THE HS-1L FLYING BOAT HANDBOOK

NAVY DEPARTMENT

BUREAU OF CONSTRUCTION AND REPAIR

JULY, 1918

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INTRODUCTION

The following text is designed to give the most satisfactory current practice of handling large flying boats with particular attention to unpacking and assembling. There are various methods of performing the component operations dealt with, and no doubt most of these would give satisfactory results, but the following, if consistently adherred to, will give good results.

INTERPLANE CABLES OF HS-2L FLYING BOAT.

Location.	Type.	Engine section.	New panel.	Intermediate.	Outer.	Overhang.
Front	Flying	Double $\frac{1}{4}$ inch	Double $\frac{1}{4}$ inch	Double $\frac{3}{16}$ inch	Double $\frac{5}{32}$ inch	Double $\frac{5}{32}$ inch.
	Landing	Double $\frac{3}{16}$ inch	Single $\frac{1}{4}$ inch	Single $\frac{3}{16}$ inch	Single $\frac{5}{32}$ inch	None.
Rear	Flying	Double $\frac{7}{32}$ inch	Double $\frac{7}{32}$ inch	Double $\frac{3}{16}$ inch	Double $\frac{5}{32}$ inch	Double $\frac{5}{32}$ inch.
	Landing	Double $\frac{3}{16}$ inch	Single $\frac{7}{32}$ inch	Single $\frac{3}{16}$ inch	Single $\frac{5}{32}$ inch	None.

Stagger { Upper front to lower rear, single $\frac{1}{8}$ inch.
Lower front to upper rear, single $\frac{1}{8}$ inch.

Engine bed to top of inner post, front to rear, rear to front, single $\frac{3}{16}$ inch.

Engine bed to hull sidewalk section, front to rear, rear to front, single $\frac{3}{16}$ inch.

King post brace wires, front and rear, single $\frac{1}{8}$ inch.

NOTE.—All wires to be galvanized nonflexible cables.

NOTE ON THE HS-2L FLYING BOAT.

As this handbook goes to press a modification of the HS–1L flying boat is being developed. This modification consists essentially in an addition to the wing surface and an increase in rudder area. The additional wing surface is obtained by adding four 6-foot panels, one in each side in both lower and upper planes adjacent to the outboard extension panels.

All the parts required to convert the HS–1L to the HS–2L will be duplicates of other parts already on the HS–1L, excepting the four 6-foot panels and the larger rudder.

The wing beams in the upper engine section of the HS–2L must be made without routing, and provision has been made to supply an upper engine section panel having unrouted beams with the other parts necessary to convert the HS–1L to the HS–2L if these beams have not already been changed.

The following represents the parts necessary to convert the HS–1L service machine into the HS–2L and shows the difference between the two models:

(*a*) Upper engine section wing panel beams to be made unrouted.

(*b*) Front engine section lift wires to be changed from two $\frac{3}{16}$-inch to two $\frac{1}{4}$-inch nonflexible cable.

(*c*) Rear engine section lift wires to be changed from two $\frac{3}{16}$-inch to two $\frac{7}{32}$-inch nonflexible cable.

(*d*) Four 6-foot panels to be supplied complete with hinges and standard HS–1L wing post fittings, including bolts, strut pins and cotters.

(*e*) Four front lift and four rear lift nonflexible cables to be supplied, $\frac{1}{4}$ inch and $\frac{7}{32}$ inch, respectively. Also single drop wires front and rear of the same size. These are for the added panels on each side.

(*f*) Two front interplane struts $2\frac{5}{8}$ by $6\frac{5}{8}$ by 84 inches to be supplied.

(*g*) Two rear interplane struts $2\frac{3}{16}$ by $5\frac{1}{2}$ by 84 inches to be supplied.

(*h*) Four $\frac{1}{8}$-inch stagger wires to be supplied with turnbuckles and end connections.

(*i*) One rudder to be supplied having an area of 26 square feet instead of present HS–1L rudder having an area of approximately 20 square feet.

(*j*) Aileron control wires to be lengthened and changed to accommodate increased span.

The HS–2L will be increased in span by 12 feet on the upper and lower planes over the HS–1L. This is the only material change in dimensions.

The HS–2L weighing 6,500 pounds has operated successfully and has attained a speed of 91 miles per hour. It is anticipated that the increased area over the HS–1L will materially increase the climb, preliminary trials having indicated that 2,500 to 3,000 feet can be attained in 10 minutes while operating with the foregoing weight. In the air and on the water the balance and handling have indicated an improvement over the HS–1L.

The wing loading has been decreased from 9.03 pounds per square foot for the HS–1L to $6{,}500/803 = 8.09$ pounds per square foot, but the horsepower loading has been increased from 17.9 pounds per rated horsepower to $6{,}500/330 = 19.7$.

A chart of interplane cables of the HS–2L appears on page 4.

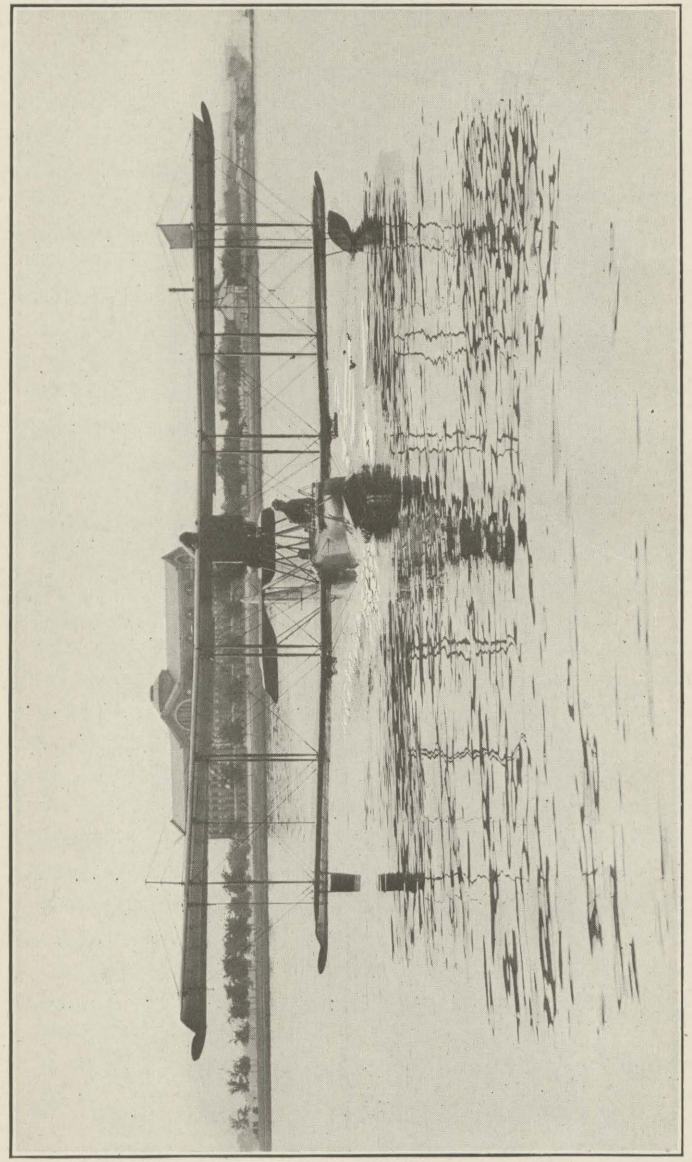


FIG. 1.—GENERAL VIEW.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS.

HS–1L FLYING BOAT HANDBOOK

SPECIFICATIONS

1. AREAS.

	Sq. ft.
Panels, upper, excluding engine section and ailerons	232.00
Panel, engine section upper	75.80
Panels:	
Lower outer, excluding ailerons	184.00
Lower inner	53.20
Ailerons:	
Upper (each 30.80 square feet)	61.60
Lower (each 21.30 square feet)	42.60
Sidewalk section	3.80
Total supporting surface	653.00
Horizontal stabilizer	54.80
Elevators (two at 22.80 square feet)	45.60
Vertical stabilizer	19.60
Rudder	19.60
Nonskid plane	16.00

2. WEIGHTS.

HULL.

	Pounds.
Hull (including soakage)	1,265

WINGS, TAIL, ETC.

Upper panels	284
Lower panels	184
Engine section	106
Sidewalks	72
Ailerons upper braces, etc	75
Ailerons lower braces, etc	40.5

	Pounds.
Aileron connecting rod	15
Rudder, etc	24
Elevator, control, etc	33
Vertical stabilizer	22
Horizontal stabilizer	49
Stabilizer braces	26
Outrigger	17
Wing-post struts	111
Engine-bed wires, etc	184
Bowpost, oil piping	29
Pontoons	58.5
Nonskid planes	16
Engine section cables	37
Sidewalk wire, etc	13
Tail skid	4
Total	1,400

ORDNANCE EQUIPMENT.

1 Lewis gun	19
1 shell deflector	3
2 ammunition trays	20
1 mount	25
1 Colt, 1 Very pistol, rockets, etc	22.5
1 Wimperis course-setting bomb sight	5.8
1 pilot directing bomb sight	26.7
2 bombs with gear	378
	500
Installation	60
Total	560

STEAM ENGINEERING EQUIPMENT.

Motor	806
Water	114.5
Radiator	83
Propeller	70
Fan gasoline pump	18
Hand pump	5
Tanks	120

	Pounds.
Gravity tank	31
Oil tank	18
Spark and throttle	2
Wire mesh	8
Tachometer	11
Oil-pressure gauge	1
Thermometer	1
Gasoline sight	1
Tools and spare parts	15
Oil thermometer	1
Radiator support	5
Hand crank	13.5
Exhaust	12
	1,336

ELECTRICAL EQUIPMENT.

Storage battery	15
Aldis signal lamp, running lights, instrument lights	9
Switchboard	3
Wiring for electrical instruments	10
Intercommunication set	10
	47
Installation	6
Total	53

CONSTRUCTION AND REPAIR EQUIPMENT.

Bilge pump	10
Sea anchor	15
Air-speed meter	5
Inclinometer	1.3
Fire extinguishers (2)	14
	45.3
Installation	6.7
Total	52

NAVIGATION EQUIPMENT.

	Pounds.
Compass	4
Watch	1
Altimeter	2
Chart board	3
Flags	2
Food and water	10
Pigeons	5
Binoculars	2
Installation	29
Total	3
	32

MEDICINE AND SURGERY EQUIPMENT.

Medical emergency kit	2

PERSONNEL AND FUEL.

Crew (2 men, at 180 pounds)	360
Gasoline (110 gallons) and oil (6 gallons)	730
Total	1,090

RADIO EQUIPMENT.

Radio and installation	110

SUMMARY.

Hull (including soakage)	1,265
Wings, tail, etc	1,400
Ordnance equipment	560
Steam Engineering equipment	1,336
Electrical equipment	53
Construction and Repair equipment	52
Navigation equipment	32
Medicine and Surgery equipment	2
Personnel	360
Gasoline and oil	730
Radio	110
Total weight	5,900

3. LOADING.

$$\frac{\text{Total weight}}{\text{Supporting area}} = \frac{5{,}900}{653} = 9.03 \text{ pounds per square foot.}$$

$$\frac{\text{Total weight}}{\text{Rated horsepower}} = \frac{5{,}900}{330} = 17.9 \text{ pounds per rated horsepower.}$$

4. DESIGN.

(A) AEROPLANE.

Angle of incidence:	
Upper panels	5½ degrees.
Lower panels	4 degrees.
Angle of dihedral, panels	2 degrees.
Stagger	0 degree.
Gap:	
Front	7 feet 7⅛ inches.
Rear	7 feet $5\frac{29}{32}$ inches.
Chord	6 feet $3\frac{5}{32}$ inches.
Wing curve	R. A. F. 6.
Span of wings:	
Upper	62 feet $\frac{19}{32}$ inch.
Lower	52 feet $1\frac{31}{32}$ inches.
Length, over all	38 feet $5\frac{15}{16}$ inches.
Width, over all	62 feet $\frac{19}{32}$ inch.
Height, over all	14 feet 7¼ inches.
Length of hull	34 feet 3 inches.
Tail plane, angle of incidence	0 degree.

(B) MOTOR.

Type, 330 horsepower Liberty twelve-cylinder, 45° vee, four-stroke cycle.

Ignition: Storage battery and induction coil. Distributor on each cam shaft.

Cooling	Water—centrifugal pump.
Oiling	Forced feed to all bearings.
Bore	5 inches.
Stroke	7 inches.
Average gasoline consumption per horsepower hour	0.55 pound.
Average oil consumption per horsepower hour	0.03 pound.
Valves	One intake, one exhaust per cylinder.
Carburetors	Two duplex Zeniths.

65022—18—2

(c) PANELS AND AILERONS.

Leading edge to center line front beam..... 9 inches.
Center line front beam to center line rear beam..... 48 inches.
Center line rear beam to trailing edge..... 18 inches.
Upper plane in three sections.
Lower plane, four sections, two each side of hull.
Sidewalk section integral with hull.

Ailerons.	Maximum width.	Length.
	Ft. in.	*Ft. in.*
Upper (balanced)	2 2	17 8½
Lower (balanced)	1 10	12 9

All fabric sewed to panels, seams laid diagonally, or normal to leading edge.

Doping: Two coats of cellulose acetate, two to four coats of cellulose nitrate on all fabric surfaces; two coats of anti-actinic gray wing enamel on top fabric surfaces and vertical fabric surfaces; one coat of anti-actinic gray wing enamel on bottom fabric surfaces.

Strut fittings..... Steel stampings and forgings.
Wing spars..... Spruce.
Ribs:
  Intermediate..... Lightened pine, wing contour.
  Compression..... Solid pine, wing contour.
Trailing edge..... Steel tube, flattened to oval shape

(D) HULL.

	Ft.	in.
Length	34	5
Width	4	0
Width over fins	8	0

Material:
  Planking—
    Bottom (outer)..... $\frac{3}{16}$ inch pine or cedar.
    Bottom (inner)..... $\frac{5}{32}$ inch pine or cedar.
    (Fabric between glued to planking.)
  Planking, top and sides..... Single, pine or cedar ($\frac{5}{32}$ by 5 inches).
  Covering..... Fabric glued to planking on top and sides.

Material—Continued.
  Frames..... Ash.
  Keel..... Ash.
  Keelson..... Pine or cedar.
  Deck stringers..... Pine or cedar.
  Chine stringers..... Pine or Port Orford cedar.
  Stern post..... Ash.
  Floors..... Pine or cedar.
  Seam strips..... Spanish cedar.
  Bulkheads..... 3-ply waterproof veneer.
  Engine beds..... Ash-spruce-ash.
  Engine bracing system:
    Compression members..... Steel tubing stream-lined.
    Tension members..... Nonflexible cable.

(E) FINISH.

(*a*) Panels and tail units are finished with low visibility gray non-actinic wing enamel.

(*b*) Hull is finished with low visibility gray wing enamel or naval gray pontoon enamel.

(*c*) All metal parts are enameled:
  (1) Wing-post fittings (over copper-plating)..... Gray.
  (2) Radiator..... Gray.

(F) CONTROLS.

(*a*) Double wheel control, located in operator's cockpit. Control bridge is of the inverted "U" type, ash frame, equipped with two 4-spoke, bronze spider, black walnut rim, 16-inch hand control wheels. Bronze sheaves for guiding control cables. Elevator control lines attached to bridge by steel fittings. Bridge ends reinforced by lightened steel fittings.

(*b*) Foot-bar controls for operating rudder.

  Foot bar..... Ash.
  Block..... Bronze.

(*c*) Throttle and spark advance control levers mounted in operator's cockpit located between the two seats on diagonal brace. Cut-out switch to be located within reach of pilot.

INTERPLANE CABLES.

Location.	Type.	Engine section.	Intermediate.	Outer.	Overhang.
Front	Flying	Double $\frac{3}{16}$-inch	Double $\frac{3}{16}$-inch	Double $\frac{5}{32}$-inch	Double $\frac{5}{32}$-inch.
	Landing	Double $\frac{3}{16}$-inch	Single $\frac{3}{16}$-inch	Single $\frac{5}{32}$-inch	None.
Rear	Flying	Double $\frac{3}{16}$-inch	Double $\frac{3}{16}$-inch	Double $\frac{5}{32}$-inch	Double $\frac{5}{32}$-inch.
	Landing	Double $\frac{3}{16}$-inch	Single $\frac{3}{16}$-inch	Single $\frac{5}{32}$-inch	None.

Stagger { Upper front to lower rear, single $\frac{1}{8}$-inch.
Lower front to upper rear, single $\frac{1}{8}$-inch.

Engine bed to top of inner post, front to rear, rear to front, single $\frac{3}{16}$-inch.

Engine bed to hull sidewalk section, front to rear, rear to front, single $\frac{3}{16}$-inch.

King post brace wires, front and rear, single $\frac{1}{8}$-inch.

NOTE.—All wires to be galvanized nonflexible cables.

A change has been made in the sizes of some of the above cables which will be incorporated in all but a few boats which had been shipped before the change was deemed advisable.

In the front, the engine section and intermediate cables will be increased to $\frac{1}{4}$ inch, the outer to $\frac{3}{16}$ inch, and the overhang decreased to $\frac{7}{64}$-inch. In the rear the engine section cables will be increased to $\frac{7}{32}$-inch and the overhang decreased to $\frac{3}{32}$-inch.

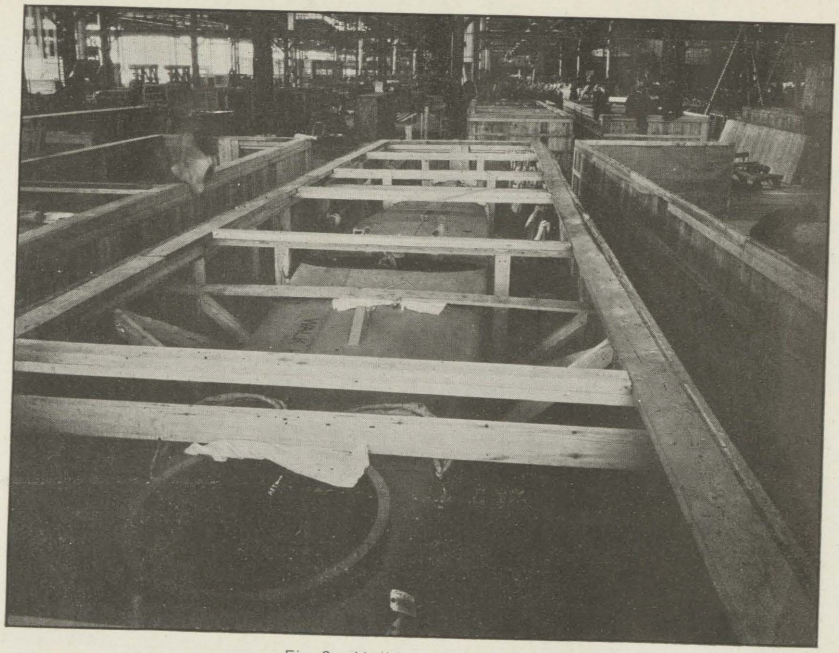


Fig. 2.—Hull box, looking aft.

