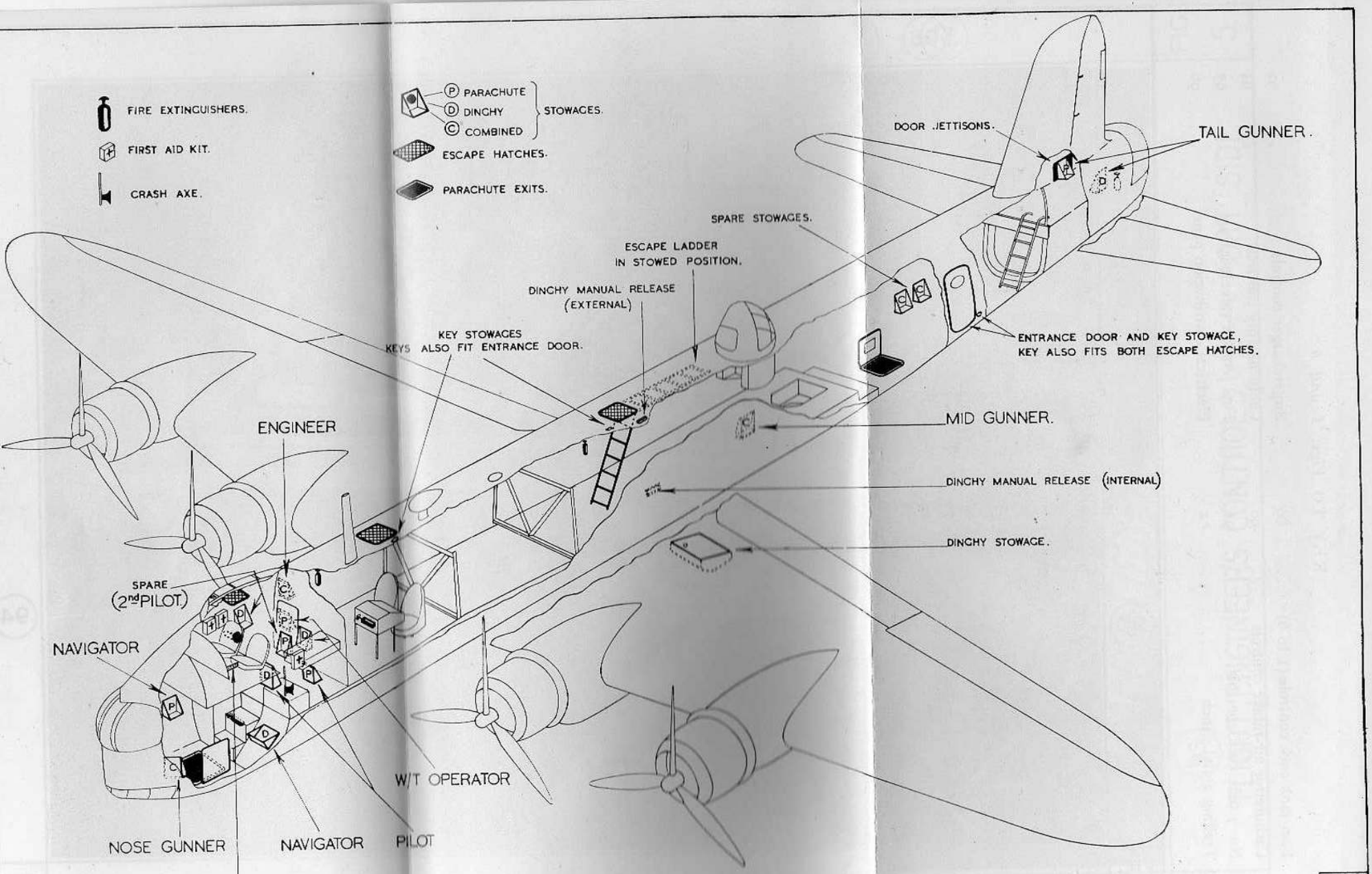


EMERGENCY EXITS & EQUIPMENT

FIG. 7

FIG. 7

PART I

DESCRIPTIVE

NOTE.—The numbers quoted in brackets after items in the text refer to the key numbers of the illustrations in Part VI.

FUEL AND OIL SYSTEMS

1. **Fuel Tanks.**—Seven tanks are fitted in each wing, and three auxiliary tanks may be carried in the wing bomb cells on each side. Capacities are:

		Each side	*Total*
Outer engine:	No. 3	63 galls.	
	No. 4	254 ,,	
	No. 5	164 ,,	
	No. 6	81 ,,	
		562 galls.	1,124 galls.
Inner engine:	No. 1	80 galls.	
	No. 2	331 ,,	
	No. 7	154 ,,	
		565 galls.	1,130 galls.
	Total normal ..	..	2,254 galls.
Auxiliary (Wing bomb cell) ..		219 galls.	438 galls.
Total (all tanks)		..	2,692 galls.

All tanks with the exception of Nos. 7 are self-sealing. The latter should not be used unless maximum range is essential; they should never be used as well as the auxiliary wing bomb cell tanks unless large oil tanks (Mod. 601) are fitted. The contents of Nos. 2 and 4 tanks are jettisonable. Later aircraft have a nitrogen fire protection system fitted; the master valve and pressure gauge are on the front spar frame on the plate carrying the starboard heating system controls. This valve should be on at all times when the engines are running.

2. **Fuel Cocks.**—The pilot controls four master fuel cocks (77) (labelled CARBURETTOR COCKS) in the cockpit roof. The flight engineer controls individual tank cocks (89, 91) at his station; the inter-engine balance cocks below the drag sheeting forward of the rear spar frame; and the inter-system balance cock under a hinged cover on the floor in front of the rear spar frame.

3. **Fuel gauges and warning lights**

(i) Contents gauges, with pushbuttons for each tank, are on the engineer's instrument panel. When taking a reading, particularly during refuelling, press the button until slight resistance is felt to release the float in the tank unit; wait for a second or two for the float to take up its proper level, and then push the button fully in to complete the gauge circuit. The gauge readings are approximate only but are within about ±3 gallons.

(ii) Fuel pressure gauges are on the instrument panel. When these indicate falling pressure, select a fresh tank immediately to avoid engine cutting. The lights may flicker during take-off due to fuel surge; this does not necessarily indicate failing pressure.

4. **Oil System.**—Each engine oil tank holds 25½ (later aircraft 32) gallons, with 5½ gallons air space. Oil pressure and temperature gauges and oil dilution pushbuttons are at the flight engineer's station. Oil is circulated in the usual manner, the oil cooler being fitted with two relief valves; the carburettors are oil heated.

MAIN SERVICES

5. **Electrical system.**—Early aircraft have a 24-volt, 1,000-watt generator on each inboard engine, connected in parallel with two 40-amp. hr. batteries. Later aircraft have a 24-volt, 1,500-watt generator on each inboard engine, connected with four 40-amp. hr. batteries. A GROUND-FLIGHT switch on the rear spar frame isolates the batteries when the aircraft is parked and when using a ground starter battery. A plug-in socket for the external supply is near the switch.

Services: Undercarriage and tail wheels
Flaps
Bomb doors
Bomb release gear
Pressure-head heating
Radio
D.R. Compass
Navigation lights
Glove and boot heating
Engine starters
Cowling gills
Internal lighting
Propeller feathering motors
Mark XIV bombsight

6. **Hydraulic system.**—The port inner engine is fitted with a twin pump for operating the nose and mid-upper turrets. The starboard inner engine is fitted with a pump for operating the tail turret. On later aircraft there is an additional pump, for the mid under turret, driven by the port inner engine.

7. **Pneumatic systems**

(i) *Vacuum system:*

(*a*) Pumps, one on each inner engine, supply the instruments and the Mk. XIV bombsight.

(*b*) A selector cock is fitted behind the loop aerial controls to enable the desired pump to be used. No. 1 position selects port inner engine pump.

(ii) *Pressure system:*

(*a*) A compressor on the port inner engine charges the wheel brake system reservoir. On later aircraft, the landing lamps are raised and lowered by this system.

(*b*) A compressor on the starboard inner engine operates the auto-pilot and Mark XIV bombsight.

(*c*) Two storage bottles, with valves for ground recharging, are fitted underneath the second pilot's seat.

AIRCRAFT CONTROLS

8. **Rudder bars.**—The pedals are adjustable by means of a star wheel (33), the top of which should be pushed forward to increase leg reach.

9. **Trimming tabs**

Elevator:	Two crank handles (78) in roof, with indicator	Operate in natural sense
Rudder:	Crank handle (80) in roof, with indicator	Operates in natural sense
Aileron:	Fixed tab on each aileron	

10. **Automatic controls.**—The Mk. IV controls are grouped together on a panel (63) beside the port pilot's seat; *see* A.P. 2095, for operation of these controls.

11. **Wheel brakes.**—The lever (55) beside the throttle levers operates the wheel brakes; the degree of braking is controlled by varying the movement of the lever. Differential braking is controlled by the rudder bars.

12. **Undercarriage controls and indicator**

(i) The lever (60) in the left-hand slot of the control box has two positions only, RAISE and LOWER, with a safety catch (61) to retain the lever in the lower position. The switch (22) on the instrument panel has three positions, UP, OFF and DOWN, and is left at OFF except when undercarriage operation is required. The complete operation requires about one minute.

(ii) The indicator (17) consists of a set of lamps on the intrument panel comprising one pair, red and green, for each of the main wheel and tail wheel units. The switch (35) for the indicator is interconnected with the ignition switches. A dimming switch and reserve set of lamps are provided. The lights indicate as follows:

All units locked up . .	. . 3 red lights
All units down and safe	. . 3 green lights only

(iii) Later aircraft have a standard type indicator indicating as follows:

All units locked up	No lights
All units unlocked	3 red lights
All units locked down and safe	3 green lights

NOTES.—

(i) When operating the undercarriage the lever must be set to RAISE or LOWER before operating the switch.

(ii) When setting to RAISE the lever must be pushed firmly in and when setting to LOWER it must be pulled firmly out.

(iii) The switch must be pushed hard over to ensure contact.

(iv) If it is necessary to switch off the motors during operation, 30 seconds must be allowed to elapse to ensure that the motors have stopped running before switching on again in the same, or the reverse, direction. Failure to observe this precaution may result in the clutch failing to engage and in damage to the motor.

(v) If it is necessary to reverse the direction of operation during raising, the wheels must be allowed to come up about half-way before the motor is switched off; otherwise, lowering electrically will not be possible.

(vi) If the red and green lights for any one wheel show together, with the wheel either up or down, a sticking limit switch or light switch is indicated. If this occurs:

(*a*) Before flight.—The aircraft should not be taken off until the trouble has been rectified.

(*b*) Before landing.—Go through the normal operation in order to lower the other wheels. Then lower the remaining wheel manually (this will not always be necessary, as on later aircraft the wheel may come down—although the light switch has stuck); but, as the green light was on before lowering, it is useless as an indicator and the wheel must be checked after lowering (electrically or manually) by the warning horn and also:

In the case of a main wheel, visually. On later aircraft check that the revolution counter fitted to undercarriage motors read the same as the reading before take off.

In the case of the tail wheels at the jack as follows:

Nut at front of jack ..	Tail wheels down
Nut at rear of jack	Tail wheels up

13. **Undercarriage warning horn.**—This sounds if the flaps are more than one-third out when any wheel is not down.

14. **Flaps control and indicator.**—The flap operating switch (83) has three positions, IN, OFF, and OUT, and is mounted on a control panel above the instrument panel. Above it are the switch (84) for the flap indicator (87) and a tell-tale lamp which shows when the indicator is on. A red warning lamp (86) lights when the flaps are more than one-third out.

ENGINE CONTROLS

15. **Throttle and mixture controls**

(i) Throttle controls:

Mk. I — (*a*) On Mk. I aircraft four throttle levers (56) are mounted in the control box. The controls are of the "Exactor" type and must be primed before starting and in flight as follows: Push the levers fully forward, past the take-off position, hold them there for about 10 seconds, and then return them very slowly to the closed position.

Mk. III & IV — (*b*) On later aircraft the controls are mechanical and no priming is required; adjustable stops at the "closed" end of the slots being provided.

(ii) Mixture controls:

Mk. I — (*a*) On Mk. I aircraft two mixture levers (59), one controlling the port engines and one the starboard engines, are below the throttle levers. The controls are of the "Exactor" type, and are primed before starting and in flight by holding them fully down, past the NORMAL position, for about 10 seconds. Priming of the mixture controls in flight every 20 minutes or so is important to ensure correct functioning of the mixture control. Each mixture control is interlocked with the throttles on the same side so that the mixture lever can only be at weak (ECONOMICAL) when both throttles are in the cruising range.

Mk. III & IV

(*b*) On later aircraft these are also mechanical, four levers being fitted, one for each engine. No priming is necessary.
(*c*) With Hercules XVI engines the mixture lever is not used and is inoperative; mixture regulation is automatic, and an economical mixture strength is obtained at or below plus 2 lb./sq.in. boost. For weak mixture cruising the throttle lever should not be opened beyond economical cruising position or beyond the white line if one is painted on the quadrant.

16. **Propeller speed controls**

(i) On Mk. I aircraft the levers (7) are in the lower part of the control box and are moved up to INCREASE and down to DECREASE, the R.P.M. The propeller speed controls are of the "Exactor" type, and should be primed before starting and in flight by holding them to the fully down position for about 10 seconds.

