PHASE 2

AIRCRAFT STRUCTURES

GENERAL INFORMATION

1 The expeditor 3 Series aircraft are twin-engine, low wing, all-metal land monoplanes. They are powered by two Pratt and Whitney 450 hp, radial, air-cooled engines, which drive full-feathering Hamilton Standard Hyromatic propellors. Other features are electrically-operated retractable landing gear, dual flight controls, and hydraulic brakes. The fuselage is of all-metal semi-monocoque construction. The wings are of all-metal construction. Control surfaces are of metal construction, fabric covered. The primary structure of the centre section consists of a single, triangular welded steel tabular truss which carries fittings for the engine mount, landing gear, and outer wing panel main spars. The remainder of the centre section structure consists of aluminum-alloy ribs, bulkheads, stringers and a smooth skin covering. The cabin door, located on the left side of the fuselage aft of the wing prvoides access to both the cabin and pilot's compartments. The expeditor 3N is fitted as a navigation trainer with astrodome and two trainee stations in the cabin. The 3NM, primarily a navigation trainer, is fitted with floor lugs to accept transport seats on removal of the navigation equipment. The 3TM is normally fitted with transport-type seats but has the necessary wiring, plumbing and fittings for conversion to a navigation trainer, including provisions for fitting an astrodome.

GENERAL

Span	- 47 ft 7 in
Length (overall)	- 34.2 ft
Height	- 9 ft 2½ in
Height (tail wheel on ground, propeller blades vertical main struts inflated to 2½ in)	- 10 ft 8 9/16 in
Height (vertical stabilizer to ground)	- 12 ft 8 in
Propeller ground clearance	- 11 in
Design gross weight	- 8,730 lbs
Maximum alternate gross weight	- 8,750 lbs

STABILIZER

Span (from centerline of each vertical stabilizer)	- 14.97 ft
Maximum chord	- 5 ft 10 in
Incidence	- -2 deg
Dihedral	- None

FUSELAGE

Width (maximum)	- 56 in
Height (maximum)	- 65 ¼ in
Length	- 34 ft 2 in
Height of door level above ground (static)	- 31 in
Door dimensions	- 44½ in x 24½ in

Total cubic foot stowage space available for baggage, cargo	- 49.5 cu ft

WINGS

Type	- low wing
Airfoil section at root	- Modified) NACA 23020
Airfoil section at tip	- Modified) NACA 23012
Chord at root (theoretical at center line of fuselage)	- 135.116 in
Chord at tip 'theoretical at outer end of tip)	- 42 in
Incidence at root	- 3.922 deg.
Incidence at tip	- 1 deg
Dihedral (at 25% of chord aft of leading edge)	- 6 deg
Sweepback (at 25% of chord aft of leading edge)	- 8 deg 23 min
Aspect ratio	- 6.5

DEVELOPMENT OF AIRFRAME STRUCTURES

Design and Performance Improvement

1 Since construction of the early Wright Biplane (1903) engineers have been steadily improving the design and performance of aircraft.

(a) Speeds

1903 - Wright - 25 MPH
1914 - Bristol "Scout" - 20 MPH
1941 - Spitfire - 300 MPH
1951 - Sabre - Mach 1.0

(b) Power Plants

1903 - 35 hp piston engine with chain drive to propellor
1915 - 80 hp radial engine
1955 - 3,000 hp jets and turbo-prop engines

(c) Dimensions

1903 - wing span 40 feet, weight 200 lbs
1914 - wing span 30 to 75 feet, weight approx 1,000 to 4,000 lbs
1939 to 1955 - wing span 30 to 300 feet, weight 1½ to 50 tons

(d) Mainplane Construction

1903 - umbrella fabric type covered biplane, wire braced
1914 - biplane, popular thick wings fabric covered

1939 - more monoplanes, semi cantilever type, stressed skin construction introduced.
1955 - monoplanes become universal, fullcantilever, semi monocoque.

(e) **Fuselage**

1903 - open structure
1914 - box shape, streamlined open cockpits
1939 - metal construction, streamlined, closed cockpits
1955 - highly streamlined, semi-monocoque construction, pressurized cockpits and cabins.

(f) **Tail Units**

1903 - tailplane front, rudder at rear
1914 - conventional tail unit, wire braced
1939 - conventional empennage, some cantilever types
1955 - fully cantilever, some swept back

(g) **Undercarriage**

1903 - skids, no shock struts
1914 - fixed, through axle type, pheumatic tires
1939 - cantilever type, some retractable
1955 - tricycle type most popular, mostly all retractable

(h) **Controls**

1903 - elevator, rudder. Wings warped for lateral control
1914 - conventional, rudder, elevator, ailerons
1939 - conventional, fabric covered, manually operated
1955 - flying tail, power assists to aid pilot

(I) **BASIC STRUCTURES**

The strength and rigidity of most aircraft is given by a Frame or "skeleton" structure to which are attached the aircraft skin and fittings. Although the modern trend is stressed skin construction, where the skin itself absorbs the greater part of the stresses many of the rules of sound from construction apply to the components attached to the aircraft. The "skeleton" or frame is compound of various number known as struts, ties and beams.

(1) **STRUTS** - Are members which are designed to absorb compression in the direction of their length is tending to shorten them.

(2) **TIES** - Are members designed to absorb tension is tending to lengthen or stretch them.

(3) **BEAMS** - Are members designed to carry loads at an angle to their length, tending to bend them. Any member can act however, in more than one capacity eg goth as a strut and tie, or as a strut and beam.

(11) **LOADS AND STRESSES**

The term "stress" means merely the load which a member has to bear, eg, the lift created on the main planes in flight is stressing the mainplane spare.

When loads sufficient to cause a deformation in a member are applied, that member is said to be under "strain". The deformation does not have to be permanent for this term to apply.

(1) **TENSION**

Is the term applied to a loading which tends to "stretch" or lengthen a member.

(2) **COMPRESSION**

Is the term applied to a loading which tends to shorten a member eg, loading struts, flap link rod.

(3) **TORTION**

Is the term applied to a loading which tends to twist a member. Torsional loading is felt on the aileron torque tube when the control column is moved sideways.

(4) **SHEAR**

Is the term applied to two opposing forces acting in the same plane on a member exacting a cutting action.

(III) **BEAMS**

As mentioned previously resists loads applied at an angle to their length. There are two types SUPPORTED AND CANTILEVER.

(1) <u>SUPPORTED BEAMS</u> - Are supported at both ends.

(2) <u>CANTILEVER BEAMS</u>

Are supported at one end only as in the case of a mainplane spar. But if a cantilever beam is under load, it will tend to bend at the root, therefore that is where the greatest strength is required. For this reason the majority of cantilever beams are largest and strongest at the root end and taper towards the tip.

When a beam is under load the upper side tends to become shorter (compression) and the under side stretch (tension). There being opposite forces on the two sides there is a plane in the centre which is neither in compression or tension. This plane is called the Neutral Axis. The material along the neutral axis is only resisting slight shear forces. So if some of the material was removed from the centre and added on the top and bottom of the beam it would increase the strength of the beam without any additions in weight.

(IV) PRINCIPAL STRUCTURAL UNITS OF AN AIRCRAFT

The principal structural units of an aircraft are: The fuselage, wings (mainplanes), stabilizers, control surfaces and <u>LANDING GEARS.</u>

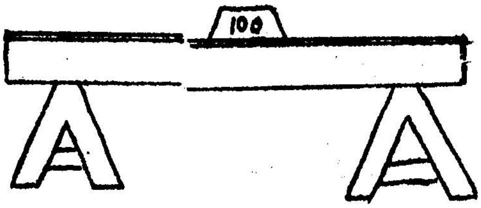
(1) The main structure is the fuselage, To this all other units are attached. On single engine aircraft it houses the engine, crew cargo etc. On multi-engined aircraft the power plants are mounted on nacelles which are attached to the wing structure.

(2) The mainplanes are the main lifting and supporting surfaces of the aircraft in flight. They are usually made in sections, such as centre section, outer wing and wing tips.

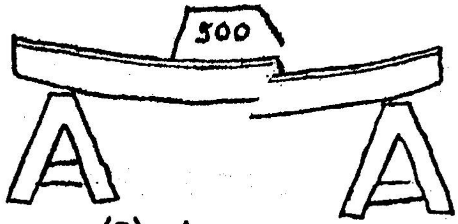
(3) Stabilizers are aerofoils whose primary purpose is to increase the stability of the aircraft. They are mounted at the rear of the aircraft and consist of the vertical fin and horizontal stabilizer or tail plane.

(4) Control Surfaces are moveable aerofoils by which the aircraft is controlled in flight. They are hinged auxiliary surfaces and consist of ailerons, elevators, rudder, tabs and flaps.

(5) Landing Gear is the structure which supports the aircraft while on the ground. It incorporates shock absorbing devices to reduce the shock of landing and taxiing and is usually retractable in flight. There are various main types e.g. wheels, skies, floats and various combinations of these.

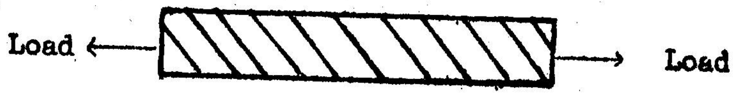


(A) A beam under stress

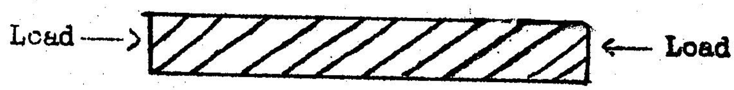


(B) A beam strained

(Fig. 1)

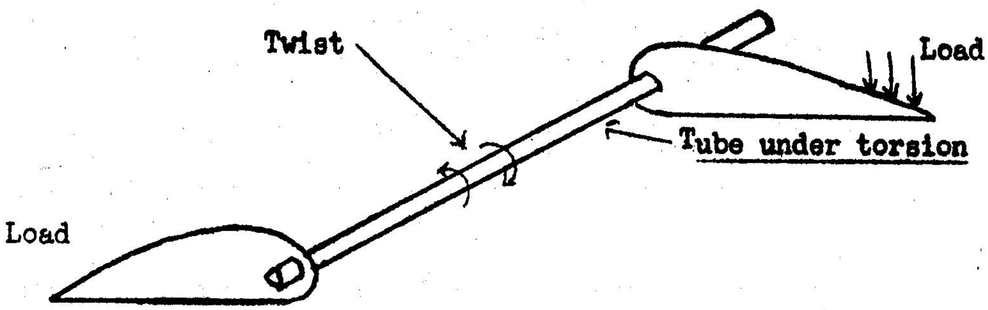


A beam in tension

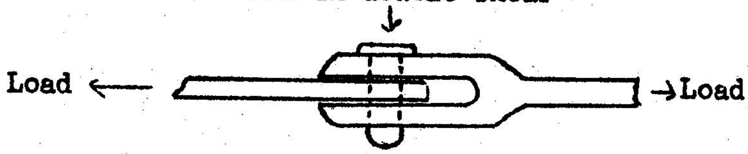


A beam under compression

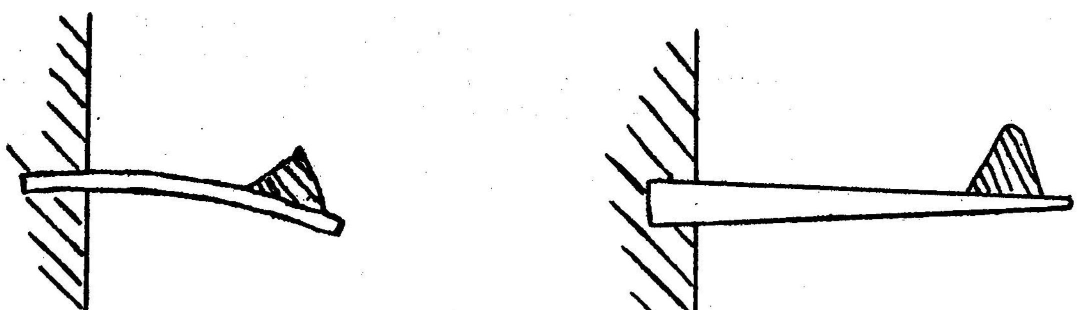
(Fig. 2)



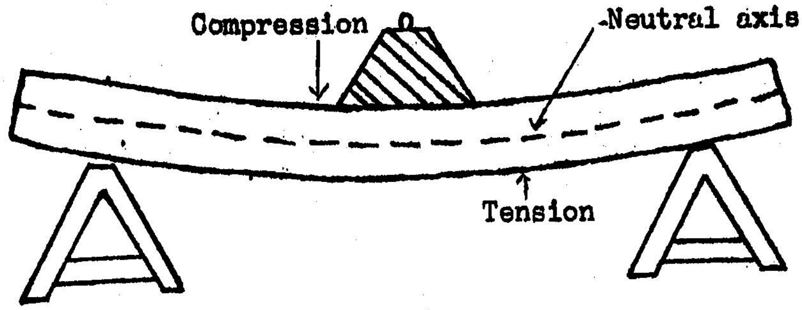
Pin in double shear



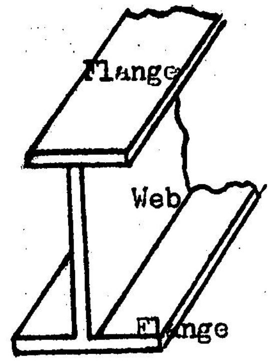
(Fig. 3)



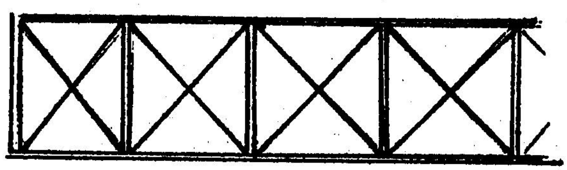
(Fig. 4)
Principle of loaded cantilever beam



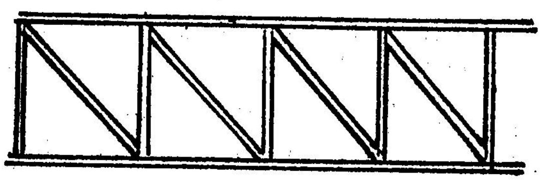
Neutral axis



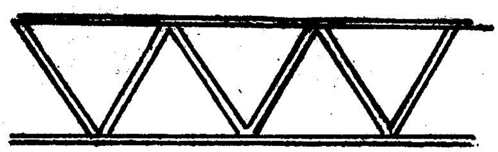
"I" BEAM



GIRDER CONSTRUCTION



SINGLE "N" CONSTRUCTION



WARREN TRUSS CONSTRUCTION

(v) FUSELAGE CONSTRUCTION

A fuselage is the main structural body of an airplane to which all other components are attached. Therefore, on the fuselage depends the location of the various "controls" and they have to be maintained in positions of correct relation to each other during flight. So it must be rigid to act as a lever. Detailed design varies with the manufacture and the requirements of the service for which the aircraft is intended.

Fuselages of most aircraft are at present all metal construction. But during the last war, wood was used. Fabric was also used over a metal girder construction. Fuselages may be considered under three principal headings: - braced structure, geodetic, monocoque or semi-monocoque.

(1) BRACED STRUCTURE

There are four longitudinal members called longerons. They are held apart by transverse and side struts forming a bay-like structure. Around this structure is built a light frame work of formers to give it cross-sectional streamline shape and stringers running lingitudinally. Braced structures are rarely used today in aircraft construction. There are three types:

(a) Girder - In the girder construction the struts are all vertical and the bays so formed are braced diagonally with wires.

(b) Single "N" - In the single "N" form of construction the struts are placed vertically and the next one diagonally forming an "N" right on through the structure.

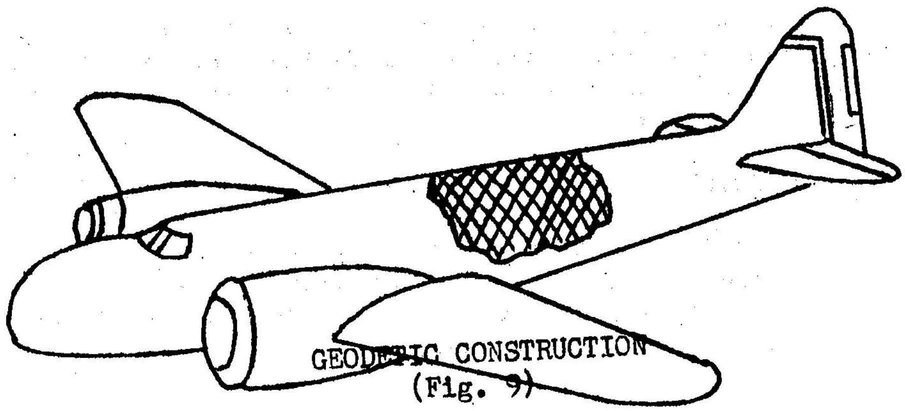
(c) Warren Truss - In this type of construction the struts are all inclined to the longerons.

(2) GEODECTIC STRUCTURE

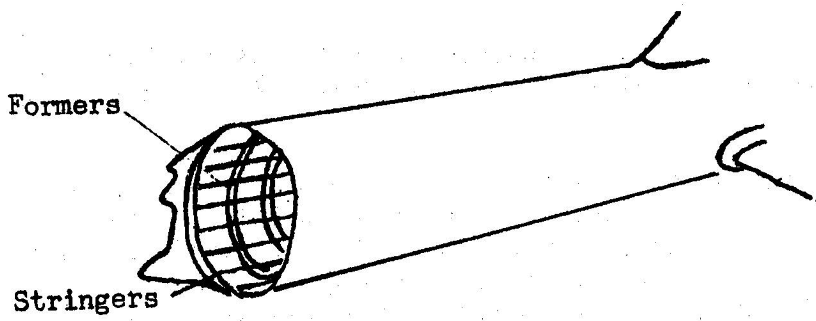
Geodectic structure was used on some aircraft during the last was e.g. Wellingtons. In the structure the structual members are placed diagonally round the fuselage, forming a number of spirals. These spirals run left and right handed, and are built through each other at points of intersection.

(3) MONOCOQUE STRUCTURE

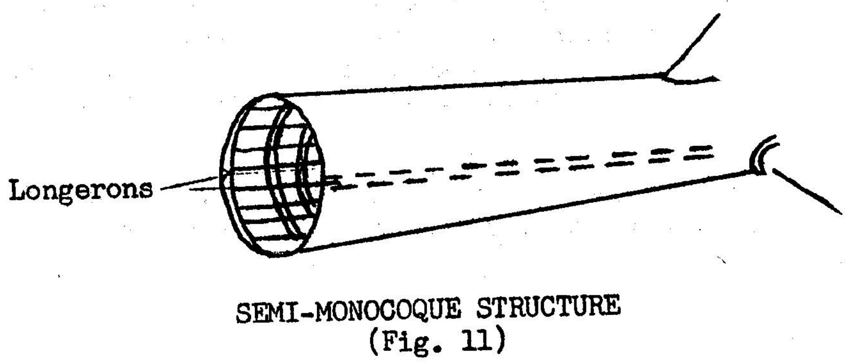
The monocoque type of fuselage consists of a tabular shape of sheet metal stiffened by longitudinal stringers and supported by transverse former rings or former. The skin acts as a covering as well as a stiff tabular sheell capable of carrying the principal loads imposed on it in flight. The hollow interior provides unobstructed space for passengers or storage.



GEODETIC CONSTRUCTION
(Fig. 9)



MONOCOQUE CONSTRUCTION
(Fig. 10)



SEMI-MONOCOQUE STRUCTURE
(Fig. 11)

(4) SEMI-MONOCOQUE STRUCTURE

The semi-monocoque is very similar to the monocoque fuselage, but uses longerons and more internal stiffening than does the monocoque. This structure is used when large bomb doors or other openings disturb the continuity of the skin.