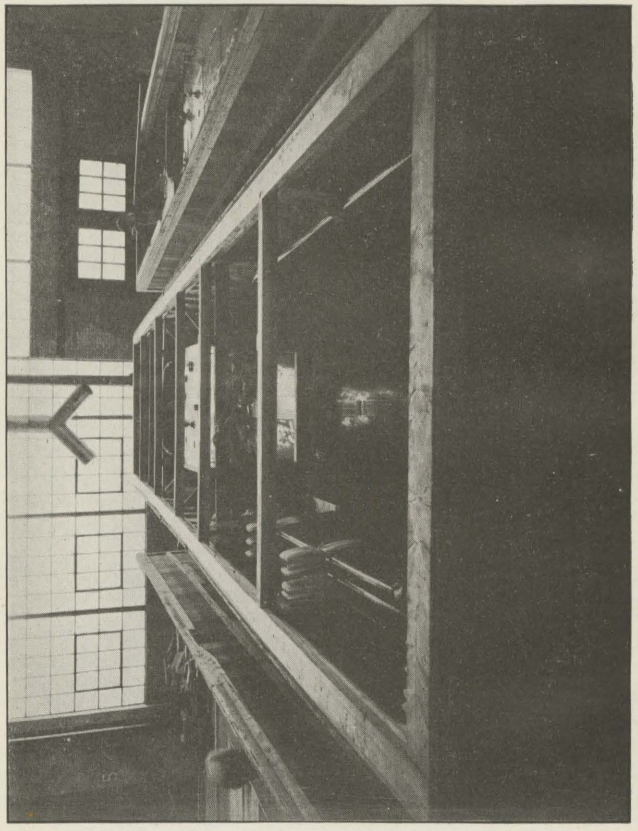


Fig. 3.—Hull box, looking forward.

INSTRUCTIONS FOR ASSEMBLING.

METHOD OF SHIPMENT.

A complete boat, including the engine and propeller, is packed in four (4) separate boxes. The large box should contain the hull, ailerons, wing floats, interplane bracing, engine parts, radiator, outrigger, two oil tanks (small), gravity gas tank, and two bomb-dropping devices. The medium sized box contains tail units and wing panels. The engine is contained in one of the small boxes and the propeller in the other. The contents of these boxes are noted on the packing sheets (figs. 28 to 35, inclusive) accompanying each shipment.

HANDLING BOXES.

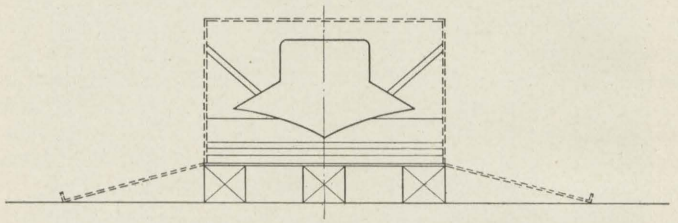
The sling for handling or hoisting the hull box should consist of four cables of equal length with hooks on the lower extremities. Two diagonal steel straps are bolted to each side of the box; the hooks on the hoisting cables should be passed through the holes in the upper ends of these straps (see fig. 4).

The hull is kept in a fixed position in the box by a system of bracing, with large cushioned bumpers on each side over the fins and under the tail. The nose and tail are firmly blocked and cushioned to prevent lateral or transverse movement. The hull is thus completely braced to the case. The top should be kept uppermost, however, as in this position the hull rests on a special cradle fastened to the bottom of the shipping box. The top of the box is easily recognizable due to the fact that the two diagonal hoisting straps on the side converge toward the top and also the top ends of these straps have the holes for the hoisting hooks. Figures 2 and 3 show the disposition of the hull in the box.

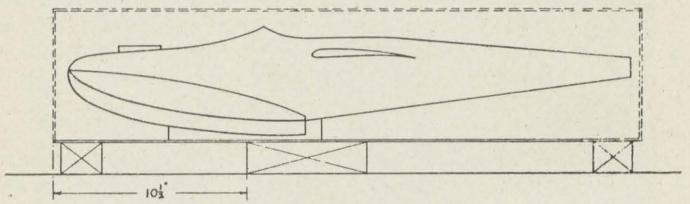
The other boxes may be handled by a sling passing under each end of the box, keeping the center of lift near the middle of the box.

Weights.—The average weights of the boxes as shipped are as follows:

	Pounds.
(*a*) Hull box	7,900
(*b*) Panel box	2,850
(*c*) Motor box	1,375



Cross section.



Longitudinal section.

FIG. 5.—Hull box on cradle.

UNPACKING LARGE BOX.

It will be of advantage to place the case containing the hull on firm blocking, high enough so that with the height of the cradle in the box, the elevation of the hull above the ground will be somewhat more than the height of the assembling cradle to be used. The lowest point of the hull is $10\frac{3}{4}$ inches above the bottom of the box. This box is as shown in figures 9, 10, and 11.

Since the weight of the hull is carried on the cradle, the flooring of the case under the cradle should be properly supported if box is raised. Cribbing 4 feet longitudinally each side of the step is recommended. (See fig. 5.)

1. Top should be carefully removed. (See figs. 2 and 3).
2. Saw across beams and braces, so same may be removed without damage to the hull, this including the bracing on nose and tail.
3. Remove ailerons.
4. If crane or chain falls are available, the hull should be lifted vertically out of the box, using a cross beam fitting into the wing hinges. (See fig. 6).

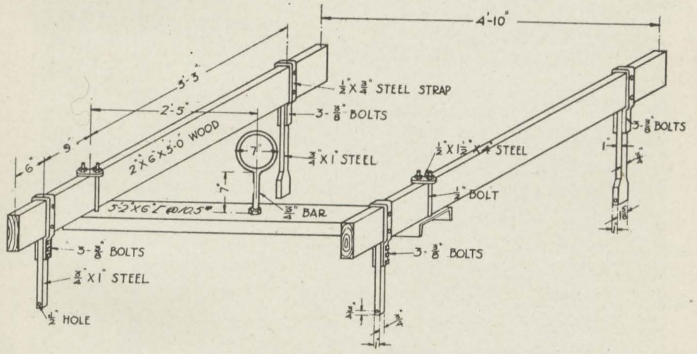


FIG. 6.—Hoisting tackle for hull.

5. If hoisting device is not available remove outrigger and boxes containing interplane bracing and engine parts, then remove side of box opposite the ailerons. Lift the boat carefully out of its bed in the box and set on cradle. About 24 men are required to properly handle the boat.

UNPACKING THE MEDIUM SIZED BOX.

Carefully remove top and such bracing as to allow the removal of panels.

UNPACKING ENGINE BOX.

Follow instructions printed on the side of box.

When hull and parts are first removed from boxes they should be carefully inspected to see that no damage has occurred during shipment.

ASSEMBLY OF CENTER SECTION.

1. Find a comparatively level spot for the cradle and level up boat fore and aft and athwartships. This can be done by using a jig fitting into the hinges (see fig. 7) and allowing for an angle of attack of four degrees (4°). This angle is measured between the chord of the wing and the horizontal, when the boat is level.

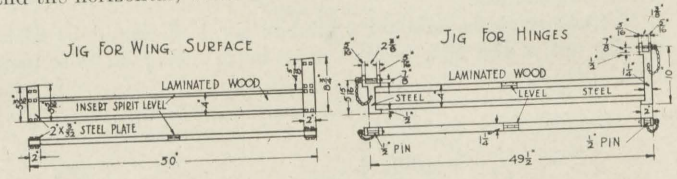


FIG. 7.—Assembly jigs.

If a jig is not available set up two blocks of wood on a straightedge, with a block under each hinge-point on sidewalk beams, with the front block three and one-half inches (3½ inches) longer than the rear block. Level up boat by making top of straightedge level. This should be done on both sides of the boat.

As an alternate method for leveling up the hull longitudinally a jig shown in figure 8 may be used. The points at each end of the jig should be placed on the center line of each beam on the bottom of the sidewalk sections. Since the vertical distance (3⅜ inches) between the jig points is fixed, a spirit level resting on the straightedge will indicate the horizontal lines.

2. Level boat across mid section by straightedge and level. Set on two blocks of equal height, first on line with front hinges then on line with rear hinges.

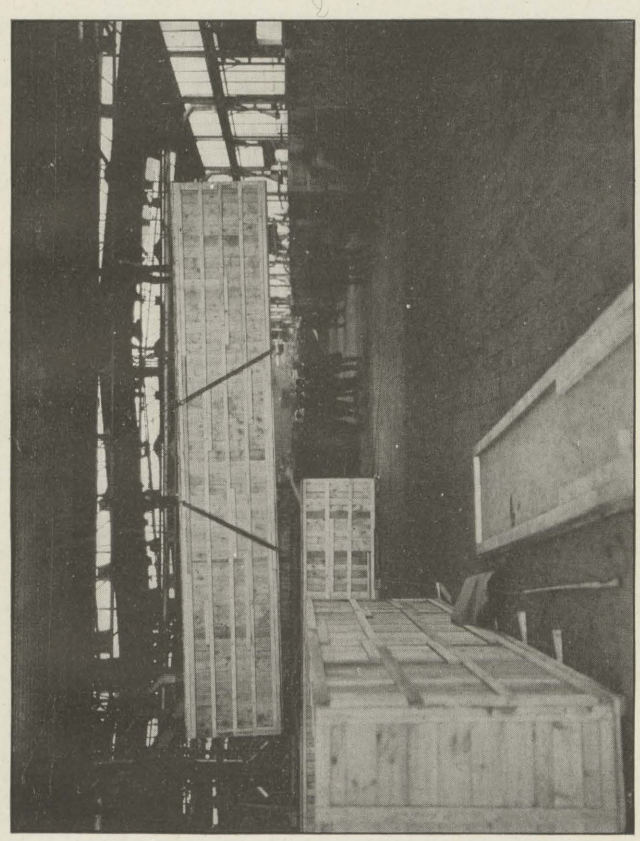


Fig. 4.—Hoisting box.

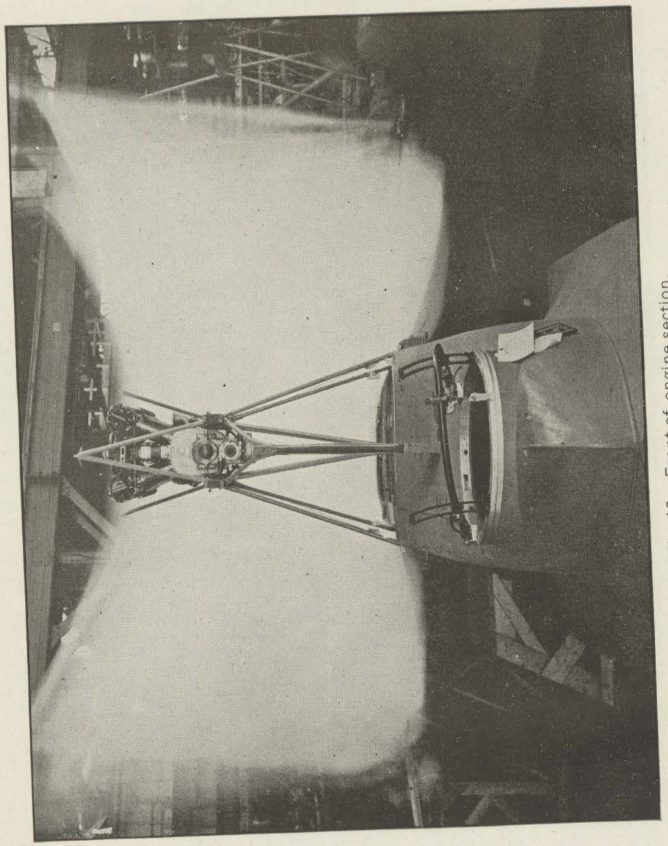


Fig. 12.—Front of engine section.

If boat is moved in order to make it level in any one direction, it should be checked to see that it is still level in the other directions. Boat can be leveled by jacking up the cradle at the corners.

3. Set engine bed in place, connecting to landing strut or bow post, and check up level fore and aft and athwartships on top of engine bed. The engine bed itself should be exactly level when the boat is level. The wire stays should be fairly taut, and can be used to make slight adjustments in the level.

4. Place engine in position by using crane or chain falls. (See fig. 12.) Engine can be skidded into position on long beams although this is difficult and should not be attempted unless necessary.

5. Connect up piping and wiring to engine.

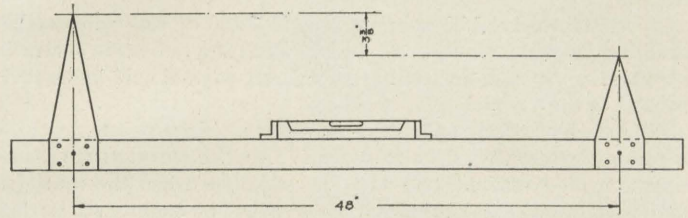


Fig. 8.—Jig for leveling up hull.

6. Place gravity tank on top of upper control panel, or engine panel, while on ground.

7. Lift upper engine panel into place and fasten on struts and wires. (See fig. 13.)

8. Attach lower intermediate panels on hinges and connect to lower end of struts and wires. Level up engine section panels and lower intermediates by using straightedge and level, along beams of lower intermediate wing sections. Lower intermediate panels should be level laterally. (See fig. 14.)

9. To check for zero stagger, drop plumb bob from leading edge of upper wing. By adjusting stagger wires the leading edge of the lower wing can be brought directly under that of the top wing.

10. All landing wires should be slightly more taut than flying wires.

11. If desired, the five and one-half degrees angle of attack of the upper wing can be checked by seeing that gap between the leading edges of upper and lower wings is seven feet seven and one-eighth inches (7 feet $7\frac{1}{8}$ inches) and gap between trailing edges is seven feet

five and twenty-nine thirty-seconds inches (7 feet $5\frac{29}{32}$ inches). When struts are in place and stagger is zero the angle of attack of upper wing should be correct.

12. Radiator can be attached at any convenient time after this.

ASSEMBLY OF TAIL SURFACES.

13. Tail surfaces can be assembled at any time while wings are being assembled. (See fig. 24.)

(*a*) Put fin and outrigger into place and check up vertically. Fin should be exactly vertical when boat is level.

(*b*) Set stabilizer in place and bolt to top of fin and end of outrigger.

(*c*) Attach steel stabilizer braces from hull and set stay wires so that stabilizer is level laterally. As this stabilizer has zero angle of attack, a center line through the leading and trailing edges should be exactly parallel to the engine bed.

(*d*) Attach vertical rudder and elevators at hinge points. Control wires on elevator should be so adjusted that the elevators are a continuation of a straight line with the stabilizer when the control is in neutral position. The control wires should be slightly slack when in neutral in order not to bind when in extreme positions. Control wires on rudder should be fairly taut, but must not cause binding on rudder pins.

ASSEMBLY OF OUTER WING PANELS.

14. Stand wings on edge parallel to each other with the leading edges on the ground. Connect wings with struts and stay wires. (Struts are numbered from 1 to 12, reading from port to starboard on front beams 1 to 6, then from port to starboard on rear beams 7 to 12.) Tighten wires to approximately flying conditions.

Attach ailerons and aileron control wires.

Attach king-posts and supporting wires and see that top beam is in line and fin perpendicular to it. Too much tension on supporting wires may pull beam out of alignment.

Care should be taken that flying wires from outer panel overhang are not too taut, as this will cause too much tension in small king-post brace wires.

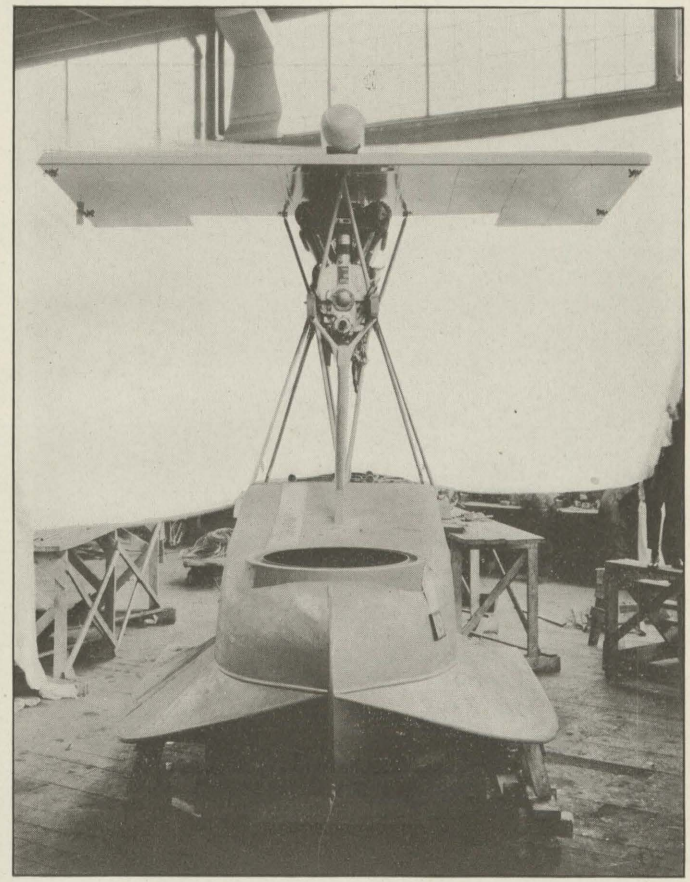


Fig. 13.—Front of engine section with upper panel.