Mk. I

(ii) On later aircraft the controls are mechanical, no priming is necessary and stops are fitted as in the case of the throttle levers.

Mk. III & IV

17. **Propeller feathering controls** (40) are at the bottom of the instrument panel on the port side. For operation *see* Part IV.

18. **Supercharger controls.** — Four handwheels (93) are mounted on the front spar frame, two on each side, for controlling the two-speed superchargers. In the S gear position the pointer at the bottom of each wheel is turned inboard; the controls should be operated smartly.

19. **Carburettor air-intake heat controls.**—Four handwheels (90) are mounted above the supercharger controls, two on each side; they may be set to either of two positions, HOT or COLD.

20. **Cowling gills.**—The switches for these are on the engineer's panel. An indicator and warning light is fitted above each switch to show the position of the gills. Cylinder temperature gauges are on the engineer's panel.

21. **Slow-running cut-out controls.**—There are two levers (88) in a central position in the roof of the cockpit, the left-hand lever controlling the inboard engines and the other the outboard engines.

22. **Priming pumps**

(i) The carburettor priming pumps are fitted in the centre section.

(ii) The induction priming system comprises Ki-gass priming pumps fitted in the centre section.

23. **Booster-coil switches.** — These switches (32) are fitted at the bottom of the pilot's instrument panel on the starboard side.

24. **Electric starter switches.**—The four engine-starter push-button switches are fitted below the ignition switches in a recess on top of the control box in the centre of the cockpit; they are protected from inadvertent operation by means of a spring-loaded cover plate (36). Provision is also made for hand turning the engines.

OTHER CONTROLS

25. **Bomb doors.**—Before bombs can be released, the trailing aerial must be wound in, fairlead retracted, and the doors under the bomb cells in the fuselage and/or main plane must be fully open. These doors are operated electrically and are controlled by two switches (27) on the right-hand side of the instrument panel, the left-hand switch controlling the fuselage doors and the other the main plane doors. Indicator lamps above the switches are illuminated when the doors are fully open, a duplicate set of lamps being fitted at the bomb aimer's station. In the event of electrical failure, the doors may be operated manually from the centre section.

26. **Bomb releasing.**—The selection, fusing and releasing of the bombs are carried out by the bomb aimer. The bomb release circuit is only complete when the appropriate bomb cell doors are fully open and, on early aircraft, when the main switch of the type "F" jettison switch on the starboard side of the instrument panel is in the ON position.
If necessary, any bombs selected by the bomb aimer can be released by the pilot by a duplicate firing switch at (52) on the port control handwheel, with a socket for connection (53) on the column.

27. **De-icing.**—A de-icing solution may be sprayed on the pilot's windscreen and bomb aimer's window by means of a handpump mounted on the floor beside the captain; a cock at the bomb aimer's station enables this supply to be cut off if not required.

28. **Cabin heating controls.**—Handwheels (94) at the engineer's station control the valves of the port and starboard heating systems. On Mk. I (steam heating system only) switches by the valves control circulating pumps and must not be turned on before the valves have been set to HOT.

29. **Cockpit lighting.**—Small floodlights (14) with dimmer switches beside them illuminate the instruments.

30. **Radio controls.**—A remote control for the T.R.9.F. with a frequency change-over switch (48) is on the port side.

31. **I.F.F.**—Two pushbuttons shielded by a hinged flap and a master switch (30) are on the starboard side of the instrument panel.

32. **Beam approach.**—A panel (73) carries control and mixer switches. The indicator (15) is above the flying instrument panel.

33. **D.R. Compass.**—The switches (21) are at the centre of the instrument panel with the repeater (26) on the starboard side of the panel.

34. **Navigation and recognition lights.**—Switches (68) and (72) control these, the signalling switchboxes (76) being mounted above them. Indicator lamps (62) show when the respective lights are on. (On later aircraft indicator lamps are on the port side of wireless operator's station.)

35. **Landing lamps**

(i) On earlier Mk. I aircraft two landing lamps are mounted in the leading edge of the port wing, outboard of the outer nacelle; the " two-way and off " control switch (37) being mounted on the port side of the throttle lever quadrant. The lamps may be dipped by "Exactor" control by means of a lever to the right of the mixture levers.

(ii) On later aircraft, one lamp is fitted in the same position in a box which can be lowered pneumatically by a similar lever (58) to that which previously dipped the lamps. The lamp box extends almost immediately after moving the lever and retracts in 4 to 5 seconds; after this time, the lever should be returned to the neutral position to cut off the air supply. A lamp dipping lever (57) is mounted beside the box control lever, and, to avoid overstraining, should not be operated whilst the lamps are retracted.

36. **Glider towing gear.**—On later aircraft a glider towing hook and remote control release are fitted; the release control is a long lever mounted on the starboard side of the throttle control box.

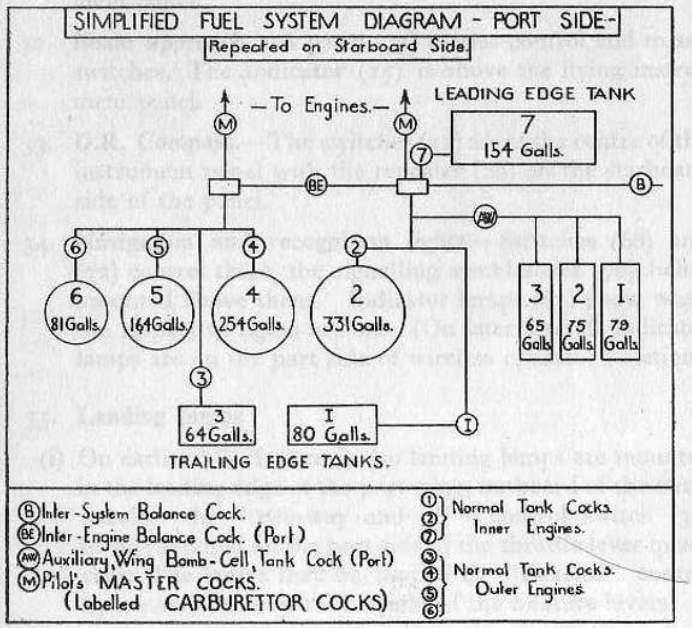
PART II

HANDLING

NOTE.—The speeds given in the following paragraphs as well as in Parts III and IV apply, except when otherwise stated, for either pressure-head position as well as when the A.S.I. is connected to the static vent.

37. Fuel System Management

The suggested sequence of use of tanks and management of the fuel system is set out in the charts and notes on the following pages. These should be read in conjunction with the diagram given below.



(i) *Normal system operation chart:*
The following table gives the recommended procedure when starting with the normal full fuel load of 2,254 gallons and assuming that 45 gallons are used for each engine for starting, take-off, and initial climb to about 3,000 ft.

	Inner Engines		Outer Engines	
	Tank and Cock	Fuel remaining	Tank and Cock	Fuel remaining
Starting T.O. and steep climbing	2 ON 2 OFF	331 galls. 286 ,,	4 ON 4 OFF	254 galls. 209 ,,
Gentle climb and Level Flight	7 ON	154 ,, 101 ,,	3 ON 3 OFF	63 ,, 10 ,,
		101 ,, 31 ,,	6 ON 6 OFF	81 ,, 10 ,,
	7 OFF	31 ,, 10 ,,	5 ON	164 ,, 143 ,,
	1 ON 1 OFF	80 ,, 10 ,,		143 ,, 73 ,,
	2 ON	286 ,, 223 ,,	5 OFF	73 ,, 10 ,,
		223 ,,	4 ON	209 ,,

NOTE:
The above sequence in use of tanks is recommended for the following reasons:
(*a*) Nos. 1 and 3 tanks should not be used for starting, take-off or steep climbing (as when taking evasive action, etc.) because in a tail down attitude they are below the level of the fuel pumps and there is a risk of fuel starvation. They should, however, be used early in flight to prevent the CG moving too far aft.

(*b*) No. 7 tanks should be used early in flight as they are not self sealing.

(*c*) If it is essential that maximum manœuverability be attained as early in flight as possible, Nos. 6 tanks may be used before Nos. 3, but Nos. 3 should, in any case, be used before any bomb load is dropped for C.G. reasons in (i)(*a*).

(ii) *Operation Chart using auxiliary wing bomb cell tanks:*

Total capacity of auxiliary wing bomb cell tanks is 438 gallons so total fuel, together with all normal tanks, is increased to 2,692, the following table gives the recommended procedure assuming that 45 gallons are again used for starting, take-off and initial climb to 3,000 feet.

	Inner Engines		Outer Engines	
	Tank and Cock	Fuel remaining	Tank and Cock	Fuel remaining
Starting T.O. and steep climbing	2 ON 2 OFF	331 galls. 286 ,,	4 ON 4 OFF	254 galls. 209 ,,
Gentle climb and Level Flight	Inter Engine Balance Cocks (BE) on 7 On 154 galls. 7 OFF— 10 ,,			
	Aux—ON	219 galls. 166 ,,	3 ON 3 OFF	63 galls. 10 ,,
		166 ,,	6 ON 6 OFF	81 ,, 10 ,,
	Aux—OFF	95 ,, 10 ,,	5 ON	164 ,, 79 ,,
	1 ON 1 OFF	80 ,, 11 ,,	5 OFF	79 ,, 10 ,,
	2 ON	286 ,,	4 ON	109 ,,
	EQUALISE—(BE)—ON then when equal—OFF say 245 galls.			245 ,,

NOTES:

(*a*) The method set out above enables numbers 3, 5 and 6 tank gauges to be used to estimate the fuel in the auxiliary tanks; allowance should be made for any excessive consumption.

(*b*) When using auxiliary tanks in the above manner, all balance cocks should be OFF.

(*c*) If there is any doubt as to the fuel remaining in the auxiliary tanks, shut them off on one side and drain right down on the other side, i.e. until the fuel pressure warning lamp flashes or engine cuts. The time for this operation gives the approximate duration of fuel remaining in auxiliary tanks on the other side.

(iii) *General Notes:*

(*a*) If it is desired to use all possible fuel from each tank, wait until warning light comes on but then change over immediately. If contents gauges indicate the probability of two tanks on one side running dry simultaneously, change over on one while say 10 gallons still remain; this tank can be emptied later, after changing over on the other.

(*b*) No tank should be used for more than one engine at a time over enemy territory. Whenever one tank on each side is being used for both engines on that side, avoid allowing both to run out simultaneously as in (*a*) above.

(*c*) When there is a possibility of having to ditch the aircraft, it is advisable to leave 50 gallons in each No. 5 tank to use while ditching so that the contents of Nos. 2 and 4 tanks can be completely jettisoned. If all tanks excepting Nos. 2 and 4 are empty, in the event of ditching use the contents of one tank with the inter engine balance cock on, and jettison the contents of the other.

(*d*) Towards the end of the flight, the contents of Nos. 2 and 4 tanks should be equalised by opening inter engine balance cocks.

(*e*) For landing, should fuel be very short, run on No. 4 tanks—inter engine balance cocks on—until 10 gallons remain; then open No. 2 tank cocks and close balance cocks. When fuel pressure warning lights indicate that No. 4 tanks are running dry, close No. 4 tank cocks and open inter engine balance cocks. Allow 5 minutes between changeover on port and starboard sides to avoid two engines cutting simultaneously. The sequence of using Nos. 4 and 2 tanks may be reversed if defective gauges make this desirable.

(*f*) If one or more gauges become unserviceable the consumption from the tanks concerned can be checked by comparison with another tank feeding an engine running at the same boost and r.p.m.

(*g*) Numbers 2 and 4 tanks should always be turned on when the fuel system is in imminent danger of being damaged, i.e. in fighter belts, target area, etc.

(*h*) Tank cock positions are not marked on all aircraft but are as follows:

Levers up	OFF
,, down	ON

NOTE.—On Stirling III and IV aircraft the No. 7 tank controls operate in the opposite direction.

Levers up	ON
,, down	OFF

38. Preliminaries

Pilot's Checks

(i) Check:

Pilot's master cocks ..	OFF
Undercarriage master switch	OFF
Undercarriage lever ..	LOWER (switch on indicator and check green lights)
Bomb-doors	CLOSED
I.F.F.	OFF

D.R. Compass	ON and SETTING
Trim tabs (rudder and elevator) for full movement and reset	NEUTRAL
Pilot's escape hatch	Fastened

(ii) Prime "Exactor" controls (Stirling I) as follows:

(*a*) Throttles ..	Fully open, wait 10 secs., fully closed
Mk. I only. (*b*) Mixture ..	Fully down, wait 10 secs., NORMAL
(*c*) Propellers ..	Fully down, wait 10 secs., fully up

Flight Engineer's Checks.—See A.P. 2764 Flight Engineer's Notes General and:

(i) Check that the jaws of the undercarriage "UP" locks are open.

(ii) Check tail chassis clutch pins are fully forward in the engaged position—emergency handle correctly stowed. See that the electrical conduit to the motor is securely screwed home.

(iii) Check that main undercarriage motors are set for electrical operation—emergency handle stowed correctly —Red star wheel wound fully anti-clockwise (looking forward).

(iv) Check that flap operating motor is correctly set for electrical operation—emergency handle stowed correctly.

(v) Set air intakes to COLD, blowers to LOW (M).

(vi) Put 2 and 4 tanks "ON", all other tanks "OFF", port and starboard.

NOTE.—Nos. 2 and 4 tanks (port and starboard) should always be used for starting, running up, take-off and landing.

