screws which fasten the booster coil to bottom of the junction box and remove the coil.

(g) Remove the high voltage line from the booster coil by loosening the knurled nut and pulling wire from the coil.

(h) Loosen conduit nut on the low voltage conduit.

(i) Break safety wire and remove the screws which fasten the two parts of the coil housing together.

(j) Remove a portion of the coil housing and disconnect the low voltage line from its terminal.

(k) Further disassembly should not be attempted except at a major overhaul base.

(3) MAINTENANCE.

(a) Tighten coil mounting screws.

(b) Check electrical connections. Clean and tighten the terminals.

(c) Replace all defective or damaged wiring.

(d) If booster coil does not work properly, replace it.

(4) INSTALLATION.

(a) Remove a portion of the booster coil housing and connect the low voltage wire to its terminal.

(b) Attach the two portions of the coil housing with screws and re-wire them with safety wire.

(c) Attach the low voltage wire conduit to the coil by means of the conduit nut.

(d) Insert the high voltage wire into the coil and re-wire it by means of the knurled nut. This is a plug type connection.

(e) Attach the booster coil to the bottom of the engine junction box with four screws and nuts.

(f) Insert the low voltage wire into the junction box and connect it to the proper terminal in the box.

Note

The wire number is 560 for port side and 561 for starboard side and attached to the cover of the junction box is a wiring diagram.

(g) Attach the low voltage conduit to the junction box by means of the conduit nut.

(h) Insert the plug end of the high voltage line into the receptacle on the magneto and secure it by means of the knurled nut.

(i) Install cover on the engine junction box.

(j) Close accessory cowl panels (6) and (17) and replace panel (8). (See figure 101.)

d. MANUAL CRANKING PROVISIONS.

(1) DESCRIPTION. (See figure 123.)—A crank for manual acceleration of the starter is stowed on the aft face of bulkhead 4. A socket for the crank is located between the exhaust stacks on the upper nacelle cowling. A manual meshing handle is on the port side of each nacelle and may be reached through the hinged access door in the upper nacelle fairing.

(2) REMOVAL.

(a) Open cowl panels (6) and (10). (See figure 101.)

(b) Remove manual meshing handle (6) by detaching clevis bolt at bell crank (5). (See figure 123.)

(c) Remove rod (4) by detaching clevis bolts at bell cranks (5) and (9).

(d) Remove rod (3) by detaching clevis bolts at lever on the starter and at bell crank (9).

(e) To remove bell cranks (5) and (9), detach bolts which fasten them to their mounting brackets.

(3) MAINTENANCE.

(a) Check bushings in the bell cranks and if they are worn or damaged, replace them.

(b) If the actuating rods and handle are bent or damaged, replace them.

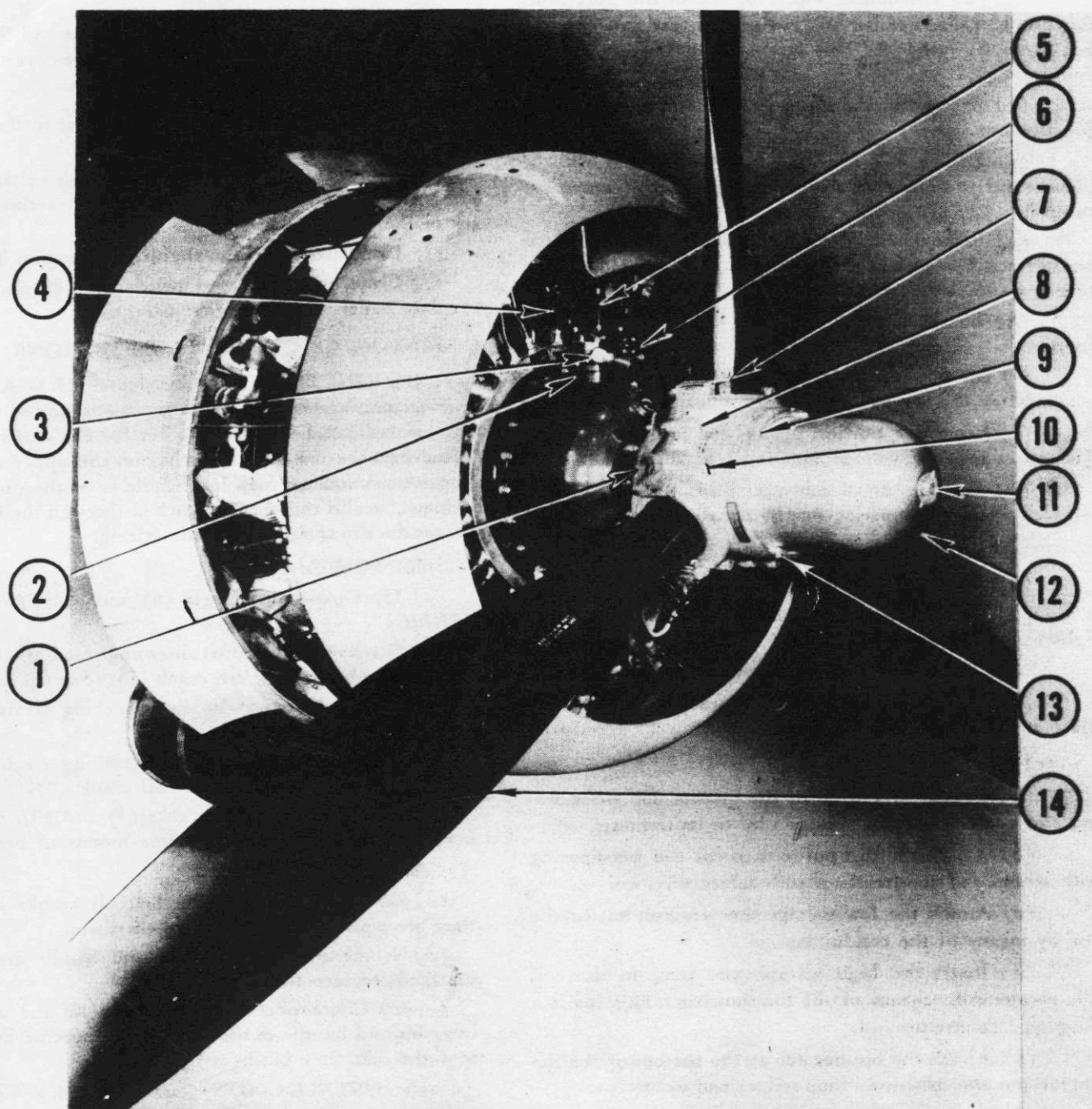
(c) Check points of attachment of the actuating rods and handle to see that they are secure but not so tight that they bind.

(4) INSTALLATION. (See figure 123.)—Reverse removal procedure as outlined in paragraph d, (2).

e. ENGINE STARTER CIRCUIT.

