PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODEL C-69 AIRPLANE

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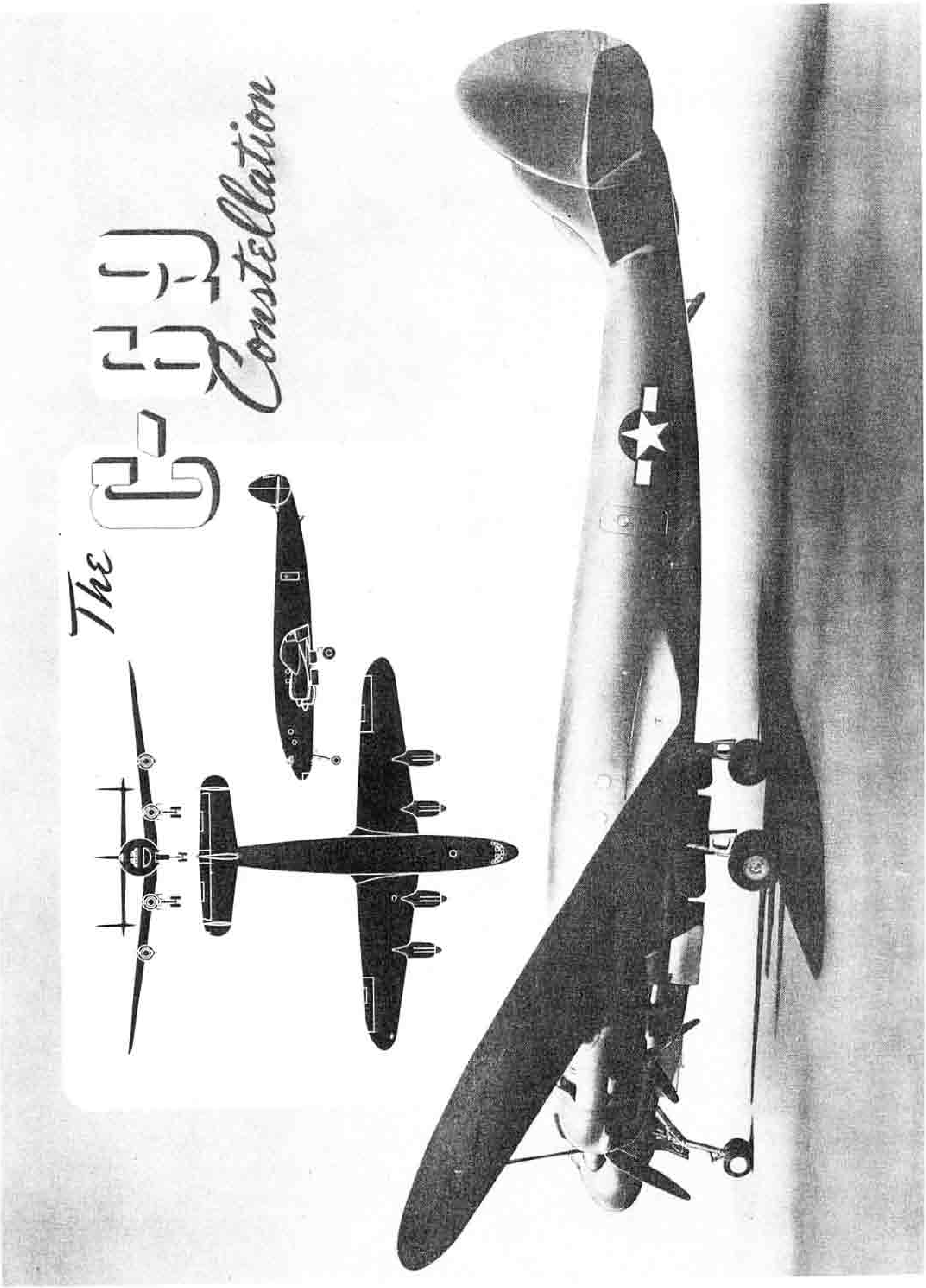
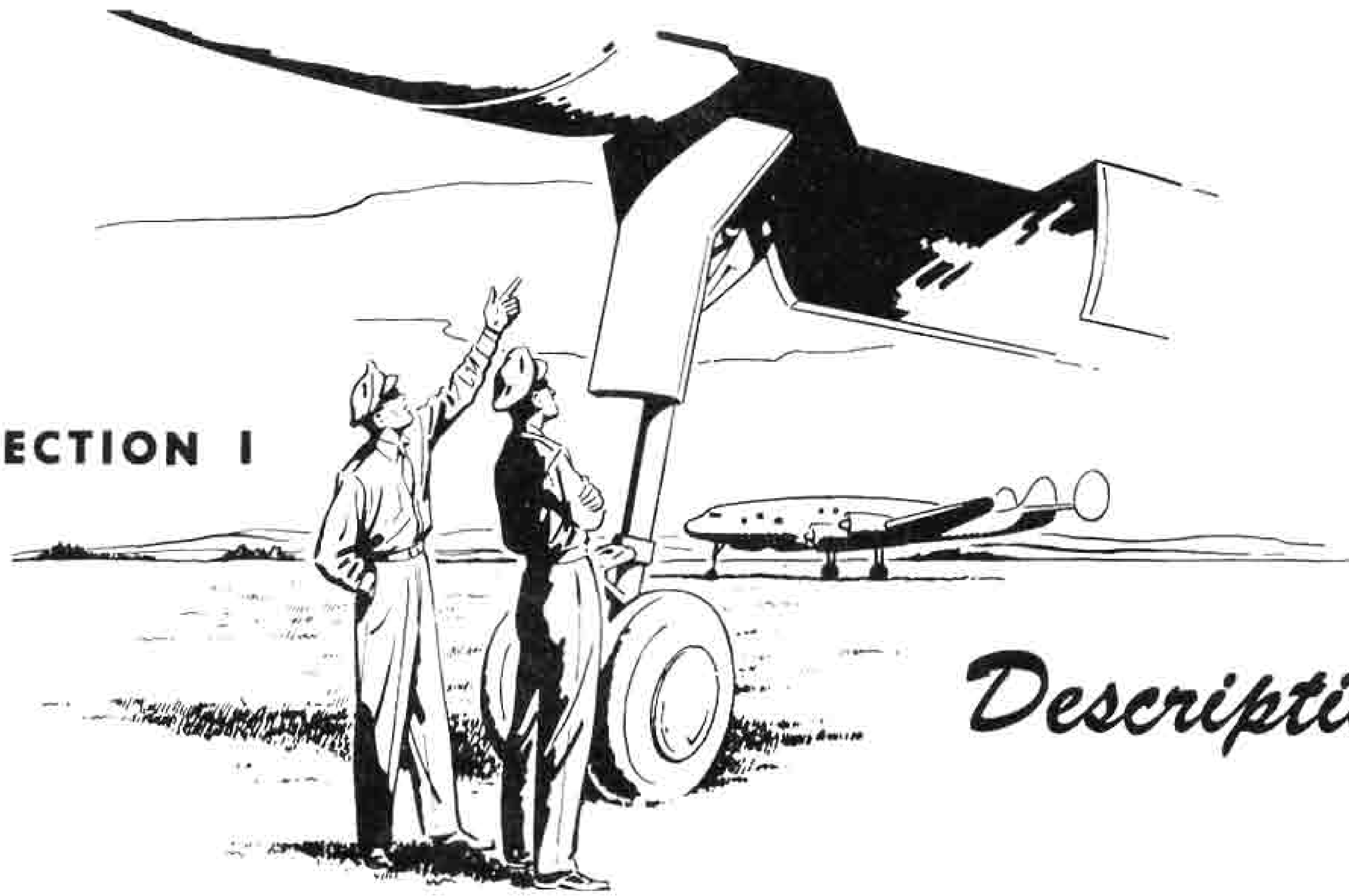

The C-69 Constellation

The C-69 Constellation



SECTION I

Description

1. AIRPLANE.

a. GENERAL.—The C-69 is a 60 passenger, low wing land transport monoplane, manufactured by the Lockheed Aircraft Corporation and powered by four Model R-3350 Wright Duplex engines. Hydraulically operated flight control boosters, landing gear, wing flaps, foot brakes, parking brakes, and cabin ventilation controls are provided. Cabin supercharging is provided, capable of maintaining an apparent 8,000 foot pressure altitude in the cabin while the airplane is flying at 20,000 feet. The airplane carries an active crew of five: pilot, co-pilot, flight engineer, radio operator, and navigator. In addition, accommodations are provided for a relief crew of four. Overall dimensions are as follows:

Span .... 123 feet
Length .... 95 feet $1\frac{3}{16}$ inches
Height, at rest .... 23 feet $7\frac{7}{8}$ inches

b. MOORING.—Mooring fittings are provided on the three landing gears, on the outer wing panels and on the aft end of the fuselage (see figure 37).

c. ARMOR PROTECTION is not provided for crew or passengers.

2. POWER PLANT.

a. The four R-3350-35 engines are twin row, 18 cylinder, air cooled engines driving 15 foot 2 inch three-bladed Hamilton Standard Hydromatic quick feathering propellers. Early airplanes have engines with a single speed blower. Later airplanes have engines with two-speed blowers.

Fuel: Specification AN-F-28
Grade 100/130

Oil: Specification AN-VV-O-446
Grade 1120
(for cold weather operation, use grade 1100 with oil dilution if necessary).

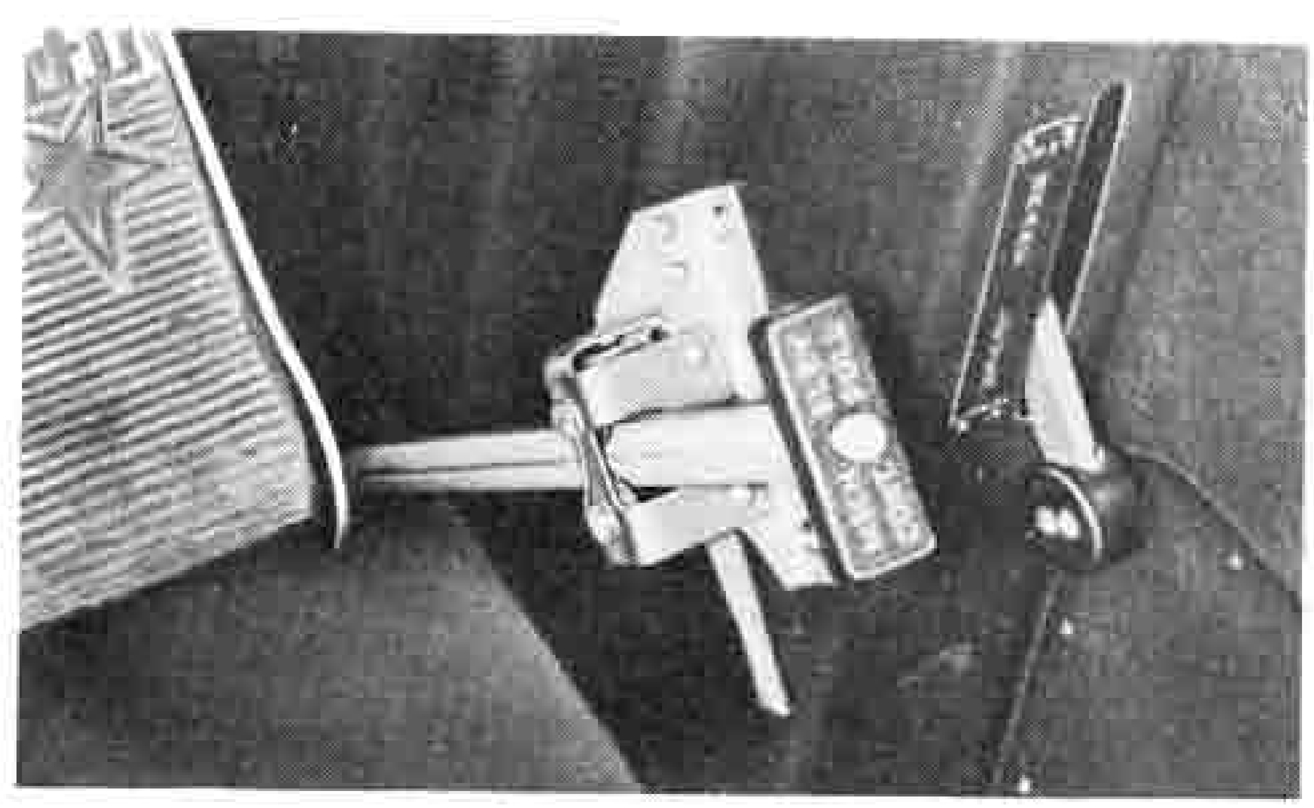


Figure 1 — Mechanical Elevator Control Handle

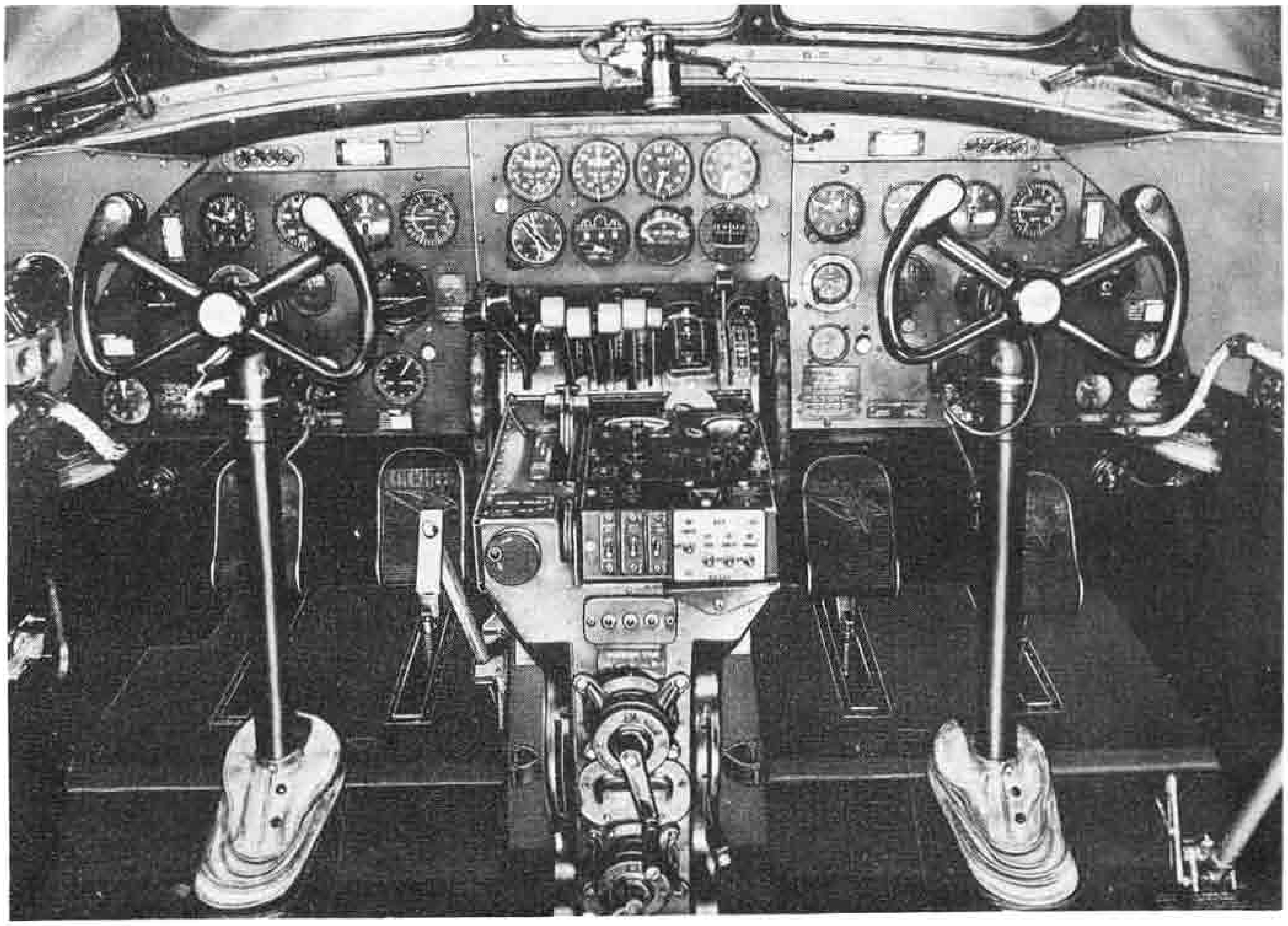


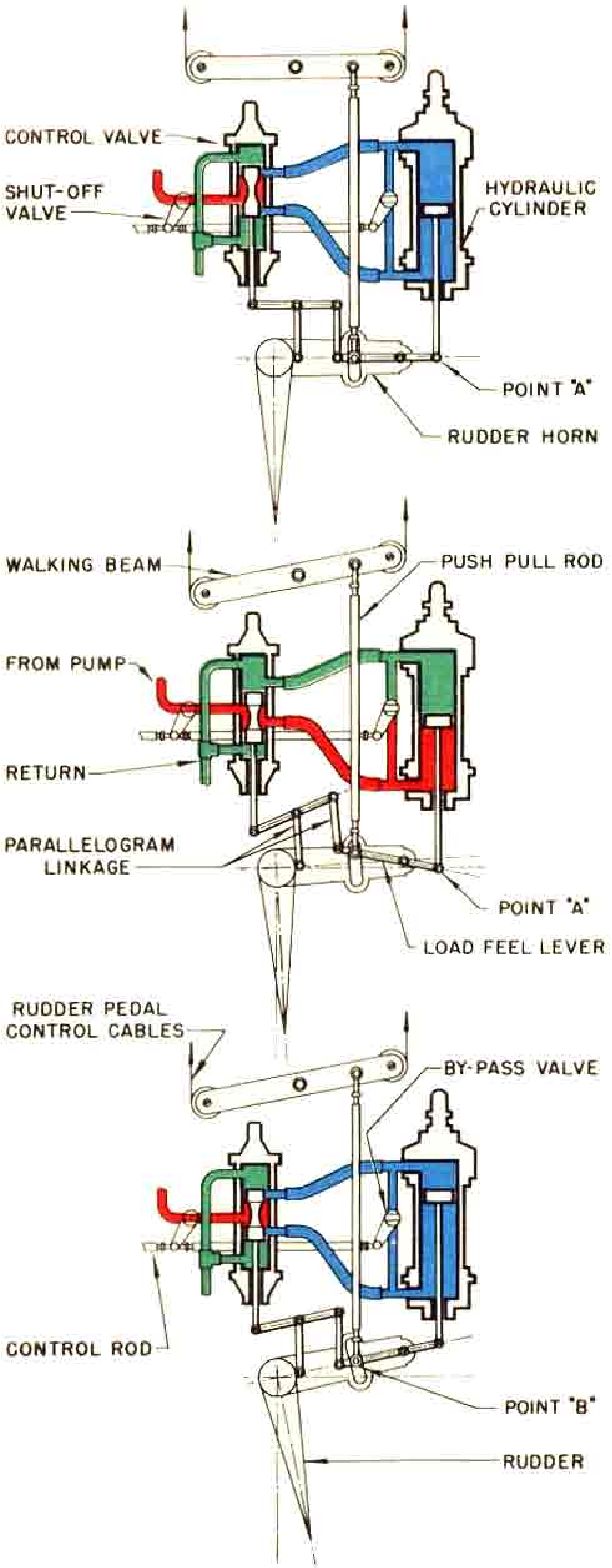
Figure 2 — Pilots' Compartment

3. FLIGHT CONTROLS.

a. AILERON, ELEVATOR AND RUDDER.—Conventional control column and wheel are provided for ailerons and elevator and conventional rudder pedals are provided for rudders. Rudder pedals are adjustable for leg length by lifting the adjustment levers (figure 4-17). Be sure that they are adjusted equally.

b. CONTROL BOOSTER SYSTEM.—Most of the flight control force is provided by hydraulic boost; the remainder is applied by the pilot. Figure 3 illustrates the working principle of a typical control boost linkage as applied to the rudder. Control cables which operate the hydraulic boost mechanisms are directly connected to the control surfaces allowing manual flight control in an emergency. Delivery of hydraulic pressure from the engine driven pumps to the control boost system is assured, before all other hydraulic units, should a partial hydraulic failure occur. In case of complete hydraulic failure, two levers on top of the pilot's control stand (figure 4-1) will disconnect the rudder and aileron boosters and allow manual control. A pull rod to the left of the pilot's control stand (figure 1) will disconnect the elevator booster and at the same time shift the elevator control linkage to provide a mechanical advantage for manual control of approximately 3 to 1 compared to the normal linkage. Shifting the linkage allows only 1/3 of the normal elevator travel.

c. ELEVATOR AND RUDDER CONTROL EMERGENCY BOOSTER SYSTEMS.—An independent hydraulic boost power system consisting of a fluid reservoir, electrically operated pump, and an accumulator is provided for the elevator and rudder for use in case of failure in the main hydraulic system. (See figure 12.) The control switches (figure 4-14 and -20) for the emergency systems are located on the pilot's control stand. The elevator linkage shift and booster engaging control (figure 1) must be in the normal position (pushed in) and the rudder booster engaging control must be ON for operation of the emergency systems.