(VI) ENGINE MOUNTING

An engine mounting structure must be extremely rigid and capable of withstanding the thrust and torque reaction of the power plant in addition to supporting the weight of the engine, both vertically and laterally. There are two main types of mountings.

(1) Mounting Ring

The mounting ring consists of a vertical circular plate or ring concentric with the cylinders and crankcase. It is used for radial engines.

(2) Mounting Cradle

The cradle consists of two horizontal fore and aft members placed one on each side of the crankcase. It is used for 'in line' or "V" type engines.

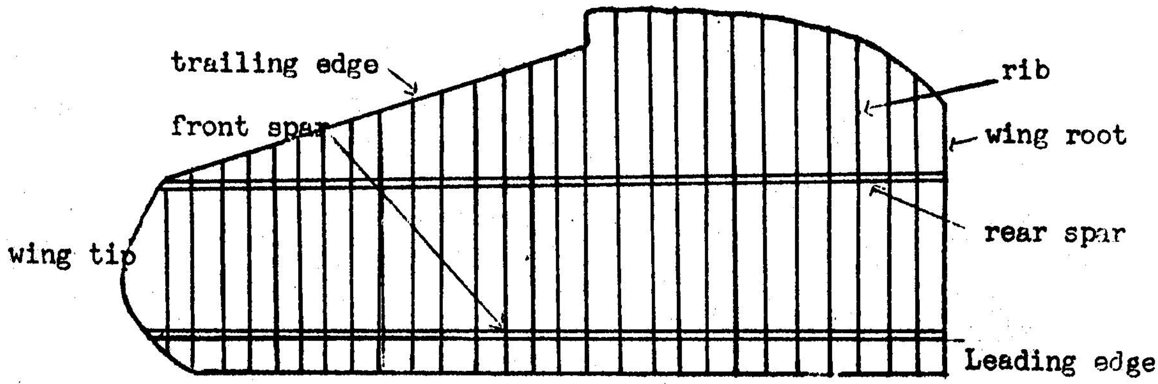
The engines mounting is separated from the fuselage proper by a fireproof bulkhead which protects the pilot and the remainder of the aircraft in case of an engine fire. This firewall is usually made of asbestos sheet covered with stainless steel. All openings for conducts, controls, tubing etc., are closed as nearly as possible.

Shape is given to the engine by cowlings which are secured by turn-botton (DZUS) fasteners of the quick release type.

(VIII) MAINPLANE CONSTRUCTION

(1) The mainplanes or wings of an aircraft are surfaces designed to give lifting forces when moved rapidly through the air. The particular design for any kind of aircraft depends on a number of factors e.g. size, weight, purpose for which the aircraft is intended, desired landing speed, rate of climb etc. Usually large compartments in the wings contain gasoline tanks and in case of fighter aircraft carry practically all of the armament.

At the present most wings are of the stressed skin type, where the skin is a part of the basic wing structure and carries part of the wing stresses.



MAINPLANE
(fig. 13)

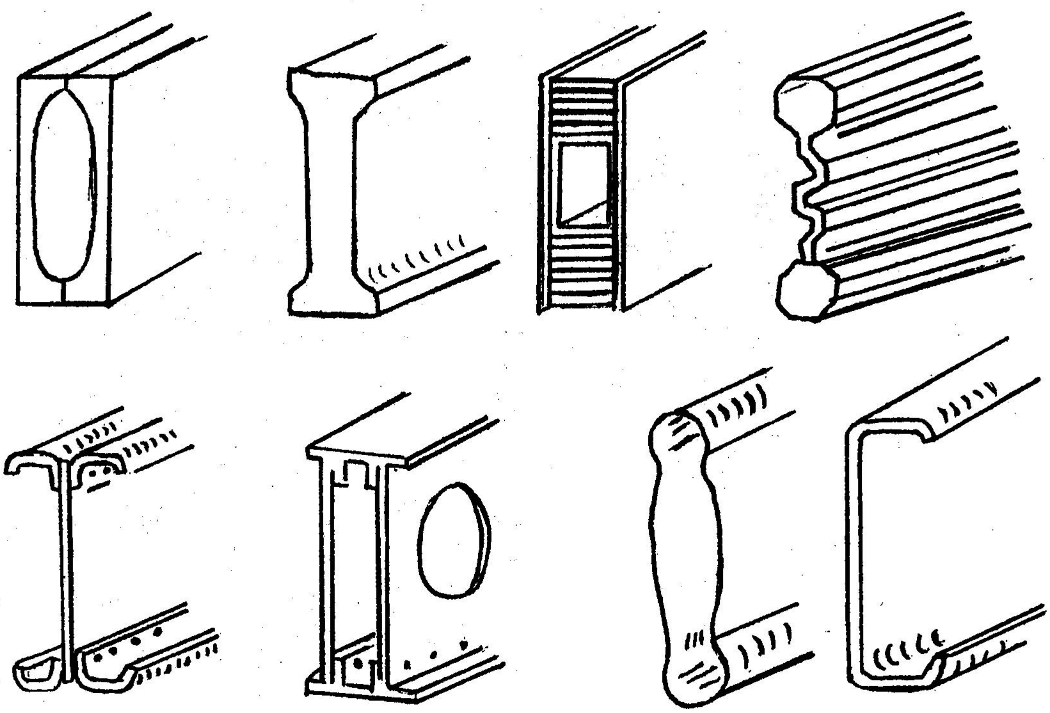
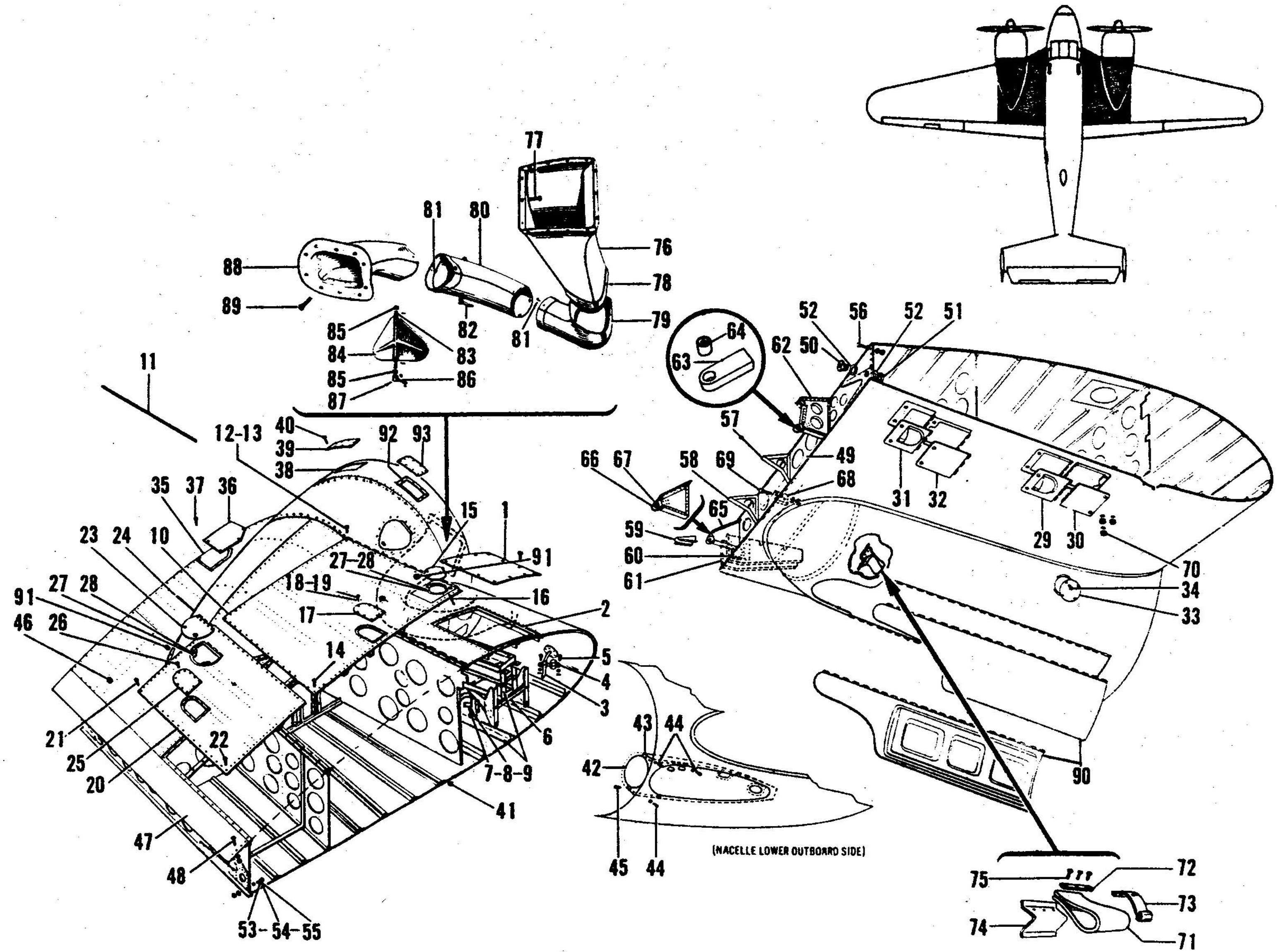


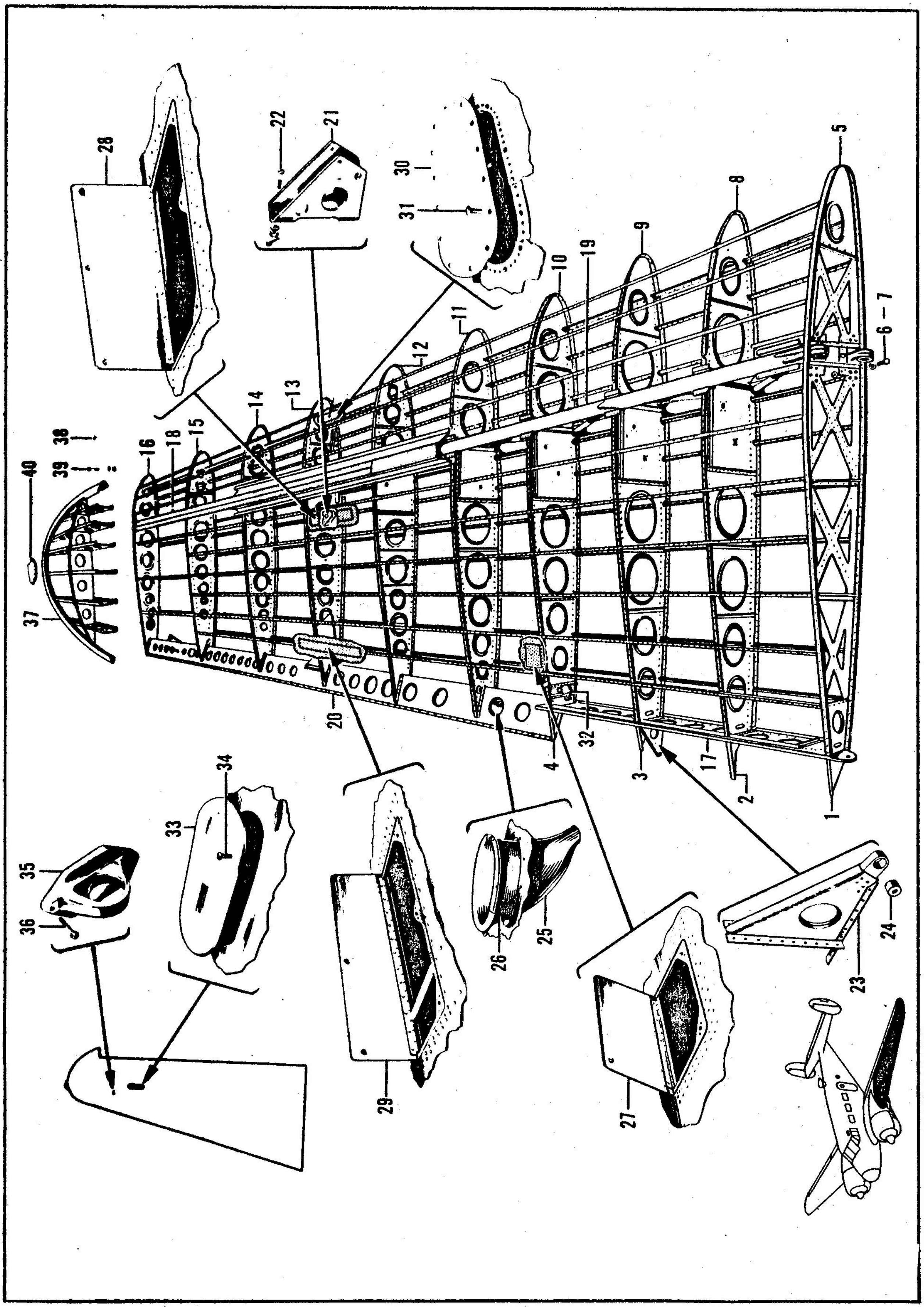
Fig 14



Center Section Wing Assembly

CENTRE SECTION WING ASSEMBLY

1 Cover Assembly - battery compartment LH and RH
2 Frame Assembly - battery compartment opening LH and RH
6 Frame Assembly - battery compartment LH and RH
10 Cover Assembly - main fuel tank LH and RH
11 Pin - Hinge
15 Door Assembly - filler neck cover
16 Pin - Hinge
17 Cover Assembly - main tank liquidometer inspection door RH and LH
20 Cover Assembly - fuel tank rear LH and RH
23 Door Assembly - filler neck cover
25 Cover Assembly - rear tank liquidometer inspection door LH and RH
27 Flange Assembly - wing fuel tank filler neck
29 Door Assembly - main fuel tank sump inspection LH
30 Door Assembly - main fuel tank sump inspection RH
31 Door Assembly - rear fuel tank sump inspection LH
32 Door Assembly - rear fuel tank sump inspection RH
35 Frame - centre section inspection door LH and RH
36 Door Assembly - centre section inspection LH and RH
38 Reinforcement Assembly - oil solenoid inspection door LH and RH
39 Door - oil solenoid inspection LH and RH
42 Shroud Assembly - exhaust tail pipe rear LH and RH
43 Section Assembly - firewall removable LH and RH
49 Spar - wing centre section rear LH and RH
57 Rib - False LH and RH
58 Rib - False LH and RH
59 Reinforcement - flap control trailing edge LH and RH
60 Bracket Assembly - flap control screw inboard LH and RH
61 Bracket Assembly - flap control screw outboard LH and RH
62 Hinge Assembly - flap inboard LH and RH
63 Bracket Assembly - wide flap hinge bearing
64 Bearing
65 Hinge Assembly - centre flap LH and RH
66 Bracket Assembly - wide flap hinge bearing
67 Bearing
68 Block - aileron control
76 Duct - oil radiator air upper end LH and RH
79 Duct Assembly - oil radiator air LH and RH
80 Duct Assembly - Valve LH and RH
82 Valve Assembly - oil radiator air duct LH and RH
83 Shaft - oil radiator air duct valve
84 Plate - oil radiator air duct valve
85 Collar - oil radiator valve thrust
86 Arm Assembly - oil radiator air duct control
88 Duct Assembly - oil radiator LH and RH
90 Door Installation - Landing Gear LH and RH
91 Jack - ground
92 Reinforcement Assembly - oil dilution inspection door LH
93 Door - oil dilution inspection LH



Wing Assembly LH

WING ASSEMBLY LH

1 Rib - no 1 wing false
2 Rib - no 2 wing false
3 Rib - no 3 wing false
4 Rib - no 4 wing false
5 Rib - wing root
8 Rib Assembly - no 2 wing section
9 Rib Assembly - no 3 wing section
10 Rib Assembly - no 4 wing section
11 Rib Assembly - no 5 wing section
12 Rib Assembly - no 6 wing section
13 Rib Assembly - no 7 wing section
14 Rib Assembly - no 8 wing section
15 Rib Assembly - no 9 wing section
16 Rib Assembly - no 10 wing section
17 Spar Assembly - wing inner rear
18 Spar Assembly - wing outer front
19 Spar Assembly - wing inner front
20 Spar Assembly - wing outer rear
23 Hinge Assembly - flap
24 Bearing - flap hinge
25 Boot - aileron tab control LH only
26 Plate - aileron tab control boot LH only
27 Door - wing inspection
28 Door - wing inspection front
29 Door - wing inspection rear
30 Door - aileron cable inspection
32 Drive Assembly - 90°
33 Cover - inspection door
37 Tip Assembly - wing
40 Bracket Installation - wing tip position light

Wings may be made in sections such as centre section, outer wings and wing tips. Or, they may be made as one complete unit which is fastened to the fuselage. Whichever form is used the basic structure usually consists of one or two spars, a large number of ribs, and leading and trailing edges.

(2) SPARS

There are several types of spars. Usually these spars taper towards the wing tip. If they are made of wood it is usually spruce. Metal spars are mostly always used to-day and can be made of steel or aluminum alloy.

(3) RIBS

There are many different types, but all have the same purpose, to take the air load from the skin covering and transfer it to the spars, while maintaining the aerofoil section in its correct shape. Some ribs are known as compression ribs. These have an added duty; that of taking the horizontal load between the spars.

(4) SKIN

The skin or covering of the wings can be aluminum alloy sheets (usually alclad) or wood and fabric on the lighter aircraft.

AIRFRAME EXPEDITOR 3

General Information

The airframe group includes the structural components, flight control surfaces, and landing gear system. It includes the body group (centre section, wing and fuselage), tail group (stabilizer, rudder, etc), surface controls, landing gear and all related component parts of these groups.

WING GROUP

Centre Section

The primary structure of the centre section consists of a single, heat treated, welded steel tabular truss. This truss carries the fittings of the engine mounts, landing gear, and outer wing panel main spars. The remainder of the centre section structure consists of aluminum alloy ribs, bulkheads, stringers, and a smooth skin covering. The rear spar is a shear beam and supports the centre and inboard flap hinges.

NOTE: Because of the stressed skin construction of the airframe and the heat treated tabular main struss, repairs should be attempted only at a designated overhaul establishment.

Engine Nacelles

The engine nacelles house the engine mounting structures and landing gears. They are built as an integral part of the centre section and are not removable. The bottom of each nacelle is equipped with automatically operated doors which enclose the landing gear when it is retracted.

Outer Wing

The outer wings are constructed with single, load carrying front spars and aluminum alloy sheet skin covering. Rear spars transfer the shear load between upper and lower skin. The remaining structure consists of ribs and stringers covered by smooth alclad skin. The outer wing front spar attaches to the centre section truss at upper and lower spar fittings, with specially tapered spar bolts and nuts. A special nut and bolt also secures the wing rear spar, to the rear spar of the centre section wing stub. A fairing strip riveted to the outer wing skin and attached to the centre section skin with machine screws and elastic stop nuts, is installed over the gap between the wing and centre section.

Wing Tips

The wing tips are of the same general construction as the outer wing. They are attached to the wing by a hinge wire through the front spar and by machine screws through the skin of the wing and the wing tip.

BODY GROUP

Fuselage

The fuselage is of semi-monocoque construction, the centre section is an integral part of the fuselage. The primary structure of the centre section consists of a single steel truss which carries fittings for attaching the engine and landing gear. This truss is attached to the fuselage and transmits the load from the fuselage to the wing.

Nose Compartment

The nose compartment is located between fuselage bulkheads 1 and 3. An Auxiliary fuel tank in this compartment reduces its volume by about 30 per cent. The maximum capacity of this compartment (baggage) is 600 lbs. including baggage and fuel. The weight of baggage which may be stowed in this compartment varies with the amount of fuel carried in the nose tank.

Pilots Compartment

The pilots compartment, containing the pilots and co-pilots seats, instruments, and controls is located between the bulkhead 3 and 5 just forward of the main cabin compartment. Access to this compartment is through the main cabin.

Cabin Compartment

Location - between bulkheads 5 and 9. Aft of pilots compartment.