(Refer to Par. 22, i.)



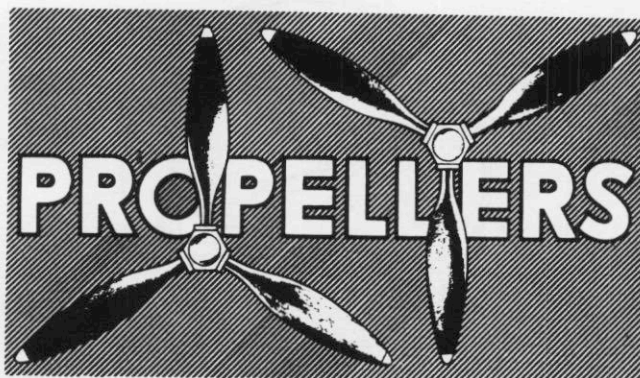


No.	NAME
1	Anti-Icer Slinger Ring
2	Governor Mounting Pad
3	Oil Line to Propeller
4	Governor Pulley
5	Constant Speed Governor
6	Fast Feathering Pressure Switch
7	Anti-Icer Nozzle

No.	NAME
8	Barrel Bolt
9	Dome Retaining Nut
10	Barrel
11	Dome Breather Plug
12	Dome
13	Dome Retaining Nut Lock Screw
14	Blade

Figure 125—Propeller Assembly

PARAGRAPH 13.



13. PROPELLERS.

a. GENERAL.—The two propellers used on these airplanes are Hamilton Standard Hydromatic Propellers with constant speed control governors.

Full feathering of both propellers is obtained through the use of a motor driven high pressure feathering pump which is controlled by a plunger switch overhead in the pilot's cockpit.

Formation of ice on the blades is prevented by alcohol which is delivered to a slinger ring on the aft side of the hub, and is then discharged onto the blades by discharge tubes connected to the slinger ring.

The engines on this airplane, which do not breathe through the propeller shaft, rotate both propellers to the right as viewed from a position facing forward.

b. PROPELLER ASSEMBLY.

(1) DESCRIPTION. (See figure 125.)—Each Hamilton Standard Hydromatic three bladed propeller (Model number 23E50-473) used on this airplane consists of the following major components: a hub and blades assembly (including de-icer ring), dome assembly, and distributor valve.

(a) HUB AND BLADES ASSEMBLY.—This assembly is made up of four major parts:

1. The spider, which acts as the foundation for the entire propeller. It is machined from a steel forging, each arm having two ground bearing surfaces which carry the thrust and torque loads. It is splined to fit the engine shaft.

2. The barrel or hub, which is made up of two halves, front and rear. It is machined in pairs from two steel forgings to insure matching and proper balance.

3. Three blades spaced 120° apart, which, when assembled to the spider, form a 12 foot diameter assembly. The blades are forged of aluminum alloy.

4. De-icer slinger ring, which is attached to the rear barrel half by eight screws. Bracket and nozzle assemblies are provided for distribution of de-icer fluid from the slinger ring to each blade.

(b) DOME ASSEMBLY.—This assembly contains the major parts of the propeller operating mechanism which are as follows:

1. DOME.—The dome is machined from an aluminum alloy forging. It acts as a case for the cam operating mechanism, and as a cylinder for the piston. The outer surface of the dome also serves as a spinner.

2. PISTON.—The piston is machined from an aluminum forging, and it is the medium by which the oil pressure forces actuate the cams which in turn rotate the blades.

3. CAMS.—These are cylindrical cams, one stationary and one rotating, which fit one inside the other. Each cam is accurately machined from a steel forging. At the inboard end of the rotating cam and integral with it is a bevel gear which engages the gear segments attached to each blade butt.

4. BLADE ANGLE STOP RINGS.—These rings, machined from steel forgings, fit in the stop locating plate on the inboard end of the stationary cam. The rotating cam movement is limited to the desired range by adjusting the position of the stop rings in the stop plate.

(c) DISTRIBUTOR VALVE.—The hydraulic distributor valve housing is an aluminum alloy casting provided with cored passages for the operating pressures. A steel sleeve, shrunk into the central bore of the casting, contains ports which align with oil passages in the housing. The distributor valve operates within the sleeve directing oil through the proper ports for changing propeller pitch (feathering).

(2) REMOVAL AND DISASSEMBLY.

(a) Attach a propeller hoisting sling to the propeller blades and take up slack in the hoist. (See figure 126.)

(b) Place a container under the propeller to catch the oil when the dome plug and dome are removed. (See figure 127.)

(c) Remove the lock ring (1) with a screw driver and unscrew the dome breather plug (2).

(d) Screw the dome lifting handle (20) into the dome (3).

(e) Remove the dome retaining nut lock screw (19) with a screw driver.

(f) Engage the composite wrench (18) on the lugs of the dome retaining nut (4) (See step 1, figure 127) and unscrew the nut counterclockwise, using a three-foot steel bar in the wrench. Tap the bar if necessary while applying pressure to loosen the nut. (The nut is attached to the dome and acts as a puller when the nut is unscrewed.)