Fluid pressure
Fluid return
Fluid trapped

With the control valve closed, hydraulic fluid on both sides of the piston holds point "A" stationary. The following events occur in rapid sequence. All motion is exaggerated for clarity.

Pilot pushes right rudder pedal causing load feel lever to pivot about point "A". The load feel lever moves the rudder slightly before warping the parallelogram linkage enough to open the control valve. This initial rudder movement is done without the help of hydraulic boost and represents the percentage of force that is always required of the pilot. With the control valve open hydraulic pressure is now applied to the piston.

Pilot holds point "B" stationary with rudder pedals. Piston moves forward pivoting the load feel lever about point "B". This moves the rudder further to the right and returns the parallelogram linkage to normal, closing the valve. The rudder will hold this position until the force on the rudder pedal is changed, starting the cycle again.

Should a hydraulic failure occur, closing a control boost lever (figure 1 or figure 4-1) will open the bypass valve and close the shut-off valve. The pin at "B" will contact the oversize hole and allow manual control.

Figure 3 — Rudder Hydraulic Boost Diagram

d. GUST LOCK.—Leaving all control boost systems engaged while airplane is parked provides a gust lock.

e. AUTOMATIC PILOT.—The type A-3 automatic pilot, on earlier airplanes, is powered by the secondary hydraulic system. (Refer to figures 9 and 17.) On later airplanes (serial No. 42-94549 and subsequent) power is supplied to the automatic pilot by an electrically operated pump which is controlled by an OFF-ON switch on the pilot's control stand. The automatic pilot operates the surface controls through the control boost system and it will not completely control the airplane unless the boost system is operating properly. If the control boost system is inoperative, the automatic pilot may be used to assist the pilot to control the airplane provided hydraulic pressure is available. The gyro instruments are driven by the airplane vacuum system. (Refer to figure 27.)

f. TRIM TAB CONTROLS.

(1) ELEVATOR.—Electrical and manual controls are provided for the two elevator tabs, and a position indicator (figure 36-20) is installed on the co-pilot's instrument panel. The tabs are Servo as well as controllable.

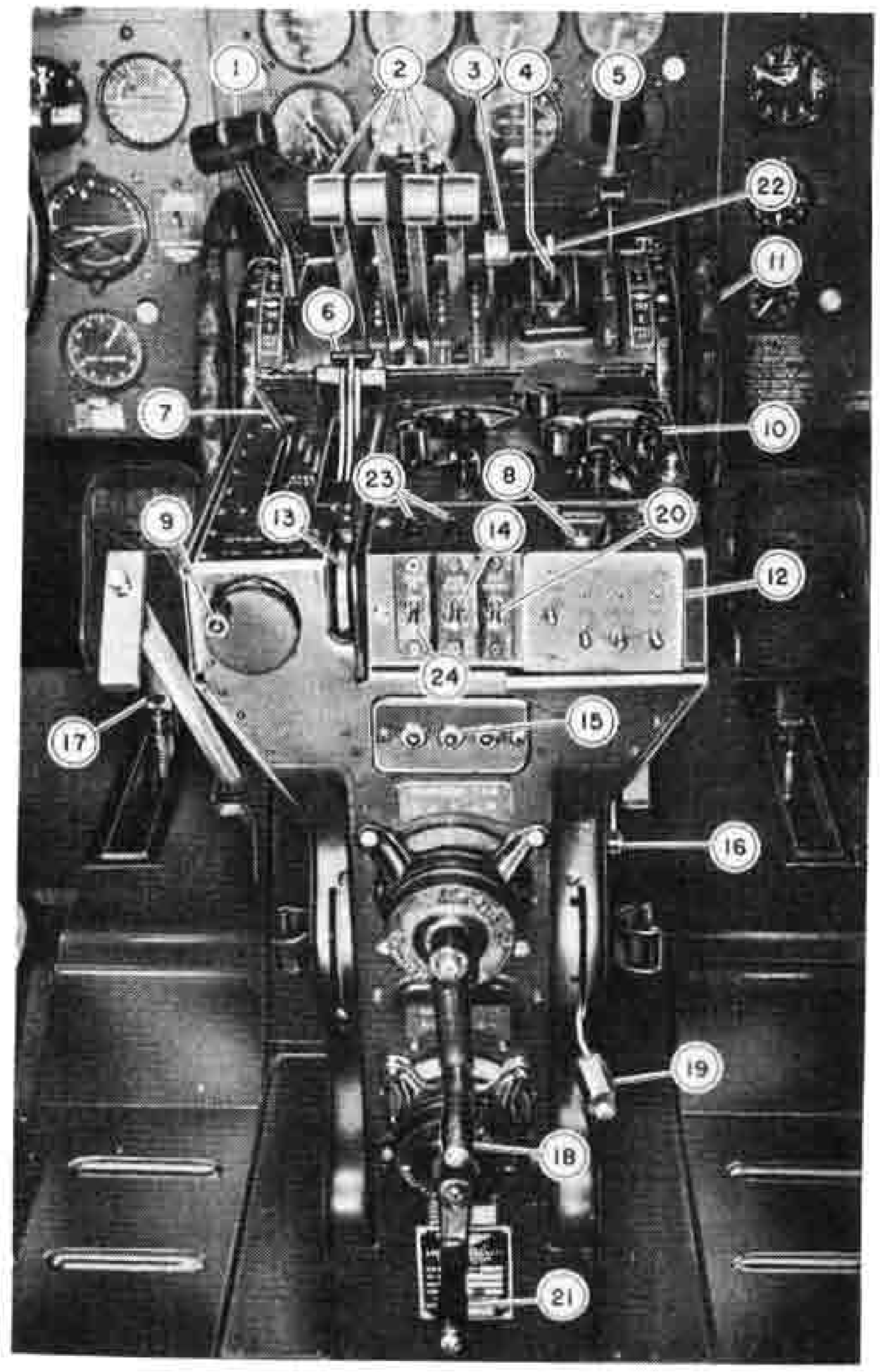
(a) The tabs are operated electrically by pulling the elevator tab control engaging lever (figure 4-22) aft to ELECT and pressing one of the two control switches which are located on the left side of the pilot's control wheel. Pressing the forward switch will bring the nose of the airplane up, and pressing the aft switch will bring the nose down.

(b) The tabs are operated manually by turning the two interconnected wheels (figure 4-11) on the pilot's control stand. The tabs cannot be operated manually when the electric motor is engaged.

(2) RUDDER.—A crank (figure 4-18) on the aft side of the pilot's control stand operates the three rudder tabs. Tabs are Servo as well as controllable.

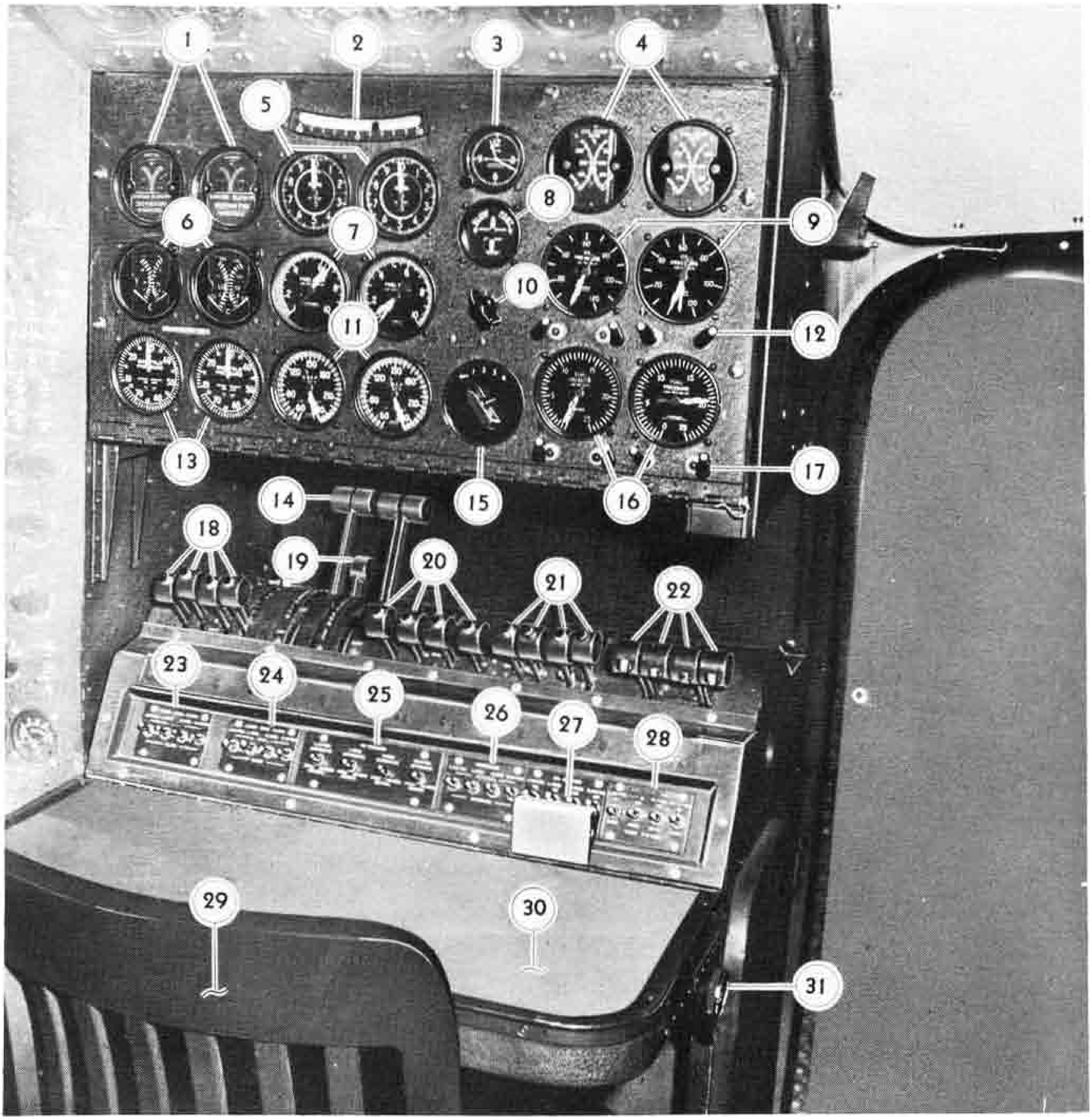
(3) AILERON.—A crank (figure 4-21) on the aft side of the pilot's control stand operates the two aileron tabs. Tabs are Servo as well as controllable.

g. LANDING GEAR. (*See figure 13.*)—The tricycle landing gear is hydraulically operated by a control (figure 4-19) located on the right side of the pilot's control stand. On airplanes 43-10309 and 43-10310 the landing gear control has only UP and DOWN positions.



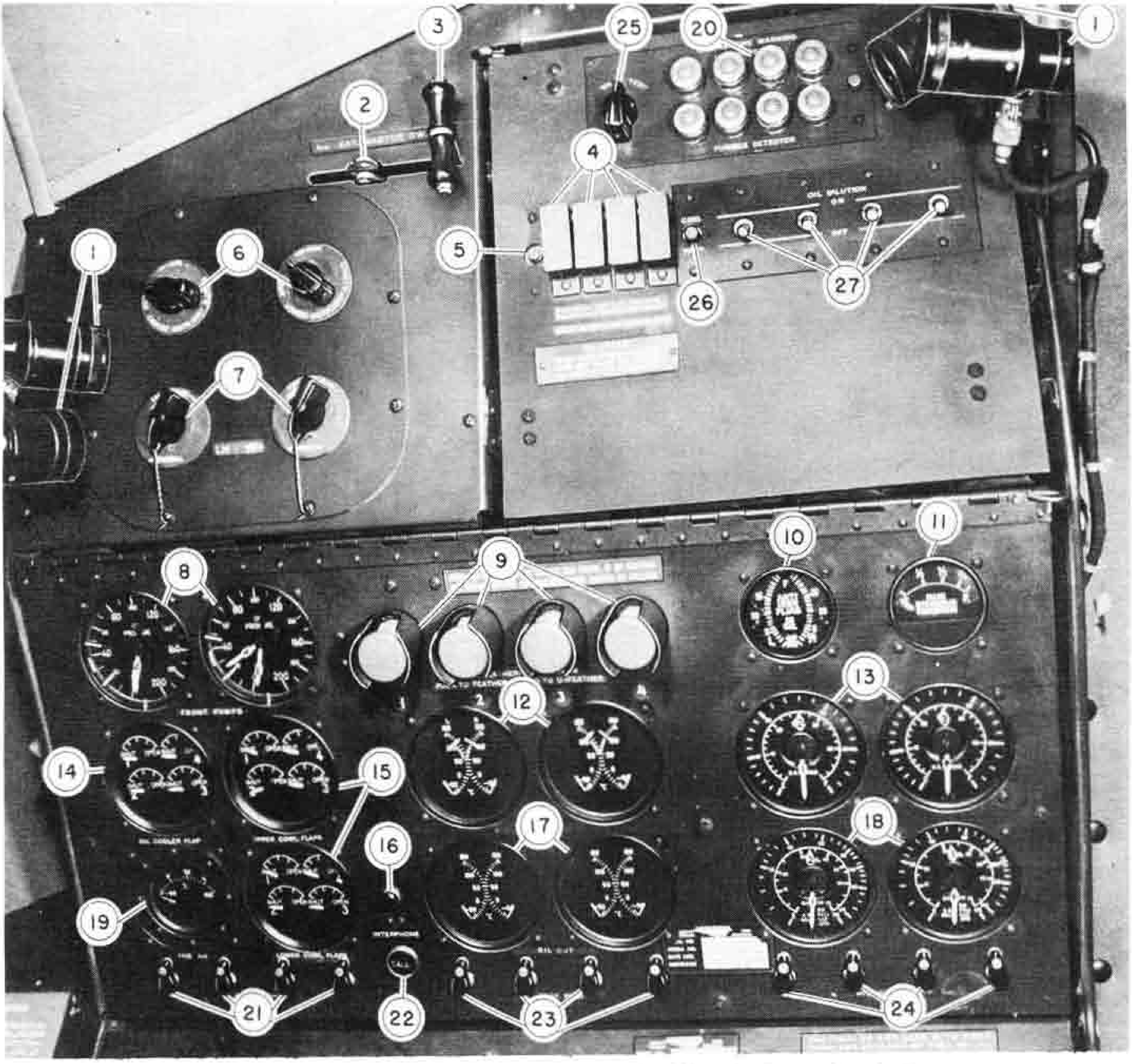
1. Rudder and aileron booster engaging levers.
2. Throttles.
3. Throttle lock.
4. Master propeller governor control switch.
5. Wing flaps control lever.
6. Automatic pilot engaging levers.
7. Automatic pilot lock.
8. Recognition lights keying button.
9. Remote automatic pilot rudder control.
10. Radio compass control box.
11. Elevator trim tab control.
12. Recognition lights selector switches.
13. Remote automatic pilot elevator control.
14. Elevator booster emergency control switch.
15. Landing gear lock indicator lights.
16. Brake selector valve.
17. Rudder pedal adjustment lever.
18. Rudder trim tab control.
19. Landing gear lever.
20. Rudder booster emergency control switch.
21. Aileron trim tab control.
22. Electric elevator tab control engaging lever.
23. Emergency booster control indicator lights.
24. Radio switch.

Figure 4 — Pilot's Control Stand



1. Blower section fire indicators.
2. Inclinometer.
3. Clock.
4. Cylinder head temperature gages.
5. Tachometers.
6. Carburetor air temperature gages.
7. Fuel flow meters.
8. Engine synchroscope.
9. Engine rear oil pump pressure gages.
10. Synchroscope engine selector switch.
11. BMEP gages.
12. Oil pressure warning lights.
13. Manifold pressure gages.
14. Throttles.
15. Cylinder head temperature selector switch.
16. Fuel pressure gages.
17. Fuel pressure warning lights.
18. Carburetor air heat and filter controls.
19. Throttle lock.
20. Supercharger control levers.
21. Mixture control levers.
22. Fuel tank shut-off valves.
23. Upper cowl flap control switches.
24. Lower cowl flap control switches.
25. Oil cooler flap control switches.
26. Propeller governor control switches.
27. Carburetor vapor return shut-off switches.
28. Auxiliary fuel pump switches.
29. Flight engineer's chair.
30. Flight engineer's desk.
31. Air conditioning panel light.

Figure 5 — Flight Engineer's Station



1. Instrument lights.
2. Airplane master switch padlock bracket.
3. Airplane master switch.
4. Hydraulic pump shut-off valve switches.
5. Hydraulic pump shut-off solenoid circuit breaker reset button.
6. Instrument light switches.
7. Manual generator voltage switch rheostats.
8. Engine front oil pump pressure gages
9. Propeller feathering switch buttons.
10. Anti-icer fluid quantity gage.
11. Hydraulic oil quantity gage.
12. Engine oil IN temperature gages.
13. Oil quantity indicators.
14. Oil cooler flap position indicators.
15. Cowl flap position indicators.
16. Flight engineer's call light.
17. Engine oil OUT temperature gages.
18. Fuel quantity indicators.
19. Free air temperature gage.
20. Nacelle fire warning lights.
21. Vacuum pump warning lights.
22. Flight engineer's call button.
23. Propeller Governor Limit Lights.
24. Hydraulic pump pressure warning lights.
25. Fire extinguisher indicator light test switch.
26. Oil dilution circuit protector.
27. Oil dilution switches.

Figure 6 — Flight Engineer's Upper Panel

On subsequent airplanes a NEUTRAL position is provided which should be used in flight after the gear is retracted to reduce the vulnerability of the hydraulic system. The tail bumper (if installed) located under the fuselage near the tail extends and retracts with the main gear. A lock is provided so the control cannot be moved to the UP position while the weight of the airplane rests on the landing gear. In case the lock fails to release when the airplane leaves the ground, press in the manual release located inside the small hole just forward of the landing gear lever. Landing gear position is given by the indicator (figure 36-27) on the co-pilot's instrument panel. When the gear is locked in the landing position, three green lights (figure 4-15) located on the aft end of pilot's control stand, illuminate and the red flags on the landing gear position indicator (figure 36-27) disappear. When the gear is NOT locked in landing position and one engine on each side of the airplane is throttled, a warning horn will sound.

b. WING FLAPS. *(See figure 16.)*—The wing flaps are hydraulically operated by the control (figure 4-5) on the pilot's control stand. The flap control quadrant is graduated in percentage extension and the flaps may be extended to any desired position by setting the flap control lever opposite the percentage extension desired. The flaps will remain at the position selected (use the flap position indicator (figure 36-27) as a check) until the flap control lever is moved. The flaps will then extend or retract to correspond with the new position selected.

4. ENGINE CONTROLS.

a. THROTTLES.—Conventional. One set of throttles (figure 4-2), located on pilot's control stand, is interconnected with the other set of throttles (figure 5-14), located on the engineer's control stand. Throttle friction locks are provided on both the pilot's control stand (figure 4-3) and on the engineer's control stand (figure 5-19). Operation of either lock affects both sets of throttles, and the other lock.

b. MIXTURE CONTROL.—Located only on engineer's control stand (figure 5-21). Each of the four controls has three main positions: AUTOMATIC RICH, CRUISING LEAN, and OFF.

c. SUPERCHARGER CONTROLS. — Located only on engineer's control stand (figure 5-20). For ground operation, see Section II, paragraph 7, *c,* (engineer). For flight operation, see Section II, paragraph 13, *e.*

d. PROPELLER CONTROLS.

(1) GOVERNORS.—The propeller governors are controlled by four momentary contact increase-decrease rpm governor switches (figure 5-26) located on the engineer's control stand. A master propeller governor switch (figure 4-4) is mounted on the pilot's control stand, which increases or decreases all four governors simultaneously, regardless of how the engineer's governor switches are operated. The master governor switch is spring loaded to the OFF position. The governor switches operate to change the engine rpm at approximately 100 rpm per second.

