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THE SINGAPORE III AEROPLANE

4 KESTREL ENGINE

(Covering aeroplanes with service numbers K.3592 to K.3595.)

Promulgated for the information and guidance of all concerned.

By Command of the Air Council.

C. Ll. BULLOCK.

CONTENTS

LIST OF ILLUSTRATIONS

LEADING PARTICULARS

DUTY	Oversea reconnaissance	
TYPE	Four engined boat seaplane	

ENGINES

	Front	Rear
Type	Kestrel III M.S.	Kestrel II M.S.

AIRSCREWS

	Front	Rear
Type	2-bladed R.H. tractor	2-bladed L.H. pusher
Diameter	12 ft. 6 in.	11 ft. 3 in.
Pitch	11.2 ft.	10.45 ft.

OVERALL DIMENSIONS

Length	64 ft. 2 in.
Span	90 ft. 0 in.
Height, keel datum horizontal	23 ft. 6 in.
Height, aeroplane on cradle	25 ft. 3 in.
Draft, at maximum weight	3 ft. 11 in.

MAIN PLANES

	Upper	Lower
Aerofoil section	Göttingen 436 Mod.	
Span, including centre planes	90 ft. 0 in.	76 ft. 0 in.
Chord	11 ft. 6 in.	11 ft. 6 in.
Incidence to keel datum	3° 30'	3° 30'
Incidence to thrust line	1° 30'	1° 30'
Dihedral	2°	3°
Sweepback	5°	5°
Stagger	Nil	
Gap	12 ft. 9 in. at spar centres	

HULL

Length overall	64 ft. 2 in.
Maximum beam at chine	10 ft. 10½ in.
Maximum beam at waist	7 ft. 1 in.
Maximum depth	9 ft. 6 in.

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WING TIP FLOATS

Length overall	14 ft. 4½ in.
Maximum beam	44.8 in.
Maximum depth	39.9 in.
Total bouyancy (each float)	5,000 lb.

TAIL PLANE AND ELEVATORS

Aerofoil section	R.A.F.27
Span	30 ft. 0 in.
Chord, complete	9 ft. 0 in.
Elevator chord	4 ft. 0½ in.

FINS AND RUDDERS (3)

Aerofoil section	R.A.F.27

AREAS

Main planes, upper, without ailerons	690 sq. ft.
Main planes, lower, without ailerons	556 sq. ft.
Centre plane, upper	210 sq. ft.
Centre plane, lower	158 sq. ft.
Ailerons, upper main planes	123 sq. ft.
Ailerons, lower main planes	94 sq. ft.
Tail plane	142.5 sq. ft.
Elevators	92.5 sq. ft.
Fins (3)	55 sq. ft.
Rudders (3)	45 sq. ft.

CONTROL SURFACE MOVEMENTS

Ailerons, range of movement	20° up 20° down
Elevators, range of movement	18½° up 15° down
Rudders, range movement	18½° port 18½° starboard
Tail plane incidence to thrust line, normal	0°
Tail plane range of incidence	+3° 30' to -1°
Control column, neutral position	6° forward
Control column, range of movement from neutral position	14°12' forward 14°12' backward
Centre fin, range of adjustment about centre line of aeroplane	5° port 5° starboard

SETTINGS OF FINS AND RUDDERS

Outer fins and outer rudders, offset to starboard______ 1° 30'

TANKAGE (FUEL)

Gravity tanks for normal load condition

Two tanks in upper centre plane __________________ 393 galls. each

Overload tanks

Two tanks in lower centre plane __________________ 240 galls. each

Total fuel, normal load __________________ 786 galls.

Total fuel, overload __________________ 1,266 galls.

TANKAGE (OIL)

Four tanks with 6½ galls. each for normal load and 10½ galls. each for overload.

Total oil, normal load __________________ 26 galls.

Total oil, overload __________________ 42 galls.

INTRODUCTORY

1. The Singapore III aeroplane is designed for oversea reconnaissance and is fitted with four Kestrel engines, arranged in tandem pairs in two nacelles which are mounted on the interplane struts joining the upper and lower centre plane wing roots. Provision is made for carrying and releasing various bomb loads, or the transport of two torpedos. The normal accommodation in the control cockpit is for one pilot who is seated on the starboard side with an observation seat for the navigator on the port side, separated from the pilot's seat by a gangway. A second set of controls may readily be installed in the observation seat position. Three gun stations are provided, one in the bow cockpit, from which bomb-aiming and mooring operations are also performed, one in the midship cockpit and the third in the tail cockpit. The midship cockpit is fitted with a gun ring on a traversing trolley. A wide central gangway provides free intercommunication throughout the aeroplane. The main planes are of biplane form and are swept back from the centre planes. The tail unit consists of an adjustable monoplane tail plane with triple fins and rudders mounted on the upper surface. The rudders are directly coupled to the pilot's rudder bar and the centre fin is adjustable by the pilot whilst in flight to counteract the effect of unequal engine torque. A three axes installation of automatic controls is fitted.

DESCRIPTIVE AND RIGGING NOTES

ERECTION AND RIGGING

General

2. The following paragraphs deal briefly with the order of erection and the method of rigging adopted by the manufacturers. If a gantry is available this should be employed as it will be found to assist greatly during erection and effect a saving of time.

Order of erection

3. (i) Adjust the hull into rigging position (see para. 5).

(ii) Position tail plane struts.

(iii) Erect tail unit on ground and lift into position.

(iv) Lift engine nacelles to lower centre plane, position vibratory struts and fit lower incidence wires and panel wires.

(v) Fit upper centre plane, insert upper incidence wires and panel wires. Install upper fuel tanks and fit upper centre plane drag wires.

(vi) Fit lower planes and support the wing tips on trestles at the correct dihedral. Fit the landing wires but leave them slack.

(vii) Lift upper planes complete with outer interplane struts into position. Insert pins at joints and lower ends of interplane struts.

(viii) Fit flying and outer incidence wires.

(ix) Tension wires, check structure for truth, symmetry, incidence and dihedral.

(x) Install engines and radiators, using the lifting gear illustrated in figs. 32 and 33.

(xi) Fit wing tip floats.

4. If a gantry is not available the order of erection is as above except that the upper planes should be erected by hand tackle and supported from the roof before the lower planes are positioned and the engines installed.

Hull

5. For checking longitudinal and transverse levels, two pairs of datum blocks are fitted inside the hull, one pair forward of the front spar frame and the other pair aft of the rear spar frame (see fig. 1). When rigging, straight-edges are placed transversely on these blocks and a further straightedge is placed longitudinally across the transverse ones, approximately on the centre line of the aeroplane. The hull will be in true rigging position when all the straightedges are horizontal, the check for this condition being made by spirit level.

Tail unit

6. The rigging of the tail plane can be varied only by the length of the tail plane struts. The manufacturers method of assembly is as follows:- The tail plane is offered up to the hull and secured with the two hinge bolts on the underside of the front spar and the double link fitting below the rear spar. The short trimming struts which join the tail plane adjusting screw to the underside of the rear spar are then inserted. With the exception of their upper extremities these struts lie within the hull and are the only tail plane struts supplied to dead length. The remainder of the struts are supplied with one end loose and are trimmed to exact length to correct inequalities in the incidence and truth of the tail plane and hull.

7. The incidence and truth of the tail plane are checked from pads on the upper surface of the tail plane by means of the incidence boards shown on fig. 1 and should show horizontal with a spirit level when the tail is at the normal setting. From the normal setting the tail plane adjusting screw allows an increasing incidence of $5\frac{1}{2}^{\circ}$ and a decreasing incidence of 1°. Further movement of the tail plane adjusting screw is prevented by bolted-on stops on the screw. These are adjusted for width before bolting on and allow for discrepancies in the positioning of the screw gear within the hull framing.

8. After the foregoing adjustments and checks have been made the tail plane is removed from the hull and the remainder of the tail unit assembled to the tail plane on the floor, during which time the tail plane is supported on trestles by felt-covered planks below the front and the rear spars. The fins and rudders are jig made and should present no difficulties during erection.

9. The complete tail unit less elevators, which are preferably fitted afterwards, is then fixed to the hull, being lifted by two wide plaited cord girths or wide canvas belts carried below the tail plane on either side of the centre fin and up to a suitable boom above the centre fin. The boom should lie parallel to the fore-and-aft axis of the aeroplane and its length should exceed the chord of the tail plane.

Engine nacelles

10. The engine nacelles complete with nacelle struts are lifted by a beam carrying pennants and shackles which are attached to the upper bolt holes of the struts,

Upper centre plane

11. The upper centre plane is lifted into position by suitable slings attached to the slinging eyes which are positioned at the extremities of this plane. The engine nacelle struts are supplied to dead length and the upper centre plane is trued for squareness and symmetry by plumblines.

Lower planes and upper planes

12. These are secured by horizontal pins at the wing roots, two pins at each spar. After the planes are attached the remainder of the wires are inserted and the complete structure checked and trued.

Incidence boards

13. At two positions along each plane, at both the front and rear spars, screwed inserts are provided in the lower profile of the plane and the incidence boards are supplied with metal brackets carrying screws for insertion in these inserts (see fig. 1). Incidence is checked by a clinometer placed on the upper surfaces of these boards and dihedral by a further straightedge spanning the two incidence boards. If no long straightedge is available the dihedral may be checked by means of a weighted cord spanning the two incidence boards and a short straightedge held to the cord.

Check for symmetry

14. The points at which checks for symmetry are to be made, together with the tolerances, are shown on fig. 2.

Engines

15. The lifting gear illustrated in fig. 32 is used for hoisting the engines and the gear shown on fig. 33 for lifting the radiators and airscrews. For hoisting purposes eyebolts are fitted on the centre front and centre rear upper tank trunnions.

FLYING CONTROLS

General

16. The complete control system is of orthodox design. One size of chain and swaged rod, $\frac{1}{2}$ in. x $\frac{1}{8}$ in. and 7/32 in. B.S.F. respectively, is used throughout the aeroplane. To ensure that all control runs are in their correct position, each lever, chain drum and roller fairlead has letters and numbers engraved thereon.

17. Thus, in the case of the elevator control, the lower lever in the control column is marked E_1 and E_2. Twin swaged rods and chains pass over chain drums and roller fairleads engraved E_1 and E_2 throughout the hull and connect to a lever in the tail plane which is similarly marked E_1 and E_2. Each control run is marked in a similar manner, letters being used to identify the system and numbers to indicate each separate run.

18. The whole control system is covered as follows:-

(i)	Rudder control	R_1, R_2, R_3 and R_4.
(ii)	Elevator control	E_1, E_2, E_3, E_4.
(iii)	Aileron control	A_1, A_2.
(iv)	Tail adjusting gear.	TT_1, TT_2.
(v)	Fin trimming gear.	FT_1, FT_2.

Locking controls

19. For rigging and for mooring-out purposes all controls can be locked in their centralised positions, which are indicated by arrows engraved at the operating points. For the elevator control system an additional lock position is provided (see fig. 4) and becomes operative when the control column is at the maximum forward position, at which position the elevator control is usually locked when the aeroplane is moored.

20. The locks consist of toothed link plates, inserted in the control run, which engage with corresponding toothed blocks fixed to two beams that form part of the hull structure. With the controls unlocked the links pass beneath the blocks, when a clearance of approximately 5/16 in. exists.

21. To lock the controls screwed saddles, actuated by large wing nuts, deflect the control run until the link plates engage with the fixed blocks. Each control run is locked by a separate saddle.

22. To ensure that the screwed saddles are secured in both the unlocked and locked positions, a safety device is incorporated consisting of two channels which are in line with the two rows of locks. Keyhole shaped slots in the channels register with cheese-headed screws fixed in the screwed shanks of the saddles.

23. With the controls unlocked the keyholes in the channels are passed over the cheese-headed screws and moved to the extent of the slots; "over-centre" catches retain the channels in this position. With the controls locked the channels are reversed (i.e., open side downward instead of upward) and secured exactly as before. With the channels in either position it is impossible for the wing nuts to be rotated.

24. The words "unlocked" and "locked" are engraved on opposite sides of the channels, and only one word at a time can be read (i.e., "unlocked" is read normally while "locked" appears upside down on the other side of the channel).

25. Both channels are rotatably fixed to a frame which forms a single unit. Fixed to a hull member immediately in front of the safety device is an engraved plate indicating the correct use of the unit. The control run is also provided with stops to limit the travel of the respective controls, and these are incorporated in the same unit as the locks. Links in the control run, with projections on the top and bottom sides, are arranged to move between the two beams and to make contact with the inner faces of the beams.

26. All sprockets and chain drums which change the direction of the controls through large angles are mounted on ball bearings, while roller fairleads which effect only a small change in angle are fitted with plain bearings. For the lubrication of all controls, see fig. 34.

Aileron control

27. The ailerons are operated by a hand mounted wheel at the top of the control column. A chain transmits the drive from the control wheel to a universally-jointed shaft at the bottom of the column. From a sprocket on the rear end of this shaft, chains and swaged rods connect to a T-shaped lever, situated in the hull at the rear spar frame, and form a closed circuit which can be adjusted independently. Levers on the underside of each lower aileron are connected by adjustable push-rods to levers pivoted below the rear spar. The ailerons of the upper planes are coupled to the lower ailerons by cables.

28. A closed circuit of swaged rods and chains forms the connection from one side of the aeroplane to the other, and also joins the T-lever. Outboard of the lower centre plane the whole of the controls, except for a small section in way of the bomb gear, are outside the profile of the lower outer planes. The control system is illustrated in fig. 3.

Elevator control

29. The elevators are operated by a pivoted control column 34 in. in length. Two levers are bolted directly to the base of the column and from these swaged rods and chains connect to levers fixed to a torque shaft on the rear spar of the tail plane. A single lever on the torque shaft is coupled to a single lever on the elevator spar by an adjustable push-rod. These two levers are positioned to provide a differential movement of the elevator surface as against an equal movement of the control column in either direction. The control system is illustrated in fig. 4.

Rudder control

30. A rudder bar adjustable in flight to suit pilots of varying stature, is fitted in the control cockpit and is connected to a torque shaft on the rear spar of the tail plane in a similar manner to that employed for the elevator control. From a single lever on the torque shaft, a push-rod is taken to operate a free double lever located on the axis of the centre fin rear post. Each outer fin rear post is furnished with similar free levers and all three sets of levers are coupled together by swaged rods. From these levers an adjustable push-rod is connected to a single lever on each rudder post. The system is illustrated in fig. 5.

Tail incidence gear

31. A hand wheel in the control cockpit is coupled to a short countershaft behind the pilot's seat by an endless chain, the chain being adjustable by moving the hand wheel mounting by means of a screwed adjuster. An indicator is driven from the hand wheel by a flexible shaft and a chain. Flexible cable is employed to connect the cockpit mechanism to the screw gear in the tail of the aeroplane (see fig. 6).

32. The screw gear consists of a self-locking square-threaded spindle to which is attached four struts; these connect to the rear spar of the tail plane at points equally spaced about the centre line of the aeroplane. The tail plane rear spar is elevated or depressed about a hinge line below the tail plane front spar by rotating a threaded nut housed between ball thrust races.

Fin trimming control

33. A hand wheel and a sprocket, positioned horizontally on the centre line of the aeroplane at the pilot's shoulder level, are connected by chains and flexible cable to the screw gear at the base of the centre fin front post. (see fig. 7). A positively driven indicator, mounted above the hand wheel, registers the incidence in degrees and also indicates the position of the centre fin by repeating the movements on an exaggerated scale. The screw gear in the tail consists of a self-locking square-threaded nut fixed in trunnions at the finpost and a similarly threaded spindle with integral sprocket anchored to the spar. The base of the centre fin front post is also guided and secured by a ball bearing roller moving in a slide fixed to the front spar of the tail plane.

AUXILIARY PILOT'S CONTROLS

34. A completely detachable set of cockpit controls (see fig. 8), is provided for training purposes and can be installed or removed in approximately thirty minutes. A platform of sufficient size to accommodate a second rudder bar and control column, similar to those on the port side, is attached to a structure on the starboard side by six studs and nuts.

35. The starboard control column is coupled to the port control column by a torque shaft which has a universal joint at each end. The universal joints are of the spider and disc type, the disc consisting of laminated spring steel plates. A spider connection is integral with each control column and four bolts in each are removed to detach the torque shaft.

36. The rudder bars are connected through levers by a push-pull rod, which can be removed by withdrawing a standard headed pin at each end.

37. The aileron controls are coupled through sprockets by chains and swaged rods. These are removed by detaching one end of each chain.

38. When this set of controls is installed a jury strut, positioned forward of the aileron coupling chains, is used to take the pull of the chain and increase the rigidity of the two structures. The strut is detached by removing a standard headed pin at each end.

39. The aeroplane is fitted with a three axes automatic control installation, each unit of which is positioned in the same plane as the respective control. The rudder and elevator units have fixed mountings and are coupled directly to the rudder bar and control column by adjustable push-rods (see fig. 9), whilst the mounting for the aileron unit is adjustable in a vertical transverse plane, the mounting comprising a tapped bracket with a screwed sleeve and lock-nut. Passing through this sleeve is an eyebolt and knurled locknut.

40. Coupling of the aileron unit is effected by a pushrod that runs to a lever and layshaft, outboard of the pilot's pedestal, which, by means of levers and a chain, operates the aileron torque shaft below the pilot's seat. To adjust the aileron unit slacken both locknuts, rotate the screwed sleeve as required, then re-tighten both locknuts.

41. Both the aileron and rudder units are enclosed in airtight compartments (see fig. 10), each compartment consisting of two halves, sealed by an endless rubber ring. The automatic control units with all pipe connections and Bowden cables are housed in the lower halves of the compartments and may be fully exposed for inspection, lubrication, etc., when the upper halves are removed. Special adaptors, positioned to suit the pipe run, connect on the outsides of the compartments with copper pipes and on the insides with petrol-resisting rubber tubing, whilst Bowden cables are passed into the compartments through screwed glands containing soft rubber rings. The push-rod outlets are made airtight by rubberised concertina sleeves.

42. The air compressor is mounted on the front vibratory strut on the centre line of the aeroplane and is connected to the oil reservoir aft of the front spar frame in the hull by pipes which run inside the strut fairings. The test cock is mounted adjacent to the oil reservoir and close to the portlight, through which a compressed air pipe may be run for testing purposes. The drain cock is positioned behind the chart table on the port side of the aeroplane. A pipeline diagram for the complete installation is given in fig. 11.

FUEL SYSTEM

43. Fuel for normal range is carried in two tanks each of 393 gallons capacity, mounted in the upper centre plane and the normal system is by gravity feed via distributor boxes in each nacelle. A balance pipe running through the front horizontal strut fairing and connecting the two distributor boxes enables any one engine to be fed from any one tank.

44. Overload fuel is carried in two tanks each of 240 gallons capacity, mounted in the lower centre plane, one on each side. The tanks are balanced by a pipe housed in a fueltight duct that passes through the hull. The recommended overload system is by gravity, the engine pumps feeding the top tanks only. A flow indicator, in the overflow pipe just aft of the radiator mounting on the nacelle, and visible from the pilot's cockpit, indicates when the gravity tanks are full and overflowing.

45. When the gravity feed is interrupted suitable operation of the cocks (see fig. 12) allows the pumps to supply direct to the carburettors, relief valves being fitted in the pump delivery lines to prevent excess pressure at the carburettors. Note:- These are external relief valves; the internal relief valves integral with the engine pumps must be blanked off.

46. Fuel cock controls are situated on the engineer's table and are clearly labelled; a diagram and an instruction plate are attached nearby. Smiths' electrical fuel contents gauges (see fig. 13), are fitted to all tanks, the dials and switches of which are mounted on the engineer's instrument board.

47. The dial calibrations are made with the aeroplane in a normal cruising attitude at normal load and a correction chart, stowed in the engineer's table, is used to determine the contents of the tanks when afloat or with the aeroplane flying at any angle other than that at which the tanks are calibrated. In the latter case the chart should be used in conjunction with the fore-and-aft level mounted on the side of the engineer's table. This level is set to show the same reading as the level on the pilot's instrument board.

48. Dipsticks are provided, stowed adjacent to the engineer's locker, to enable a check to be made on the contents of each tank. The dipsticks are suitably engraved to meet the case of either wing tip float at rest on the water.

Removal of fuel tanks in lower centre plane

49. A bracing strut runs through each of these tanks; the struts must be removed and replaced with the tanks. The struts run from the engine strut joints at the front spar to the sides of the hull at the rear spar.

Removal of fuel tanks in upper centre plane

50. Cross bracing wires run through each tank and must be removed and replaced with the tanks. The central gap between the two tanks is filled with a laced fabric panel attached to the tanks by a hooked metal strip. A similar fabric attachment is fitted at the fore, aft and outboard ends of the tank, the fabric being doped down on to the plane.

ENGINE CONTROLS

Engines not fitted with automatic mixture control

51. The throttle control hand levers are of the normal type. The mixture control is fitted with a handwheel working on a toothed quadrant which provides a fine adjustment. Both controls are fitted with adjustable friction devices and the levers are interconnected by a link on the underside, thus enabling the throttle control to bring the mixture control to "strong" when returning the levers to the closed position. The movement of the hand levers is transmitted to the engines by push-pull rods and bell-cranks. It is important that all push-rod fork-ends, bell-crank bearings and fairleads are frequently lubricated.

Engines fitted with automatic mixture control

52. The foregoing particulars apply in general to engines fitted with automatic mixture control with the exception that levers are fitted to the mixture control in lieu of handwheels. In addition, the interconnecting links between the throttle and mixture hand controls are removed and the layout of the push-pull rods in the engine nacelle is varied. An instruction plate on the pilot's instrument board states that the mixture must be strengthened before closing the throttles.

OIL SYSTEM

53. The oil is carried in two saddle tanks on the top of each engine nacelle, behind the front engine strut (see fig. 14). To facilitate quick warming of the oil, each tank is fitted with a small circulating chamber to which the feed and return pipes are connected. A dipstick is provided to ascertain the level in the tanks; this is stowed in the hull adjacent to the tool locker.

54. The filter fitted in the sump of each tank can be removed for cleaning without draining the tank. When the large diameter filler seating flange is unscrewed the top end of the filter spindle may be disengaged from its clip inside the tank and the filter withdrawn. An upstanding flange is provided round the sump to prevent sludge being washed down the feed pipe.

55. The tank is drained by the operation of a 3-way cock in the sump. This cock should be normally kept wired in the "tank to engine" position. To facilitate removal of the oil a length of hose is provided and clips on to the drain elbow. When not in use the hose is stowed in the nacelle.

56. Two Air Ministry type oil coolers are mounted on the outboard side of each nacelle, the front engine coolers having nine fins and the rear engine coolers eleven fins; each are mounted on thirteen fin connecting tubes. In the event of damage the fins may be removed and replaced without disturbing the mounting or pipe runs by slackening the outer nuts (A) fig. 14. The coolers are fitted with by-pass valves operable from the engineer's instrument board. In each case the forward cooler and the in-board tank serve the front engine. The piping is of aluminium, rubber-jointed with petrol-resisting hose.

WATER COOLING SYSTEM

57. The radiators are mounted in pairs above the engine nacelles, one on each side of the front engine strut. Each radiator has a header tank built on top for reserve water. The port side radiator in each case is piped to the rear engine. (See fig. 15).

58. The radiator is constructed with a baffle which covers the top of the tube block; it is open only at the front end and so prevents the rear portion of the block being uncovered when the aeroplane is in a diving attitude, and possibly trapping air in the block when the aeroplane returns to a normal attitude. When the aeroplane is afloat, the radiator should be filled to the level of the filler cap before draining off to the level of the pet cock, in order to minimise the possibility of an airlock in the block and to ensure that the radiator is filled to capacity. When the aeroplane is on the trolley, fill to the level of the filler cap.

59. The radiator shutters are mounted on tubes extending forward from the front engine strut and are not attached to the radiators. The complete shutter unit may be withdrawn in a forward direction by removing the two bolts marked * on fig. 15. Independent shutter control is provided for each radiator and is operated by hand gear on the engineer's instrument board. The final connection between the operating run and the shutters takes the form of a self-aligning dog clutch, so that should it be necessary to remove the shutters the run of wires and chains remains intact. A geared down indicator with adjustable stops is fitted to each operating handle. If it should become necessary to replace a control wire, care must be taken to ensure that the shutter has full open and closed travel when the indicator pointer is just <u>clear</u> of its stops, as these stops are only position indicators for the engineer and will be damaged if not clear. The actual stops for the shutters are provided by the shutter frame itself.

GAS STARTING SYSTEM

60. The gas starting system is illustrated in fig. 18, which clearly indicates the components employed and the run of the pipelines. All the starter and engine primer controls are grouped together on a panel mounted on the starboard side of the hull, immediately under the engineer's hatchway, so that all the engines may be started from within the hull. Access to the back of the panel is obtained by removing the cover plates situated on the top and underside of the lower centre plane.

61. The three air bottles are mounted in the starboard nacelle and are charged either by the main engine compressor, fitted to the starboard front engine, or by the auxiliary power unit. Provision is also made for the air bottles to be charged from an external source.

62. Three separate oil bottles are provided, (see fig. 16) one for each compressor on the auxiliary power unit and one for the main engine compressor. The oil level plug fitted on the side of each bottle should be removed when filling.

63. For the atomiser supply pipe, drain pipe and primer pipes, $\frac{3}{16}$ in. diameter copper tubing is employed, while for the air and gas pipelines, $\frac{3}{8}$ in. diameter aluminium tubing is used. The final runs to the distributors on the main engines are of $\frac{3}{8}$ in. diameter copper tubing.

HAND STARTING

64. Three starting handles, one of which is a spare, are stowed in a leather satchel attached to the starboard side of the hull in the vicinity of the engineer's hatchway. The engine primers and starter magnetos employed are common to both gas and hand starting systems.

REFUELLING

65. The three following methods are available for refuelling -

(i) By the auxiliary power unit, mounted in the port nacelle and accessible from a manhole door in the nacelle, which hinges up and forms a platform. A skin connection is provided on the inboard side of this nacelle for the attachment of the portable suction hoses which are stowed in the hull just aft of the midship cockpit. A filter is fitted in the suction line between the skin connection and the auxiliary engine pump and should be cleaned periodically. An instruction plate is fitted which gives the necessary information regarding the operation of the cocks.

(ii) By the Zwicky hand pump which is mounted on top of the hull just aft of the pilot's control cockpit. For this method the portable pipes are used, one for suction and one for delivery to the skin connection. Loose adaptors are supplied chained to the pipes to suit the connections on the Zwicky pump. The same skin connection is used as for the auxiliary power unit, but a cock is fitted to short-circuit the engine pump.

(iii) By hand filling through the filler necks on all tanks. The top tanks are reached by the ladder illustrated in fig. 31. Electrical bonding points are provided on each filler neck for use when hand filling.

FUEL JETTISON VALVES

66. A jettison valve having a nominal bore of 2 in., is fitted to each of the four fuel tanks. The valves are all of similar design and are easily removable for the replacement of seatings, etc. Each valve is bolted to a ring provided on the tank, a small projecting rim on this ring bedding down on to an annular "Langite" seating set in the flange of the valve body. The valve itself seats down on to a similar, but smaller ring.

67. The valves are connected by short lengths of rubber hose to 2 in. diameter pipes which convey the fuel to suitable outlet points on the underside of the lower centre plane at the rear engine struts in the case of the upper tanks, and on the starboard side of the planing bottom just behind the step in the case of the lower tanks.

68. The head obtained by the use of these pipes is largely instrumental in securing the high rate of discharge provided by these valves, any airleak in the pipes having the effect of destroying the head in the length of pipe below the leak. To obtain maximum efficiency therefore, it is important that all the rubber hose joints in the pipe-lines are quite airtight. In this connection it should be mentioned that the leak which would normally occur where the valve spindle enters the body casting is automatically guarded against when the valve is opened to its fullest extent by a special "Langite" washer.

69. The valves are operated by screw and nut devices, rotation of the cable drum causing the valves to lift. The control cables are brought down into the hull and thence forward into the pilot's cockpit. The pilot's control takes the form of four small handles mounted on the cockpit ceiling, accessible also to the auxiliary or second pilot. To fully open the valves approximately three revolutions of each handle are required.