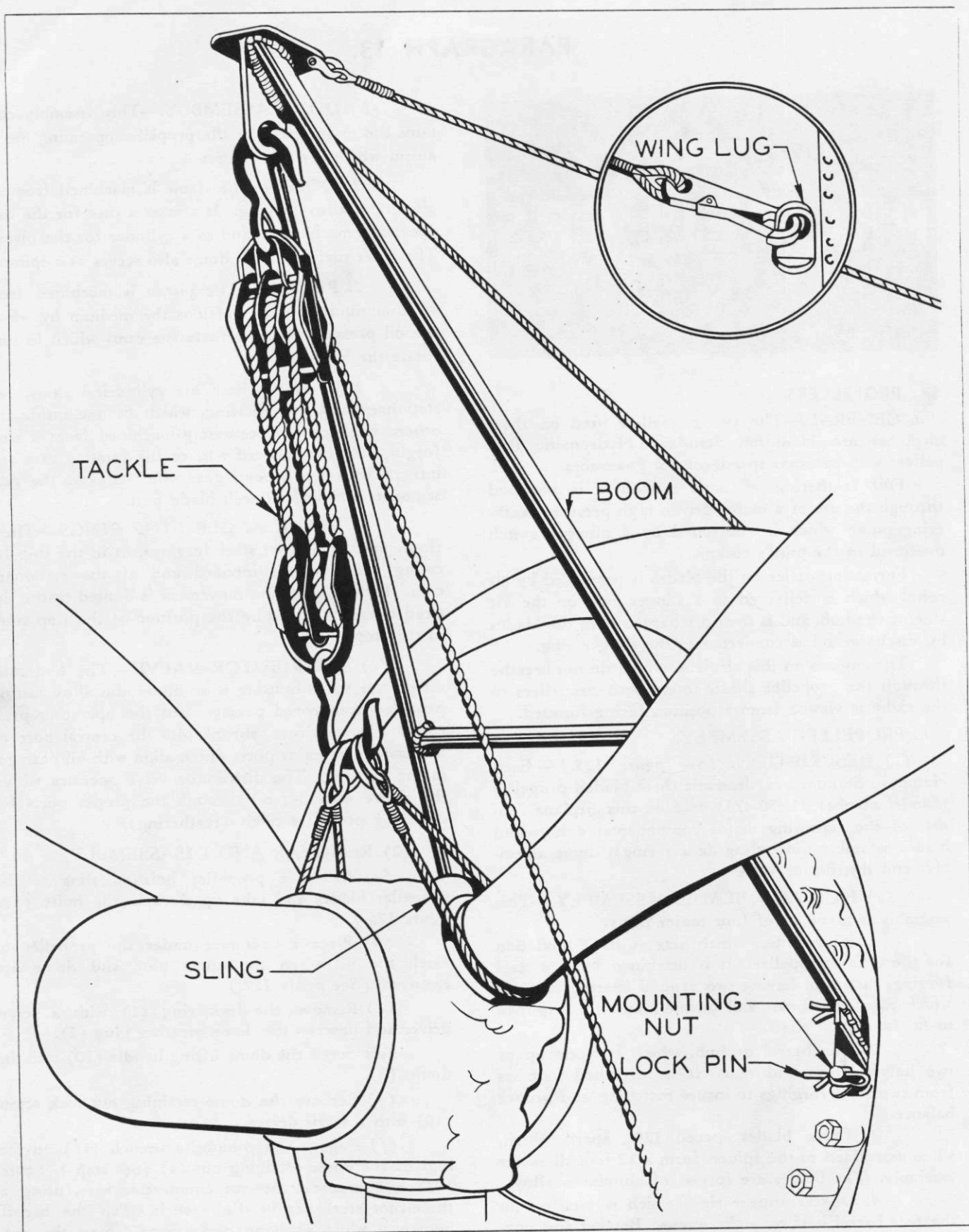


Figure 126—Propeller Hoist Sling

(g) Remove the dome (3), grasping the lifting handle and pulling the dome straight forward until it clears the distributor valve. (See step 2, figure 127.)

(h) Remove the hub retaining nut lock ring (8) using two screw drivers. (See step 3, figure 127.)

CAUTION

Never attempt to remove the distributor valve before removing the lock ring.

(i) Engage the composite wrench (18) on the distributor valve (5) and unscrew the valve assembly using a one-foot bar in the wrench. (See step 4, figure 127.)

(j) Remove the copper gasket (6) from the shaft.

(k) Engage the composite wrench (18) together with the socket (16) on the hub retaining nut (10) and unscrew the nut about $\frac{3}{4}$ inch to pull the hub off the rear cone. (See step 5, figure 127.)

CAUTION

Do not damage the propeller anti-icing nozzle at the slinger ring back of the propeller below the shaft in removing the propeller from the shaft.

(l) Remove the hub snap ring (7) with two screw drivers. (See step 6, figure 127.)

(m) Continue unscrewing the hub retaining nut and remove it with the two front cone halves (9) taking care not to drop the cones as they will come loose when backed out of the spider.

(n) Remove the oil seal expander ring (15), the oil seal (11), and the oil seal washer (14) in the order named.

(o) Use the hoisting sling, and while lifting the propeller weight, slowly inch the propeller forward until it clears the shaft. Take extreme care to see that no damage is done to the shaft threads. If available, install a No. 50 SAE thread protector on the shaft threads before removing the propeller from the shaft.

(p) Slide the rear cone (12) off and place a protective cover on the propeller shaft.

Note

Further disassembly or repair of propellers should only be performed at major repair bases.

(3) MAINTENANCE.

(a) Propeller blades and hub should be inspected visually each day or after each flight for damage or defects.

(b) Bends, dents, nicks, or cracks should be dressed out longitudinally with a fine toothed smooth cut file and smoothed up with fine emery cloth or crocus cloth. Deep cracks or other imperfections which cannot be dressed off or rounded out without materially weak-

ening or unbalancing the blade or otherwise impairing its performance shall be cause for condemning the blade. Cracks in the barrel forging shall be cause for condemning it.

(c) In cleaning aluminum alloy propeller blades, use either warm water and soap, gasoline, or kerosene with suitable brushes or cloths. Scrapers, power buffers, steel wool, steel brushes, or any tool or substance that will scratch or mark the surface must not be used. After cleaning or polishing, the blades are to be coated with a thin film of engine oil (Specification AN-VV-O-446).

(d) In cleaning the hub, the same materials are to be used as those specified for the blades. Tools and abrasives which will scratch or damage the plating should not be used, nor should acid or caustic material be used at any time.

(e) It is important that all surfaces of the propellers be flushed off with fresh water as soon as possible after landings are made in salt water, or whenever salt water has come in contact with the propellers. The surfaces should be dried and coated with clean engine oil.

(f) If oil leaks appear aft of the propeller hub, replace the shaft oil seal.

(g) If oil leaks appear forward of the hub, replace the dome and barrel seal.

(4) ASSEMBLY AND INSTALLATION. (See figure 127.)—Prior to installation, the hub and blades assembly (including the retaining nut and front cone), the distributor valve assembly, and the dome assembly should be carefully inspected for cleanliness and, insofar as possible, kept together as a complete assembly. Proceed with installation in the following steps:

(a) Coat the engine shaft and cones with engine oil, and then slide the rear cone (12) all the way back on the shaft.

(b) By means of the hoisting sling (See figure 126), hoist the barrel and blades assembly and install it on the propeller shaft, sliding it back only far enough at first to engage the threads of the propeller retaining nut (10) with those of the shaft.

Note

Care should be taken to pick the propeller up in such a way that the master spline on the shaft will mesh with the one on the spider without having to rotate the barrel and blades assembly.

(c) Insert the hub oil seal washer (14), the hub oil seal (11), and the hub oil seal expander (15).