(2) GOVERNOR INDICATOR LIGHTS. — Four amber indicator lights (figure 6-23) are provided on the engineer's instrument panel. These lights glow whenever any of the governor switches (figure 5-26) or the master propeller governor switch (figure 4-4) is operated and the propeller governor is in either the full increase rpm or full decrease rpm position.

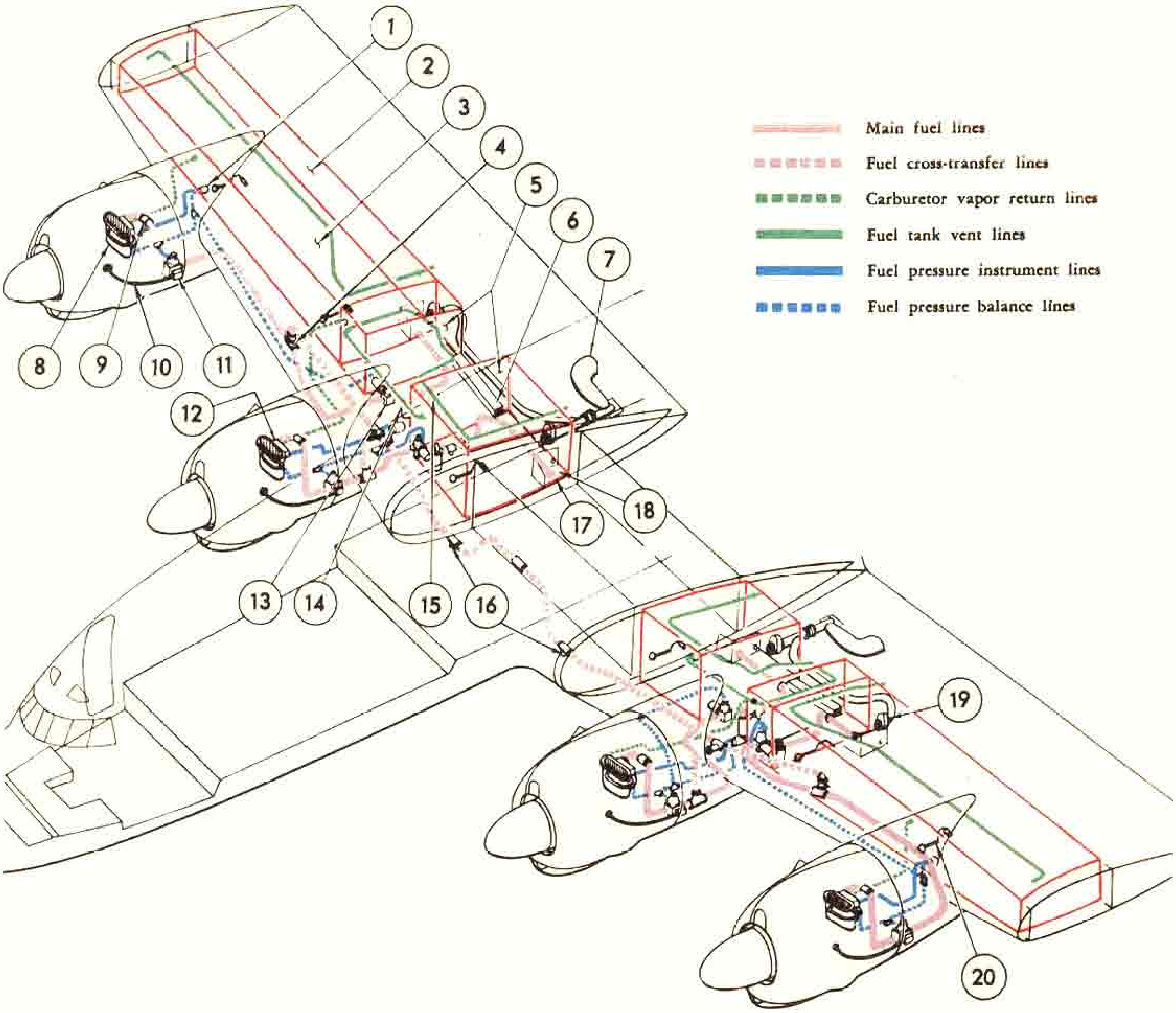
(3) SYNCHROSCOPE.—By use of the synchroscope (figure 5-8) and the synchroscope selector switch (figure 5-10) and by manipulation of the propeller governor switches, it is possible to synchronize engines numbers one, two and three with engine number four (right outboard engine).

(4) FEATHERING. — The feathering controls (figure 6-9) are located on the flight engineer's instrument panel and the feathering operations should be performed by the flight engineer. Refer to Section IV, paragraph 9, "Engine Failure During Flight."

e. COWL FLAPS.—Four electrically operated cowl flaps are provided for each engine. Two sets of switches (figure 5-23 and 5-24) on the flight engineer's control stand operate the upper flaps and the lower flaps respectively. Cowl flaps position indicators (figure 6-15) are located on the flight engineer's instrument panel.

f. CYLINDER HEAD TEMPERATURE INDICATORS (figure 5-4) and a cylinder head temperature selector switch (figure 5-15) are provided on the flight engineer's instrument panel. The cylinder temperature selector switch has four positions numbered from one to four connected to cylinder heads numbered 1, 5, 14, and 17 respectively.

g. CARBURETOR HEATERS AND AIR FILTERS are operated by one set of levers (figure 5-18) located on flight engineer's control stand. The controls are set



1. Fuel pressure transmitter.
2. Rear shear beam.
3. Outboard fuel tank.
4. Cross transfer valve.
5. Inboard fuel tank.
6. Inboard fuel tank connection tunnel.
7. Right-hand fuel dump valve chute.
8. Carburetor.
9. Fuel flow transmitter
10. Engine fuel pump flexible drive.
11. Engine driven fuel pump.
12. Engine primer solenoid.
13. Auxiliary fuel pump.
14. Fuel line strainer.
15. Fuel tank shut-off valve.
16. Fuel drain tee.
17. Right-hand inboard fuel tank outlet.
18. Surge box.
19. Outboard fuel tank dump valve.
20. Fuel quantity transmitter.

Figure 7 — Fuel System

to HOT when pulled towards the flight engineer. They are set to COLD when pushed away from the flight engineer. When pushed approximately 10° beyond the COLD position, the levers close a switch which brings the air filters into operation.

h. CARBURETOR ANTI-ICER. — Carbuetor anti-icers operated by switches (figure 65-8) on the shelf to the right of the co-pilot are provided to clear the carburetors in case the carburetor heaters prove ineffective or in case high powers are being used.

i. BMEP GAGES (figure 5-11) installed on the flight engineer's instrument panel are connected to torquemeters located in each engine nose section. The BMEP gages and the tachometers together with the Torquemeter Power Chart (figure 38) provide a means for determining the power output of any engine.

j. FUEL SYSTEM. *(See figure 7.)*—Four complete fuel system are provided, connected only by cross transfer lines. Two integral fuel tanks are built into each wing, the inboard tanks each hold 820 U. S. gallons (682 Imp. gallons) and the outboard tanks each hold 1590 U. S. gallons (1325 Imp. gallons) (1207 U. S. gallons [1006 Imp. gallons] each on airplanes 43-10309 and 43-10310). Fuel quantity indicators (figure 6-18) are installed on the flight engineer's instrument panel.

(1) FUEL TANK SHUT-OFF VALVES. *(Figure 5-22.)*—Four valves operated from engineer's control stand are installed to shut off the fuel flow at each tank.

(2) ENGINE FUEL EMERGENCY SHUT-OFF VALVES.—Four levers (figure 24-2) are located on the pilot's overhead panel to shut off the fuel supply to the engines. The same levers operate the engine and hydraulic oil emergency shut-off valves.

Note

These valves might not be installed on early airplanes.

(3) FUEL TRANSFER VALVE. *(Figure 32-4.)*—These four valves are operated by levers located on floor to left of engineer's seat. They provide means for supplying fuel to any engine from any fuel tank.

(4) AUXILIARY FUEL PUMPS. *(Figure 5-28.)*—Four switches are located on the flight engineer's panel to control the four electric auxiliary fuel pumps. These pumps are provided for use during take-off, landings and at other times when engine-driven fuel pumps will not maintain 16 lb/sq in. fuel pressure.

(5) FUEL FLOW METER INDICATORS (figure 5-7), which are installed on the engineer's instrument panel, are calibrated in pounds of fuel per hour. The meters are located in the primary fuel line just before the carburetors.

(6) ENGINE PRIMERS (figure 22-12) are the electric solenoid type which require 16-19 lb/sq in. fuel pressure to operate properly.

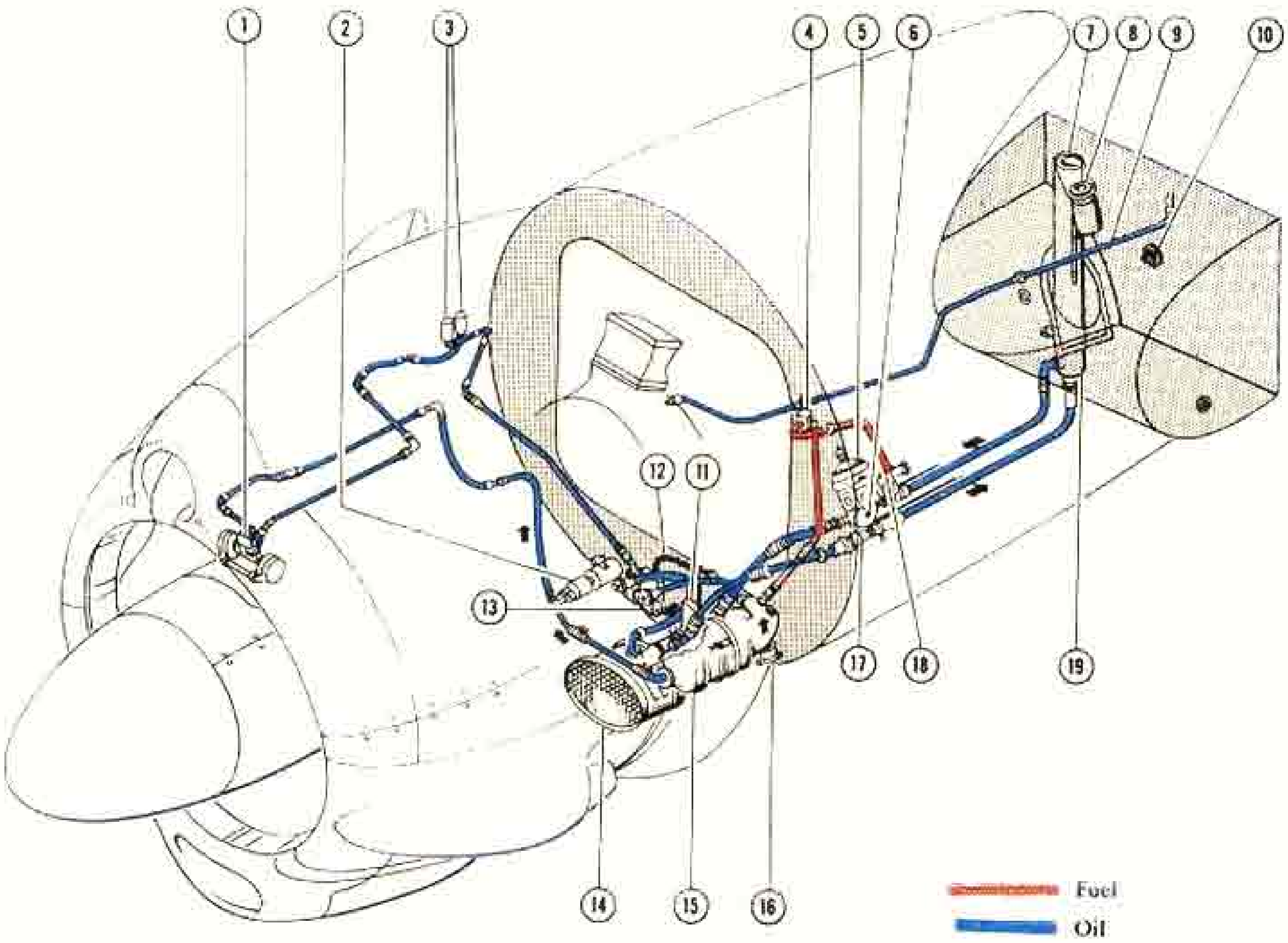
(7) FUEL DUMP VALVES. — One retractable dump chute is provided on the lower surface of each inner wing panel connected to both the inboard and outboard tanks. Operation of the two fuel dump control levers (figure 24-1 and 24-3) located on the pilot's overhead panel, both extends the dump chutes and open the dump valves. The rate of flow is approximately 190 U. S. gallons (158 Imp. gallons) per minute from each dump chute [105 U. S. gallons (87 Imp. gallons) from each outboard tank and 85 U. S. gallons (71 Imp. gallons) from each inboard tank]. Following any emergency dumping of fuel, there are 70 U. S. gallons (58 Imp. gallons) left in the inboard tanks and 30 U. S. gallons (25 Imp. gallons) left in the outboard tanks.

(8) FUEL PRESSURE.—Two dual fuel pressure gages (figure 5-16) are installed on the engineer's instrument panel. Maximum fuel pressure is 19 lb/sq in., minimum 15 lb/sq in., desired 17 lb/sq in. Fuel pressure warning lights (figure 5-17) located below the pressure gages and on the pilot's instrument panel (figure 35-2) glow when the fuel pressure falls below 14 lb/sq in.

(9) CARBURETOR VAPOR RETURN SHUT-OFF VALVES. — Solenoid operated shut-off valves, which are controlled by switches (figure 5-27) on the engineer's lower control panel, are installed in the carburetor vapor return lines. These valves should be OPEN at all times except when fuel flow readings are being taken.

k. OIL SYSTEM. *(See figure 8.)*—One integral oil tank of approximately 50 U. S. gallons (41.5 Imp gallons) usable capacity is installed outboard of each nacelle. Oil quantity indicators (figure 6-13) are installed on the flight engineer's instrument panel.

(1) OIL PRESSURE.—The engines are equipped with two oil pumps, one on the front and one on the rear. Four dual oil pressure gages are installed on the engineer's instrument panel. The gages (figure 6-8) on the upper panel indicate front pump pressure which



1. Propeller governor.
2. Propeller feathering pump and motor.
3. Pressure transmitters.
4. Engine oil dilution solenoid valve.
5. Fuel pump.
6. Emergency shut-off valve.
7. Oil tank hopper.
8. Oil tank filler cap and bayonet gage.
9. Oil tank vent line to engine.
10. Oil quantity transmitter.
11. Automatic oil cooler flap control.
12. Flexible drive—flap control to flap motor.
13. Oil cooler flap motor.
14. Oil cooler.
15. Sump tank.
16. Oil system drain valve.
17. Check valve.
18. Oil dilution line.
19. Oil tank hopper drain cock.

Figure 8 — Oil System Diagram

should be 40 lb/sq in. maximum, 30 lb/sq in. minimum, desired 35 lb/sq in. The gages (figure 5-9) on the lower panel indicate rear pump pressure which should be 80 lb/sq in. maximum, 60 lb/sq in. minimum, 25 lb/sq in. permissible at idling speed (550 rpm), desired 70 lb/sq in. Oil pressure warning lights (figure 5-12) located below the rear pump oil pressure gages glow when the rear oil pressure falls below 50 lb/sq in.

(2) OIL TEMPERATURE. — Two dual oil-in temperature gages (figure 6-12) and two dual oil-out temperature gages (figure 6-17) are installed on the flight engineer's instrument panel.

(3) OIL COOLER FLAPS. — Switches (figure 5-25) having four positions: AUTOMATIC, OFF, OPEN, and CLOSE are installed on the engineer's control stand. Normally these switches will be left in AUTOMATIC, however, the OPEN and CLOSE positions allow manual setting of the flaps to any desired position, in case of failure of the automatic mechanism. An oil flap position indicator (figure 6-14) is installed on the flight engineer's instrument panel. The automatic control is set to regulate between 71°C (160°F) (flaps closed) and 90°C (196°F) (flaps open). The emergency temperature limit is 105°C (220°F).

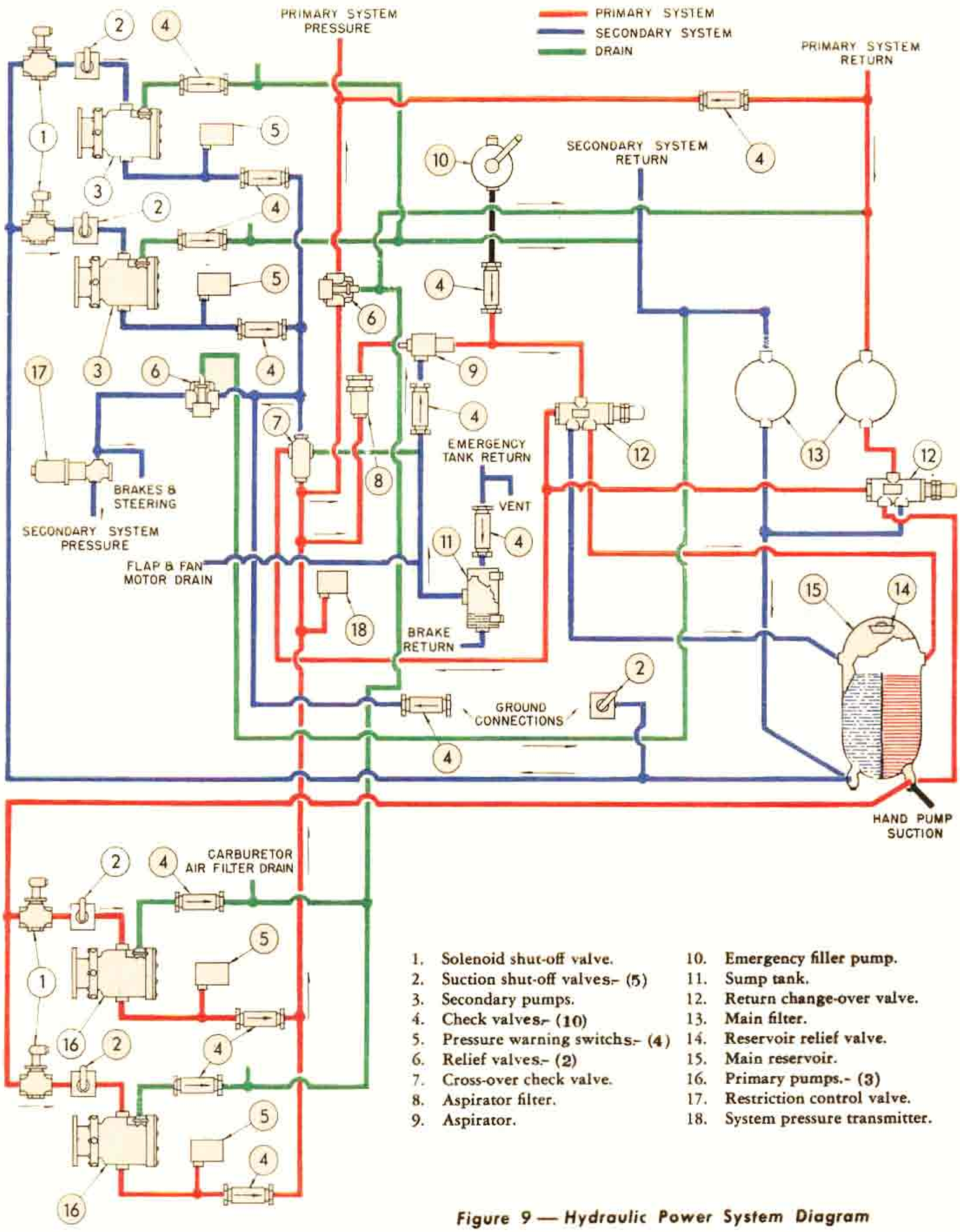
(4) OIL DILUTION.—Switches (figure 6-27) are located on the engineer's upper panel. When it is anticipated that the temperature at the next start will be below 5°C (40°F) the oil system should be diluted before stopping the engines. Refer to Section IX, paragraph 6, for proper oil dilution procedure.

(5) OIL SHUT-OFF EMERGENCY VALVES.— Four levers (figure 24-2) located on the pilot's overhead panel shut off the engine oil supply. The same levers operate the fuel and hydraulic oil emergency shut-off valves.