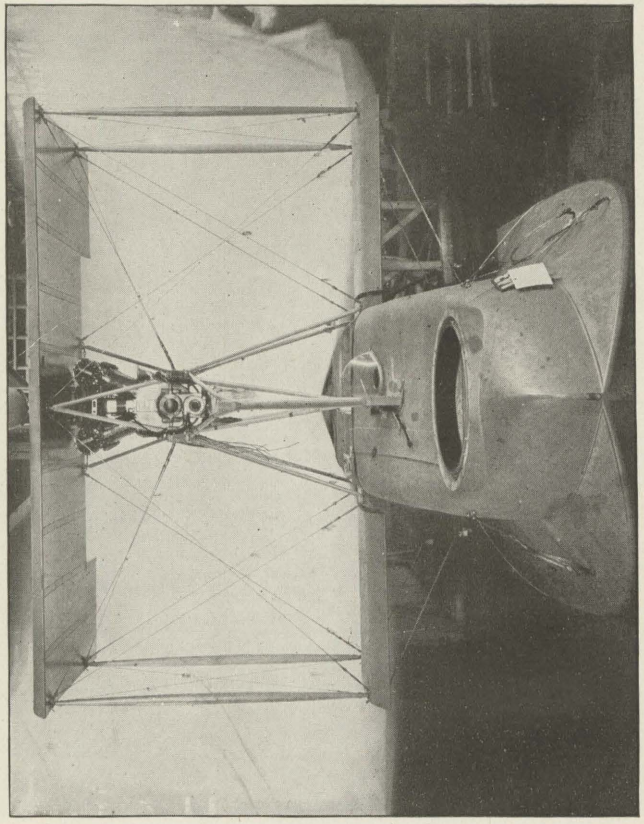


Fig. 14.—Front of engine section with upper and lower panels.

15. (*a*) Lift outer wing panels, completely assembled, into position and support them by horses (fig. 17). The blocking on the horses should be arranged so that the weight of the panels comes on the spars and not on leading or trailing edges. This is shown in figure 18, which gives two methods of carrying the panels. The upper dotted portion is for the crane system and the lower for transporting by hand. Attach hinge fittings and connect up landing wires.

Connect all wing control wires.

(*b*) Adjust interplane wires. In making this adjustment landing wires should be used to get proper alignment before adjusting flying wires. Then bring flying wires to proper tension (not as taut as landing wires). Tightening flying wires may throw wings out of alignment, so landing wires should be again checked and corrected if necessary. Checking should be made both for tension and alignment, being careful to see that flying wires are not as taut as landing wires and that too much tension is not put in landing wires, which may cause buckling of struts.

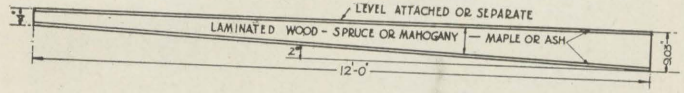


Fig. 15.—Bevel board for dihedral angle.

Flying wires from lower inside panel to hull should not be given as much tension as flying wires on outer panels.

Make adjustment of stagger wires last, having both at same tension.

(*c*) Make preliminary checking of alignment by eye to see if upper leading edge is parallel to lower leading edge. Sight along wings from center section to see that edges are straight.

(*d*) Check for zero stagger by dropping plumb bob from upper leading edge, or by using eye if plumb bob is not available.

(*e*) Check for dihedral by using a long straightedge laid parallel to wing beams with level tube set at two degrees (2°) or by making a bevel board with the required angle, using a spirit level on the top edge. This bevel board should be made in laminated sections of three pieces, spruce center, ash or maple on outside. Dimensions should be 12 feet long, about 1 inch thick, 4 inches wide on outside end, and 9.03 inches wide on inside end. This gives an upward slope of the wings laterally of two degrees when the top edge of the board is level. (See fig. 15.)

65022—18——3

As an alternate method, the adjustable level shown in figure 16 may be used.

(*f*) See that all aileron control wires leading to the three horns are given the same tension, also that all aileron brace wires are adjusted to keep ailerons from warping.

16. Attach wing tip pontoons and set wires taut with nose of pontoon 15½ inches ahead of forward strut socket.

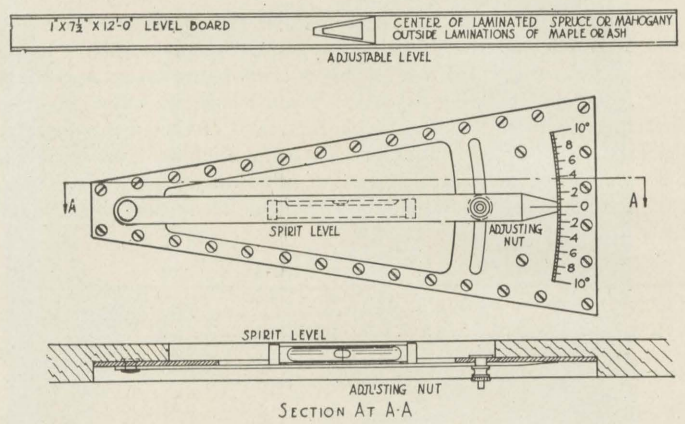


FIG. 16.—Adjustable level for dihedral angle.

17. Attach bomb-dropping devices, being careful not to set U-bolts up harder than necessary to secure them.

18. Check length of nose wires from each side of nose to upper and lower wing panels to see that corresponding wires on each side are equal in length and of the same tension. This squares the wings with the axis of the hull. (See fig. 27.)

Do same with outrigger wires from vertical stabilizer post to outer wing panels. These can be used to take slight twists out of tail if necessary.

19. Make a general inspection of all wires, clevises, cotter pins, turnbuckles, tie-rods, etc., and all connections of any kind to see that they are taut and in proper place.

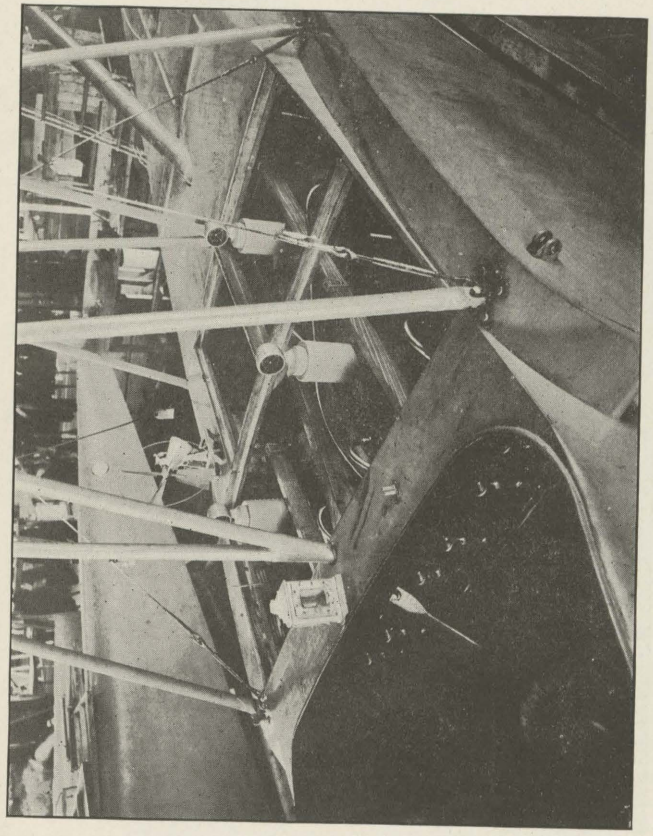


Fig. 19.—Fuel tanks.

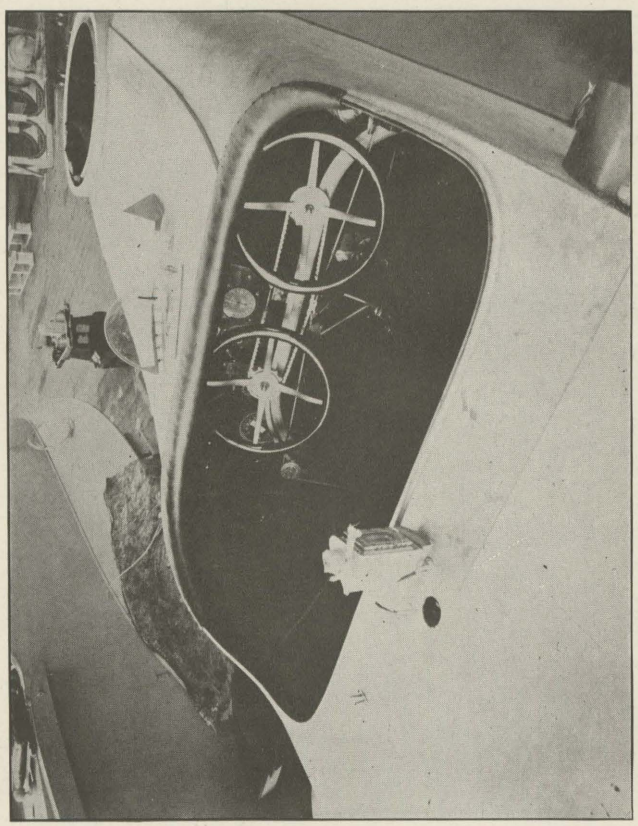


Fig. 20.—Main cockpit.

Put safety wires on all turnbuckles after final adjustment of wires. Turnbuckles after final adjustment should show not more than three threads outside of barrel and not less than $\frac{3}{4}$ inch shank outside of barrel.

20. Attach propeller, guns, and any accessories.

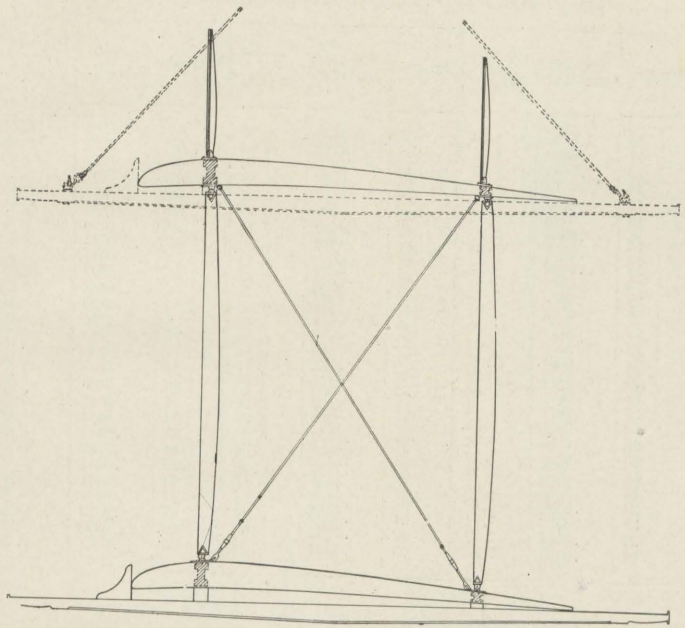


FIG. 18.—Method of carrying panels.

TABLE I.—*Specific gravity equivalents for degrees Baumé for liquids lighter than water.*

Formula: Degrees Baumé $= \frac{140}{\text{Sp. gr. } \frac{60°}{60°} \text{ F.}} = 130$

[Sp. gr. taken at 60° F. and referred to distilled water at 60° F.]

Baumé.	Specific gravity.	Pounds per gallon.	Baumé.	Specific gravity.	Pounds per gallon.	Baumé.	Specific gravity.	Pounds per gallon.
10	1.0000	8.33	37	0.8383	6.98	64	0.7217	6.01
11	.9929	8.27	38	.8333	6.94	65	.7179	5.98
12	.9859	8.21	39	.8285	6.90	66	.7143	5.95
13	.9790	8.16	40	.8235	6.86	67	.7107	5.92
14	.9722	8.10	41	.8187	6.82	68	.7071	5.89
15	.9655	8.04	42	.8139	6.78	69	.7035	5.86
16	.9589	7.99	43	.8092	6.74	70	.7000	5.83
17	.9524	7.93	44	.8046	6.70	71	.6965	5.80
18	.9459	7.88	45	.8000	6.66	72	.6931	5.78
19	.9396	7.83	46	.7955	6.63	73	.6897	5.75
20	.9333	7.78	47	.7909	6.59	74	.6863	5.72
21	.9272	7.72	48	.7865	6.55	75	.6829	5.69
22	.9211	7.67	49	.7821	6.52	76	.6796	5.66
23	.9150	7.62	50	.7777	6.48	77	.6763	5.63
24	.9091	7.57	51	.7735	6.44	78	.6730	5.60
25	.9032	7.53	52	.7692	6.41	79	.6698	5.58
26	.8974	7.48	53	.7650	6.37	80	.6666	5.55
27	.8917	7.43	54	.7609	6.34	81	.6635	5.52
28	.8861	7.38	55	.7568	6.30	82	.6604	5.50
29	.8805	7.34	56	.7527	6.27	83	.6573	5.48
30	.8750	7.29	57	.7487	6.24	84	.6542	5.45
31	.8696	7.24	58	.7447	6.20	85	.6511	5.42
32	.8642	7.20	59	.7407	6.17	86	.6481	5.40
33	.8589	7.15	60	.7368	6.14	87	.6451	5.38
34	.8537	7.11	61	.7329	6.11	88	.6422	5.36
35	.8485	7.07	62	.7292	6.07	89	.6392	5.33
36	.8433	7.03	63	.7254	6.04	90	.6363	5.30

TABLE II.—*Metric conversion table.*

[English to metric.]

English units.	Hundredths of an inch to milimeters.	Feet to meters.	Miles to kilometers.	Gallons to liters.	Pounds to kilograms.
1	0.254	0.30480	1.6093	3.7853	0.45359
2	.508	.60960	3.2187	7.5707	.90718
3	.762	.91440	4.8280	11.3560	1.36078
4	1.016	1.21920	6.4373	15.1413	1.81437
5	1.270	1.52400	8.0467	18.9267	2.26796
6	1.524	1.82880	9.6561	22.7120	2.72155
7	1.778	2.13360	11.2654	26.4973	3.17515
8	2.032	2.43840	12.8748	30.2827	3.62874
9	2.286	2.74321	14.4841	34.0680	4.08233
10	2.540	3.04801	16.0935	37.8533	4.53592
11	2.794	3.35281	17.7028	41.6387	4.98552
12	3.048	3.65761	19.3122	45.4240	5.44311
13	3.302	3.96241	20.9215	49.2093	5.89670
14	3.556	4.26721	22.5309	52.9947	6.35029
15	3.810	4.57201	24.1402	56.7800	6.80389
16	4.064	4.87681	25.7496	60.5653	7.25748
17	4.318	5.18161	27.3589	64.3506	7.71107
18	4.572	5.48641	28.9682	68.1360	8.16466
19	4.826	5.79121	30 5776	71.9213	8 61826
20	5.080	6.09601	32.1869	75.7066	9.07185
21	5.334	6.40081	33.7963	79.4920	9.52544
22	5.588	6.70561	35.4056	83.2773	9.97903
23	5.842	7.01041	37.0150	87.0626	10.43263
24	6.096	7.31521	38.6243	90.8480	10.88622
25	6.350	7.62002	40.2337	94.6333	11.33981
26	6.604	7.92482	41.8430	98.4186	11.79340
27	6.858	8.22962	43.4524	102.2040	12.24700
28	7.112	8.53442	45.0617	105.9893	12.70059
29	7.366	8.83922	46.6711	109.7746	13.15418
30	7.620	9.14402	48.2804	113.5600	13.60777
31	7.874	9.44882	49.8898	117.3453	14.06137
32	8.128	9.75362	51.4991	121.1306	14.51496
33	8.382	10.05842	53.1085	124.9160	14.96855
34	8.636	10.36322	54.7178	128.7013	15.42214
35	8.890	10.66802	56.3272	132.4866	15.87573
36	9.144	10.97282	57.9365	136.2720	16.32933
37	9.398	11.27762	59.5458	140.0573	16.78292
38	9 652	11.58242	61.1552	143.8426	17.23651
39	9.906	11.88722	62.7645	147.6280	17.69010
40	10.160	12.19202	64.3739	151.4133	18.14370
41	10.414	12.49682	65.9832	155.1986	18.59729
42	10.668	12.80163	67.5926	158.9840	19.05088
43	10.922	13.10643	69.2019	162.7693	19.50447
44	11.176	13.41123	70.8113	166.5546	19.95807
45	11.430	13.71603	72.4206	170.3400	20.41166
46	11.684	14.02083	74.0300	174.1253	20.86525
47	11.938	14.32563	75.6393	177.9106	21.31880
48	12.192	14.63043	77.2487	181.6960	21.77244
49	12.446	14.93523	78.8580	185.4813	22.22603
50	12.700	15.24003	80.4674	189.2666	22.67962
100	25.400	30.48006	160.9347	378.5330	45.35924

TABLE III.—*Metric conversion table.*

[Metric to English.]