(d) Install the split front cones (9) and the hub retaining nut (10) as a unit, tightening the nut with the composite wrench (18) and a bar about three feet long, applying a force of 180 lbs. Line up the next locking hole in the nut with the hole in the

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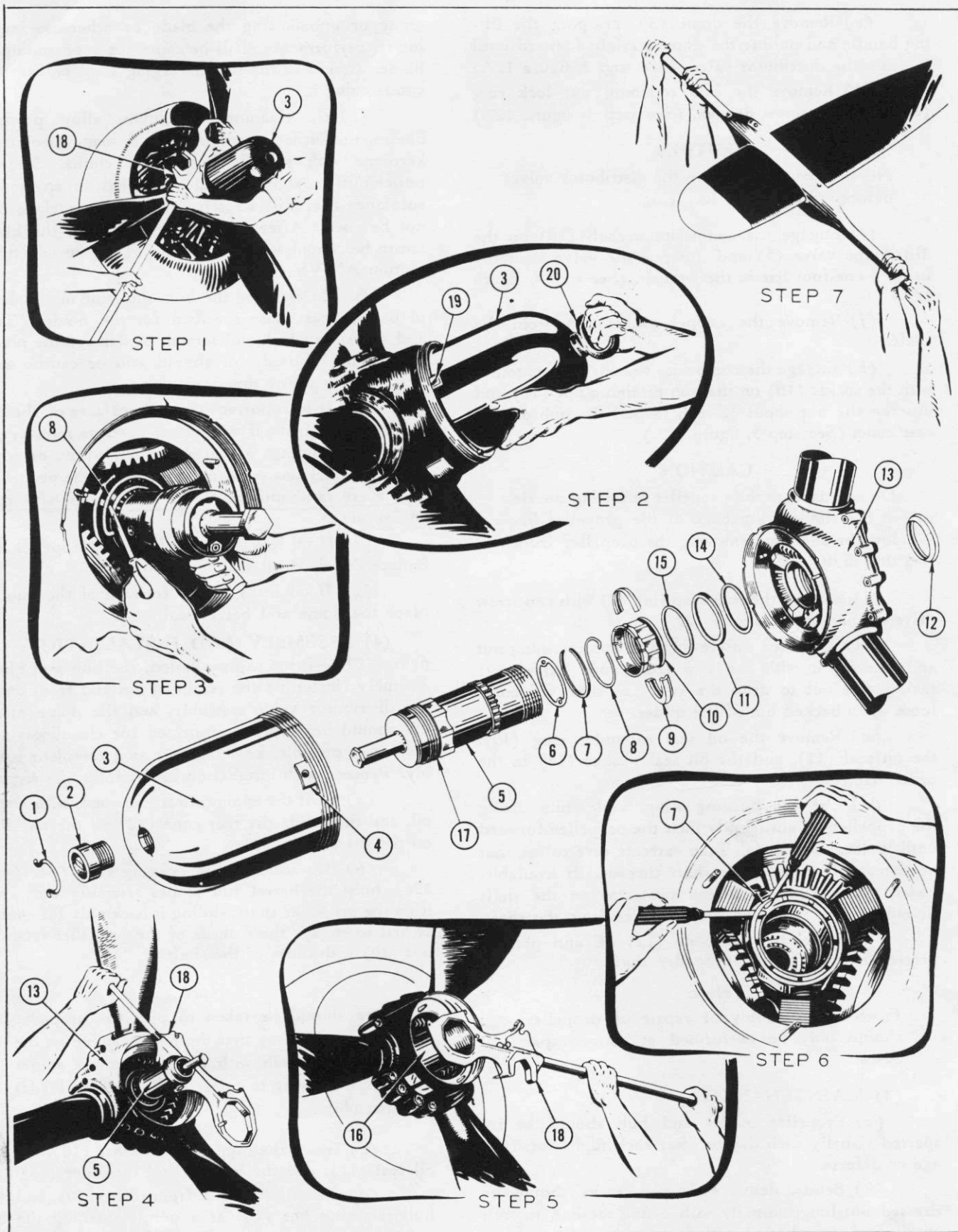


Figure 127—Removal of Propeller

No.	PART No.	NAME	No.	PART No.	NAME
1	53211	Lock Ring	11	52965	Oil Seal
2	53209	Dome Breather Plug	12		Rear Cone
3	52930	Dome Assembly	13	52647	Barrel
4	52484	Dome Retaining Nut	14	52608	Oil Seal Washer
5	52820	Distributor Valve Assem.	15	52966	Oil Seal Expander Ring
6	AN900-40	Gasket	16	53004	Socket
7	AN5009-50	Hub Snap Ring	17	52691	Dist. Valve Oil Seal Ring
8	52676	Nut Lock Ring	18	52829	Composite Wrench
9	51215	Front Cone	19	52479	Dome Retaining Nut Lock Screw
10	52675	Hub Retaining Ring	20		Lifting Handle

All part numbers except items 6 and 7 are Hamilton Standard part numbers.

shaft by striking the bar near the wrench with a mallet or hammer.

(e) Install the hub snap ring (7).

(f) Insert the copper gasket (6) into the shaft.

(g) After lubricating the threads with engine oil (Specification AN-VV-O-466), screw the distributor valve into the shaft making certain that the valve housing oil transfer plate on the base of the distributor valve assembly (5) is properly in place with the copper gasket (6) between it and the valve housing. Tighten the distributor valve assembly with the wrench (18) using a bar about one foot long. Apply a force of approximately 100 lbs and strike the bar near the wrench a light blow with a hammer weighing not more than 2½ lbs until one of the locking slots in the valve housing are aligned with the hole in the propeller shaft previously aligned with the hub retaining nut (10).

CAUTION

Under no circumstances should the valve housing be backed off even slightly in order to obtain slot and hole alignment. If alignment cannot be obtained, a new gasket should be used or the original gasket lapped slightly.

(h) Install the locking ring (8) with the pin through the retaining nut slot, the propeller shaft hole, and into the distributor valve housing slot. Snap the wire into position in the groove provided for it in the retaining nut.

(i) Install the distributor valve oil seal rings (17), making certain the rings flex in the grooves. Stagger the ring gaps.

(j) If the pitch stop rings in the dome assembly were dislodged in removal, they should be re-set. Set the low pitch ring first with the pitch setting at 17°, and the high pitch stop ring last at 88°.

(k) Check to see that the six screws which hold the cam base to the dome are tight. Lubricate the dome retaining nut bearings and threads with engine oil,

and install the dome and barrel oil seal around the stationary cam base against the dome.

(l) Move the piston in the dome assembly into the extreme forward position. This position will be reached when the cam gear stop lugs are against the high pitch stop lugs.

(m) Turn each blade to the pitch position (feathered) against the stop pins. (See step 7, figure 127.)

(n) Lift the dome assembly and slide it over the end of the valve assembly, making sure that the oil seal rings on the valve assembly enter properly into the sleeve inside the piston. Turn the dome COUNTERCLOCKWISE until the dowels in the barrel slip into the holes in the cam gear base. (The dome unit should be installed in the position indicated by the markings on the dome and barrel.)

(o) Start the dome retaining nut (4) and screw in by hand about ¾ of an inch. Continue tightening the nut, using the composite wrench with 180 lbs. applied at the end of a three-foot bar. Line up the retaining nut slot with the lock screw hole by tapping the bar at the wrench with a hammer. Never back up the dome retaining nut to align the locking holes.