In the 3N and 3 NM, aircraft, the cabin is fitted with a plastic astrodome equipped for astrocompass and sextant, and two navigation training stations with work tables, lamps and navigation instruments on the right and a folding instructors seat on the left. The rear training station has a type B-3 driftmeter; behind it a type B-5 driftmeter is mounted in the cabin wall. The 3T aircraft are equipped to fit 5 cabin chairs.

The 3NM aircraft carry navigation equipment as in the 3N, and floor lugs for attaching 5 cabin chairs.

The 3TM aircraft carry 5 cabin chairs, with the necessary fittings, plumbing and wiring for astrome and navigation equipment as in the 3N.

The cabin door is equipped with an emergency release so it may be jettisoned in flight. An emergency escape panel is fitted in the right, aft side of the compartment.

Lavatory and Rear Baggage Compartment

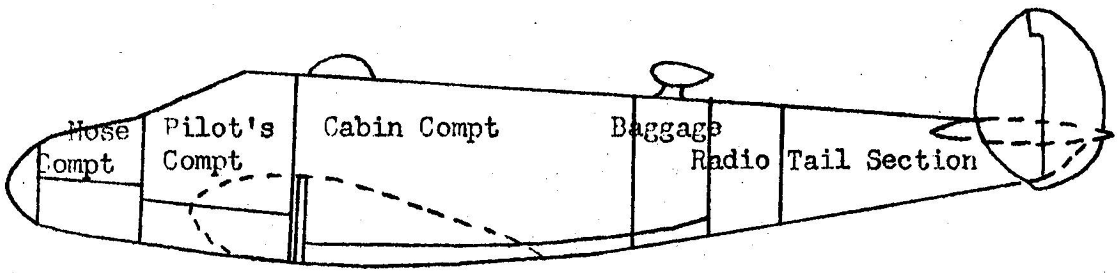
Location - between bulkhead 9 and 10 just aft of the cabin compartment.

It contains a chemical-type lavatory, vented through the left side. The right side of this compartment is used for baggage and miscellaneous tool storage. This compartment is accessible for the main cabin through a door in bulkhead 9.

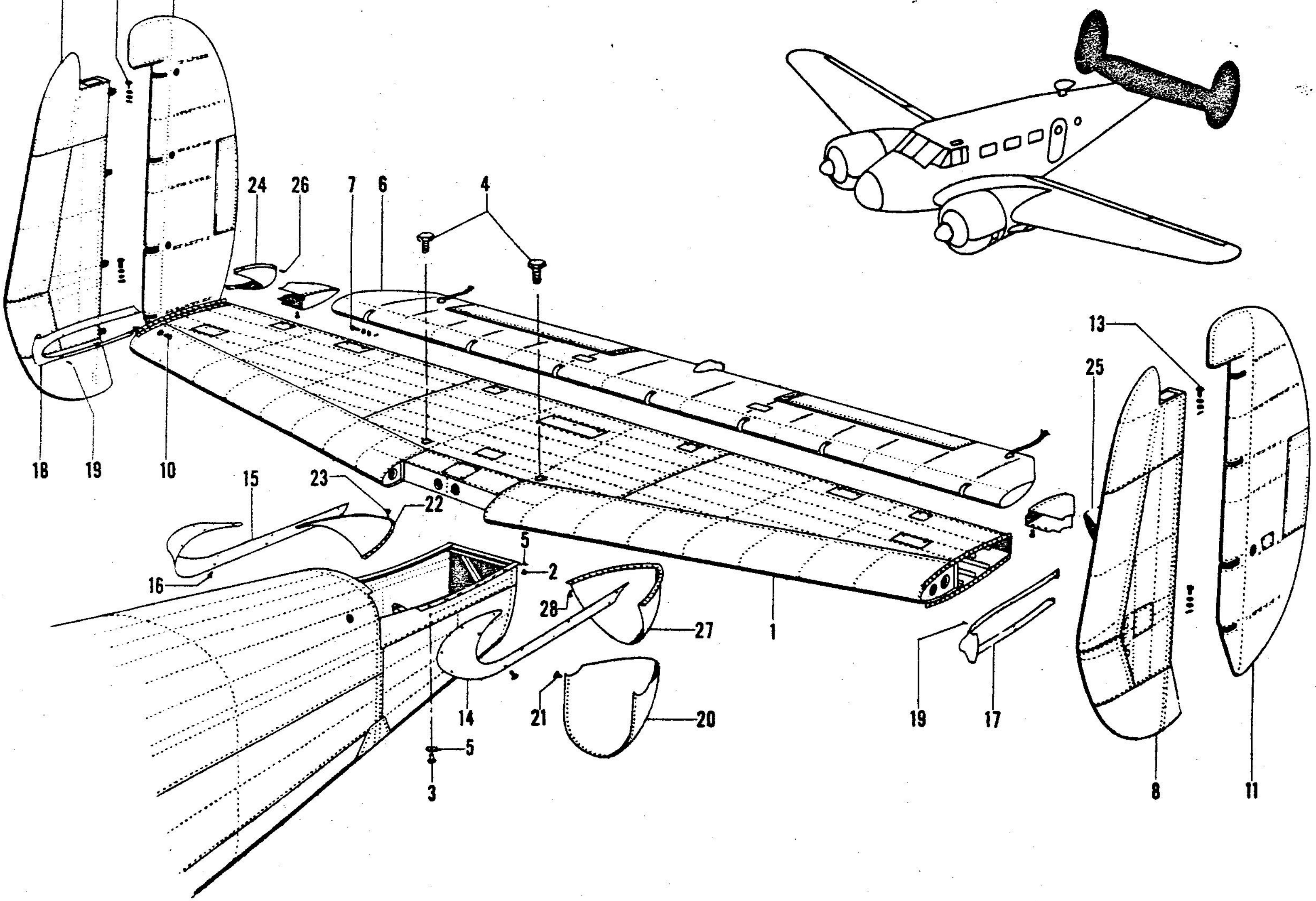
Tail Compartment

Location - between bulkhead 10 to bulkhead 15 just aft of lavatory and rear baggage compartment.

A removable panel on the upper half of bulkhead 10 allows access to the tail compartment for servicing the flight control cables, pulleys - radio equipment.


Nose Compt
Pilot's Compt
Cabin Compt
Baggage
Radio
Tail Section

(Fig. 15



Tail Surface Installation

TAIL SURFACE INSTALLATION

1 Stabilizer Assembly

2 Screw - Fillister head

3 Screw - Fillister head

4 Bolt - Internal wrenching

5 Washer

6 Elevator Assembly

7 Bolt - Aircraft

8 Gin Assembly LH

9 Fin Assembly RH

10 Screw - Fillister head

11 Rudder Assembly LH

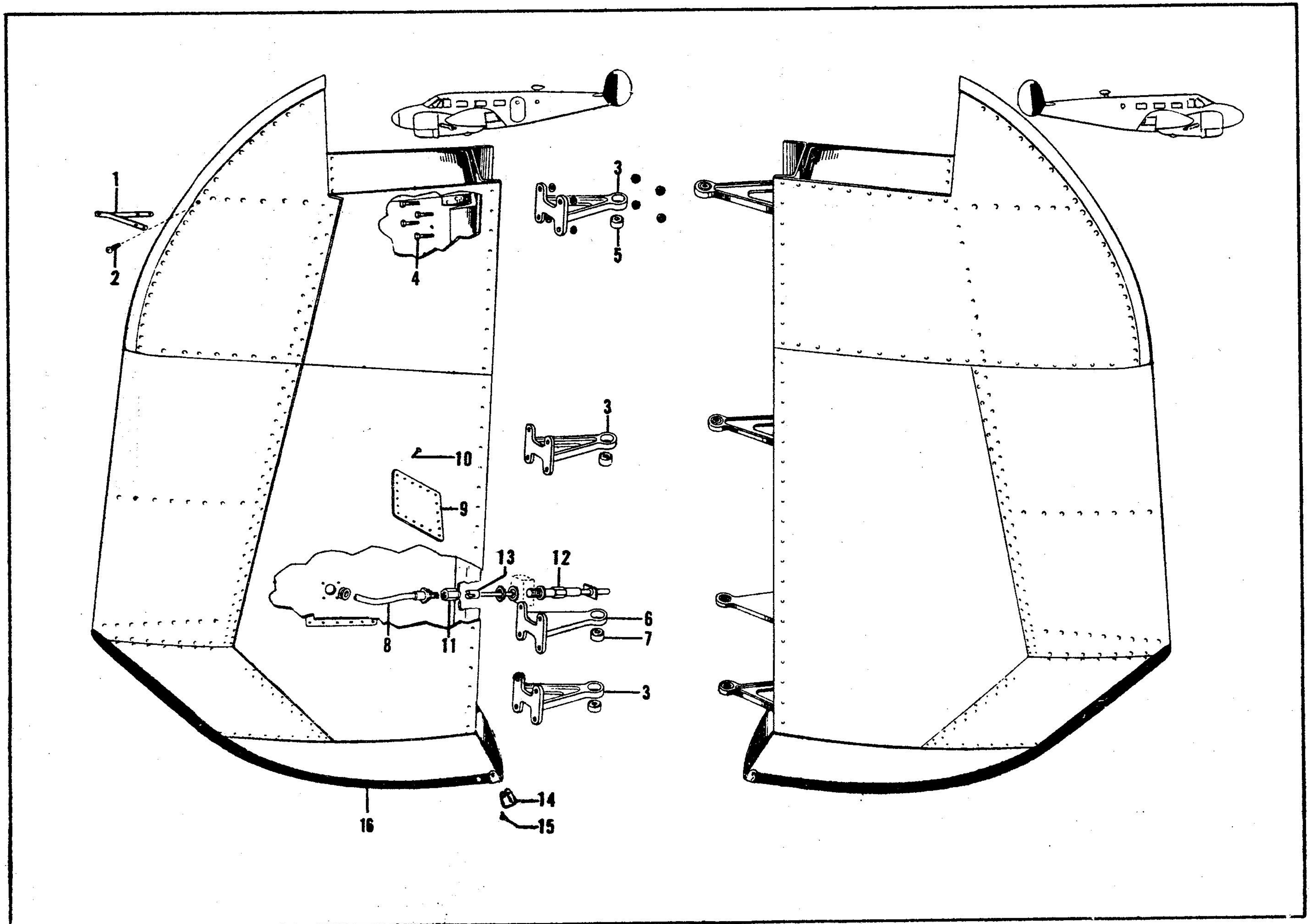
12 Rudder Assembly RH

13 Bolt - Aircraft

14 Fairing Assembly LH

15 Fairing Assembly RH

16 Screw - Truss head



Fin Assembly

FIN ASSEMBLY

1 Bracket Assembly - Antenna Mounting

2 Screw - Truss Head

3 Bracket - hinge

4 Bolt - àircraft

5 Bearing

6 Bracket - Hinge

7 Bearing

8 Shaft Assembly - Rudder tab control

9 Door - Fin inspection

10 Screw - Truss head

11 Nut - connecting rudder tab control

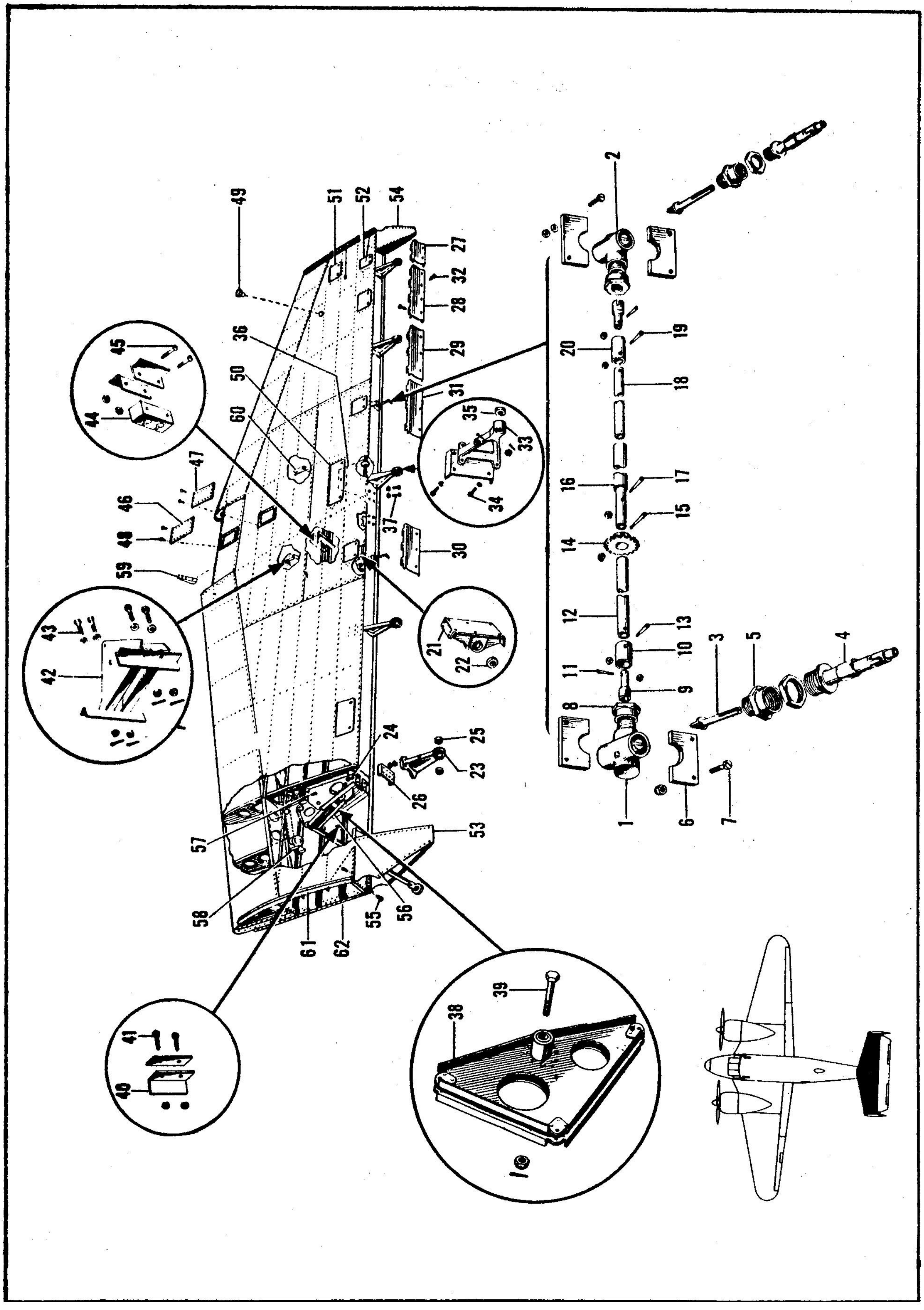
12 Drive - Tab mechanism torque tube

13 Fitting - Rudder tab control flexible shaft end

14 Strap - Fin

15 Screw - Truss head

16 Shoe - abrasion V-type



Stabilizer Assembly

STABILIZER ASSEMBLY

1 Drive Assembly - elevator tab 90 degree LH
2 Drive Assembly - elevator tab 90 degree RH
3 Shaft - elevator tab
4 Drive - tab mechanism
5 Nut - elevator tab control connector
6 Reinforcement - elevator tab 90 degree drive
12 Shaft - elevator tab control torque
14 Sprocket - elevator tab control torque
16 Shaft - elevator tab control torque
18 Shaft - elevator tab control torque tube
20 Coupling - elevator tab control torque tube
21 Bracket - elevator tab control
22 Bearing
23 Bracket - male elevator hinge outboard
26 Reinforcement - stabilizer
27 Strip assembly - elevator gap fairing outboard LH and RH
28 Strip assembly - elevator gap fairing outboard LH and RH
29 Strip assembly - elevator gap fairing inboard LH and RH
30 Strip assembly - elevator gap fairing centre LH
31 Strip assembly - elevator gap fairing centre
33 Bracket - male elevator hinge centre
35 Bearing
36 Bracket Assembly - stabilizer pulley
38 Bellcrank - rudder control
40 Bumper - rudder bellcrank stop
44 Block - rudder tab control stop
46 Door - stabilizer inspection
47 Door - stabilizer inspection
50 Plate Assembly - stabilizer rudder cable inspection
51 Plate Assembly - stabilizer rudder cable and tab inspection
52 Plate Assembly - rudder bullcrank inspection
53 Box assembly - rudder horn LH
54 Box assembly - rudder horn RH
56 Bracket - support bellcrank stabilizer LH and RH
58 Drive Assembly - rudder tab control
59 Fitting - stabilizer attaching upper LH and RH
60 Fairlead - rudder tab control
61 Angle - stabilizer attaching LH and RH
62 Angle - stabilizer attaching LH and RH

Pilots Compartment Windshield

General - the pilots and co-pilots windshields are constructed in 9 sections. Each section is encased in removable channels or fairing sections and sealed.

Astrodome

An acrylic plastic astrodome, with fittings to accommodate the astrocompass and sextant, is installed in the cabin roof beside the forward navigators station. The dome isheld in place by a rubber seal around the base.

Caution - do not buff the astrodome. Was with soap and water only, then wax.

Tail Cowling

The tail cowling consist of an outer and inner cowling, the outer attached to the fuselage and the inner attached to the elevator. The cowling stremmlines the fuselage and covers the elevator bellcrank and link rod.

TAIL GROUP

Horizontal Stabilizer

The horizontal stabilizer is of a conventional reveted sheet meyal construction and has 2 spars of aluminum alloy sheet. The elevator hinges are attached to the rear spar. The stabilizer is attached to the fuselage, by fillister head machine screws.

Vertical Stabilizer

The construction of the vertical stabilizer is similar to that of the horizontal stabilizer. It is an all metal construction. The vertical stabilizers are attached to the horizontal stabilizer by machine scres anchored in the vertical stabilizer with self locking nuts.

AIRCRAFT CONTROL SYSTEMS - General

Control of an aircraft in flight is achieved by operating the control surfaces. These are hinged, moveable aerofoils which can be moved by the pilot in order to produce the desired altitu de of the aircraft. They consist of ailerons, elevators, rudders and trimming tabs.

All these control surfaces are operated by a set of controls in the pilot's cockpit; a control column (or wheel) operates the elevators and ailerons, a rudder bar (or pedal) operates the rudder. Controllable trimming tabs are usually operated by a wheel or crank.

The various parts essential to the safe, efficient and freely operating control system of most aircraft is basically the same. They usually consist of:

Flexible Steel Cable

This cable consists of six strands of wire laid around a similar central or core strand laid clockwise. Each strand is composed of wires laid around a central wire in two layers. The inner layers consist of six wires laid around the core and the outer layer of twelve wires laid around the inner six wires. Each layer has a counter clockwise pitch and equal length of lay. The wires are made of high tensile steel and are coated with tin as a protection against corrosion. This cable construction is known as 7 x 19.

Turnbuckle

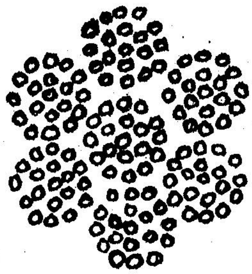
A turnbuckle is a unit having three threaded parts of the adjustment of the tension or length of a cable. The barrel type consists of a central member having a tabular shape with female threads at either end, one left-handed and one right-handed. Into each end may be introduced an eye end. These either have a left-handed or right-handed thread as applicable. The end fittings are made of steel, the barrel of a copper alloy. Rotation of the barrel with end fittings stationary either lengthens or shortens the attached cable thereby adjusting the tension. When this type of turnbuckle is used to be in "safety" nor more than three threads must be showing on the end fittings. To prevent slackening under vibration turnbuckles are locked with copper, brass or soft iron locking wire.

Pulleys

Pulleys are used to change the direction of a cable more than 15 degrees. They are usually made from synthetic plastics and sometimes light metal alloy. A ball bearing race is pressed into the pivot point to reduce bearing friction to a minimum.