Metric units.	Millimeters to inches.	Meters to feet.	Kilometers to miles.	Liters to gallons.	Kilograms to pounds.
1	0.03937	3.28083	0.62137	0.26418	2.2046
2	.07874	6.56167	1.24274	.52836	4.4092
3	.11811	9.84250	1.86411	.79253	6.6139
4	.15748	13.12333	2.48548	1.05671	8.8185
5	.19685	16.40417	3.10685	1.32089	11.0231
6	.23622	19.68500	3.72822	1.58507	13.2277
7	.27559	22.96583	4.34959	1.84924	15.4324
8	.31496	26.24667	4.97096	2.11342	17.6370
9	.35433	29.52750	5.59233	2.37760	19.8416
10	.39370	32.80833	6.21370	2.64178	22.0462
11	.43307	36.08917	6.83507	2.90595	24.2508
12	.47244	39.37000	7.45644	3.17013	26.4555
13	.51181	42.65083	8.07781	3.43431	28.6601
14	.55118	45.93167	8.69918	3.69849	30.8647
15	.59055	49.21250	9.32055	3.96266	33.0693
16	.62992	52.49333	9.94192	4.22684	35.2740
17	.66929	55.77417	10.56329	4.49102	37.4786
18	.70866	59.05500	11.18466	4.75520	39.6832
19	.74803	62.33583	11.80603	5.01937	41.8878
20	.78740	65.61667	12.42740	5.28355	44.0924
21	.82677	68.89750	13.04877	5.54773	46.2971
22	.86614	72.17833	13.67014	5.81191	48.5017
23	.90551	75.45917	14.29151	6.07608	50.7063
24	.94488	78.74000	14.91288	6.34026	52.9109
25	.98425	82.02083	15.53425	6.60444	55.1156
26	1.02362	85.30167	16.15562	6.86862	57.3202
27	1.06299	88.58250	16.77699	7.13280	59.5248
28	1.10236	91.86333	17.39836	7.39697	61.7294
29	1.14173	95.14417	18.01973	7.66115	63.9340
30	1.18110	98.42500	18.64110	7.92533	66.1387
31	1.22047	101.70583	19.26247	8.18951	68.3433
32	1.25984	104.98667	19.88384	8.45368	70.5479
33	1.29921	108.26750	20.50521	8.71786	72.7525
34	1.33858	111.54833	21.12658	8.98204	74.9572
35	1.37795	114.82917	21.74795	9.24622	77.1618
36	1.41732	118.11000	22.36932	9.51039	79.3664
37	1.45669	121.39083	22.99069	9.77457	81.5710
38	1.49606	124.67167	23.61206	10.03875	83.7756
39	1.53543	127.95250	24.23343	10.30293	85.9803
40	1.57480	131.23330	24.85480	10.56710	88.1849
41	1.61417	134.51417	25.47617	10.83128	90.3895
42	1.65354	137.79500	26.09754	11.09546	92.5941
43	1.69291	141.07583	26.71891	11.35694	94.7988
44	1.73228	144.35667	27.34028	11.62381	97.0034
45	1.77165	147.63750	27.96165	11.88799	99.2080
46	1.81102	150.91833	28.58302	12.15217	101.4126
47	1.85039	154.19917	29.20439	12.41635	103.6173
48	1.88976	157.48000	29.82576	12.68052	105.8219
49	1.92913	160.76083	30.44713	12.94470	108.0265
50	1.96850	164.04167	31.06850	13.20888	110.2311
100	3.93700	328.08334	62.13700	26.41776	220.4622

TABLE IV.—*Variation of wind velocity with altitude during the day.*

Elevation.	Velocities in miles per hour.				
Surface	5	10	15	20	25
500 feet	7	15	21	28	35
1,000 feet	8	18	26	34	43
2,000 feet	8	18	28	37	47
3,000 feet	8	18	29	40	49
4,000 feet	10	19	29	40	50
5,000 feet	13	20	29	40	50

TABLE V.—*Variation of direction of wind and altitude.*

[Upper region winds vary in direction from those near the earth's surface. The amount of deviation is given approximately in the tabulation.]

Elevation.	Deviation to right in degrees.	Directions.			
Surface	0	N	E	S	W.
500 feet	5	N. ½ E	E. ½ S	S. ½ W	W. ½ N.
1,000 feet	10	N. by E	E. by S	S. by W	W. by N.
2,000 feet	16	N. by E. ½ E	E. by S. ½ S	S. by W. ½ W.	W. by N. ½ N.
3,000 feet	19	N. by E. ¾ E	E. by S. ¾ S	S. by W. ¾ W.	W. by N. ¾ N.
4,000 feet	20	NNE	ESE	SSW	WNW.
5,000 feet	21	NNE	ESE	SSW	WNW.

TABLE VI.—*Compass points and their equivalents.*

° ′	Points.	° ′	Points.	° ′	Points.	° ′	Points.
0 00	N	90 00	E	180 00	S	270 00	W
2 49	N ¼ E	92 49	E ¼ S	182 49	S ¼ W	272 49	W ¼ N
5 38	N ½ E	95 38	E ½ S	185 38	S ½ W	275 38	W ½ N
8 26	N ¾ E	98 26	E ¾ S	188 26	S ¾ W	278 26	W ¾ N
11 15	N by E	101 15	E by S	191 15	S by W	281 15	W by N
14 04	N by E ¼ E	104 04	ESE ¾ E	194 04	S by W ¼ W	284 04	WNW ¾ W
16 53	N by E ½ E	106 53	ESE ½ E	196 53	S by W ½ W	286 53	WNW ½ W
19 41	N by E ¾ E	109 41	ESE ¼ E	199 41	S by W ¾ W	289 41	WNW ¼ W
22 30	NNE	112 30	ESE	202 30	SSW	292 30	WNW
25 19	NNE ¼ E	115 19	SE by E ¾ E	205 19	SSW ¼ W	295 19	NW by W ¾ W
28 08	NNE ½ E	118 08	SE by E ½ E	208 08	SSW ½ W	298 08	NW by W ½ W
30 56	NNE ¾ E	120 56	SE by E ¼ E	210 56	SSW ¾ W	300 56	NW by W ¼ W
33 45	NE by N	123 45	SE by E	213 45	SW by S	303 45	NW by W
36 34	NE ¾ N	126 34	SE ¾ E	216 34	SW ¾ S	306 34	NW ¾ W
39 23	NE ½ N	129 23	SE ½ E	219 23	SW ½ S	309 23	NW ½ W
42 11	NE ¼ N	132 11	SE ¼ E	222 11	SW ¼ S	312 11	NW ¼ W
45 00	NE	135 00	SE	225 00	SW	315 00	NW
47 49	NE ¼ E	137 49	SE ¼ S	227 49	SW ¼ W	317 49	NW ¼ N
50 38	NE ½ E	140 38	SE ½ S	230 38	SW ½ W	320 38	NW ½ N
53 26	NE ¾ E	143 26	SE ¾ S	233 26	SW ¾ W	323 26	NW ¾ N
56 15	NE by E	146 15	SE by S	236 15	SW by W	326 15	NW by N
59 04	NE by E ¼ E	149 04	SSE ¾ E	239 04	SW by W ¼ W	329 04	NNW ¾ W
61 53	NE by E ½ E	151 53	SSE ½ E	241 53	SW by W ½ W	331 53	NNW ½ W
64 41	NE by E ¾ E	154 41	SSE ¼ E	244 41	SW by W ¾ W	334 41	NNW ¼ W
67 30	ENE	157 30	SSE	247 30	WSW	337 30	NNW
70 19	ENE ¼ E	160 19	S by E ¾ E	250 19	WSW ¼ W	340 19	N by W ¾ W
73 08	ENE ½ E	163 08	S by E ½ E	253 08	WSW ½ W	343 08	N by W ½ W
75 56	ENE ¾ E	165 56	S by E ¼ E	255 56	WSW ¾ W	345 56	N by W ¼ W
78 45	E by N	168 45	S by E	258 45	W by S	348 45	N by W
81 34	E ¾ N	171 34	S ¾ E	261 34	W ¾ S	351 34	N ¾ W
84 23	E ½ N	174 23	S ½ E	264 23	W ½ S	354 23	N ½ W
87 11	E ¼ N	177 11	S ¼ E	267 11	W ¼ S	357 11	N ¼ W

TABLE VII.—*Equivalent value in degrees of each fractional division of the compass to the nearest minute of arc.*

	°	′
⅛ point equals	1	24
¼ point equals	2	49
⅜ point equals	4	13
½ point equals	5	38
⅝ point equals	7	02
¾ point equals	8	26
⅞ point equals	9	51

DATE SHIPPED

PACKING SHEET

CURTISS AEROPLANE AND MOTOR CORPORATION

SALES ORDER NO.

CONTRACT NO.

FORM NO. 257-A SUM 8-15-18

Boat Hull BOX

MACHINE NUMBER: GUNS / CUSTOMER'S

P.O. Govt. R.L.

VIA

CAR NO. AND INITIAL

BOX NO.

DIMENSIONS OF BOX:

VOLUME

WEIGHTS: NET / BOX / GROSS 7885#

SHIP TO

SPECIAL MARKS

THIS SHIPMENT CONSISTS OF CASES AND

PACKED	CHECKED	INSPECTED	CHECKED	PART NO.	QUANTITY	NAME OF PART
				HS-1L	1	Boat Hull complete equipped with dual dep. side by side
					1	Towing cable
					2	Right, and
					2	Left drift wires complete with turnbuckles, shackles & pins with cotters
					1	Gunner's cockpit equipped with hatch cover and 8 bolts with nuts and lock washers
					1	Scarf gun mount with single gun flexible gun mount
					1	Aneroid
					1	Right, and
					1	Left aileron control cables
					1	Pilot's cockpit hatch door for gas tanks
					2	Seats with back & bottom cushions in pilot's cockpit
					2	Safety belts
					2	Rudder foot bars complete with: 1 right and 1 left control
					2	Upper left, and
					2	" right elevator control wires with turnbuckles & shackles with bolt, nut and cotter
					2	Lower right, and
					2	" left elevator control wires with turnbuckles & shackles with bolt, nut and cotter
					1	Wind shield
						Instruments in pilot's cockpit:
					1	Tachometer
					1	Interior communication set between cockpits
					1	Liberty switch
					1	Oil gauge
					1	Air speed meter
					1	Aneroid
					1	Compass, with: 3 Electric bulbs 4 Compass magnetic sticks 1 " mirror
					1	Clock
					1	Inclinometer, transverse and longitudinal
					1	Storage battery
					1	Water thermometer
					1	Light with bracket and switch
					1	Dry Cell Battery
					1	Hand pump
					1	Pyrene
					1	Spark control lever with control wires.

PACKED BY

CHECKED BY

INSPECTED BY

CUSTOMER'S INSPECTOR

FIG. 28.—Boat hull box packing sheet (1).

DATE SHIPPED

SHEET NO. 2

PACKING SHEET

CURTISS AEROPLANE AND MOTOR CORPORATION

SALES ORDER NO.

CONTRACT NO.

FORM NO. 257-F 30M 2-18

WITH Boat Hull BOX

MACHINE NUMBER: GUNS / CUSTOMER'S | F. O. B. Govt. B.L. | VIA | CAR NO. AND INITIAL | BOX NO.

PACKERS CHECK	INSPECTORS CHECK	TYPE CHECK	PART NO.	QUANTITY	NAME OF PART
			HS-1L	1	Gas control lever with control wires
				1	Sight feed oil gauge
				3	Gas tanks and gauges
				1	Windmill pump including fan & driving mechanism
				1	Bilge pump
				4	Lengths of copper tubing for gas line
				2	Hand hole covers in place
				2	Bolts with nuts & lock washers for "V" brace below deck cover
				1	Gasoline shut off lever
					- -
				1	Right upper, and
				1	Left " ailerons, each complete with:
					6 Sets of brace wires, each complete with 3 turnbuckles, 1 shackle with pins & cotters
				6	Hinges complete with hinge pins & cotters
				2	Aileron connecting rod sockets with bolts, nuts & lock washers
				1	Right lower, and
				1	Left " ailerons, each complete with:
					2 Aileron connecting rod sockets
				4	Hinges complete with hinge pins & cotters
				2	Brace sockets on sides aft, each complete with:
					1 Bolt, nut & lock washer
					1 Cable with turnbuckle & shackle
					2 Pins & cotters
					1 Cable with turnbuckle, pin, cotter, eyebolt, nut & lock washer
				4	Bolts, nuts & lock washers for attaching vertical stabilizer on top of hull
				1	Tail skid cleat on bottom of hull
				1	Outrigger brace wires with turnbuckle complete with pins & cotters
				4	Hinges
				4	Brace sockets, each with:
					1 Bolt, nut & lock washer
					3 Pins & cotters
					4 Bolts, nuts & cotters
					1 Plate
				4	Terminals, each with:
					2 Bolts, nuts & cotters
					- -
					Assembly parts:
				1	Outrigger with:
					2 Cables & turnbuckles complete with pins & cotters
					6 Bolts, nuts & lock washers

PACKED BY | CHECKED BY | INSPECTED BY

CUSTOMER'S INSPECTOR

FIG. 29.—Boat hull box packing sheet (2).

DATE SHIPPED

SHEET NO. 3

PACKING SHEET

CURTISS AEROPLANE AND MOTOR CORPORATION

SALES ORDER NO.

CONTRACT NO.

FORM NO. 257-F 30M 2-18

WITH Boat Hull BOX

MACHINE NUMBER: GUNS / CUSTOMER'S | F. O. B. Govt. B.L. | VIA | CAR NO. AND INITIAL | BOX NO.

PACKERS CHECK	INSPECTORS CHECK	TYPE CHECK	PART NO.	QUANTITY	NAME OF PART
			HS-1L	2	"V" engine bed braces, each complete with:
					2 Brace wires complete with turnbuckles on one end & shackle on the other with pins & cotters
					3 Section gas line tubings
				4	Vertical engine bed braces
				3	Metal engine section struts
				2	Engine beds, each with:
					14 Bolts, nuts & lock washers
					1 Plate
					5 Washers
					2 Terminals
					2 Brass wood screws on left bed
				1	Right, and
				1	Left oil tanks complete with brackets, &
					4 Bolts, nuts & cotters
				1	Gravity gas tank with:
					3 Straps
				1	Radiator complete with connections
				2	Wing pontoons, with:
					4 Braces
					4 Brace wires on each
				4	Aileron connecting rods
				6	Pairs of aileron operating braces with:
					24 Bolts & lock washers & nuts
				1	Pair of rudder operating braces, with:
					4 Bolts, nuts & lock washers
				2	Pairs of elevator operating braces, with:
					4 Bolts, nuts & cotters in each
				2	Front, and
				2	Rear horizontal stabilizer braces
				8	Wing struts
				3	Intermediate wing struts
				1	" " " #3 with venturie nozzle & tubing
					- -
				1	Tail skid
				1	Engine nose plate
				1	Bow post with tachometer shaft & distributing wires &
					3 Bolts, nuts & lock washers
				1	Length of $\frac{1}{4}$" copper tubing
				1	Set of general arrangement plans
				1	Bomb dropping device complete with:
					2 Cradles
					2 Wires
					2 Control eye
				1	Coil of copper safety wire

PACKED BY | CHECKED BY | INSPECTED BY

CUSTOMER'S INSPECTOR

FIG. 30.—Boat hull box packing sheet (3).

4

SHEET NO.

DATE SHIPPED — PACKING SHEET — SALES ORDER NO.

CURTISS AEROPLANE AND MOTOR CORPORATION — CONTRACT NO.

WITH BOX — MACHINE NUMBER OURS / CUSTOMER'S — Govt. B.L. — VIA — CAR NO. AND INITIAL — BOX NO.

PACKER'S CHECK	1ST CHECK	2ND CHECK	PART NO.	QUANTITY	NAME OF PART
			Small	1	~~Box of motor fittings~~
				1	16 Ga. 3/8" x 19" tube with bell crank
				1	" " 1/2" x 8" " " " "
				1	Lever for distributing
				1	Yoke with pin & cotter pin
				1	Rod distributing control with yoke & pin key
				3	#0 split taper pins
				1	Wood priming block, with:
					4 Brass screws
					- -
					Gasoline system assembly containing the following:
				2	Carburetor bushings
				2	3/8" gas lines complete
				1	Carburetor coupling
				1	Filter complete with:
					1 Nipple
					1 Tee
					1 Stop cock
					1 Brass bushing
					1 Hose connection
					2 3/8" elbows
					1 #40 wire gauge strainer
					- -
				1	Liberty adapter
				1	1/8" primer tube and 2 brackets
				1	Gravity tank gas pipe bracket
					- -
				1	Upper and lower 2" water pipe
					4 2" x 3½" hose connections
					16 Wire clamps
					- -
				1	Oil system containing the following:
					6 3/8" x 6¼" bolts with 2 washers, nuts & lock washer
					3 Oil pipes
					2 " pump elbows
					2 " " nuts
					7 3/4" x 3½" hose connections
					28 Wire hose clamps
					1 Right overflow pipe
					1 Left " "
					4 Oil overflow pipe bushings
				1	Oil pressure gauge line
					- -
				1	Gasoline shut off assembly with:
					1 Bronze pulley
					1 Rod & bracket
					1 Universal coupling & split pin
					1 Double pulley
					2 Bowden wire guides
					1 Control cable with 2 turnbuckles
				2	5/8" Radiator bolts, with:
					2 washers, lock washers & felt pads
				1	Starting crank bracket

PACKED BY — CHECKED BY — INSPECTED BY — CUSTOMER'S INSPECTOR

FIG. 31.—Boat hull box packing sheet (4).

DATE SHIPPED — PACKING SHEET — SALES ORDER NO.

CURTISS AEROPLANE AND MOTOR CORPORATION — CONTRACT NO.

Panel BOX — MACHINE NUMBER OURS / CUSTOMER'S — Govt. B.L. — VIA — CAR NO. AND INITIAL — BOX NO.

DIMENSIONS OF BOX: VOLUME — WEIGHTS: NET, BOX, GROSS 2850# — SHIP TO — SPECIAL MARKS

THIS SHIPMENT CONSISTS OF ____ CASES AND

PACKER'S CHECK	1ST CHECK	2ND CHECK	PART NO.	QUANTITY	NAME OF PART
			HS-1L	1	Right upper, and
				1	Left " panels including insignia on upper side of each
				2	20 Cables & turnbuckles complete with pins & cotters
					4 Post sockets with bolts, nuts & cotters
					3 "U" bolts
					3 Pulleys on upper side of each panel
					4 Aileron cables with 3 turnbuckles with pins & cotters complete on upper side
					2 Aileron guides
					1 Nose wire terminal on lower side
					4 Pulleys on lower side
					4 Aileron cables with 3 turnbuckles with pins & cotters complete on lower side
					2 Non-skid sockets with bolts & lock washers
					2 Hinges with split pins & cotters
					2 Nose wire terminals on upper side
					- -
				1	Right lower, and
				1	Left " panels, including insignia on lower side of each:
					4 Post sockets with bolts, nuts & cotters
					1 Eyebolt on lower side
					4 Pontoon wires with turnbuckles complete
					2 Hinges with split pins & cotters
					- -
				1	Right intermediate, and
				1	Left " panels, each with:
					2 Post sockets complete with bolts, nuts & cotters
					2 Wing hinge pins with taper split pins & cotters in hinges
					4 Cables & turnbuckles complete with pins & cotters
					- -
				2	Non-skids, each with:
					4 Brace wires with turnbuckles, pins, cotters & cables
					- -
				1	Engine section panel with:
					25 Cables & turnbuckles complete with pins & cotters
					7 Post sockets
					6 Clamp fittings

PACKED BY — CHECKED BY — INSPECTED BY — CUSTOMER'S INSPECTOR

FIG. 32.—Panel box packing sheet (1).