Balance cocks SHUT.

(vii) Check that all fuses are in position on the charging and distribution panel. (N.B.—Pay particular attention to the undercarriage fuse, which should be *OUT*.)

(viii) Check tension of undercarriage operating cables.

(ix) Vacuum pump to No. 2 position.

(x) Check inter-comm. at panel and bunk positions.

(xi) Check parachute stowage and security of all loose articles of equipment.

(iii) Flight engineer should also check with pilot that all actions in Pilot's List under (i) and (ii) have been carried out as well as all usual checks.

39. Starting engines and warming up

(i) Normally engines should be started in turn commencing with the port outer, unless starting from aircraft batteries, when start inner engines first. Before starting each engine, the following should be checked by the pilot and rechecked by the engineer visually and verbally:

(*a*) Check engines have been turned two revolutions by hand within the previous six hours.

(*b*) 2 and 4 tanks ON. All balance cocks OFF.

(*c*) COLD air, " M " Blower, gills OPEN.

(*d*) Carburettor cocks ON.

(*e*) Pilot should turn over engines to be started at least two revolutions with the starter (unless starting on aircraft batteries when engines should be turned over by hand) with throttle 1 in. open.

(ii) Start engines in turn as follows:

(*a*) Carburettors should not be primed, unless engines have not been run for one week or more, when engineer should prime with four single strokes of the wobble pump. If carburettors have been drained, nine single strokes should be given. *See* Part V.

(*b*) Engineer should prime induction system by working ki-gass pump, until the suction and delivery pipes are full; this may be judged by a sudden increase in resistance. High volatility fuel (stores ref. 34A/111) should be used, if an external priming connection is fitted, for priming at air temperatures below freezing.

(*c*) Pilot should switch ON ignition and booster coils, press starter button and call " contact " to engineer, who will work the priming pump as firmly as possible while the engine is being turned. It should start after the following number of strokes:

Air temperature °C	+30	+20	+10	0	−10	−20
Normal fuel ..	3	4	7	10		
High volatility fuel				3	8	18

If K.40 (40 c.c.) pumps are fitted, divide above number of strokes by four, giving an incomplete stroke where necessary.

Turning periods should normally be restricted to 10 seconds and must never exceed 20 seconds, with a 30-second wait between each.

(*d*) It will probably be necessary to continue priming after the engine has fired and until it has picked up on the carburettor.

(*e*) When the engine is running satisfactorily, switch OFF the booster coil (or starting magneto) and instruct the flight engineer to turn OFF the priming cock and screw down the priming pump.

(*f*) Run the engine as slowly as possible for half a minute, then warm up at about 1,000 r.p.m. to allow oil to circulate through the engine.

(*g*) After all engines have been started, flight engineer should check external supply disconnected and GROUND/FLIGHT switch set to FLIGHT.

40. Testing engines and installations

(i) If the aircraft is facing out of wind, signal chocks away, turn into wind and apply brakes.

(ii) *While warming up :*

(*a*) Keep gills open and check with engineer the usual temperatures, etc.

(*b*) Test operation of controls, switch on flap indicator and test flaps. Flight engineer should check operation of flap motor while pilot is testing.

(*c*) Check brake pressure, at least—100 lb./sq.in.

(iii) *After warming up :*

The following comprehensive checks should be carried out after repair, inspection (other than daily), or otherwise at the pilot's discretion. Normally they may be reduced in accordance with local instructions.

(*a*) At 1,500 r.p.m. with propeller lever fully up, order the engineer to put in " S " gear. Note a momentary drop in oil pressure (engineer) and a slight flicker in boost (pilot). Change back to " M " gear.

NOTE.—This test need only be carried out once per day.

(*b*) Open engine up to 2,400 r.p.m. and set propeller lever fully down to check speed variation of governor through full range; drop should be 600/800 r.p.m. A drop of say 200 r.p.m. is, however, sufficient to indicate that the C.S.U. is functioning. Return lever fully up. Ensure that the r.p.m. returns to 2,400.

(*c*) When running up inners, check instruments, and the engineer should check the charging rate of the generators.

(*d*) Check functioning of mixture control (except Hercules XVI); at −1 to −2 lb./sq.in. R.p.m. should drop slightly.

(*e*) If necessary to check static boost and r.p.m., open throttle slowly to the take-off position, noting the boost reading of $+8\frac{1}{4}$ at 2,800 to 2,850 r.p.m. ($+6\frac{3}{4}$ and 2,800 r.p.m. with Hercules XI).

(*f*) With propeller levers set fully up, open up to rated boost. If the propeller is constant speeding at this boost, the throttle should be closed until a slight drop in r.p.m. is noted. Test magnetos: maximum drop 50 r.p.m.

(*g*) While throttling back, check boost at climbing and cruising stops.

(*h*) Close throttle and check slow running: 400/600 r.p.m.

(*i*) Open throttle to obtain 1,000 r.p.m. approximately.

NOTE.—(*a*) Ground running should be reduced to a minimum; by co-operation with ground crew, one run-up can sometimes take the place of two. (*b*) Throttles must not be opened quickly and engines should not be run at high boost and r.p.m. for longer than is absolutely necessary.

41. Taxying out

(i) Do not run engines at less than 1,000 r.p.m., using mainly outer engines for manœuvring on the ground.

(ii) Signal chocks away, set inners at 1,000 r.p.m. and taxy to the take-off position. Ensure the brake pressure is sufficient to reach the take-off point—min. 120 lb./sq.in.

(iii) When turning, the aircraft must on no account be allowed to pivot about one wheel, or considerable damage to tyres may result.

(iv) After clearing engines prior to take-off, check that the throttles are synchronized for slow running. If not, prime " exactor " control as necessary.

Mk. I. WARNING.—When fitted, the under-turret guns tend to creep into the fully-down position, when they may foul the ground. The air gunner should, therefore, ensure that the guns are fully elevated before (and if no stop or catch is fitted remain so during) taxying, take-off and landing.

42. Check lists before take-off

(i) *Pilot checks*

T—Trimming tabs:	
Rudder tab:	Neutral
Elevator tab:	
(*a*) C.G. forward	Neutral
(*b*) C.G. normal (111 to 112 ins. aft) ..	4 divisions forward
(*c*) For each 5 ins. aft of (*b*)	4 divisions further forward
M—Mixture	NORMAL
P—Propeller	Speed controls fully up
F—Fuel	Check master cocks, also tank cock settings and contents with engineer
F—Flaps	One-third out
Superchargers	LOW. Check with engineer
Gills	One-third open. Check with engineer
D.R. compass	NORMAL

NOTE.—When setting flaps one-third out, set switch to IN when one-third warning light comes on, and to OFF immediately it goes out.

(ii) *Flight engineer checks*

(*a*) Superchargers LOW.

(*b*) Gills one-third open and check by indicator and visually that all are at same angle to engine cowlings.

(*c*) Check and inform pilot, temperatures and pressures normal, undercarriage fuses *IN*.

NOTE.—Desired temperatures for take-off:

Oil	25° C.–70° C.
Cylinder	160° C.–220° C.

43. **Take-off**

(i) Turn into the take-off direction, and run forward a few yards to straighten the tail wheels.

(ii) With brakes on, open each throttle until the engines are running at about 2,000 r.p.m. Then release the brakes and open the throttles slowly (holding all four levers with one hand) the starboard throttles leading, to counteract the slight tendency to swing to starboard. Ease the control column forward enough to lift the tail as speed is gained, then keep straight with the rudder.

(iii) If taking off at full load and with the C.G. 120 ins. or more aft, the elevator tabs should be wound fully forward as the undercarriage is rising. When the undercarriage is up, the aircraft will still be markedly tail heavy, but when the flaps are raised, trim is regained, the tab setting for the climb being 8 divisions forward.

(iv) (*a*) The aircraft should be eased off the ground at not less than the following speeds:

	Thousand lb.		
Weight	56–60	60–65	65–70
Take-off speed m.p.h. I.A.S.*	100	105	110

(*b*) The safety speed is 135 m.p.h. I.A.S.*

* On early aircraft which have the pressure head on top of the wireless mast add 5 m.p.h.

44. **After take-off**

(i) (*a*) Brakes on gently, undercarriage up, brakes off.

(*b*) Second pilot to check operation as wheels come up and report anything abnormal to engineer at once.

(*c*) When wheels are up, set switch OFF.

(ii) (*a*) Do not start to raise the flaps until the undercarriage is completely retracted. The flaps come up very slowly and there is little tendency to lose height.

(*b*) Before raising flaps the switch may be set OUT until $\frac{1}{3}$ out lamp lights to check that warning buzzer operates, then set to IN to raise flaps.

45. **Climb**

When undercarriage and flaps are up, the aircraft may be climbed at 150 m.p.h. I.A.S. with the gills $\frac{1}{3}$ open (if temperatures permit to not more than the "straight" position) or at about 185 m.p.h. I.A.S. with the gills closed.

See para. 57.

46. **General flying**

(i) *Stability.*—The aircraft is directionally and laterally stable. It is reasonably stable longitudinally except at full load with the C.G. in the most aft position.

(ii) *Change of trim*

Flaps down	Nose up
Undercarriage down	Nose down
Gills closed	Little change

(iii) *Controls.*—The controls are good, the ailerons being reasonably light for such a large aircraft. The elevator control has a slightly heavy and sluggish initial movement.

(iv) *Flying at low airspeeds.*—Flaps may be lowered to the $\frac{1}{3}$ out position and the speed reduced to about 145 m.p.h. I.A.S.

(v) *Astro-navigation.*—The aircraft can be flown by experienced pilots under manual control with sufficient steadiness for astro-navigation, but it is recommended that the auto-control should be used while sextant observations are taken.

(vi) *Synchronising engines.*—The engines may be synchronised by r.p.m. indicators; a fine adjustment of the inners can usually be made by sound and then of the port and starboard pairs visually by looking through the propeller discs.

(vii) Desired engine temperatures for continuous flight:

Cylinder	200° C. to 220° C.
Oil	55° C. to 70° C.

47. Stalling

(i) Experience indicates that the I.A.S. at the stall varies considerably with different aircraft; only very approximate figures can therefore be quoted. At about 10 m.p.h. above the stall buffeting occurs, and at the stall the nose drops, followed by a slight tendency for the starboard wing to drop.

(ii) Approximate stalling speeds at 62,000 lb. (engines off) with underbody pressure heads are:

Flaps and undercarriage up ..	110 m.p.h. I.A.S.
,, ,, ,, down ..	85 m.p.h. I.A.S.

With pressure head on wireless mast, or with A.S.I. connected to static vents, about 10 to 15 m.p.h. higher.

48. Before landing

Flight Engineer's checks

(i) Check, as accurately as possible, the amount of fuel remaining and inform the pilot quantity and distribution.

(ii) Check that the all-up weight of the aircraft does not exceed 60,000 lb. for landing, by adding to the normal service weight (about 48,900 lb. Mk. I, 49,800 lb. Mk. III and IV without bombs or fuel) the weight of fuel remaining, i.e. gallons × 7·3 lb. At 49,800 lb. service weight, fuel should not exceed about 1,300 gallons. If A.U.W. is excessive, jettison fuel as necessary.

49. Approach and landing

(i) *Pilot's actions*

Reduce speed to about 145 m.p.h. I.A.S. and act as follows:

(*a*) Lower flaps to ⅓ out.

Mk. I. (*b*) Prime "Exactor" throttle and propeller controls (Mk. I only) and set latter to give 2,500 r.p.m.

(*c*) Check brake pressure with lever applied. If the system has been damaged, the gauge may give a false reading with the brakes off. Release brakes after check.

(ii) *Flight Engineer's actions*

Check superchargers ..	LOW
Gills	⅓ open (if necessary)
Carburettor air ..	COLD
Check fuel	*See* paras. 37 and 48.

(iii) *Check lists before landing*

(*a*) *Pilot*

U—Undercarriage ..	Operating lever LOWER Master switch DOWN When green lights appear, put master switch OFF
M—Mixture controls ..	NORMAL
P —Propeller	Speed controls 2,500 r.p.m. or fully up, for final approach
F —Flaps	Fully OUT for straight final approach
Under turret (if fitted)..	Guns elevated (*see* para. 41 WARNING)

(*b*) Flight engineer, as wheels come down, checks:
Main wheels, visually (and by revolution-counter on later aircraft); tail wheel, jack nut fully forward to tail wheel motor.
Gauge readings.

(*c*) If desired by pilot, second pilot should call out I.A.S. and height at intervals.

(iv) The recommended minimum approach speeds are:

	A.S.I. connected to:		
	Mast Pressure Head	Under Body Pressure Head	Static Vent
At 48,000 lb.:			
Engine asstd.	115	100	105
Glide ..	125	110	115
At 56,000 lb.:			
Engine asstd.	125	110	115
Glide	135	120	125

50. **Mislanding**

Opening the throttles with the flaps and undercarriage down makes the aircraft markedly tail heavy. After mislanding, open throttles slowly to maximum rich continuous boost, retrim the aircraft and then open the throttles fully. Raise the flaps to $\frac{1}{3}$ out (this produces no tendency to sink) and retrim as necessary, raise the undercarriage and proceed as for normal take-off. If propellers are set to 2,500 r.p.m., set fully up immediately should it be necessary to open up to take-off boost.

51. **After landing**

(i) Engineer opens gills fully before taxying.

(ii) If taxied for long distances, engines should be cleared by opening up to 2,000 r.p.m. with propeller controls fully up.