ELECTRICAL INSTALLATION

Power supply and accumulator charging

70. Two sources of power are provided for this installation, namely:-

(i) A 500-watt, 40-amp. generator which is mounted in the port nacelle on the port side of the front engine, from which it is driven by means of a flexible drive. Terminal blocks, adjacent to the generator mounting, are furnished to accommodate the cable ends when the generator is removed.

(ii) A 300-watt, 12-volt dynamotor which is directly driven by the auxiliary power unit in the port nacelle. The dynamotor is also employed to start the auxiliary unit, power for this purpose being derived from an accumulator (12 v. 50 a.h. Alkaline, type M). A push-button switch on the main control panel (see fig. 17) is operated to make the necessary circuit for starting.

71. The cables from both generators are run to the main control panel and the change-over of the connections from the 500-watt engine-driven generator to the 300-watt generator is effected by 5-pin sockets on each cable which engage a 5-pin plug situated at the top of the control panel. A dummy plug is provided to receive the 5-pin socket of the generator not in use.

72. When the Alkaline accumulator is removed from the aeroplane, the leads which previously charged this accumulator are connected to a special dummy terminal block (see para. 75).

73. The engine-driven generator control consists of a standard Mk.II. battery cut-out, a special regulating switch, a fixed resistance unit, a 0-20 ammeter and a 20-0-20 voltmeter. The regulating switch has three positions - "Full Charge", "Half Charge" and "Off", and at the commencement of a flight the switch should be placed in the "Full Charge" position, when the generator will supply all loads connected, and in addition charge the Alkaline accumulator at about 3 amperes.

74. After a time, depending on the initial state of the accumulator, the fully charged state will be approached, this being indicated by the voltmeter showing a rise in voltage, which, if allowed to continue, may possibly reach 17 volts. The switch should be moved to the "Half Charge" position when the voltage exceeds 14½ volts, this change reducing the voltage to about 14 volts and the charging rate to a small value, say 0-1 ampere. When a fully charged accumulator is placed in the aeroplane, this effect will usually occur in the first few minutes.

75. It is imperative that the engine should not be run unless the Alkaline accumulator leads are properly connected to the accumulator or connected to the special dummy terminal block provided. The dummy terminal block will be found adjacent to the accumulator stowage, and is wired to the system in such a way as to prevent excitation of the generator if the aeroplane is flown without an accumulator. This is effected by connecting the accumulator negative lead to the generator positive lead through a resistance, thereby converting the generator control winding into a powerful shunt winding of demagnetising polarity when the control switch is in the charge position. It is immaterial which way round the connections are made as the two dummy terminals are electrically connected.

76. A small resistance (about 1 ohm) is incorporated in the dummy terminal block to limit the short circuit current which would flow due to residual generator voltage with the control switch in the 'off' position. A faulty connection in this circuit will lead to excessive voltage and damage to the generator and any services connected if the control switch is inadvertently placed in the 'charge' position.

77. Should it be desired to run any load from the accumulator with the generator removed, the charge switch must be in the 'off' position, otherwise the accumulator circuit is broken.

78. The accumulator charging switches, etc., occupy the lower half of the main control panel. The main switch for charging the 2-volt accumulators is on the left-hand side of the panel and the rheostat for regulating the charge rate is mounted in the centre. An 0-5 ammeter is mounted below the main switch to indicate the charging current. The main switch for the 12-volt 15 amp.hr. accumulators is on the right-hand side and a special coupled change-over switch is mounted in the centre at the bottom of the panel. The 20-0-20 ammeter for these accumulators is to the right and below the main switch. A tapping taken from both sides of the coupled change-over switch supplies the filament heating current for the wireless valves. The auxiliary driven dynamotor is regulated by a rheostat.

Lighting and flares

79. The port and starboard navigation lamps are situated at the tips of the upper planes and housed in the leading edge. Access to the lamps is obtained from the upper surface of the planes, but since tread-plates are not provided at these positions, a piece of 3-ply wood approximately 2 ft. 6 in. square and at least a ¼ in. thick should be placed across the ribs in the vicinity of each lamp when it is necessary to inspect them. This will ensure adequate support and prevent damage to the planes.

80. The tail navigation lamp is mounted on the stern of the hull, and all three lamps are controlled by the pilot from one unit of a 3-unit switchbox (see fig. 18), situated on his instrument board. The upward identification lamp is mounted above the upper centre plane on the centre line of the aeroplane. The identification switchbox with built-in morse key is also mounted on the pilot's instrument board.

81. The mooring lamp (white light) is carried at the top of a hinging mast above the upper centre plane; when the aeroplane is in flight the mast is lowered. The lamp is controlled by a switch situated outside the entrance hatch. Raising and lowering operations are effected by a cord which terminates at a cleat located on the starboard engine nacelle.

82. The steaming lamp is employed when the aeroplane is moving in darkness on the water. The lamp is mounted on the mooring lamp mast, immediately beneath the mooring lamp, and is controlled from the 3-unit switchbox previously referred to. The type of mooring mast supplied has two further lamp sockets located near the base but as these are not used they are blanked off.

83. The wing tip flares are carried below the tips of the lower planes and are operated by push-buttons, wired in the negative lead of this service. The flares master-control, wired in the positive lead, is provided by one unit of the 3-unit switchbox.

BOMB GEAR

General

84. Provision is made for carrying below the lower planes the alternative bomb and torpedo loads shown on fig. 19. The torpedo load is not releasable in flight. Each bomb position is numbered to coincide with the number on the release switch panels (see fig. 20).

Fusing

85. The main bombs are fused by two levers which are located to the starboard side of the bomb-aimer's cockpit. The left-hand lever operates the fusing gear for the port bombs and the right-hand lever the fusing gear for the starboard bombs.

86. Two bare wires, one for each fusing system, run from these levers along the starboard side of the hull to the top of the front spar frame where they diverge, one to port and the other to starboard. Following the run of the port wire, this then passes through the leading edge of the lower centre plane to the leading edge of the lower outer plane where it is connected to a lever mounted on a torque shaft. To the torque shaft are pinned two trip levers which project from the underside of the plane and which, in turn, engage trip levers positioned on the forward end of the external bomb beams. The universal bomb carriers are mounted in tandem on these beams and their fusing tubes are interconnected, thus making it possible for the bomb-aimer to fuse all bombs on the port plane by operating the left-hand lever. As previously stated, the starboard bombs are fused by operation of the right-hand lever. 'Tail', 'Nose' and 'Safe' positions are made clear by an indicator plate and notched quadrant. It is important that the bearings of the trip levers in the lower plane and the fusing gear on the bomb beams are kept thoroughly lubricated.

Releasing and bomb-aimer's controls

87. The main bomb load is released by electrically operated cartridge-fired bomb release gear, the selector switches for which are located to starboard of the bomb-aimer. The switches, which are in four units of four, are individually marked (see fig. 20) to correspond with the numbered bomb positions shown on the key diagram riveted to the inside of the hinged door that protects the switches. After closing the required selector switches, bombs are released by the operation of the pear-shaped firing switch common to all positions. It should be understood that every bomb for which a selector switch is closed will be released simultaneously by a single operation of the firing switch.

88. The entire bomb load can be discharged in emergency by the operation of a jettison switch which is disposed centrally below the selector switches. The wiring of the jettison switch is arranged in such a manner that operation of the switch energises all bomb releases, whether the selector switches are in the "on" or "off" position, and fires all cartridges. The jettison operation is performed by lifting the cover of the switch and depressing the indicating lamp bulb which forms the knob of the press type switch incorporated in the unit.

Pilot's controls

89. A selector switchbox, mounted on the instrument board, provides the pilot with alternative control of the port light series carrier i.e., positions 1, 2,3 and 4 in the bomb system. (see fig.20) This is to enable him to discharge flares, landing lights, smoke floats, etc. In these circumstances the pilot is given full and sole control of these positions by putting them out of circuit on the bomb-aimer's panel.

90. This is effected by transferring the 5-pin plug, controlling positions 1, 2, 3 and 4 on the bomb-aimer's panel, from its "live" socket to an adjacent "dummy" socket, thereby rendering impossible the accidental release of landing flares, etc., by the bomb-aimer. The pilot's firing switch, which works in conjunction with the selector switchbox, is of the fixed type and is mounted on the port side of the cockpit. A jettison switch is mounted immediately above the selector box on the instrument board and in an emergency the pilot can release the entire bomb load by depressing the indicator lamp of this switch. It should be noted that the pilot's jettison switch is effective under all conditions, even when positions, 1,2, 3 and 4 are out of circuit on the bomb-aimer's panel.

91. The pilot's controls are completed by a double-pole master switch, located on the instrument board adjacent to his selector switchbox. By placing the switch in the "off" position, and thereby cutting off the supply current, the pilot can render the whole release system inoperative. The switch is wired to a 2-way terminal block and 20 amp. fuse situated on the main electrical control panel (See fig. 17)

Light series carriers

92. The release of bombs, flares, etc., from the light series carriers is in general as described for the main bomb load, the only important difference being that release is effected by electro-magnetic slip instead of cartridge firing.

Bomb loading afloat

93. The loading winches (see fig.21) are fixed in position on the upper surface of the lower plane by dropping them over spigots, and securing them in position by the links and pins provided. The rear end of each winch is

held down by a knurled screw which is screwed down into a socket in the plane, midway between the rubber pads that provide a steady at the rear of the winch. The winches are ground equipment.

94. Access to the latch fittings and the spigot mountings for the winches is obtained by removing the cover plates on the upper surface of the lower plane; the covers are secured by quick-release catches.

95. The latches are secured in the "Free" position by the tapered locking-pin and the winch cables are fed down through the latch fittings to the waiting scow beneath. The cable ends are made fast to the stalk fittings on the bomb beam assembly after which hoisting may commence. Attention is drawn to the notice, located beneath the leading edge of the lower plane, referring to the projecting fusing levers, which reads:- "Levers must be at red line when loading bombs".

96. Hoisting should be continued until the cable connection appears at the latch fitting, co-operation between front and rear winch operators will ensure that this takes place simultaneously at both front and rear fittings. The catches should then be released by the removal of the tapered locking-pins and a further hoist of an inch or so will permit the tongues of the catches to snap into engagement with the slots on the stalks. The tops of the stalks are shaped in such a manner as to ensure smooth engagement and disengagement with the catch fittings. When engaging, a double-snap occurs at the catch fittings, but the tongues are only safely home at the second snap, when it is possible to insert the tapered locking-pins into the holes marked "Locked". Only after the locking-pins are inserted may the winch cables be removed. Replacement of the covers referred to in para. 94, automatically holds the tapered locking-pins in position. Finally the electrical connections are made beneath the leading edge of the lower plane just forward of the bomb racks, all of which are clearly marked for their respective bombs. Reversal of this procedure permits the lowering of the bomb beams.

Torpedo loading afloat

97. For torpedo hoisting (see fig. 21.) the winches are mounted on the centre spigot of the three at the front and the rear spars. No catches are provided at the centre spigots, as they are only torpedo hoisting points and are not arranged to carry bombs.

98. The suspension is taken wholly at the four bomb latches and the general procedure for hoisting and snapping home the tongues of the latches follows that adopted for the bombs. Before attempting to uncouple the winch cables it is important to see that all four latch tongues are correctly engaged and locked by the taper-pins. The winches may then be removed and the covers replaced.

WIRELESS INSTALLATION

Instruments

99. Provision is made in the fixed wiring for the alternative installations T.R.4, or T.X.45 and R.X.49 (see figs. 22 and 23). The motor generator, which provides the H.T. supply for either installation, is mounted on the bulkhead behind the wireless operator. The motor generator starting switch is situated above the porthole at the side of the operator. The filter unit, comprising two 1-mfd. condensers, two 2-mfd. condensers, an H.T. choke and an L.T. choke, is mounted in a crate on the shelf above the motor generator. The hand-driven generator is mounted on a partition

under the operator's table, above the battery crates, and the fixed wiring is so arranged as to allow for either installation being employed. The L.T. supply for either installation is obtained from a 12-volt accumulator through a rheostat and voltmeter panel. One of these chokes is cut out of circuit when the T.R.4 installation is in use, by the tumbler switch marked "Transmitter filament" situated on the side panel. When the transmitter-receiver, type T.R.4 is installed the side tone unit is mounted on a wedge plate provided on the operator's table. The H.F. filament chokes are mounted behind the wireless bulkhead above the instruments. When the T.X.45 and T.R.X.49 installation is employed the neutralising unit is fitted to a bracket provided at the right hand corner of the shelf above the instruments.

Aerials

100. Two overhead aerials are fitted, one for short wave and the other for long wave transmission and reception. The long wave aerial consists of two parallel wires each of which extend from an outer fin to a boom on the trailing edge of the upper centre plane. The lead-in is taken from the booms and the leads converge to an insulator, fixed to the centre plane panel wires, and then pass to a deck insulator on the port edge of the hull deck. The aerial attachments at the fins are each provided with a spring in order to provide for the adjustable incidence of the tail plane. The short wave aerial is attached by insulators to the port boom on the upper centre plane and to a deck insulator, similar to those employed for the long way aerial. The aerial leads inside the hull are of 3/16 in. diameter copper tubing, rubber-covered.

101. A trailing aerial is provided with its operating winch mounted on a wedge plate. The aerial is paid out through the hull by way of an insulated fairlead. A watertight cap is furnished from this insulator when the fairlead, or inner portion, is removed. As the top of the insulator is approximately only 12 in. above the normal waterline, the aerial must be wound in and the watertight cap fitted before landing; failure to observe this precaution will result in the compartment becoming flooded.

INTERCOMMUNICATION INSTALLATION

102. A combined microphone and telephone jack is provided at each of the eight stations in the aeroplane (see fig.24). For communication a selector switch, controlled by the wireless operator, is fitted. The installation includes an amplifier, three 2-volt accumulators, two 60-volt H.T. batteries and appropriate plugs, sockets and terminal blocks.

103. The amplifier is mounted on the shelf above the wireless installation and the selector switch is situated on the instrument panel. The batteries and accumulators for the H.T. and L.T. supply, are housed in a crate, marked I/C, which is located below the wireless operator's desk.

MARINE EQUIPMENT

General

104. The aeroplane is provided with all the necessary marine equipment, the components of which are of the usual type and needing no special mention.

Bollards, etc.

105. A main mooring post is situated at the bow on the centre line of the aeroplane, and it may be left in its operating position except when the bomb sight is to be used. Stowage is provided for the post on the starboard side of the front air gunner's cockpit. A pair of twin bollards for heaving lines, etc., is situated one on each side of the front air gunner's cockpit. A large fixed eye for anchoring purposes is located on the keel, aft of the rear step, and a large single bollard is situated at about the same position aft, but on the top of the hull. Holding-down eyes are provided below the tips of the lower planes, and anchoring eyes for boats are furnished on the inboard sides of the wing tip floats.

Mooring.

106. The main mooring is from an eye, situated at the keel near the bow, which carries the usual pennant and shackle. Associated with it is a riding pennant anchored at the junction of the keel and the chine and terminating in a running block embracing the main mooring pennant.

107. Supplementary storm mooring, or towing gear, is provided by a three-legged bridle, the legs of which are coupled to a shackle; the short centre leg terminates in a noose that fits over the main mooring post. The outer legs terminate in quick-attachment fittings which embrace the jacking points situated below the roots of the lower planes. The attachment fittings may be placed in position by lying prone on the plane and reaching over the leading edge.

108. Anchor mooring is also provided by a Mark XIIA. anchor and a chain. The anchor is stowed on the starboard side of the front air-gunner's cockpit and the chain in a locker below the floor of the cockpit. Sheaves for the anchor chain are situated as follows:- One stepped into the top of the main mooring post (this sheave is stowed on the starboard side of the front cockpit) and another on a hinging stowage below the floor.

109. The end of the anchor chain is attached to a strong point on the keel to which is also attached, by a short pennant, a claw-type chain stopper, this may be secured to the chain at any point and so permit any desired length of chain to be paid out. Heaving lines, boat hook and drogues are also provided. For details of the mooring equipment see fig. 25.

BILGE SYSTEM

Power

110. The main bilge pipeline runs longitudinally through the hull and picks up the bilge pipes from the various watertight compartments (see fig. 26). Each pipe is fitted with a hand controlled valve, the positions of which are indicated by labels. The suction pipe, connecting the main pipeline to the auxiliary engine pump in the port nacelle, runs to the pump by way of the lower plane rear spar and rear engine strut. A coarse mesh filter, incorporated in this pipeline, is located at the rear spar frame. The delivery pipe from the auxiliary engine pump passes down the rear engine strut and discharges from the underside of the lower plane.

Hand

111. A portable hand-operated bilge pump is provided, the suction hose of which is attached to a connection fitted in the main pipeline, just forward of the midship cockpit. The connection to which the suction

hose is attached is furnished with a blanking cap which is removed only when the hand pump is employed. Before bilging operations commence, the discharge hose should be led outboard through any convenient opening. The pump is stowed forward of the midship cockpit.

112. The hand pump may be detached from its stowage and fitted with the nozzles provided, to remove local water. The nozzles are stowed adjacent to the pump.

113. Bilge water is pumped from the floats by means of the hand pump. Four suction connections are provided on the upper surface of the lower plane immediately above each float, and suitable adaptors are stowed in a bag adjacent to the pump stowage.

AWNINGS, VENTILATORS, ETC.

114. Two large triangular awnings are provided for use while on the water in tropical climates. The lower points of the awnings are attached to two bollards located one forward and one aft on the hull decking. The upper points and edges are secured to the centre and outer planes (see fig. 27). When erecting the awnings, use should be made of the aileron inspection ladders illustrated in fig. 31. The awnings are of such a width as to cover the engine nacelles, and thus afford protection from the sun to personnel working on the engines.

115. Six large ventilator scoops are provided. These may be used at any of the opening portlights to assist in ventilating the hull while the aeroplane is operating under tropical conditions. Canvas covers are furnished for the engines, the airscrews and the midship cockpit.

EMERGENCY EQUIPMENT (VARIOUS.).

116. In addition to the parachute stowages a number of other items can conveniently be grouped under this heading.

117. The hull is provided with a number of watertight partial bulkheads of such a height as to permit any one compartment being flooded without overflow into the adjoining compartments. In order to provide a reasonable gangway, parts of three of these bulkheads are hinged and normally lie flush with the flooring of the hull, but may readily be closed upwards and clamped into position.

118. Each compartment in the hull is provided with a bilge pipe connection for both power and hand bilging (see fig. 26).

119. For access to the hull bottom all floors, etc., are readily removable and for emergency repairs a box of leak stoppers is provided in the engineer's tool locker.

120. In addition to the usual signal pistol and cartridges, six distress signals are carried, three in housings adjacent to the midship cockpit and three in a compartment in the upper surface of the upper centre plane. Access to this compartment is gained by means of a rip wire.

121. An inflatable rubber dinghy, complete with bellows, short paddles and emergency rations, is stowed in the hull aft of the midship cockpit and a further stowage for emergency rations is provided below the cooker table.

HANDLING

122. The aeroplane is transported to and from the water on a wooden cradle mounted on a standard trolley. Cables are fixed to the rear of the trolley, one on each side, and with their free ends terminating in hooks. These cables when hooked into eyes on the sides of the hull serve to correctly position it above the cradle (see fig. 28). Alternatively the aeroplane may be lifted from the water by a crane and by the use of the sling illustrated in fig. 29.

123. If the aeroplane is beached in an emergency it may be brought to and maintained on an even keel by means of the adjustable beaching legs (see fig. 30) fixed under the jacking points at the lower plane roots.

MAINTENANCE

Engine footrails, ladders, etc.

124. One pair of engine access footrails is provided complete with canvas tool catchers (see fig. 31). The footrails are each made in two sections, the forward portion of each being intended primarily for airscrew removal. A plank placed transversely across the extreme forward ends of the two footrails provides access to the spinner and airscrew hub bolts.

125. Each rail is attached by two spherical plugs at the top of the two vertical tubes, front and rear, and by a pin at the bottom of the front tube, all of which slide into suitably designed sockets bolted to the side of the nacelle.

126. The forward extension, which is readily detachable for stowing, is provided with a third ball plug for convenience of erection. When the footrail, complete with extension, is erected the front ball should first be entered into the long slide on the front end of the nacelle in order to take the overhung weight. The rail should then be pushed forward until the front attachment ball proper can be entered into the same slid further movement forward then disengaging the first ball. Still further movement forward will allow the rear attachment ball to be entered into its appropriate slide, the lower front pin entering immediately before the footrail is pushed right home.

127. A fabric bucket seat is supplied for obtaining access to the fuel and oil pumps, jets, etc. below the engine. It may be slung from the eyes provided on the footrails. Eyes are provided on the centre line of the engine cowling, adjacent to the nacelle strut, to which a safety line may be attached.

128. A ladder is supplied for access to the upper centre plane for hand refuelling, etc. The top rung of this ladder hooks on to fittings attached to the top centre plane just inboard of the nacelles. Fork-bolts are provided on the vibratory struts for securing the lower end of the ladder by means of the drop-ended pin attached; similar pins are also employed for hooking the upper end. The ladder may be fitted on either the port or the starboard side of the centre plane. It is stowed on hooks on the port side of the hull, aft of the rear spar frame. The manhole cover below the nacelle, when open provides a convenient platform from which the lower end of the ladder may be reached, and also provides access to the oil tanks, auxiliary power unit and the top of the nacelle.

Aileron inspection ladders

129. Two ladders are provided and also a plank which may be supported between them (see fig. 31). By the aid of these ladders the lubrication and inspection of the aileron hinges, etc. may be effected.

ENGINE CHANGING GEAR

Engine jib

130. A jib, with all necessary accessories, is provided for the purpose of changing engines and equipment pertaining thereto, either when the aeroplane is ashore or afloat.

131. Toward the lower end of the jib (see fig. 32) a cable-driven winch is housed, operated by a pair of crank handles. A cable runs from the winch and passes up inside the jib to a pulley situated at the top, and thence over a second pulley fitted with a sheave and an attachment bolt; the latter picks up the links on the lifting bar (see para. 134).

132. When in use the lower end of the jib, which is furnished with a fixing bolt, is located in screwed sockets on the top of the hull or lower centre plane. The sockets are provided with brass blanking plugs to prevent the ingress of dirt when the jib is not employed.

133. The upper end of the jib is held in position by a tie-wire anchored to the front or the rear spar of the upper centre plane, this depending on whether a front or rear engine is to be fitted. The tie-wire is adjusted approximately for the necessary service by means of a number of link plates, suitably labelled, inserted in its length, whilst fine adjustment is effected by a screwed adjuster, also located in the tie-wire run, which is operated by a tommy bar (see fig. 32).

Engine lifting

134. The engine that is to be slung is lifted by flexible cable slings which pass under the reduction gear casing and the crankcase at the carburettor end (see fig. 32). The cable ends terminate in eyes which are attached to two tubes fitted to either end of the lifting bar; on the lifting bar are the two link plates that accommodate the attachment bolt referred to in para. 131. It should be noted that padding of a soft nature must be applied to the slings where they come in contact with the engine.

Radiator lifting

135. A special sling is provided for slinging the radiators. The sling consists of a padded fabric band, which passes around the upper end of the tube block, and a pair of wire pennants which attach to the radiator lower rear fixing eyes (see fig. 33). The sling may be readily attached when the radiator rear securing bolts are removed and the radiator hinged forward on the front bolts. The jib and winch employed for engine lifting are employed for hoisting purposes.

Airscrew lifting

136. The engine jib and winch are again employed, and a split shackle is provided which is secured to the attachment bolt on the winch cable lower pulley (see fig. 33).

SPARE ENGINE AND AIRSCREW TRANSPORT

137. Provision is made for the transport of a spare engine on the top of the hull between the main spar frames (see fig. 32). The engine, complete with special transport trolley, is hoisted by the jib referred to in previous paragraphs, and lowered on to a pair of demountable rails which attach to the front and rear spar frames and project forward therefrom to receive the cradle.

138. The rails are attached to suitable fittings (see fig.32) which in turn are secured to the top of the hull by bolts that enter screwed sockets provided thereon. When the rails are not fitted, the sockets are closed by brass blanking plugs. At the forward end the rails are joined by a detachable distance piece (see fig.32) which must always be secured in position before an engine is lowered on to the rails. The distance piece acts as a tie-bar and prevents the rails from spreading.

139. The engine trolley, when lowered on to the rails, may be wheeled aft to the correct stowage position where it should be firmly clamped by the fittings provided. A canvas cover is provided to protect the engine when carried in this position.

140. Stowage is provided for two spare airscrews in the rear end of the hull; the tractor airscrew is stowed on the port side and the pusher airscrew on the starboard side.

DOMESTIC EQUIPMENT

141. An ice chest of special design is provided, having an inner grid food container around which ice is packed. Insulating material is inserted between the double skin of the outer casing. A cock is provided for draining purposes and the complete chest is readily removable for cleaning.

142. The lavatory fitted is of the "Elsan" chemical type which has a removable inner container within an outer shell. The shell is connected to a special venturi type ventilator. To ensure satisfactory service, it is important that the removable container is charged with the special "Elsanol" chemical solution, a one gallon tin of which is stowed in the lavatory compartment.

143. The correct procedure for charging is to pour approximately one gallon of clean water into the bottom of the container and stir well into this about one pint of the concentrated chemical. The outfit is now ready for use and requires no further attention until the container becomes half full when it must be removed, emptied and recharged as above. When not in use the lid should always be closed.

144. A Clyde cooker is provided having two standard Primus stoves as heating units. The cooker is mounted on a stand covered with stainless steel, which ensures adequate protection from fire. Stowage is provided for 1½ gallons of paraffin on the port side of the galley.