DATE SHIPPED

SHEET NO. 6

PACKING SHEET

CURTISS AEROPLANE AND MOTOR CORPORATION

SALES ORDER NO.

CONTRACT NO.

WITH BOX | MACHINE NUMBER: OURS, CUSTOMER'S | F. O. B. | VIA | CAR NO. AND INITIAL | BOX NO.

PACKERS CHECK	INSPECTORS CHECK	GOVT. INSPECTORS CHECK	PART NO.	QUANTITY	Govt. B.L. NAME OF PART
			HS-1L		1 Aileron connecting wires with 4 guides 1 Tank streamline 1 Felt pad
				1	Horizontal stabilizer complete with: 4 Brace sockets 3 Bolts, nuts & lock washers 2 Lugs for rudder brace cables 1 Brace lug
				1	Rudder complete with number & insignia, and 2 Sets of brace wires complete with 2 turnbuckles & 1 shackle with pins and cotters 4 Hinges complete with hinge pins 2 Guy wires for rudder with turnbuckles, shackles & pins with cotters
				1	Pair of elevators each complete with: 2 Sets of brace wires with turnbuckles, pins & cotters complete 3 Strap hinges on each with "U" bolts, nuts & cotters
				1	Vertical stabilizer complete with: 2 Plates 17 Bolts, nuts & lock washers 3 Stern post plates 1 Post socket 1 Forward clip, bolt, nut & lock washer 3 Hinges, bolts & lock washers
				24	Strips of streamline
				1	Roll of tape

PACKED BY | CHECKED BY | INSPECTED BY | CUSTOMER'S INSPECTOR

FIG. 33.—Panel box packing sheet (2).

DATE SHIPPED

PACKING SHEET

CURTISS AEROPLANE AND MOTOR CORPORATION

SALES ORDER NO.

CONTRACT NO.

Motor BOX | MACHINE NUMBER: OURS, CUSTOMER'S | Govt. B.L. | VIA | CAR NO. AND INITIAL | BOX NO.

DIMENSIONS OF BOX: VOLUME | WEIGHTS: Net, Box, Gross | SHIP TO | SPECIAL MARKS 3392

THIS SHIPMENT CONSISTS OF CASES AND

PACKERS CHECK	INSPECTORS CHECK	GOVT. INSPECTORS CHECK	PART NO.	QUANTITY	NAME OF PART
			HS-1L	1	Liberty Motor No. S.E.No.
				1	Primer with tubing
				1	Hand starter with handle
				1	Spark plug wrench
				2	Test sheet
				12	Exhaust pipe manifold gaskets
				1	Hub No.

PACKED BY | CHECKED BY | INSPECTED BY | CUSTOMER'S INSPECTOR

FIG. 34.—Motor box packing sheet.

DATE SHIPPED

PACKING SHEET

CURTISS AEROPLANE AND MOTOR CORPORATION

SALES ORDER NO.

CONTRACT NO.

FORM NO. 287-A 10M 3-6-18

Propeller BOX | MACHINE NUMBER OURS | CUSTOMER'S | Govt. B.L. VIA | CAR NO. AND INITIAL | BOX NO.

DIMENSIONS OF BOX; VOLUME | WEIGHTS Net Box Gross | SHIP TO | SPECIAL MARKS

THIS SHIPMENT CONSISTS OF CASES AND

PACKERS CHECK	SHIPPERS CHECK	PART NO.	QUANTITY	NAME OF PART
		HS-1L	1	Propeller No. complete, drilled, ready for hub.

PACKED BY | CHECKED BY | INSPECTED BY

CUSTOMER'S INSPECTOR

FIG. 35.—Propeller box packing sheet.

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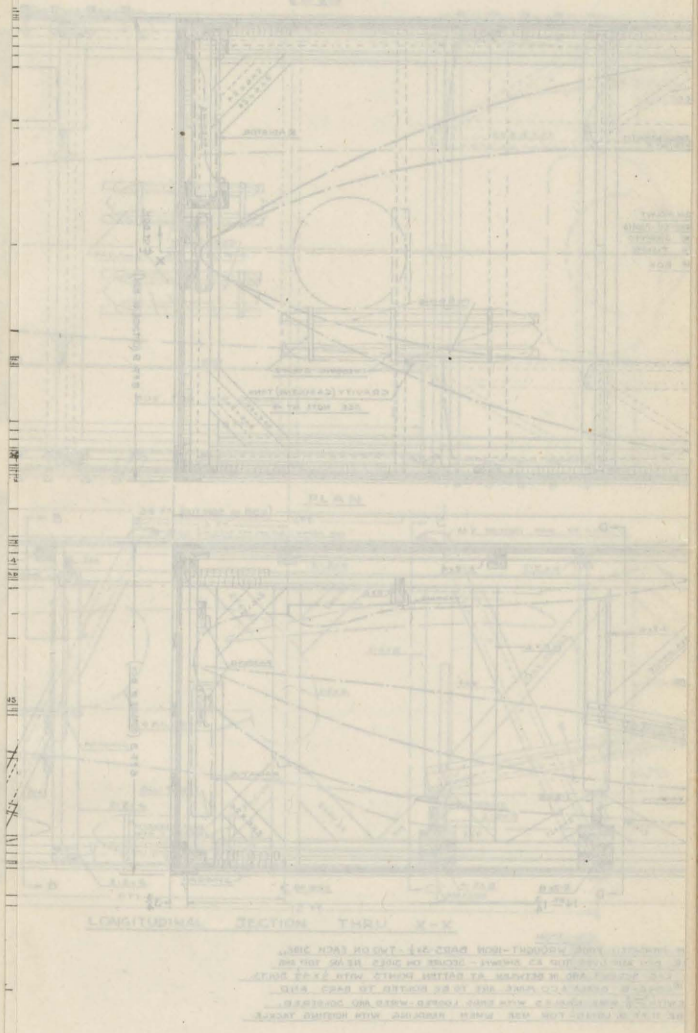
MEMORANDA.

Fig. 9.—HULL BOX: PLAN AND LONGITUDINAL SECTION.



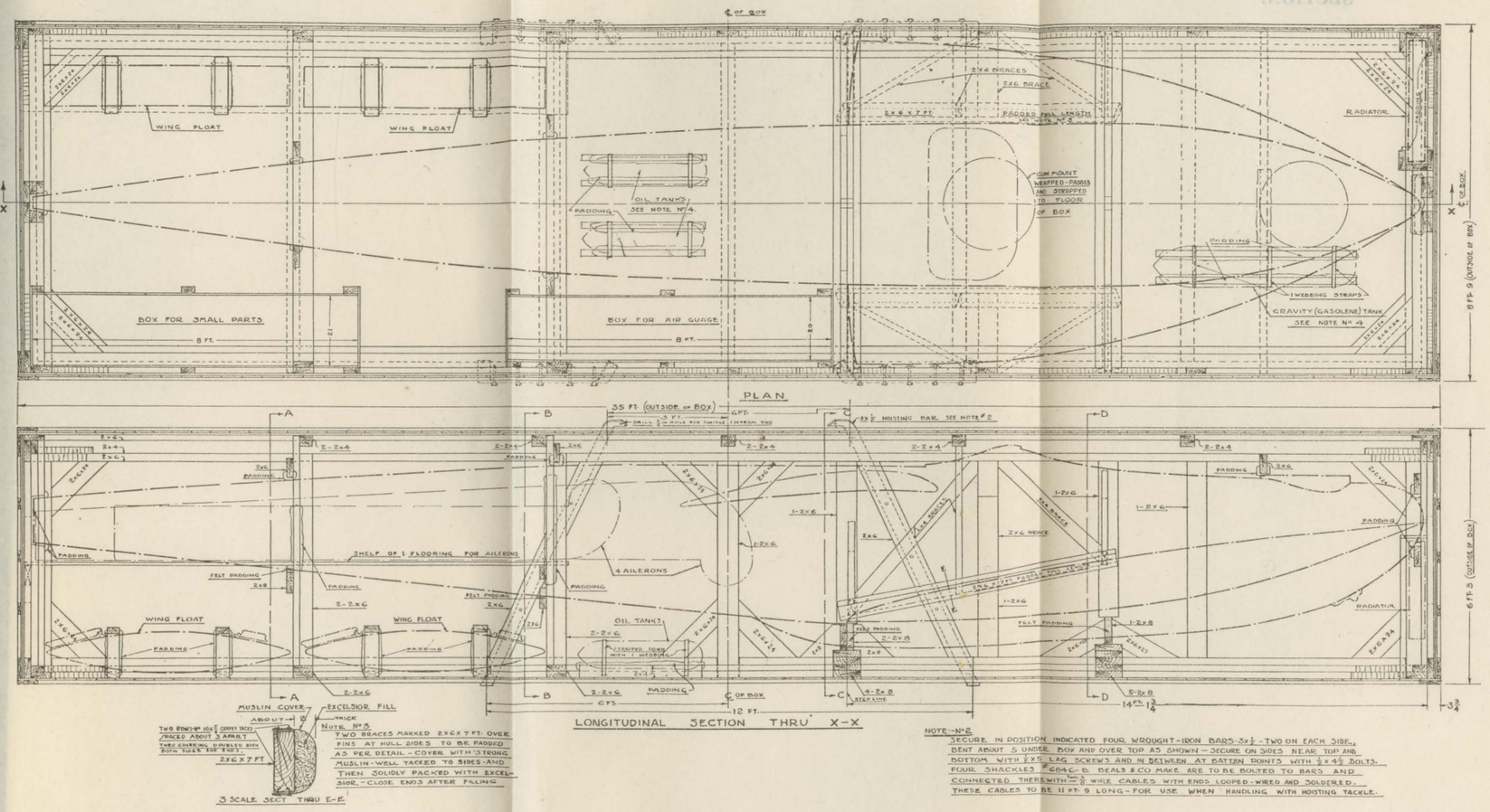
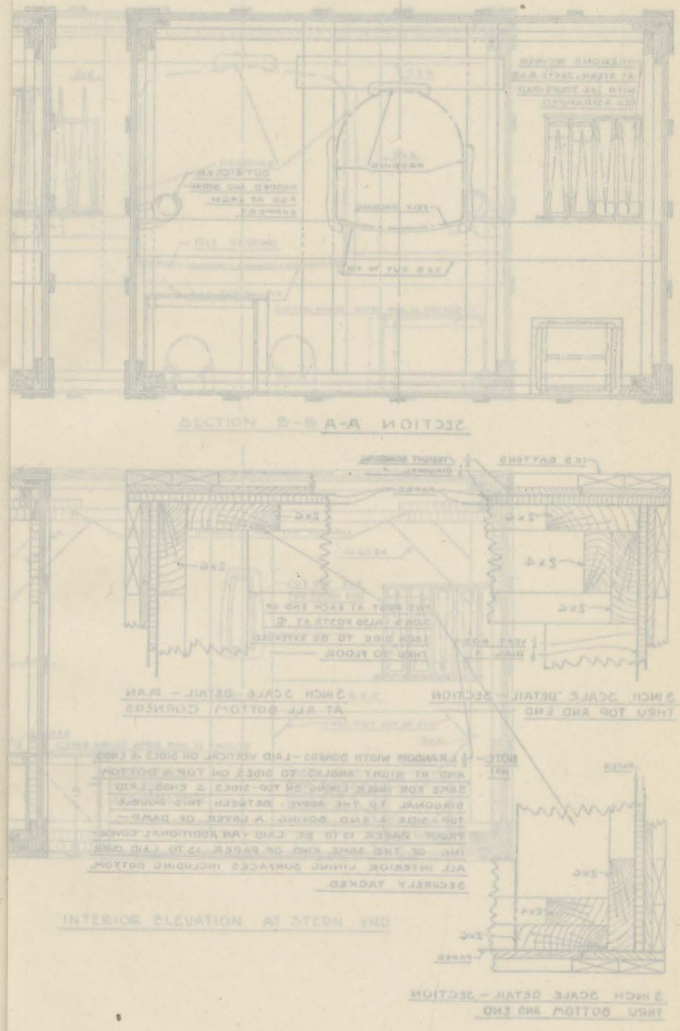
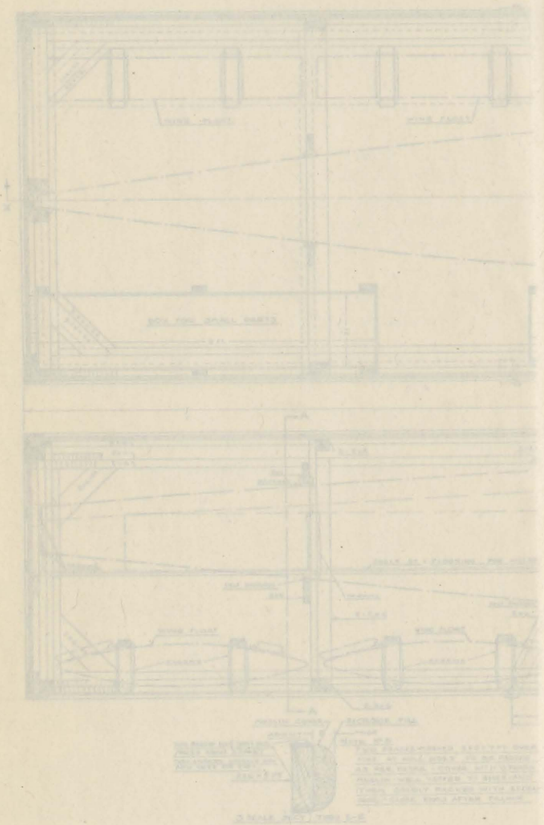
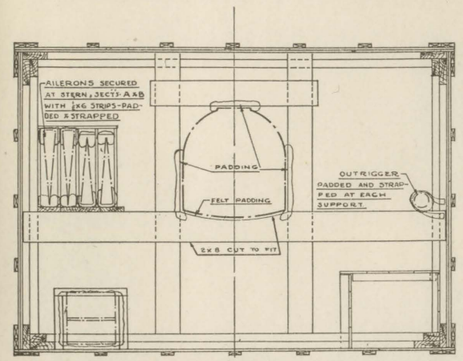


FIG. 9.—Hull box: Plan and longitudinal section.

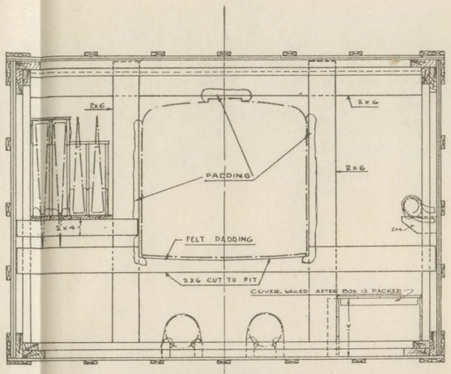
Fig. 10.—HULL BOX: TRANSVERSE SECTIONS.



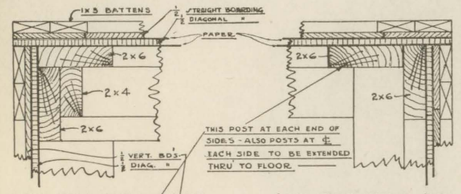




SECTION A-A

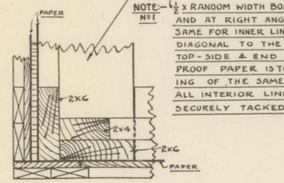


SECTION B-B



3 INCH SCALE DETAIL — SECTION THRU TOP AND END

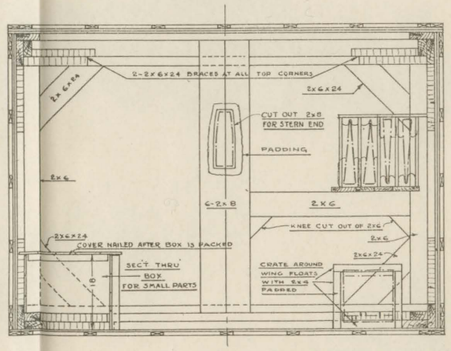
3 INCH SCALE DETAIL — PLAN AT ALL BOTTOM CORNERS



3 INCH SCALE DETAIL — SECTION THRU BOTTOM AND END

NOTE — NO 1

½ X RANDOM WIDTH BOARDS — LAID VERTICAL ON SIDES & ENDS AND AT RIGHT ANGLES TO SIDES ON TOP & BOTTOM. SAME FOR INNER LINING ON TOP-SIDES & ENDS, LAID DIAGONAL TO THE ABOVE. BETWEEN THIS DOUBLE TOP-SIDE & END BOXING A LAYER OF DAMP-PROOF PAPER IS TO BE LAID — AN ADDITIONAL COVERING OF THE SAME KIND OF PAPER IS TO LAID OVER ALL INTERIOR LINING SURFACES INCLUDING BOTTOM, SECURELY TACKED.

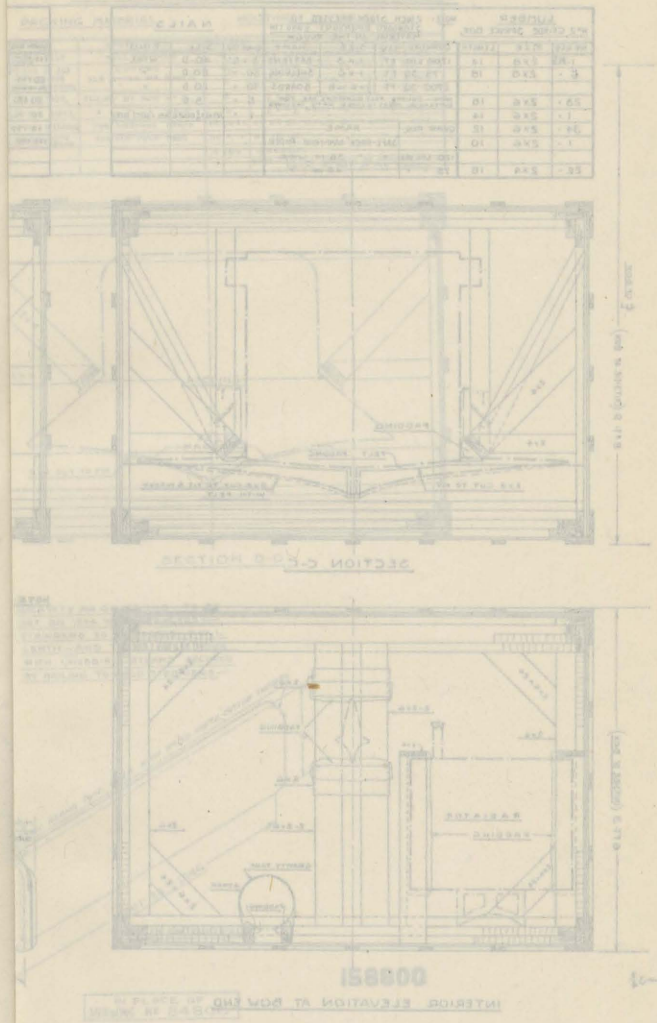


INTERIOR ELEVATION AT STERN END

65022—18

FIG. 10.—Hull box: Transverse sections.