52. **Stopping engines**

(i) Turn into wind with tail wheels straight.

(ii) To reduce risk of fire in the induction system and to prevent subsequent hydraulicing, stop engines as follows:

(*a*) Run engine at 800 to 900 r.p.m. until cool.

(*b*) Open up slowly and evenly to 2 lb./sq.in. boost for 5 seconds.

(*c*) Close throttles slowly and evenly, taking about 5 seconds, until speed is reduced to 800 to 1,000 r.p.m. and run at this speed for 2 minutes, or longer if diluting.

(*d*) Pull carburettor cut-out and switch off when engine stops

(iii) *Oil dilution.*—*See* A.P. 2095 and note: the correct period is 4 minutes with engines running at 900 to 1,000 r.p.m.

53. **When parking**

See A.P. 2764 Flight Engineer's Notes General and note:

(i) Pilot and Engineer — All electrical switches OFF
GROUND/FLIGHT switch—GROUND
Remove u/c fuse

(ii) On Mark I aircraft, to relieve load on exactor controls, leave as follows:

Mk. I.

Throttles ..	Fully OPEN (after engines have cooled off)
Mixture ..	NORMAL
Propellers ..	Fully down

PART III

OPERATING DATA

54. **Engine data**

(i) *Hercules XI (Operational)*

(*a*) Fuel .. .. 100 octane only

(*b*) Limitations:

		R.p.m.	Boost lb./sq.in.	Temp. ° C. Cylr.	Oil
MAX. TAKE-OFF TO 1,000 FT. ..	M	2,800	+6¾		
MAX. CLIMBING 1 HR. LIMIT ..	M, S	2,500	+3½	270 (290)	90
MAX. RICH CONTINUOUS ..	M, S	2,500	+3½	270 (290)	80
MAX. WEAK CONTINUOUS ..	M, S	2,500	+1	270 (290)	80
COMBAT .. .. 5 MINS. LIMIT ..	M, S	2,800	+6¾	280 (300)	100

NOTE.—Use of the higher temperatures in brackets is permitted only when operational conditions make the observance of the normal limitations impracticable, but the life of the engine will be shortened.

OIL PRESSURE:
NORMAL .. .. 80 lb./sq.in.
EMERGENCY MINM. (5 MINS.) .. 70 lb./sq.in.

MINM. TEMP. FOR TAKE-OFF:
OIL .. .. .. 5° C. (recommended 15° C.)

MAX. TEMP. FOR TAKE-OFF:
CYLINDER .. .. 230° C.

MAX. TEMP. FOR STOPPING ENGINES:
CYLINDER .. .. 230° C.

(ii) *Hercules VI and XVI (Operational)*

(*a*) Fuel .. .. 100 octane

(*b*) Limitations:

		R.p.m.	Boost lb./sq.in.	Temp. ° C. Cylr.	Oil
MAX. TAKE-OFF TO 1,000 FT. ..	M	2,800	+8¼		
MAX. CLIMBING 1 HR. LIMIT ..	M	2,400	+6	270 (290)	90
	S	2,500			
MAX. RICH CONTINUOUS ..	M	2,400	+6	270 (290)	80
	S				
MAX. WEAK CONTINUOUS ..	M	2,400	+2	270 (290)	80
	S				
COMBAT .. .. 5 MINS. LIMIT..	M	2,800	+8¼	280 (300)	100
	S				

Temperatures in brackets are permitted when thermo-couples are fitted to No. 14 cylinder.

OIL PRESSURE:

NORMAL .. .. 80–90 lb./sq. in.
EMERGENCY MINM. (5 MINS.) .. 70 lb./sq. in.

MINM. TEMP. FOR TAKE-OFF:

OIL .. .. 5° C. (15° C. recommended)

MAX. TEMP. FOR TAKE-OFF:

CYLINDER .. .. 230° C.

MAX. TEMP. FOR STOPPING ENGINES:

CYLINDER .. .. 230° C.

(iii) *Hercules XI, VI and XVI (Training)*

The following limitations apply for use with 87 octane fuel in training service:

		R.p.m.	Boost lb./sq.in.	Temp. ° C. Cylr.	Oil
MAX. TAKE-OFF TO 1,000 FEET ..	M	2,800	+5		
MAX. CLIMBING 1 HR. LIMIT ..	M	2,400	+2½	270	90
	S				
MAX. RICH CONTINUOUS ..	M	2,400	+2½	270 (250)	80
	S				
MAX. WEAK CONTINUOUS ..	M	2,200 (2,400)	Zero	270 (250)	80
	S				
MAX. ALL-OUT 5 MINS.	M	2,800	+5	280	100
	S				

NOTE.—Figures in brackets apply to Hercules VI and XVI.

OIL PRESSURE:

NORMAL .. .. 80 lb./sq.in.
EMERGENCY MINM. (5 MINS.) .. 70 lb./sq.in.

MINM. TEMP. FOR TAKE-OFF:

OIL .. .. 5° C. (recommended 15° C.)

MAX. TEMP. FOR TAKE-OFF:

CYLINDER .. .. 230° C.

MAX. TEMP. FOR STOPPING ENGINES:

CYLINDER .. .. 230° C.

55. **Position error corrections**

(i) On aircraft with the pressure head on top of the aerial mast, the corrections are as follows:

(*a*) At 65,000 lb.:

	Flaps Down		Flaps Up								
From ..	100	120	120	135	150	165	180	200	215	230	m.p.h. I.A.S.
To ..	120	140	135	150	165	180	200	215	230	245	
Add ..	–	–	–	–	–	–	–	2	4	6	m.p.h.
Subtract	4	2	8	6	4	2	0	–	–	–	

(*b*) At 50,000 lb.:

	Flaps Down		Flaps Up								
From ..	100	120	115	130	145	160	175	190	205	220	m.p.h. I.A.S.
To ..	120	140	130	145	160	175	190	205	220	240	
Add ..	–	–	–	–	–	–	2	4	6	8	m.p.h.
Subtract	2	0	6	4	2	0	–	–	–	–	

(ii) On aircraft with the pressure head beneath the fuselage, the corrections are as follows:

(*a*) At 65,000 lb., flaps up:

From	120	130	145	160	180	200	220	240	m.p.h. I.A.S.
To	130	145	160	180	200	220	240	270	
Add	4	2	0	–	–	–	–	–	m.p.h.
Subtract	–	–	–	2	4	6	8	10	

(*b*) At 50,000 lb., flaps up:

From	120	130	140	155	170	190	210	240	m.p.h. I.A.S.
To	130	140	155	170	190	210	240	270	
Add	2	0	–	–	–	–	–	–	m.p.h.
Subtract	–	–	2	4	6	8	10	12	

(iii) When connected to the static vents the I.A.S. position error is less than 2 m.p.h. throughout the speed range, and may, therefore, be neglected.

56. **Flying limitations**

(i) This aircraft is designed for duty as a heavy bomber and intentional spinning and aerobatics are not permitted.

(ii) *Maximum speeds in m.p.h. I.A.S. :*

Diving: Pressure head under fuselage		325
,, ,, on mast		295
A.S.I. connected to static vents		310
Undercarriage locked down	155	With pressure head on top of mast, add 5 m.p.h.
Flaps down	145	
Landing lamp lowered	155	

(iii) *Maximum weights :*

Take-off and straight flying only	70,000 lb.
Landing and all forms of flying	60,000 lb.

(iv) *Bomb clearance angles :*

Dive	30°
Climb	20°
Bank	8° (with S.B.C. 11°)

57. **Maximum performance**

(i) *Climbing:*

(*a*) Speed for maximum rate of climb in m.p.h. I.A.S.:

From S.L. to 10,000 ft.	150
Above 10,000 ft.	145

NOTE.—Experience indicates that under normal conditions an equally good rate of climb, with somewhat lower oil temperatures, can be maintained by climbing at 180/185 m.p.h. I.A.S. with gills closed.

(*b*) Change to S gear when the boost has fallen by 3 lb./sq.in.

(ii) *Combat:*

Use S gear if the boost in M gear is less than 3 lb. below combat boost limit.

58. **Maximum range** (*see* curves, page 36.)

(i) *Climbing:*

(*a*) Climb at 150 m.p.h. I.A.S. using maximum boost and r.p.m. (+3½ lb./sq.in. and 2,500 r.p.m. with Hercules XI and +6 lb./sq.in. and 2,400 r.p.m. with Hercules VI)—*see* para. 57(i).

(*b*) The climb may be made in stages as follows: Level off, and then reduce to maximum weak mixture cruising conditions. The speed which can then be maintained is about 155 to 165 m.p.h. I.A.S. When resuming the climb, change to climbing conditions, if necessary flying level until the desired climbing speed is reached.

(*c*) Above full throttle height follow the boost back with the throttle levers and change to S gear only when boost has fallen by 3 lb./sq.in.

(*d*) Delay the climb above full throttle height as late as possible until the aircraft is lighter. The I.A.S. should be reduced progressively to maintain a reasonable rate of climb and should be about 145 m.p.h. I.A.S. at about 17,000 ft.

(ii) *Cruising:*

(*a*) The recommended speeds are:

(i) Fully loaded, outward journey: 165 m.p.h. I.A.S. (when fully loaded it may not be possible to maintain more than 155–160 m.p.h. I.A.S.).

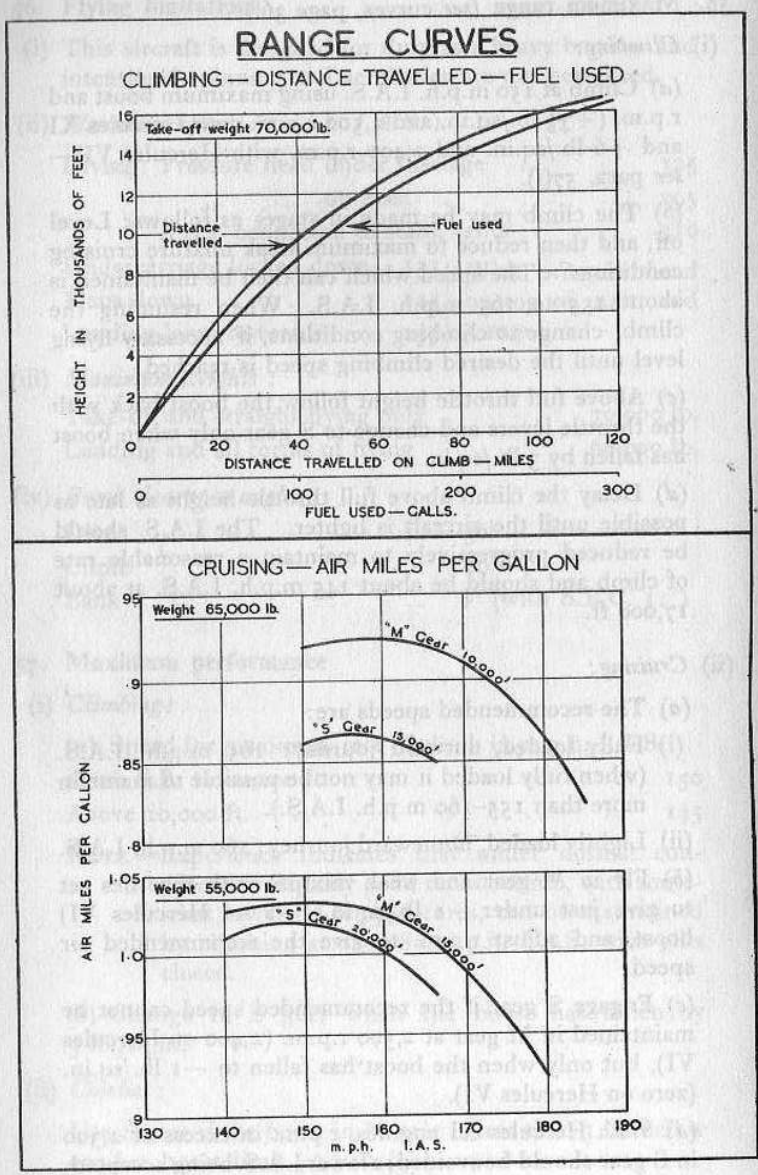
Mk. I

(ii) Lightly loaded, homeward journey: 160 m.p.h. I.A.S.

(*b*) Fly in M gear and weak mixture with throttles set to give just under +1 lb./sq.in. (+2 on Hercules VI) boost, and adjust r.p.m. to give the recommended air speed.

(*c*) Engage S gear if the recommended speed cannot be maintained in M gear at 2,500 r.p.m. (2,400 on Hercules VI), but only when the boost has fallen to −1 lb./sq.in. (zero on Hercules VI).

(*d*) With Hercules XI engines, r.p.m. in excess of 2,300 in S gear should be avoided; a lower I.A.S. being accepted.



59. **Use of warm and cold air**

See A.P. 2095 P.N. General and note that use of warm air may result in a slight reduction in range.

60. **Fuel capacities and consumptions**

(i) Normal fuel capacity excluding No. 7 tanks 1,946 galls.
,, ,, ,, including No. 7 tanks 2,254 galls.
Auxiliary (wing bomb cell) tanks .. .. 438 galls.
Total fuel (excluding No. 7 tanks) .. 2,384 galls.
,, ,, (including No. 7 tanks) .. 2,692 galls.