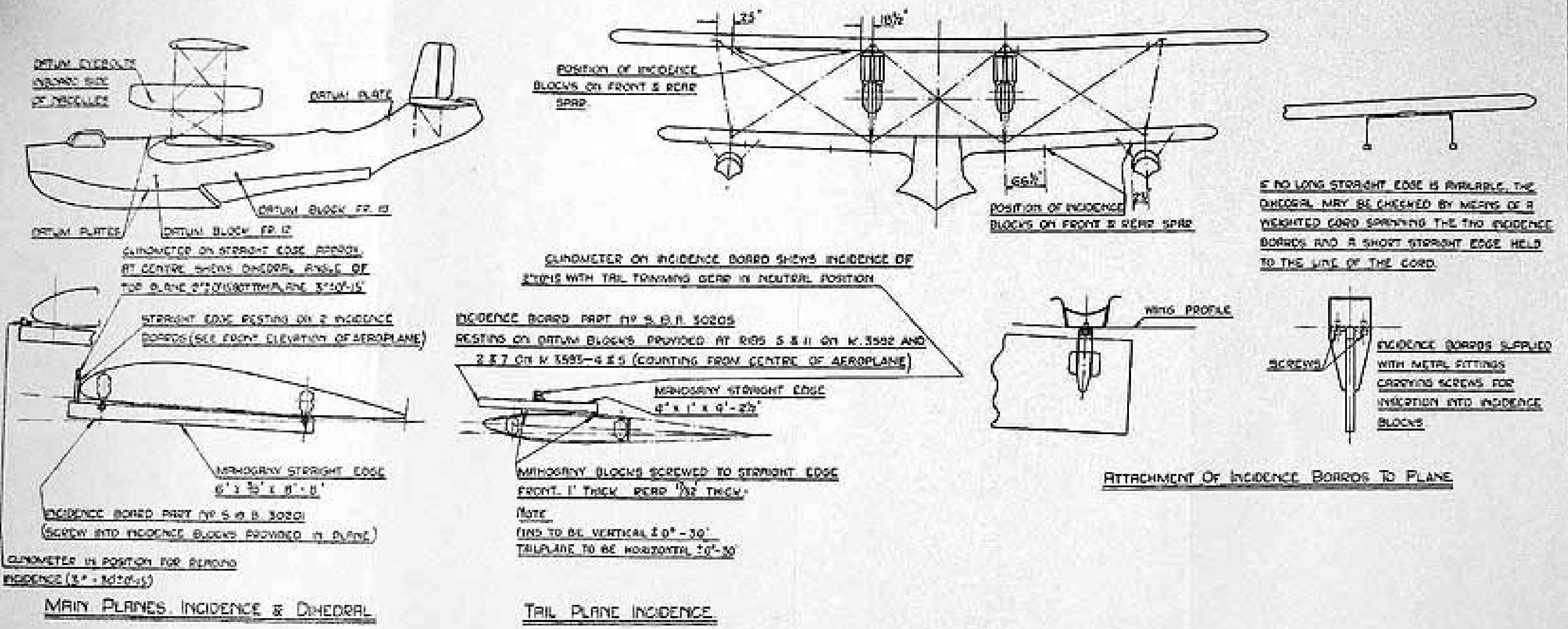


FIG. 1. RIGGING DIAGRAM

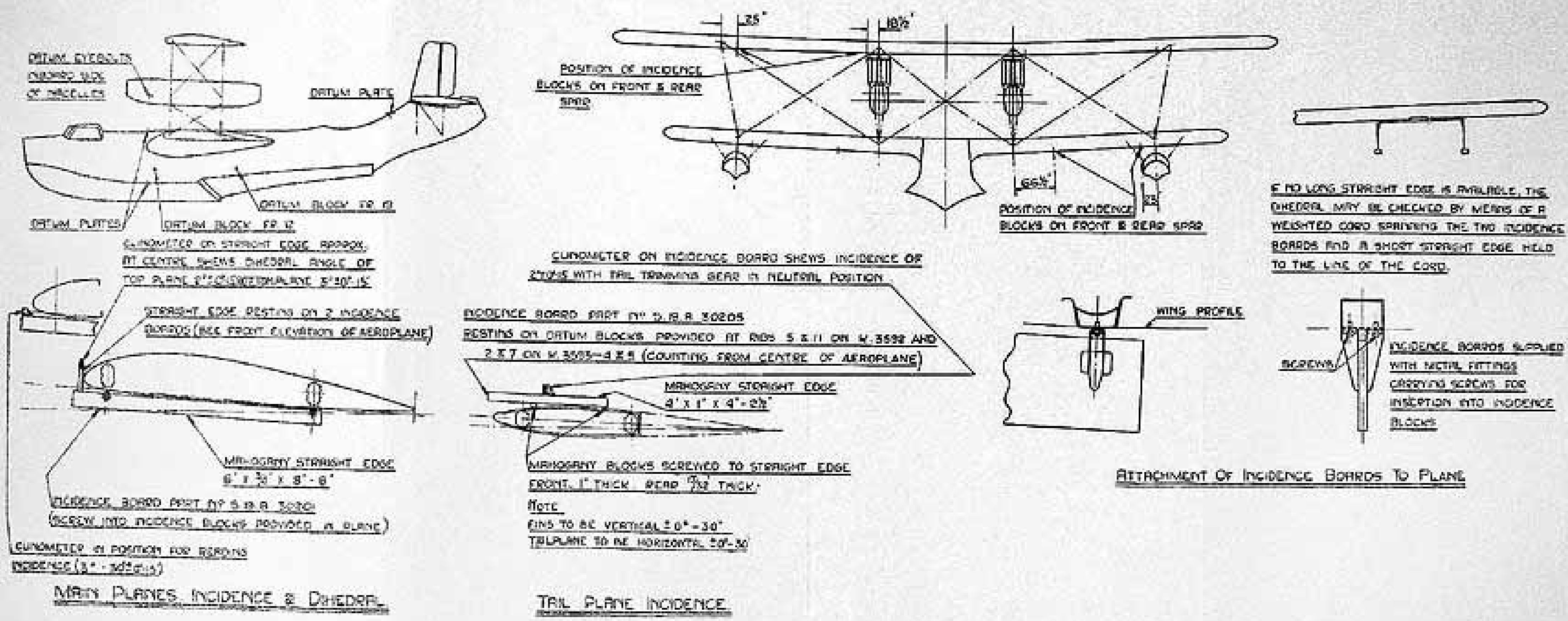
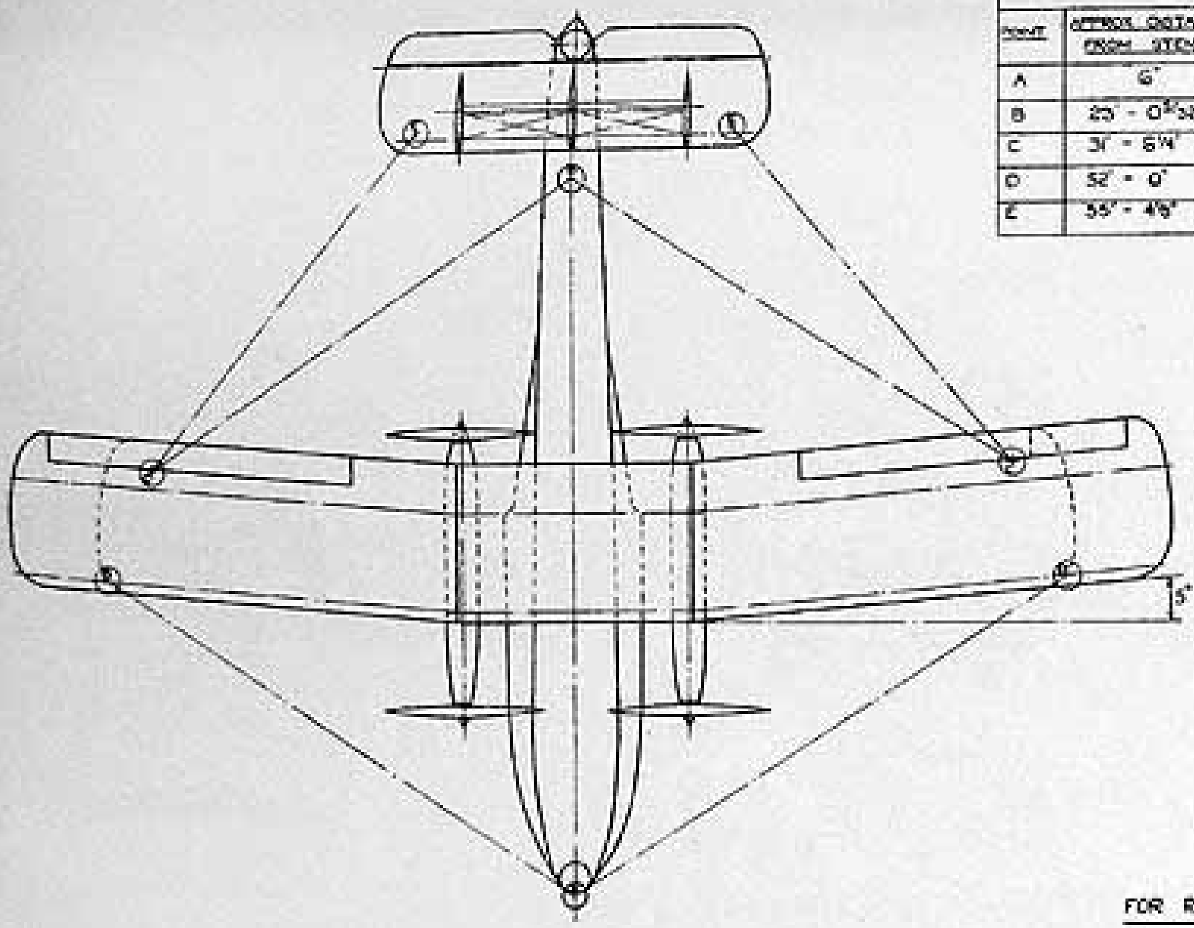


FIG. 1. RIGGING DIAGRAM



POSITION OF DATUM POINTS.			
POINT	APPROX. DISTANCE FROM STEM.	APPROX. DISTANCE FROM ℄ OF AEROPLANE	DESCRIPTION OF POSITION.
A	6"	0	ON FRONT BOLT OF FORWARD GUN RING
B	25' - 0 3/32"	37' - 2 1/8"	ON FRONT HANDLING EYE AT WING TIP (BOTTOM PLANE)
C	31' - 6 1/4"	33' - 7 11/16"	ON 1ST AILERON HINGE RIB FROM WING TIP (BOTTOM PLANE)
D	52' - 0"	0	OUTSIDE HULL ON TOP NEAR LEADING EDGE OF TAIL PLANE.
E	55' - 4 1/8"	12' - 3"	ON TOP SURFACE OF TAIL PLANE NEAR FRONT SPAR TIP.

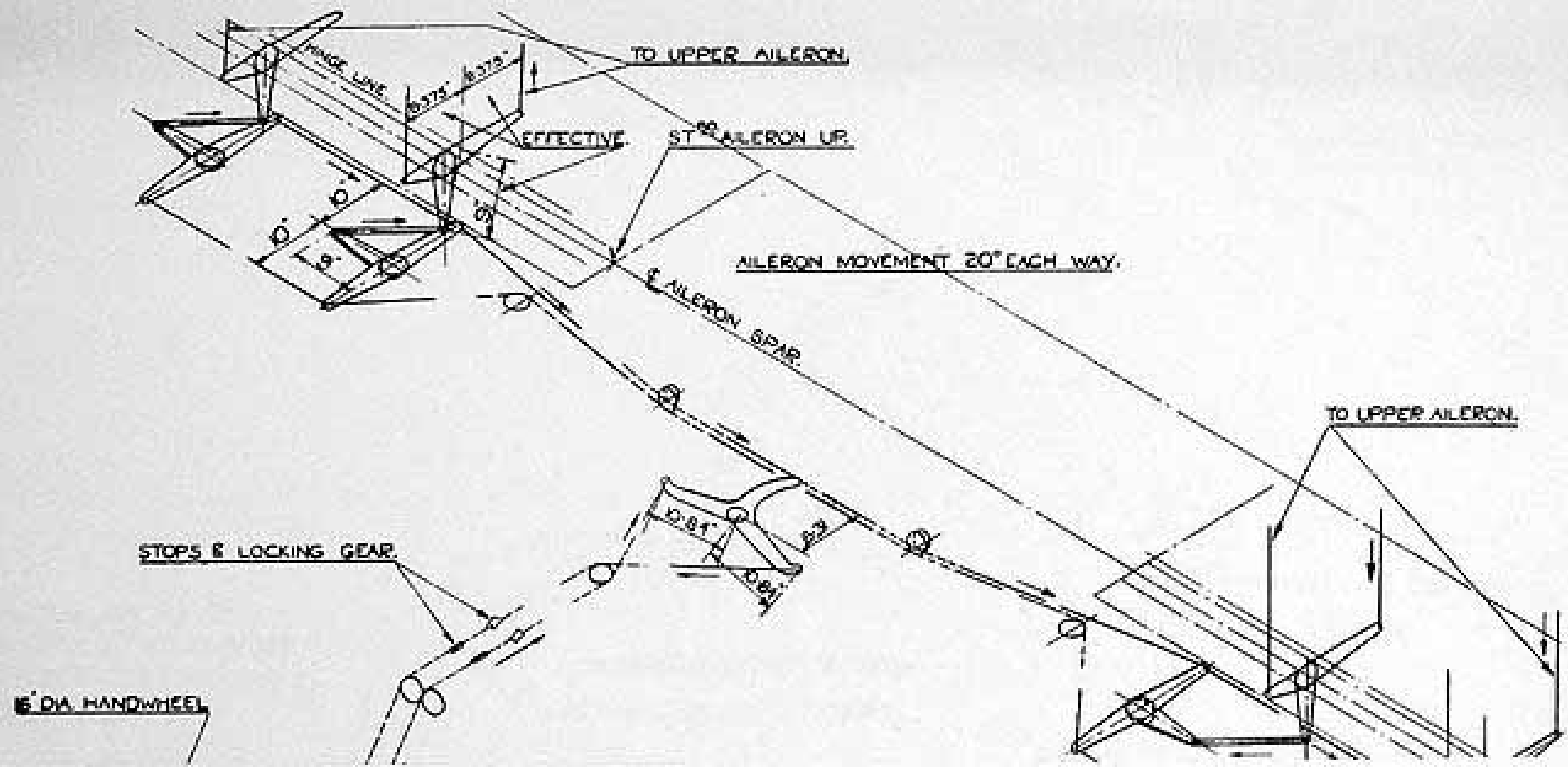
THIS TABLE IS ONLY FOR USE AS A GUIDE IN FINDING DATUM POINTS.

RIGGING LENGTHS		TOLERANCE
A TO B	43' - 4 1/4"	± 3/4"
C TO D	39' - 3 1/2"	± 3/4"
C TO E	32' - 4"	± 1 1/8"

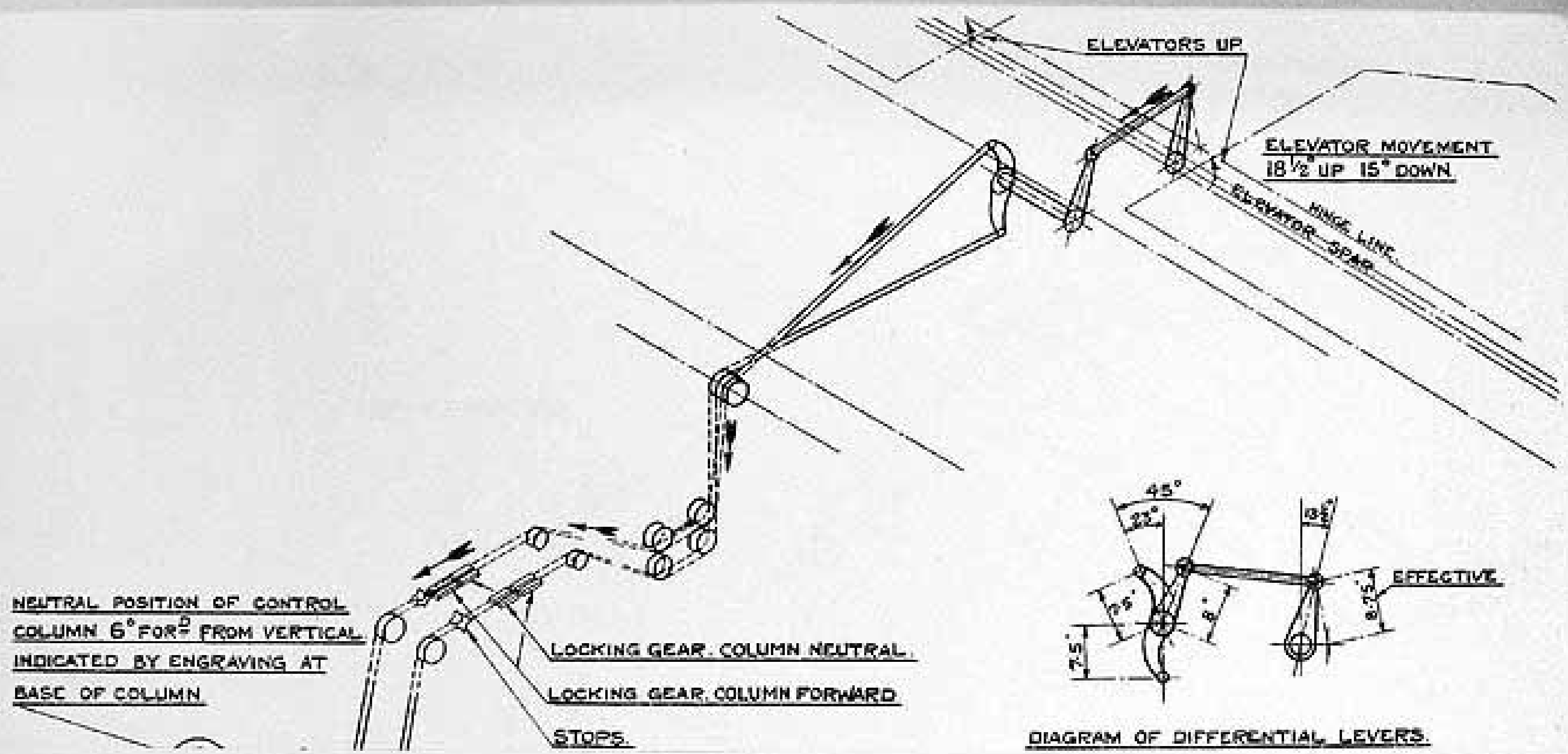
FOR RIGGING, INCIDENCE & DIHEDRAL, SEE FIG. 1.

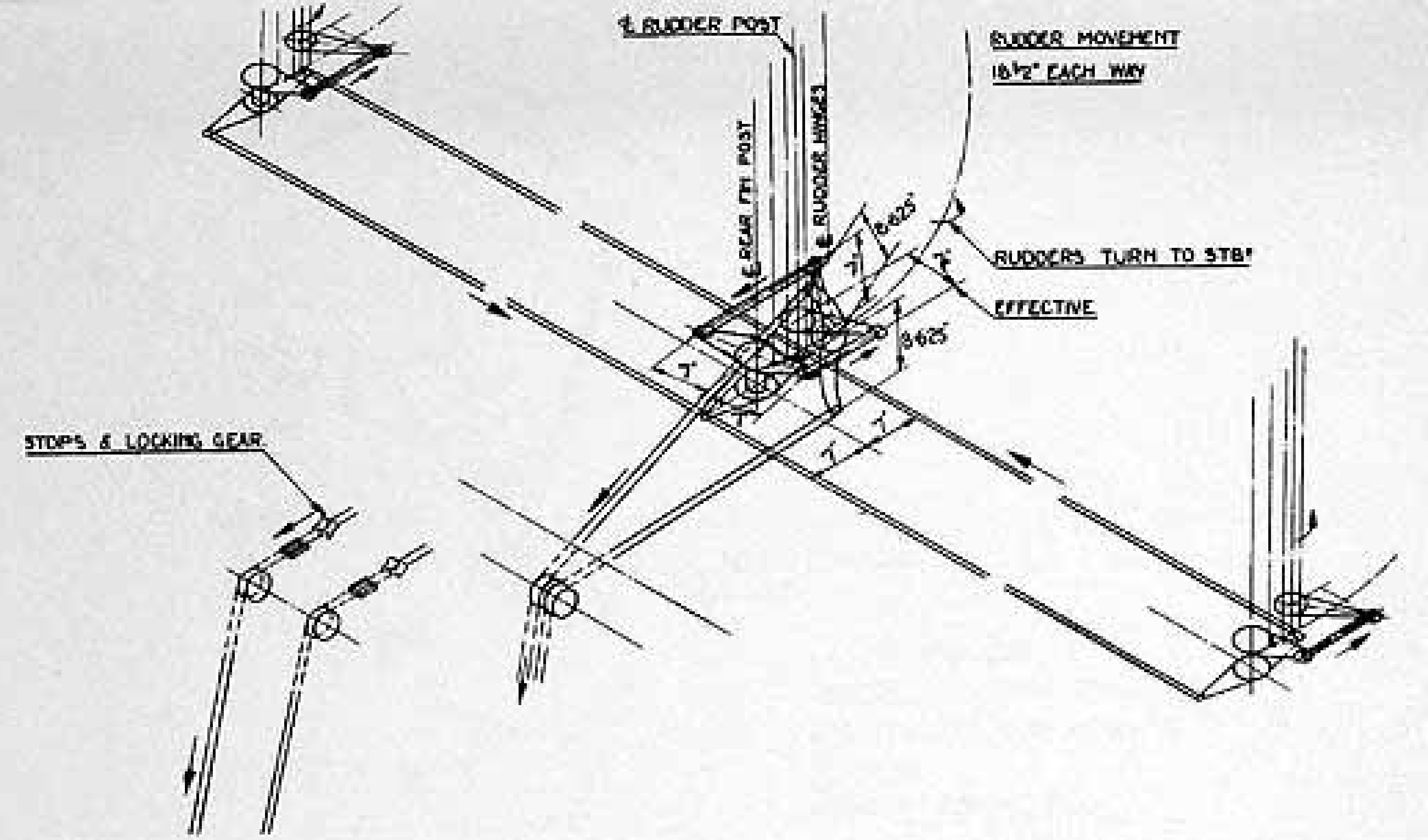
(406)

FIG. 2. RIGGING DIAGRAM

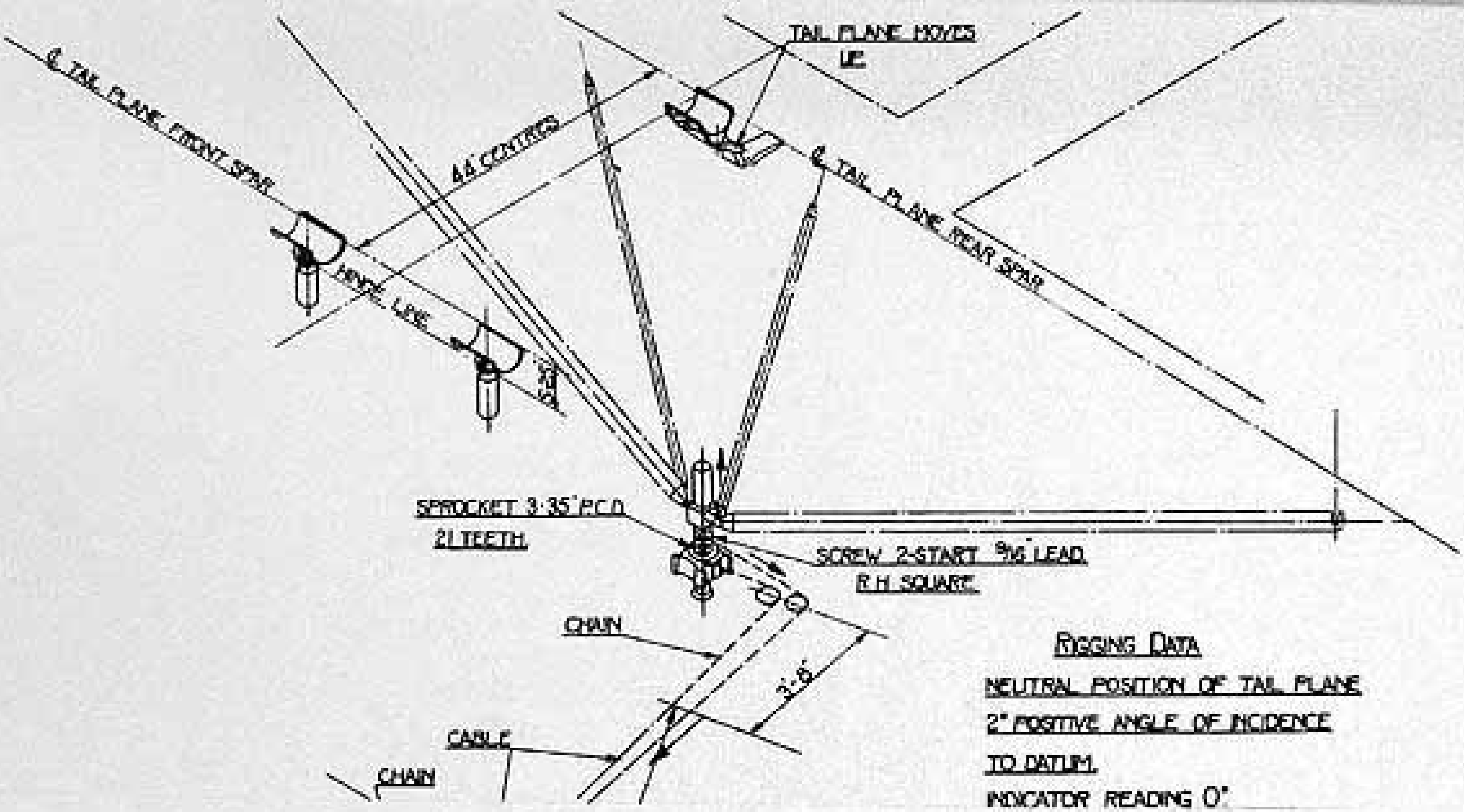


TO UPPER AILERON.
HINGE LINE.
6.375"
6.375"
EFFECTIVE.
ST^D AILERON UP.
10"
10"
8"
5"
AILERON MOVEMENT 20° EACH WAY.
℄ AILERON SPAR.
10.84"
10.84"
6.3"
TO UPPER AILERON.
STOPS & LOCKING GEAR.
16" DIA. HANDWHEEL.


ELEVATORS UP
ELEVATOR MOVEMENT
18½° UP 15° DOWN
HINGE LINE.
ELEVATOR SPAR
NEUTRAL POSITION OF CONTROL
COLUMN 6° FORD FROM VERTICAL
INDICATED BY ENGRAVING AT
BASE OF COLUMN
LOCKING GEAR. COLUMN NEUTRAL.
LOCKING GEAR. COLUMN FORWARD
STOPS.
45°
22°
13½°
EFFECTIVE.
8·75"
7·5"
8"
DIAGRAM OF DIFFERENTIAL LEVERS.