5. HYDRAULIC SYSTEM.

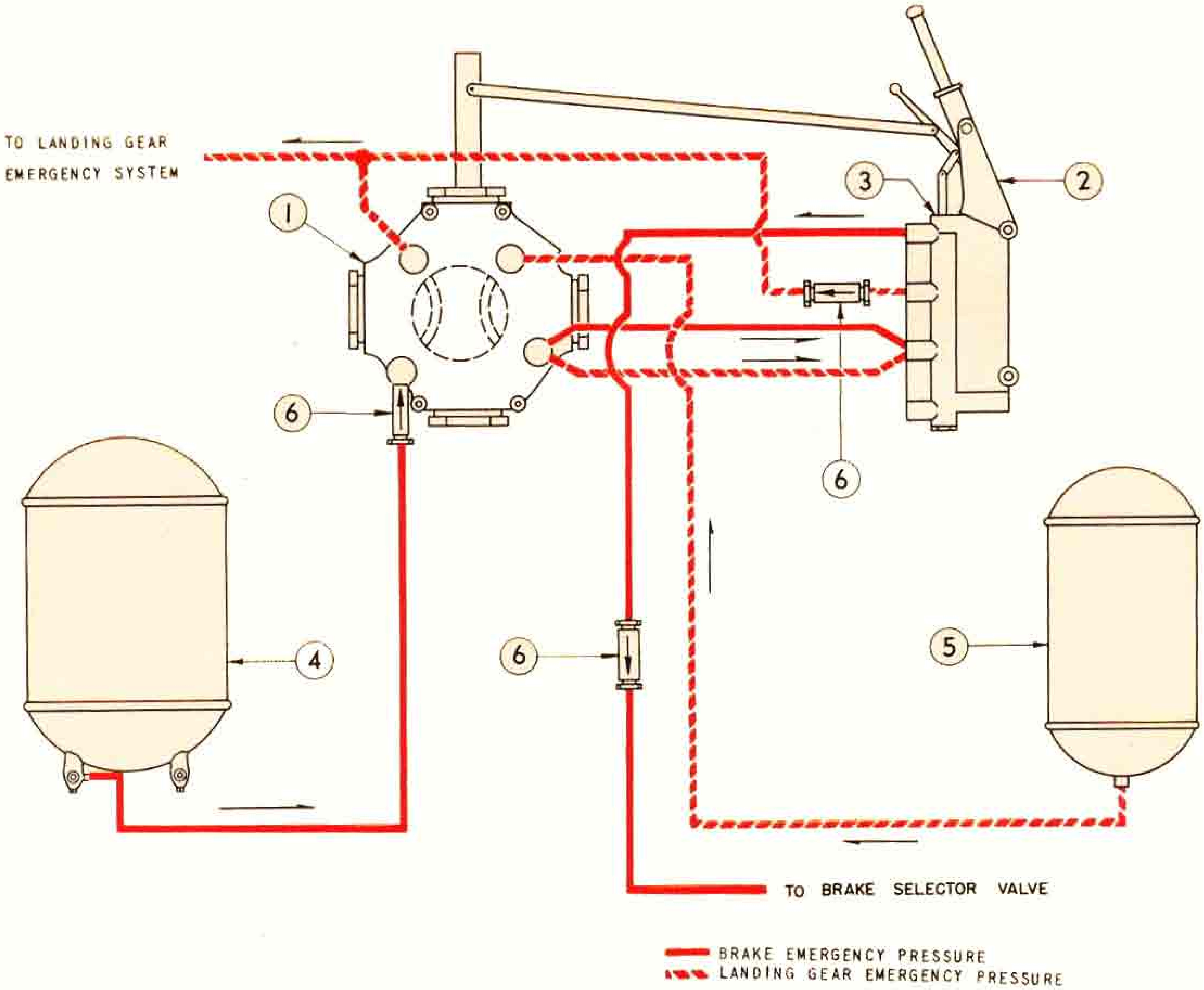
(See figure 9 through 18.)

a. GENERAL.—The hydraulic system is divided into two parts, the primary system, which operates the flight control boosters, and the secondary system, which supplies all other hydraulic units. Normally the systems



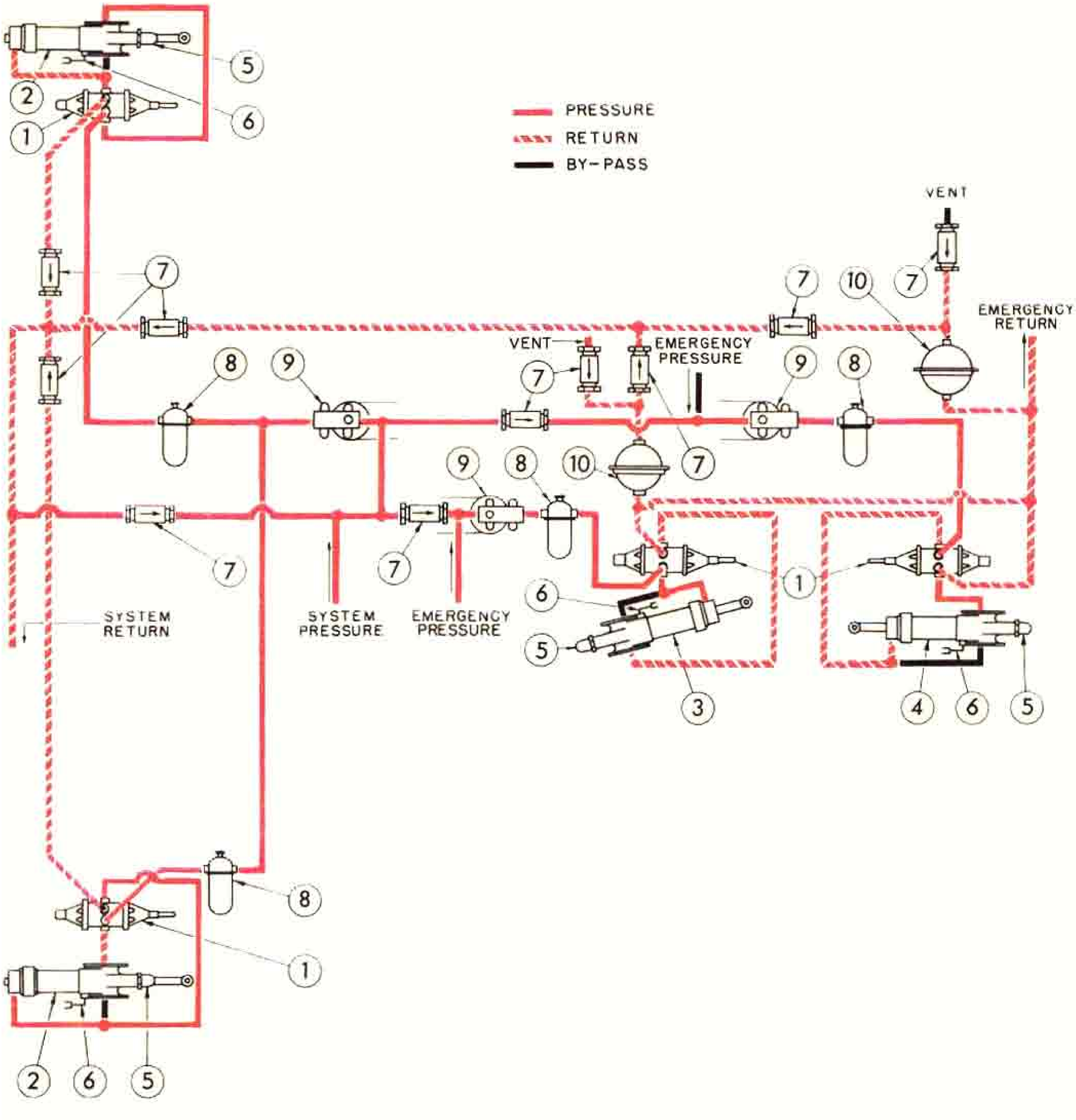
1. Solenoid shut-off valve.
2. Suction shut-off valves.- (5)
3. Secondary pumps.
4. Check valves.- (10)
5. Pressure warning switchs.- (4)
6. Relief valves.- (2)
7. Cross-over check valve.
8. Aspirator filter.
9. Aspirator.
10. Emergency filler pump.
11. Sump tank.
12. Return change-over valve.
13. Main filter.
14. Reservoir relief valve.
15. Main reservoir.
16. Primary pumps.- (3)
17. Restriction control valve.
18. System pressure transmitter.

Figure 9 — Hydraulic Power System Diagram



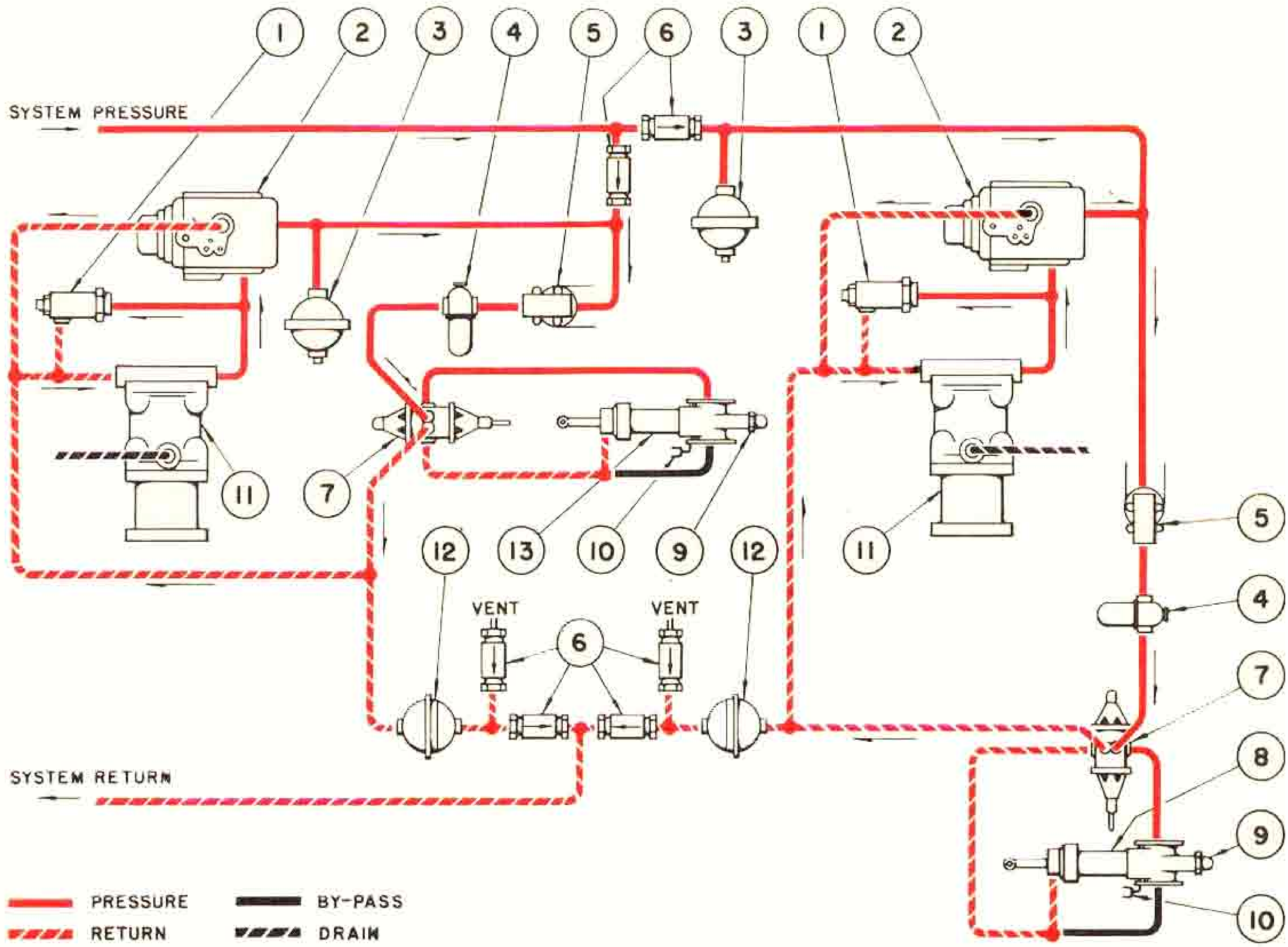
1. Four-way hand pump selector valve.
2. Hand pump.
3. Hand pump selector valve.
4. Main reservoir.
5. Emergency extension tank.
6. Check valves.- (2)
7. Three-way check valve.
8. Brake accumulator.

Figure 10 — Hydraulic Emergency Hand Pump System Diagram



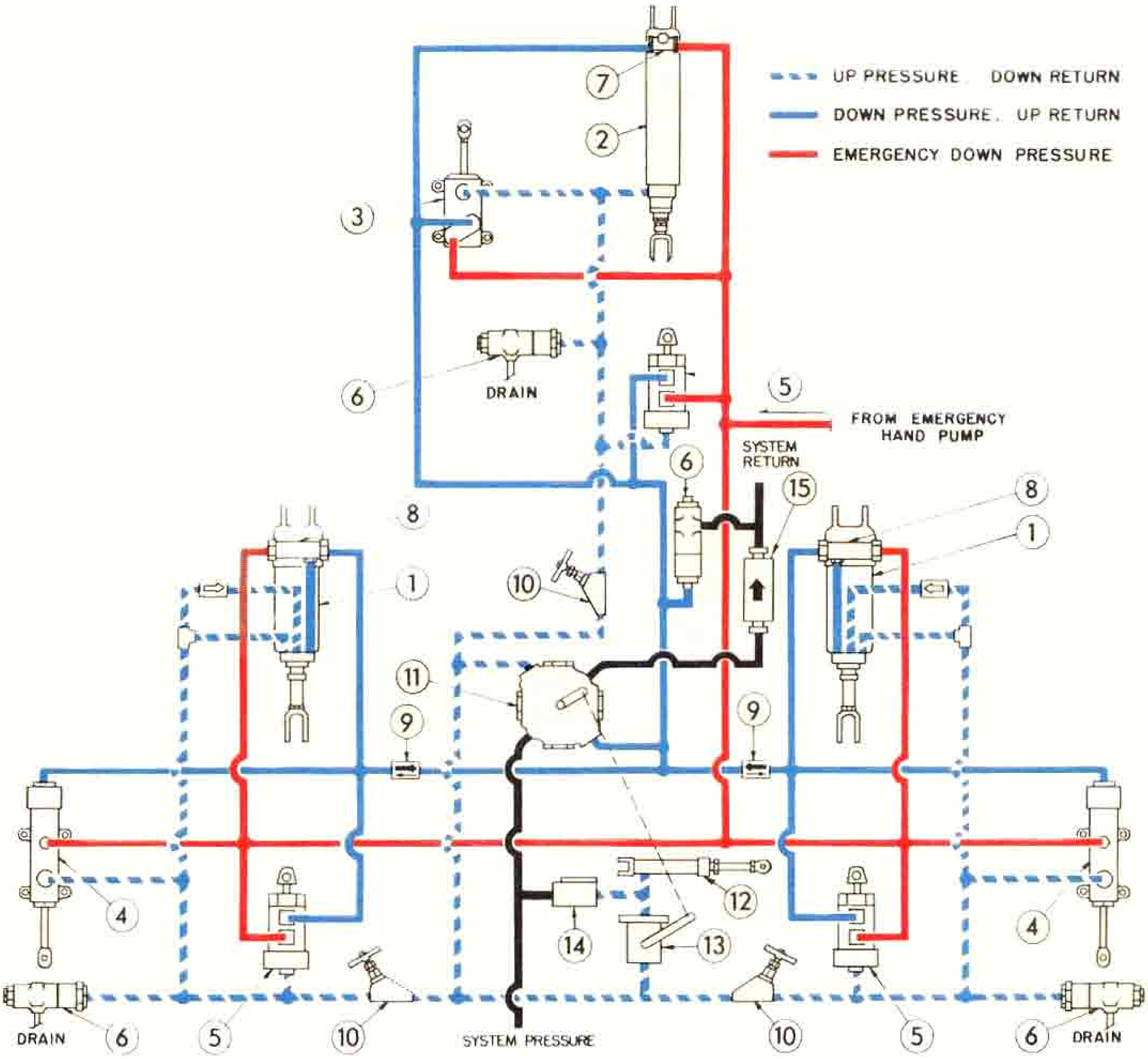
1. Booster control valves.- (4)
2. Aileron booster cylinders.- (2)
3. Rudder booster cylinder.
4. Elevator booster cylinder.
5. Cylinder relief valves.- (4)
6. By-pass valves.- (4)
7. Check valves.- (5)
8. Filters.- (4)
9. Shut-off valves.- (3)
10. Emergency system fluid storage tank.

Figure 11 — Hydraulic Surface Control Booster System Diagram



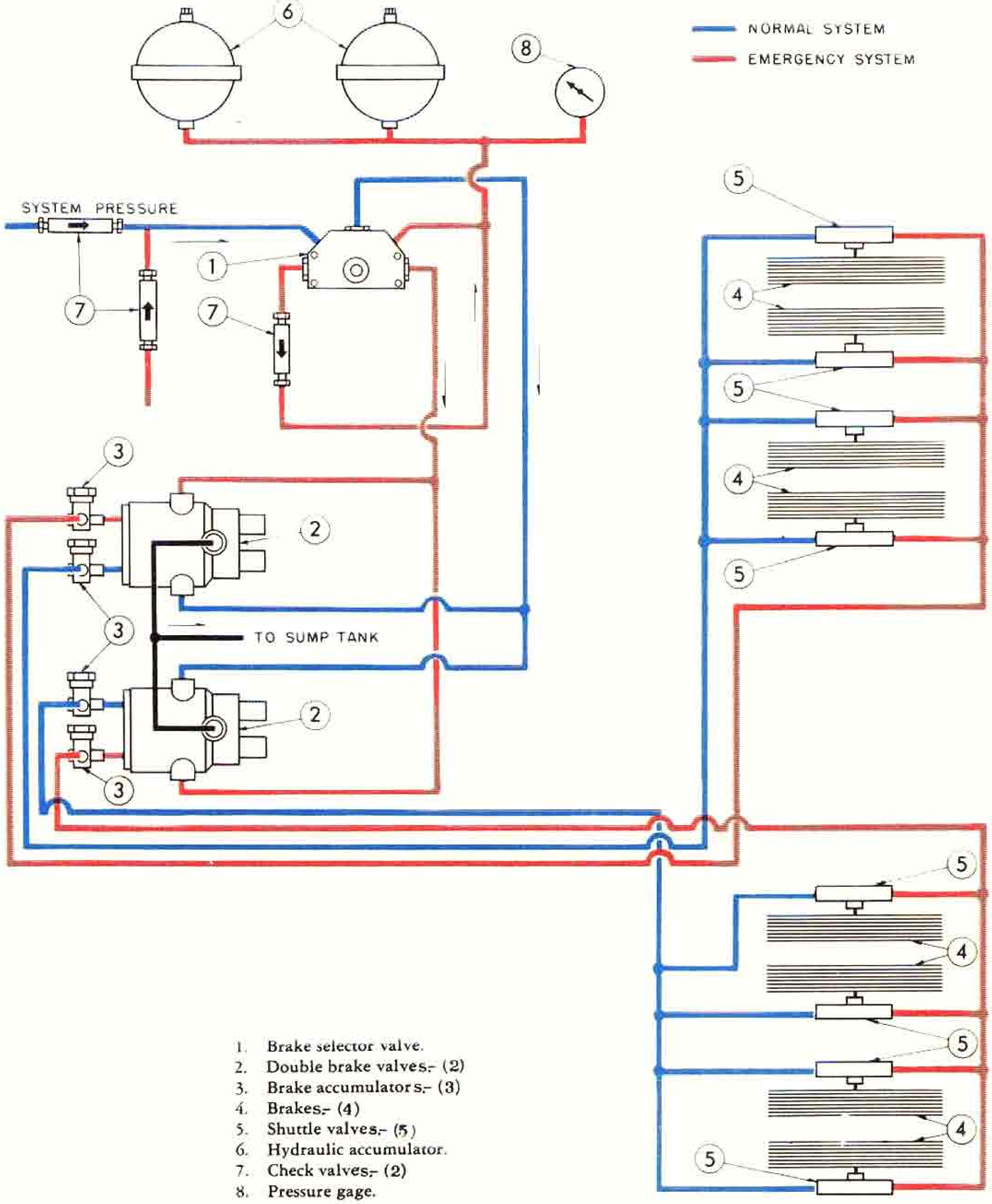
1. Relief valves. (2)
2. Pressure regulators. (2)
3. Accumulators. (2)
4. Filters. (2)
5. Shut-off valves. (2)
6. Check valves. (4)
7. Booster control valves. (2)
8. Elevator booster cylinder.
9. Cylinder relief valve.
10. By-pass valve.
11. Motor and pump.
12. Fluid reservoir.
13. Rudder booster cylinder.