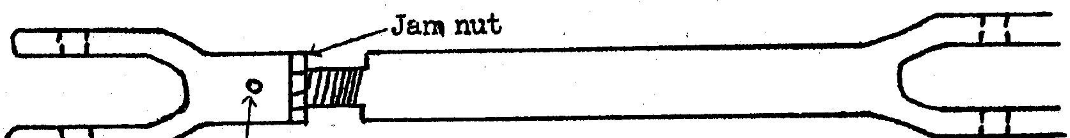
Fairleads

A fairlead is a plate block tube to prevent chafing of a cable by adjacent metal parts when passing through a bulkhead, floor former etc., or to change the direction of a cable up to 15 degrees. They are made from the same materials as pulleys.

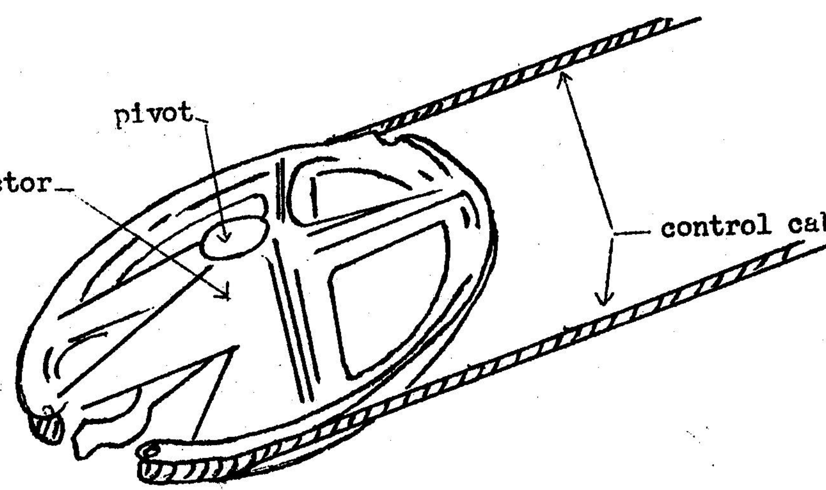


7 x 19 flexible steel cable
(fig. 16)

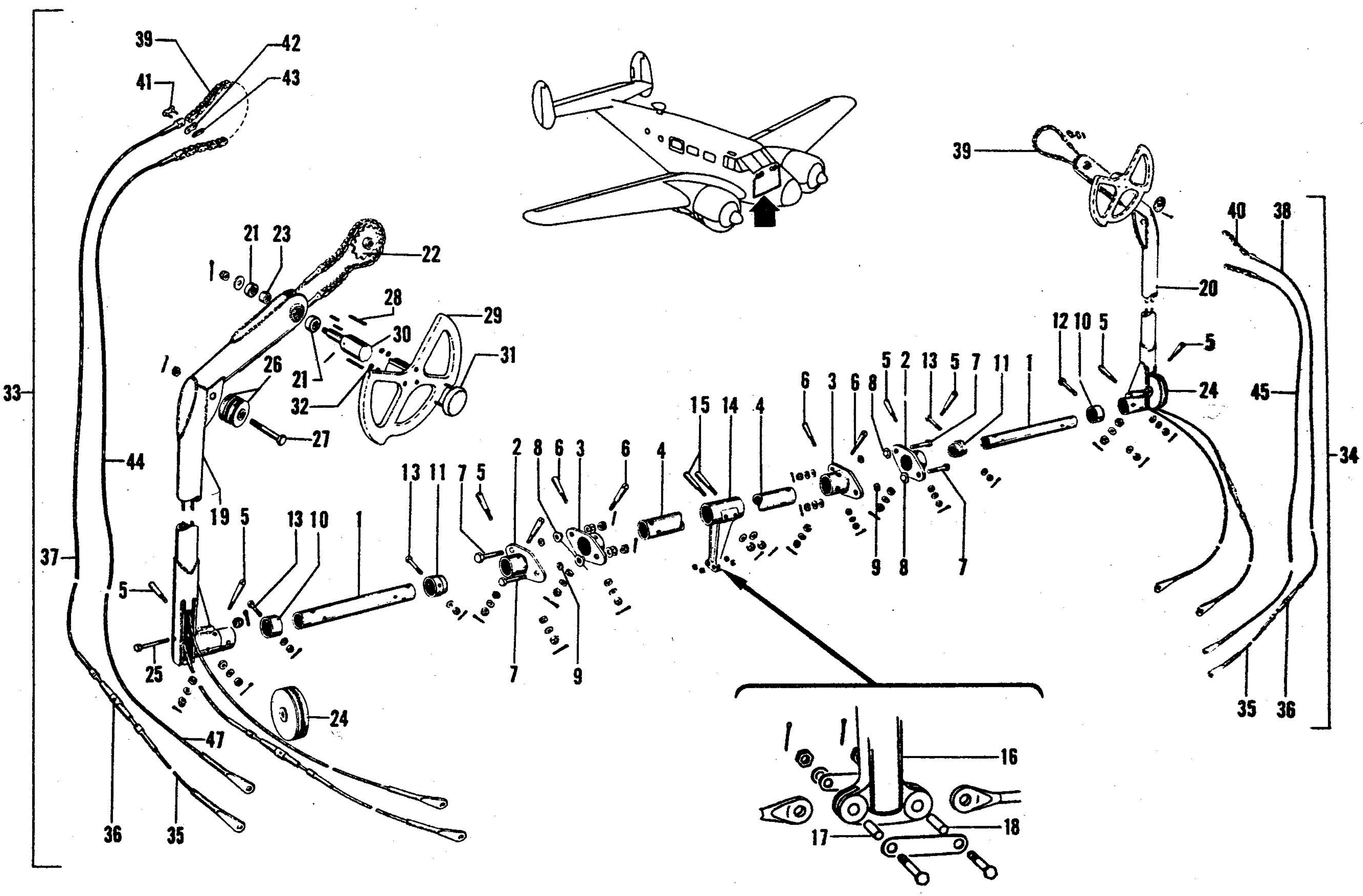
BARREL TYPE TURNBUCKLE
(fig. 17)



PUSH/PULL ROD
Fig. 18



ACTUATING SECTOR
Fig. 19



Torque Shaft and Control Column Assembly

TORQUE SHAFT AND CONTROL COLUMN ASSEMBLY

1 Shaft - Torque
2 Flange - Torque shaft outer
3 Flange - Torque shaft inner
4 Shaft - control column torque
10 Collar - torque shaft
11 Bushing - torque shaft
14 Arm Assembly - torque shaft
16 Casting - arm assembly
17 Bushing - torque shaft arm
18 Bushing - torque shaft arm
19 Column - elevator control LH
20 Column - elevator control RH
21 Bearing
22 Sprocket
23 Spacer
24 Pulley
26 Pulley
29 Wheel control
30 Hub Assembly - control wheel
31 Button Assembly - control wheel
33 Cable Assembly - aileron control column LH
34 Cable Assembly - aileron control column RH
35 Cable - LH and RH
36 Barrel - turnbuckle LH and RH
37 Cable - LH
38 Cable - RH
39 Chain - LH
40 Chain - RH
41 Link - Plate
42 Cover - Plate
43 Lock - spring
44 Cable - LH
45 Cable - RH

Bellcrank

A pivoted unit having one or more arms used to give sharp change in load direction without the extensive use of pulleys. In the case of ailerons it can give differential control.

Push-Pull Rods

Are used to transfer the energy from a cable or bell crank directly to control surface. They must be adjusted so that the threaded rod is visible through the inspection hole in the boaring or clevis end; at least one thread must be visible beyond the jam nut.

Control Actuating Sectors

A pivoted round unit to which the control cables are attached. Used to transfer the energy from the cables directly to the control surfaces via a push-pull rod.

EXPEDITOR SURFACE CONTROL SYSTEM

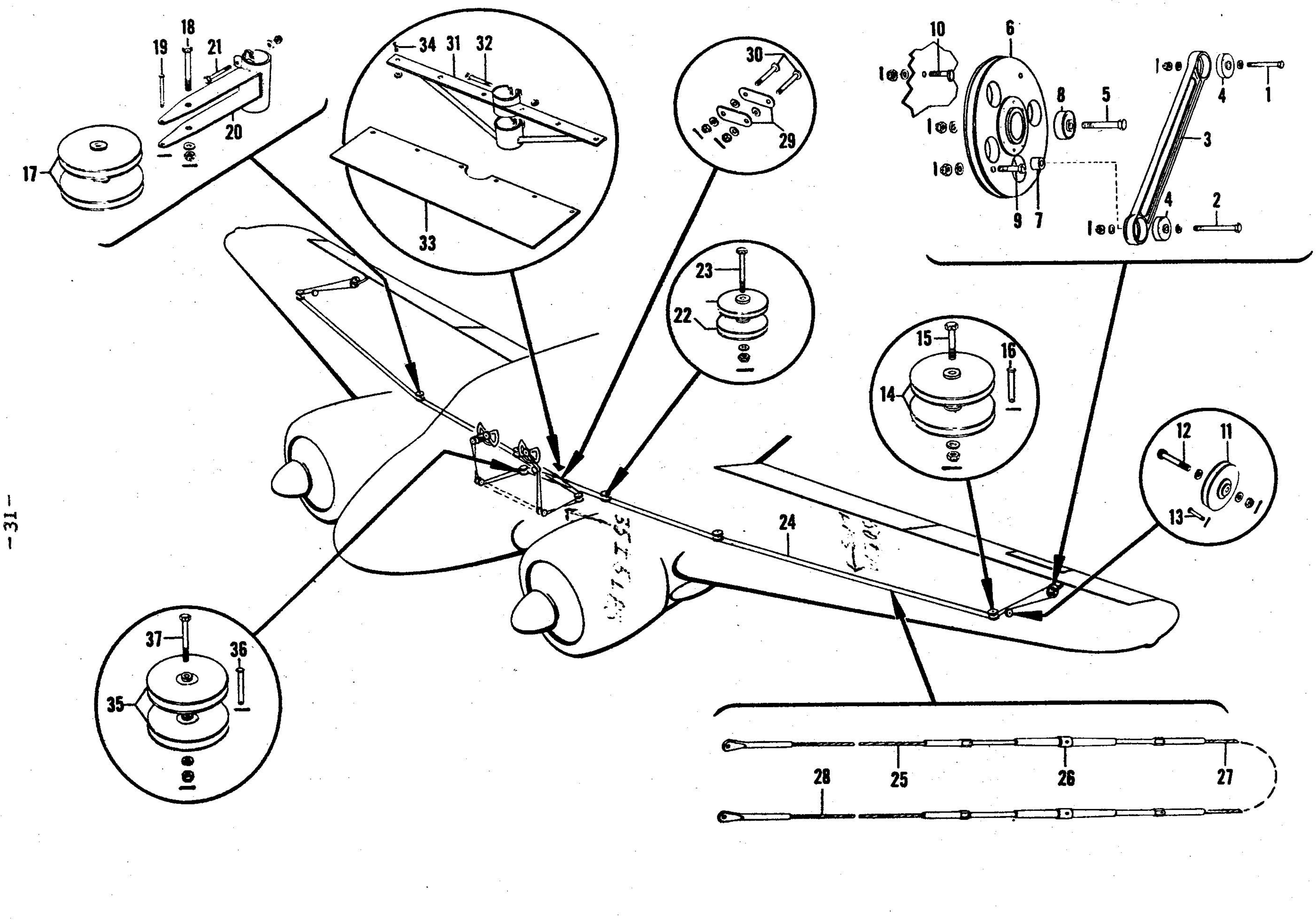
General

All flight control surfaces are operated by means of cable systems attached to the controls in the pilots compartment. The main control cables are made of 7 x 19 pre-fonned extra flexible, corrosion resistant steel. The rudder and aileron cables are 1/8 inch diameter, elevator cables are 5/32 inch diameter and 3/16 diameter, and trim tab cables are 3/32 inch diameter. Turnbuckles are provided at access points to facilitate installation adjustment, and removal of the cables. Anti-friction, prelubricated pulleys are used throughout the system.

Ailerons

Ailerons are hinged to the outer wing by a piano wire type hinge extending almost the full length of the aileron. On the left aileron is a controllable trim tab; also Serial CA-213 and after, except CA-281, have a ground adjustable trim tab on the right aileron. The ailerons are fabric covered, with an aluminum alloy structure.

The aileron system is controlled by the wheels on each control column in the pilots compartment. Each wheel is mounted on a shaft running inside the column. Chains are routed over the sprockets to short cables



Aileron Control Installation

AILERON CONTROL INSTALLATION

3 Link - aileron

4 Bearing

Pulley Assembly - aileron bellcrank LH and RH

6 Pulley - aileron control LH and RH

7 Bushing

8 Bearing

10 Stop - aileron control

11 Pulley - idler

14 Pulley

17 Pulley

20 Bracket - aileron pulley LH and RH

22 Pulley - aileron top

Pulley - aileron bottom

24 Cable Assembly - aileron outboard LH and RH

25 Cable - aileron end

26 Barrel - Turnbuckle

27 Cable - aileron centre

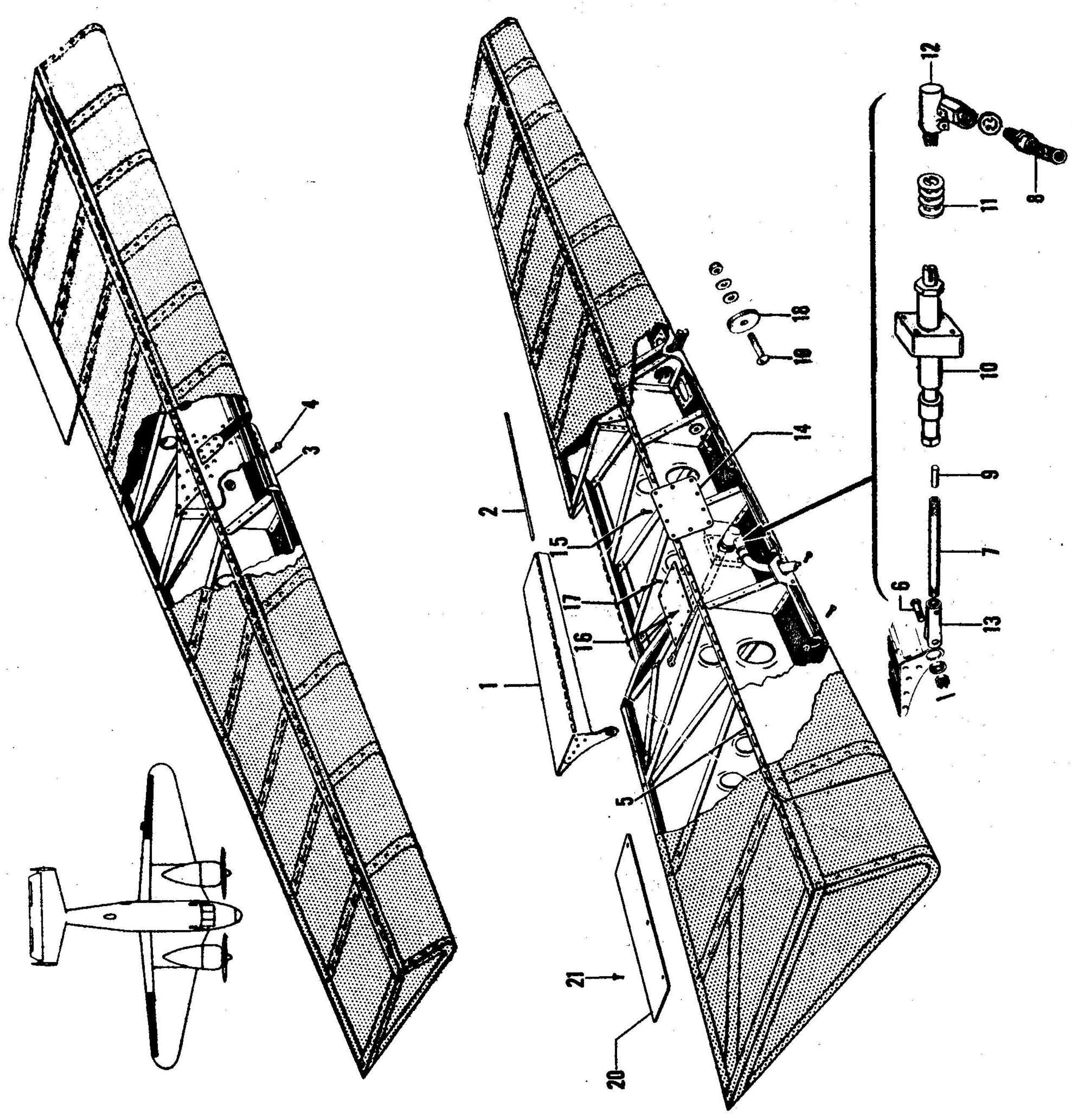
28 Cable - aileron end

29 Link - aileron cable attaching

31 Bracket Assembly - aileron cable fairlead support

33 Fairlead - aileron cables

35 Pulley - aileron cable.



Covered Aileron Assembly

COVERED AILERON ASSEMBLY

1 Tab Assembly - LH only

2 Pin - aileron tab LH only

3 Lead - balancing

4 Screw - brazier head

5 Hinge - aileron LH and RH

6 Bolt

7 Rod - aileron tab control

8 Case Assembly - ·aileron tab control

9 Plug - aileron tab control

10 Actuator Assembly

11 Washer

12 Drive Assembly - 90 degree

13 End - rod LH only

14 Door - aileron tab inspection LH only

15 Dcrew - Brazier head

16 Door - aileron tab inspection rear LH only

17 Screw - brazier head

18 Washer - lead balancing 12 x 1½ inch

19 Screw - brazier head

20 Tab - stationary aileron LH and RH

21 Screw

running down through the control columns and aft under the pilots floorboards. They are then routed inboard to connect with the main aileron control cables. The main aileron control cables run laterally through the centre section and outer wing panel to a point just inboard of the seventh rib from the outer panel root. At this point they turn aft and attach to the aileron bellcranks. A link rod connects the bell crank to the aileron.

Minor Repairs and Parts Replacement

Check cables, pulleys and bellcranks for excessive wear. Replace if worn.

Cables that are rusted or corroded are not considered serviceable.

Frayed cables are considered unserviceable when there is more than 6 broken strands in 1 inch.

Control cables are not considered serviceable cannot be repaired.

Adjustment

Balance cable in bulkhead 5 - cables rigged to 35 lbs plus or minus 5 lbs.

Aileron cables in wing - cables rigged to 50 lbs plus or minus 10 lbs.

Rigging Ailerons

The aileron travel is set with control column in neutral by adjusting the eccentric bell crank stop located in No. 7 wing rib adjacent to the aileron bell crank. The eccentric stops in the left wing controls the up travel of the left aileron and the down travel of the right aileron. The eccentric stop on the right wing controls the up travel of the right aileron and the down travel of the left aileron. Using a bubble protractor to check the travel, adjust the eccentric stops accordingly. If bubble protractor not available the travel may be checked by measuring in inches. Place flap in up neutral position and measure the from inboard trailing edge of aileron to the outboard trailing edge of flap. After adjusting make sure all turnbuckles and stops are locked and in safety.

Wing Flap

The wing flap are constructed of aluminum alloy. The main and nose ribs are attached to a single spar. Fabric is used as a covering over this frame, portected at the loading edge by a metal nose plate and on the trailing edge by a rolled section. Further protection is provided by a metal scuff plate attached to the under surface which protects the flaps from the exhaust blast and debris thrown by the wheels. The flap attaches to the rear wing spar with 3 hinge brackets.