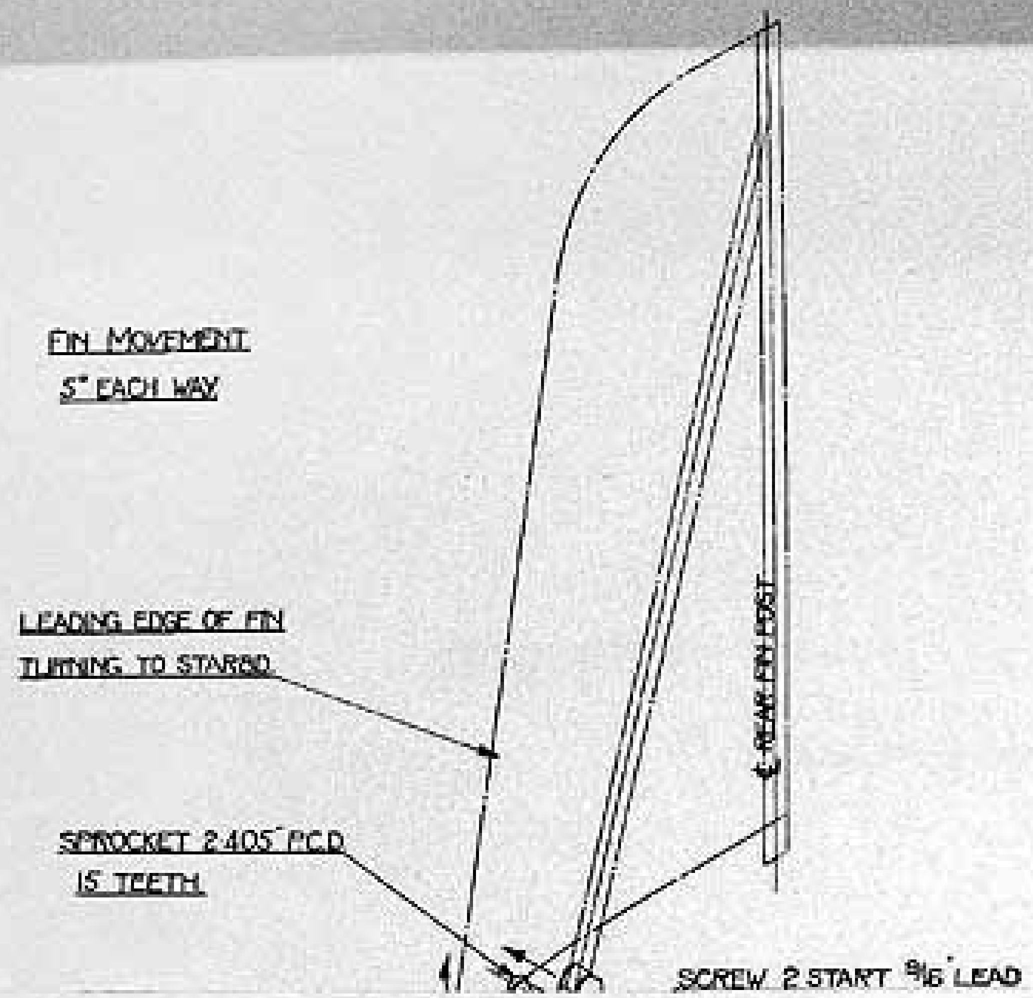


℄ RUDDER POST
RUDDER MOVEMENT
18½" EACH WAY
℄ REAR FIN POST
℄ RUDDER HINGES
RUDDERS TURN TO STBᵈ
EFFECTIVE
3.625"
STOPS & LOCKING GEAR



RIGGING DATA

NEUTRAL POSITION OF TAIL PLANE
2° POSITIVE ANGLE OF INCIDENCE
TO DATUM.
INDICATOR READING 0°


FIN MOVEMENT
5° EACH WAY
LEADING EDGE OF FIN
TURNING TO STARBD.
SPROCKET 2.405" P.C.D
15 TEETH
SCREW 2 START 9/16" LEAD
℄ REAR FIN POST