Figure 12 — Hydraulic Elevator and Rudder Booster Control Emergency System Diagram



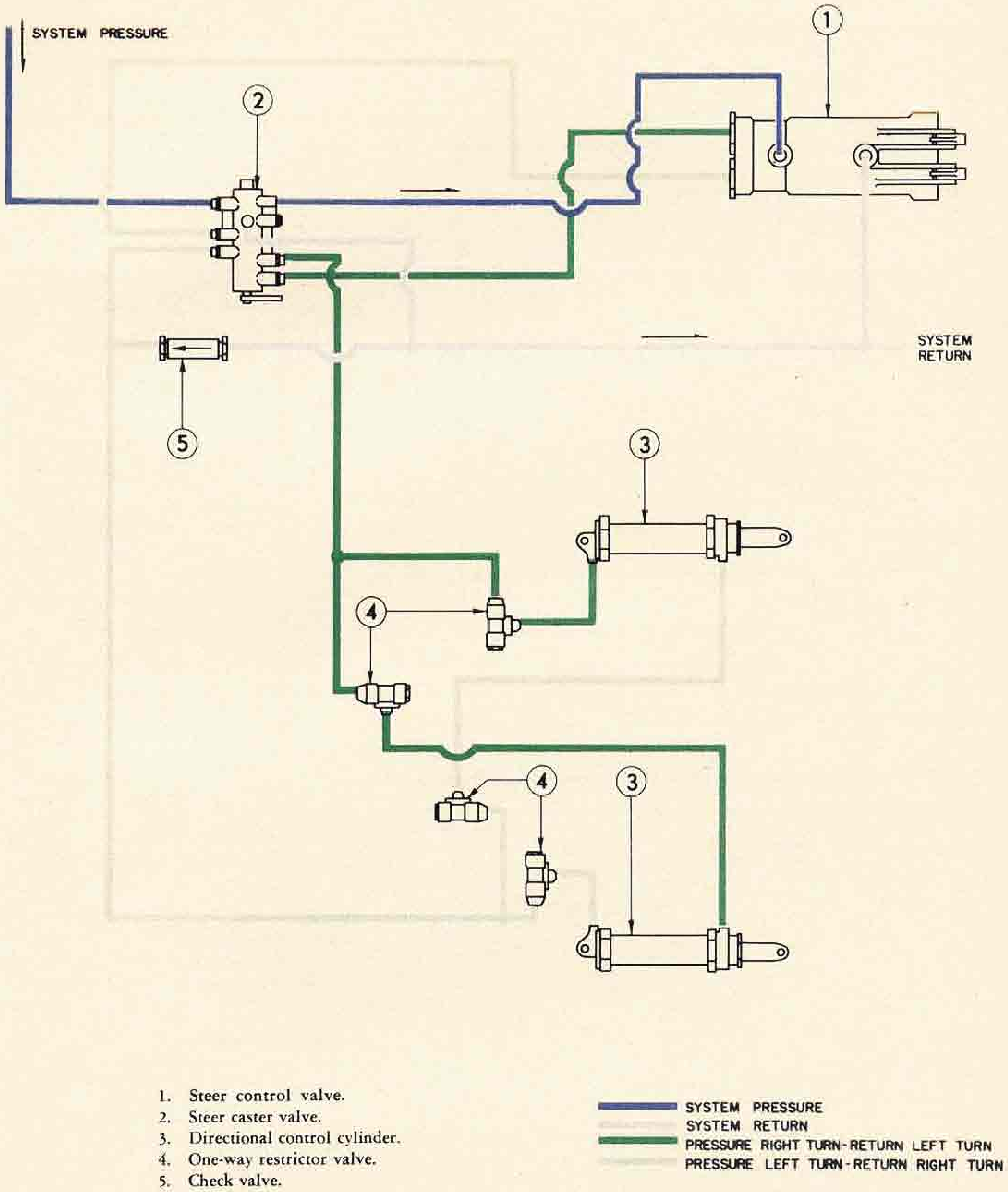
1. Main actuating cylinders. (2)
2. Nose actuating cylinder.
3. Nose downlock release cylinder.
4. Main downlock release cylinders. (2)
5. Uplock actuating cylinders. (3)
6. Thermal relief valves. (4)
7. Nose cylinder shuttle valves. (2)
8. Main cylinder shuttle valve.
9. Restrictors—one way (2)
10. Test shut-off valves. (3)
11. Selector valve.
12. Rear bumper cylinder.
13. Shut-off valve.
14. Compensator.
15. Check valve.

Figure 13 — Hydraulic Landing Gear System Diagram



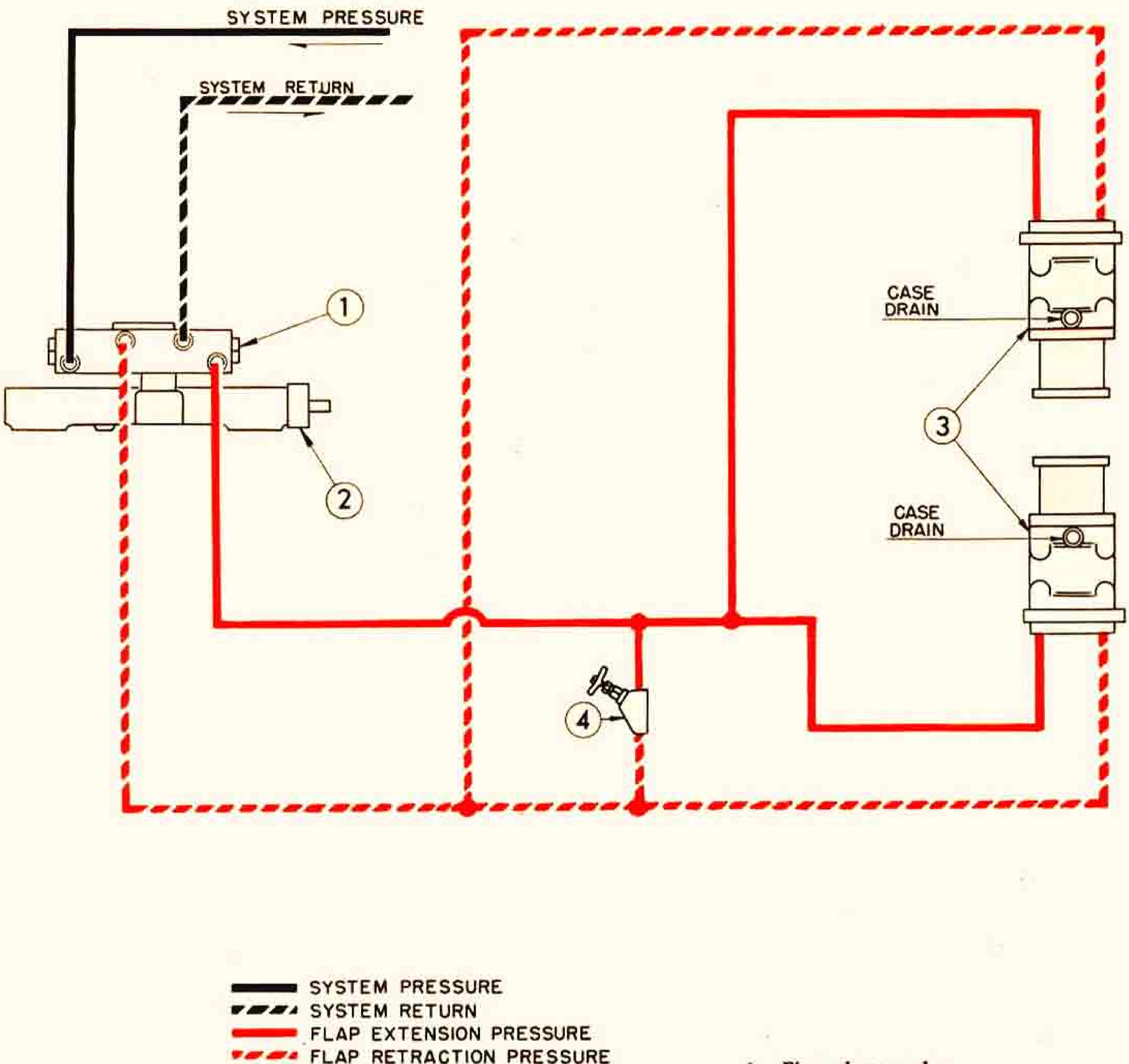
1. Brake selector valve.
2. Double brake valves.- (2)
3. Brake accumulators.- (3)
4. Brakes.- (4)
5. Shuttle valves.- (5)
6. Hydraulic accumulator.
7. Check valves.- (2)
8. Pressure gage.

Figure 14 — Hydraulic Braking System Diagram



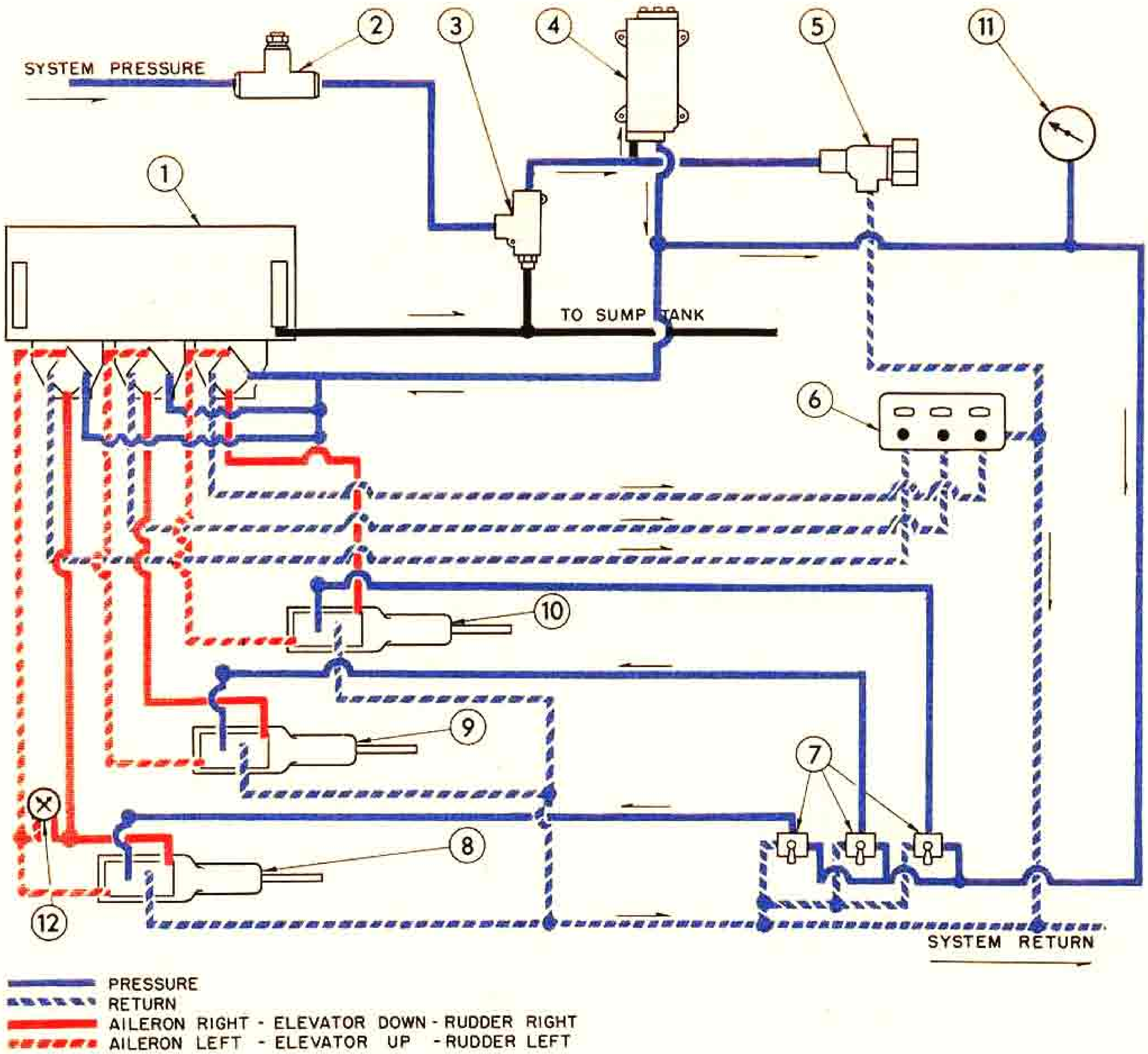
1. Steer control valve.
2. Steer caster valve.
3. Directional control cylinder.
4. One-way restrictor valve.
5. Check valve.

Figure 15 — Hydraulic Steering System Diagram



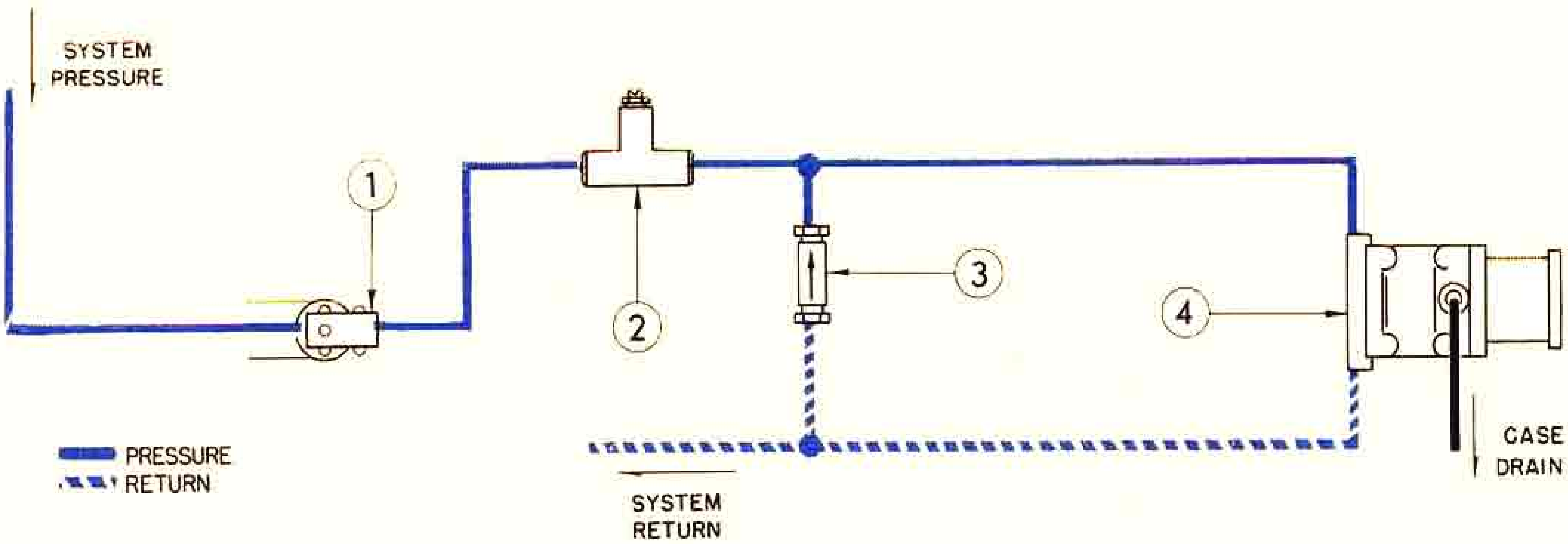
1. Flap selector valve.
2. Follow-up mechanism.
3. Hydraulic motors.
4. By-pass valve.

Figure 16 — Hydraulic Wing Flap Actuating System Diagram



1. Gyro mounting unit.
2. Restrictor.
3. Pressure reducing valve.
4. Filter.
5. Relief valve.
6. Speed control valve.
7. Shut-off valves.
8. Elevator Servo unit.
9. Aileron Servo unit.
10. Rudder Servo unit.
11. Pressure gage.
12. Elevator trim indicator.

Figure 17 — Automatic Pilot System Hydraulic Diagram



1. Shut-off valve.
2. Restrictor.
3. Check valve.
4. Hydraulic motor.

Figure 18 — Hydraulic Cabin Air Blower System Diagram

work independently, but a cross over line is installed so that in case the primary system pressure fails, the secondary system will supply the flight control boosters. A check valve is installed in this line so that fluid cannot flow in reverse direction, and a restriction control valve is installed in the secondary system downstream from the cross over check valve so that when the boosters require a large flow the restriction control valve will nearly close, thus assuring pressure to the flight controls booster at the expense of all other hydraulic units. Hydraulic pumps on engines number 1 and number 2 supply the primary system and pumps on engines number 3 and number 4 supply the secondary system. Warning lights on the engineer's instrument panel (figure 6-24) and on the co-pilot's instrument panel (figure 36-4) illuminate when the pressure at any pump falls below approximately 1325 lb/sq in. Combined fuel (figure 7-15) hydraulic (figure 9-2) and engine (figure 8-6) oil emergency shut-off valves are operated by levers (figure 24-2) on the pilot's overhead panel. Solenoid operated hydraulic pump shut-off valves (figure 9-1) are controlled by switches (figure 6-4) located on the flight engineer's instrument panel. The hydraulic pressure gage (figure 36-24) on the co-pilot's instrument panel shows primary system pressure which should be between 1500 and 1700 lb/sq in. There is no secondary hydraulic system pressure gage.

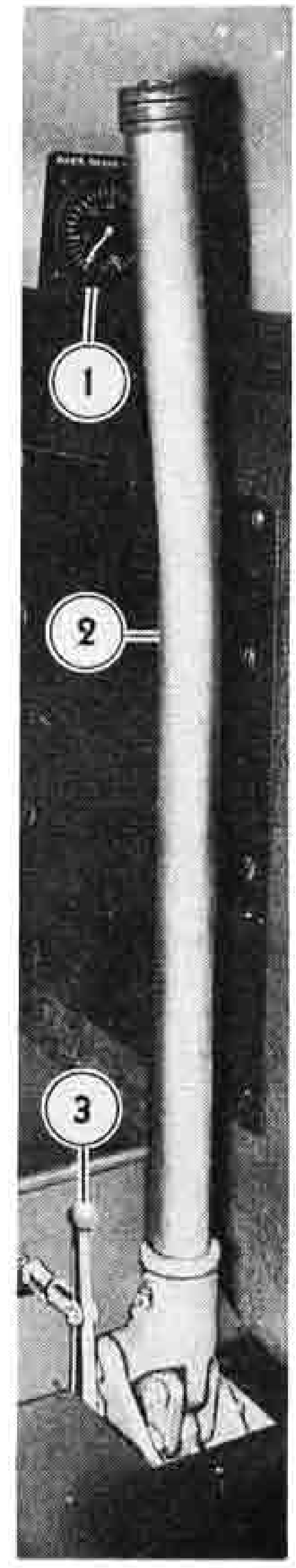
b. EMERGENCY FILLER PUMP (figure 39) is located immediately aft of the radio rack. This pump is used for refilling the hydraulic tank in flight.

c. HAND HYDRAULIC PUMP (figure 19-2) is located to the right of the co-pilot's seat. This pump is used only for emergency extension of the landing gear or for emergency operation of the brakes. Set the hand pump selector valve (figure 19-3) FORWARD to operate the brakes and AFT to operate the landing gear.

CAUTION

The hand pump selector valve should be left in the FORWARD position at all times unless the emergency extension system is being used. Failure to do this will close the emergency extension system lines and may cause these lines to burst due to thermal expansion of the trapped oil.

d. BRAKES. *(Figure 14.)*—The brakes are operated from either the pilot's or co-pilot's station by rotating the top of the rudder pedals forward. The eight brakes are power operated hydraulically and are installed on



1. Emergency brake hydraulic pressure.
2. Emergency hydraulic hand pump.
3. Emergency hand pump selector valve.

Figure 19 — Emergency Hydraulic Hand Pump

both sides of each of the four main wheels. Two complete braking systems, except for the brakes themselves, are installed. The brake selector valve is controlled by levers (figure 4-16) located on both sides of the pilot's control stand. The NORMAL and EMERGENCY brakes operate from the secondary hydraulic system or the hand hydraulic pump. In addition, two accumulators are installed in the emergency brake system which, when fully charged, provide for approximately six complete applications of the brakes after all hydraulic pressure has failed. The accumulator pressure (figure 19-1) should be checked and charged to a minimum of 1600 lb/sq in. before take-off, periodically during flight and before landing by momentarily moving the brake selector valve (figure 4-16) to EMERGENCY or by operating the hand pump if there is no secondary hydraulic system pressure.