(ii) The approximate consumptions for the aircraft in rich mixture are:

R.p.m. and boost for:	Gallons/hour Herc. XI	Herc. VI
Max. climbing	420	480
Max. rich continuous	420	480
Combat	580	640

(iii) The approximate consumptions for the aircraft in a weak mixture in gallons per hour are:

(*a*) With Hercules XI engines:

Boost	M ratio at 5,000 ft. r.p.m.				S ratio at 15,000 ft. r.p.m.			
lb./sq.in.	2,500	2,400	2,200	2,000	2,500	2,400	2,200	2,000
+1	(254)	(248)	(226)	(186)	(236)	(230)	—	—
0	(234)	228	214	192	(228)	222	208	—
−1	(222)	216	198	182	(218)	214	196	184
−2	(208)	202	186	164	(210)	202	184	174
−3	(192)	198	172	154	(200)	192	174	162
−4	(176)	170	158	142	(192)	180	162	150

For each 2,000 ft. above or below the altitudes quoted add or subtract 2 gallons/hour. The figures in brackets are estimated only.

(*b*) With Hercules VI engines:

Boost lb./sq.in.	M gear at 5,000 ft. r.p.m.			S gear at 15,000 ft. r.p.m.		
	2,400	2,200	2,000	2,400	2,200	2,000
+2	235	220	204	236	226	216
0	212	196	184	212	204	196
−2	188	176	164	192	184	176
−4		160	148		128	160

Add or subtract for each 1,000 ft. above or below the above heights:

M gear .. .. .. 1 gallon per 2,000 ft.
S gear .. .. .. 1 gallon per 1,000 ft.

(iv) Air miles per gallon.—The curves on page 36 show the air miles per gallon for typical outward and homeward loads, at various I.A.S.

PART IV

EMERGENCIES

61. **Engine failure during take-off**

(i) Failure of one engine.—At loads up to 58,000 lb. the aircraft will climb at 145 m.p.h. I.A.S. and climbing boost. Do not climb at less than 145 m.p.h. I.A.S. With pressure head on mast add 5 m.p.h. Leave the flaps at the take-off setting until a safe height has been reached and until the undercarriage has been raised.

NOTE.—Pilots with considerable experience of the type *may* find it possible to climb away at loads up to 62,000 lb. Performance is affected by the position of the undercarriage at the time of engine failure, and depends upon which engine fails (e.g. failure of the starboard outer engine has the worst effect).

(ii) Failure of two engines. It will be necessary to close the throttles and land.

62. **Engine failure in flight**

(i) With any one engine out of action, the aircraft can maintain height at any load.

(ii) With two engines out of action, difficulty will be experienced in maintaining height at any load over about 50,000 lb., and therefore jettisoning may be necessary.

(iii) The fuel supply to a failed engine should be shut off by the pilot at the master cock after feathering.

(iv) A speed of 145 m.p.h. I.A.S. (or more if foot load with full trim is excessive) should be maintained.

63. **Feathering**

(i) Press feathering button and let go.

(ii) Close throttle immediately.

(iii) If engine is to be out of action for any length of time, after it has stopped switch off and turn off master fuel cock.

64. **Unfeathering**

(i) Set propeller speed control fully down and throttle closed or slightly open.

(ii) Turn on ignition and master fuel cock (if off).

(iii) Press feathering button and hold until r.p.m. reach 1,000 to 1,300. If the propeller does not return to normal constant-speed operation, open throttle slightly.

65. **Undercarriage emergency operation**

(i) Before operation, the pilot must set the master switch to OFF.

(ii) The undercarriage can then be operated manually by a member of the crew as follows.

(iii) *Lowering main wheels:*

(Later aircraft with motors in fuselage)

(*a*) Check with pilot, master switch OFF.

(*b*) Remove the locking pin and rotate the red lock-release star wheel clockwise (looking forward) until the limit stop is reached; this ensures that the undercarriage locks are released and that, in the event of failure at an intermediate stage, it will not be necessary to operate this control.

(*c*) Hinge down the transparent cover.

(*d*) Pull out the *green* clutch body and twist so that the notch against the flap on the body is in line with one of the notches on the internal barrel; this disengages the motor from the gearbox and ensures that when fitted, the handle engages correctly.

(*e*) Fit the handle so that its lug engages against the flat on the clutch body and turn the handle until the *green* light shows and the revolution counter reaches 0 (the switch for the revolution counter lamp is on the fuselage side forward of the gearbox and motor).

(*f*) Turn as follows:

Port wheel	Anti-clockwise
Starboard wheel	Clockwise

(iv) *Lowering main wheels:*

(Early aircraft only)

NOTE.—The figures in brackets in the following paragraphs correspond with the figures stamped on the undercarriage control levers in the aircraft.

On aircraft with undercarriage manual control boxes (consisting of a cylindrical casing) fitted on either side of the fuselage aft of the top main rear spar truss.

(*a*) Remove locking pin from red star wheel (by lower rear spar on starboard side) and turn clockwise to full extent.

(*b*) Remove locking pins from the blue handle (2) and the green lever (3) on the undercarriage control box.

(*c*) Exert pressure on green lever (3) while rotating handle (2) back and forth, until green lever (3) is fully over to the " hand operation " position.

(*d*) If the green lever (3) does not come fully over to the " hand operation " position, maintain pressure, remove locking bolt from handle (4) and oscillate slightly; if necessary, continue to rock (2) until the lever (3) is fully over to the hand operation position.

(*e*) Turn handle (4) in the direction indicated by the arrow until the green light (5) appears; give additional turns as stated on the undercarriage instruction plate on the side of the fuselage near the emergency gear.

Some early aircraft have no undercarriage manual control boxes fitted, when proceed as follows:

(*f*) Remove locking pin from red star wheel and turn clockwise to full extent.

(*g*) Pull (1) inboard and lock by rotating.

(*h*) Remove locking pin from (2) and (3).

(*i*) Pull (3) inboard while rotating (2) back and forth from stop to stop.

(*j*) If (3) cannot be fully withdrawn, maintain pressure and oscillate handle (4); if necessary, continue to operate (2) from stop to stop until the disengaging pinion operated by (3) is fully withdrawn.

(*k*) When (3) is fully withdrawn, turn (4) in the direction indicated by the arrow until the green light (5) appears. Give additional turns as in (*e*) above.

(v) *Raising main wheels* (later aircraft)

Proceed as for lowering, but turn as follows:

Port wheel	Clockwise
Starboard wheel	Anti-clockwise

(vi) *Raising main wheels* (early aircraft)

This cannot be done manually.

(vii) *Lowering tail wheel* (all aircraft)

(*a*) Check with pilot, master switch OFF.

(*b*) Push rearwards the clutch pins projecting from the gearbox casing and twist clockwise to lock; this disengages the motor.

(*c*) Fit the handle and turn it anti-clockwise until the *green* light shows; continue turning with the number of turns specified on the instruction label.

NOTES.—(*a*) The approximate times for raising and lowering the units are as follows:

Later aircraft

Main wheels:

Lowering, 5½ mins.; raising, 14 mins.

Tail wheels:

Lowering, 4 mins.

Early aircraft

Main wheels:

Lowering, 8½ mins.

Tail wheels:

Lowering, 4 mins.

(*b*) Once manual operation has been commenced, do not revert to electrical operation without first resetting (*see* ix).

(viii) *Crew drill to be carried out during manual lowering of undercarriage:*

The following drill is recommended as the time taken for manual operation of the undercarriage can be considerably reduced thereby; this is a great advantage when returning from a long trip (little fuel left, etc.).

(*a*) The engineer should set the gear for manual operation on both main wheels and should start winding the wheels down. He should then instruct two other members of the crew, e.g. W.Op. and navigator, to continue winding the main wheels keeping the number of turns decreasing on the rev. counter gauges approximately the same. They should be instructed that should anything abnormal happen, both are to cease winding and await the engineer who, in the meantime, will go aft, set the tail wheels for manual operation and wind fully down.

(*b*) On return to the rear spar position, the engineer will inspect the rev. counters, and check or complete the locking of both main wheels himself.

(ix) *Resetting main wheels*

Later aircraft

(*a*) Ensure that the lock-release star wheel is fully wound anti-clockwise.

(*b*) Pull the operating handle straight out and stow.

(*c*) Twist the clutch body (either way) until it snaps back into position with the dogs fully engaged. This re-engages the motor ready for electrical operation.

(*d*) Hinge up the transparent cover over the clutch body.

Early aircraft

(*e*) The resetting operation cannot be carried out by the air crew in flight.

(x) *Tail wheel resetting* (*all aircraft*)

(*a*) Twist the clutch pins anti-clockwise and allow the internal spring to return them to the front of the horizontal slots; if necessary, rotate the handle slightly to assist the gears to engage and thus permit the pins to return.

(*b*) Remove the handle and stow.

66. **Flaps emergency operation**

In the event of electrical failure, a member of the crew should operate the flaps manually as follows:

(i) Push the knurled barrel beside the gearbox outward ar twist anti-clockwise (facing starboard); this disengag motor.

(ii) Fit the operating handle and turn as indicated.

67. **Bomb door emergency operation**

(i) In the event of electrical failure, a member of the crew should pull out the knob below the emergency position indicator lamps on the port side of the centre section (this brings them into operation) and proceed as follows:

Fuselage bomb doors

(*a*) Hinge back domed cover plate in the floor beside the gearbox.

(*b*) Push down the handle and twist to lock (on early aircraft pull out toggle and turn to lock).

(*c*) Fit the handle and rotate as required until the indicator lamp lights.

Wing bomb doors

(*a*) Pull out the toggle (S) on the centre section side and twist to lock.

(*b*) Fit the handle and rotate as required until the indicator lamp is illuminated.

NOTE.—Once manual operation has been commenced, do not revert to electrical operation without resetting.

(ii) *Resetting*

Unlock the handle and allow the spring action to return it to its former position; if it does not return, rotate the handle slightly until it does. Remove the handle and stow.

68. **Damage by enemy action**

Engineer's checks:

The engineer should know the run of all control cables and tank cock cables as well as the location of all fuses, other accessories and equipment which may require attention. The following checks should be made:

(i) Check that engines are running on Nos. 2 and 4 tanks, check fuel remaining in each tank and note.

(ii) Check engine temperatures and all pressures and instruct another member of the crew to keep a watch on them.

(iii) Go to the rear turret and check elevator, rudder and trimmer control cables throughout their length for damage. Report to pilot.

NOTE.—Always carry a spare piece of cable, locking wire, and pliers. It does not matter how rough the repair on control cables is, so long as the pilot can obtain a certain amount of response from the control.

(iv) Check all turret pipe lines and recuperators.

(v) Check all oxygen equipment.

(vi) Inspect aircraft structure for serious damage.

(vii) Check batteries.

(viii) As far as possible, check the undercarriage and flaps for damage.

(ix) Should any fires be located, use asbestos gloves and hand extinguishers. Keep oxygen mask and goggles on when dealing with fires. Any detachable equipment such as pyrotechnics, boardings, covers, etc., should be jettisoned.

Do not hesitate—act immediately.

(x) Should a fire be located in the bomb bays, request pilot to open doors, jettison bombs and dive aircraft.

(xi) Have mid-upper gunner inspect carefully (if he is not otherwise engaged) the upper side of both wings for damage, oil, etc. This enables an engineer, who should know the exact position of the various components in his wings, to estimate more accurately what damage may have occurred and so anticipate trouble which may not come to light until later in the flight.

(xii) Engineer should return to his fuel gauges and check. Should loss of fuel become apparent he should act in accordance with the fuel system management instructions. *See* Part II and Part V.

(xiii) A constant check on fuel, engine temperatures and pressures, etc. should be kept.

(xiv) Check aileron controls from the control column to the point where they disappear into the wing roots.

NOTES:

(*a*) A partially frayed cable is a danger—reinforce with spare piece of cable and bind together with locking wire.

(*b*) A broken rod can be bent up, joined with spare cable, and bound up with locking wire.

(*c*) A broken chain can be repaired thus: remove sprocket, join chain with cable and bind with locking wire.

(*d*) If a bunch of cables is hit, the cables will in most cases, be severed. In the case of tank cock cables (this will be indicated by the levers falling down under their own weight) it will be possible for the engineer, should the engines not be running on Nos. 2 and 4 tanks, to go behind the front spar of the centre section and operate the cocks by pulling them on with the cables. He should not forget to pull the other tanks off. If the damage has occurred in the wings access to the cable will usually be impossible. Nos. 2 and 4 tanks should, therefore, be turned on immediately.

69. **Fire-extinguishers**

(i) A graviner fire-extinguisher system is installed in the engine nacelles, each extinguisher being electrically operated by pushbuttons on the port side of the cockpit. Automatic operation is provided by an impact switch in the nose of the aircraft.

(ii) For actions in the event of fire in an engine in flight, *see* A.P. 2095, Pilot's Notes General.

(iii) Hand extinguishers are carried at the following points in the fuselage:

Bomb-aimer's station ..	Under top step between pilots' seats.
Cockpit	Behind starboard pilot's seat.

Engineer's station	Beside instrument panel.
W/T operator's station ..	Behind radio equipment framing.
Mid gunner's station ..	On the starboard side forward of the turret.
Tail gunner's station ..	On the port side forward of the turret.

70. **First-aid outfits**

Stowages for three first-aid outfits are provided on the fuselage sides behind the pilots' seats, two on the starboard and one on the port side.