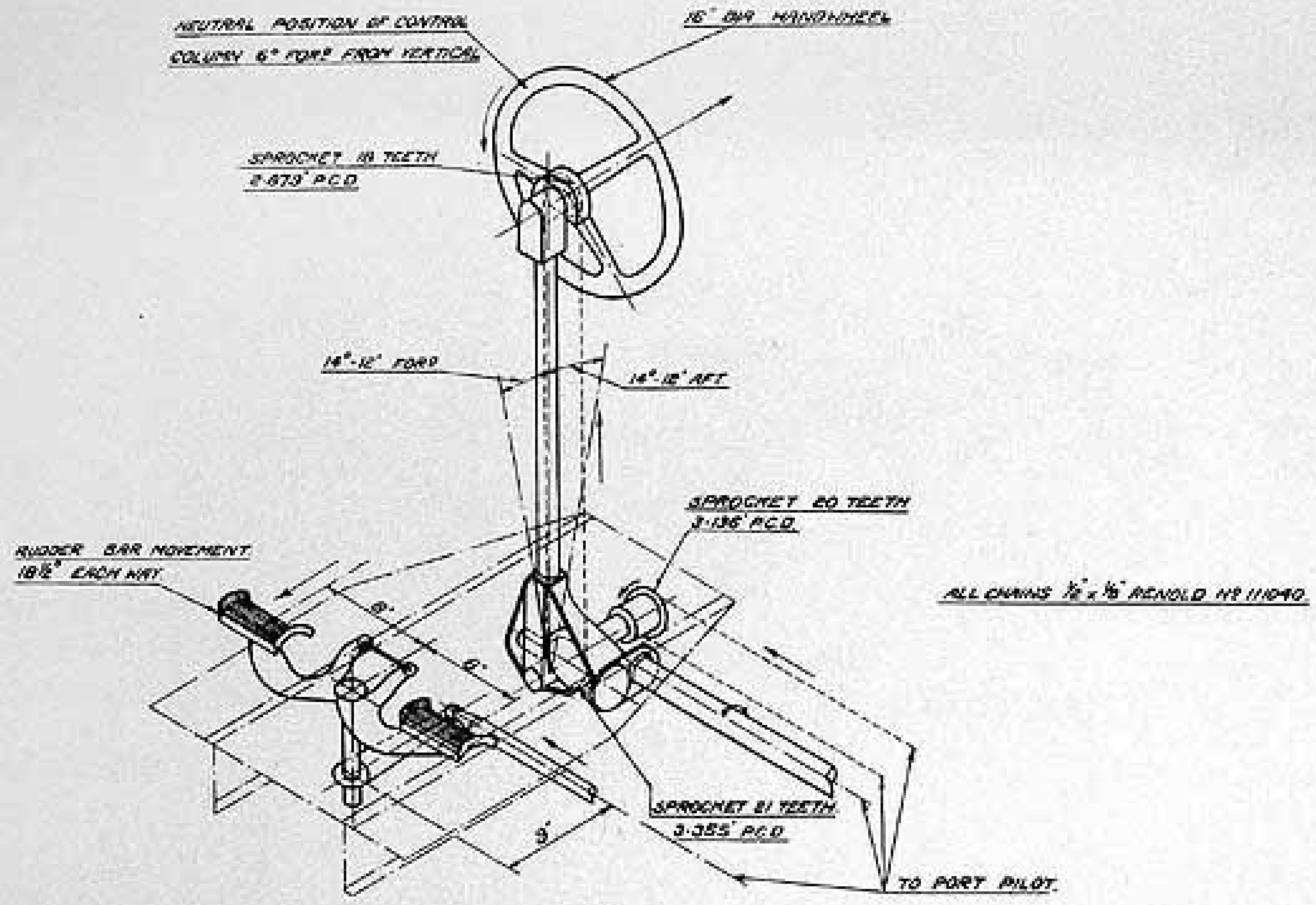


FIG. 8. AUXILIARY PILOT'S CONTROLS

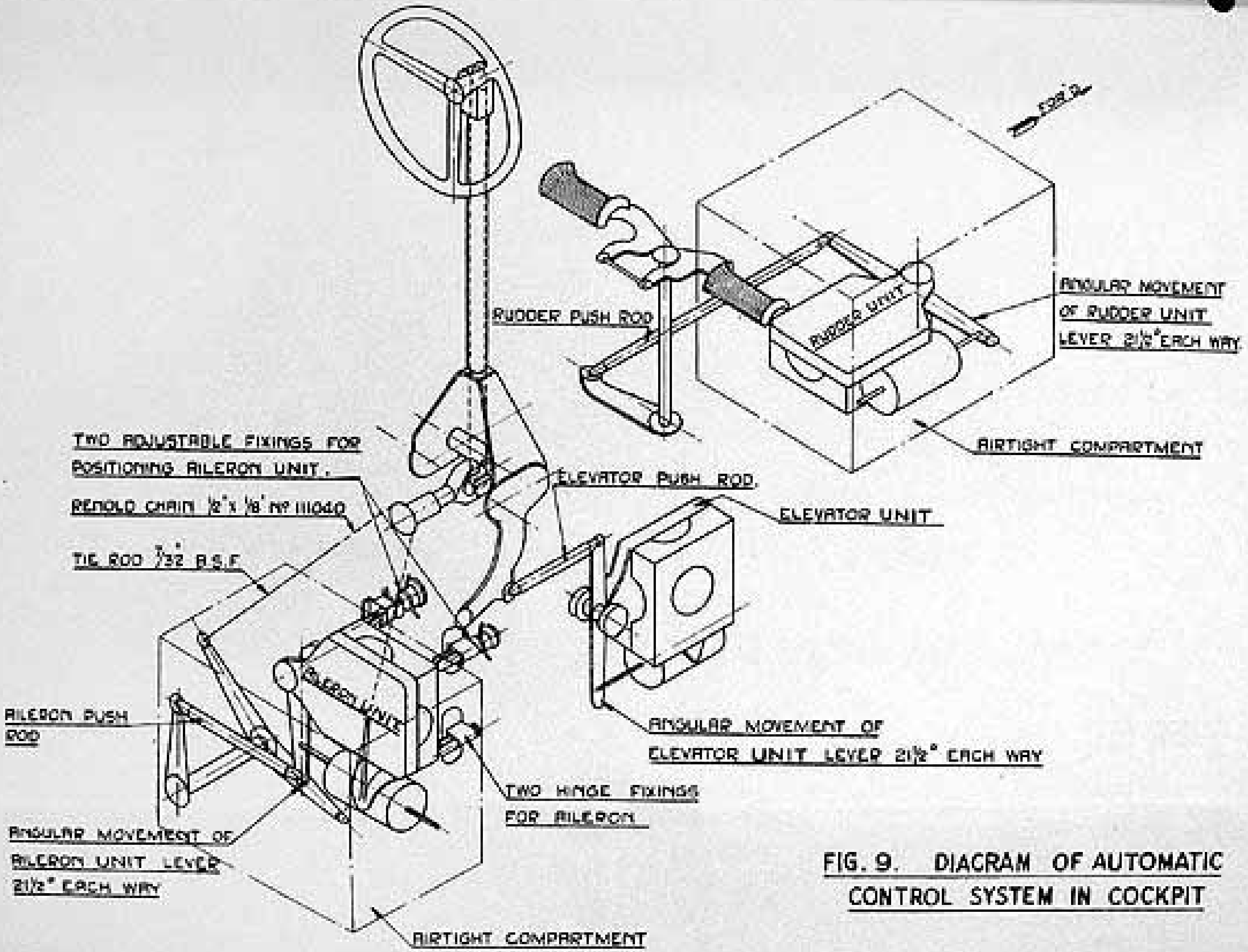


FIG. 9. DIAGRAM OF AUTOMATIC CONTROL SYSTEM IN COCKPIT

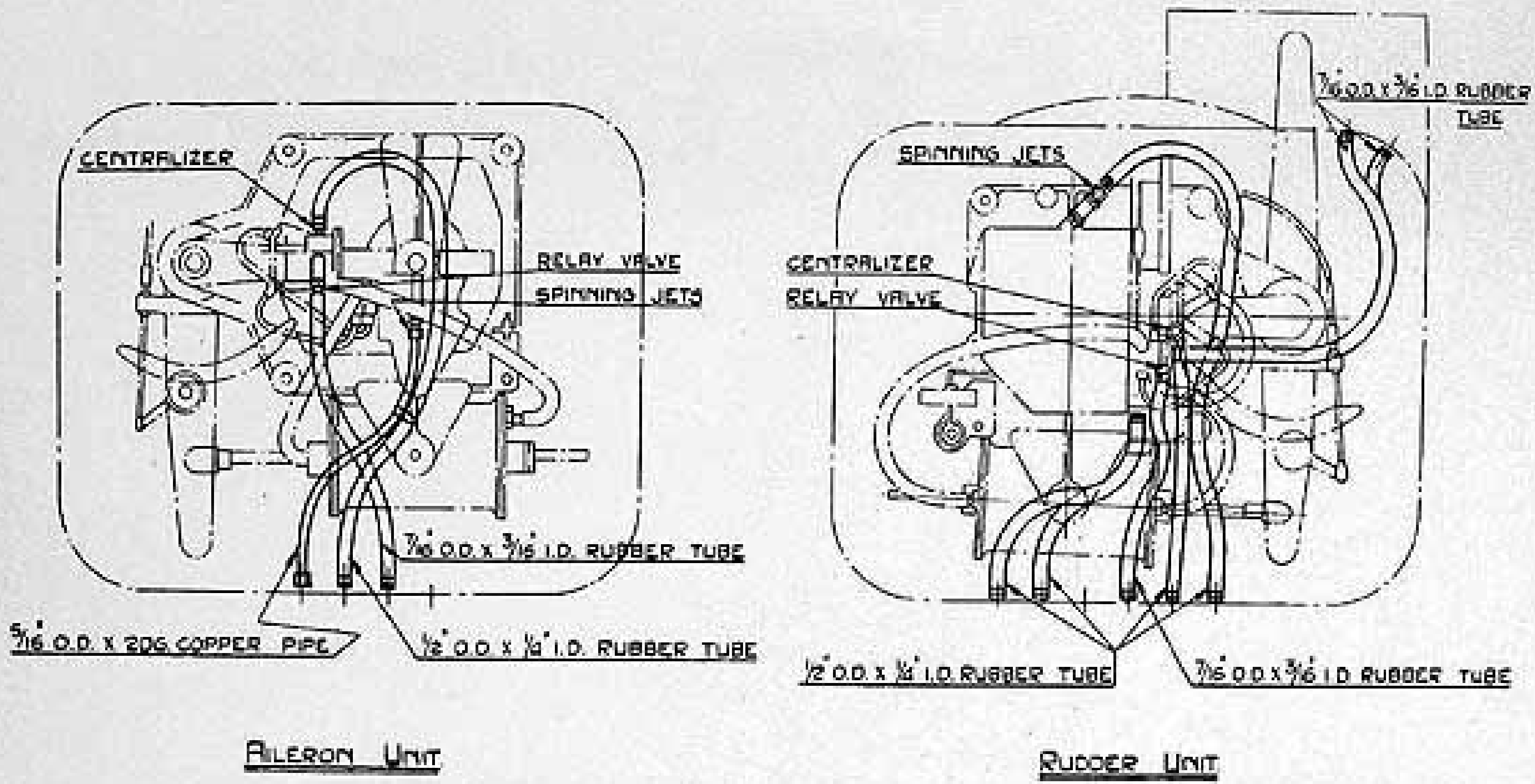


FIG.10. PIPE CONNECTIONS OF AUTOMATIC CONTROL COMPARTMENTS

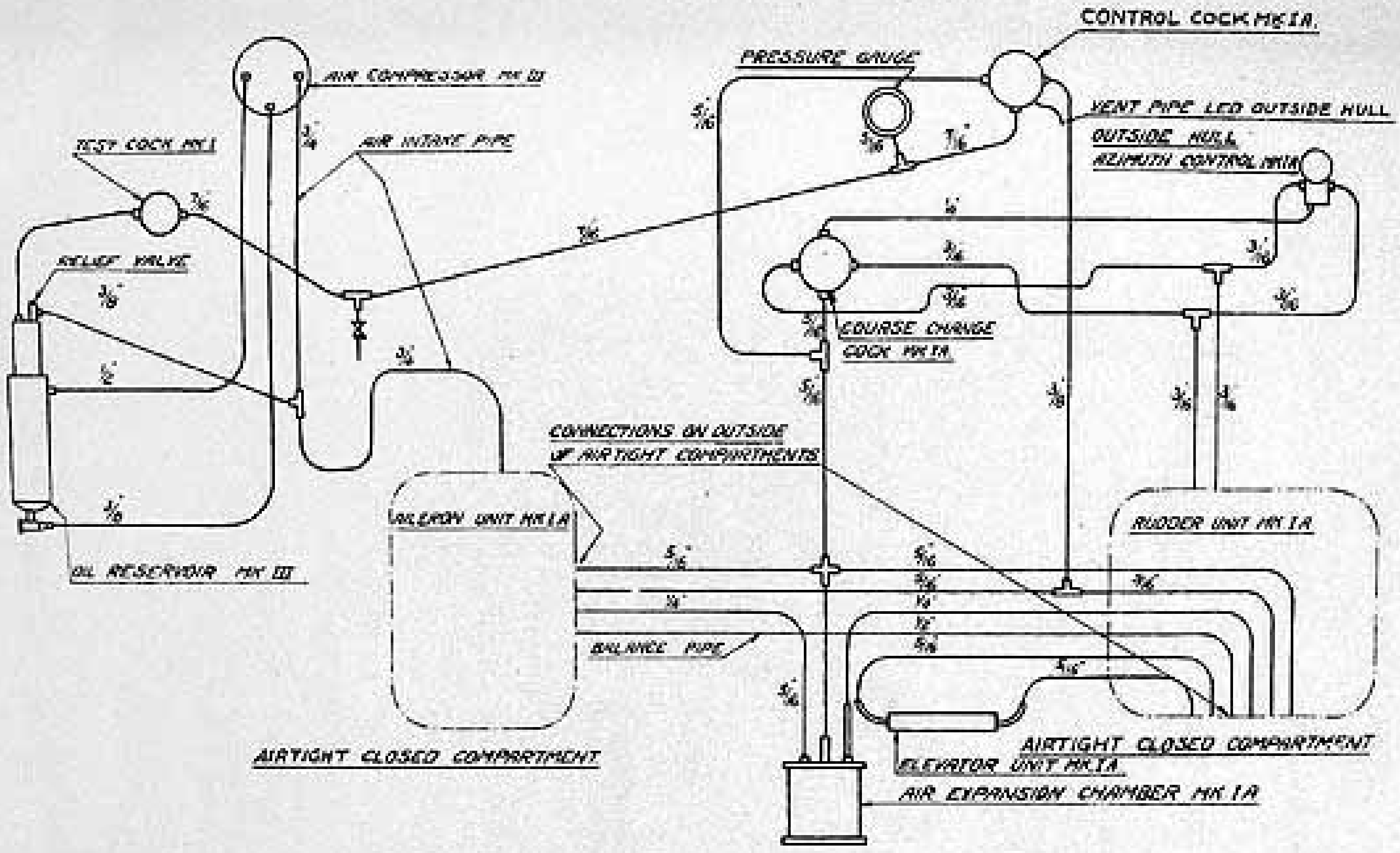


FIG. II. PIPELINE DIAGRAM FOR AUTOMATIC CONTROL INSTALLATION

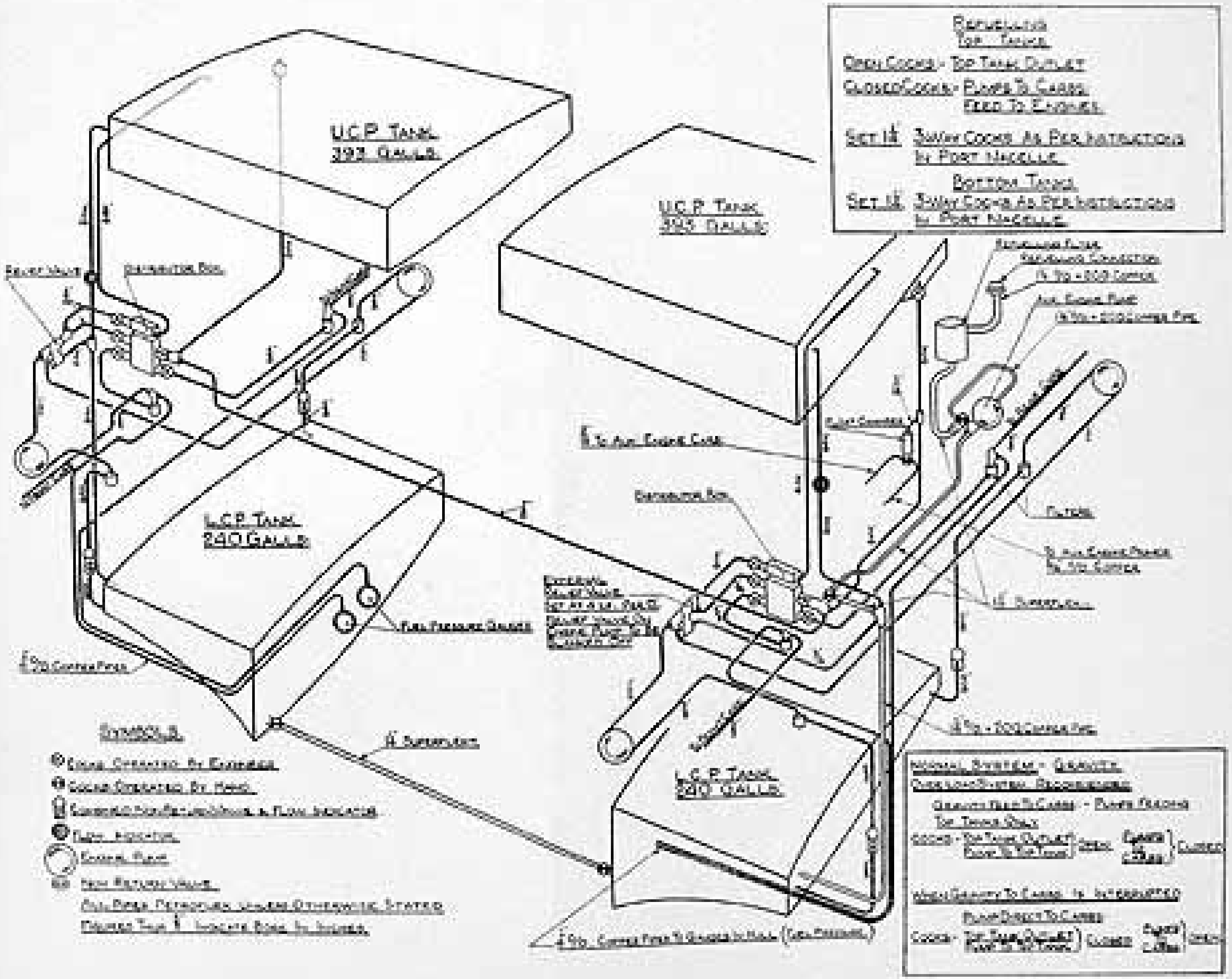


FIG. 12. FUEL SYSTEM

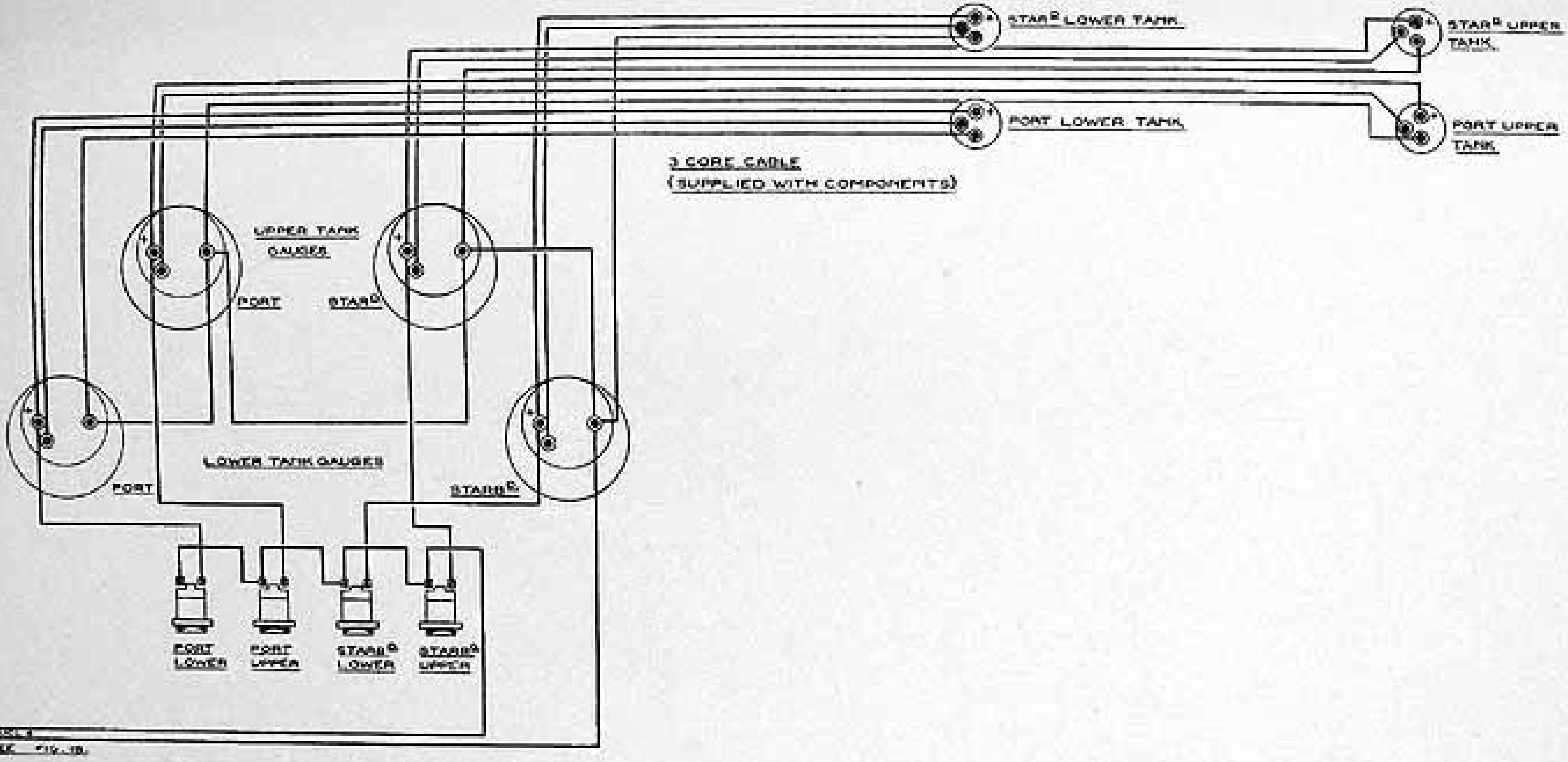


FIG. 13. WIRING DIAGRAM FOR ELECTRICAL FUEL GAUGES

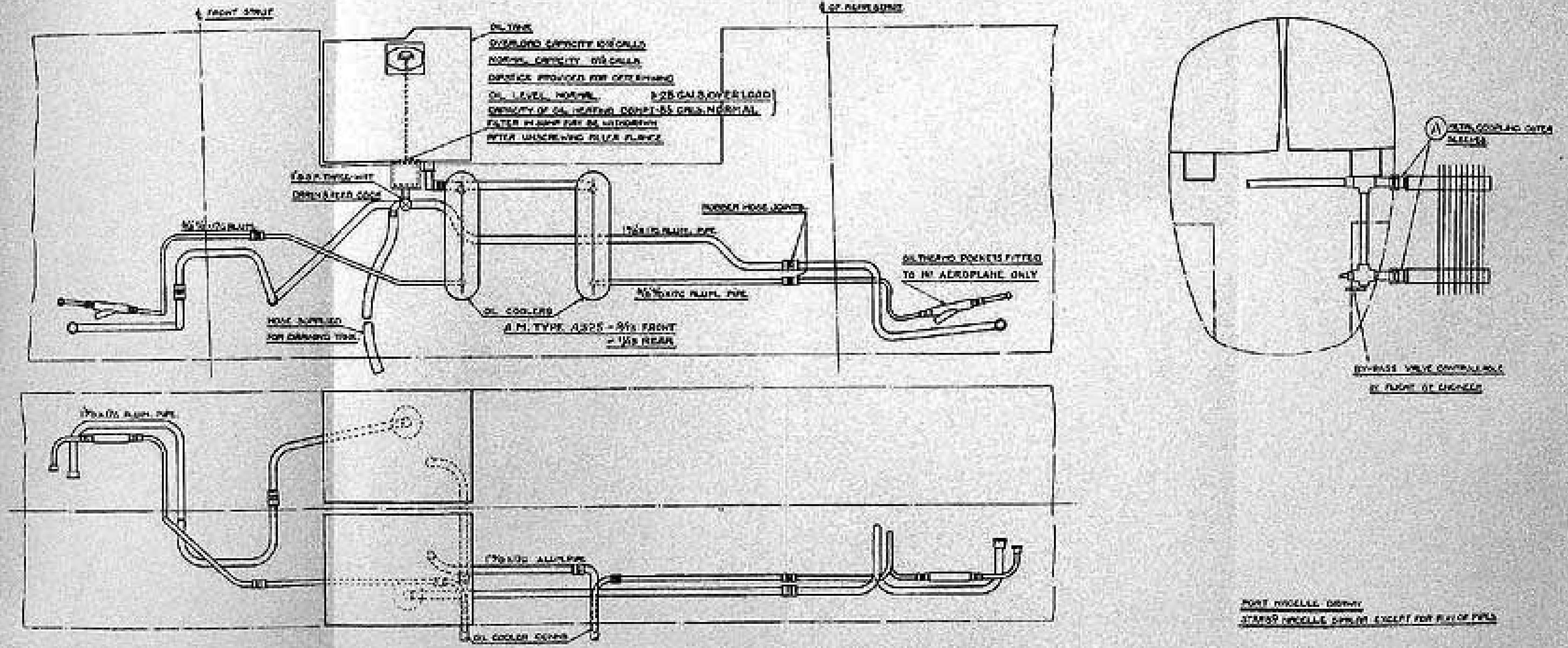


FIG.14. OIL SYSTEM

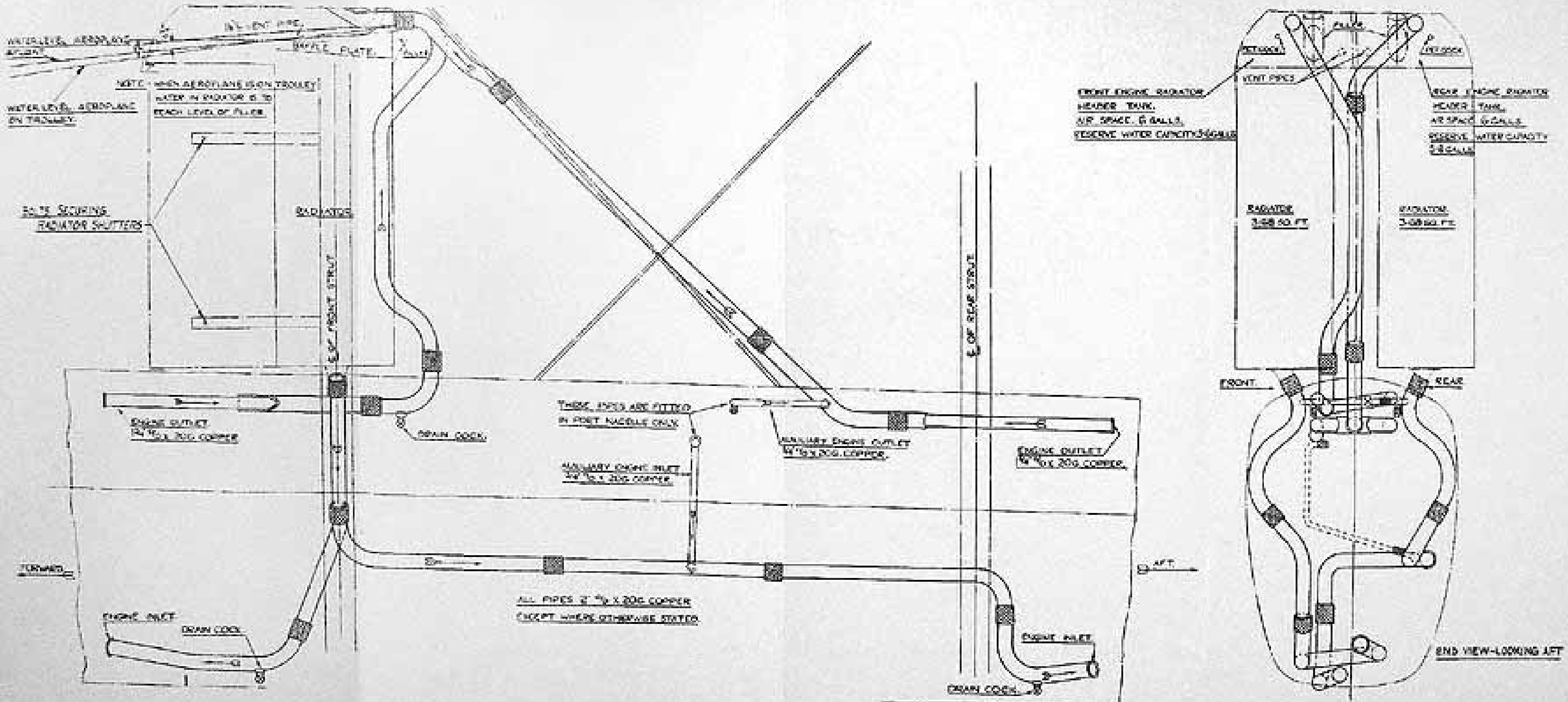
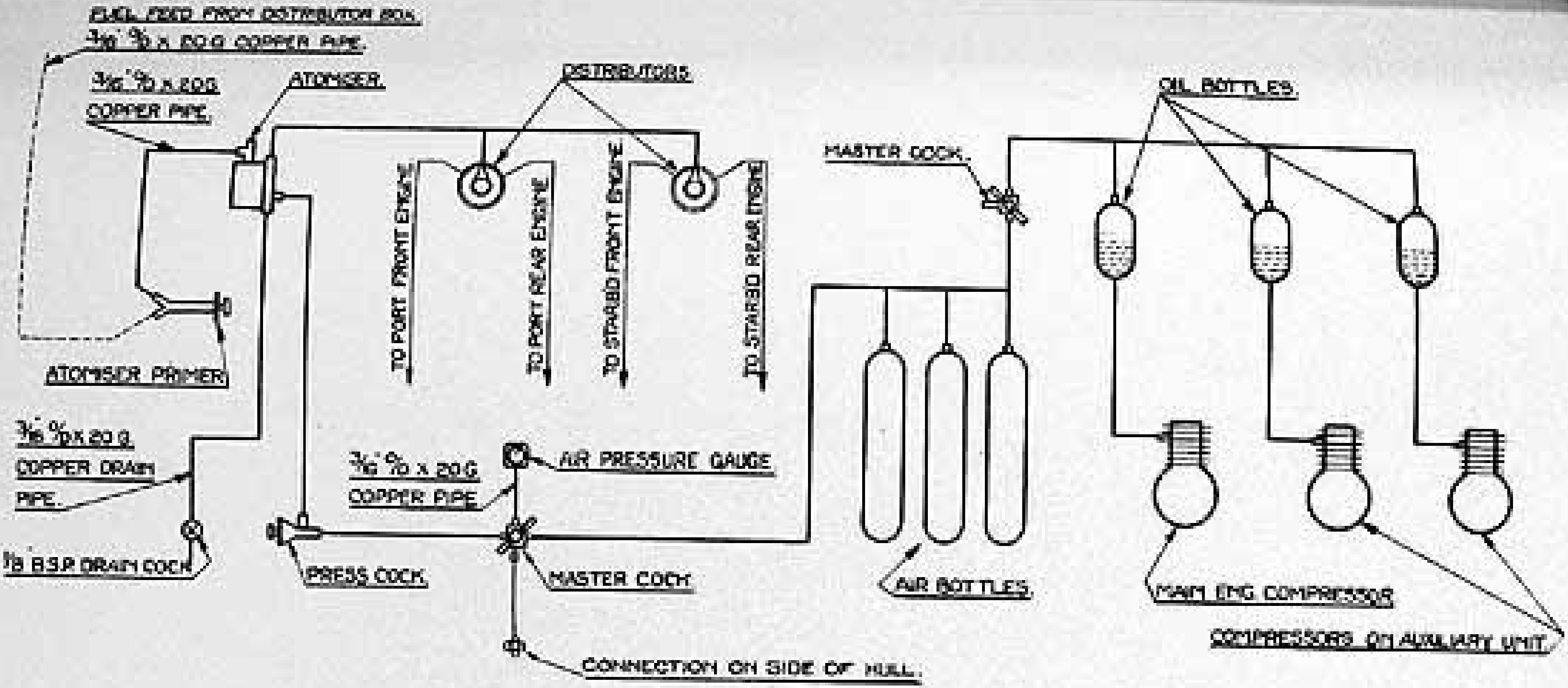


FIG. 15. COOLING SYSTEM



NOTE.

PRESSURE IN SYSTEM NOT TO EXCEED 200 LB. PER SQ. IN.

OIL BOTTLES MUST ALWAYS BE HALF FULL OF OIL.

EXCEPT WHERE OTHERWISE STATED ALL PIPES TO BE

3/8" O/D x 17 G ALUMINIUM T.9.

FIG. 16. GAS STARTING SYSTEM

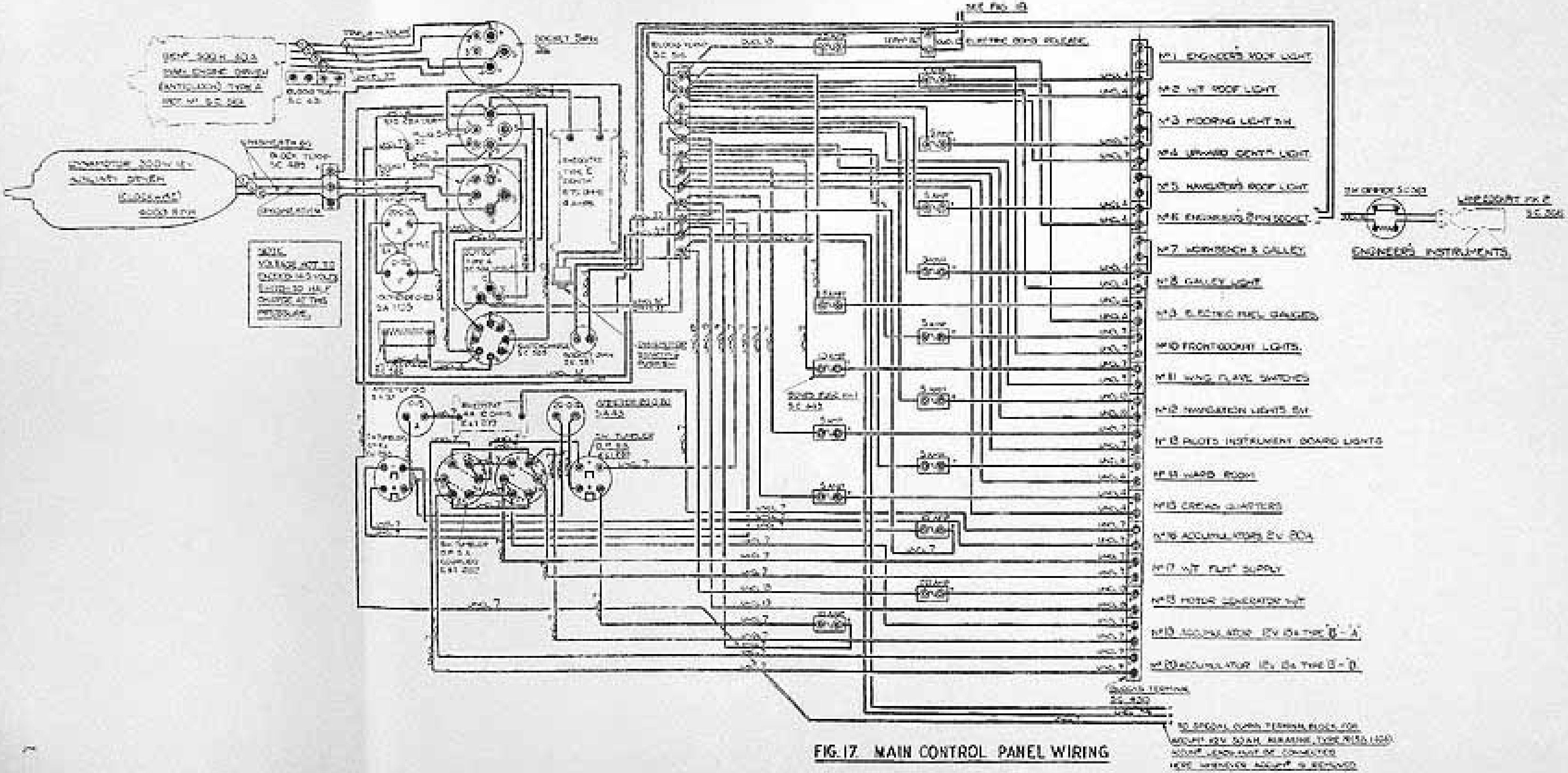
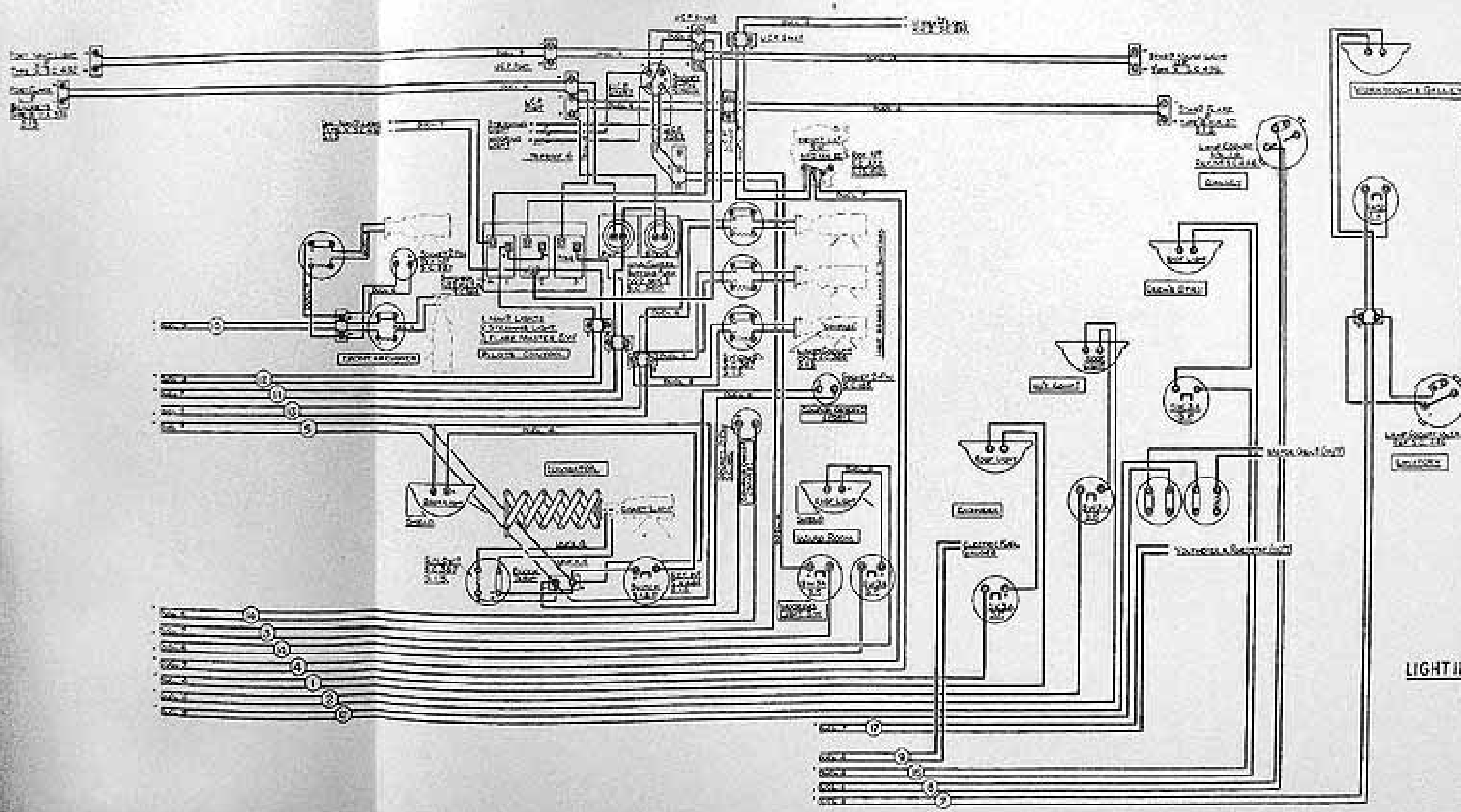


FIG. 17 MAIN CONTROL PANEL WIRING



1	Engineer's Roof Light
2	W/T Roof Light
3	Mooring Light Switch
4	Upward Ident^{n} Light
5	Navigator's Roof Light
6	Engineer's 2 Pin Socket
7	Workshop & Galley
8	Galley Light
9	Electric Fuel Gauges
10	Front Cockpit Lights
11	Wing Flare Switches
12	Navigation Light Switch
13	Pilots Inst. Board Lights
14	Ward Room
15	Crew's Quarters
16	Accum^{rs} 2V 20A
17	W/T Filament Supply
18	Motor Gen^{r} W/T
19	Accum^{r} 12V 15A 'A'
20	Accum^{r} 12V 15A 'B'

FIG. 18.
LIGHTING DISTRIBUTION
DIAGRAM

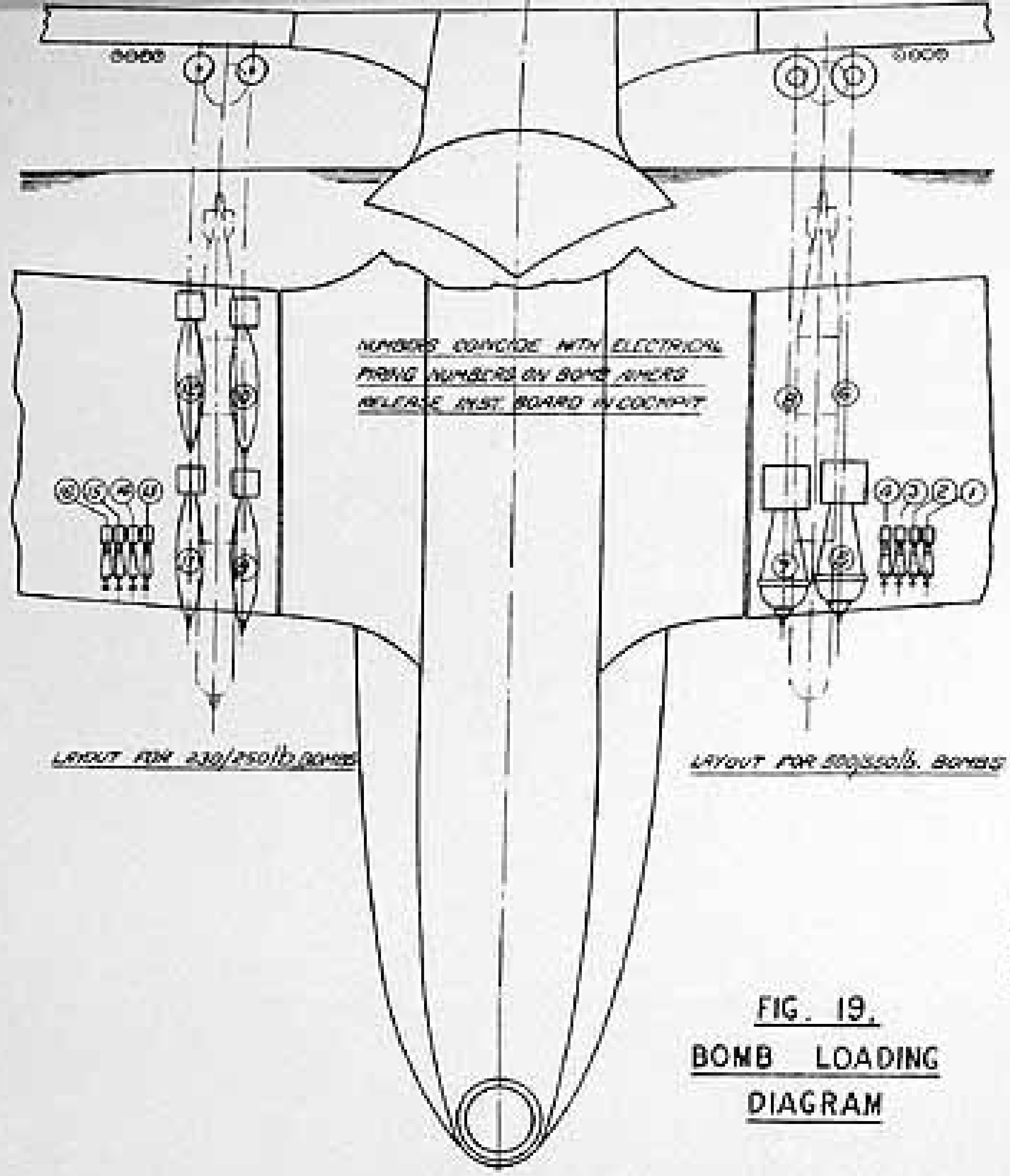


FIG. 19.
BOMB LOADING
DIAGRAM

LOADING CONDITIONS

TORPEDO (TRANSPORT ONLY NOT LAUNCHING)

1 ON PORT LOWER PLANE
1 ON STARBD LOWER PLANE

OR ALTERNATIVELY:-

BOMBS 500/550 lb.

2 ON PORT PLANE AT POSITIONS 5 & 7 ONLY
2 ON STARBD PLANE AT POSITIONS 3 & 11 ONLY.

OR ALTERNATIVELY:-

BOMBS 230/250 lb.

4 ON PORT PLANE AT POSITIONS 5, 6, 7 & 8
4 ON STARBD PLANE AT POSITIONS 9, 10, 11 & 12

BOMBS - LIGHT SERIES

1 RACK ON PORT PLANE
1 RACK ON STARBD PLANE

NOTE:-

IT IS IMPORTANT THAT 500/550 lb. BOMBS BE LOADED ONLY IN FORWARD POSITION WHEN A 500/550 lb. BOMBS OCCUPIES ANY ONE OF POSITIONS 5, 6, 9 OR 10 NO OTHER TYPE MUST BE LOADED IN TANDEM. I.E. EACH WOODEN ADAPTOR BEAM MAY CARRY:-

ONE 500/550 lb. BOMB
OR
TWO 230/250 lb. BOMBS
BUT NEVER
ONE 500/550 lb. PLUS ONE 230/250 lb.