CAUTION

Be sure to release toe brakes when shifting from one brake system to the other whenever the airplane is moving, to prevent possibility of sudden application of full brakes.

(1) PARKING BRAKES are controlled by the lever (figure 63-29) on the pilot's side panel. To set the parking brakes, move the brake selector lever (figure 4-16) to EMERGENCY so that accumulators will hold the brakes, press the toe brakes and move the parking brake lever (figure 63-29) to ON. To release the parking brake, press the toe brakes.

e. STEERING MECHANISM.

(1) The nose wheel is normally free swiveling to an angle of approximately 45 degrees, but it may be steered on airplanes 43-10309 and 43-10310. To steer the nose wheel raise the

steering lever and steer with the rudder pedals. It is necessary to hold the control in the STEER position as it is spring loaded to the CASTER position to prevent landing with the nose wheel steerable. With the steering lever in the CASTER position, the hydraulic steering cylinders act as shimmy dampers.

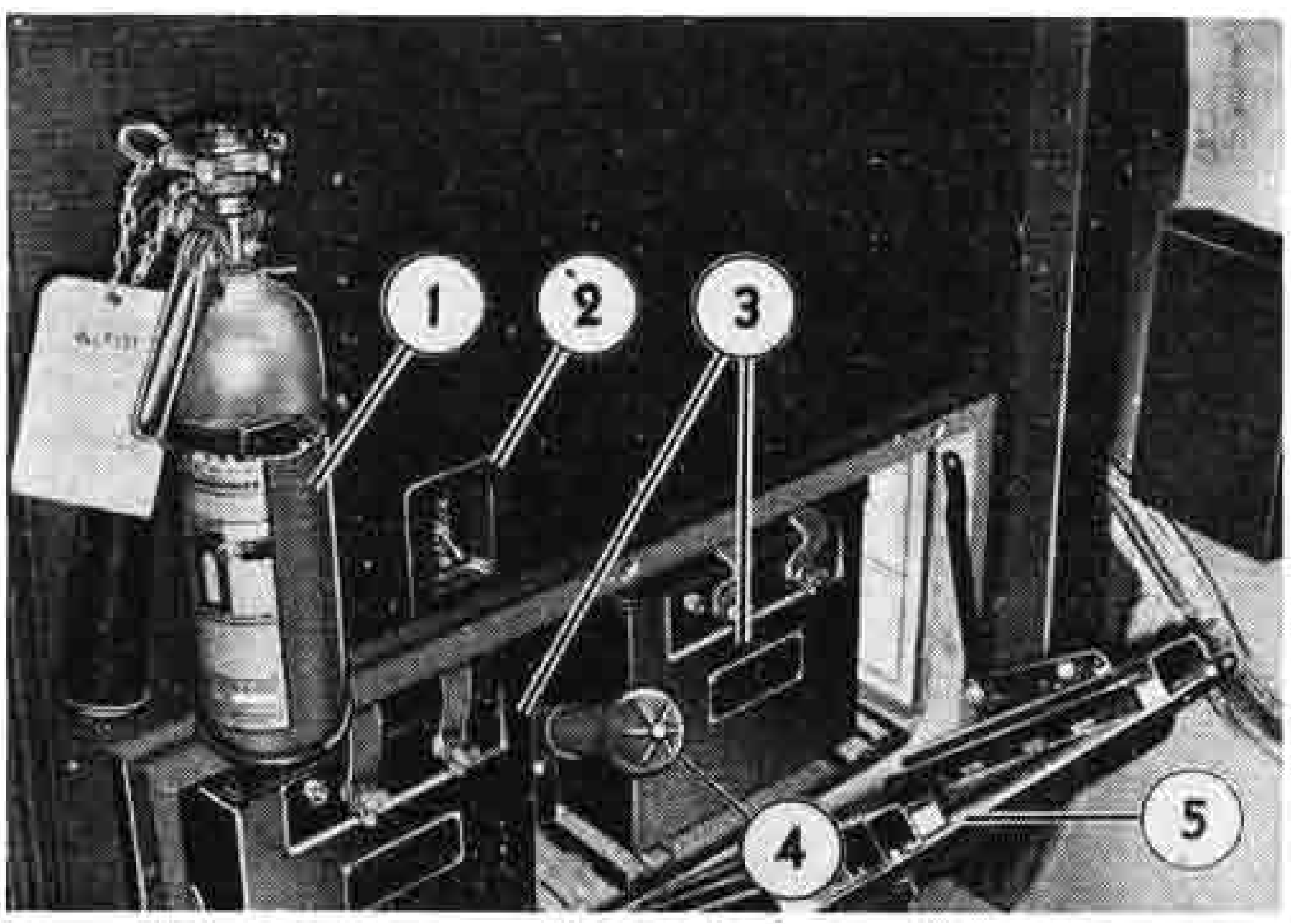
CAUTION

Use extreme care in power steering the airplane, particularly at speeds above 30 mph.

6. ELECTRICAL SYSTEM.

(See figure 23.)

a. GENERAL.—This airplane is equipped with two complete, 24 volt electrical systems each containing a 200 ampere generator, a voltage regulator, a reverse current relay, a 34 ampere-hour battery, and a power bus. In all normal operation, the systems are operated independently. In general, the number one system supplies the accessories powered with electric motors and the number two system supplies the instruments and lights. Both batteries (figure 20-3) are located under the navigator's table and are accessible in flight from the radio operator's station. A hydrometer (figure 20-4) is carried in the battery compartment for measuring the specific gravity of the battery electrolyte in flight. Number one generator is located in the left inboard nacelle and number two generator is located in the right inboard nacelle.



1. Hand fire extinguisher.
2. Radio master switch.
3. Batteries.
4. Hydrometer.
5. Battery compartment door.

Figure 20 — Airplane Battery Compartment

b. AIRPLANE MASTER SWITCH is located directly over the batteries and is controlled by a lever (figure 6-3) on the flight engineer's instrument panel. This switch isolates the batteries except for the IFF radio destructor circuit, the hydraulic pump shut-off solenoid valves and the emergency elevator booster pump, and prevents normal operation of the generators. Turn ON before every flight.

c. LOAD TRANSFER SWITCH. *(Figure 22-10.)*—This switch is operated by push buttons located on the flight engineer's electrical panel to the left of the flight engineer. Operation is as follows:

(1) Position 5 is NORMAL—Battery number 1 and generator number 1 supply bus number 1, and battery number 2 and generator number 2 supply bus number 2. Each system functions independently.

(2) Position 4 is the same as NORMAL except battery number 2 supplies bus number 1 and battery number 1 supplies bus number 2. This position should be used to shift batteries if their charge becomes unequal.

(3) Position 3 disconnects battery number 2 and connects battery number 1 and both generators to both busses. This position should be used in case battery number 2 fails or becomes overcharged or if one of the generators or inboard engines fails.

NOTE

Do not use position number 2 or 3 unless the manual voltage switch rheostats (figure 6-7) are set to NORMAL.

(4) Position 2 is the same as position 3 except battery number 1 is disconnected and battery number 2 supplies both busses. This position should be used in case battery number 1 fails or becomes overcharged or if one of the generators or inboard engines fails.

(5) Position 1 connects both busses to the cart plug and disconnects both batteries from the busses, however the primers and ignition boosters are connected to the airplane batteries through the master switch. Use position 1 for starting when a battery cart is available.

(6) OFF position disconnects everything except the primers, ignition booster, emergency elevator booster pump, IFF radio destructor circuit and hydraulic pump shut-off solenoid valves.

d. GENERATOR CONTROLS.

(1) GENERATOR SWITCHES *(figure 22-7 and 22-20)* are located on the flight engineer's electrical panel. Turn both switches ON for normal operation.

If one generator fails or if, on a long range flight, the batteries are overcharging, it may be desirable to set the load transfer switch to position number 2 or 3 and turn OFF one generator allowing the other generator to supply both busses.

(2) GENERATOR SWITCH BY-PASS *(figure 22-26)*.—These switches are located on the flight engineer's electrical panel. These two switches will turn ON the generators in case the master switch, the load transfer switch or the generator switch fails. Normally these switches are safetied OFF.

(3) MANUAL GENERATOR VOLTAGE SWITCH RHEOSTATS *(figure 6-7)* are installed on the engineer's instrument panel. If batteries are overcharging, it is possible to adjust the generator voltage as desired. It is necessary to watch the ammeter and voltmeter closely at all times when using the manual voltage controls as any change in engine rpm or generator load will affect the output voltage. These controls must be set to the NORMAL position (turned full left) in order to obtain automatic voltage regulation.

e. VOLTMETER *(figure 22-6)*.—The voltage of either battery or either generator may be read by setting the voltmeter selector switch (figure 22-19) located on the flight engineer's electrical panel. The load transfer switch must be in position OFF, 1 or 2 to read the voltage of number 1 battery or in position OFF, 1 or 3, to read the voltage in the number 2 battery.

f. AMMETERS *(figure 22-8 and 22-21)* located on flight engineer's electrical panel indicate the current out put by the generators.

g. BATTERY CART PLUG *(figure 21)* is located on center of right side of nose wheel well. The load transfer switch (figure 22-10) must be in position 1 to connect the battery cart plug to the electrical system.

h. AUTOSYN DYNAMOTORS.—The two dynamotors provide alternating current for operation of the autosyn instruments and the navigator's table light. A switch (figure 22-3) for selecting either dynamotor is located on the flight engineer's electrical panel.

i. LIGHTS.

(1) LANDING LIGHTS are located one on each outer wing panel, and are controlled by switches (figure 24-12) on the pilot's overhead panel. With the switches ON the lights extend and turn on. With the switches OFF the lights turn off, but remain extended. Never fly above 140 mph unless the landing light switches are in the RETRACT position.

(2) NAVIGATION LIGHTS are controlled by switches (figures 24-16 and 24-21) on the pilots overhead panel. BRIGHT, OFF and DIM positions are provided.

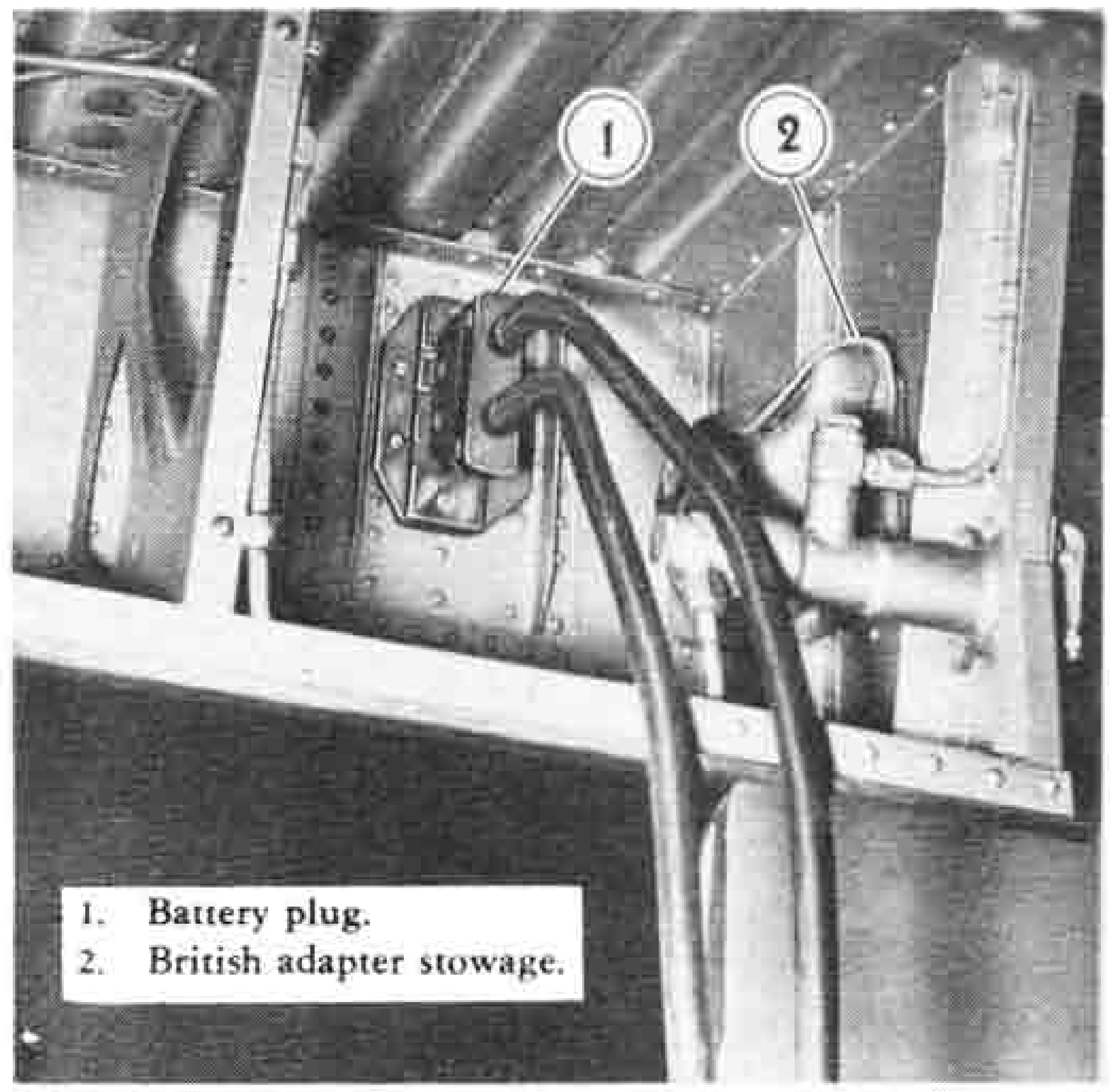


Figure 21 — External Battery Connection

(3) COURTESY LIGHT located on the fuselage nose is controlled by the ON-OFF switch (figure 24-15) on the pilot's overhead panel.

(4) RECOGNITION LIGHTS.—One (white) upward and three (red, green and amber) downward recognition lights are controlled by switches on the pilot's control stand. To operate turn the selector switches (figure 4-12) to STEADY or to KEY and press the keying button (figure 4-8).

(5) INSTRUMENT LIGHTS.—Three fluorescent lights, controlled by switch rheostats (figure 24-7, 24-8 and 24-11) on the pilot's overhead panel, are installed to light the pilot's instrument panels. Four fluorescent lights, controlled by two switch rheostats (figure 22-5 and 22-17) on the flight engineer's electrical panel and two switch rheostats (figure 6-6) on flight engineer's instrument panel, are installed to light the engineer's instrument panels. One fluorescent light, controlled by a switch rheostat (figure 22-18) on the flight engineer's electrical panel, is installed to light the air conditioning panel.

(6) CHART LIGHTS *(figure 24-6)* are installed on both sides of the pilot's overhead panel. A switch (figure 63-24 and 65-9) and a rheostat (figure 63-25 and 65-14) are located on the shelf outboard of each pilot to control each light.

(7) PILOT'S OVERHEAD PANEL LIGHT is controlled by a switch (figure 24-22) on the pilot's overhead panel.

(8) FLIGHT ENGINEER'S DESK LIGHTS are controlled by a switch rheostat (figure 22-16) on the flight engineer's electrical panel.

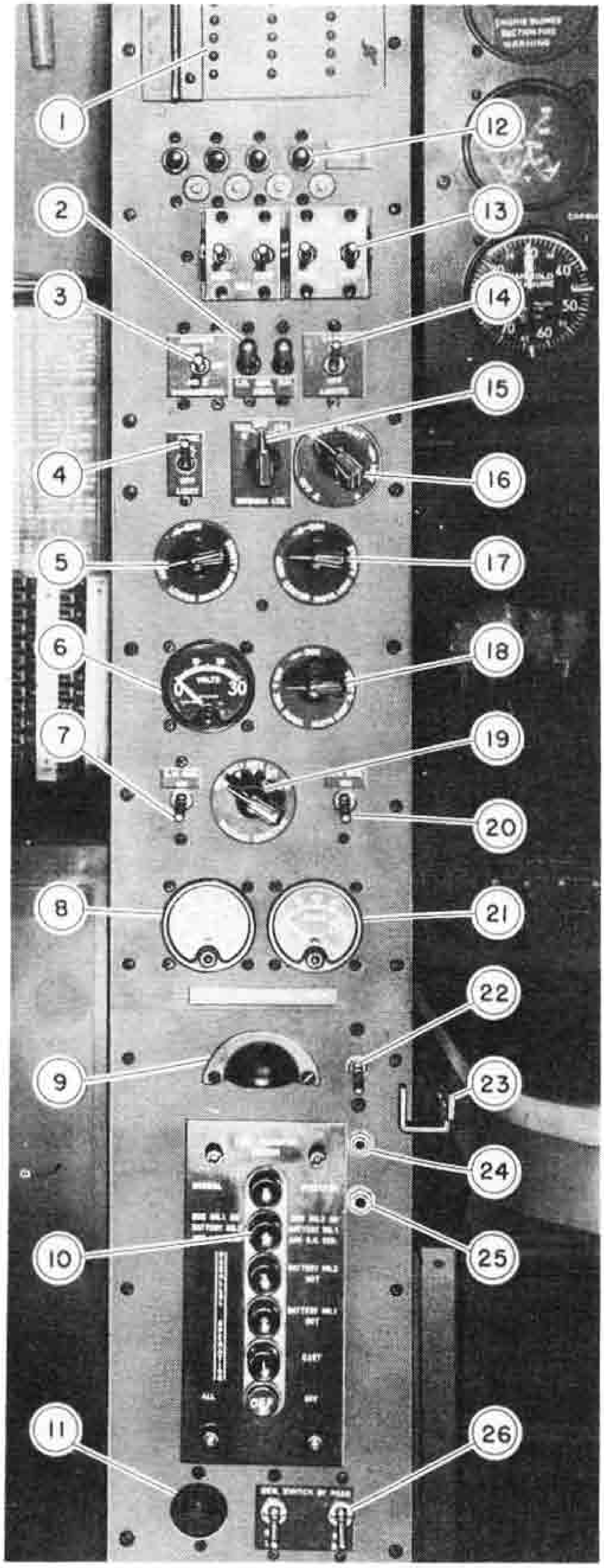
(9) LOAD TRANSFER SWITCH LIGHT (22-9) is controlled by a switch (figure 22-22) on the flight engineer's electrical panel.

(10) PILOT'S COMPARTMENT DOME LIGHT is controlled by a switch (figure 22-4) on the flight engineer's electrical panel.

(11) CABIN LIGHTS AND ACCESSORIES.—Lights in the crew compartment, cabin cargo compartment, main cabin, galley, lounge, and lavatories are controlled by switches near the lights. The cabin lights switch (figure 22-14) on the flight engineer's electrical panel must be ON before any of these lights, the razor receptacle or the coffee heater will operate. A light on the step between the cabin cargo compartment and the main cabin is illuminated whenever there is voltage in bus number 2.

(12) DOOR WARNING LIGHT.—Switches are installed on all external doors except emergency exits which operate the door warning light (figure 36-17) on the co-pilot's instrument panel. Compartment or step lights turn ON when the crew or cargo doors are opened.

(13) WARNING LIGHTS on the pilot's and co-pilot's instrument panels are tested or dimmed by a switch (figure 24-10) on the pilot's overhead panel. Warning lights at the engineer's station are tested or dimmed by a switch (figure 22-15) on the flight engineer's electrical panel.



1. Fuse box (Spare fuses inside).
2. Generator protector switches.
3. Autosyn dynamotors switch.
4. Dome light switch.
5. Lower instrument panel light switch.
6. Voltmeter.
7. Left-hand generator switch.
8. Left-hand generator ammeter.
9. Load transfer switch light.
10. Load transfer switch.
11. Interaircraft signal light plug in.
12. Engine primer switch buttons.
13. Engine starter switches.
14. Cabin lights switch.
15. Warning light test switch.
16. Flight engineer's desk light switch.
17. Center instrument panel light switch.
18. Cabin air conditioning panel light switch.
19. Voltmeter selector switch.
20. Right-hand generator switch.
21. Right-hand generator ammeter.
22. Load transfer switch light switch.
23. Flight engineer's phone hook.
24. Flight engineer's microphone jack.
25. Flight engineer's phone jack.
26. Generator switches by-pass.