Description

The wing flaps are operated by an electric motor installed near the centre of the floor structure and the pilots compartment floor boards. The flap motor is controlled by the flap position switch, and a dynamic brake relay. The motor connects through a worm gear, to a cross shaft connected to the ends of the shaft are 90 degree drive assemblies, which turn the flap actuator screws. The centre part of the drive shaft has a threaded section on which a travelling arm moves to actuate the flap limit switches. In an emergency the flap system may be operated with the hand crank. The hand crank is pushed toward the pilots seat to engage the flap mechanism. A double spline drive on the shaft of the hand crank makes it possible for the crank to operate either thelanding gear or the flaps.

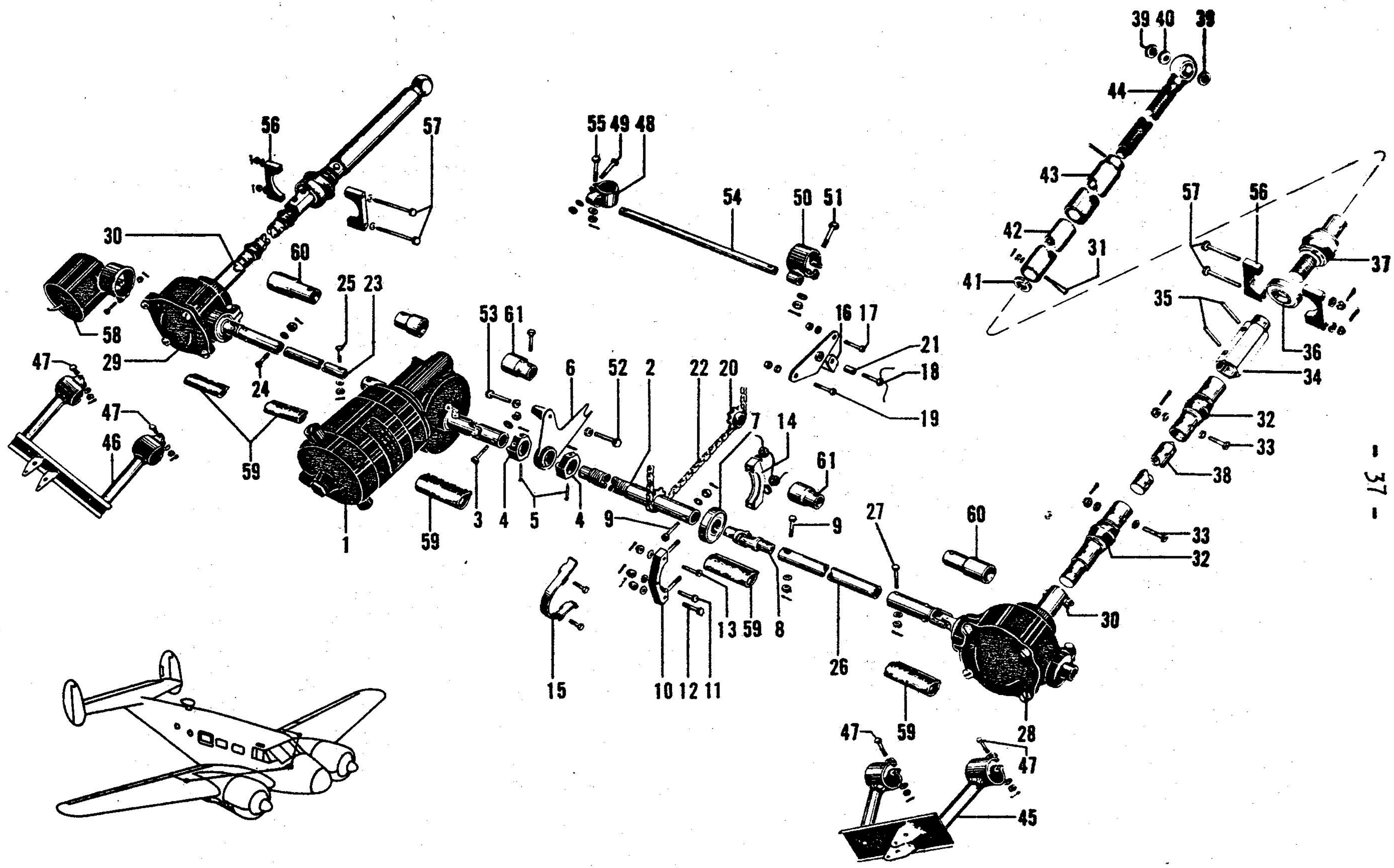
The position indicator is operated by a rheostat located on the flap gear box in the right wheel well. On some remanufactured Expeditor 3T aircraft a cone type overload clutch is incorporated in the flap motor gear box. The overload clutch was used prior to installation of dynamic braking equipment. On remanufacture, the clutch was tightened sufficiently to render it inoperative.

Wing Flap Electrical System

The flap position switch shaped like a minature flap, is mounted on the right front side of the control pedestal. This switch has 3 positions up, down, and off. The switch controls the flap motor located below the pilots floorboard. Travel is governed by the limit switches and a dynamic brake. Position is registered by an indicator on the pilots instrument panel. The indicator is connected to a rheostat on the flap gear box in the right necelle.

Flap Position Switch

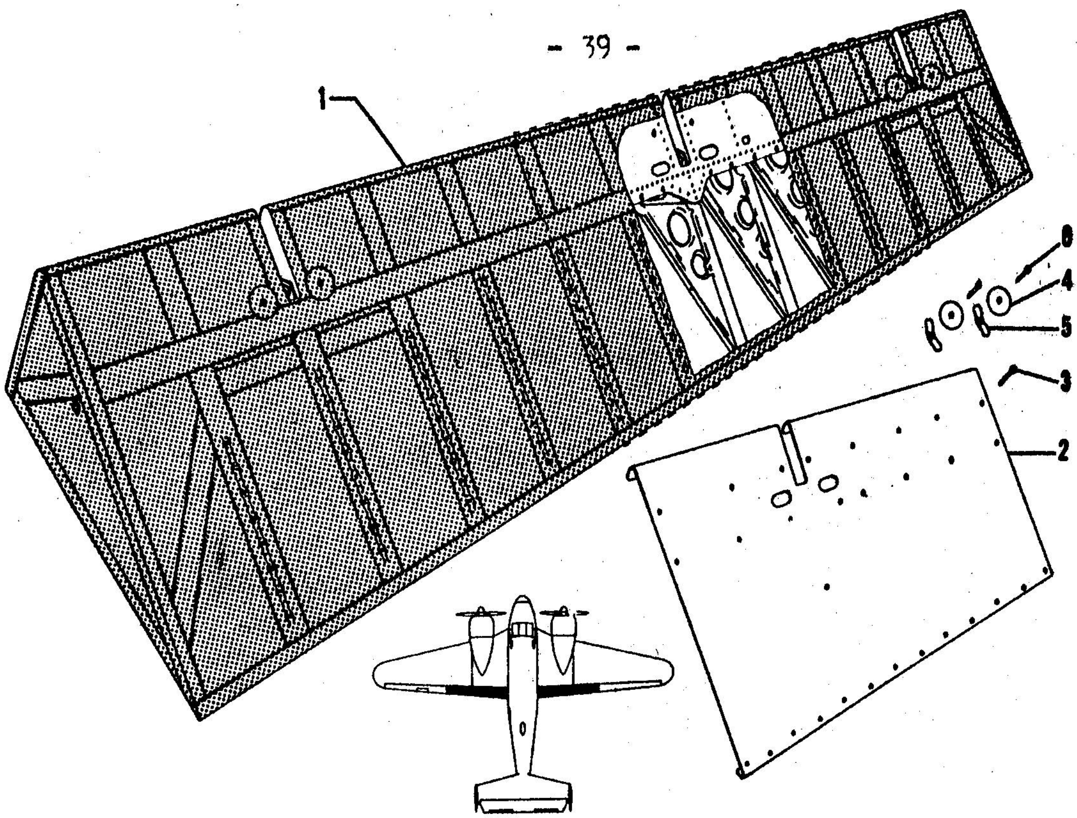
The flap position switch consists of 2 muro switches, one up, and one for the down positions, and a lever with a handle in the form of a minature wing flap.



Wing Flap Mechanism Installation

WING FLAP MECHANISM INSTALLATION

1 Motor Assembly - flap mechanism
2 Shaft - flap mechanism cross
4 Stop - flap mechanism arm limit switch
6 Arm - flap limit switch
7 Bearing
8 Universal - flap mechanism
10 Housing Assembly - Bearing cross shaft flap
14 Housing - bearing cross shaft flap
15 Guard - sprocket
16 Guard Assembly - wing flap hand crank chain
20 Sprocket - tail wheel idler
21 Bushing - sprocket
22 Chain - wing flap handcrank
23 Tube - wing flap drive
25 Tube - wing flap mechanism drive
28 Gear box Assembly - flap control LH
29 Gear box Assembly - flap control LH
32 Joint - universal
34 Collar
35 Pin - collar
36 Bearing
37 Universal
38 Shaft - flap control
39 Bearing
40 Spacer - bearing
41 Ring - Lock
42 Housing - flap screw
43 Shield - flap screw dust
44 Screw - flap
45 Bracket Assembly - flap gear housing LH
46 Bracket Assembly - flap gear housing RH
48 Bracket Assembly - Flap limit switch arm slide
50 Bracket Assembly - flap limit switch arm slid



Covered Flap Assembly

1 Flap Assembly

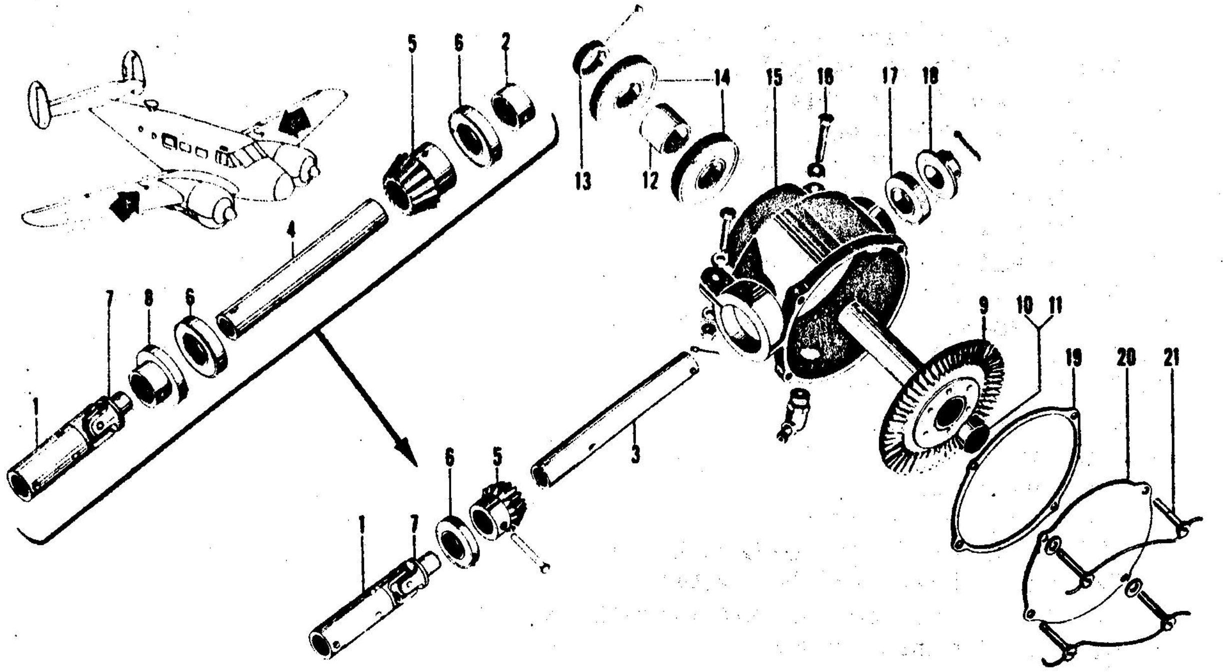
2 Plate Assembly

3 Screw - Brazier head no 6-32 x 3/8 inch

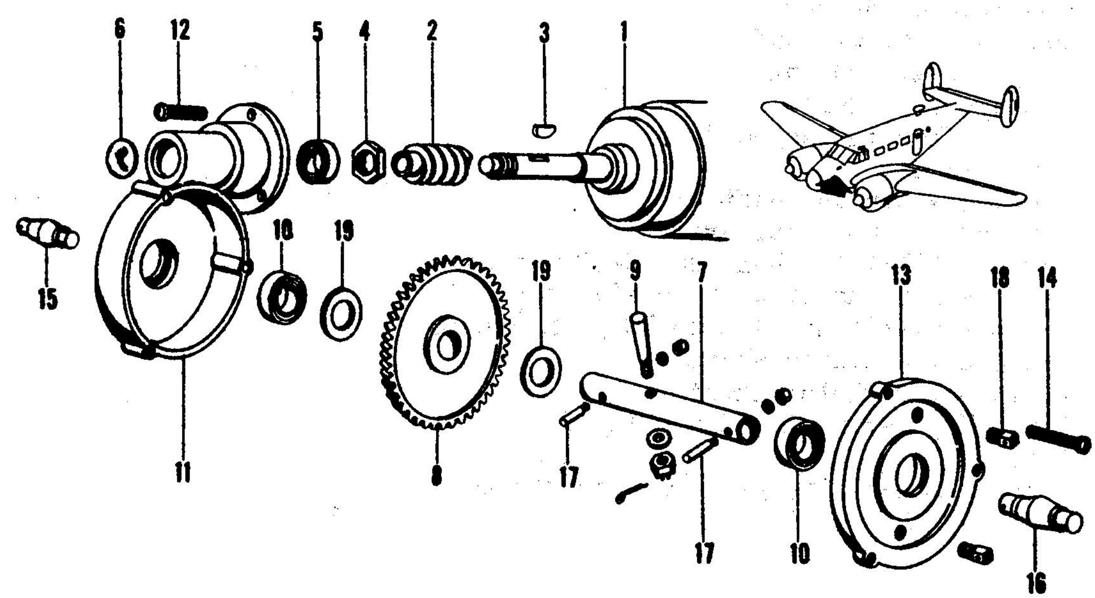
4 Cover - Flap inspection hole

5 Spring

6 Screw - round head no 8-32 x 1 inch



Flap Control Gear Box Assembly



Flap Mechanism Motor Assembly

FLAP CONTROL GEAR BOX ASSEMBLY

1 Tube - shaft assembly L and R
2 Tube - shaft assembly L
3 Tube - shaft assembly R
4 Tube - shaft assembly L
5 Gear - Pinion flap control
6 Bearing - right shaft
Bearing - left shaft
7 Universal - flap mechanism
8 Collar - flap control LH
9 Gear Assembly - flap control ring
10 Plug - maple
11 Plug - maple
12 Spacer - bearing
13 Collar
14 Bearing - Shaft
15 Housing - Gear Box RH
16 Bolt - aircraft no 10-32 x 1 inch
17 Bearing - shaft (RH box only)
18 Collar - flap control box assembly RH
19 Gasket - housing cover
20 Cover - housing
21 Screw - fillister head $\frac{1}{4}$-20 x $\frac{1}{2}$ inch

FLAP MECHANISM MOTOR ASSEMBLY

1 Motor assembly
2 Worm - motor shaft
3 Key - woodruff 3/32 x $\frac{1}{2}$ inch
4 Nut - check 5/16-24
5 Bearing - motor shaft
6 Plug - Gear housing
7 Shaft - flap gear
8 Gear - flap mechanism drive
9 Pin - Taper
10 Bearing - clutch shaft
11 Housing - flap motor drive
12 Screw - fillister head no 10-32 x $\frac{1}{2}$ inch
13 Plate - flap motor gear housing cover
14 Screw - fillister head no 10-32 x $\frac{1}{2}$ inch
15 Universal - clutch shaft
16 Universal 0 clutch shaft
17 Pin - Tapered no 10-32 x 1 14/32
18 Plug
19 Washer - gear flap centering mechanism

Dynamic Brake Relay

If so arranged that when the adjustable actuator bolt on the travelling arm opens the control circuit (by actuating the limit switches), it also establishes a dynamic braking circuit through either the forward or reverse contactors of the relay. Counter voltage induced in the armature, while the motor is running, returns to ground through the opposite field, and the relay thereby braking the armature. A selector switch contact selects for braking the opposite field from the one last used for running.

Adjustments

Flap travel - 45 degrees.

Run flap to up position with hand crank, the back of 1/6 of a turn.

Check trailing edge of flap for alignment with the flap fillet at the inboard aft end of the flap and using a contour jig, or visually is no jig is available, check for alignment with wing contour.

Re-install actuator bolt. Place bubble protractor in flaps surface, adjacent to the centre rib and adjust protractor until the bubble is central.

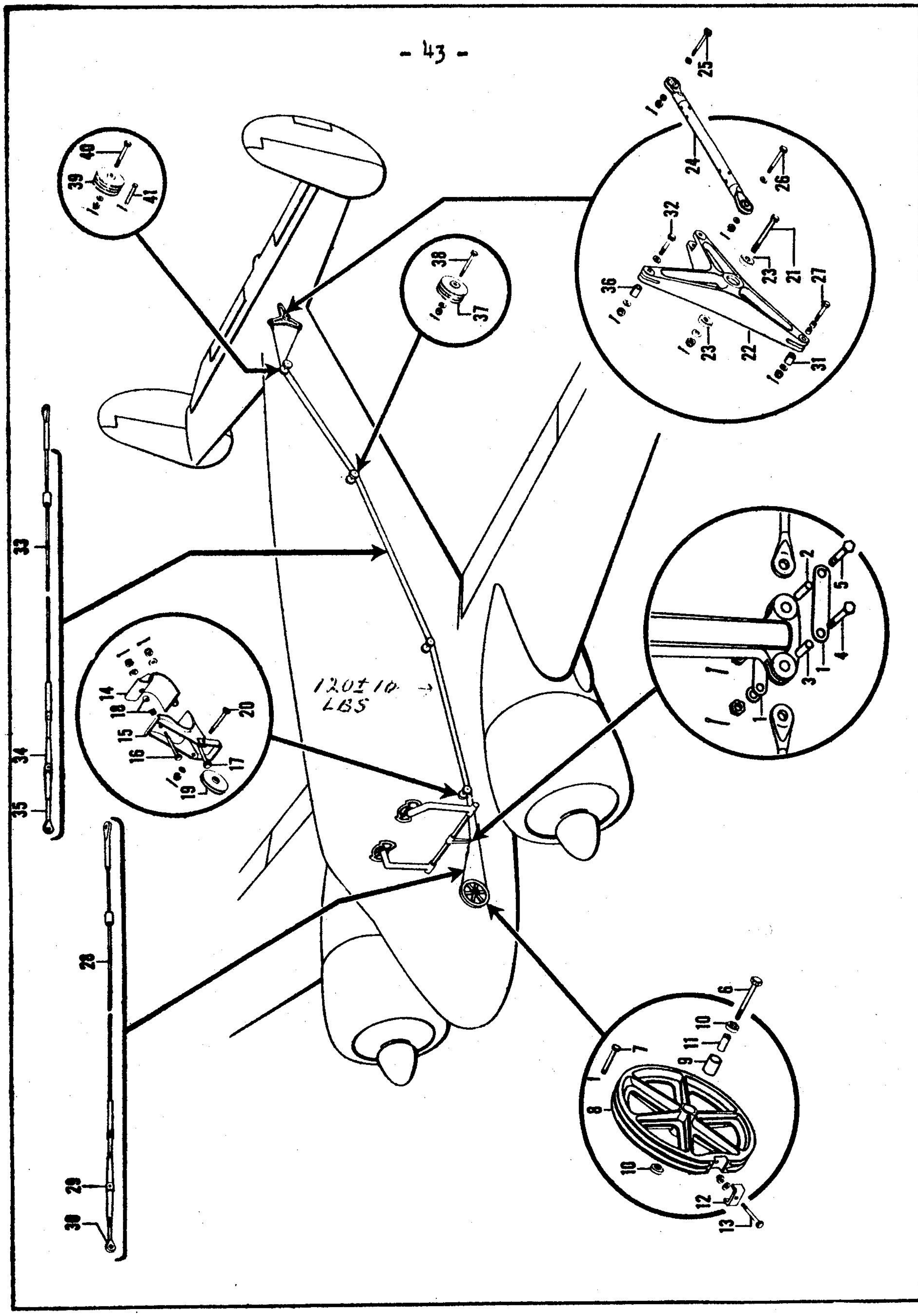
Remove protractor, run flaps down electrically and check for 5 degrees travel.