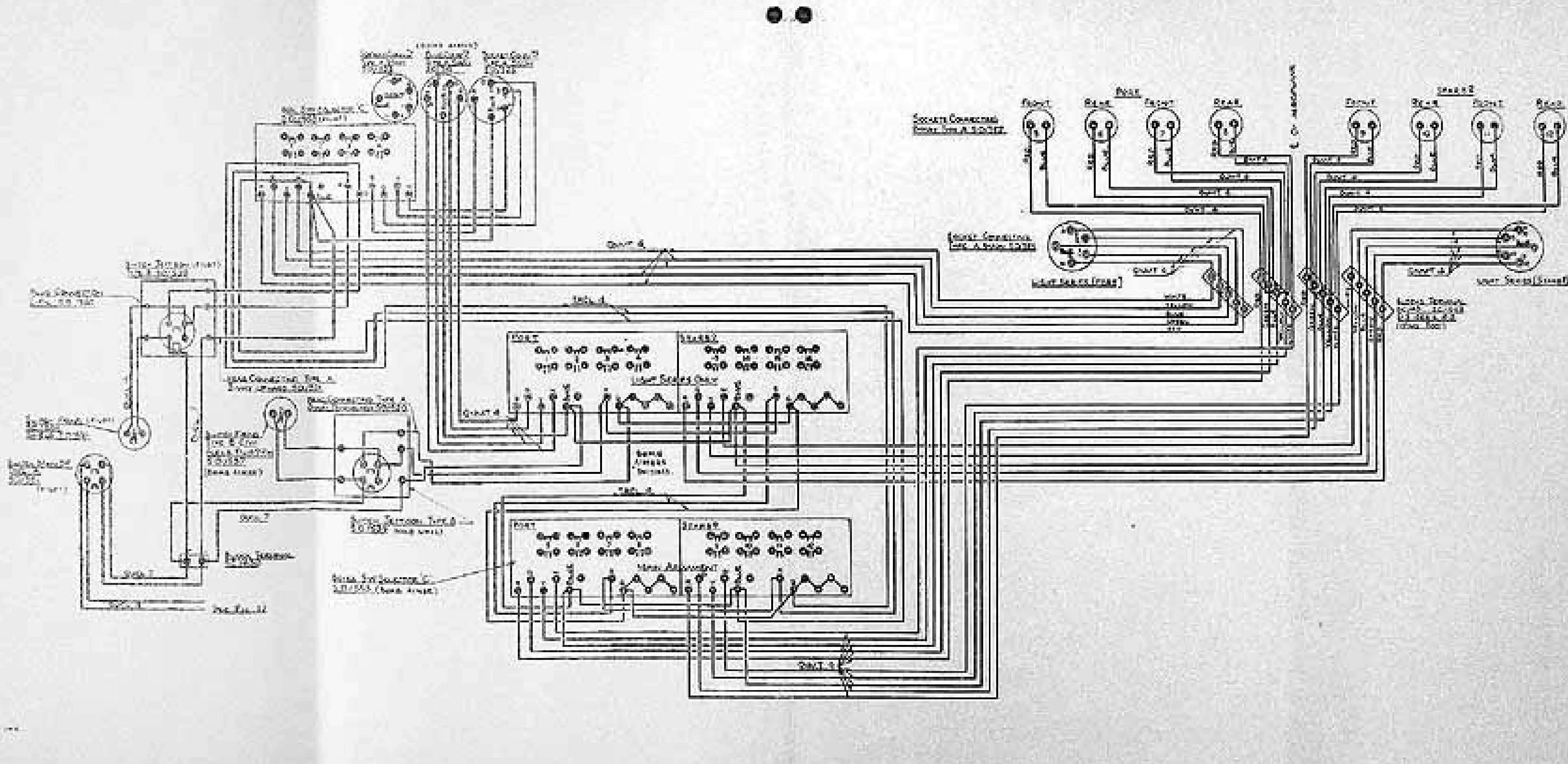


FIG. 20. ELECTRICAL BOMB RELEASE GEAR

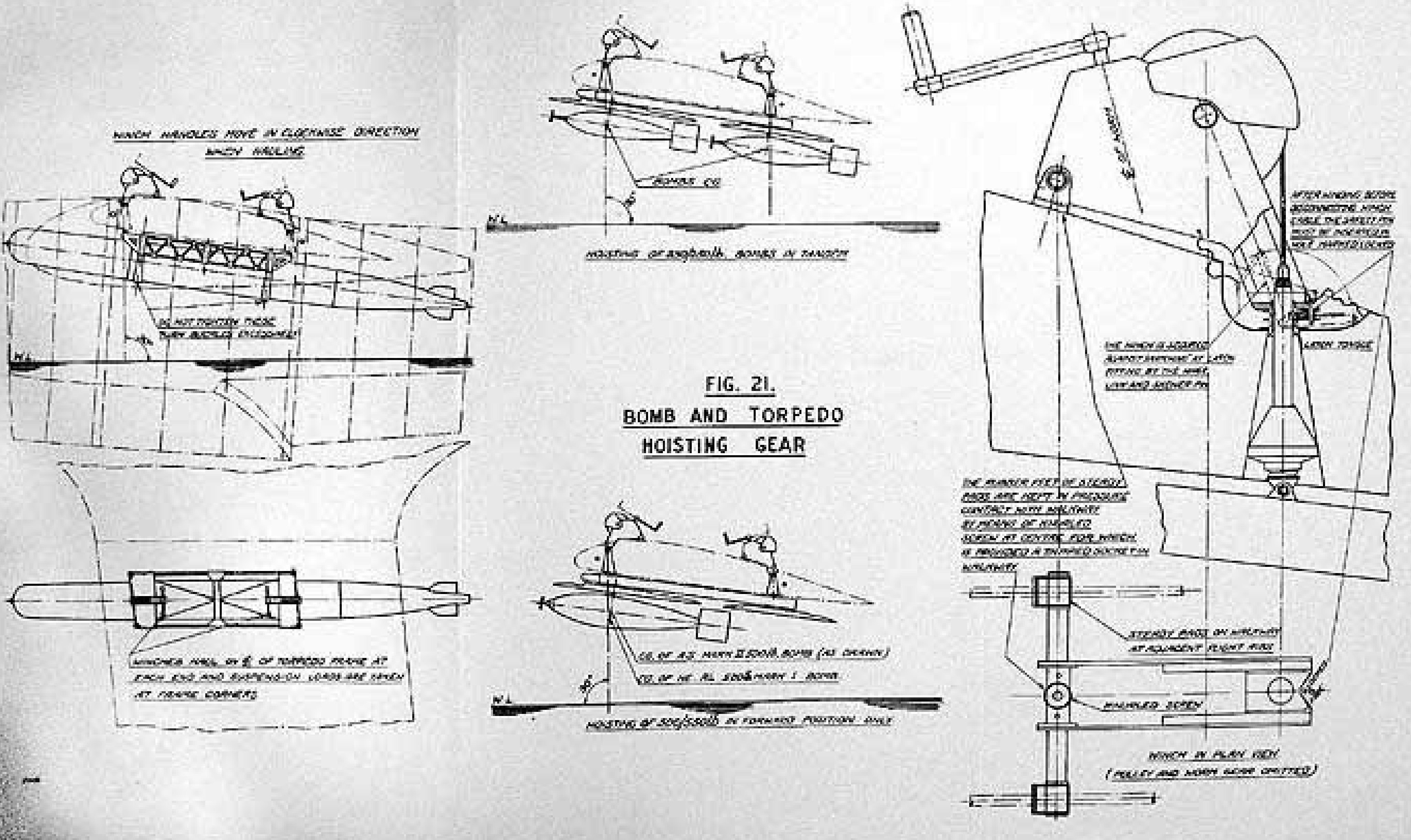


FIG. 21.
BOMB AND TORPEDO
HOISTING GEAR

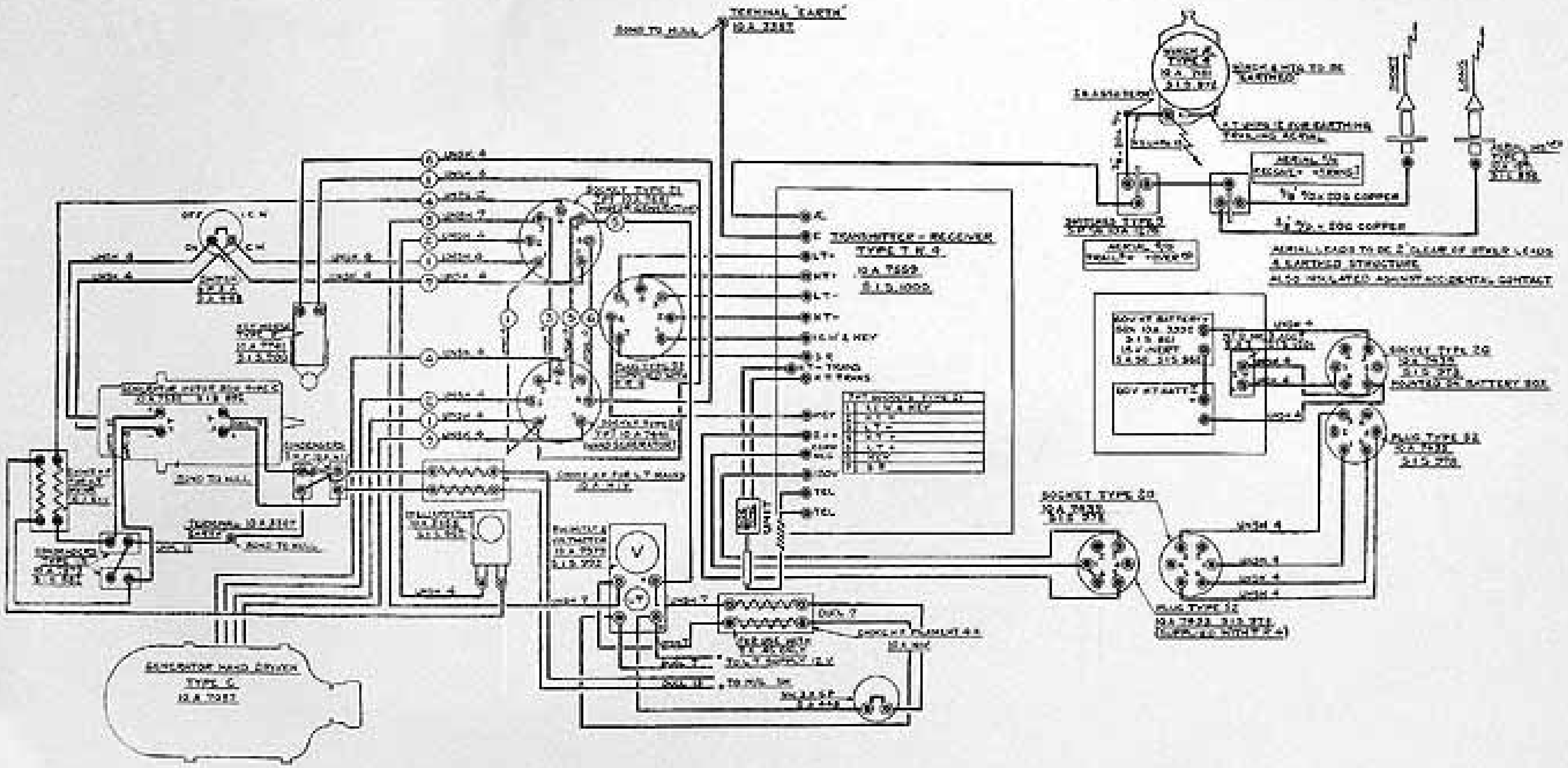


FIG. 22. TR4. INSTALLATION

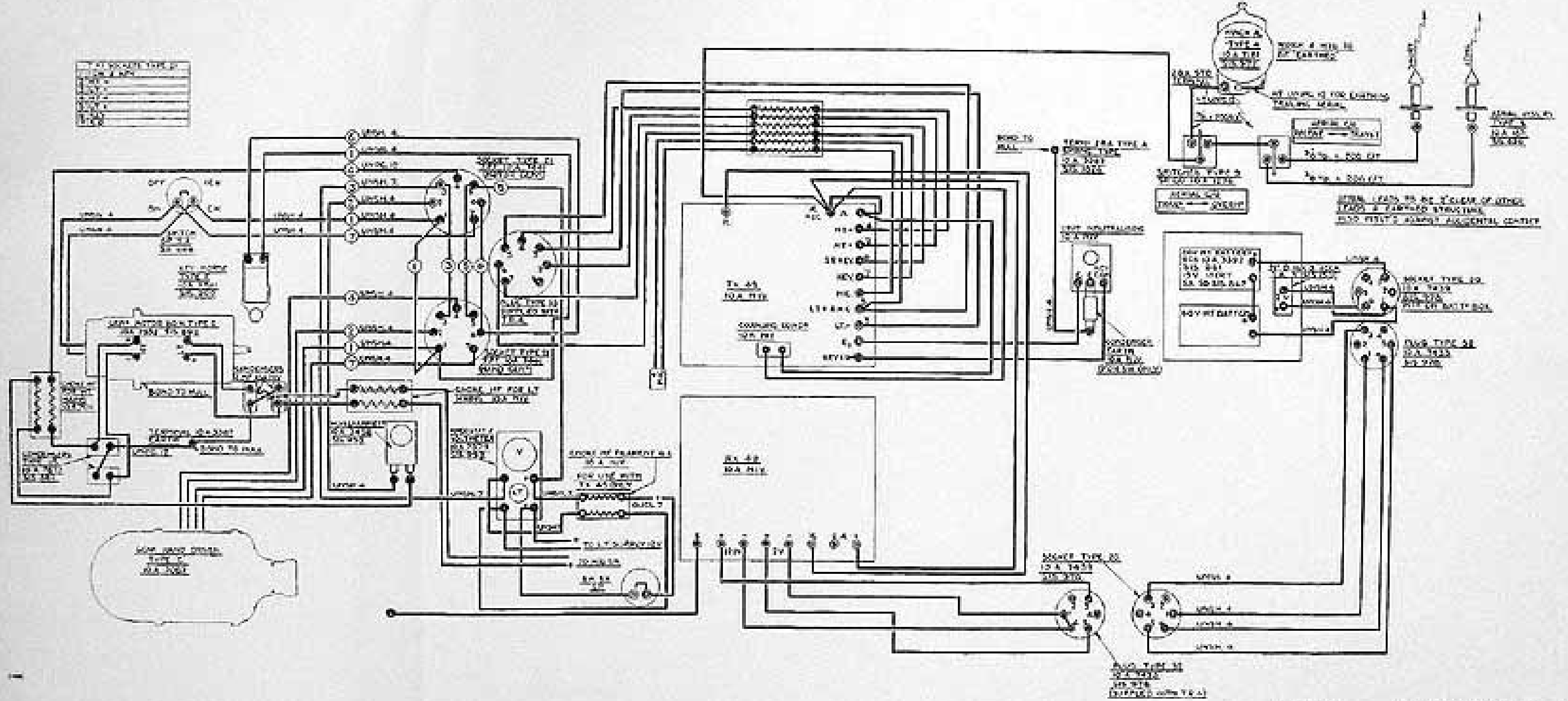


FIG. 23 TX45 AND R.X49 INSTALLATION

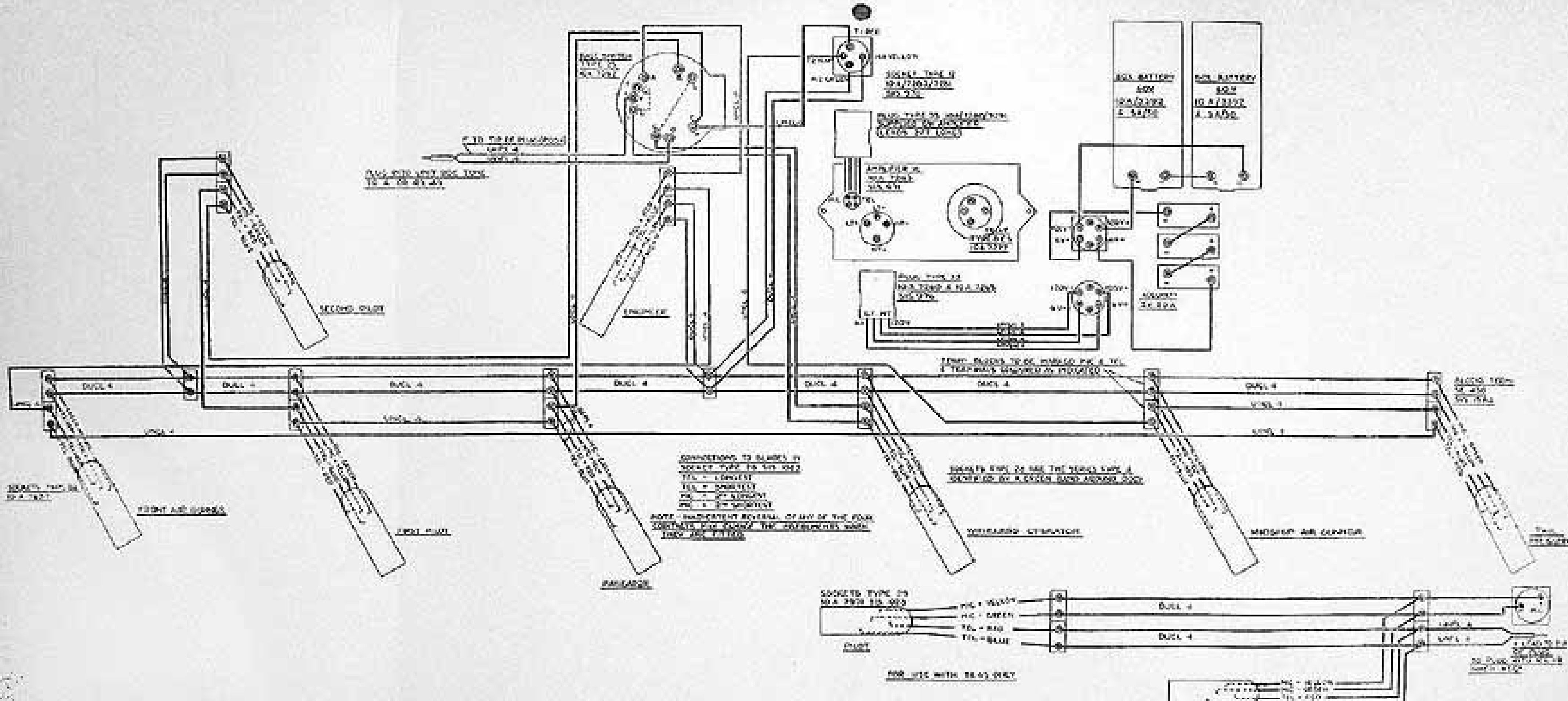


FIG. 24. INTERCOMMUNICATION SYSTEM

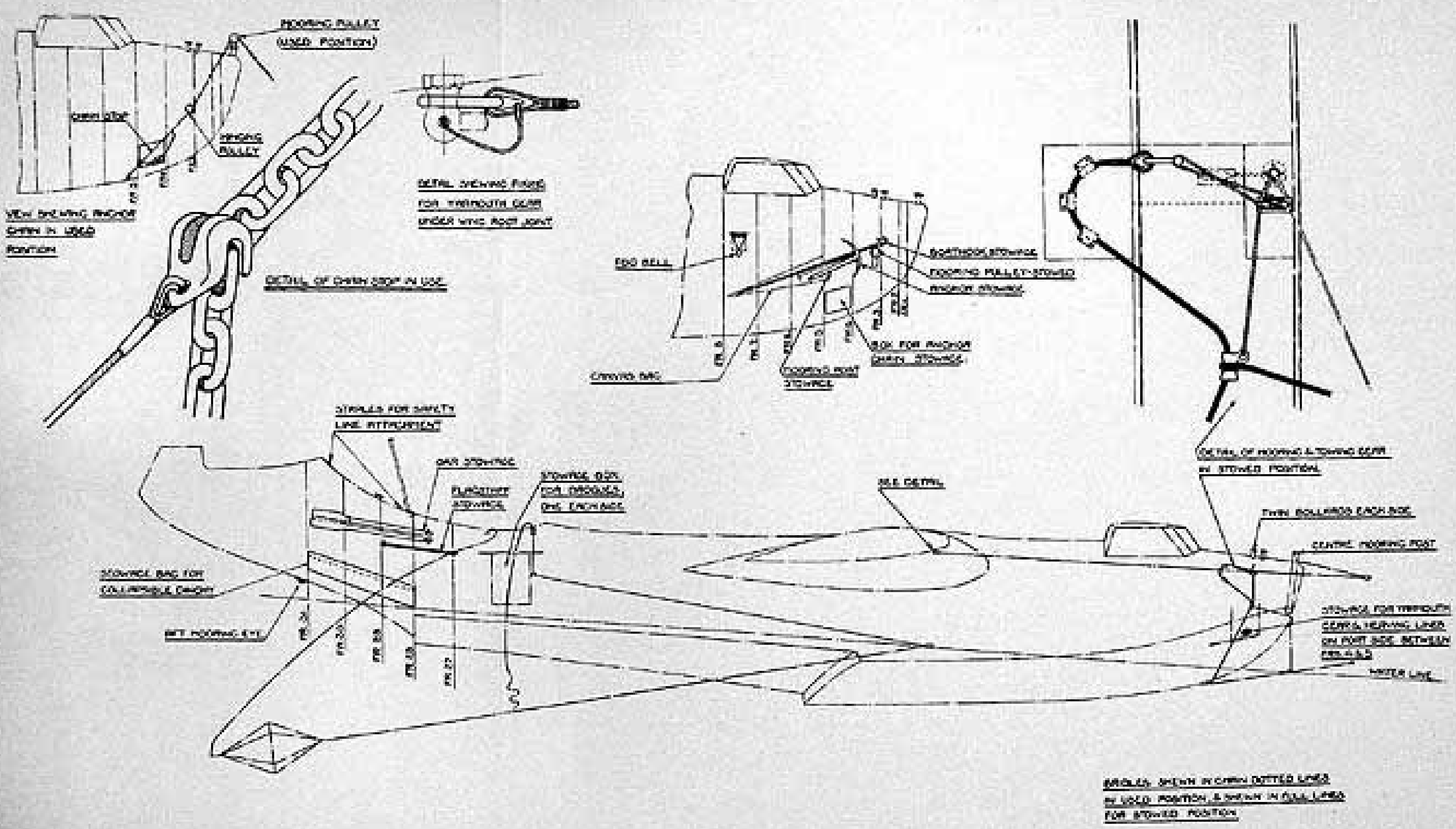


FIG. 25. MARINE EQUIPMENT

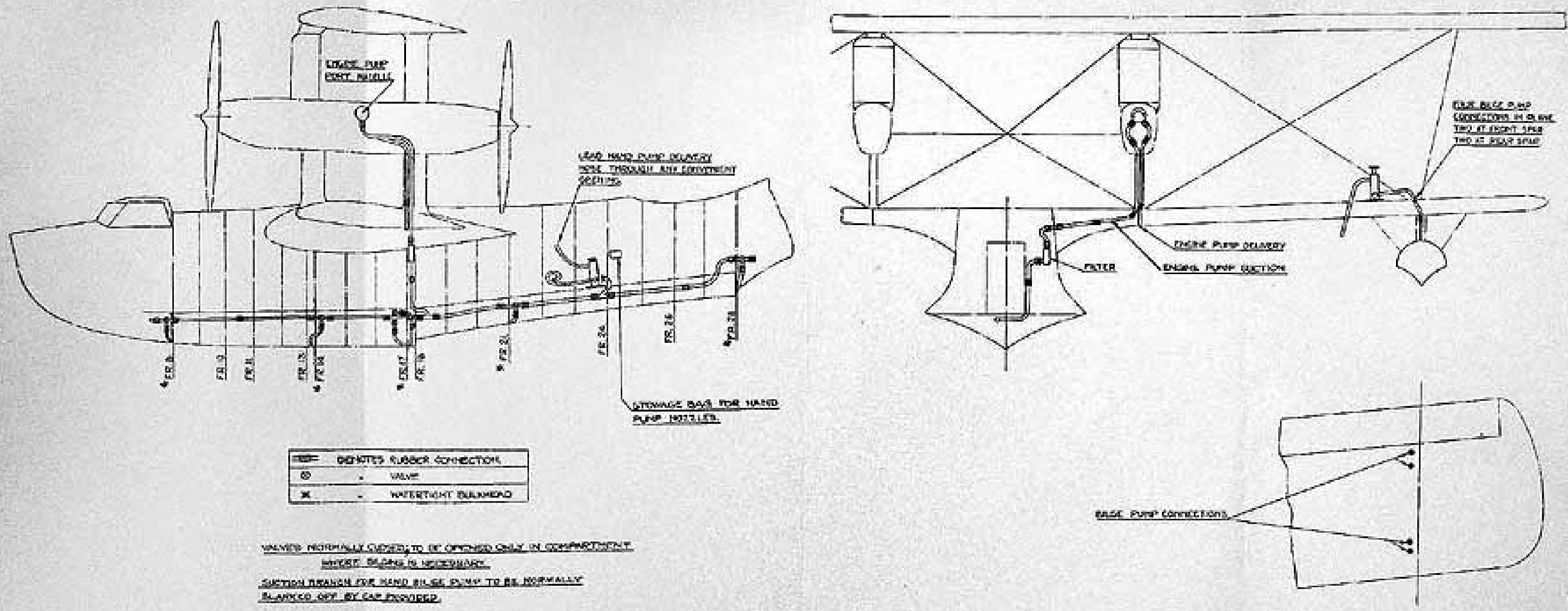


FIG. 26. BILGE SYSTEM DIAGRAM

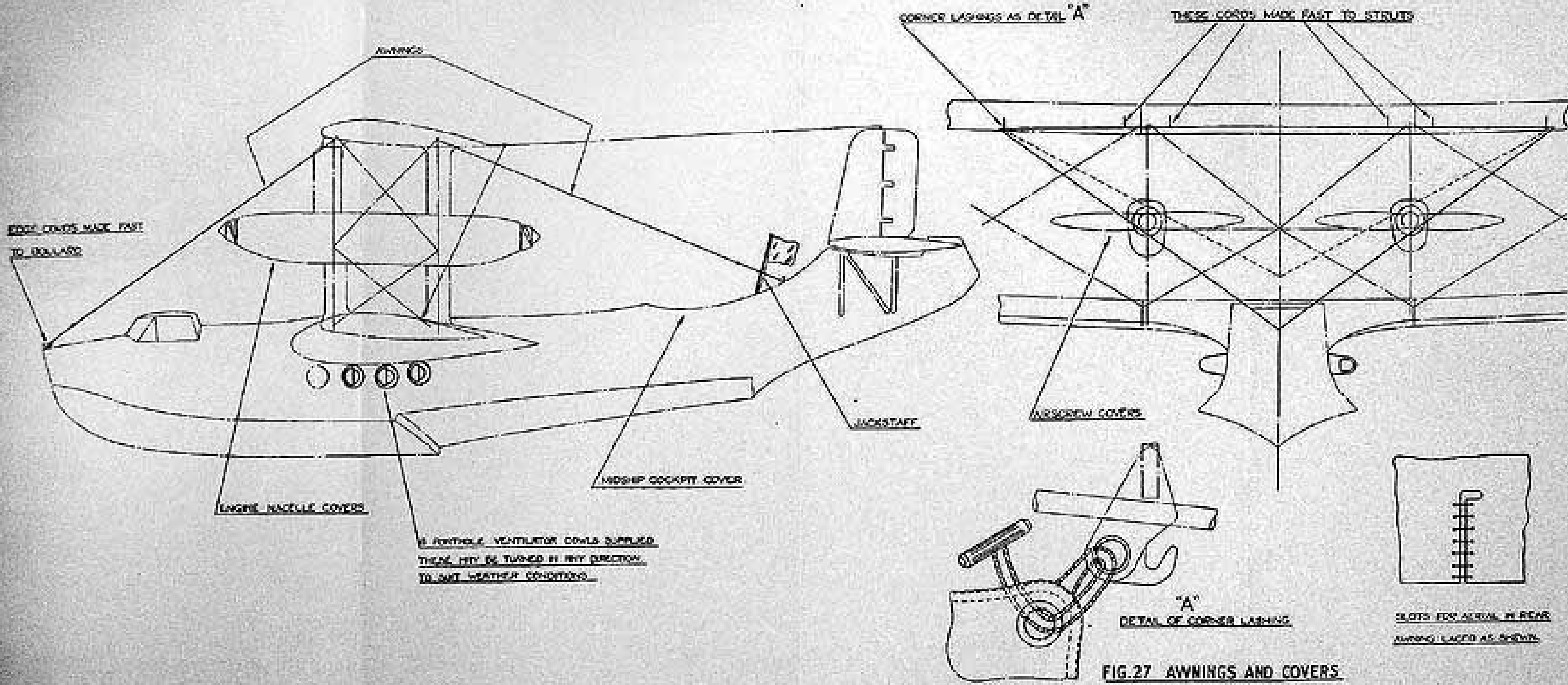


FIG.27 AWNINGS AND COVERS

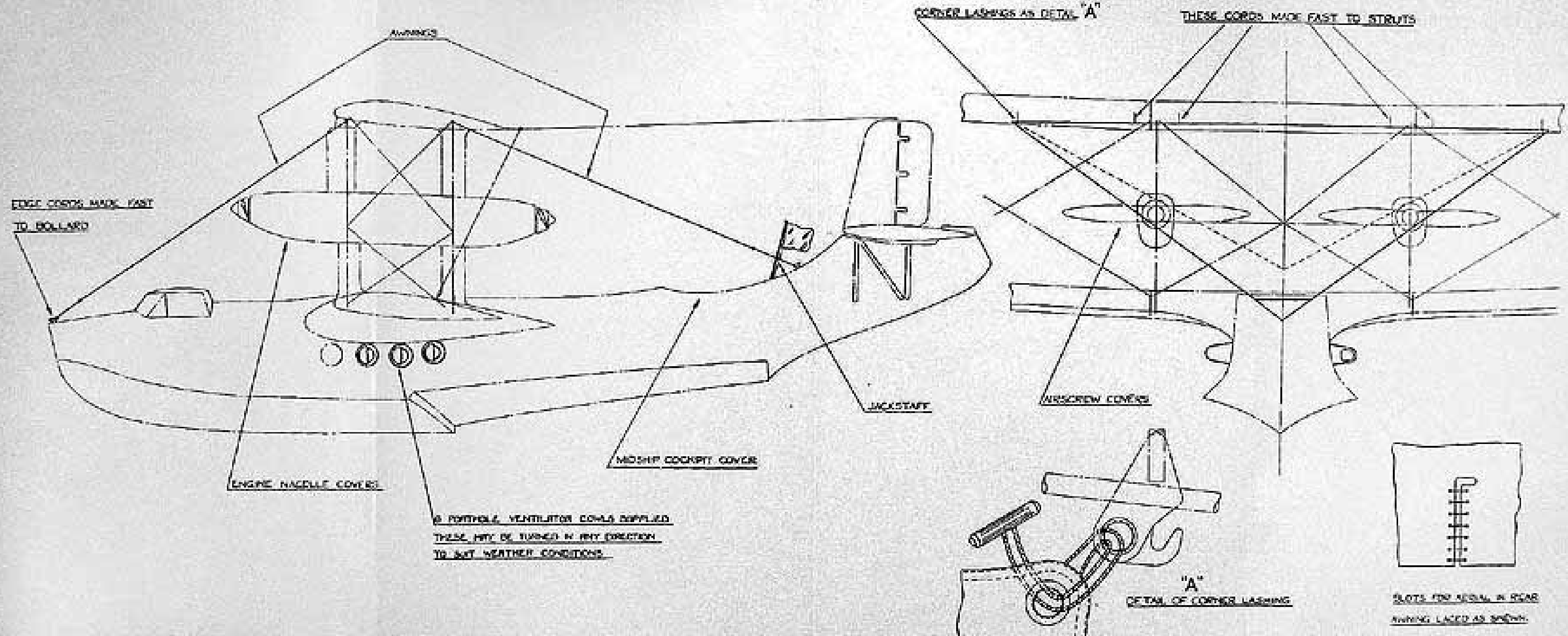
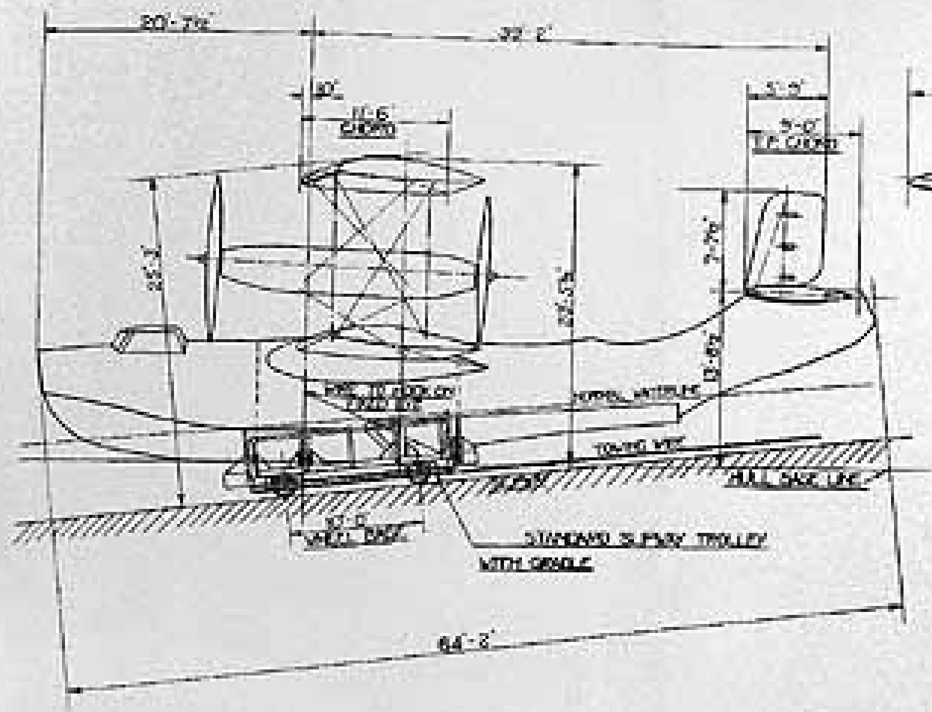