71. **Bomb jettisoning**

In an emergency, the entire bomb load may be jettisoned by means of a pushbutton (24) and a toggle (23) on the right-hand side of the instrument panel. The jettison control is inoperative unless the bomb cell doors are fully open. Bombs are jettisoned by pulling the toggle, and the bomb containers by pressing the pushbuttons; when containers are being carried they should be jettisoned first.

72. **Fuel jettisoning**

(i) The contents of tanks Nos. 2 and 4 on each side can be jettisoned. Cock controls, consisting of four handwheels (95), are mounted on the front spar frame. The wheels are mounted in pairs consisting of a small wheel within a larger one; the large wheels control the No. 4 tank cocks and the small wheels the No. 2 tank cocks. The handwheels are located in the closed position by a small thumb lever in the boss and are rotated anti-clockwise to open the jettison valves. The jettison pipes extend automatically from the underside of the main plane as the valves are opened.

(ii) Before jettisoning, the pilot should set the flaps one-third or more out to prevent fuel flowing over the tail of the aircraft.

(iii) When full, the total quantity of fuel which can be jettisoned from Nos. 2 and 4 tanks is 1,170 gallons—8,500 lb.

73. **Parachutes**

(i) On early aircraft the seats for both pilots, W/T operator and navigator are designed for seat type parachutes. On later aircraft lap-type parachutes are used.

(ii) Parachute (P) and K type dinghy (D)* or combined (C) stowage are installed as follows:

Pilot	P—under forward end of navigator's table.
	D—behind port pilot's seat.
Navigator	P—on starboard side aft of the front escape hatch.
	D—on sloping bulkhead on port side of bomb-aimer's compartment
Flight engineer	C—on aft face of armoured bulkhead on door.
W/T operator	P—on lower part of aft face of armoured door.
	D—on forward face of armoured bulkhead, near floor.
Nose gunner	C—on port side of fuselage near turret.
Mid gunner	C—on port side of fuselage.
Tail gunner	P—on starboard side of fuselage near turret.
	D—on port side of fuselage near turret.
Second pilot (when carried)	P—on forward face of armoured bulkhead above door.
	D—on starboard side behind 2nd pilot's seat.
Extra crew (two)	C—Two; on starboard side opposite door.

* K type dinghy stowages vary on some aircraft.

(iii) *Static lines.* These are stowed on the port side of the fuselage, immediately forward of the main fuselage entrance door.

(iv) When incapacitated personnel are being parachuted the aircraft should be flown at about 145 m.p.h. I.A.S. with flaps one-third out. Check that the tail wheels are fully retracted to prevent the parachutes from catching.

74. **Emergency exits**

(i) Parachute exits:

(*a*) Two parachute exits are provided in the floor of the fuselage, one at the rear of the bomb-aimer's station and the other in the centre of the fuselage, just forward of the entrance door; each comprises a hatch hinging inwards. Access to the former exit from the cockpit is by means of two steps between the pilots' seats; a hand lever is provided on the starboard side of these steps to release the catches securing the hatch. On later aircraft the hatch is secured by a catch bar. The rear exit is held by clamp handles.

(*b*) A panel in the starboard side of the fuselage by the tail plane may be pushed out by operating the release bar.

(ii) Dinghy and crash exits:

(*a*) Two escape hatches are provided in the roof, one forward and one aft of the centre section; both hinge inwards and are held by clamp handles. A step is built out from the fuselage side at the front hatch to facilitate exit, and an escape ladder is stowed in the roof at the rear hatch. These escape hatches and the rear entrance door may be opened from the outside by means of keys stowed in adjacent pockets.

(*b*) An outwardly-opening escape hatch is provided in the cockpit roof above the captain's seat and is released by pulling back the catch bar (1) beside the centre roof member.

(*c*) Two knock-out type windows are fitted one on each side of the fuselage aft of the pilots' seats; these are released by delivering a sharp blow towards one edge with the foot or hand.

75. **Dinghy and air/sea rescue equipment**

(i) A type J dinghy—complete with topping up bellows, leak stoppers, rescue line and knife, is stowed in the port wing. It is attached to a point just inside the rear top escape hatch by a steel cable which terminates, at the dinghy end, in a length of 150 lb. breaking-strength cord. The free end of this cord is attached to the dinghy life-line and the knife is supplied for cutting it when ready to cast off. The dinghy may be released and inflated as follows:

On aircraft from which the external manual release has been deleted or blanked off:

(*a*) From inside the fuselage by pulling the handle located on the port side below and just forward of the rear top escape hatch.

(*b*) From outside by a direct pull on the CO_2 head operating cable, reached through the inspection aperture in the dinghy cover in the port wing. The inspection window can be removed after turning two finger-operated fasteners.

(*c*) Automatically by the flooding of the immersion switch located in the fuselage nose.

On aircraft retaining the external manual release:

(*d*) From inside the fuselage by pulling the handle located on the port side, just forward of the bulkhead forward of the rear top escape hatch.

(*e*) From outside by pulling the handle located in a recess just outside the rear top escape hatch, after ripping the fabric patch. OR by a direct pull on the CO_2 operating cable, through the inspection aperture on the dinghy blow-out cover. In this case it is necessary to smash the cellon window.

(*f*) Automatically by the flooding of the immersion switch.

(ii) (*a*) On aircraft fitted with large dinghy stowage an emergency pack is provided in the dinghy compartment secured to the dinghy by a coiled lanyard. This contains:

28 tins of water

7 tins of emergency supply rations.

1 Very pistol—1 in. bore.

18 tins of cartridges for above

NOTE.—Aircraft signal pistol cartridges do not fit dinghy pistol

3 fluorescine sea markers

1 first-aid outfit.

1 sponge

2 paddles

1 mast aerial and flag

2 tins of matches

(*b*) On aircraft fitted with the smaller (metal) dinghy stowage a smaller emergency pack is provided. This contains all the items listed above with the exception of the water. On these aircraft a supplementary type 4 and/or type 7 pack is carried in the fuselage on the rear face of the bulkhead on the port side immediately forward of the rear top escape hatch. These contain the water not included in the dinghy stowage pack.

(iii) Single Seat Dinghies.—On later aircraft stowages are provided in the fuselage for K type single seat dinghies in C type packs for each member of crew. *See* para. 73.

(iv) Dinghy Radio Equipment.—(to be transferred to the dinghy after ditching) consists of:

(*a*) Transmitter: stowed on starboard rear face of the wooden bulkhead forward of rear top escape hatch.

(*b*) Kite aerial: stowed in starboard side of fuselage roof, adjacent to the rear top escape hatch.

(*c*) Mast aerial complete: Stowed in the emergency pack in the dinghy stowage.

NOTE.—On later aircraft this equipment is stowed with the dinghy.

76. **Ditching**

See A.P. 2095, Pilot's Notes General, and note—best flap seting is one-third out. Flight engineers should see also fuel system management instructions, Part II.

PART V

DATA AND INSTRUCTIONS FOR FLIGHT ENGINEERS

77. **Fuel system**

Details:

(i) Of the seven tanks fitted in each wing, all are self-sealing excepting No. 7. Nos. 2, 4, 5 and 6 are fitted between the spar trusses, Nos. 1 and 3 being behind the rear spar truss. No. 7 tanks are in the leading edges inboard of the inner engine nacelles.

(ii) (*a*) In each wing, Nos. 1, 2 and 7 tanks feed to a distributor on the fuselage side and thence to the inner engines. Nos. 3, 4, 5 and 6 tanks feed to a distributor on the rear spar outboard of the undercarriage bay and thence to the outer engine.

(*b*) The cocks fitted to each tank sump are remotely controlled by levers (89) as are the inter engine balance cocks fitted in the cross feed pipes connecting the two distributors on each side.

(*c*) The two inner distributors are connected by a cross feed pipe, with a direct controlled balance cock (inter system balance cock fitted under a hinged cover in the centre of the floor immediately forward of the rear spar frame).

(iii) An auxiliary tank, consisting of three inter-connected cells, can be carried in the wing bomb cells on each side. These tanks feed to the inner distributors on each side via the remotely controlled auxiliary tank cocks. The controls for these cocks (91) are fitted at the lower corners aft of the spar frame, one on each side.

(iv) From each distributor fuel passes through a non-return valve, and filters, to the engine pump and thence through regulating valves to the carburettors to which are fitted the pilot's master cocks (CARBURETTOR COCKS).

Refuelling:

(v) (*a*) Remove small access cover, secured by two cowling clips, and unscrew the filler cap with the appropriate spanner; this is stowed on the starboard side of the fuselage opposite the entrance door.

(*b*) Ensure that the tank cock controls in the fuselage are OFF. Screw the filler extension on to the filler neck (except No. 7 tanks, which are filled direct) and fill tank.

78. Oil system

(i) *For description, see* Part I.

(ii) *Refilling:*

(*a*) Open the access covers over the filler cap and dipstick. These covers are in the nacelle top plating and are clearly marked. The filler cap cover is hinged and has one clip, the dipstick cover has 2 clips.

(*b*) Unscrew the filler cap and knurled cap over the dipstick, using the special spanner stowed with the fuel tank spanner. When filling the tank check contents by dipstick which can be withdrawn by the flanged collar at its upper end.

NOTE.—When the tank is not to be completely filled, add 2 gallons to the amount calculated for the required range to allow for the oil required for propeller operation.

79. Engine details

(i) *Carburettors:*

(*a*) From 0°–65° throttle butterfly opening, corresponding to the fully closed to the first notch position of the throttle levers in the quadrant, main and slow running jets only are in use. This corresponds to the economical cruising range up to +1 lb./sq.in. boost (Hercules XI) +2 lb./sq.in (Hercules VI).

(*b*) From 65°–85° throttle opening the main and power jets are in action while beyond 85° throttle opening (at throttle settings in excess of +3½lb./sq.in boost in Hercules XI and + 6 lb./sq.in Hercules VI) the enrichment jet comes into action.

(*c*) Engineers should check on the ground the adjustment of the controls to ensure that the throttle butterfly settings correspond correctly with the positions of the throttle levers.

(*d*) As the carburettor is tuned in S gear a corrector jet is brought into operation when in M gear.

(*e*) Rime or hoarfrost may affect a diffuser tube, air balance screen, and accelerator pump discharge nozzle. Icing should not be experienced with oil temperatures in excess of 60°C. and in any case it practically never occurs on this type of carburettor.

(ii) *Auxiliaries:*

The following auxiliaries are driven by the engines:

Port Inner	*Starboard Inner*
(*a*) Top and front turret hydraulic pump	(*a*) Rear turret hydraulic pump
(*b*) BTH compressor (brakes)	(*b*) 1 RAE compressor (Mk. XIV bomb sight, Auto pilot)
(*c*) 1 vacuum pump	(*c*) 1 vacuum pump
(*d*) 1 24-volt generator	(*d*) 1 24-volt generator

80. Engine handling

(i) *Carburettor priming:*

(*a*) If it is necessary to prime the carburettors, *see* Para. 39 (ii), and note the number of strokes quoted therein applies with zwicky type of pump. Some aircraft are fitted with SPE pumps when the following number of strokes should be given if carburettors are known to be empty.

Pump:

SPE Mark I—12 double.

SPE XIXA—6 double.

If engine has not been run for one week or more, half the above number of strokes. If engine has been run within one week, no priming should be necessary.

(*b*) Do not rely entirely on fuel pressure gauges or warning lights. Watch the volute casing drains and stop priming *immediately* should fuel drain therefrom.

(ii) *Priming induction system:*
See para. 39

(iii) *Gear changes:*
(*a*) If practicable, request pilot to fly straight and level for approximately five minutes while changing gear.
(*b*) Oil pressure should drop and then rise to the original figure if gear change is operating correctly. If oil pressure is not restored after changing, the gear should be exercised.
(*c*) To prevent a sudden surge of boost when the change from M to S gear is effected, check with the pilot that the boost has been followed back with the throttles before making the change.
(*d*) It is advisable to change gear on the inner engines first, followed by the outer engines rather than change on the two engines on one side first. When changing from M to S gear the control should be operated as smartly as possible to ensure proper operation of the snap-over spring on the engine bulkhead.

(iv) *Cowling gill adjustment:*
(*a*) Always inform the pilot if the cowling gills are open.
(*b*) Provided the maximum cylinder temperatures are not exceeded the gills should be opened as little as possible beyond the "straight" attitude, i.e. in line with the engine cowling, and should never be opened beyond the one-third position which gives the best cooling in flight.
(*c*) When hot air is being used the gills should be fully closed as this increases the efficiency of the hot intake system.

(v) *General:*
(*a*) For maximum efficiency the cylinder temperatures should be between 200 and 220°C.
(*b*) At night the appearance of the exhaust flames gives a good indication of mixture strength, i.e.:

White flame—weak mixture
Red-blue—rich mixture

(*c*) If possible avoid low oil temperature. If oil temperature drops below 20° and then increases rapidly it may indicate that the oil in the oil cooler is congealing. The cure is to increase boost and r.p.m. considerably for 20 seconds or so; if this does not cure the trouble the propeller of the engine affected should be feathered when the oil temperature reaches 100°C.

81. **Defects**

(*a*) If a power failure warning light comes on — bright or dim — cut-out is open or fuze has blown; request pilot to increase r.p.m. slightly on engine affected. If light does not go out, check and replace generator fuze; if this does not cure, defect cannot be rectified in flight.
(*b*) On aircraft not fitted with warning lights, a zero reading of a generator voltmeter indicates charge failure; check and replace generator fuze. If voltmeter still reads zero, defect cannot be rectified in flight.