Fig. 11.—HULL BOX: TRANSVERSE SECTIONS.



BILL OF MATERIAL

LUMBER — No 2 GRADE SPRUCE BOX. NOTE:— 2 INCH STOCK DRESSED TO STANDARD DIMENSIONS. ½ AND 1 IN. MATERIAL IN THE ROUGH

No REQ.	SIZE	LENGTH	QUANTITY REQ.	SIZE	NAME
1-PCS	2×8	14	1700 LIN. FT.	1×3	BATTENS
6 "	2×8	18	75 SQ. FT.	1×6	SHELVING
			2700 SQ. FT.	½×6 TO 8	BOARDS
23 "	2×6	18	NOTE:— SQUARE FEET QUANTITIES ARE FOR SUPERFICIAL AREAS TO COVER WASTE INCLUDED		
1 "	2×6	14			
34 "	2×6	12	QUAN. REQ.	NAME	
1 "	2×6	10		"SAFE-PACK" DAMP-PROOF PAPER	
			120 LIN. YDS.	" " 36 IN. WIDE	
22 "	2×4	18	75 " "	" " 48 IN. "	

NAILS

QUAN. REQ.	SIZE	KIND
5 LBS	40-D	WIRE
50 "	20-D	"
10 "	10 D	"
5 "	5-D	"
1 "	No 10×⅝ BLUED	AM. CARPET TACKS

BILL OF MATERIAL (CONTINUED)

PACKING MATERIAL

QUAN. REQ.	NAME	WHERE USED
1 YD. 60 IN. WIDE	½ GREY FELT	HULL CRADLES
20 YDS. 36 IN. WIDE	No 325 OR 350 UNBLEACHED COTTON SHEETING	COVERS SEE NOTES No 3 AND 5
20 LBS	EXCELSIOR	FILLING - SEE NOTE No 3
30 "	CARDED JUTE	" " " No 5
15 YDS	1" RED WEBBING	FOR STRAPPING PARTS
120 YDS.	No 30 WHITE COTTON THREAD	FOR SEW. PACK. PADS

HOISTING MATERIAL

QUAN. REQ.	NAME AND SIZE
4	3×½ WROUGHT-IRON BARS - 8 FT. LONG
4	GALV. IRON SHACKLES #6846-E BEALS & CO.
2	⅜ INCH WIRE CABLES - 13 FT. 6 LONG.
8	½×5 LAG SCREWS
12	½×4½ BOLTS - NUTS & WASHERS
50 LIN. FT.	No 24 GA. GALV. SOFT BINDING WIRE
50 " "	No 18 GA. " " " "
4 LBS	SOLDER.
	NOTE:— LIFTING STRENGTH OF SHACKLES TO BE EQUAL TO THAT OF THE CABLES.

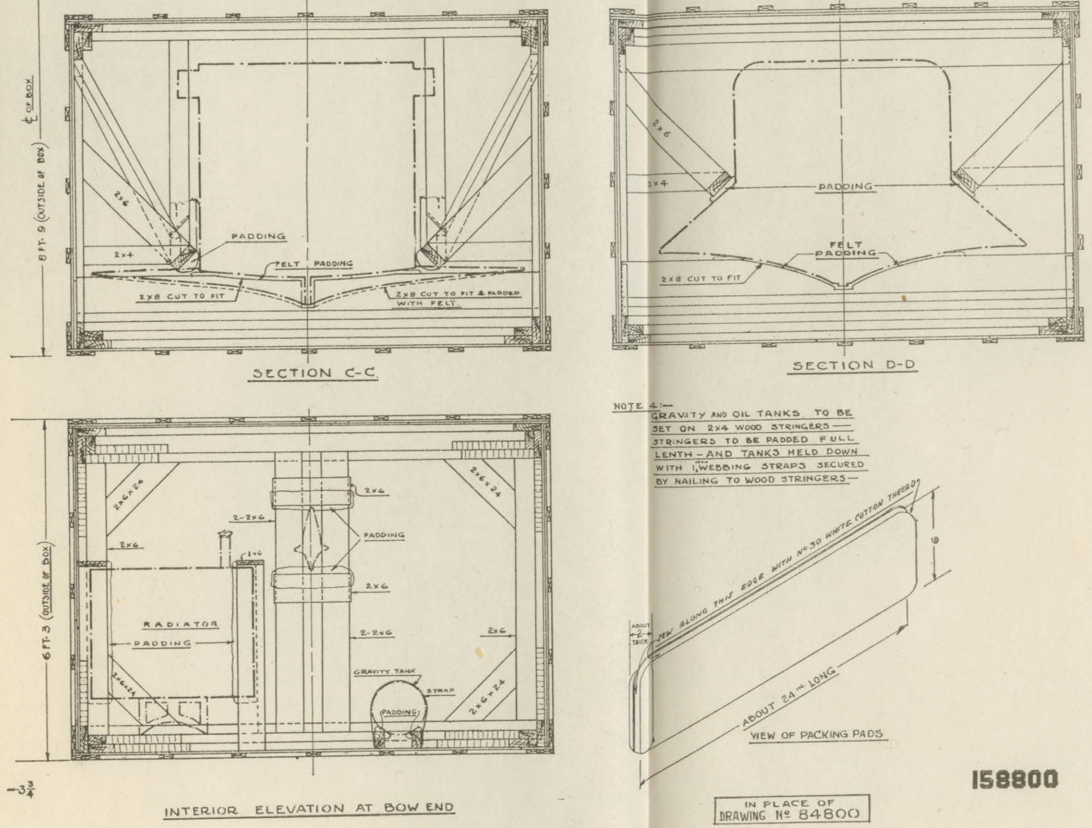
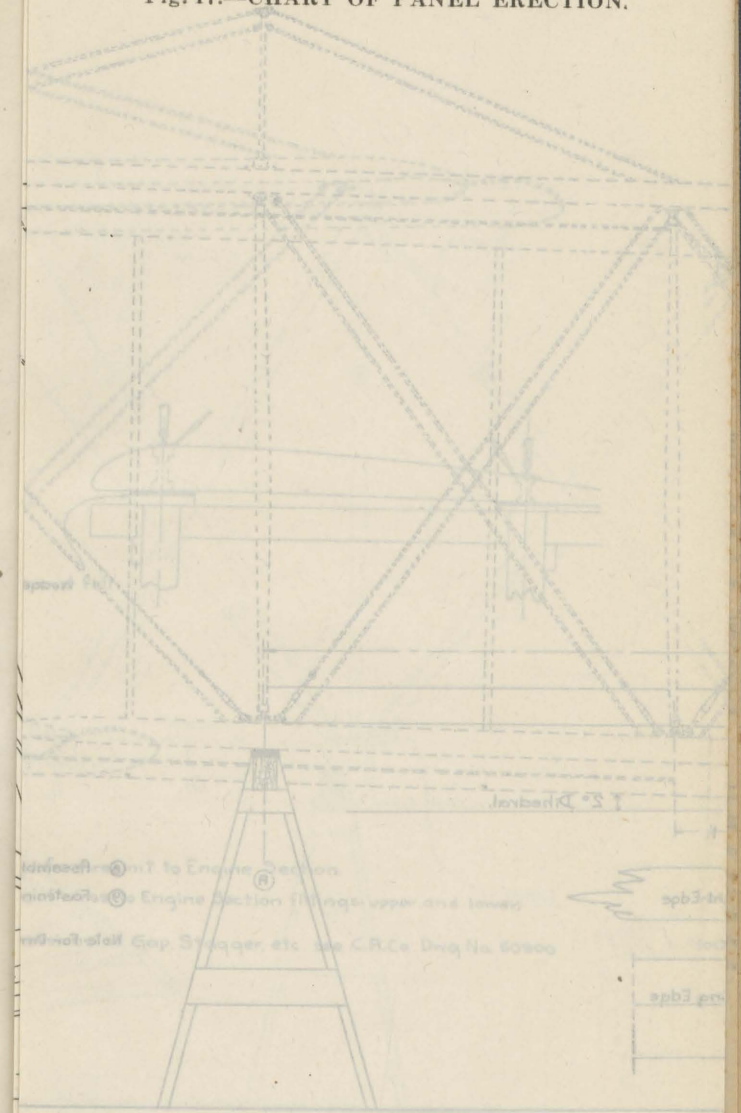


FIG. 11.—Hull box: Transverse sections.

Fig. 17.—CHART OF PANEL ERECTION.



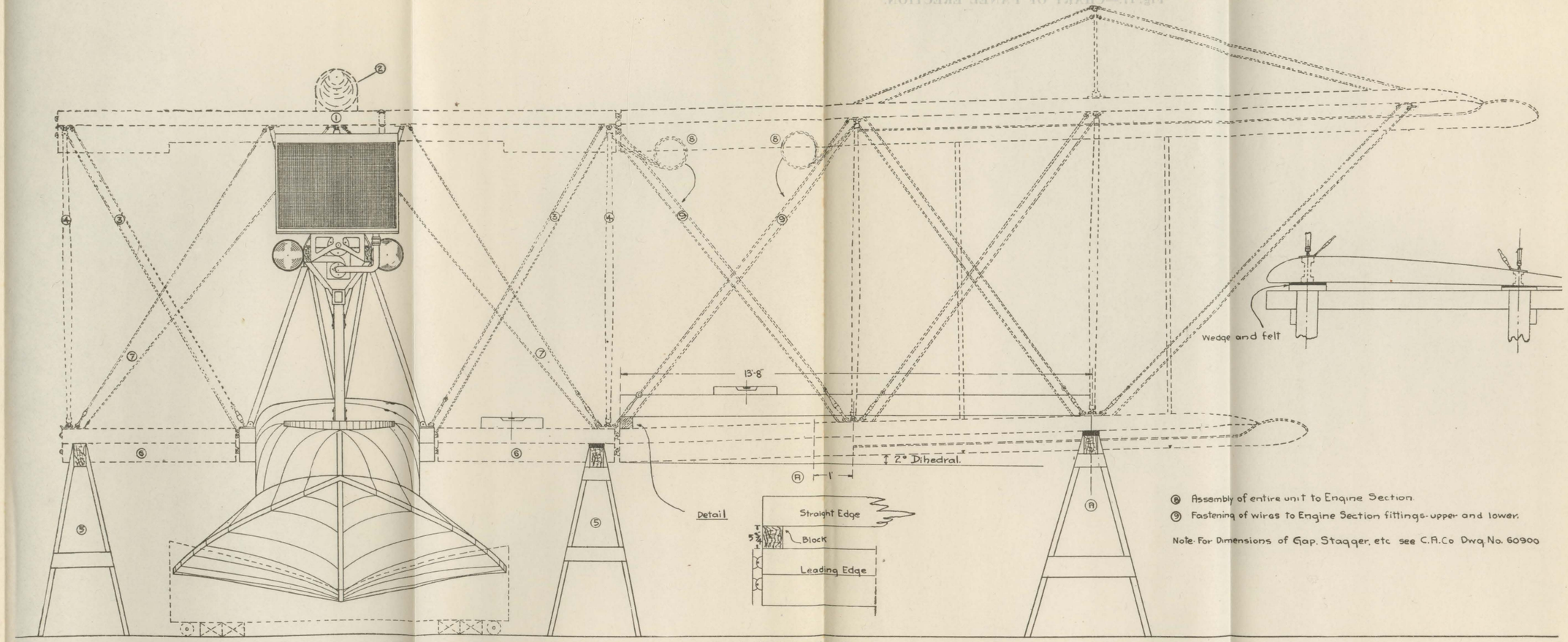


FIG. 17—Chart of panel erection.

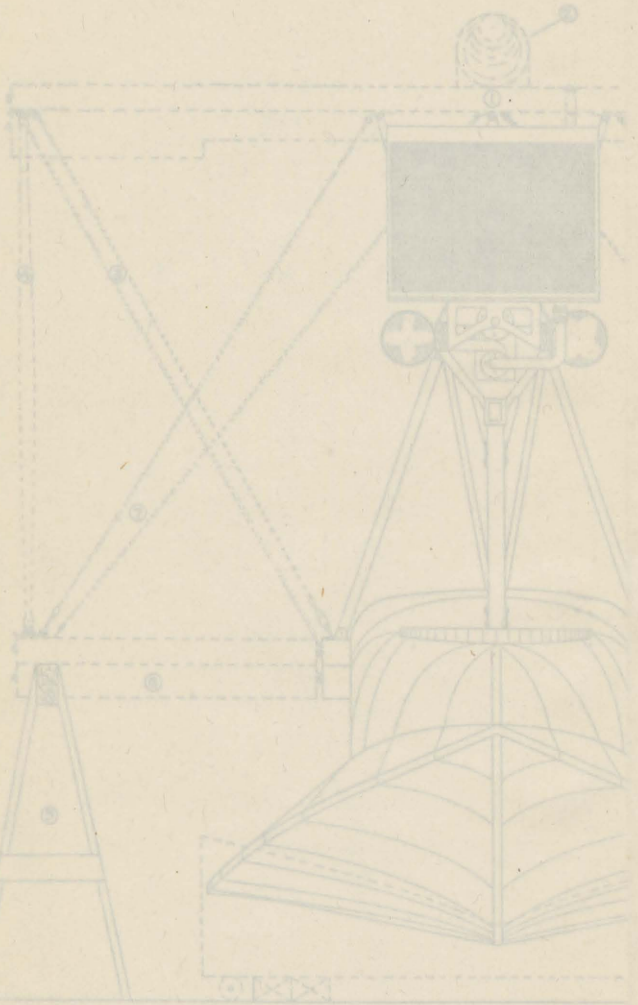


Fig. 21.—CONTROLS.

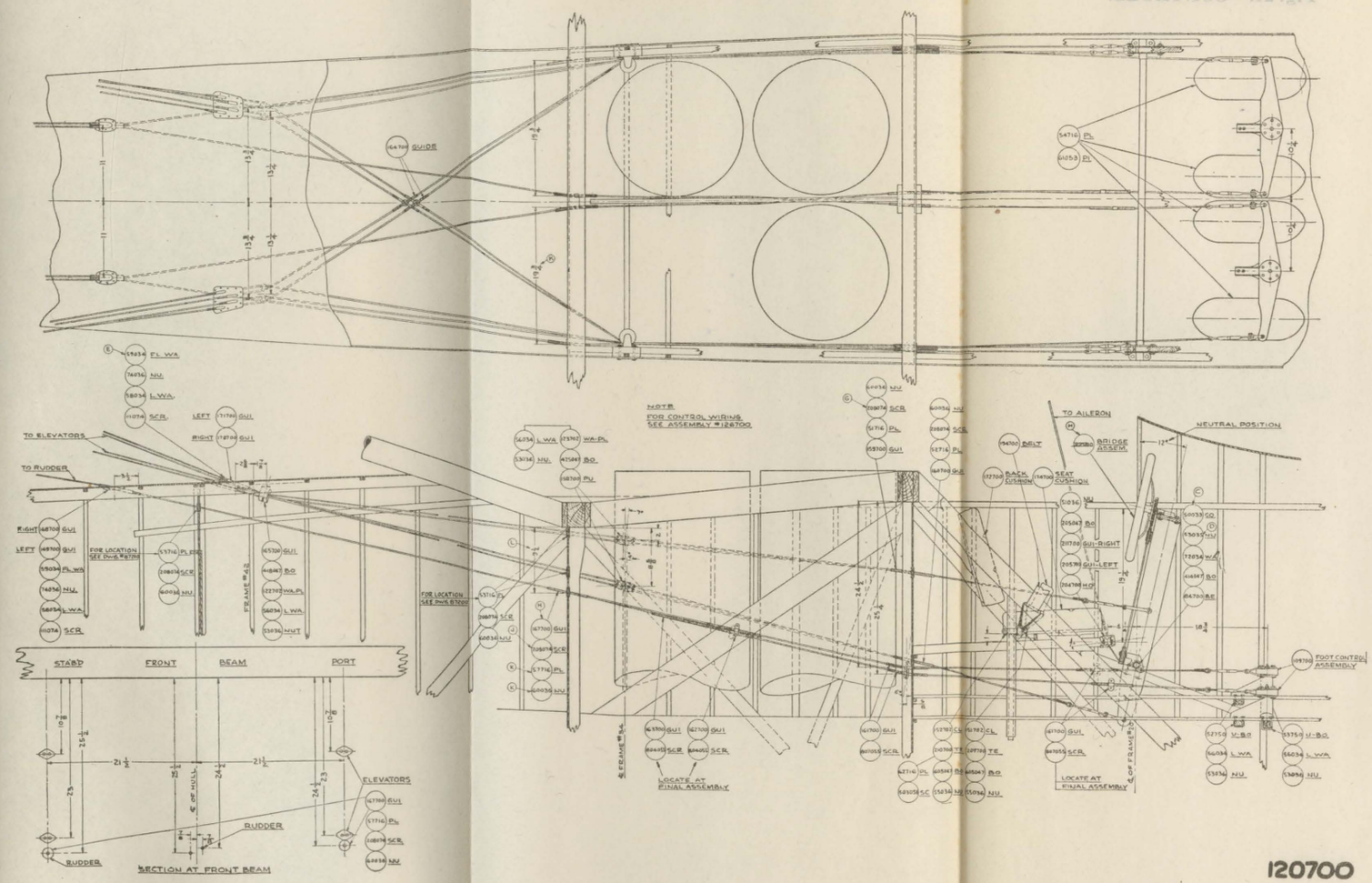


Fig. 21.—Controls.

65022—18

Fig. 22.—MOTOR CONTROL.