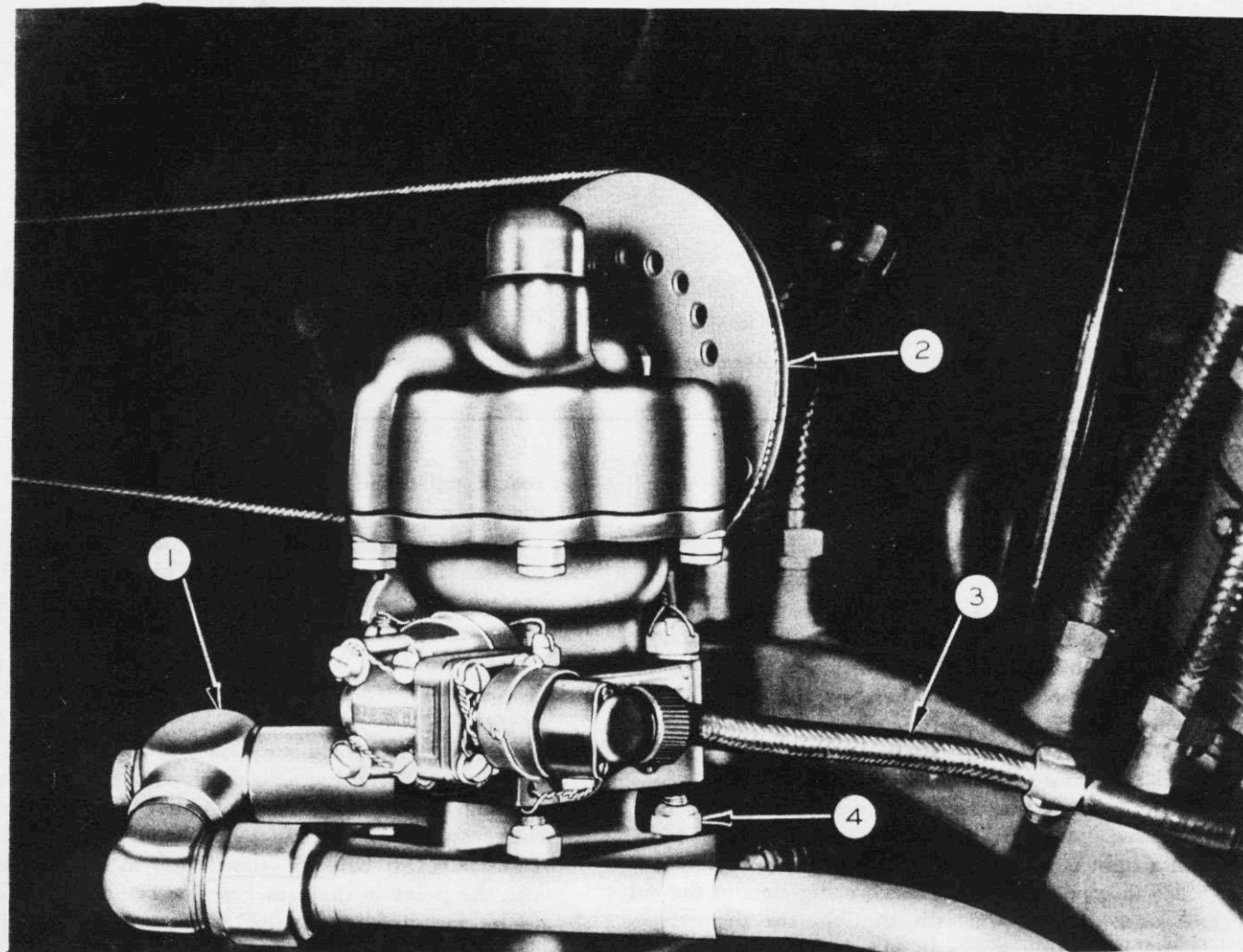
(p) Install the dome retaining nut lock screw (19), and lock it with a safety wire or a 1/16" x ½" cotter pin.

(q) Remove the dome lifting handle (20) and insert the dome breather plug (2) and install the breather plug lock ring (1).

(r) Using suitable levers to turn the blades, shift the propeller into full low pitch position and check all three blade angles by the index lines on the blades and the graduations on the barrel or with a protractor. These angles should be equal and should agree with the low pitch setting. If the marks are off 8°, the propeller blade is out of alignment by one gear tooth, and therefore should be re-aligned.

c. CONSTANT SPEED CONTROL GOVERNOR.

(1) DESCRIPTION. (See figure 128.)—The con-



No.	NAME
1	Propeller Feathering Line
2	Pulley
3	Electrical Conduit
4	Mounting Nuts

Figure 128—Propeller Governor

stant speed control for the propeller is a self-contained governor unit mounted on a special pad on the nose of the engine, immediately aft of the propeller. It is coupled to the engine through a drive shaft and gear which extends through the pad into the engine nose. The unit consists of a gear type booster pump which boosts the engine oil from engine pressure to the higher pressures required to operate the propeller pitch changing mechanism, and a pilot valve actuated by a spring balanced flyball governor to control the flow of oil to and from the propeller. It maintains the speed of the propeller at a constant rate. This constant propeller speed may be adjusted by the pilot by causing a change in blade angle to meet changing conditions of altitude, airplane attitude, and throttle set-

ting. Adjustment from high rpm to low rpm by the pilot is accomplished by means of a quadrant in the pilot's enclosure connected to a cable which rotates a pulley on the back side of the governor, and which in turn compresses or releases the spring on the flyball governor.

When the propeller is feathered, the oil pressure enters the governor on the lower right side from an auxiliary line. The feathering action is stopped when complete by a pressure switch which turns off the circuit to the feathering pump.

(2) REMOVAL.

(See figure 128.)

(a) Remove the pulley (2) from the shaft.

(b) Disconnect the propeller feathering line (1) from the base of the unit.

(c) Disconnect the electrical conduit (3) from the pressure switch.

(d) Remove the mounting nuts (4) which hold the unit to the engine pad, and lift the unit from the engine.

Note

Whenever it is necessary to temporarily remove the governor between propeller overhaul periods, the cockpit control should be moved to the minimum rpm position and the pulley marked in relation to the cover before removal from the control shaft. This will permit reinstallation in exactly the same position and facilitate the re-adjustment of the control system.

(3) MAINTENANCE.—Since the governor is a self-contained unit and is constantly working in oil, there is relatively little wear. Maintenance at overhaul periods consists mainly of cleaning the unit.

(a) If failure occurs, remove the unit and replace with a new one.

(b) Keep the mounting stud nuts tight. If oil leaks appear at the mounting seat, replace the gasket.

(c) Keep the tube fitting on the feathering line tight, and examine the electrical connection at the pressure switch to see that it is free from dirt or corrosion.

(4) INSTALLATION.