82. **Actions when aircraft is damaged**

(i) *See* Part IV, Para. 68

(ii) *Typical examples:*
Example A
(*a*) Assume that No. 4 (starboard) tank, or the starboard outer engine system has been damaged. This will be indicated by the gauge readings which will show that the outer engine appears to be consuming more fuel than another engine running at the same power.
(*b*) No. 4 starboard tank should then be shut off and any other available tank turned on to supply the starboard outer engine.
(*c*) Should the gauge readings now indicate that the starboard outer engine is still consuming more than another engine running at the same power and that No. 4 starboard tank is not losing fuel, some part of the outer engine pipe system is damaged.
(*d*) The object should now be to use up the fuel left in the whole of the starboard outer system as quickly as possible by running *all* engines from this part of the system, i.e. turn on all balance cocks and turn off all tanks excepting those feeding into the damaged part of the system.

(*c*) When this part of the system has been drained the starboard outer engine should be feathered and the starboard outer part of the system isolated by turning off the starboard inter engine balance cock.

Example B.

(*a*) In the example quoted above, should it have been found that No. 4 starboard tank was losing fuel after being shut off, this would indicate that No. 4 tank itself had been damaged. It would then be necessary to use up the fuel remaining in this tank as quickly as possible by turning on all balance cocks and turning off all tanks excepting No. 4 starboard.

(*b*) When this tank has been drained it should be turned off and the balance cocks used to distribute the remaining fuel equally between all four engines.

NOTE.—In the event of damage to the fuel system the aircraft should always be flown at the air speed recommended to give the maximum possible number of air miles per gallon. *See* para. 58.

PART VI

ILLUSTRATIONS

Fig. 1—COCKPIT, GENERAL VIEW

1. Escape hatch release bar.
2. Sliding window.
3. Safety harness.
4. Stowages for portable oxygen bottles.
5. Fire-extinguisher.
6. Windscreen de-icing fluid tank.
7. Propeller speed controls.
8. Folding step (access to bomb aimer's station and front turret).
9. Crash axe.
10. Signal pistol stowage.
11. Armour plating (shown hinged down).
12. Armrest release ring.
13. Armrest (shown hinged up)
14. Instrument panel lamp.

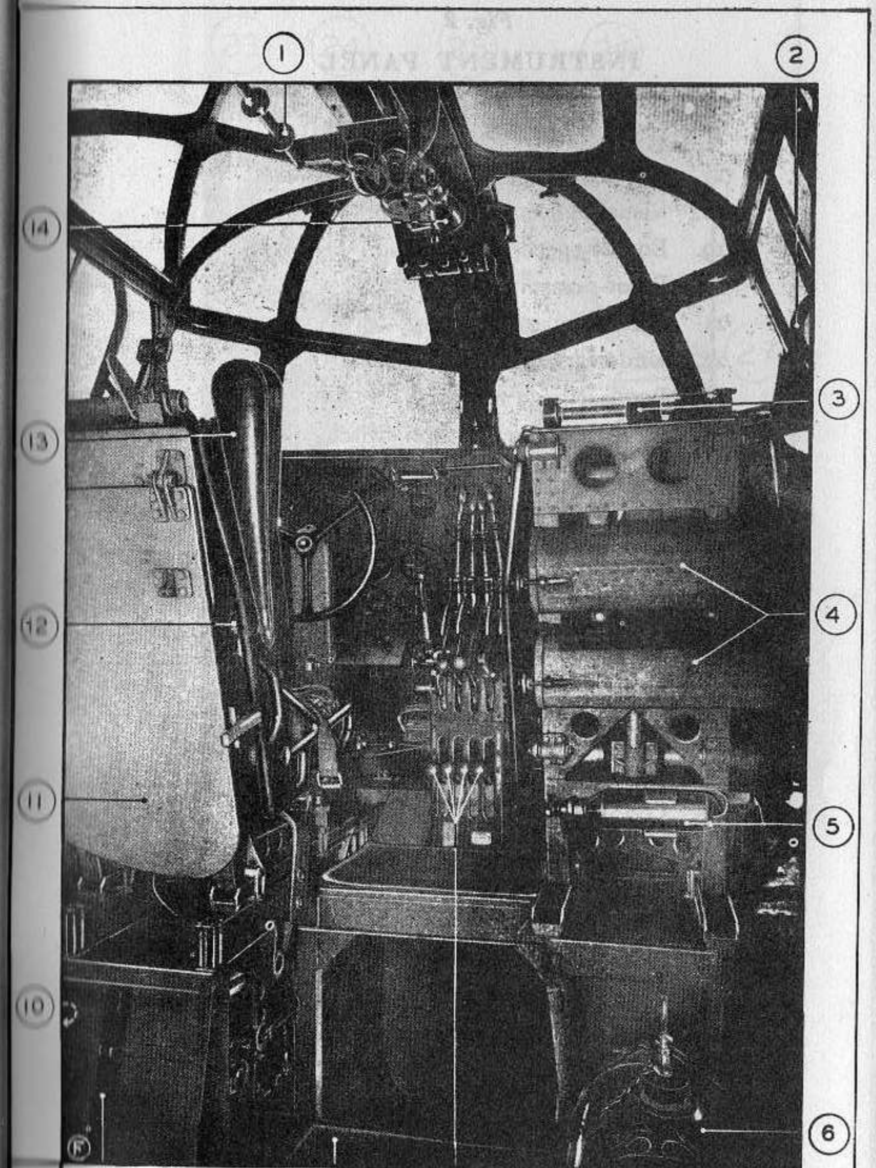


FIG. 1 COCKPIT - GENERAL VIEW FIG. 1

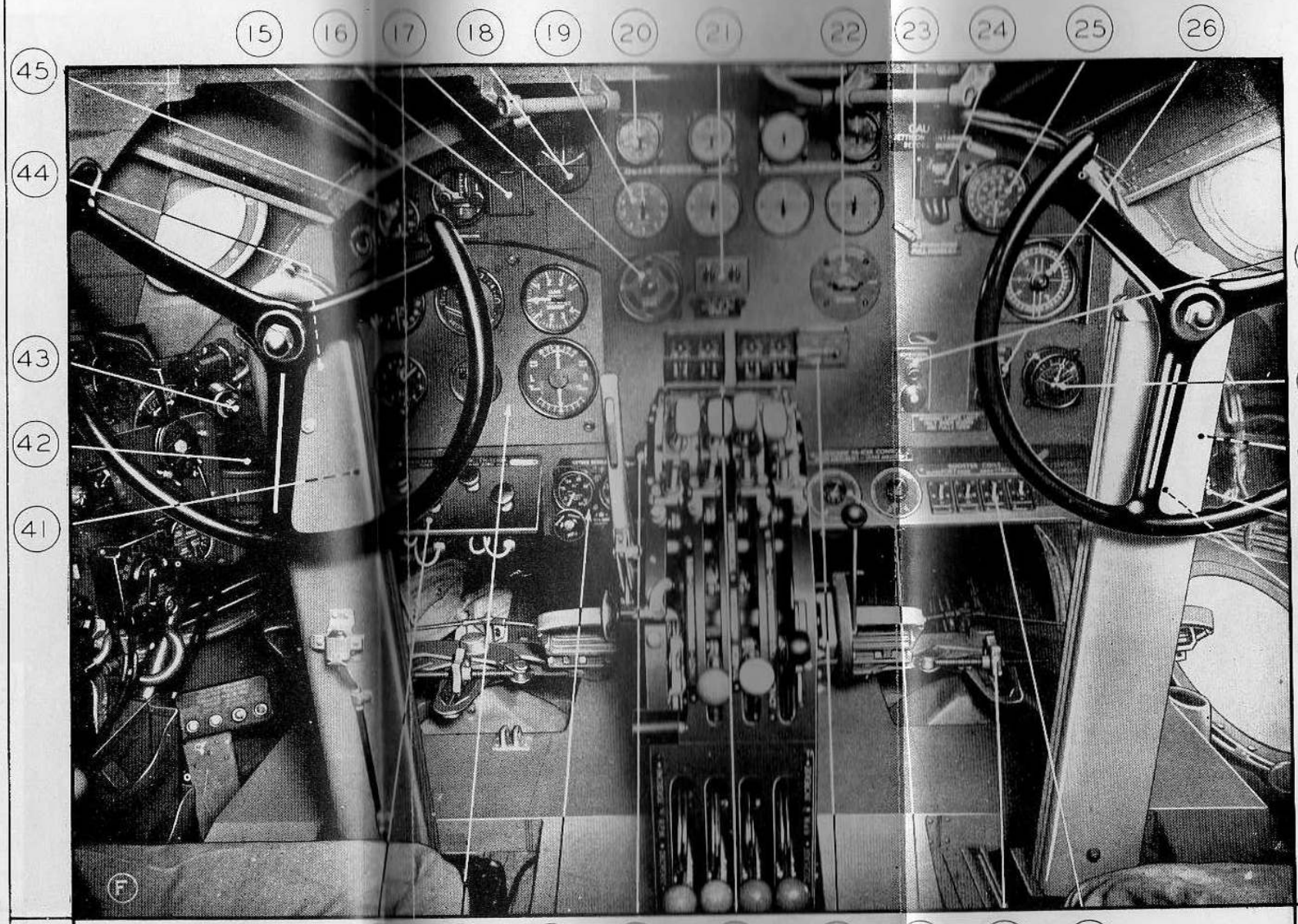


FIG 2 INSTRUMENT PANEL

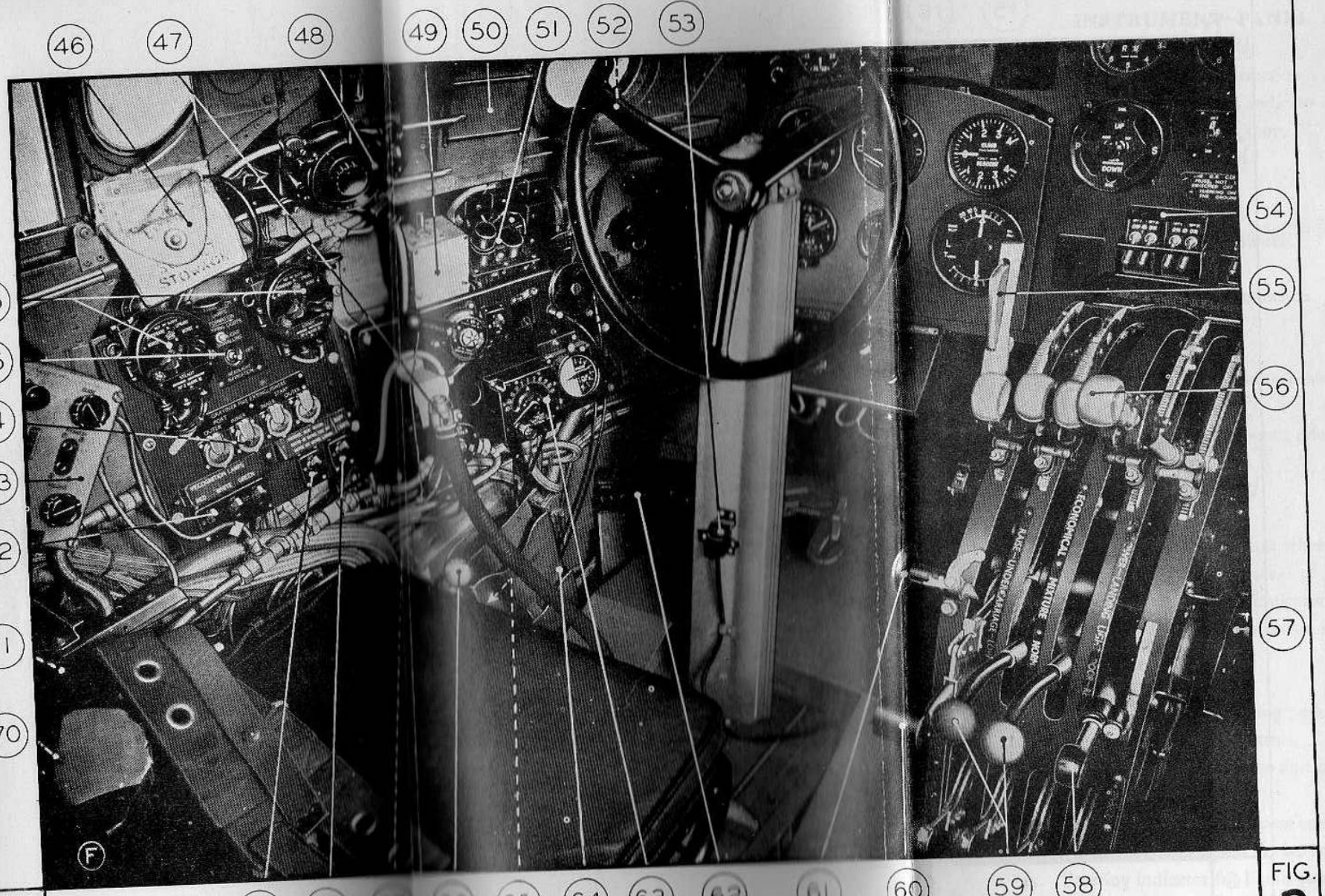


FIG. 3

COCKPIT - PORT SIDE

FIG. 3

Fig. 3

COCKPIT PORT SIDE

46. Stowage for camera control lead.
47. Oxygen conduit clip (port pilot).
48. Remote controls and frequency switch (T.R.9).
49. Mixer box-beam approach.
50. Card holder—D.R. compass correction.
51. Intercommunication socket.
52. Pilot's bomb release switch (location).
53. Connector for (52).
54. Ignition switches.
55. Wheel-brakes lever.
56. Throttle levers.
57. Landing lamp dipping lever.
58. Landing lamp retraction lever.
59. Mixture levers.
60. Undercarriage operating lever.
61. Safety catch—undercarriage operating lever.
62. Indicators for external lamps.
63. Automatic controls panel.
64. Map case.
65. Windscreen de-icing pump.
66. Safety harness release knob.
67. Forced landing flare release toggles.
68. Navigation lamps switch.
69. Pressure-head heating switch.
70. Glove and boot heating socket (location).
71. Seat-height adjusting lever (location).
72. Downward recognition lamps switches.
73. Beam approach control panel.
74. Nacelle fire-extinguisher switches.
75. Headlamp switch.
76. Signalling switch boxes.