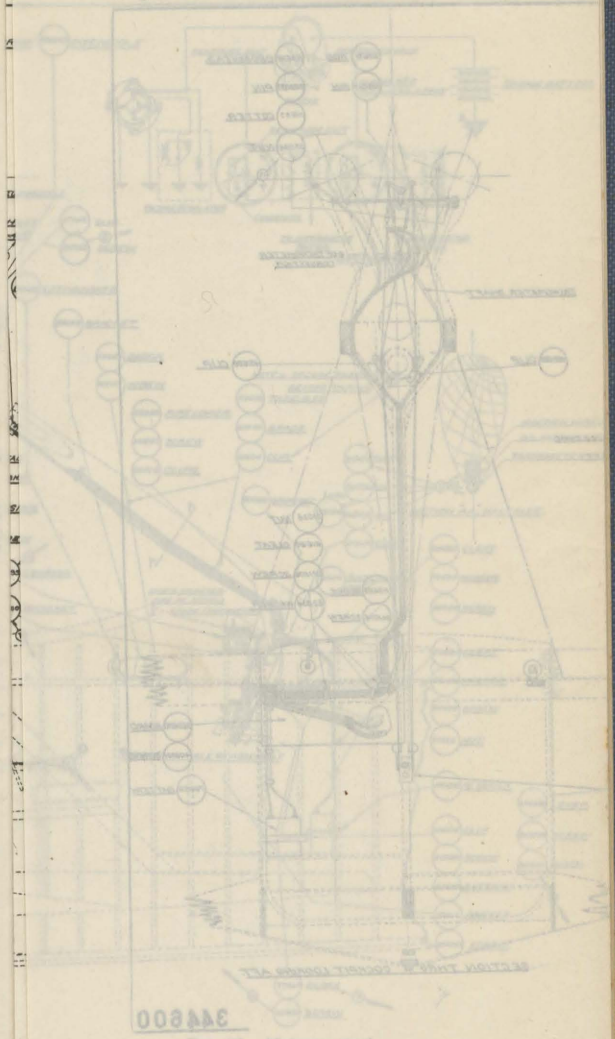


Fig. 22.—Motor control.

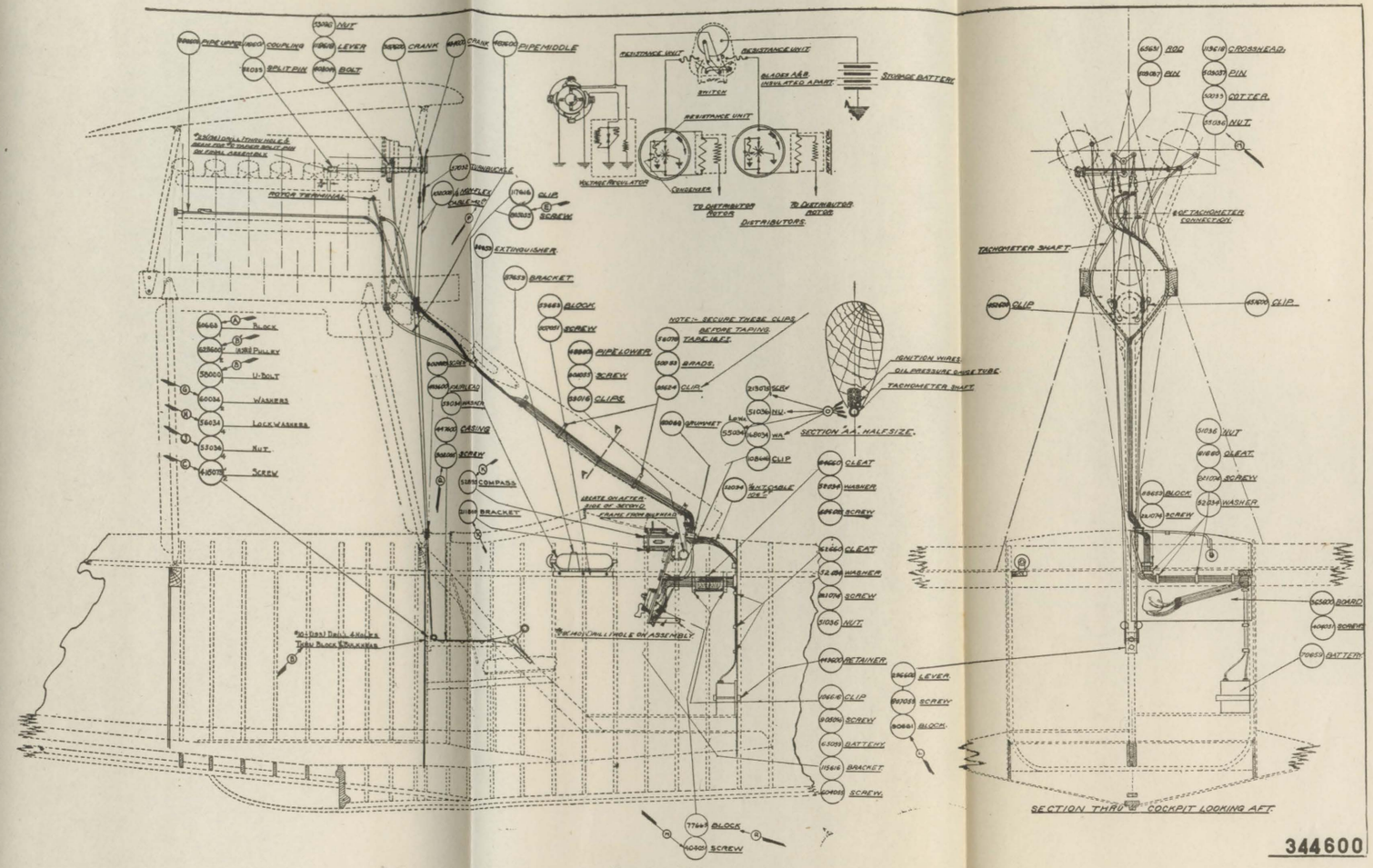


FIG. 22.—Motor control.

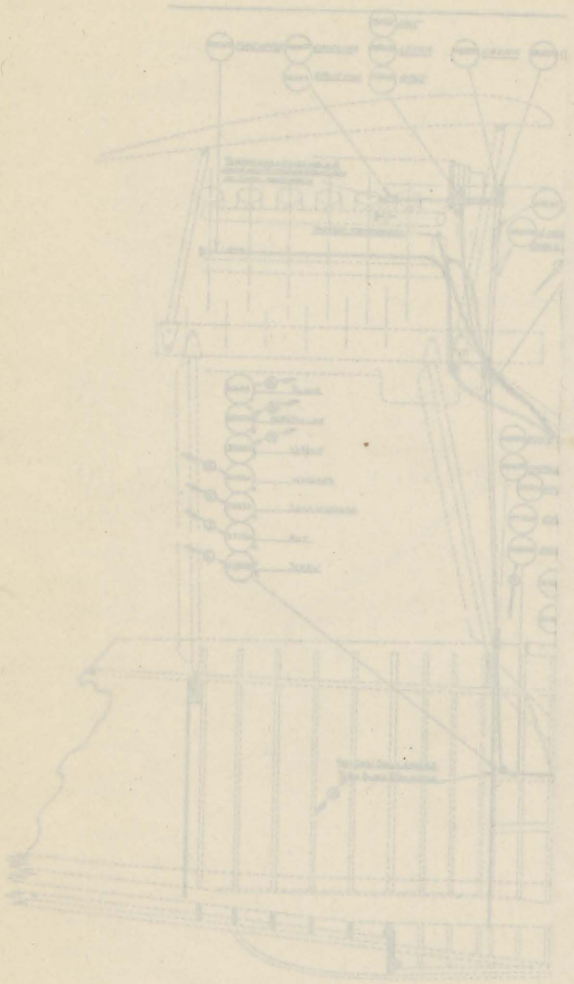


Fig. 23.—FITTINGS DIAGRAM.

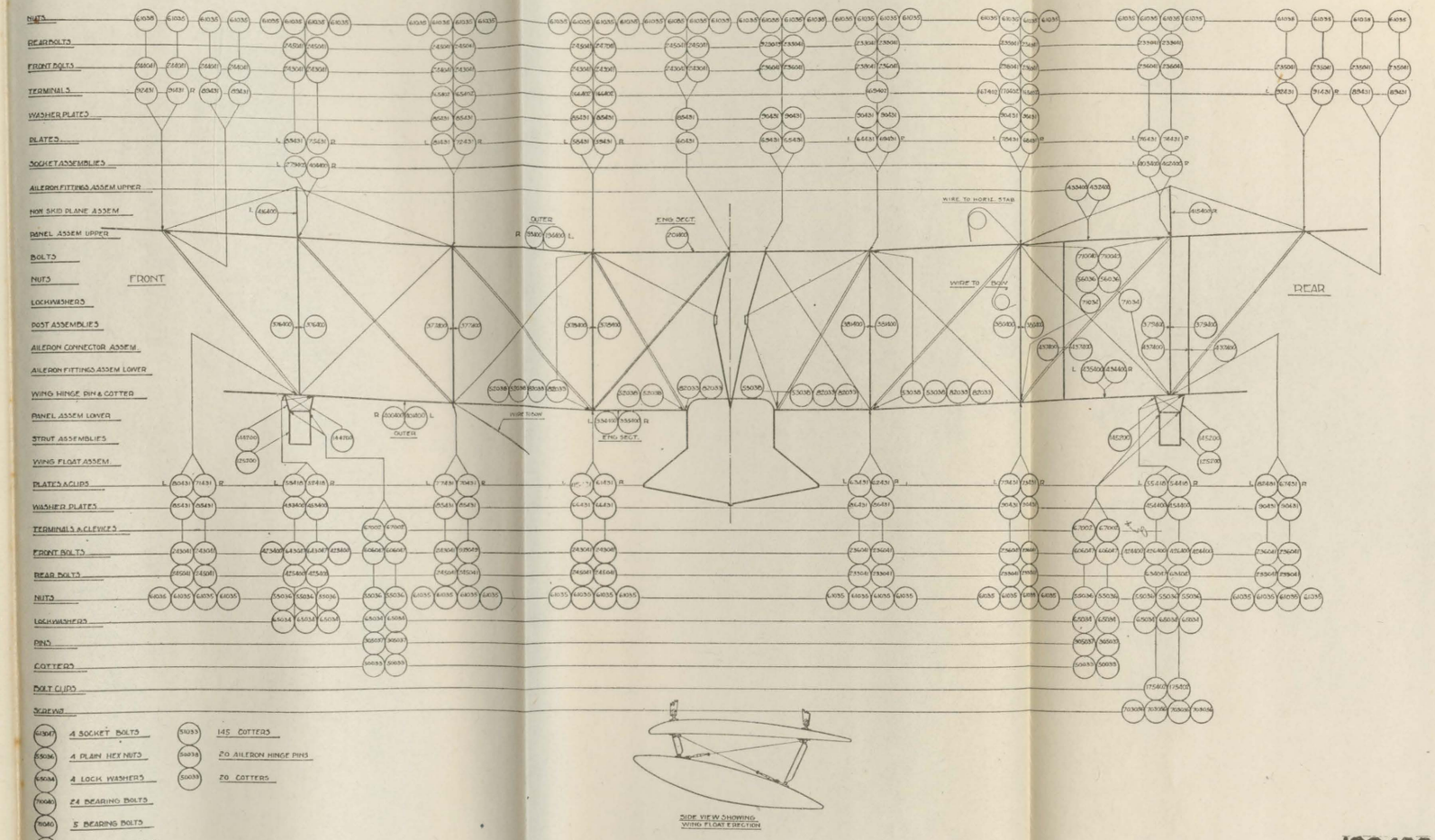


FIG. 23.—Fittings diagram.

65022—18

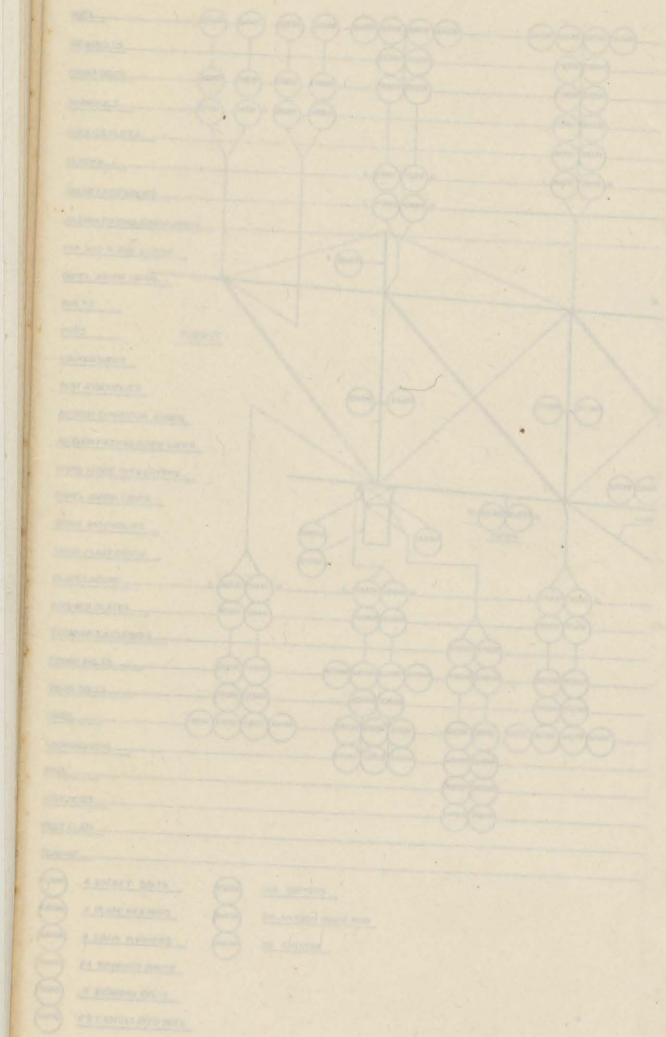


Fig. 24.—TAIL UNIT.

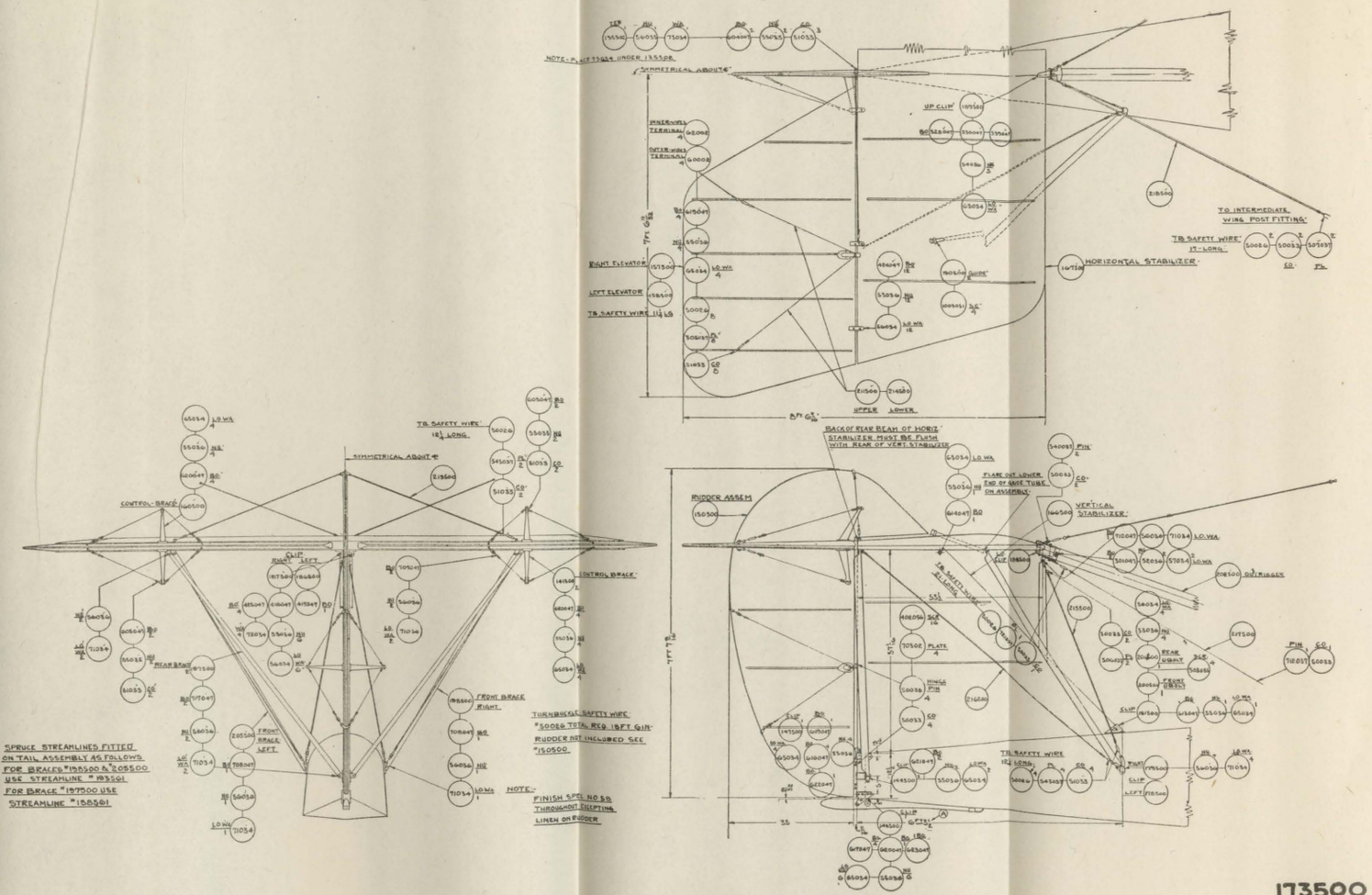
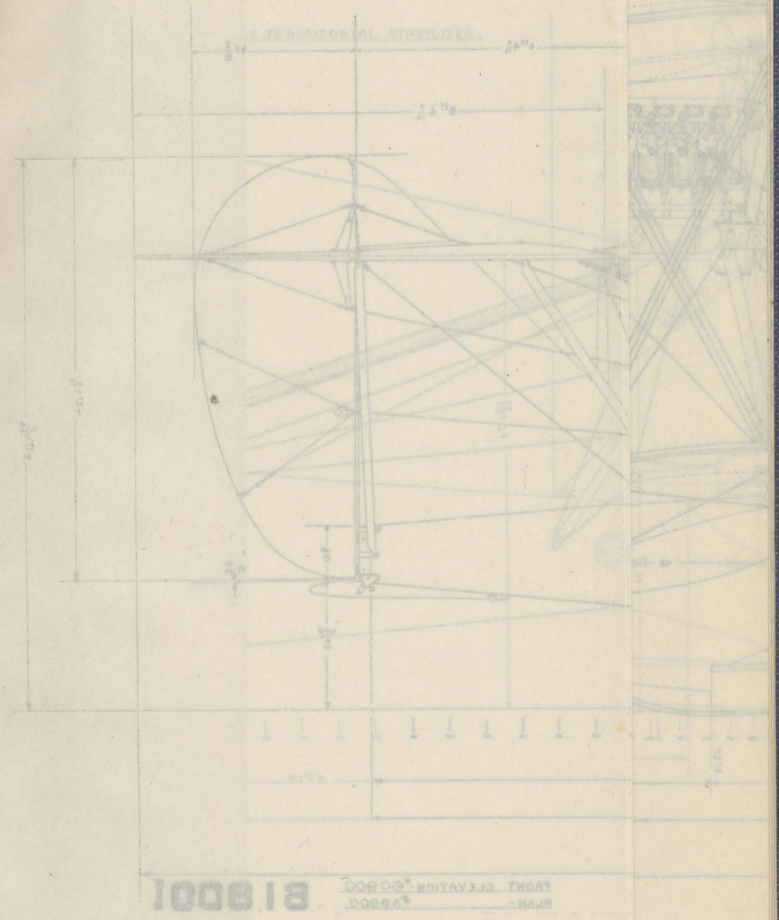


FIG. 24.—Tail unit.