Install nut on actuator bolt and key after the correct flap travel is obtained.

Elevator

The elevator construction is of aluminum alloy with a main spar, formed ribs and fabric covering. It is attached to the horizontal stabilizer by 5 cast aluminum hinge brackets. Two trim tabs are located on the trailing edge of the elevator.

The lower ends of the control columns are attached to an elevator torque shaft, under the pilots floorboards. A horn attached to the torque shaft actuates the elevator cables. One cable runs from the horn directly aft, while the other passes around a large bull wheel in the forward section of the aircraft and then aft. Both cables run under the fuselage floor near the centre line to bulkhead 10. From this point they run aft and upwards and attach to the elevator bellcrank aft of bulkhead 15. The travel



Elevator Control Installation

ELEVATOR CONTROL INSTALLATION

1 Plate - control side arm

2 Bushing - control side arm rear

3 Bushing - control side arm front

8 Wheel O casting

9 Spacer

10 Bearing

11 Spacer

12 Clamp - elevator servo cable

14 Bracket - half rear

15 Bracket - half front

18 Bushing - bracket bolt

19 Pulley

22 Bellcrank - casting

23 Bearing

24 Link Assembly - tail surface control

28 Cable - elevator long

29 Barrel - Turnbuckle

30 Eye - cable

31 Bushing - cable eye

33 Cable - elevator short

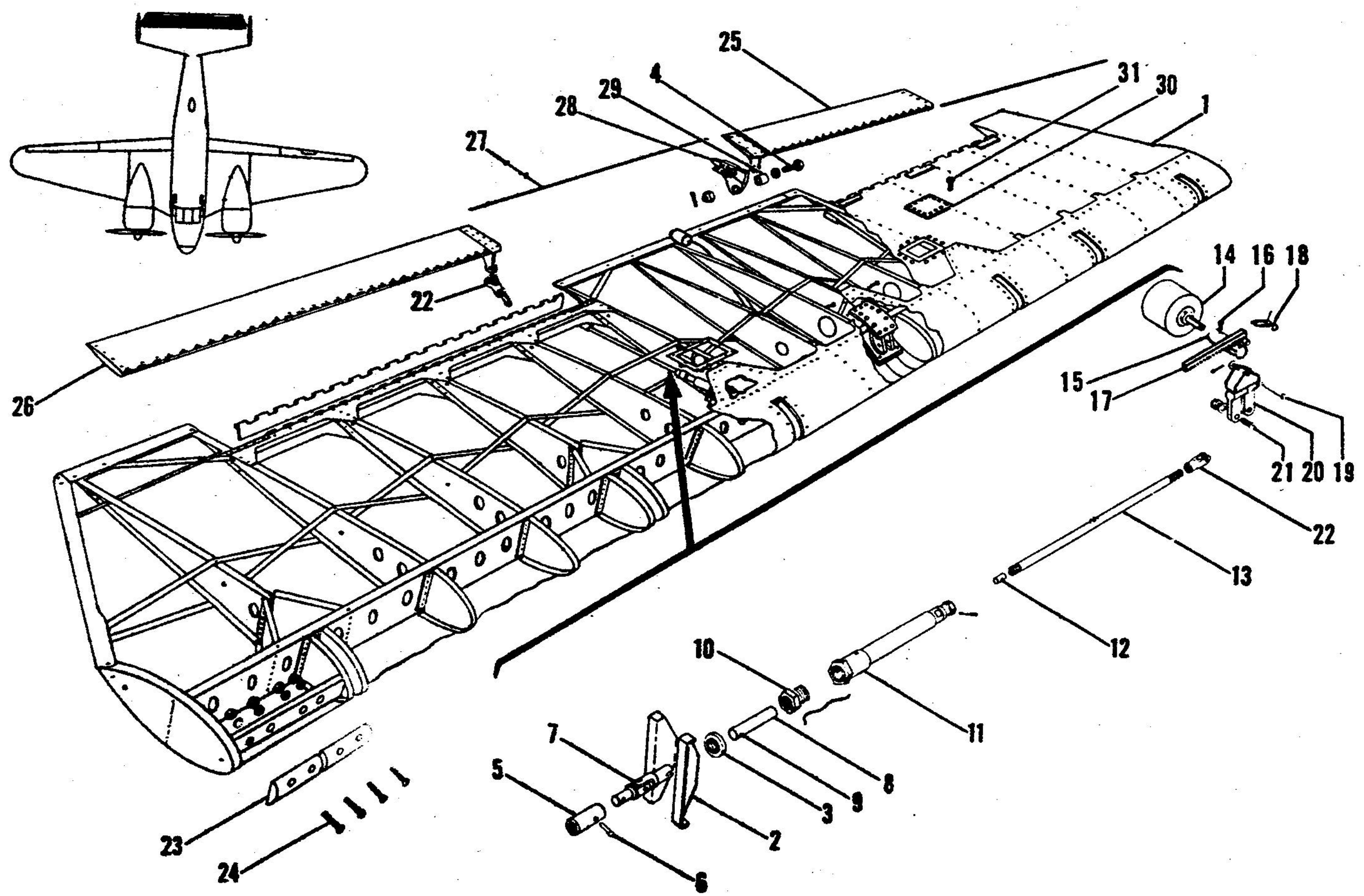
34 Barrel - turnbuckle

35 Eye - cable

36 Bushing - Cable eye

37 Pulley

39 Pulley



Covered Elevator Assembly

COVERED ELEVATOR ASSEMBLY

1 Elevator Assembly - Covered

2 Bracket - Elevator tab control bearing

3 Bearing

4 Bolt - machine, short thread

5 Tube - elevator tab control torque

6 Pin

7 Universal - Tab control

8 Shaft - Tab control torque drive

9 Pin

10 Nut - Tab control actuator end cover

11 Actuator Assembly

12 Plug - Tab control actuator end cover

13 Rod Assembly - Elevator tab control LH and RH

14 Rheostat - LH only

15 Pinion Assembly - LH only

16 Screw - Fillister head

17 Rock Assembly - LH only

18 Spring - LH only

19 Pin - flat head

20 Bracket Assembly - elevator tab mechanism LH

21 Screw - Round head

22 Fitting - End

23 Weight - Balance

24 Screw - flat head

25 Tab Assembly - Elevator LH

26 Tab Assembly - Elevator RH

27 Pin - Hinge

28 Horn - Elevator Tab

29 Bearing

30 Door - Elevator tab indicator

31 Screw Truss head

of the elevator is controlled by adjustable stop bolts which strike against the arms of the bellcrank. The torque shaft incorporates a special universal joint to dampen vibration in the control column. This joint should be checked for looseness or evidence of wear. Play in the universal joint will cause vibration in the control column. Pulleys and cables should also be checked for wear and the presence of dirt and grit.

Minor Repairs and Parts Replacement

Check cables, pulleys, and bellcrank for excessive wear. Replace if worn.

Cables that are rusted or corroded are not considered serviceable.

Frayed cables are considered unserviceable when more than 6 broken strands in 1 inch are broken.

Control cables that are not considered serviceable cannot be repaired.

Rigging Elevators

Install elevator contour jig, or provide other means by having the elevators in a neutral position.

Adjust cable turnbuckles to 120 lbs plus or minus 10 lbs tension. With both cables at proper tension check control column position, should be 10 5/8 to 10 7/8 inches from instrument panel stationary mounting.

Remove contour jig and check system for ease and smoothness of operation.

Recheck cable tension and make any necessary adjustment. Then safety all turnbuckles.

NOTE: To remove the control column andtorque shaft always refer to the appropriate Engineering Order -2.

Rudder

The two rudders are similar to the elevator in construction. Metal structure with fabric covering. They are attached to the vertical stabilizers by 4 cast aluminum hinge brackets. Each rudder has a trim tab attached with hinge wire. (Expeditor 3T has tab on left rudder only). The rudders are statically and dynamically balanced.

Rudder movement is controlled by dual sets of pedals, mounted in separate shafts. The shafts operate through slots in the cockpit floor-boards. A rudder control balance cable connects the co-pilots pedals. Cables from the pilots and co-pilots pedals converge at pulleys on centre section truss and pass aftwhere they are connected to the reduction pulleys. These pulleys reduce cable movements at the rudder pedals to one half that of the rudder control bellcranks. The long rudder cables are routed around these pulleys. One end is attached to bulkhead 6; the other end runs aft to the rudder bellcranks in the stabilizer. The bellcranks are connected by 2 balance cables running laterally through the stabilizer. Link rods connect the bellcranks and the actuating horns on the rudders. Rudder travel islimited by the bellcranks contacting the stops.

Minor Repairs and Parts Replacement

Check pulleys, cables, and bellcranks for excessive wear. Replace if worn.

Cables that are rusted or corroded are not considered serviceable.

Frayed cables are considered unserviceable when there is more than 6 broken strands in 1 inch.

Control cables that are not considered serviceable cannot be repaired.

Controls are sticky in operation.

Check reduction pulley slides for dirt, grit or excessive wear.

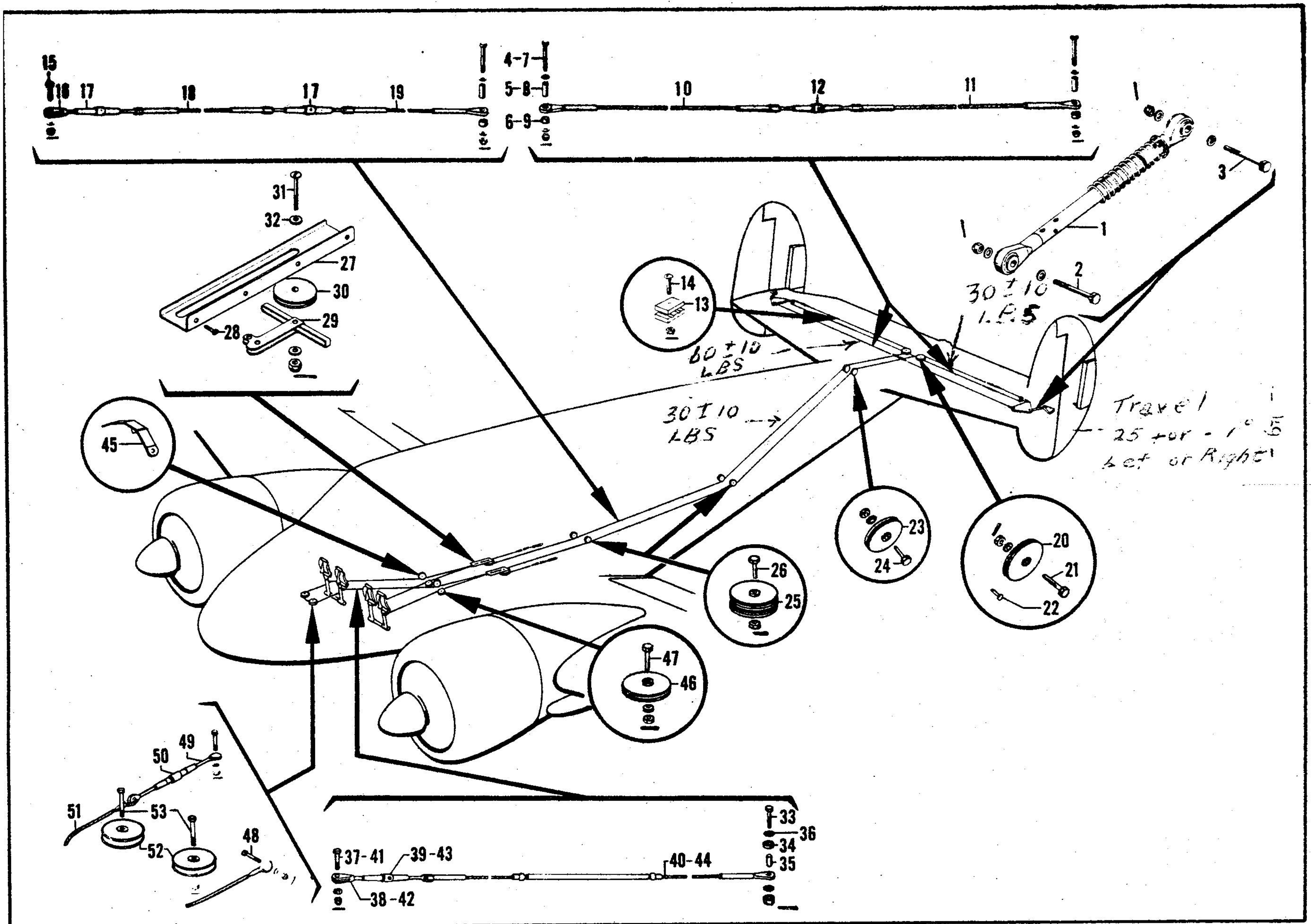
Rigging - Rudder

Rudder travel - 25° plus or minus 1° right and left.

NOTE: Proper travel can be obtained by adding or removing the fixed shims in the horizontal stabilizer.

Position the rudders in neutral by installing a contour jig on either the right or left rudder.

Using "C" clamps secure the reduction pulley's so the aft edge of each pulley is 5/32 inch from the aft end of the slot in the slide.



Rudder Control Installation

RUDDER CONTROL INSTALLATION

1 Link Assembly - rudder control

10 Cable - rudder front and rear cross LH

11 Cable - rudder front and rear cross RH

12 Barrel - turnbuckle

13 Spacer - rudder balance

16 Fork - cable end

17 Barrel - turnbuckle

18 Cable Assembly - long

19 Cable Assembly - short

20 Pulley

23 Pulley

25 Pulley

27 Bracket - cabin floor channel upper pulley LH and RH

29 Bracket - rudder reduction pulley

30 Pulley

38 Fork - turnbuckle

39 Barrle

40 Cable Assembly - co-pilots rudder LH

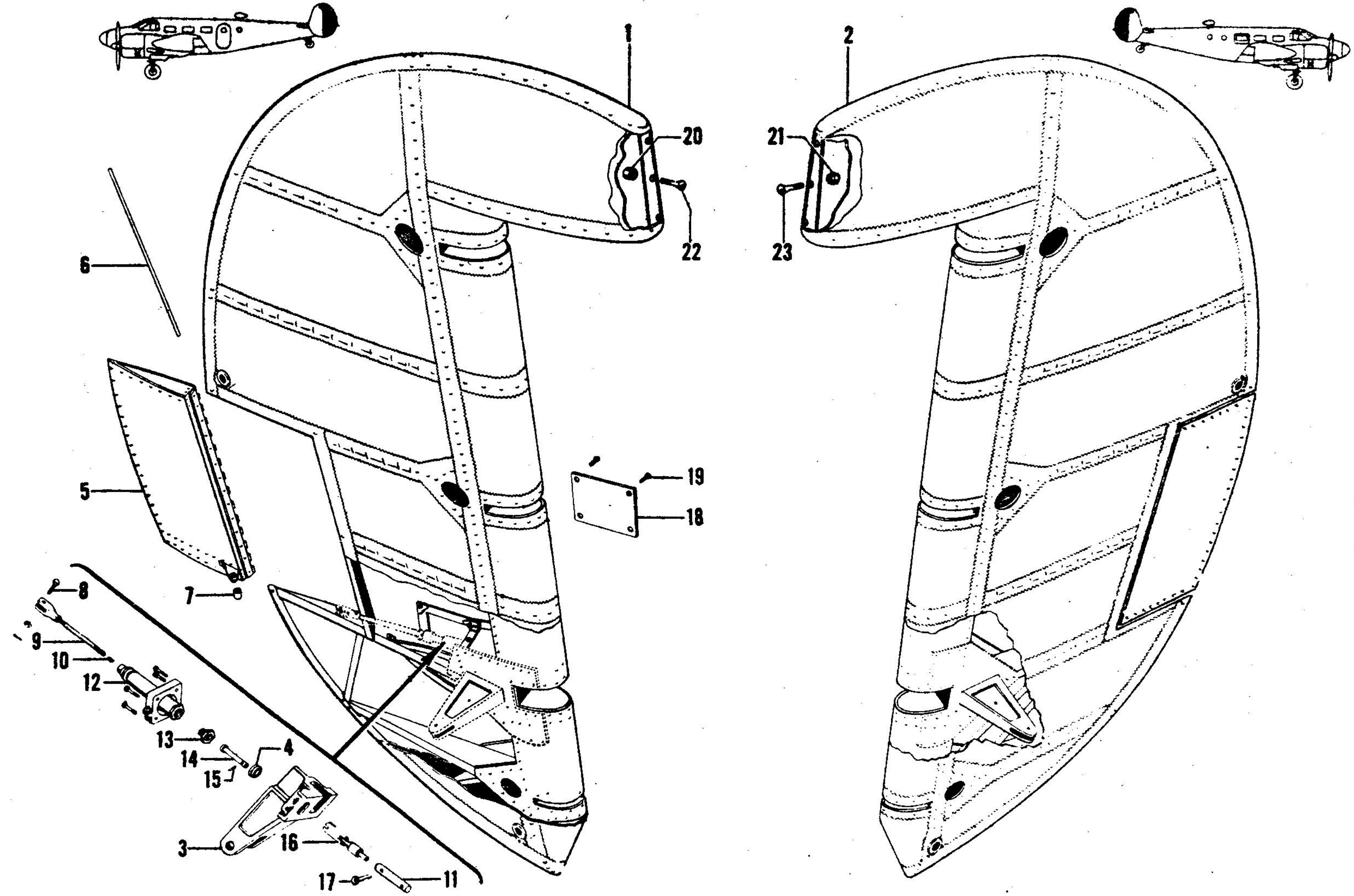
42 Fork - turnbuckle

43 Barrel

44 Cable Assembly - rudder

45 Guard Assembly - truss rudder pulley

46 Pulley - rudder cable



Covered Rudder Assembly

COVERED RUDDER ASSEMBLY

1 Rudder Assembly LH

2 Rudder Assembly RH

3 Horn - Rudder LH and RH

4 Bearing

5 Tab Assembly - Rudder

6 Pin - rudder tab hinge

7 Rib Assembly - rudder tab horn

8 Bolt - machine, short thread

9 Rod - rudder tab control

10 Plug - Tab control

11 Tube - Elevator tab control torque

12 Actuator Assembly

13 Nut - Tab control actuator end cover

14 Shaft - tab control torque drive

15 Pin

16 Joint - Tab control universal

17 Pin

18 Plate - rudder tab mechanism inspection LH and RH

19 Screw - Truss head

20 Lead - Balance - rudder LH and RH

21 Lead - Balance - rudder RH only

22 Screw - Flat head

23 Screw - flat head

Adjust rear balance cable in the horizontal stabilizer to 30 lbs plus or minus 10 lbs tension, rudder reduction cables to 30 lbs plus or minus 10 lbs tension, and the front balance cable in the horizontal stabilizer to 60 lbs plus or minus 10 lbs tension. Turnbuckles are accessible through inspection panels in the horizontal stabilizer. Maintain neutral position of the rudders.

Adjust rudder pedal balance cable (forward of co-pilots pedals) and brake balance cables (aft of co-pilots pedals) to align the co-pilots pedals in neutral position at $12\frac{1}{4}$ inches aft of bulkhead 3. Set the pilots pedals in neutral position at $11\frac{1}{2}$ inches aft of bulkhead 3.

Tighten the turnbuckles on the co-pilots rudder cables in the belly, until the reduction pulleys at bulkhead 6 maintain the 5/32 inch dimension with "C" clamp removed. Maintain neutral position of co-pilots pedals.