FIG.27 AWNINGS AND COVERS



PORT VIEW SHEWING AEROPLANE ON TROLLEY LEAVING WATER

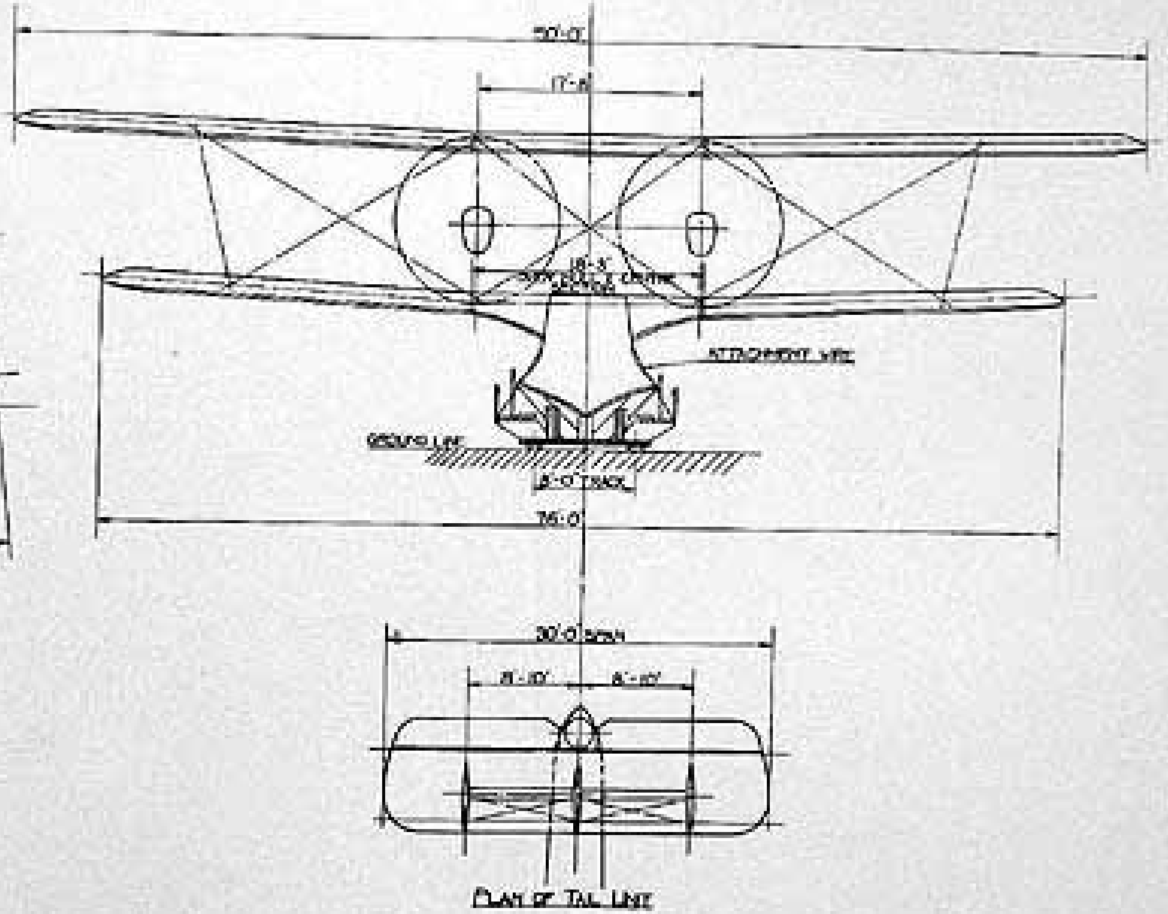


FIG. 28. PRINCIPAL DIMENSIONS WITH AEROPLANE ON SLIPWAY TROLLEY

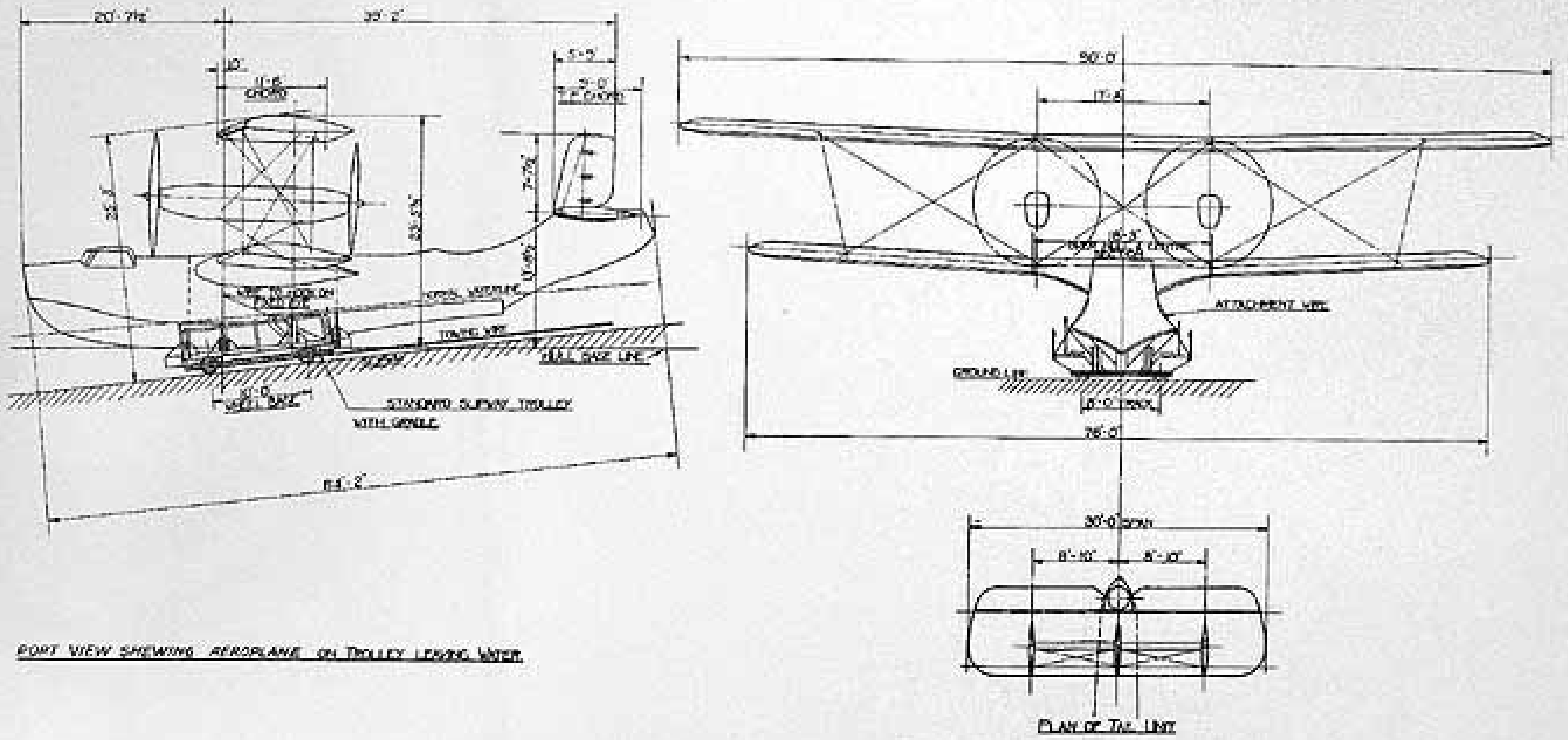


FIG. 28. PRINCIPAL DIMENSIONS WITH AEROPLANE ON SLIPWAY TROLLEY

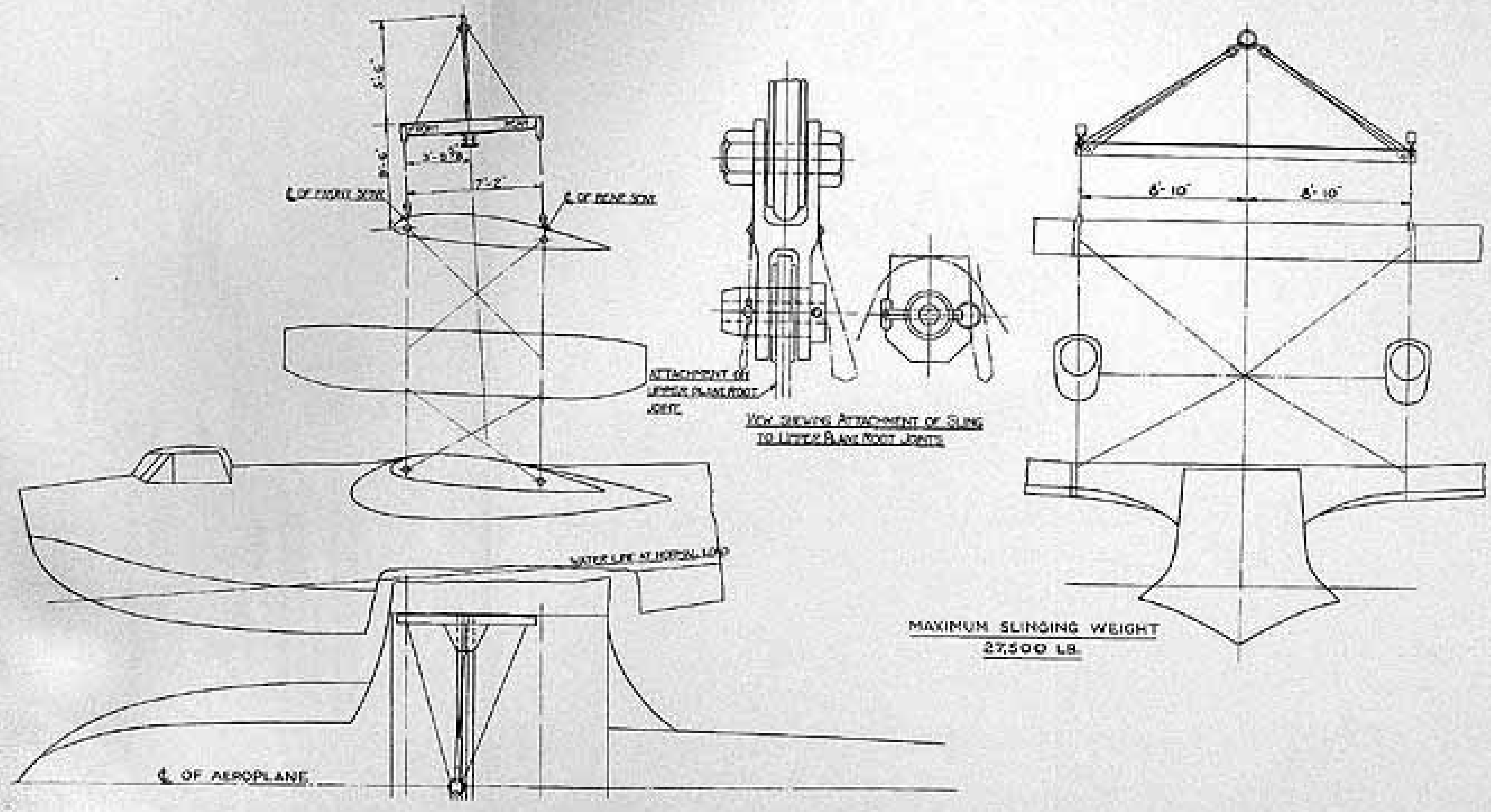


FIG. 29. AEROPLANE SLINGING GEAR

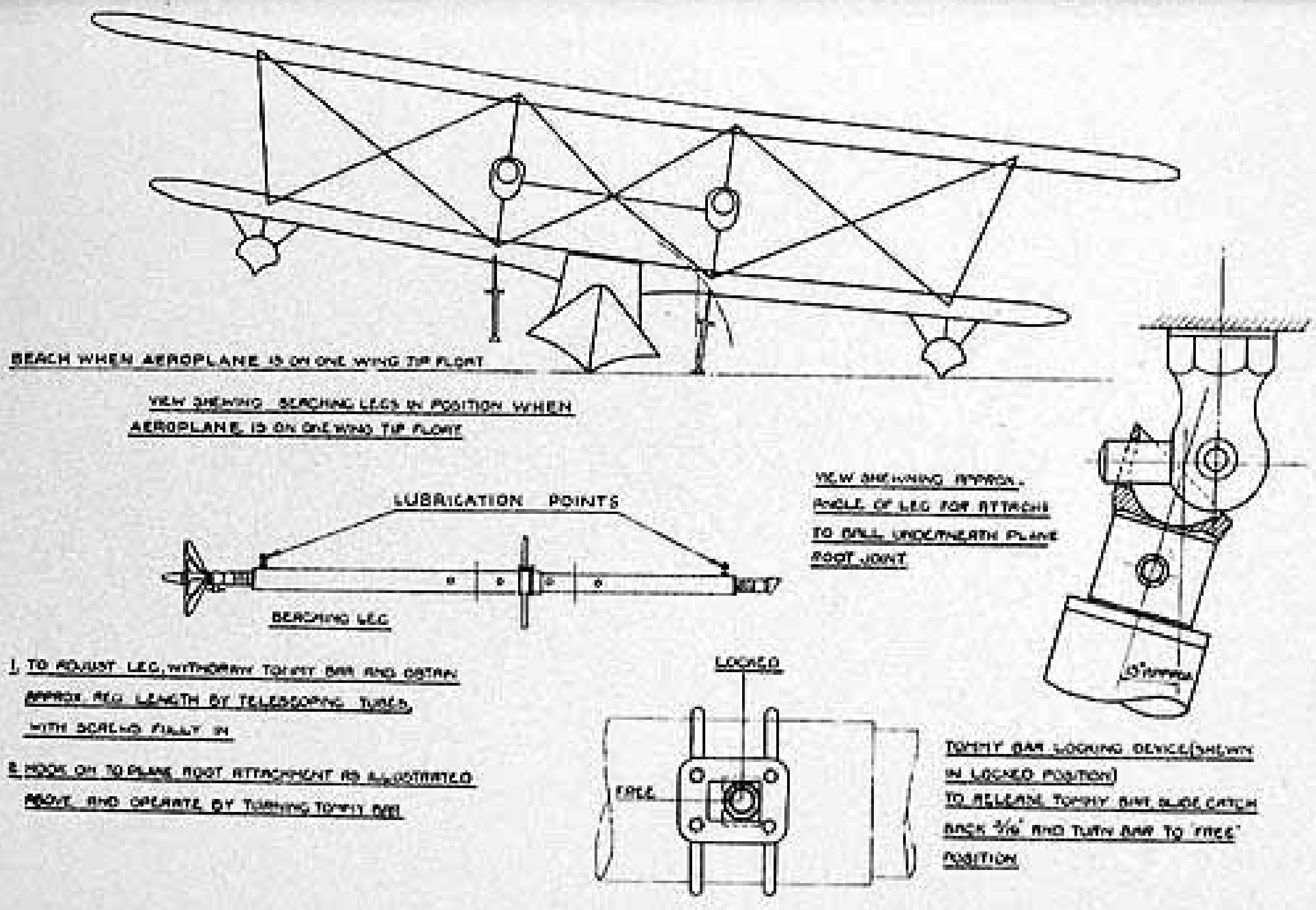


FIG. 30. BEACHING LEGS

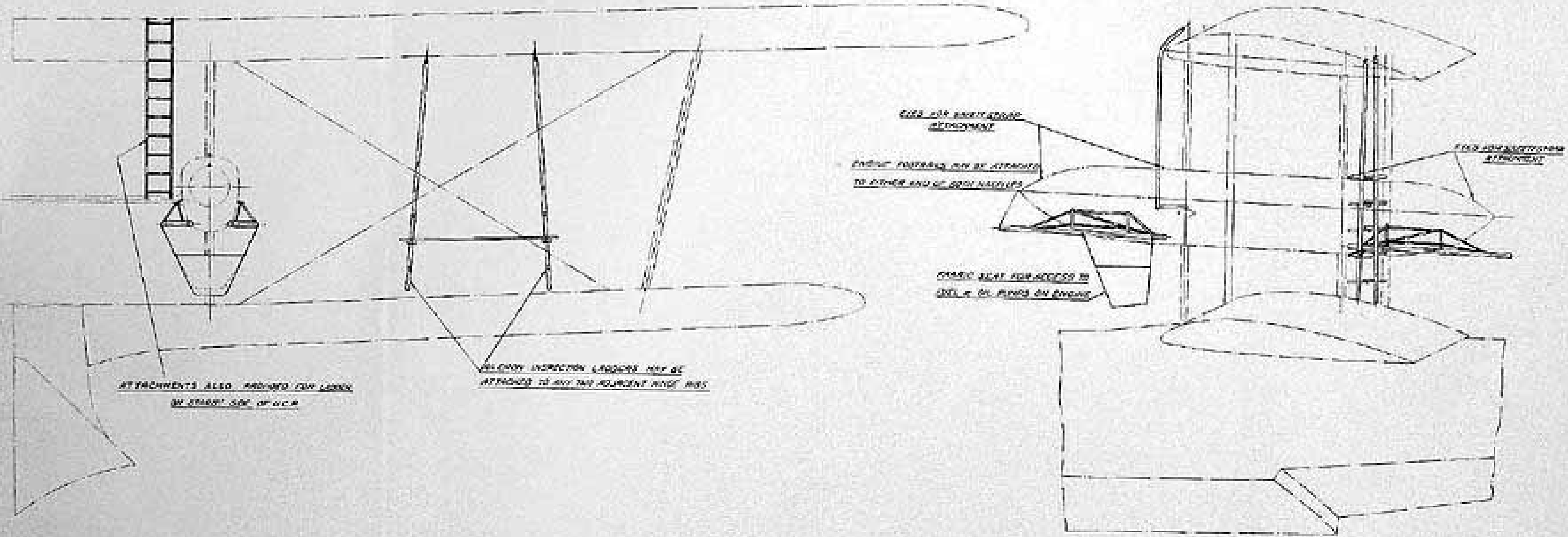


FIG. 31. MAINTENANCE LADDERS AND FOOTRAILS

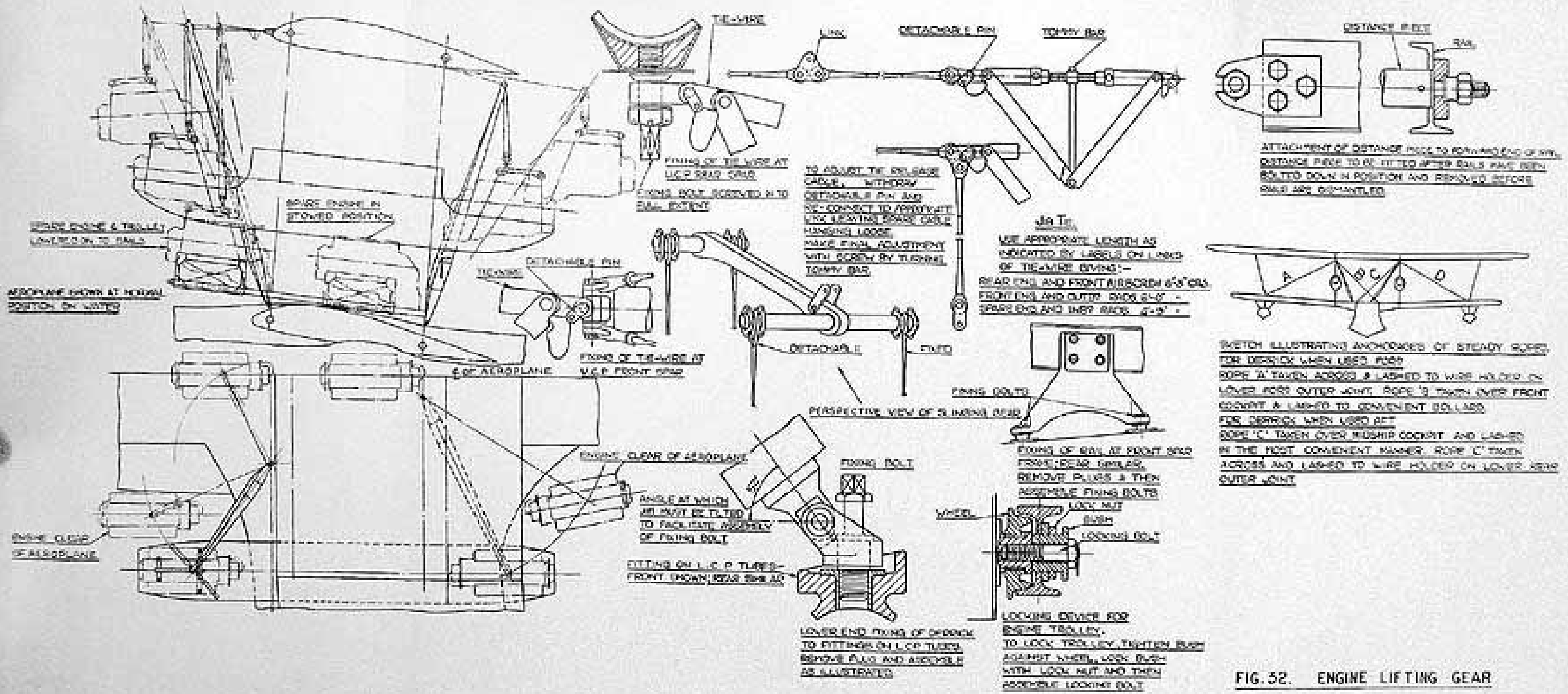


FIG. 32. ENGINE LIFTING GEAR

JIB TIE. FOR ILLUSTRATIONS, SEE FIG. 32.
USE APPROPRIATE LENGTH AS INDICATED BY LABELS ON LINKS OF TIE-WIRE, GIVING :—

REAR AIRSCREW 10'-0" CRS.
REAR ENGINE & FRONT AIRSCREW 8'-3" CRS.
FRONT ENGINE & OUTBOARD RADS 6'-0" CRS
SPARE ENGINE & INBOARD RADS 4'-8" CRS.

FOR ILLUSTRATION OF DERRICK STEADY ROPES, SEE FIG. 32.

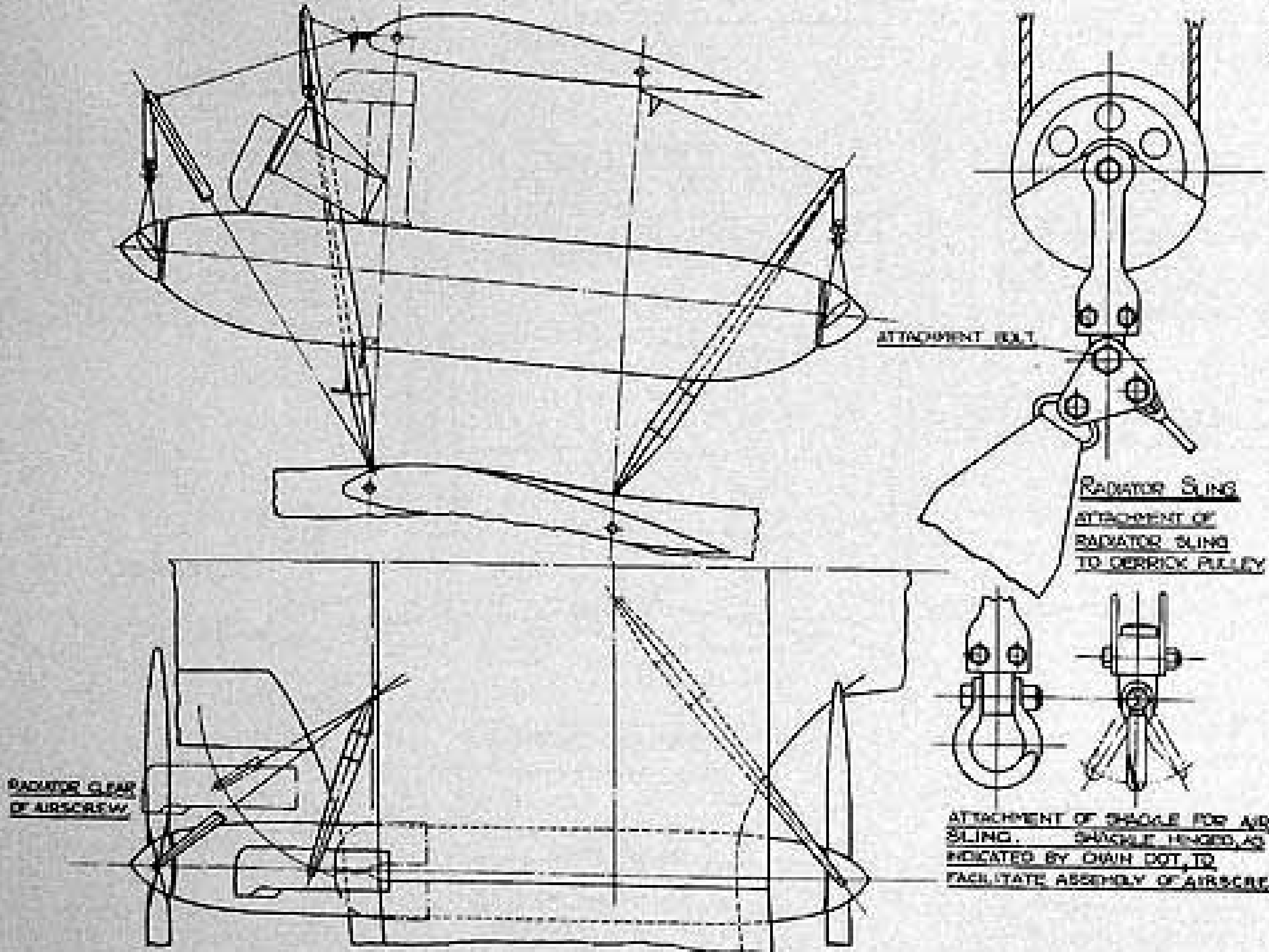


FIG. 33. AIRSCREW AND RADIATOR LIFTING GEAR

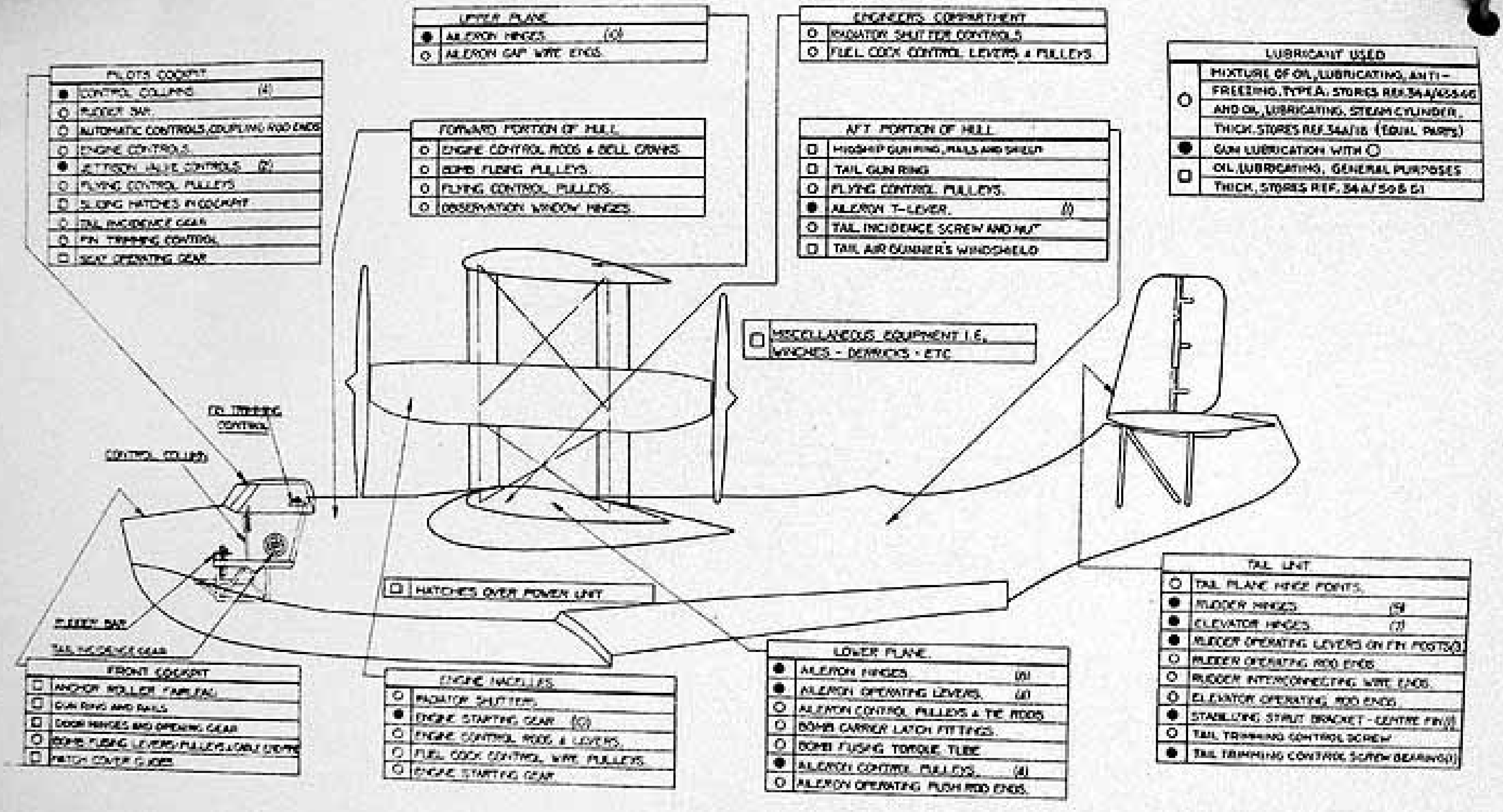
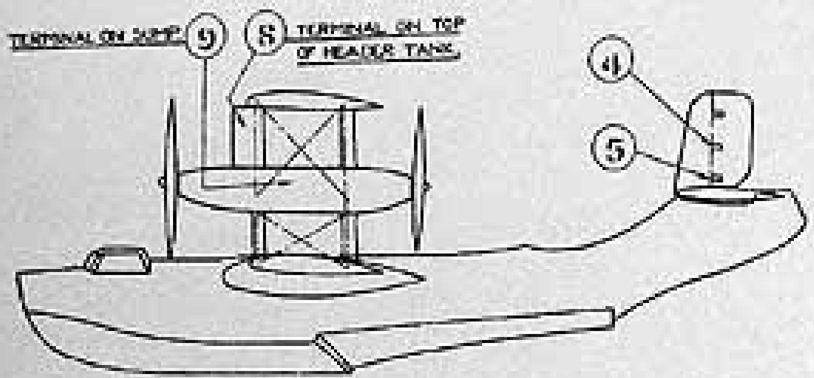