Fig. 25.—SIDE ELEVATION.



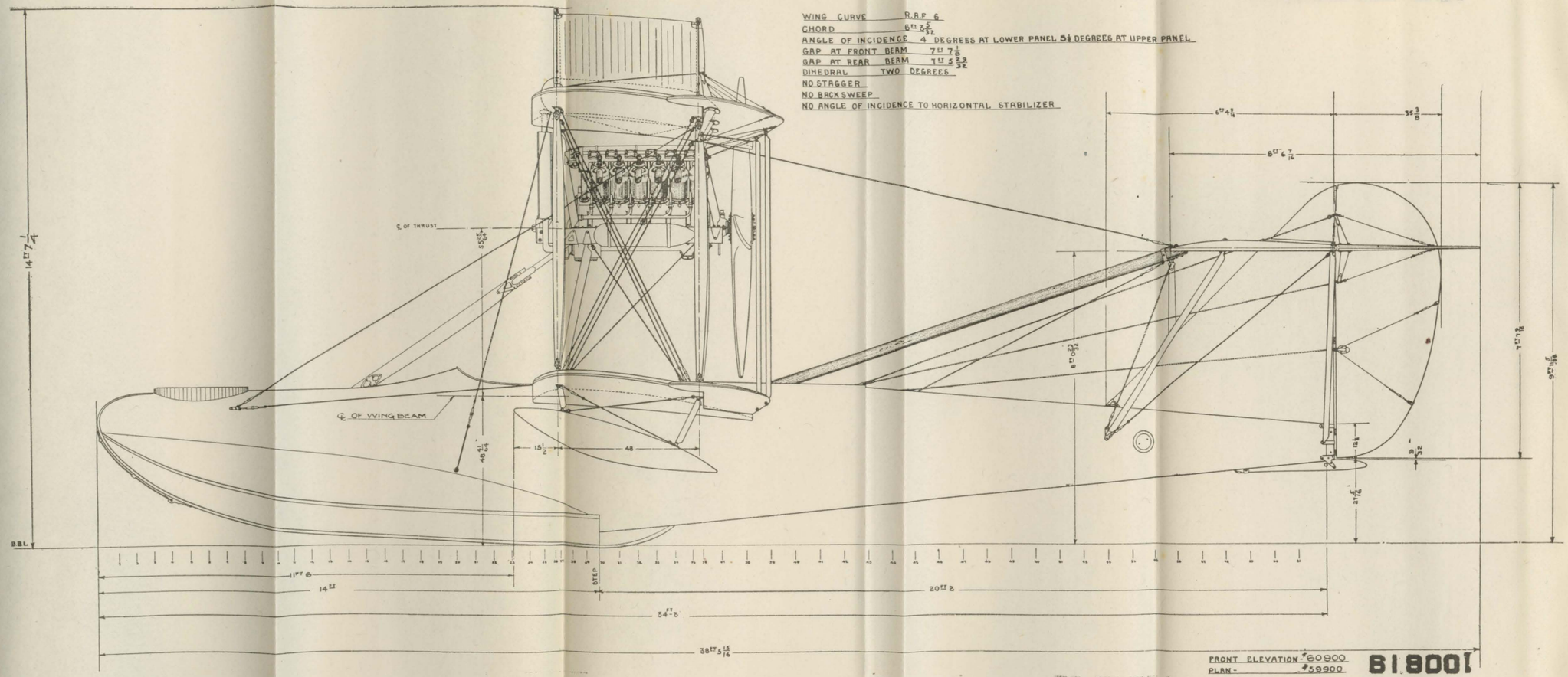


FIG. 25.—Side elevation.

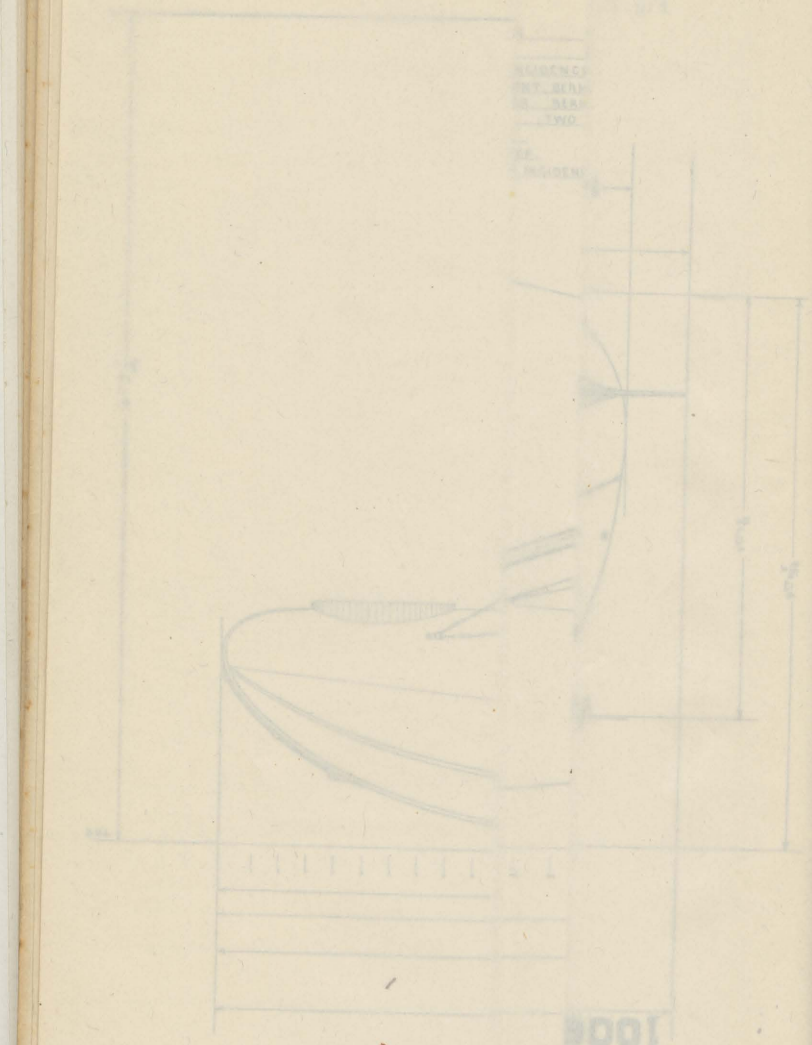
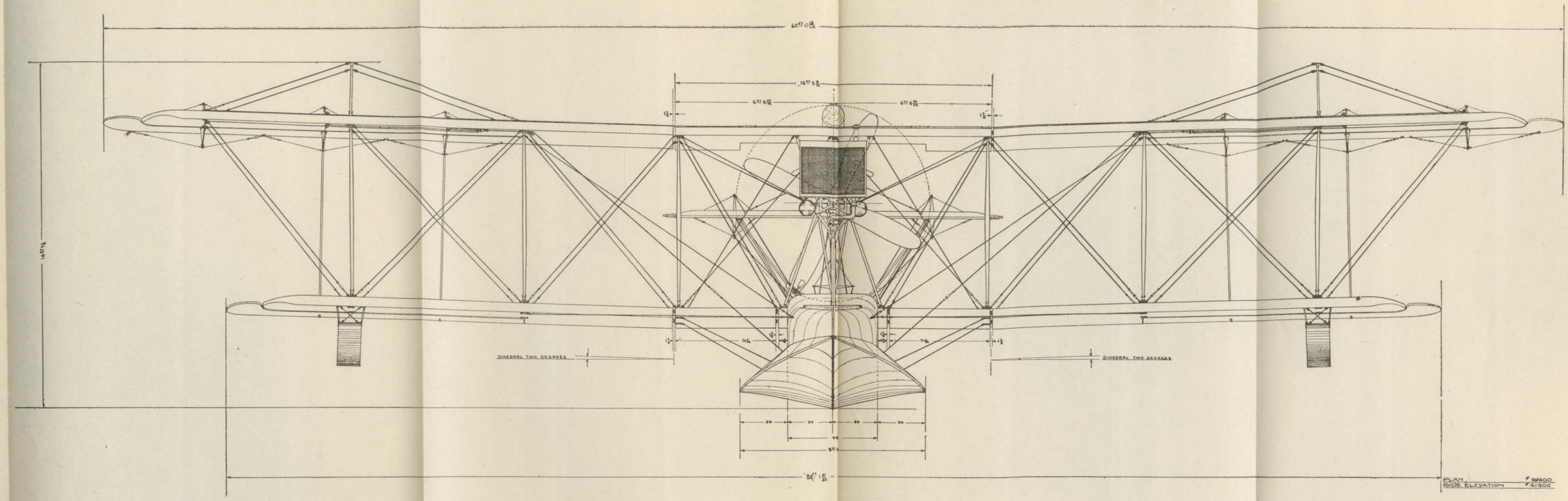


Fig. 26.—FRONT ELEVATION.



PLAN 60900
SIDE ELEVATION 61900

WING CURVE R.A.F. "6"
CHORD 6 3/8
ANGLE OF INCIDENCE 4 DEGREES AT LOWER PANEL, 3½ DEGREES AT UPPER PANEL
GAP AT FRONT BEAM 7 7/8
GAP AT REAR BEAM 7 3/8
DIHEDRAL TWO DEGREES
NO STAGGER
NO BACK SWEEP
NO ANGLE OF INCIDENCE TO HORIZONTAL STABILIZER

60900

FIG. 26.—Front elevation.

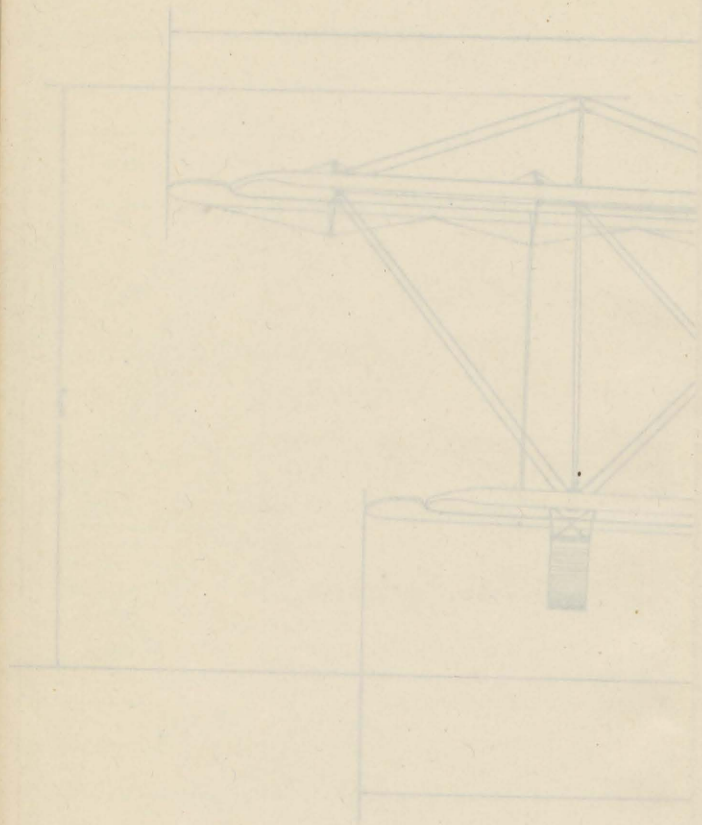
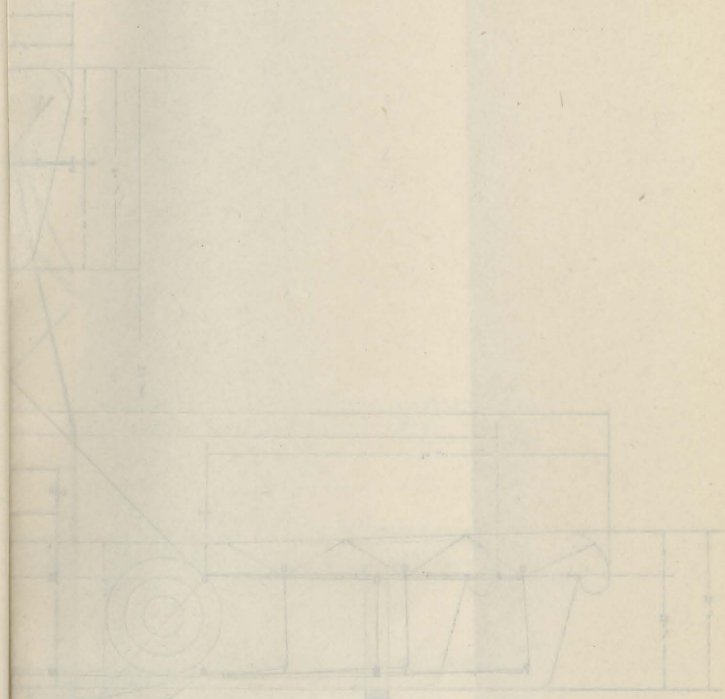


Fig. 27.—PLAN.



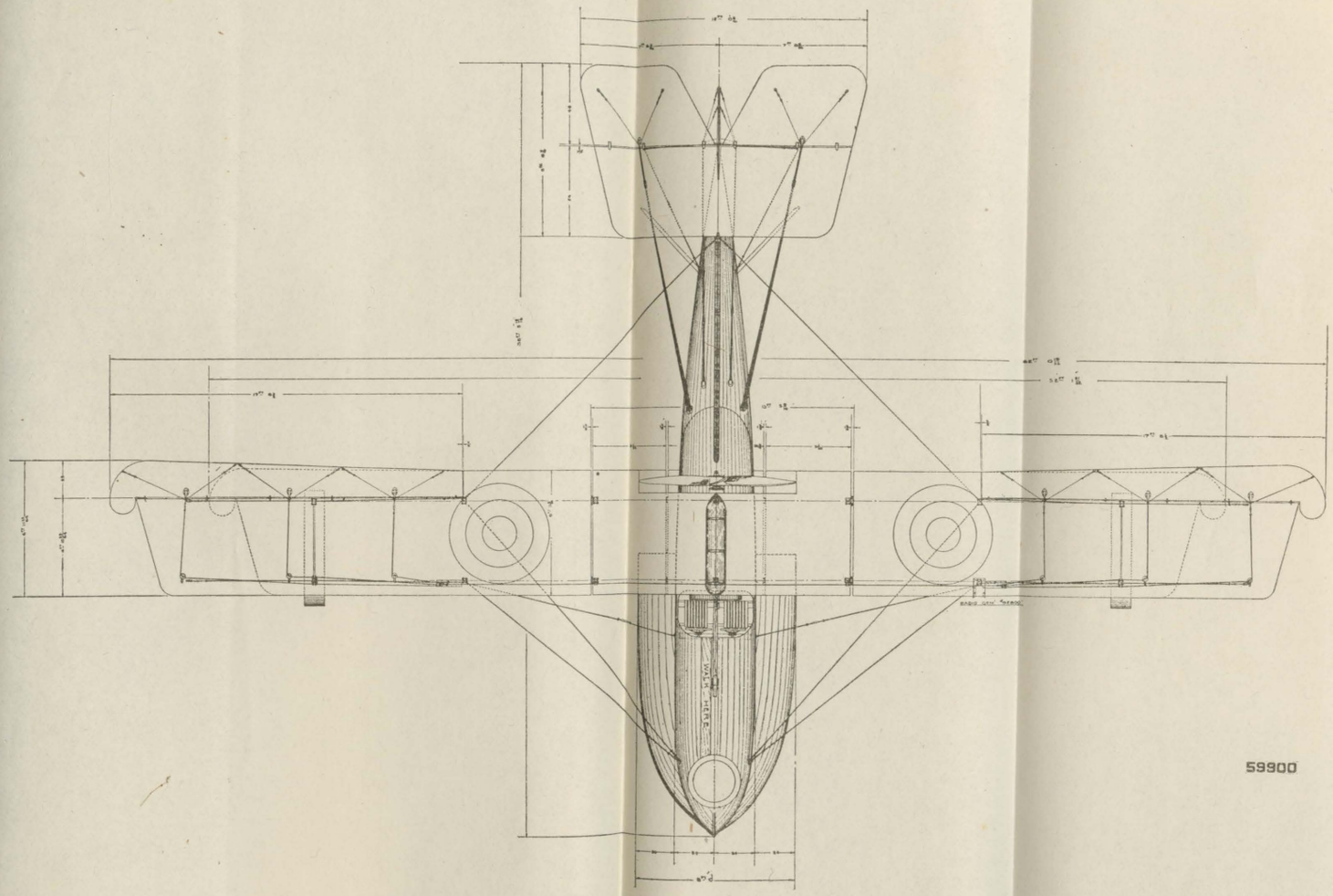


Fig. 27.—Plan.