(See figure 128.)

(a) Check governor for freedom of movement before installing.

(b) Clean off mounting surfaces. Use a new gasket if the old one is damaged.

(c) Place the governor on the mounting pads with the pulley side next to the engine, and install washers and nuts (4) on the mounting studs, tightening slowly and evenly.

(d) Connect the propeller feathering oil line (1) and the electrical conduit (3) to the pressure switch.

(e) Install the pulley (2) on the governor control unit in accordance with markings previously made on the pulley and the cover. If no such markings were made, or if the cable was disconnected from the pulley, proceed as follows:

1. Place the control lever in the pilot's enclosure in the "LOW" position, then pull it back about 3/16 inch and lock it in this position.

2. Place the pulley on the governor control unit in the low pitch position so the stop on the pulley rests against the low pitch adjusting screw.

3. Place the cable on the pulley and tighten the nut on the cable clamping bolt.

d. FEATHERING PUMP AND MOTOR.

(1) DESCRIPTION. (See figure 129.)—The higher oil pressure required for feathering or unfeathering the propeller is supplied by a motor driven Pesco pump No. 1E-AR-280-BH located on the forward face of each firewall on the lower left hand side of each nacelle. The control switch is located in the pilot's compartment just forward of the throttle control levers. The electric motor used to drive the pump is a 24-volt, D. C. series wound unit designed for intermittent duty. The drive coupling has a safety shear section to protect the motor and pump against excessive load.

(2) REMOVAL.

(See figure 129.)

(a) Loosen knurl nut (1) at top of motor junction box (3).

(b) Detach cover from motor junction box; disconnect electric lead (2); and then remove box from motor.

(c) Remove coupling (7) from pump (6).

(d) Remove the eight bracket mounting bolts (10) and (11).

(e) Remove the four motor mounting bolts (8).

(f) Remove pump mounting screws (5) and withdraw pump from motor.

(3) MAINTENANCE.

(a) Inspect bolts that hold pump to motor, as well as motor mounting bolts to see that they are kept tight.

(b) See that all pipe connections are tight and do not leak.

(c) If the pump leaks between the main body and cover, replace the pump. If it leaks around the relief valve cap, replace the gasket.

(d) Brush compartment at upper end of motor should be blown out with compressed air. Brushes should maintain good contact with commutator, and should be replaced if worn.

(e) Remove any brushes that tend to stick in the holders and clean with unleaded gasoline or with No. 000 sandpaper.

(f) When brushes are installed, fold over brush leads or pigtails so that they touch no metal parts other than the brush holders. Re-seat new brushes to the curve of the commutator by holding a piece of No. 000 sandpaper on the curved surface of the commutator, sanding in the direction of rotation.

(g) If commutator is rough or coated, clean the surface by holding a piece of No. 000 sandpaper against the surface of the commutator while rotating it. Do not use emery cloth, and do not use metal to apply the sandpaper. If commutator is rough or eccentric, it must be removed and re-surfaced in a lathe.

(4) INSTALLATION.

(See figure 129.)

(a) Clean the face of the mounting flanges of pump (6) and motor (4).

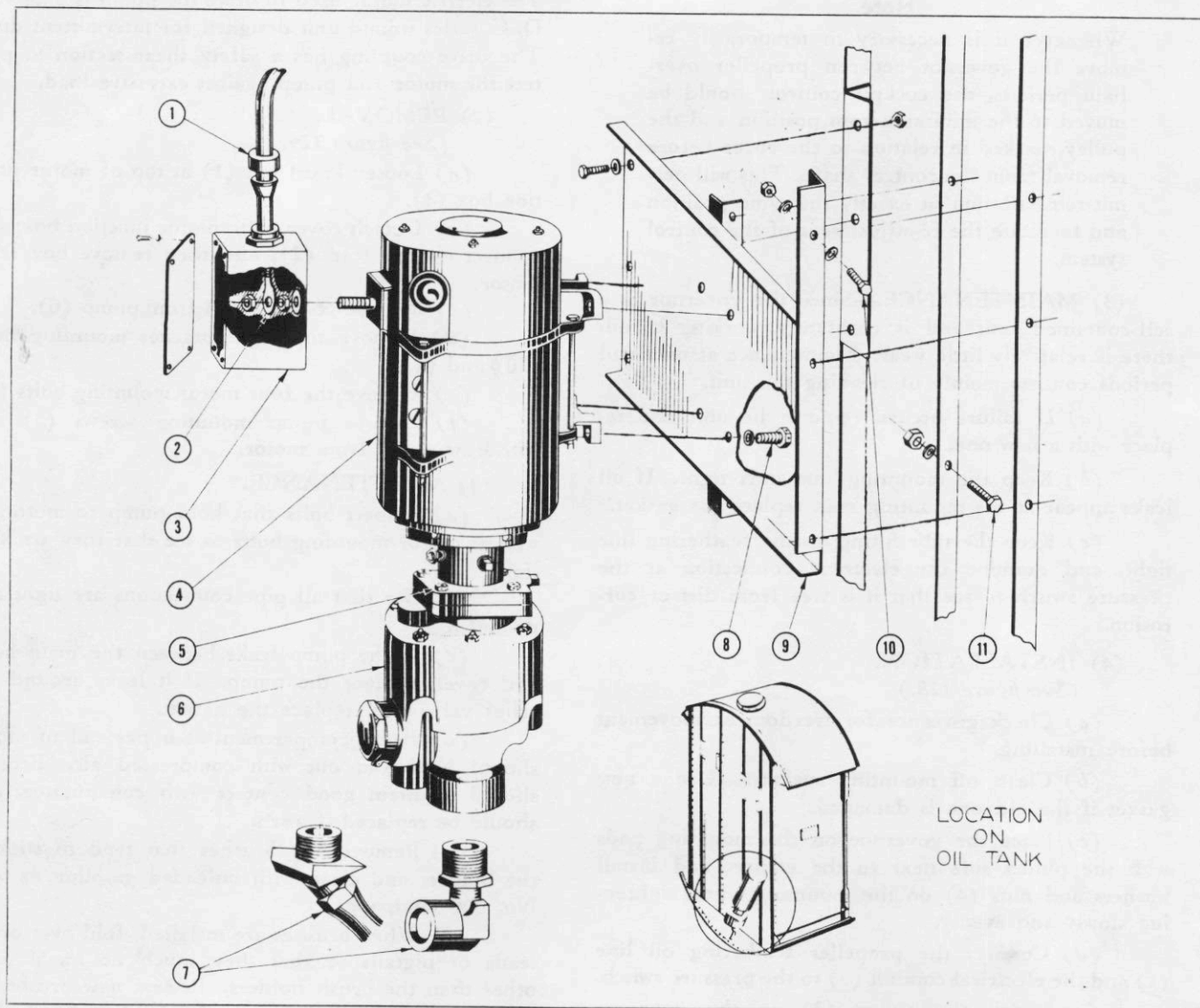
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(e) Install the assembly on the firewall with eight bracket mounting bolts (10) and (11).