Remove contour jig from rudder cables in the belly. Maintain neutral position of the pilots pedals.

Remove contour jig from rudder and check system for ease and smoothness of operation.

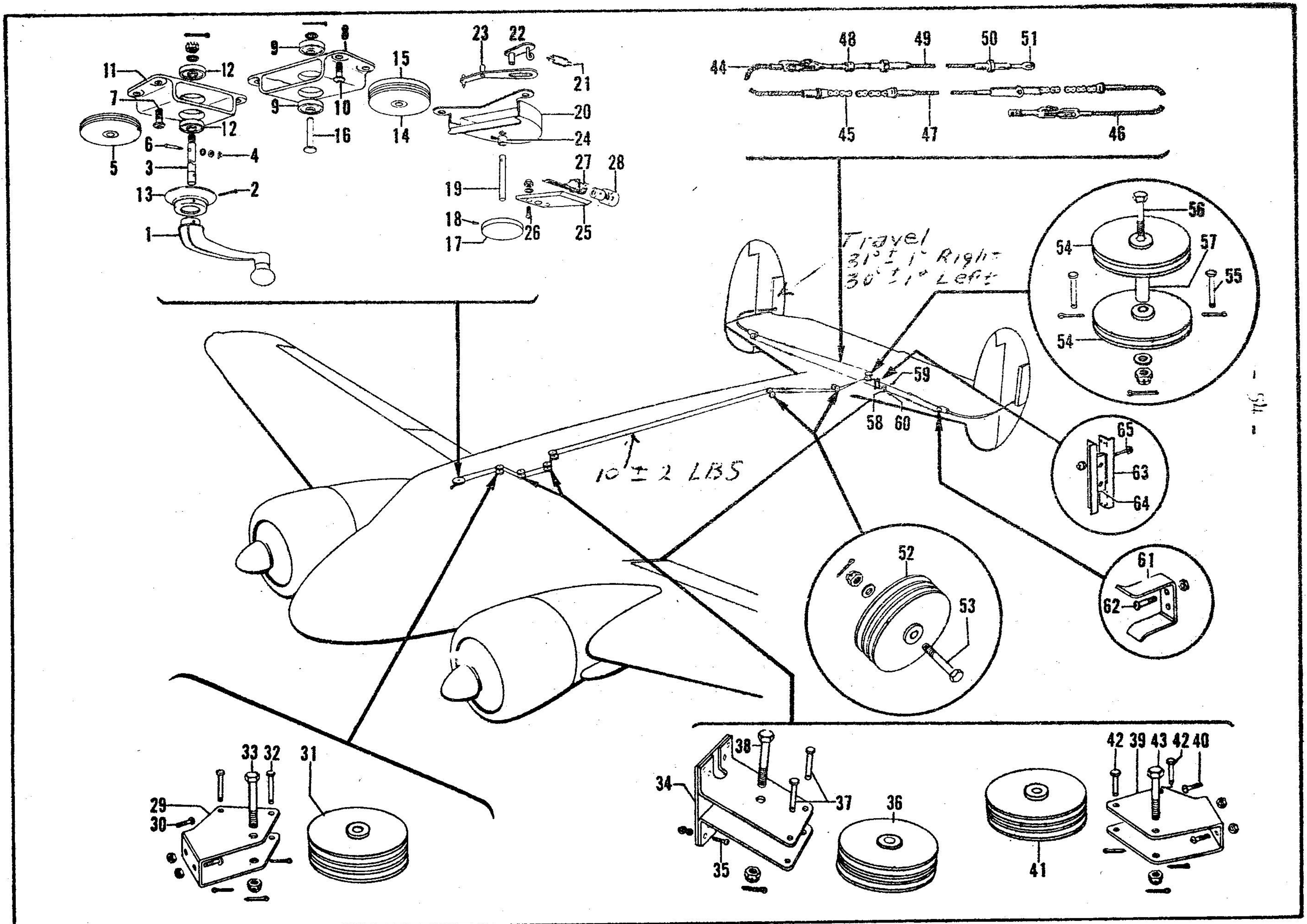
Check rudder reduction pulleys for the correct 5/32 inch dimension with the rudders in neutral.

Re-check cable tension and make any necessary adjustments. Safety all turnbuckles and install centre aisle floorboards.

EXPEDITOR TRIM TAB CONTROL SYSTEM

Rudder Trim Tab

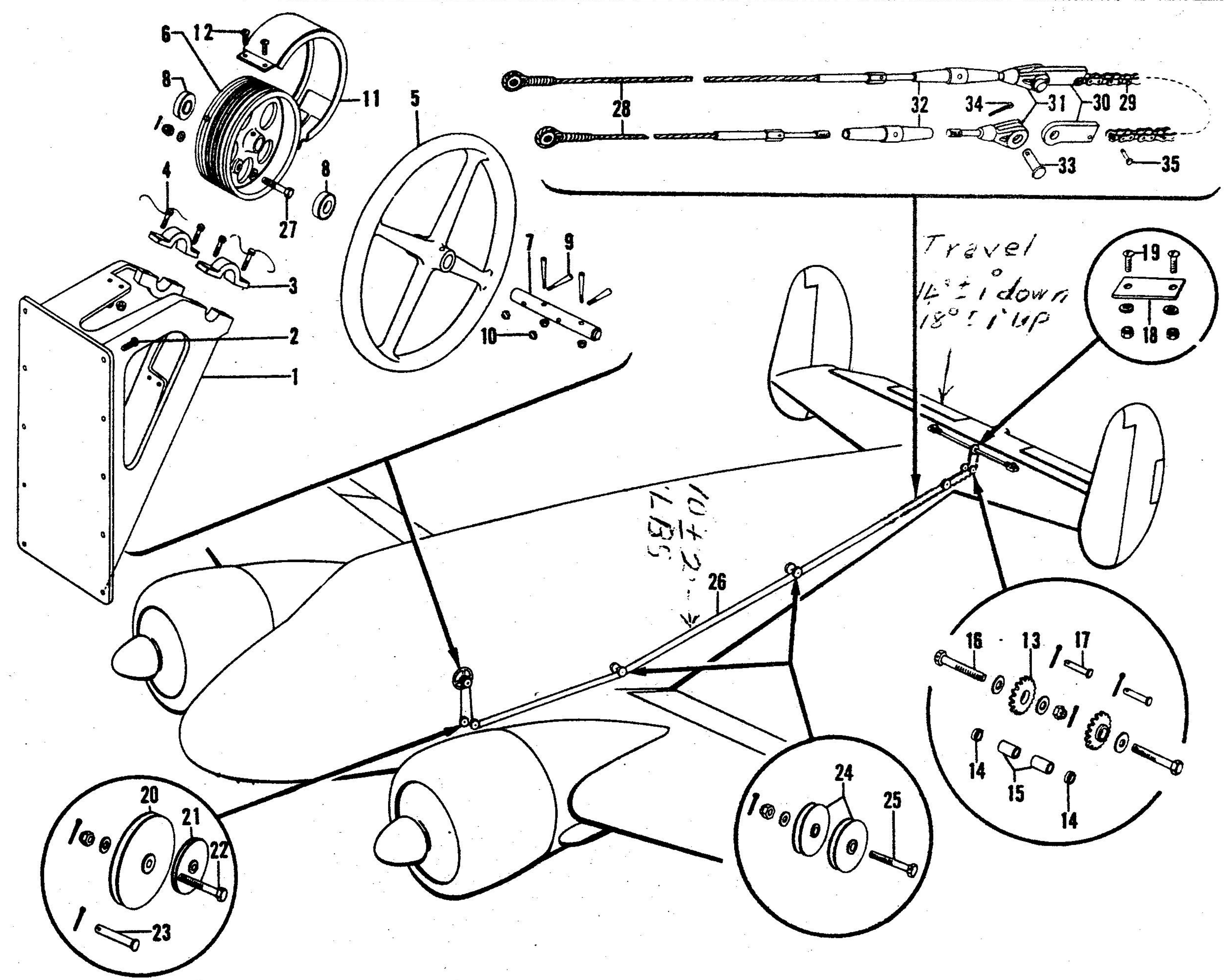
Both rudders are equipped with trim tabs, controlled by a hand crank mounted overhead in pilots compartment. A mechanical operated position indicator adjacent to the hand crank registers the position tabs. The tab control cable passes around the crank pulley and runs aft, routed around the astrodome on a series of pulleys. About the centre of the horizontal stabilizer it runs off to the right and to the left, connecting to a chain which actuates a 90 degree drive for each tab. Passing around the drive, it ties together again to form a continuous cable. From the 90 degree drives, flexible shafts turn actuators which move the tabs.



Rudder Tab Control Installation

RUDDER TAB CONTROL INSTALLATION

1 Crank Assembly - rudder tab control
2 Pin - tab control crank
3 Shaft - crank
5 Pulley
8 Housing - rudder tab crank control
9 Bearing
11 Housing - rudder tab crank control
12 Bearing
14 Pulley
15 Actuator - rudder tab indicator spiral
17 Dial Assembly - Removable tab indicator
19 Shaft - indicator
20 Cover Assembly - tab linkage
21 Spring
22 Link Assembly - tab
23 Link Assembly - tab
24 Bushing
29 Bracket - rudder tab pulley front
31 Pulley
34 Bracket Assembly - rudder tab pulley LH and RH
36 Pulley
39 Bracket - rudder tab pulley
41 Pulley
44 Cable Assembly - rudder trim tab
45 Chain
46 Cable Assembly - rudder trim tab
47 Cable Assembly - rudder trim tab
48 Barrel - turnbuckle
49 Cable Assembly - rudder trim tab
50 Barrel - turnbuckle
51 Eye - turnbuckle
52 Pulley



Elevator Tab Control Installation

ELEVATOR TAB CONTROL INSTALLATION

1 Bracket - tab control wheel

3 Cap - control wheel bracket

5 Wheel - control

6 Sheave - elevator tab control

7 Shaft - control wheel

8 Bearing

9 Pin - Taper

11 Guard - elevator tab control chain

13 Sprocket - elevator tab control

14 Spacer - sprocket

15 Bushing - sprocket spacer

18 Guard - elevator tab control chain

20 Pulley

21 Pulley

24 Pulley

26 Cable Assembly - elevator tab control

28 Cable - elevator tab control

29 Chain

30 Link - chain

31 Fork

32 Barrel - turnbuckle

NOTE: Expeditor 3T is equipped with a trim tab on the left rudder only.

NOTE: A new hinge wire must be installed each time tab is removed and reinstalled.

Minor Repairs and Parts Replacement

Check tab hinge for excessive wear.

If new wire will not remove play the hinge should be replaced.

Adjustment

Cable tension - 10 lbs plus or minus 2 lbs
Tab Travel - 31 degrees plus or minus 1 degree right side
or - 30 degrees plus or minus 1 degree left side

Elevator Trim Tab

The elevator is trimmed by two tabs, one on each side of the elevator centerline. They are operated simultaneously by a control wheel in the pilots compartment, mounted to the right and below the pilots seat. A rheostat operated position indicator, located on the instrument panel, registers the position of the tabs. The control cables are anchored around a sheave on the control wheel shaft. From the sheave the cables are routed down through the pilots floorboard and aft to the centre aisle floorboards to the first bulkhead aft to the rear baggage compartment. At this point they angle upward and aft, connecting to a chain. The chain passes around a guide and stop block in bulkhead 14 and up to a drive sprocket in the horizontal stabilizer. A cross-shaft extends from the sprocket in each direction and connects to 90 degree torque drives. Universal points connect each of these 90 degree drives with actuators in the elevator, which in turn operate the tabs.

Minor Repairs and Parts Replacement

Check cable sheaves, bearing, caps, and shaft for damage. Replace if necessary.

Adjustments

Cable tension - 10 lbs plus or minus 2 lbs
Tab Travel - 18 degrees plus or minus 1 degree up
- 14 degrees plus or minus 1 degree down

Aileron Trim Tab - Controllable Trim Tab

The left aileron is equipped with a trim tab operated by a control wheel on the lower face of the pilots control pedestal. A mechanically operated position indicator, adjacent to the control wheel, registers the position of the tab. The tab control cables pass around a pulley on the control wheel shaft to pulleys in the belly of the aircraft. From this point they angle aft towards the left side of the fuselage to a point just ahead of the fuselage bulkhead 7, then turn outboard through the centre section. Just outboard from the fuel tank well, the cables pass through a block which acts as a stop, to limit the travelof the aileron tab. The cables attach to a chain which actuates a tab chain drive connected by a flexible shaft to the 90 degree drive and actuator mechanism in the aileron. The actuator is connected to the aileron tab horn.

NOTE: CA-213 and after, except CA-281, have a ground-adjustable trim tab on the right aileron.

Minor Repairs and Parts Replacement

Check condition of actuator. Replace if screw shows excessive wear.

Check actuator mounting to see that mechanism moves freely in the mounting but does not have too much play. If excessive play cannot be removed by tightening setscrew, the mounting bracket or setscrew probably will need replacement. Lubricate as required.

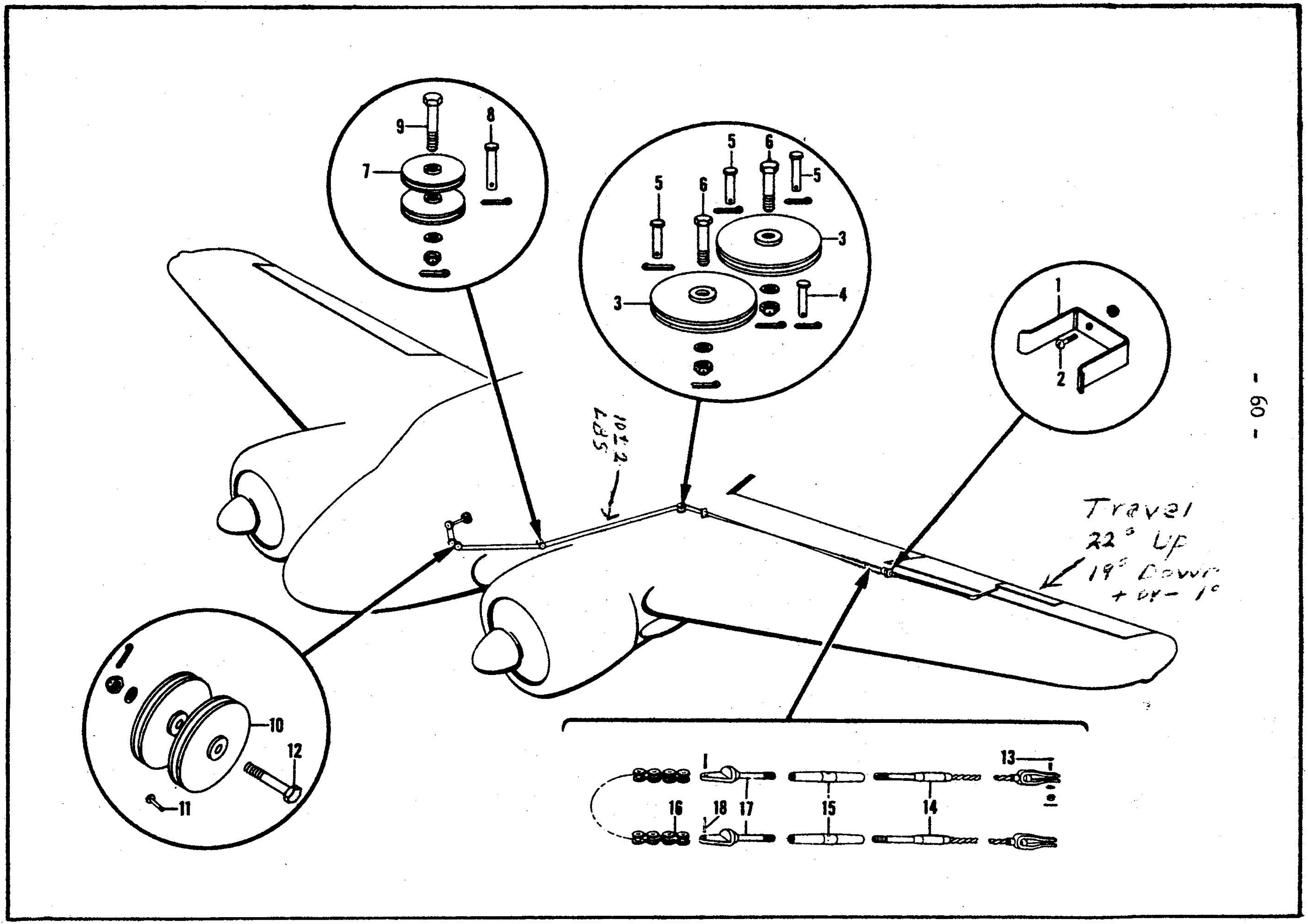
Check aileron tab hinges for wear. If hinge is worn, it must be replaced at a designated overhaul activity.

Tab Adjustments

Cable tension - 10 lbs plus or minus 2 lbs
Tab Tarvel - 22 degrees up, plus or minus 1 degree tolerance
19 degrees down, plus or minus 1 degree tolerance

or with scale

1 5/8 inches up) measured from the inboard trailing
1 1/8 inches down) edge of the tab, to trailing edge of aileron.