FIG. 34. LUBRICATION DIAGRAM



ITEM	DESCRIPTION.
1	UPPER AILERONS
2	LOWER AILERONS
3	ELEVATOR.
4	CENTRE RUDDER.
5	OUTER RUDDERS
6	LOWER FUEL TANKS
7	UPPER FUEL TANKS
8	RADIATORS
9	OIL TANKS

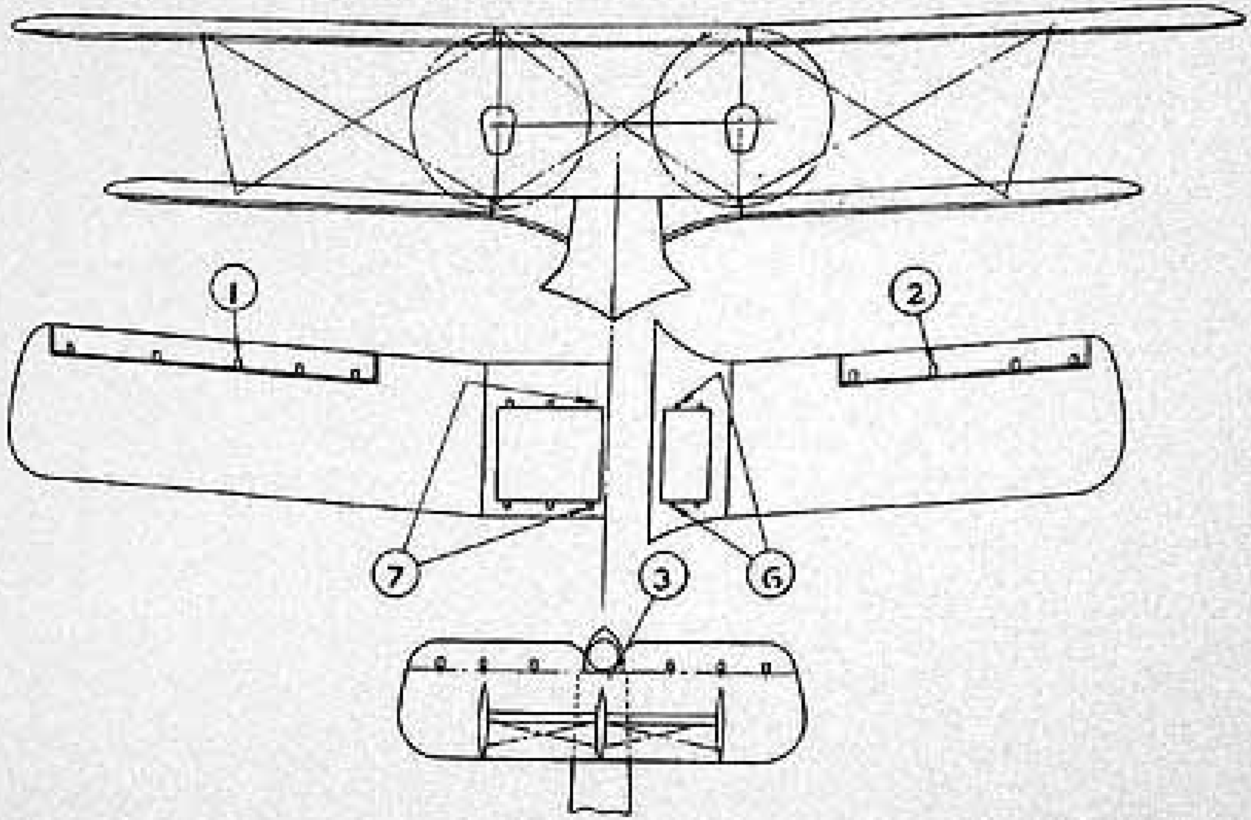
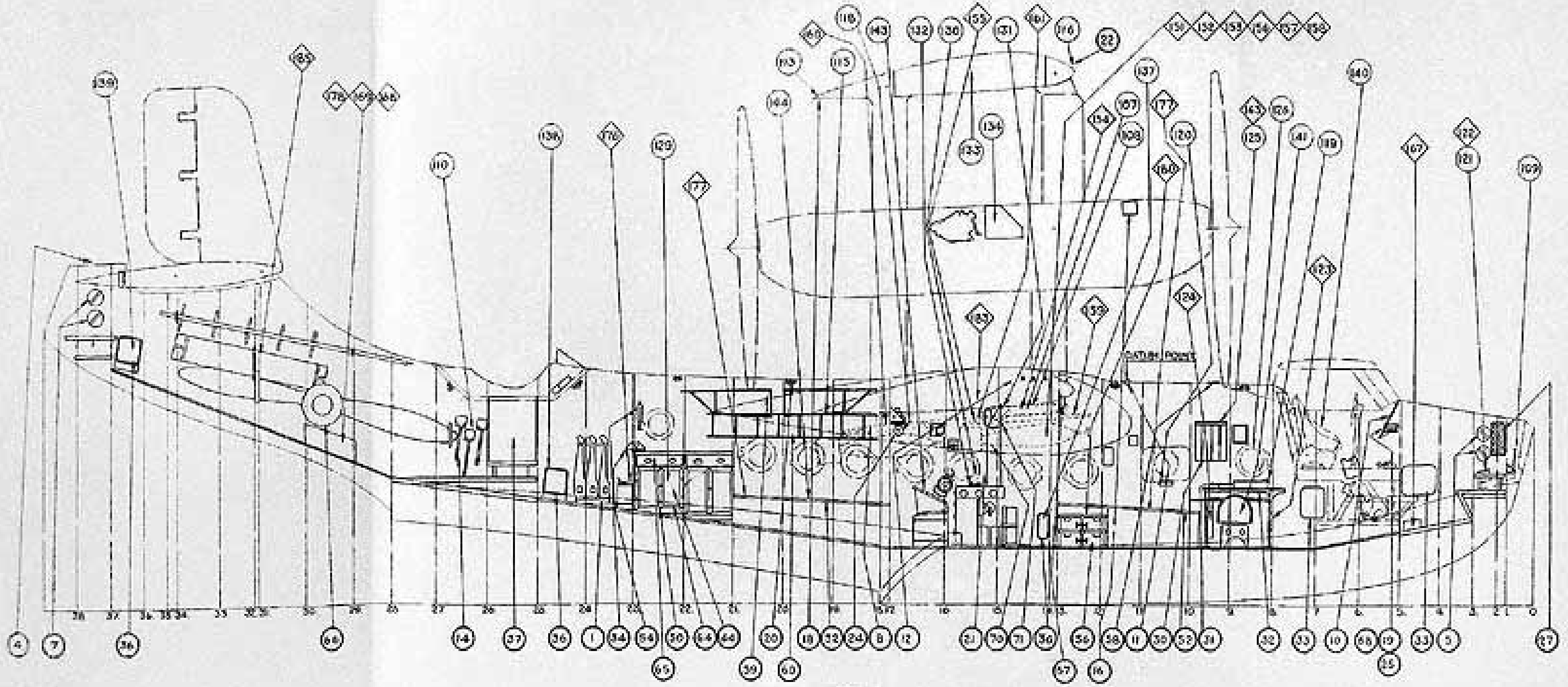


FIG. 35. DIAGRAM SHOWING BONDING POINTS

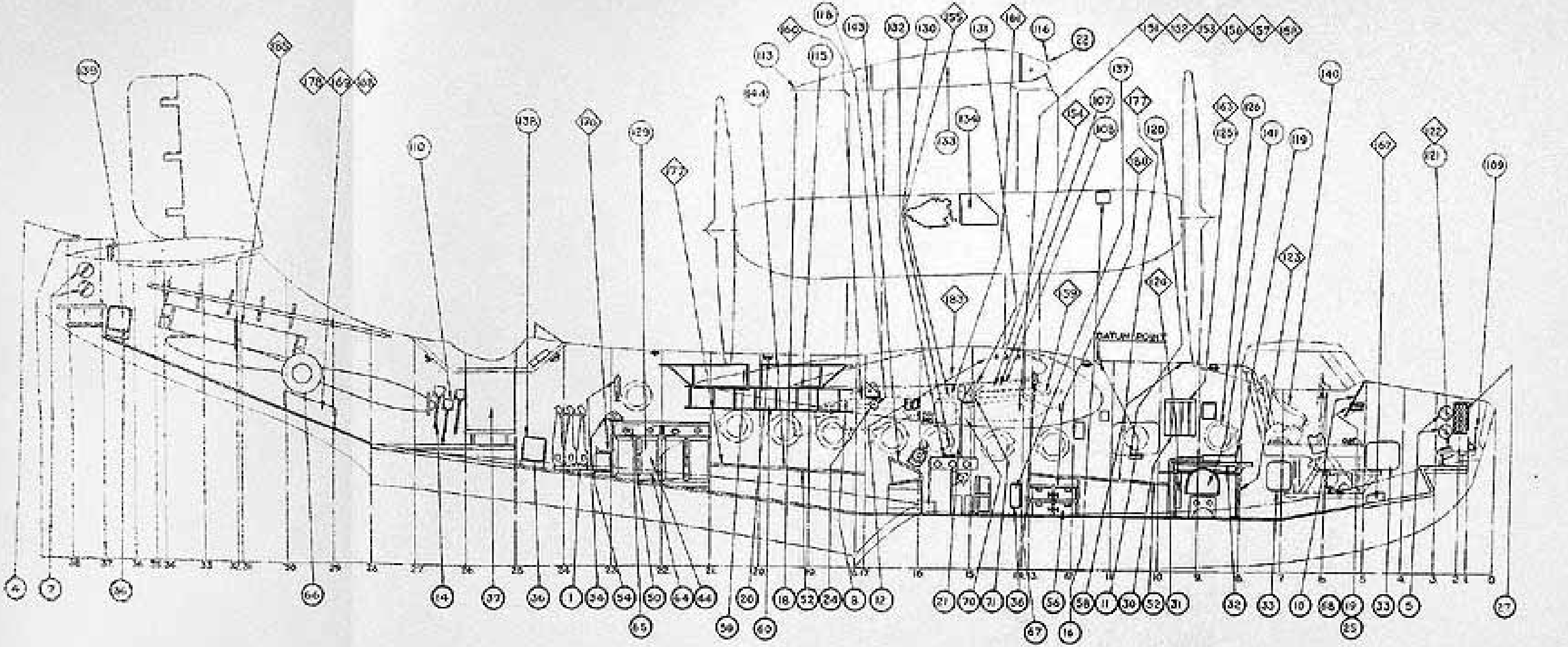


○ = FIXED MILITARY LOAD

○ = TYPICAL SERVICE LOAD

◇ = ALTERNATIVE REMOVABLE LOAD

FIG. 36. LOAD DISTRIBUTION DIAGRAM, PORT SIDE



○ - FIXED MILITARY LOAD

○ - TYPICAL SERVICE LOAD

◇ - ALTERNATIVE REMOVABLE LOAD

FIG. 36. LOAD DISTRIBUTION DIAGRAM, PORT SIDE

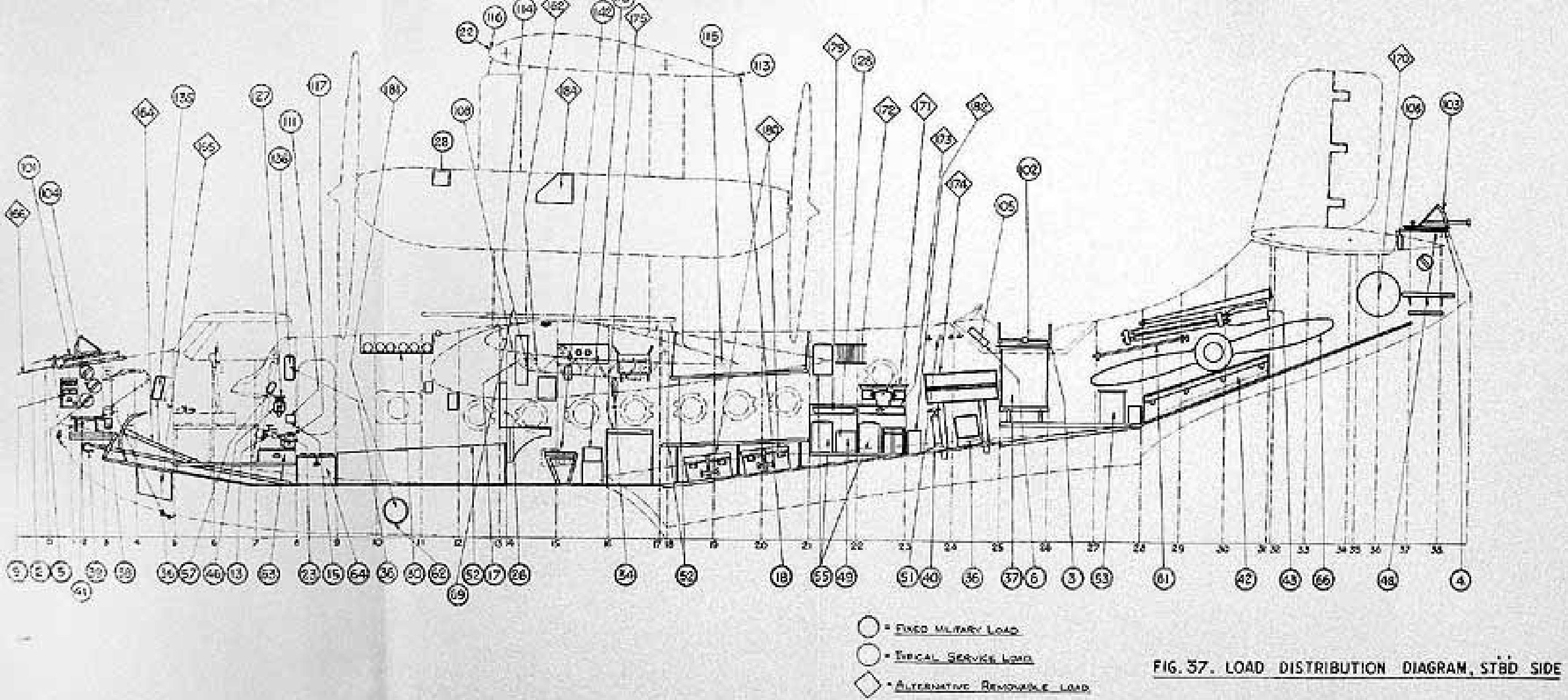


FIG. 37. LOAD DISTRIBUTION DIAGRAM, STBD SIDE

MILITARY LOAD (FIXED)

ITEM	DESCRIPTION	WT	FOR'D	AFT	ABOVE	BELOW
1	GUN STOWAGE ETC.	8.8	—	22.8	—	4.38
2	FORWARD GUN MOUNTING	16.5	24.36	—	—	2.2
3	MID GUN MOUNTING	69.3	—	26.3	—	.6
4	AFT GUN MOUNTING	21.0	—	44.2	4.92	—
5	FORWARD AMMUNITION PEGS	.9	24.25	—	—	2.45
6	MID AMMUNITION PEGS	.4	—	26.3	—	—
7	AFT AMMUNITION PEGS	.6	—	44.1	3.6	—
8	BOMB CARRIER FITTINGS	112.0	—	7.0	—	.3
9	BOMB SIGHTING GEAR BOMBING	3.8	16.4	—	—	2.75
10	BOMB RELEASE GEAR (PILOTS)	.3	16.3	—	—	1.9
11	CABLES ETC. [illegible]	25.3	—	—	—	—
12	CABLES ETC. (L. PLANE)	57.3	—	5.5	—	—
13	BOMB SIGHT [illegible] STOWAGE	1.3	16.0	—	—	3.2
14	[illegible] SIGNALS STOWAGE	.8	—	28.0	—	2.42
15	BOMB PISTOL & CARTRIDGE STOWAGE	.8	16.3	—	—	2.22
16	GENERATOR 500 WATT	22.5	.8	—	4.06	—
17	ELECTRICAL PANEL	25.9	—	2.85	—	1.8
18	NAVIGATION LAMPS ETC. MOUNTING	3.3	—	12.7	11.5	—
19	SWITCHES ETC. PILOTS INST BOARD	8.0	11.7	—	—	3.6
20	INTERIOR LIGHTING ETC.	5.4	—	15.0	—	.3
21	ELECTRICAL CABLES	47.1	—	6.0	—	4.0
22	MOORING LIGHTS MOUNTING	.6	—	3.0	12.6	—
23	SIGNALLING LAMPS STOWAGE	.4	7.0	—	—	3.75
24	GENERATOR MOUNTING	.5	—	5.5	—	3.6
25	INSTRUMENTS PILOTS	23.6	11.1	—	—	1.4
26	INSTRUMENTS ENGINEERS	37.7	—	3.0	—	3.3
27	INSTRUMENTS BOMB AIMERS	1.2	—	16.2	—	3.0
28	GENERATOR [illegible]	26.5	—	11.1	16.2	—
29	[illegible] HEATING [illegible]	3.5	—	2.7	2.0	—
30	SEA MARKERS STOWAGE	1.3	3.6	—	—	2.75
31	INSTRUMENTS NAVIGATORS	3.4	5.1	—	—	4.0
32	NAVIGATORS TABLE ETC.	26.4	4.7	—	—	5.0
33	AUTOMATIC CONTROLS	199.6	10.5	—	—	5.0
34	FIRE EXTINGUISHERS	16.3	—	16.4	—	1.7
35	BOLTS & ANCHORAGES	13.7		4.4		.76
36	PARACHUTE STOWAGES	15.5		5.5		2.33
37	DROGUES & STOWAGE	34.0	—	34.3	—	1.85
38	[illegible]	5.5	34.0	—	—	3.7
39	BOAT HOOK & STOWAGE	7.4	36.7	—	—	3.3
40	BILGE PUMP	15.3		28.7		4.4
41	[illegible] GEAR ATTACHMENTS	4.9	15.5	—	—	4.0
42	DINGHY & STOWAGE	87.1	—	34.1	—	2.05
43	[illegible] & STOWAGE	6.2	—	34.1	.9	—
44	[illegible]	10.0	—	38.6	—	4.75
45						
46	[illegible] STOWAGE	.3	7.0	—	—	3.75
47	[illegible] STOWAGE	22.0	11.0	—	—	3.7
48	[illegible] STOWAGE	.4	—	38.1	.9	—
49	FOOD LOCKER	12.0	—	17.9	—	4.6
50	TOOLS & SPARES LOCKER	10.4	—	19.0	—	4.5

MILITARY LOAD (FIXED)

ITEM	DESCRIPTION	WT	FOR'D	AFT	ABOVE	BELOW
51	[illegible] HOOKS	.9	—	14.4	—	.6
52	[illegible] ATTACHMENTS	6.5	—	14.8	—	2.2
53	LAVATORY	22.1	—	20.5	—	3.3
54	VICE & MOUNTING	3.3	—	20.7	—	2.7
55	WATER TANKS & WATER & [illegible]	95.0	—	17.3	—	3.85
56	[illegible] CASES STOWAGE	1.8	—	7.7	—	6.0
57	FIRST AID OUTFIT	3.4	7.0	—	—	3.7
58	[illegible] PUMP MOUNTING	8.6	2.7	—	.3	—
59	[illegible] MAINTENANCE PLATFORM	51.0	—	19.7	—	1.0
60	[illegible] & STOWAGE	15.0	—	14.6	—	2.33
61	FLAG [illegible]	.4	—	30.1	—	.3
62	VENTILATOR STOWAGE	.4	3.0	—	—	7.5
63	[illegible] DRAWER	7.4	4.7	—	—	4.4
64	TOOLS STOWAGE	5.5	3.4	—	—	6.5
65	[illegible] GUN	1.3	—	12.5	—	4.4
66	SPARE [illegible] STOWAGE	3.4	—	28.4	—	.3
67	[illegible] CLOCK	2.1	—	2.5	—	1.78
68	[illegible] MOTOR	.2	11.5	—	—	.3
69	SPARE ENGINE STOWAGE	18.3	—	3.3	.3	—
70	WIRELESS EQUIPMENT	83.3	—	6.0	—	2.95
71	INTERCOMMUNICATION EQUIPT	6.3	—	6.5	—	2.95
72						
73						
74						
75						
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TYPICAL SERVICE LOAD (REMOVABLE)

ITEM	DESCRIPTION	WT	FOR'D	AFT	ABOVE	BELOW
101	FORWARD GUN SIGHTS ETC.	21.9	15.35	—	—	1.1
102	MID GUN SIGHTS ETC.	21.9	—	26.1	—	.4
103	AFT GUN SIGHTS ETC.	21.9	—	44.2	4.92	—
104	FORWARD AMMUNITION	45.0	15.45	—	—	2.45
105	MID AMMUNITION	45.0	—	26.3	—	—
106	AFT AMMUNITION	45.0	—	44.1	3.6	—
107	SPARE FLOATS 4 LB. (4)	44.0	—	4.3	—	1.75
108	LIGHT SERIES BOMB CARRIERS	11.6	—	4.3	—	.18
109	[illegible] BOAT, ETC.	14.8	16.0	—	—	2.43
110	[illegible] SIGNALS	16.0	—	28.0	—	2.45
111	SIGNAL PISTOL & CARTRIDGES	4.4	6.5	—	—	4.11
112	ACCUMULATORS	121.0	—	4.3	—	3.93
113	NAVIGATION LAMPS ETC.	1.6	—	13.0	11.5	—
114	INSPECTION LAMPS ETC.	.7	—	4.8	—	4.33
115	[illegible] FLARES	8.0	—	12.5	—	1.8
116	MOORING LIGHTS	5.4	—	4.0	12.7	—
117	SIGNALLING LAMP	5.3	7.0	—	—	3.75
118	GENERATOR, 500 WATT	9.1	—	5.5	—	1.75
119	[illegible]	.8	—	—	—	3.85
120	COMPASS, ETC.	7.7	.8	—	—	7.4
121	HEIGHT & AIR SPEED COMPUTER	.8	4.8	—	—	4.35
122	COURSE & DISTANCE CALCULATOR	3.2	4.9	—	—	4.0
123	COURSE & WIND CALCULATOR	2.5	4.1	—	—	5.35
124	CHART BOARD	4.2	4.9	—	—	4.2
125	SEA MARKERS & CONTAINERS	12.0	5.4	—	—	2.75
126	WRITING PAD	.5	5.4	—	—	4.55
127	HAND BELL	1.8	7.9	—	—	3.25
128	EMERGENCY FLYING RATIONS	10.0	—	9.0	—	3.75
129	SPARES	40.0	—	15.8	—	4.75
130	WIRELESS EQUIPMENT	33.3	—	6.0	—	4.75
131	INTERCOMMUNICATION EQUIPT	1.7	—	6.0	—	4.75
132	W/T OPERATORS TABLE	12.5	—	6.5	—	4.35
133	MAIN FUEL 745 GALS	5615	—	6.45	8.54	—
134	OIL 36 GALS	338	—	3.17	5.52	—
135	PARACHUTE	20	12.0	—	—	4.75
136	PARACHUTE	20	7.0	—	—	3.25
137	PARACHUTE	20	—	6.5	—	5.5
138	PARACHUTE	20	—	27.3	—	4.65
139	PARACHUTE	20	—	43.1	3.24	—
140	PILOT	160	9.5	—	—	2.91
141	NAVIGATOR	160	4.7	—	—	3.25
142	ENGINEER	160	—	5.5	—	3.35
143	W/T OPERATOR	160	—	7.5	—	3.25
144	MEMBER OF CREW	160	—	3.8	—	4.75
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ALTERNATIVE REMOVABLE LOAD (NOT INCLUDED IN TYPICAL SERVICE LOAD)

ITEM	DESCRIPTION	WT	FOR'D	AFT	ABOVE	BELOW
151	BOMBS MK I H.E. 20 LB. (8)	196.0	—	4.25	—	1.2
152	BOMBS PRACTICE 8½ LB. (8)	88.0	—	4.25	—	1.2
153	FLARES MK I 12 LB. (8)	96.0	—	4.25	—	1.2
154	SPARE FLOATS 11 LB. (4)	44.0	—	4.25	—	1.2
155	BOMBS H.E. 250 LB. (8)	2000	—	7.0	—	2.4
156	BOMBS H.E. 500 LB. (4)	2000	—	3.6	—	2.2
157	BOMBS H.E. 500 LB. (4)	2000	—	3.6	—	2.2
158	BOMBS H.E. 550 LB. (4)	2200	—	3.6	—	2.2
159	CARRIERS No I ETC.	48.0	—	3.75	—	1.5
160	CARRIERS No 2 ETC.	59.0	—	10.5	—	2.0
161	CARRIER ADAPTOR BEAMS ETC.	148.0	—	7.0	—	1.2
162	TORPEDO CARRIERS	120.0	—	7.0	—	1.5
163	SEA MARKERS & CONTAINERS	13.0	5.4	—	—	2.76
164	GROUND ANCHOR & CHAIN	25.3	9.6	—	—	3.7
165	CHART LOCKER	6.5	12.4	—	—	6.76
166	[illegible] GEAR	13.0	12.0	—	—	5.6
167	CORDAGE	1.3	12.6	—	—	5.8
168	ENGINE COVERS	34.0	—	34.4	—	2.4
169	AIRSCREW COVERS	15.0	—	34.4	—	2.4
170	REAR GUNPIT COVER	3.3	—	42.2	.9	—
171	[illegible] COOKER	18.9	—	19.9	—	2.6
172	PLATE RACK	1.6	—	19.0	—	1.56
173	COOKING TABLE	21.6	—	18.9	—	3.2
174	TABLES	21.1	—	27.3	—	2.3
175	[illegible] BOX	40.4	—	8.6	—	5.5
176	PARAFFIN TANK	2.1	—	20.5	—	4.7
177	BUNKS & PARTITIONS	82.3	—	7.2	—	5.06
178	[illegible] & BAGS	50.6	—	34.4	—	2.4
179	[illegible] BASIN	1.5	—	17.6	—	3.3
180	SUIT CASES	46.3	—	7.7	—	6.0
181	VENTILATORS	15.6	8.0	—	—	7.6
182	WASTE BOX	3.5	—	20.5	—	4.7
183	FUEL 425 GALS	3013	—	6.36	—	1.45
184	OIL 16 GALS	144	—	3.17	6.54	—
185	AILERON INSPECTION LADDERS	35.1	—	37.5	1.8	—

AEROPLANE AT TARE CONDITION [illegible]

C.G. LIMITS OF AEROPLANE 81' TO 92'·0 AFT OF DATUM POINT
I.E. 48·4' TO 58·4' AFT OF LEADING EDGE
OF MEAN AERODYNAMIC CHORD (30% TO 38·[illegible] M.A.C.)

LEADING EDGE OF M.A.C. IS 39·6' AFT DATUM POINT

NOTE:- ALL LEVERS ARE MEASURED FROM DATUM POINT PARALLEL & PERPENDICULAR TO KEEL BASE. DATUM POINT IS SITUATED ON ℄ OF AEROPLANE ON TOP OF HULL 36' FORWARD OF LOWER FRONT SPAR & 26' FORD OF L.E. OF LOWER PLANE AT ℄ OF ENGINE STRUTS

NORMAL WT OF AEROPLANE WITH TYPICAL SERVICE LOAD AS ABOVE IS 37400 LB.

NORMAL C.G. IS 86·2' AFT & 54·3' ABOVE DATUM.

FIG. 38. KEY TO LOAD DISTRIBUTION DIAGRAMS