(f) Install coupling (7) in bottom of pump.

(g) Attach electric lead box (3) to pump, and connect electric lead (21).

(h) Install cover on box, and tighten knurled nut (1) to top of box.

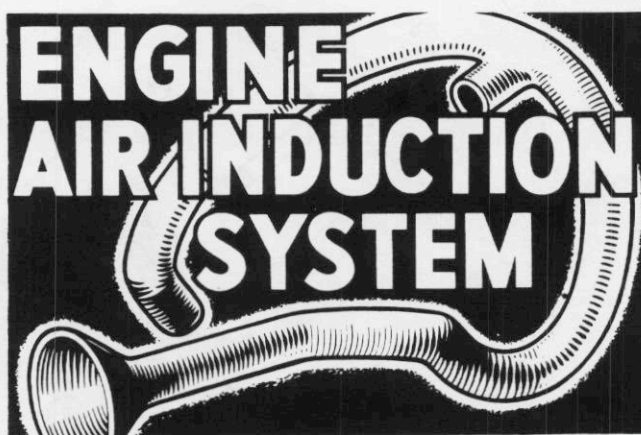


No.	PART No.	NAME	No.	PART No.	NAME
1	NAF213022-4	Knurl Nut	8	AN76A5	Bolt
2	Q6211-11	Electric Lead		AN960AL616	Washer
3		Motor Junction Box		28P5102	Mounting Bracket
4	280-2C	Motor	10	AN3-5A	Bolt
5	181-19A	Screw		AN365-1032	Nut
	181-22	Washer		Q7102-AL10	Washer
	203-15	Nut	11	AN3-4A	Bolt
6	IE-AR-280-BH	Pump		AN365-1032	Nut
7	NAF213711-12D	Coupling		Q7102-AL10	Washer

Items 4, 5, and 6 are Pesco Products Co. part numbers.

Figure 129—Fast-Feathering Pump

PARAGRAPH 14.



14. AIR INDUCTION SYSTEM.

a. GENERAL. (See figure 130.)—The engine air induction system is comprised of four major units: the carburetor air induction system; the magneto air blast tube; the oil cooler air duct; and the generator air scoop and blast tube.

b. CARBURETOR AIR INDUCTION SYSTEM.

(1) DESCRIPTION. (See figure 130.)—The carburetor air induction system consists of the duct, the carburetor elbow scoop, and the alternate air control assembly.

The duct is designed in three sections: a forward section forming an entrance scoop on the cowl ring; a center section integral with, and removable with, the top segment of the engine cowling; and an aft section attached at its forward end to the engine cowl former ring and at its aft end to the carburetor elbow scoop.

The carburetor elbow scoop is a casting located at the aft end of the duct. It encloses, and provides support for an air flow control valve operated by the alternate air control assembly.

The alternate air control assembly includes the valve bell crank outside of the elbow scoop, and a cable connection to a pull-handle marked "CARB AIR", mounted on the engineer's panel. Two positions for this pull-handle are indicated on the panel as "DIRECT" and "ALTERNATE." It is the purpose of the valve and control assembly to protect the carburetor by permitting the engineer to cut off the direct air supply during threatening conditions of ice, snow or rain. When the control handle is in "DIRECT" position, a spring on the valve bell crank holds the valve closed over a port in the lower surface of the elbow neck. Air then enters the carburetor through the duct and the elbow scoop.

The control handle can be placed in "ALTERNATE" position by pulling it out from the engineer's panel and locking it with a twist until it indicates

"ALTERNATE." Pulling the control rotates the valve away from the lower elbow port and up into a position across the forward mouth of the elbow. Air flow through the duct is halted and air for the carburetor is drawn from the engine compartment into the elbow through the lower elbow port.

To effect a return to direct air flow, the handle is twisted back to vertical alignment and released. The spring, acting at the valve bell crank, pulls the valve down to close the alternate air flow port, and leave the duct air passage unobstructed.

(2) REMOVAL.

(See figure 130.)

(a) The nose scoop (1) is an integral part of the nose cowl ring and is removed by removing the cowl ring. (See Par. 7, b, (1), (b).)

(b) The center duct section (2) is integral with the top panel of the intermediate cowl panels and is removed by withdrawing ten screws (23) which hold it in place.

(c) Remove center upper cowl flap. (See Par. 7, b, (3), (b).)

(d) Remove the rear duct section (3) by removing four screws (19) which attach it to the engine cowl former ring. In removing duct, lift the forward end slightly, and at the same time pull the section forward to disengage it from the elbow scoop (4).

(e) Release spring (5) from bracket at forward end by removing bolt (18).

(f) Disconnect control cable by removing bolt (13) at control bell crank (12).

(g) Disconnect vent line from fitting at rear face of elbow scoop.

(h) Free shroud (21) by withdrawing six bolts (22) attaching it, and slide shroud forward to uncover the bolts in the elbow scoop flange.

(i) Remove ten bolts (17) from lower flange of elbow scoop. The scoop is now completely disconnected and may be lifted from place.

(j) To disassemble elbow scoop:

1. Remove spring (5) from control bell crank (12) by withdrawing clevis bolt (14).

2. Remove control bell crank (12) from shaft (8) by removing taper pin (10).

3. Remove link (15) by withdrawing bolts (14) and (16) at each end.

4. Remove bell crank (11) by taking out taper pin (10) and withdrawing shaft (8) out of its bearings.

5. Remove valve (7) by backing out two bolts (6) and pulling valve out through mouth of scoop.

(3) MAINTENANCE.