Figure 22 — Flight Engineer's Electrical Panel

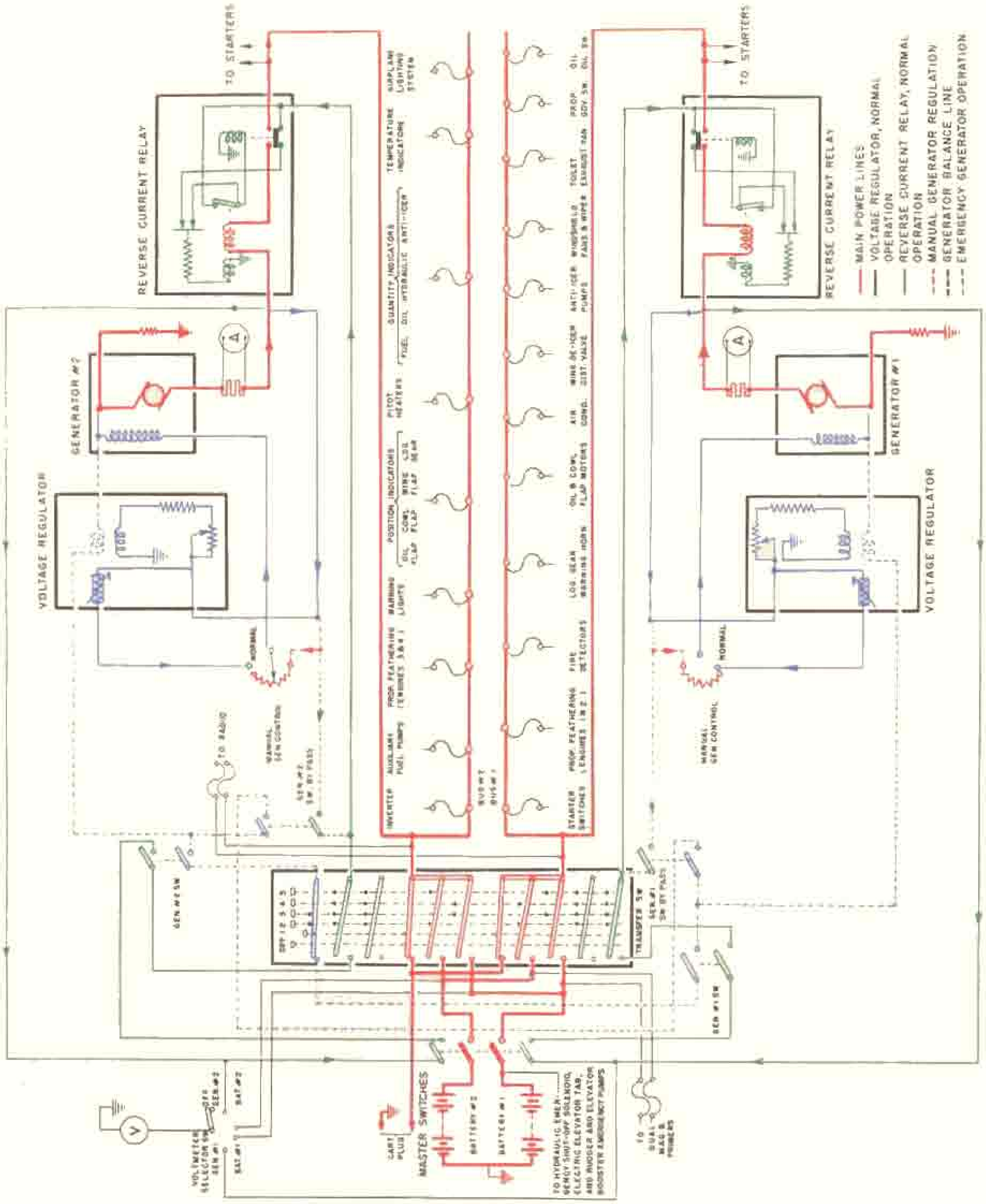


Figure 23 — Electrical System

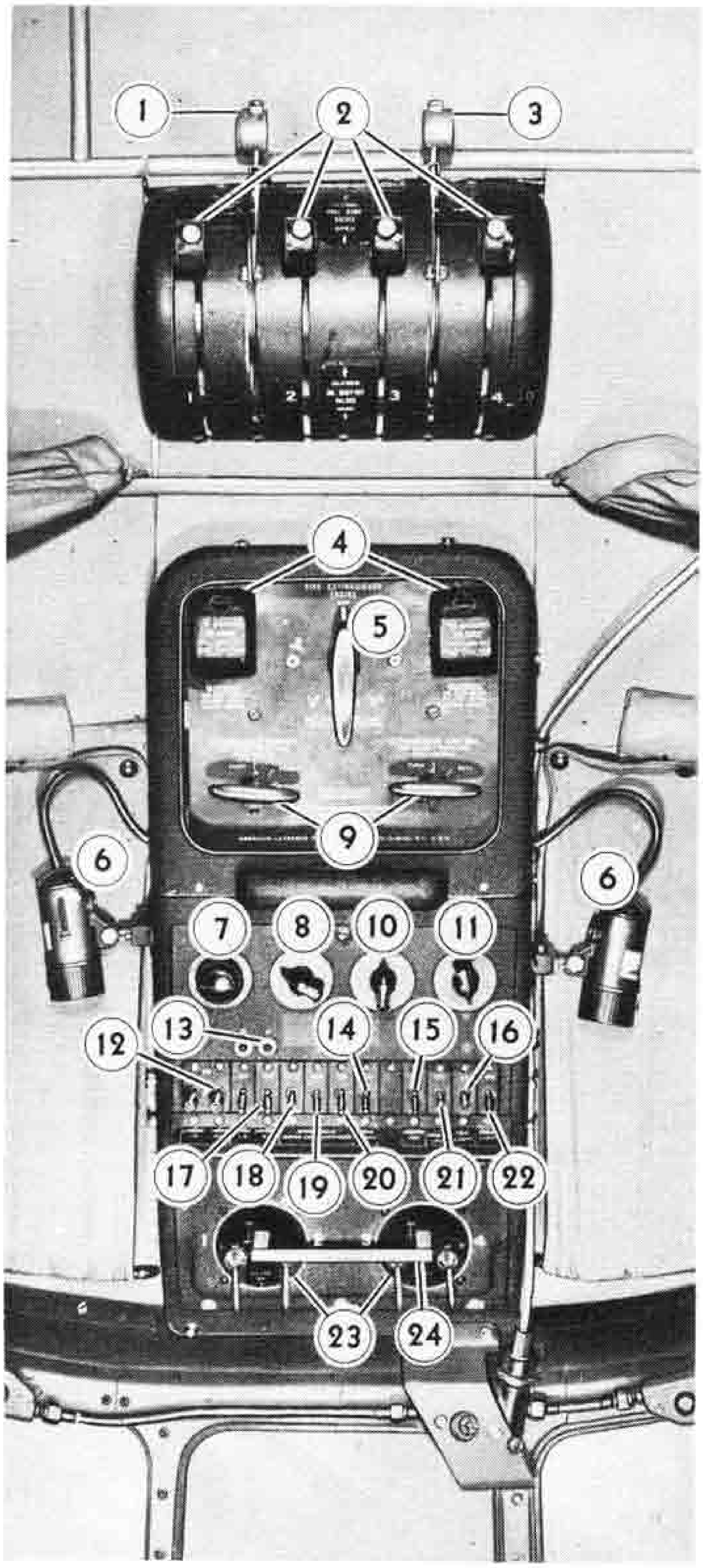


Figure 24 — Pilot's Overhead Panel

1. Left hand fuel dump valve lever.
2. Fuel, hydraulic and engine oil shut-off valve levers.
3. Right hand fuel dump valve lever.
4. Landing flare release controls.
5. Nacelle fire extinguisher selector valve.
6. Chart lights.
7. Left hand instrument light switch.
8. Center instrument light switch.
9. Engine fire extinguisher pull controls.
10. Pilot's warning light test switch.
11. Right hand instrument light switch.
12. Landing light switches.
13. Pitot heater burn out warning lights.
14. Wing de-icer switch.
15. Courtesy light switch.
16. Tail light switch.
17. Pitot heater switches.
18. Windshield wiper switch.
19. Windshield fan switch.
20. Windshield anti-icer switch.
21. Wing tip light switch.
22. Pilot's overhead panel light switch.
23. Ignition switches.
24. Master ignition switch.

7. ICE ELIMINATING SYSTEM.

a. ICE DETECTOR.—A short strut (figure 63-2) is provided on the left side of the fuselage within easy view of the pilot for the purpose of ice detection. If ice forms on this easily visible strut, ice will also form on the wings, tail and propellers.

b. WING AND TAIL DE-ICER.—De-icer boots are provided for the wing and tail (figure 25). They are turned ON by a switch (figure 24-14) located on the pilot's overhead panel. When not operating, the boots are held flush with the surface by suction from the vacuum pumps which are operating the instruments. If a leak develops in the boots, shut off the valve (figure 43-22) on the floor under the navigator's table to turn off the vacuum supply to the boots. The de-icer gage (figure 36-22) on the co-pilot's instrument panel is connected to the de-icer distributor valve and indicates proper functioning of the de-icer boots.

c. PROPELLER ANTI-ICER.—One electric pump (figure 26-23) located in each outboard nacelle delivers anti-icing fluid to the propellers on that side. Two rheostats (figure 65-3) are provided on the co-pilot's shelf for controlling the anti-icer pumps. Turn on full at first to wet the blades, then retard for economy.

d. CARBURETOR ANTI-ICER AND HEAT.—Located in each outboard nacelle are two electric pumps (figure 26-24 and 26-25) each supplying anti-icing fluid to one carburetor on that side. The pumps are operated at a fixed speed by four momentary contact switches (figure 65-8) on the co-pilot's shelf. Carburetor ice is indicated by either or all of the following: Carburetor air temperature gage (figure 5-6) within icing range; free air temperature gage (figure 6-19) within

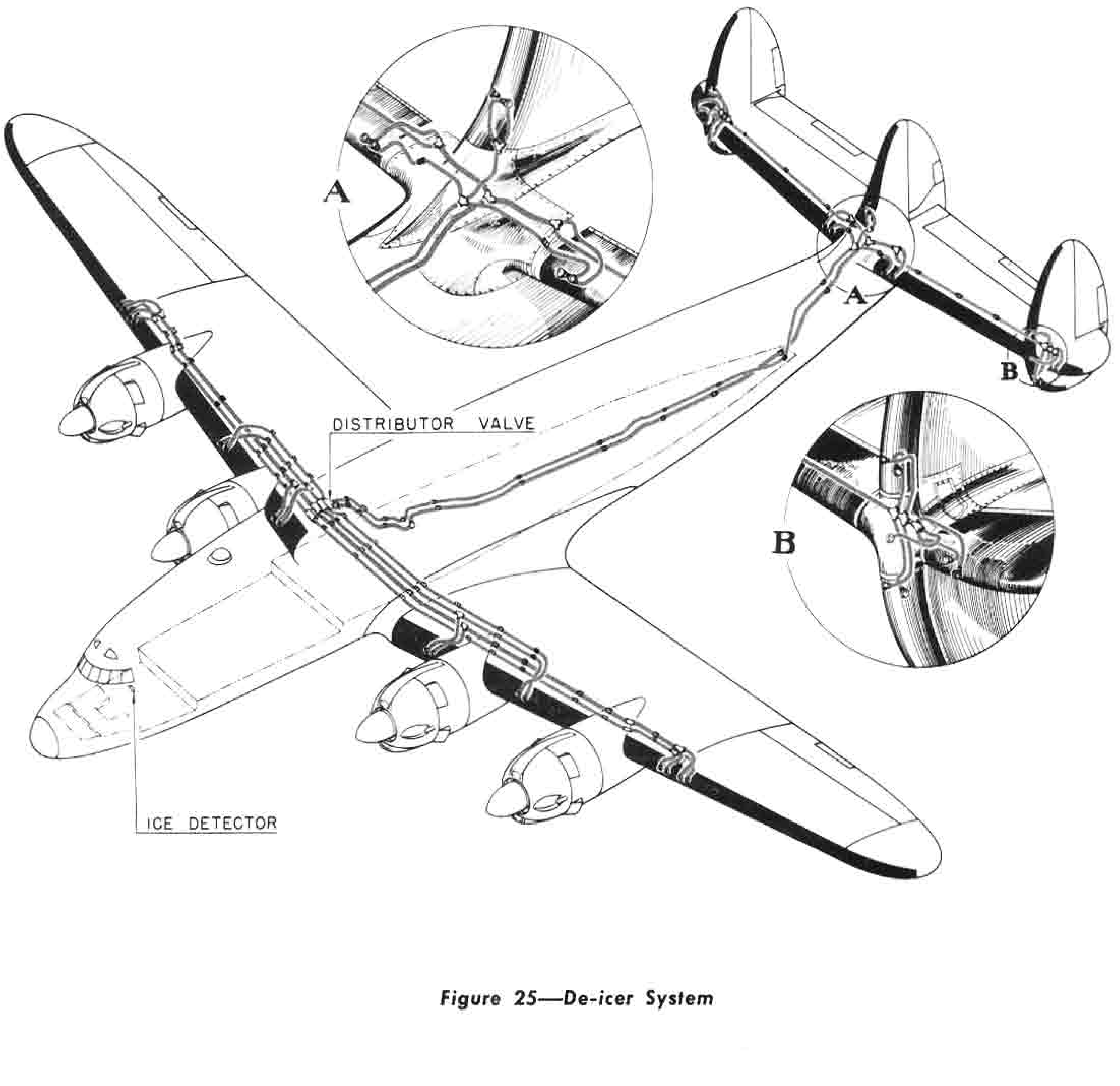
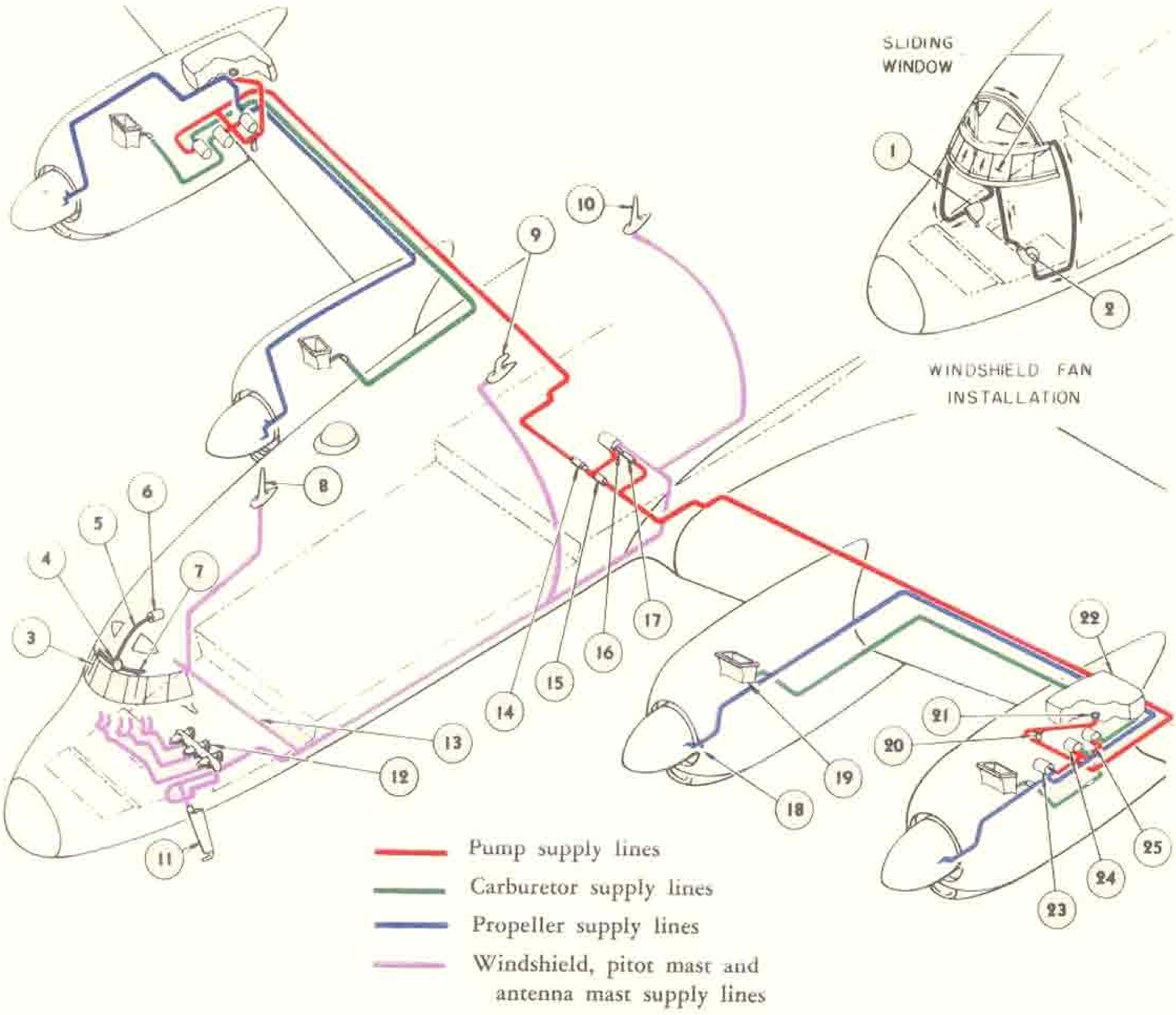


Figure 25—De-icer System

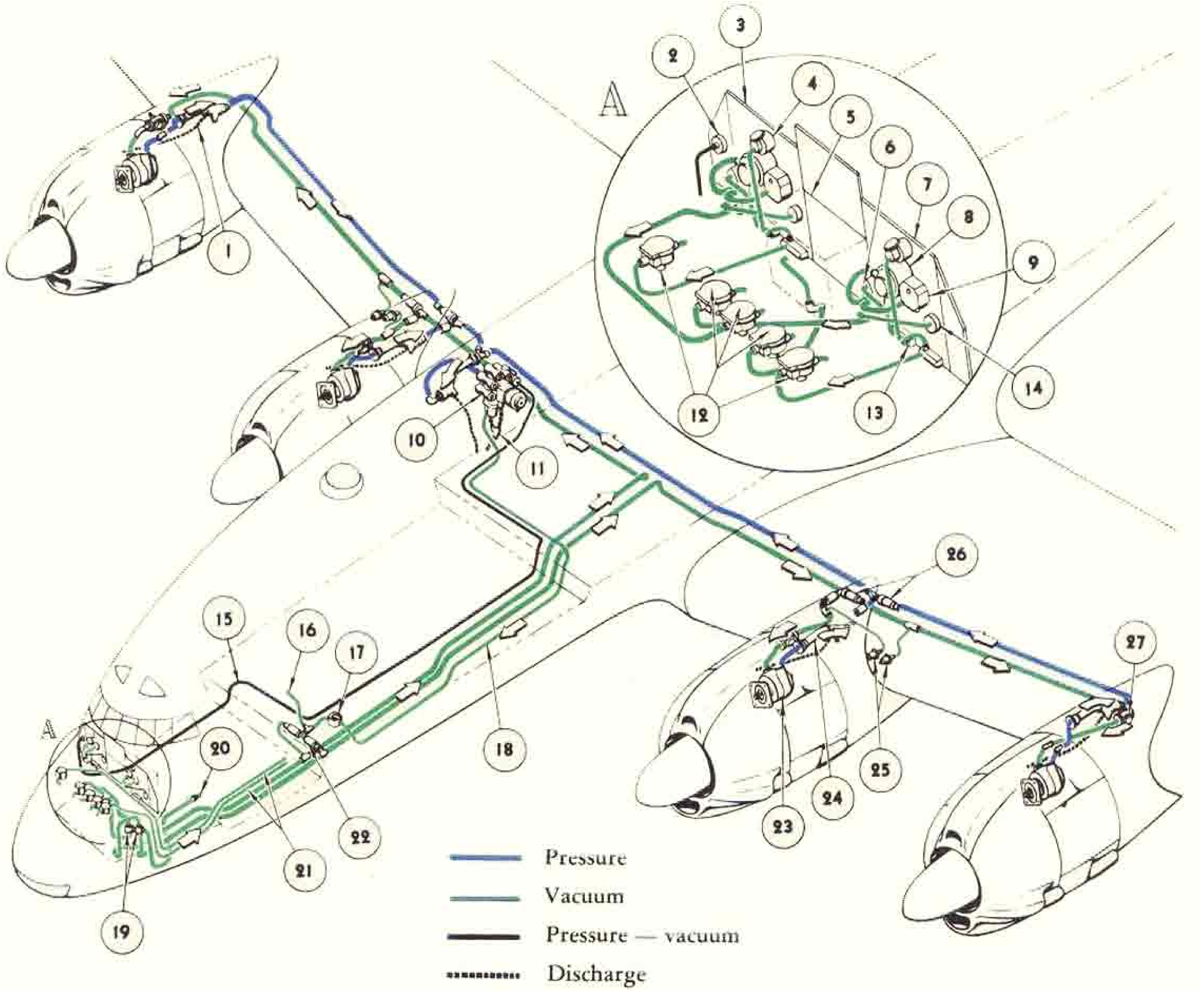
icing range; manifold pressure (figure 5-13) falls off; and B M E P gage (figure 5-11) falls off. Turn anti-icer pumps off when above instruments show correction. Four carburetor heat control levers are located on the flight engineer's control stand (figure 5-18). These control hot air muff valves which are designed to give a temperature rise of at least 32°C (90° F) with a 5° C (40° F) outside air temperature at 65% or greater engine power. Set to HOT if danger of carburetor ice exists except when operating at normal rated power or over. At high power danger of detonation exists and only the carburetor anti-icer should be used.