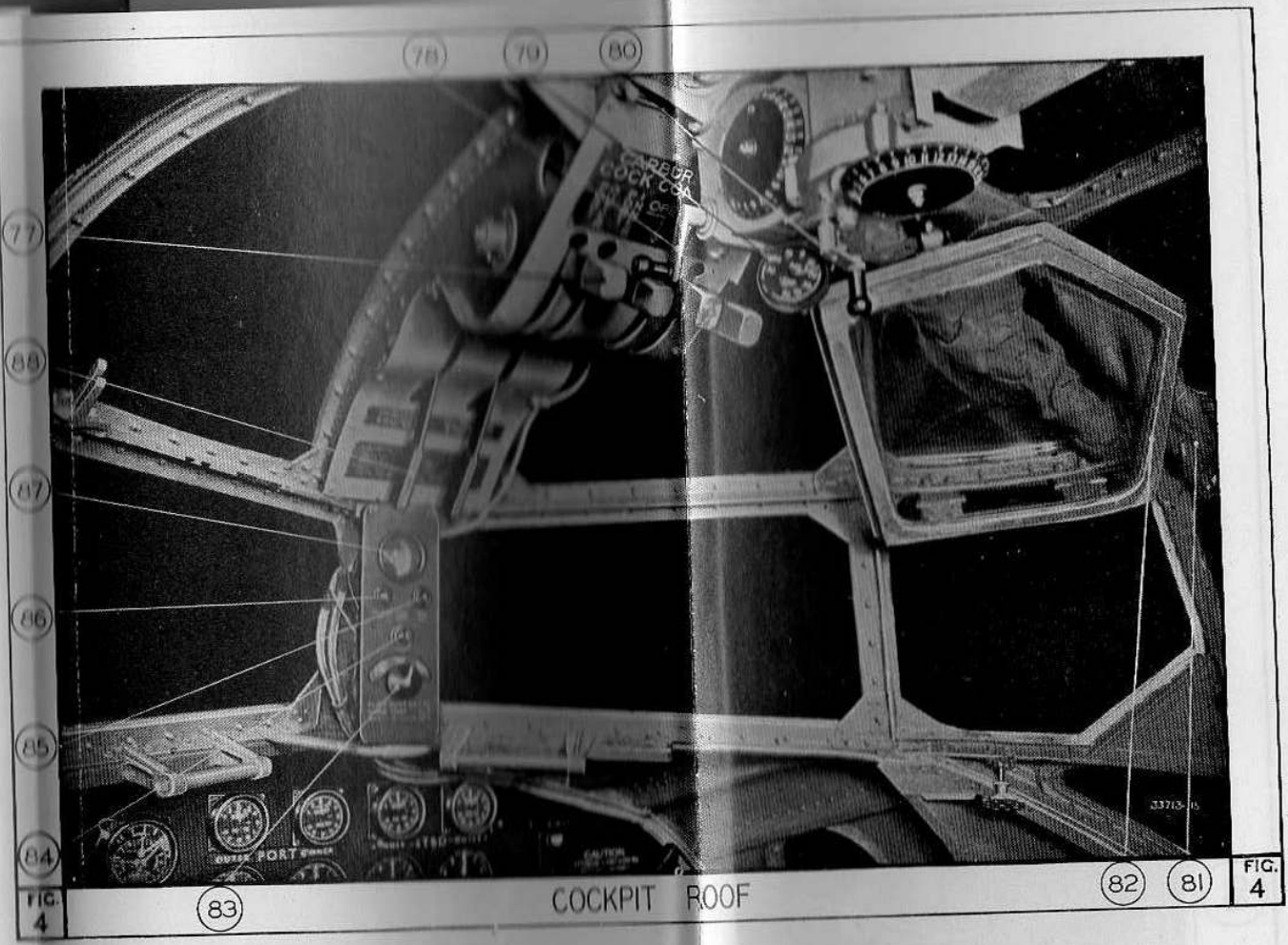


Fig. 4

COCKPIT ROOF

77. Pilot's master cock controls.
78. Elevator trimming tab handle.
79. Air temperature thermometer.
80. Rudder trimming tab handle.
81. Window blind.
82. Hinged window panel.
83. Flaps control knob.
84. Flaps position-indicator switch.
85. Flaps-indicator warning lamp.
86. Flaps one-third-out warning lamp.
87. Flaps-position indicator.
88. Slow-running cut-out controls.

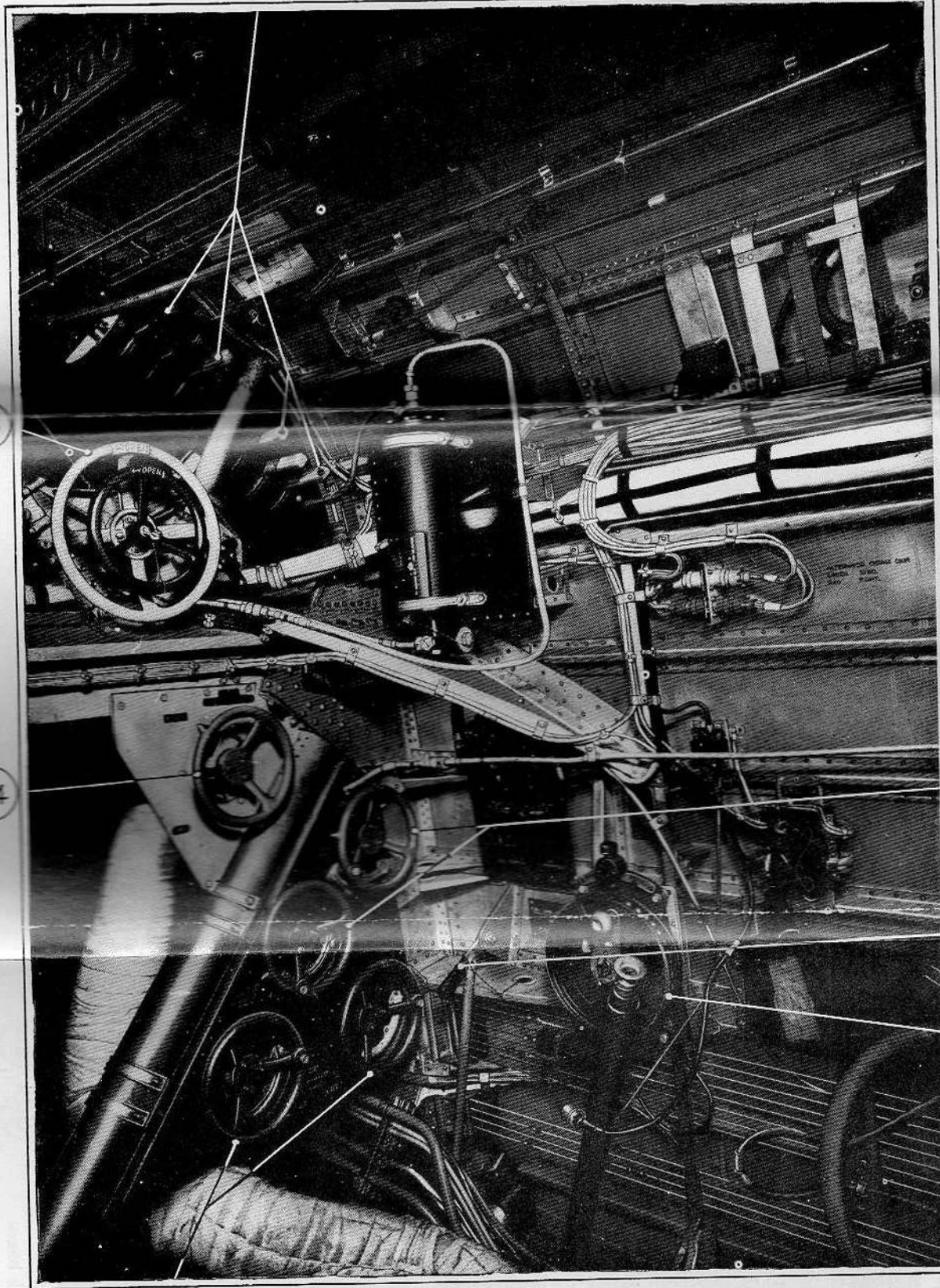


FIG. 5

FLIGHT ENGINEER'S CONTROLS —— PORT SIDE

FIG. 5

KEY TO *Figs. 5 and 6*

Fuel tank cock controls (1 to 6)	..	89	Supercharger controls	..	93
Carburettor air-intake controls	..	90	Cabin heating controls	..	94
No. 7 tank cock controls	..	91	Fuel jettison valve controls	..	95
Trailing aerial winch	..	92	Electrical distribution panel	..	96

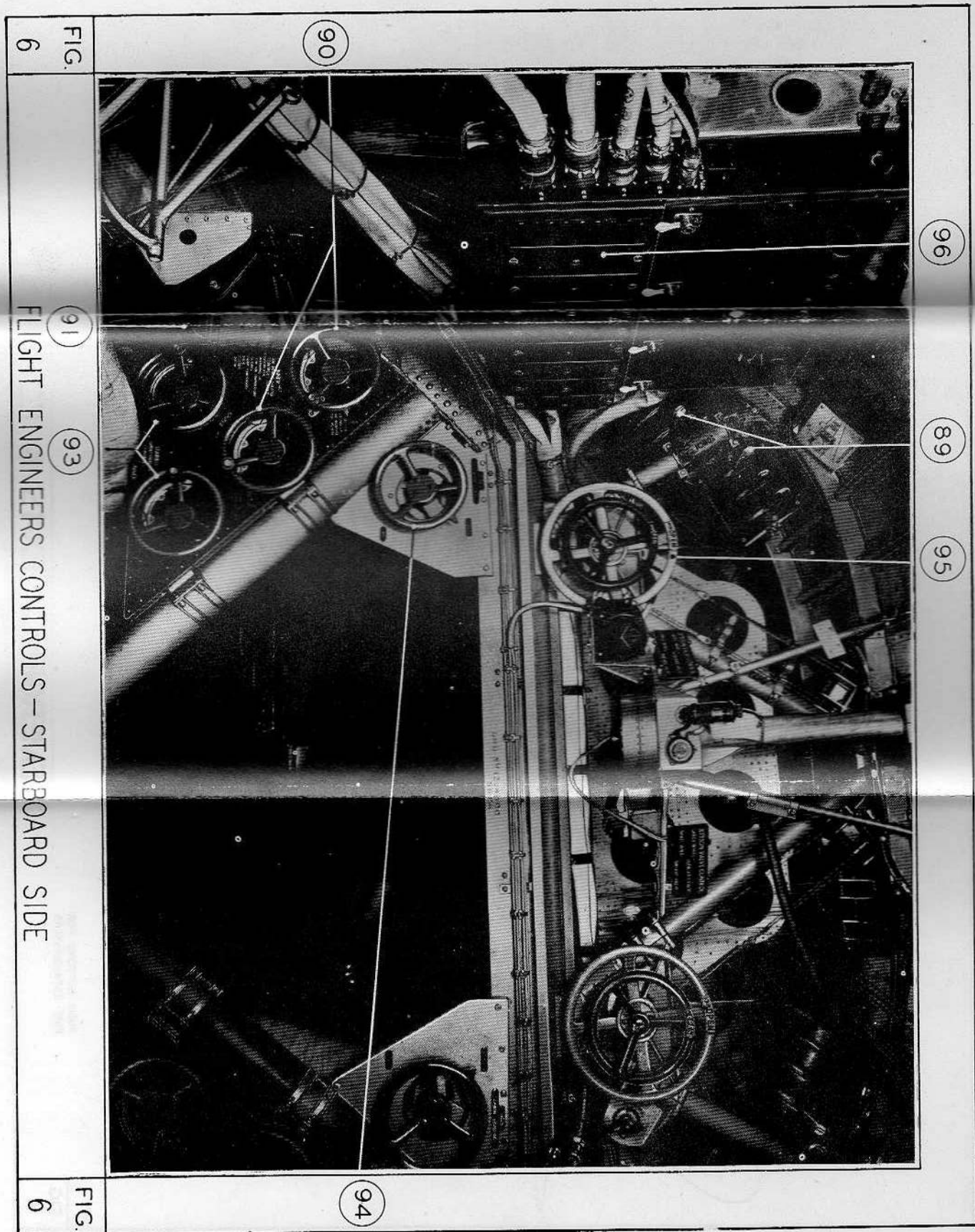


FIG. 6 FLIGHT ENGINEERS CONTROLS—STARBOARD SIDE FIG. 6