(a) Inspect all parts for signs of corrosion, es-

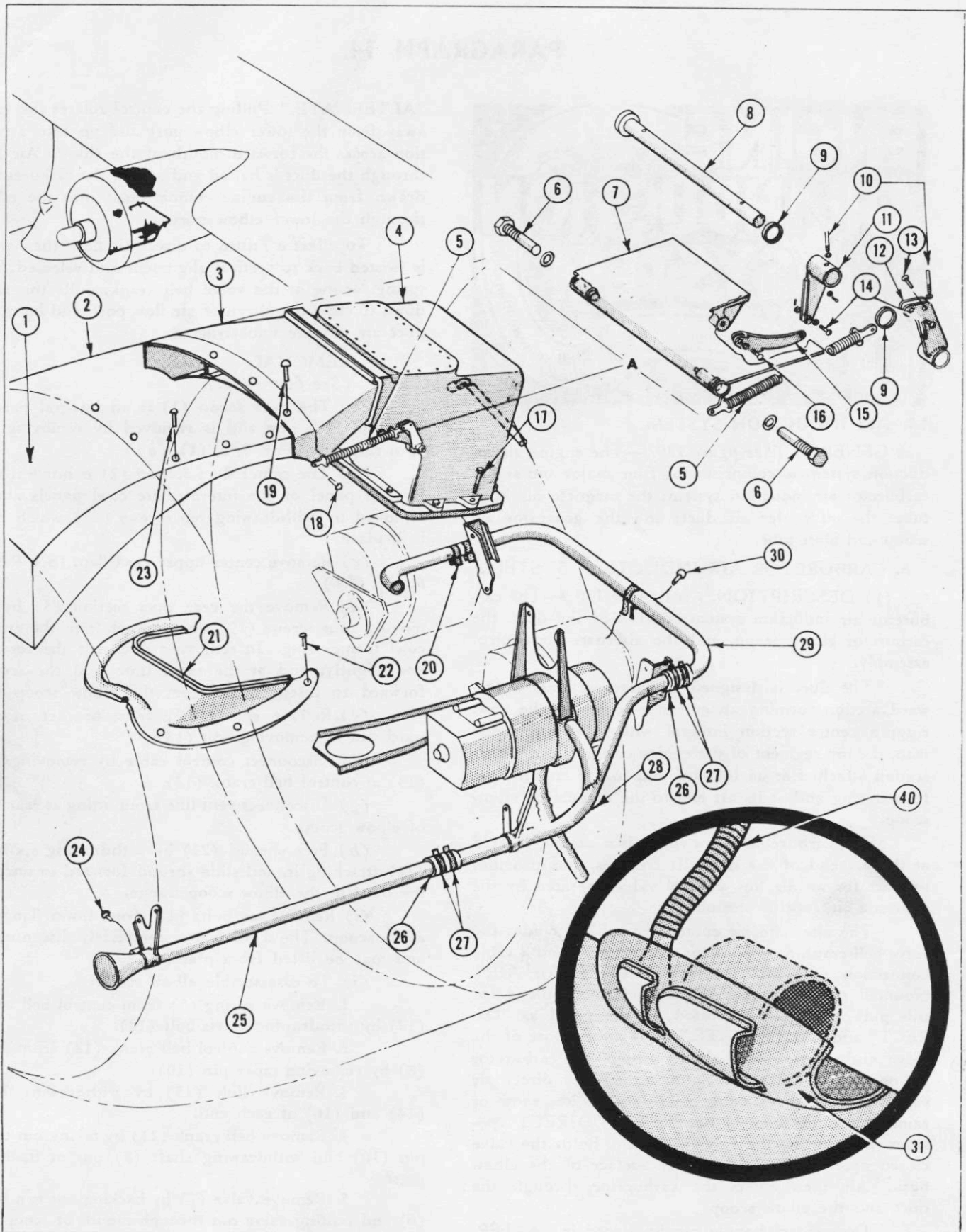


Figure 130—Air Induction System

No.	PART No.	NAME	No.	PART No.	NAME
1		Nose Scoop	17	28P5155	Bolt
2	32D024-2	Center Duct		Q7007AL17-.064	Washer
3	28P5007	Rear Duct Section	18	AN5-12	Bolt
4	28P5009	Elbow Scoop		AN310-5	Nut
5	28P1290-5	Spring	18	AN380C2-3	Cotter
6	28P5013	Bolt	19	AN510-10-8	Screw
	Q7014-C33-.064	Washer	20	755-16-2-8	Clip
7	28P5012	Valve		AN526-1032-10	Screw
8	32P023	Shaft		AN365-1032	Nut
9	Q7014-C33-.064	Washer		Q7102A10	Insulating Washer
10	AC386-1-7	Taper Pin	21	28P5003-17	Shroud
	AN320-3	Nut	22	AN3-3A	Bolt
	AN380C2-2	Cotter	23	AN526-1032-10	Screw
	AC975-3	Washer	24	AN3-5A	Bolt
11	28P5014	Bell Crank		AN365-1032	Nut
12	28P5526	Bell Crank	25	28P5530	Magneto Blast Tube— Front Sect.
13	AN23-9	Bolt	26	AN878-16-13	Hose
	AN320-3	Nut	27	AN748-46	Clamp
	AN380C2-2	Cotter	28	28P5127-6	Magneto Blast Tube— Fork Sect.
14	AN23-10	Bolt	29	*28P5127-10	Magneto Blast Tube— Rear Sect.
	AN320-3	Nut		**28P5127-7	
	AN960C10	Washer	30	AN515-1032-10	Screw
	AN380C2-2	Cotter		AN365-1032	Nut
15	28P5016	Link	31	28-0-5015	Duct
16	AN23-12	Bolt	40		Generator Blast Tube
	AN320-3	Nut			
	AN960C10	Washer			
	AN380C2-2	Cotter			

*PBY-5A only.

**PBY-5 only.

Item 20 is an Adel Precision Products Co. part number.

pecially where bolts or bearings offer contact for dissimilar metals. Refinish parts showing minor corrosion. Replace any parts which show serious attack.

(b) Inspect bearings for wear or corrosion. Replace if either condition exists.

(4) ASSEMBLY AND INSTALLATION.

(a) To assemble elbow scoop:

1. Place valve (7) in position, with washers (6) located so that all holes are in line, and insert bolts (6). Secure bolts to casting with lockwire (AC995-C-32) through adjacent holes.

2. Assemble shaft (8), link (15), bell cranks (11) and (12), and spring (5) by performing steps in reverse order as outlined in paragraph b, (2), (j).

Note

If, when taper pin (10) is inserted and the nut tightened, the larger end of the pin is drawn more than 1/32" below the fitting surface, the hole in the fittings and shaft has become excessively enlarged and the parts should be replaced.

(b) Place new gaskets above and below the flange of the strainer unit on top of the carburetor, place the elbow scoop in position over the strainer unit

and insert the ten flange bolts (17). Secure all bolts in each flange by lockwiring heads together in groups of two or three.

(c) Replace shroud (21) by securing with six bolts (22).

(d) Connect vent line at rear of elbow.

(e) Connect control cable to bell crank with bolt (13).

(f) Connect spring (5) to bracket by means of bolt (18).

(g) Insert aft end of aft duct section (3) into mouth of elbow scoop (4); place in position against engine cowl former ring; and secure by inserting four screws (19).

(h) Replace center upper cowl flap, reversing removal procedure of Par. 7, b, (3), (b).

(i) Replace center duct section and nose scoop by installing the portions of engine cowling of which they form integral parts.

c. MAGNETO AIR BLAST TUBE.

(1) DESCRIPTION. (See figure 130.)—The magneto air blast tube is composed of three sections joined by short clamped hose pieces. This assembly extends from an entrance funnel, attached to the nose section of the engine, aft between engine cylinders to a welded