Aileron Tab Control Installation

AILERON TAB CONTROL INSTALLATION

1 **Guard - aileron tab chain**

3 Pulley

7 Pulley

10 Pulley

14 Cable Assembly - aileron tab control

15 Barrel - turnbuckle

16 Chain - aileron tab control

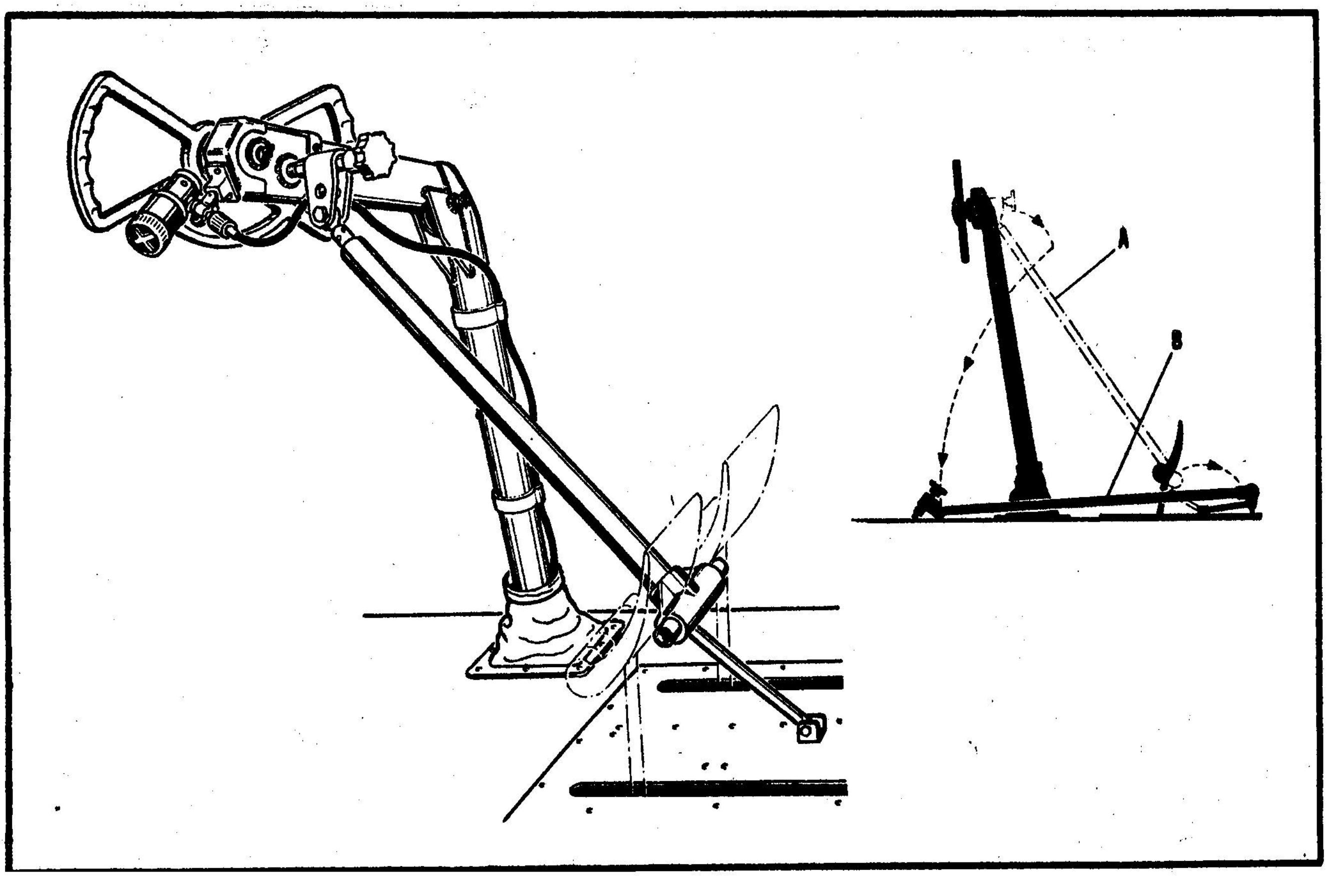
17 Stop aileron tab

18 Pin - aileron tab chain

CONTROL CABLE TENSIONS

Rudder Cables

	TENSION Determined by #2	TOLERANCE
Forward of reduction pulleys		± 10 lbs
Aft of reduction pulleys	30	± 10 lbs
Rudder front balance cable	60	± 10 lbs
Rudder rear balance cable	30	± 10 lbs
Elevator Cables		
Elevator Cable Upper	120	± 10 lbs
Elevator Cable Lower	120	± 10 lbs
Aileron Cables		
Control Column	35	± 5 lbs
Outer wing panel	50	± 10 lbs
Centre Section Wing	50	± 10 lbs
All Tab Cables	10	± 2 lbs


A
B

CONTROL SURFACE TRAVELS

SURFACE	DEGREES	INCHES	MEASURING POINTS
Elevator	35 ± 1° up 25 ± 1° down	12" up	Midway between inboard and outboard ends at the neutral setting at the trailing edge centre line.
Elevator Tab	18 ± 1° up 13 ± 1° down	1" up 5/8" down	From the centre line of the trailing edge of the tab to the centre line of the trailing edge of the elevator.
Rudder	25 ± 1° right 25 ± 1° left	8¾" right 8¾" left	From the centre line of the rudder counter-balance to the centre line of the vertical stabilizer.
Rudder Tab	31 ± 1° right 32 ± 1° left	3½" right 4" left	From the trailing edge centre line on top of tab to trailing edge centre line of rudder
Flaps	0° up 45 ± 1° down	18" down	From trailing edge of flap fillet centre line to centre line of trailing edge centre line line of rudder.
Aircraft with Aileron Hex Head Be ll Crank Stop	45 ± 2° up 20 ± 2° down	11" up 5" down	From centre line of trailing edge of the aileron to the centre line of the trailing edge of the flap in "neutral" position.
Aircraft with Eccentric Bell Crank Stop	38½ ± 1° up 21 ± 1° down	9½" up 5¼" down	From centre line of trailing edge of aileron to the centre line of the trailing edge of the flap in "neutral" position.

SURFACE	DEGREES	INCHES	MEASURING POINTS
Aircraft with Hex Head and One Eccentric Bell Crank Stop	20 ± 2° up 20 ± 2° down	5" up 5" down	From centre line of trailing edge of the aileron to the centre line of the trailing edge of the flap in "neutral" position.
Adjustable Aileron Tab	22 ± 1° up 19 ± 1° down	1 5/8" up 1 1/8" down	From centre line of the tab at inboard end to centre line of aileron at trailing edge.
Stationary Aileron Tab	May be bent at trailing edge of aileron as required to provide proper rigging of the aircraft, but do not exceed 20 degrees up or down.		

Surface Control Locks

Surface control lock is stored on the deck forward of the pilots seat, secured at aft end by a leather strap. To lock the control surfaces:

Release aft end of surface control lock.

Place rudder pedals in neutral, then press rudder lock pins in and lift assembly until the lock pins will engage the holes in the rudder pedals.

Place the aileron controls in neutral, then position the control column so the lock screw can be screwed into the hole.

NOTE: External surface control locks should be used, if the aircraft may be subjected to strong variable winds.

EXPEDITOR FUEL SYSTEM

Fuel is supplied to the engines from five supply tanks. Two main tanks each 63 imperial (76 US) gallons capacity, are located in the centre section wing - one on each side of the fuselage just aft of the centre section truss. Two auxiliary tanks, each of 21 imperial (25 US) gallon capacity, are so located in centre section wing immediately aft of each main tank. In the nose compartment of the aircraft there is 67 imperial (80 US) gallon tank. Each engine is equipped with an engine driven fuel pump. In case of failure of both of the engine driven fuel pumps, a wobble pump in the pilots compartment may be operated to maintain fuel pressure. The wobble pump also is used to build up fuel pressure for starting. Fuel strainers are mounted on the engine fire wall - one of the lower outboard side of each nacelle. Fuel is fed to the primer system from the left fuel strainer and pressure in the system is provided by a two engine primer located on the pilots control pedestal.

Fuel Tanks

The main and auxiliary fuel tanks are welded and rivetted structures constructed of 52S-½H aluminum sheet with internal baffles. Each tank has a water-collecting cast-aluminum alloy sump containing a drain cock, a finger strainer, and chromate cartridge. The nose auxiliary fuel tank is a bladder type fuel cell of rubber construction which incorporates a drain cock, finger strainer, and a chromate cartridge.

Minor Repairs and Parts Replacement

Replace defective tank straps and finger strainers. Replace or reglue tank protective strips. If repairs to the tank proper are needed, tag as unserviceable and return to stores.

Adjustment

The only adjustment on the fuel tank are the turnbuckles on the tank retaining straps to the liquidometer unit adjustment.

Fuel Lines

Fuel lines are seamless aluminum tubing. The lines are preformed and are supported in phenolite blocks, clamps and bulkhead fittings to protect the lines from vibration and chafing.

RIGGING POSITION, JACKING POINTS OF EXPEDITOR

The main jacking points are located on the under side the wing centre section between the fuselage and each nacelle. Three rubber plugs must be removed and the jack pads installed. Before jacking, a rubber plus must be removed from each of the three access holes in the skin at each jack point location and the jack pads installed. These pads are attached to the aircraft by 3 bolts furnished with each jack pad. Jack points incorporated in each main wheel fork permit individual wheel jacking. A jack point at bulkhead 15, for tail jacking, extends downward past the fuselage skin. It requires no jack pads.

CAUTION: When using a wheel jack, use care to prevent aircraft from falling off the jack. Only one side should be raised at a time.

WARNING: The hoisting or jacking the aircraft always place a minimum ballast of 200 pounds on the horizontal stabilizer to prevent aircraft from nosing over. The ballast should be placed over the front spar near the fuselage and a felt or canvas pad should be used to protect the horizontal stabilizer.

Hoisting

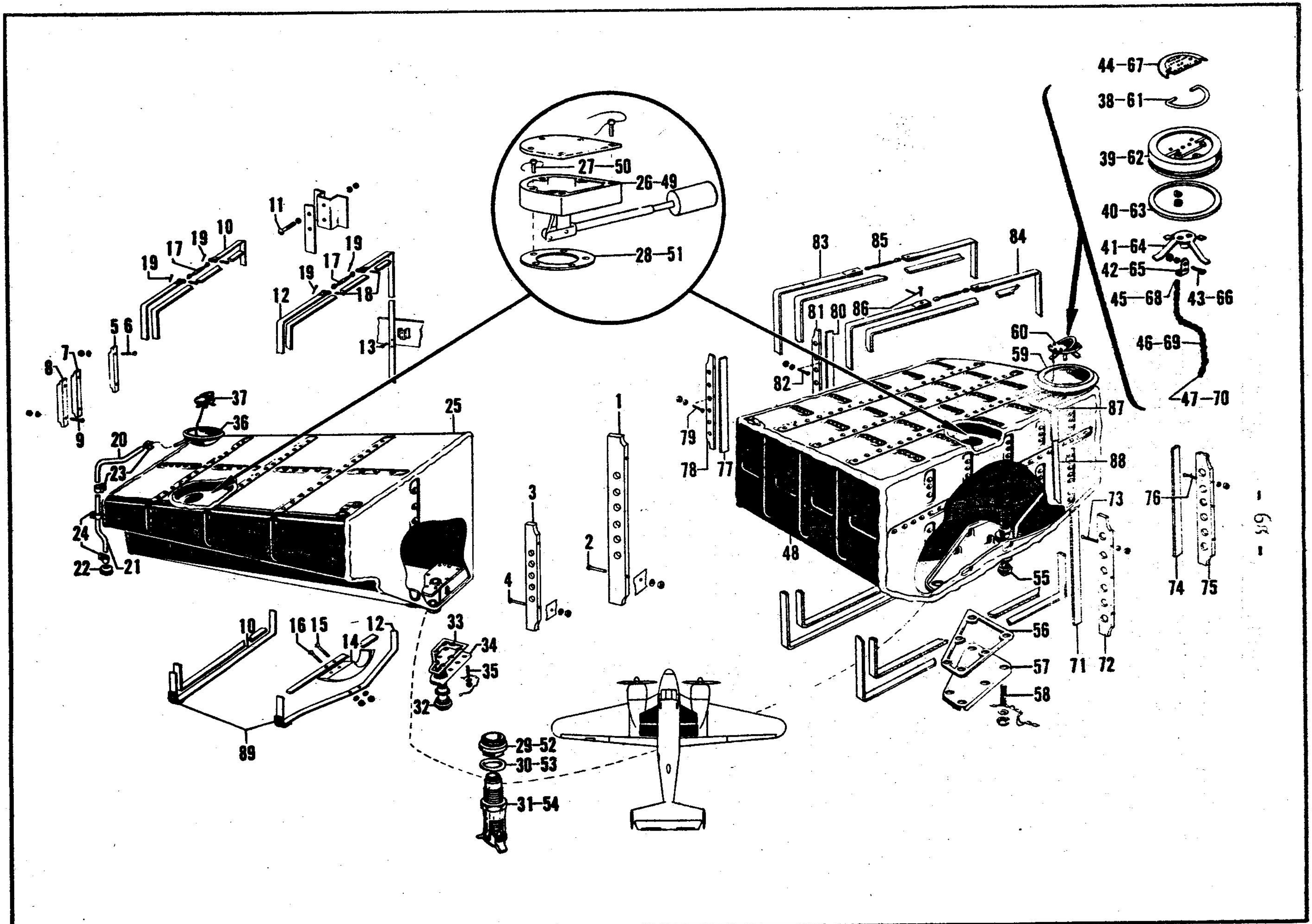
The aircraft may be hoisted either with a single hoist and sling, or with two hoists.

Single Hoist

A hoist with a minimum capacity of five tons should be used. Remove the fabric patches over the hoisting bracket attaching holes and install the hoisting brackets, using the special bolts furnished with the brackets. The hoisting sling should be just long enough to clear the fuselage by approximately two inches.

Double Hoist

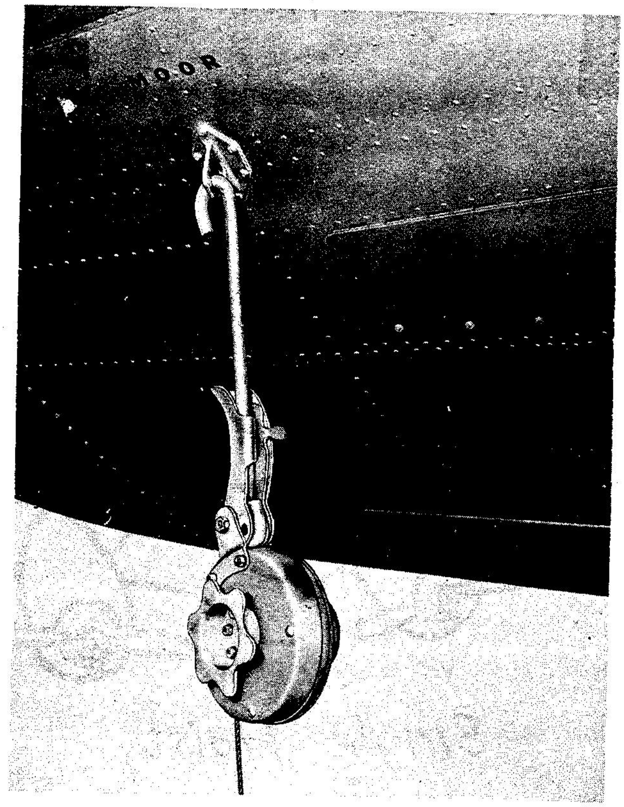
When using two hoists each should have a minimum capacity of three tons. Remove fabric patches over the hoisting lub attaching holes, install the special hoisting eye bolts, and attach the hoists to the aircraft. They must be spaced so the pull is directly on line with the center-line of the hoisting eye bolt shank.



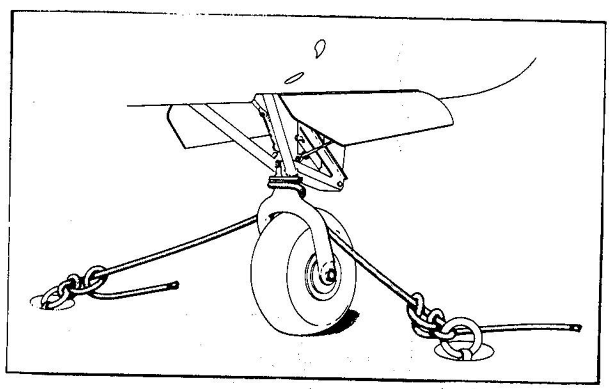
Wing Fuel Tank Installation

WING FUEL TANK INSTALLATION

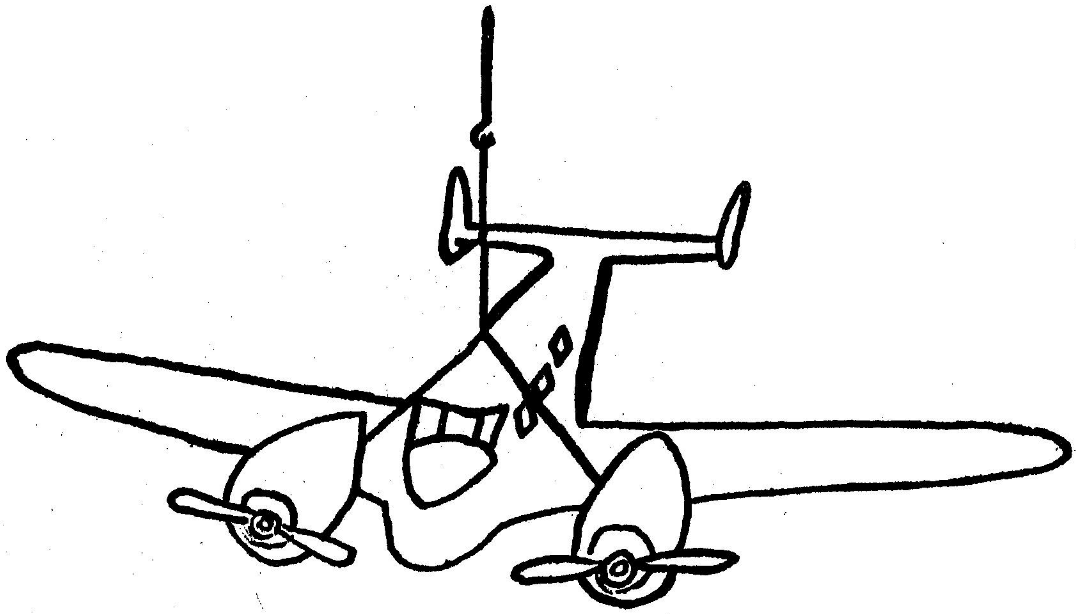
1 Strip - centre section fuel tank inboard front
3 Strip - centre section fuel tank inboard rear
5 Strip - centre section fuel tank outboard front
7 Strip - centre section fuel tank outboard centre
8 Strip - centre section fuel tank outboard rear
10 Strap Assembly - fuel tank outboard
12 Strap Assembly - fuel tank inboard
14 Spacer - rear fuel tank strap
17 Turnbuckle Assembly
25 Tank - Centre section rear fuel LH and RH
26 Gauge - rear fuel tank LH and RH
31 Cock - drain
32 Strainer Assembly - fuel
33 Gasket rear fuel tank sump plate
34 Plate rear fuel tank sump LH and RH
36 Collar Assembly - fuel tank filler neck
37 Cap Assembly - rear fuel tank
48 Tank Assembly - centre section main fuel LH and RH
49 Gauge - main fuel tank LH and RH
54 Cock - drain
55 Strainer Assembly - Fuel
56 Gasket - main fuel tank sump plate
57 Plate - main fuel tank sump LH and RH
59 Collar Assembly - fuel tank filler neck
60 Cap Assembly - main fuel tank
83 Strap Assembly - tank mounting outboard
84 Strap Assembly - tank mounting inboard
85 Turnbuckle Assembly
87 Tube - filler neck drain upper
88 Tube - filler neck drain lower
89 Strip - tank assembly



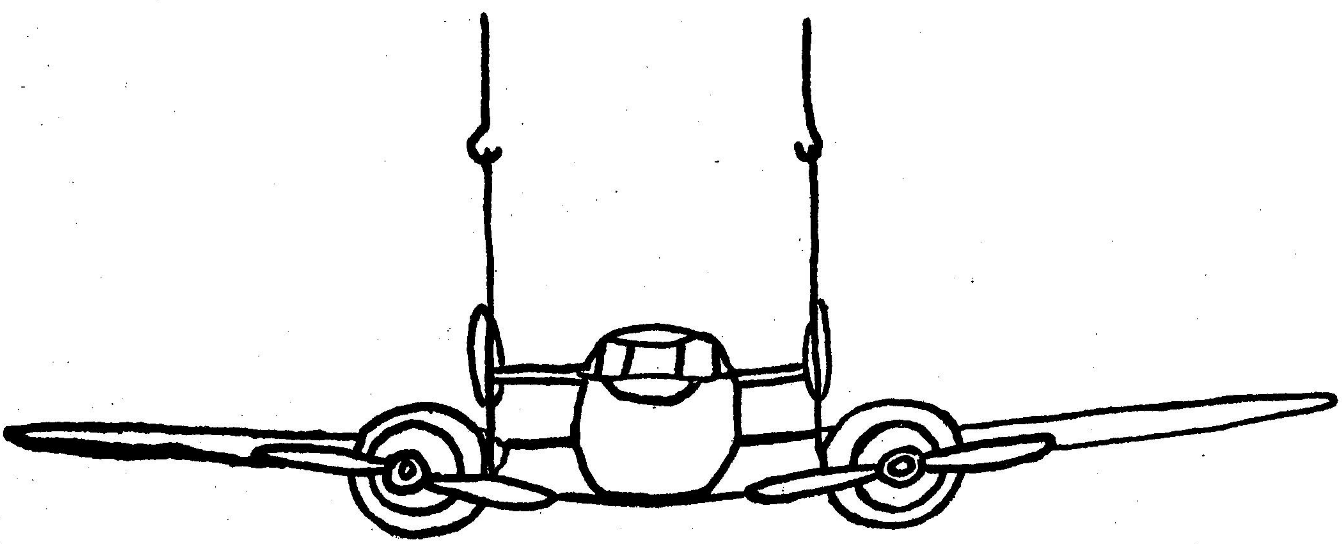
Wing Picketing



Tail Picketing



Single Hoist



Double Hoist