e. WINDSHIELD ANTI-ICER, WIPER AND AIR BLAST. — A separate electric pump (figure 26-16) located in the forward baggage compartment supplies anti-icer fluid to the windshield. Three needle control valves (figure 63-23 and 65-16) on both the pilot's and co-pilot's shelf control the quantity. Two centrifugal blowers controlled by switches (figure 24-19) on the pilot's overhead panel force dried cabin air between the windshield glass panels to eliminate frost or fog. The windshield air is dried by dessicators accessible through doors on the pilot's and co-pilot's side panels. The charge in the dessicators should be replaced at frequent



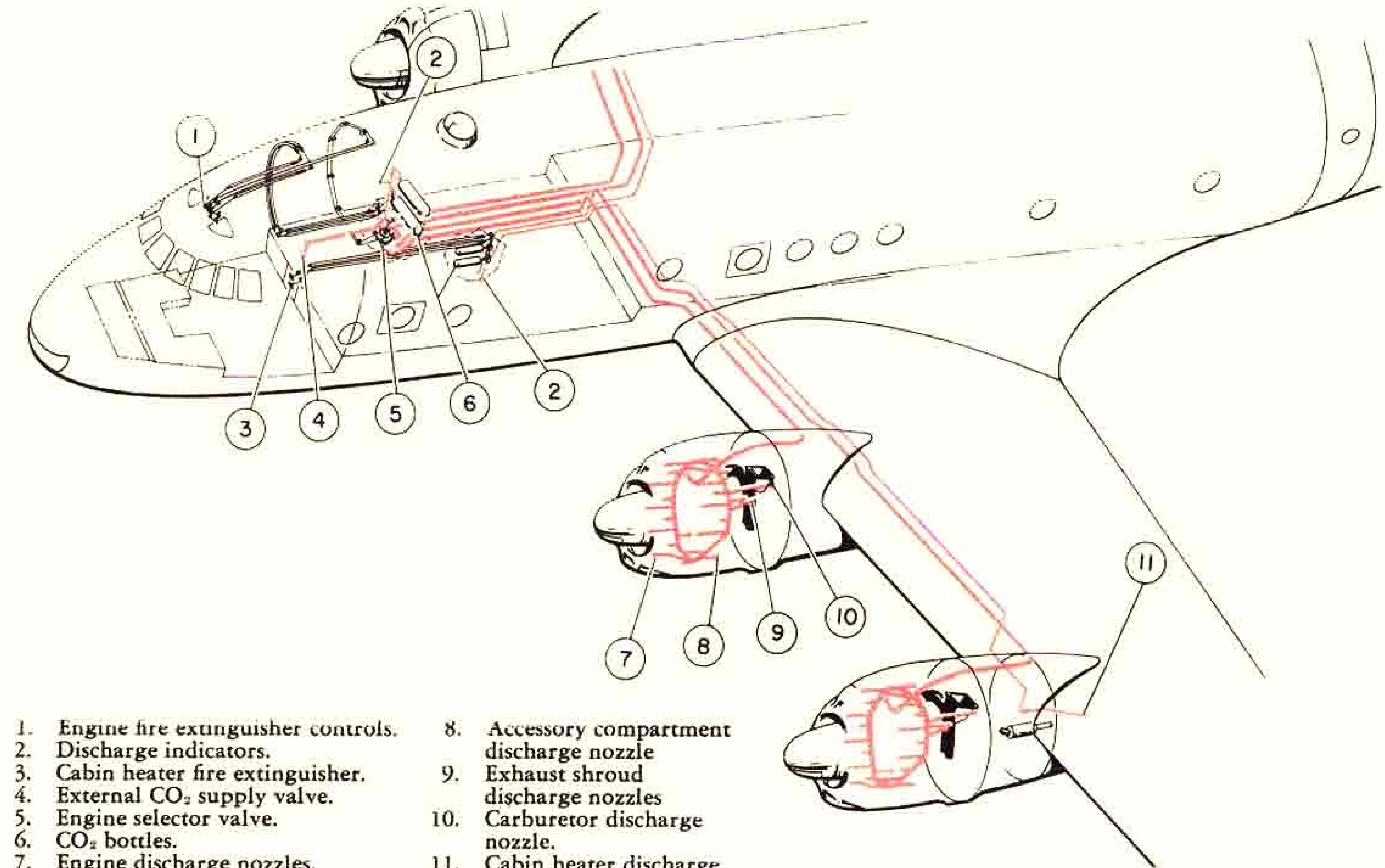
1. Right-hand windshield fan.
2. Left hand windshield fan.
3. Right hand windshield wiper.
4. Windshield wiper actuating mechanism.
5. Windshield wiper flexible drive.
6. Windshield wiper motor.
7. Left-hand windshield wiper.
8. Front antenna mast.
9. Hook antenna mast.
10. Rear antenna mast.
11. Left hand pitot tube.
12. Pilot's windshield anti-icer controls.
13. Anti-icer fluid line to co-pilot's windshield.
14. Check valve.
15. Check valve.
16. Windshield anti-icer fluid pump.
17. Check valve.
18. To propeller slinger ring.
19. Carburetor.
20. Anti-icer tank drain valve.
21. Anti-icer tank outlet.
22. Left hand anti-icer fluid supply tank.
23. Left hand propellers anti-icer pump.
24. Carburetor anti-icer pump (Engine No. 1)
25. Carburetor anti-icer pump (Engine No. 2).

Figure 26 — Anti-icer Systems



1. Oil separator drain line.
2. De-icer boot gage.
3. Co-pilot's instrument panel.
4. Co-pilot's bank and turn indicator.
5. Automatic pilot instrument panel.
6. Vacuum manifold.
7. Pilot's instrument panel.
8. Gyro horizon.
9. Directional gyro.
10. De-icer boot vacuum distributor valve.
11. De-icer boot distributor valve discharge.
12. Vacuum regulators.
13. Pilot's turn and bank vacuum selector valve.
14. Pilot's vacuum system suction gage.
15. De-icer boot gage line.
16. Vacuum line to cabin pressurizing control.
17. De-icer boot emergency shut-off valve.
18. De-icer boot distributor valve vacuum line.
19. Vacuum pump and instrument group selector valves.
20. Idle vacuum pump intake in nose wheel well.
21. Cabin supercharger throat vacuum lines (emergency source).
22. Check valve.
23. Engine driven vacuum pump.
24. Oil separator.
25. Vacuum warning units.
26. Check valves.
27. Suction relief valve.

Figure 27 — Vacuum System



1. Engine fire extinguisher controls.
2. Discharge indicators.
3. Cabin heater fire extinguisher.
4. External CO_2 supply valve.
5. Engine selector valve.
6. CO_2 bottles.
7. Engine discharge nozzles.
8. Accessory compartment discharge nozzle
9. Exhaust shroud discharge nozzles
10. Carburetor discharge nozzle.
11. Cabin heater discharge nozzle.

Figure 28 — Fire Extinguisher System

intervals. Two electric windshield wipers are provided and controlled by one switch (figure 24-18) on the pilot's overhead panel. Do not operate wipers on dry glass.

f. ANTENNA MAST ANTI-ICER, PITOT ANTI-ICER AND PITOT HEAT.—The antenna masts and the two pitot static heads are supplied with anti-icing fluid by the same pump which supplies the windshield anti-icer. Both pitot heads incorporate a heater element which is operated by a switch (figure 24-17) on the pilot's overhead panel. Burn out warning lights (figure 24-13) are provided over each switch.

CAUTION

Heater elements will burn out if turned ON while on the ground for more than 30 seconds.

g. ANTI-ICER FLUID SUPPLY.—All anti-icer fluid is stored in two 20 gallon tanks located one in each outboard nacelle (figure 26-22).

8. VACUUM SYSTEM.

(Figure 27.)

a. GENERAL.—Four vacuum pumps are provided, one driven by each engine. The pumps operate in pairs with one pair acting as a standby at all times. The vacuum pump selector valve (figure 63-30) located on the pilot's side panel selects either the two left pumps or the two right pumps. Failure of a pump is indicated by the vacuum pump warning lights (figure 6-21), located on the flight engineer's instrument panel, which glow when the vacuum falls below 4 in. Hg. Check valves protect each pump against failure of another pump. Suction gages (figure 35-16 and 36-18) are installed on the pilot's and co-pilot's instrument panels. Each gage indicates the suction supplied to the vacuum instruments on its panel.

b. INSTRUMENT GROUP VACUUM SELECTOR. *(Figure 63-31).*—This valve located on the pilot's side panel operates as follows:

(1) LEFT—Operates pilot's vacuum instruments and automatic pilot. Co-pilot's vacuum instruments inoperative.

(2) BOTH—Operates pilot's and co-pilot's vacuum instruments and automatic pilot.

(3) RIGHT—Operates co-pilot's vacuum instruments. Pilot's vacuum instruments and automatic pilot inoperative.

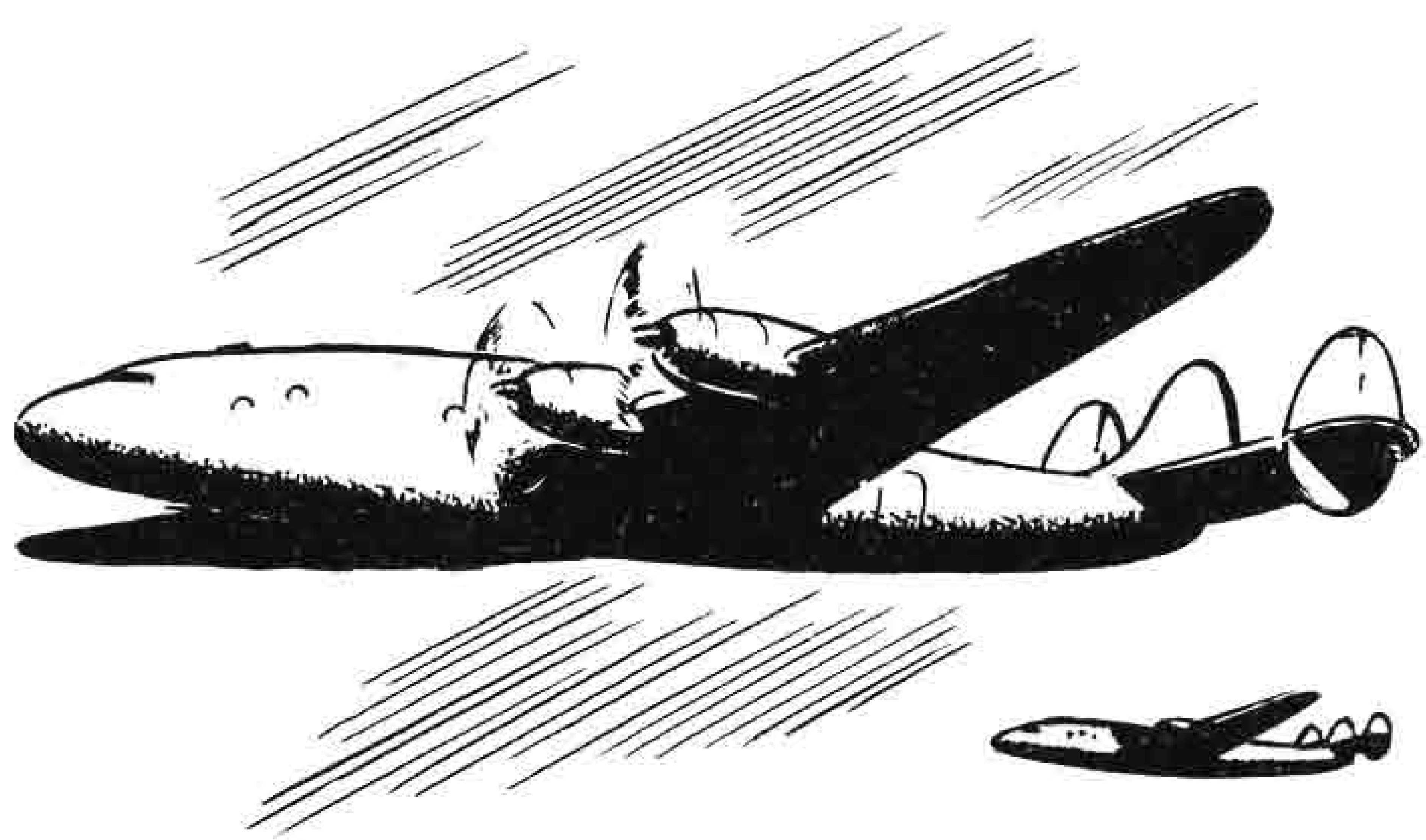
c. TURN AND BANK VACUUM SWITCHES (figure 35-23 and 36-23) are located on both the pilot's and co-pilot's instrument panels. The switches are normally set to ENGINE PUMP. If the engine pumps have failed or if the instrument group vacuum selector (figure 63-31) is not set to supply vacuum, set the switch to ENGINE BLOWER.

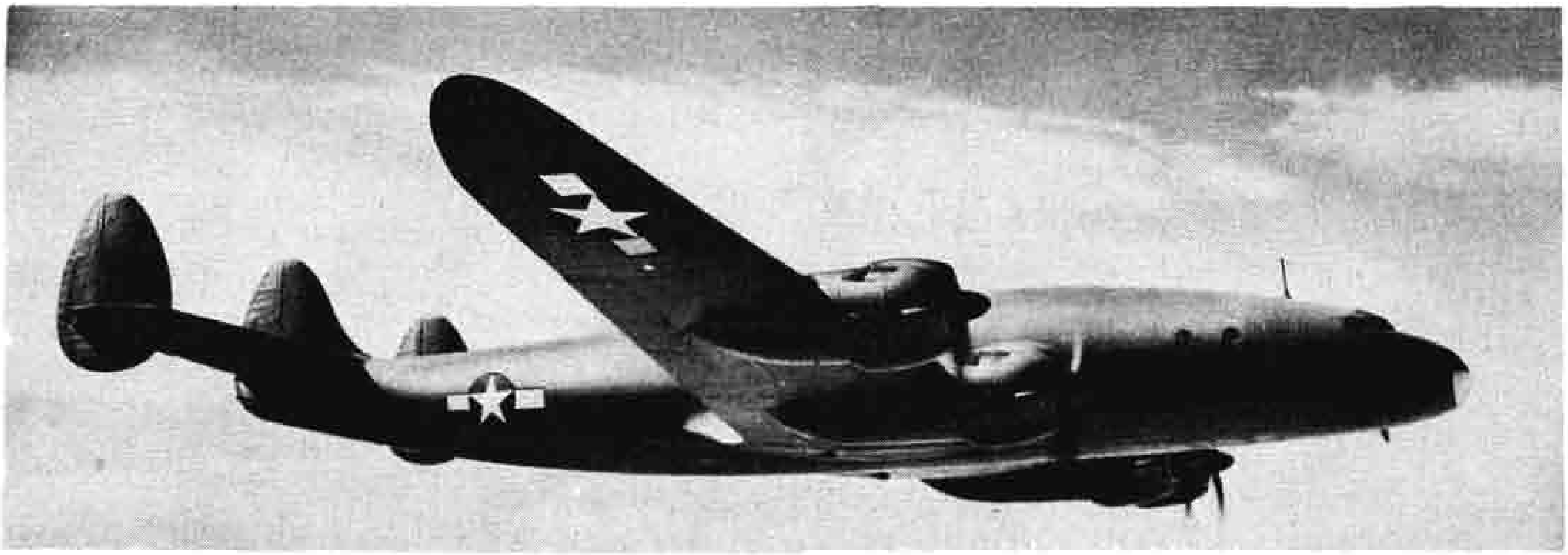
9. FIRE EXTINGUISHER SYSTEM.

a. Fire detectors are located at various points in each nacelle and blower section. In case of a nacelle fire, both the pilot's master fire warning light (figure 36-2) and the flight engineer's warning light (figure 6-20) corresponding to that nacelle will glow. In case of a blower section fire, the needle on the indicator (figure 5-1) corresponding to that blower section will become visible. Two carbon dioxide bottles of 15 pounds capacity each are located on the forward wall of the upper cargo compartment (figure 28-6). A selector valve (figure 24-5) and two control handles (figure 24-9) will deliver carbon dioxide to a manifold in each nacelle. Refer to Section IV, paragraph 10 for operation of the fire extinguisher system. A connection is provided on the right side of the nose wheel well (figure 28-4) for an external supply of CO_2 which can be routed to any nacelle by properly setting the selector valve in the flight station. A rupture disc is installed in each bottle to discharge the CO_2 overboard should thermal expansion cause a dangerously high pressure in the bottle. The outlets are located under the fuselage aft of the nose wheel well. Red celluloid discs normally cover these openings.

b. Three small hand fire extinguishers are provided in the airplane. One containing carbon tetrachloride is located just aft of the main cabin door (figure 56-16), one containing carbon dioxide is located at the forward end of the main cabin (figure 60-1) and one containing carbon dioxide is provided in the flight station aft of the radio operator (figure 20-1).

c. Cabin heater fire extinguishers are provided and operated by two handles (figure 66-29) located below the air-conditioning panel.





SECTION II

Pilot Operating Instructions

1. BEFORE ENTERING FLIGHT STATION.

a. Plan flight thoroughly using data in Appendix I.

b. Check the airplane weight and balance. Refer to AN 01-1B-40 Weight and Balance Data supplied with the airplane.

c. Check that landing gear pins and pitot covers have been removed.

d. Check that all tires are inflated. Visual inspection of dual wheel tires is not dependable.

e. Check that the red celluloid fire extinguisher rupture discs located underneath the fuselage aft of the nose wheel well are in place.

f. ACCESS TO AIRPLANE.—The airplane is entered through the main entrance door located on the left side of the fuselage aft of the wing fillet or through the crew door located on the right side of the fuselage near the nose. To open these doors, operate the latch release located in the center of the door, push in three inches and then slide main entrance door forward and the crew door upwards. When closing, seat these doors firmly before attempting to latch them. These doors and all other locked doors in the airplane can be locked with the same key. Since the entrances are approximately ten feet above the ground, it will be necessary to use stands or ladders. An emergency entrance ladder (figure 51-5) is carried under the passenger benches on the left side of the airplane for use when station equipment is not available.

2. ON ENTERING FLIGHT STATION.

a. CHECK FOR ALL FLIGHTS.

Pilot	Co-Pilot	Engineer
(1) Adjust seat (see figure 31) and rudder pedal length (figure 4-17).	(1) Adjust seat (see figure 31) and rudder length (figure 4-17).	(1) Adjust seat (see figure 59).
(2) Master ignition switches (figure 24-24) OFF and individual ignition switches (fig. 24-23) OFF.	(2) If the wheels are not chocked, set hand pump selector valve (figure 19-3) FORWARD and pump brake pressure (figure 19-1) to 1500 to 1700 lb/sq. in. using the emergency hand pump.	(2) Airplane master switch (figure 6-3) ON.

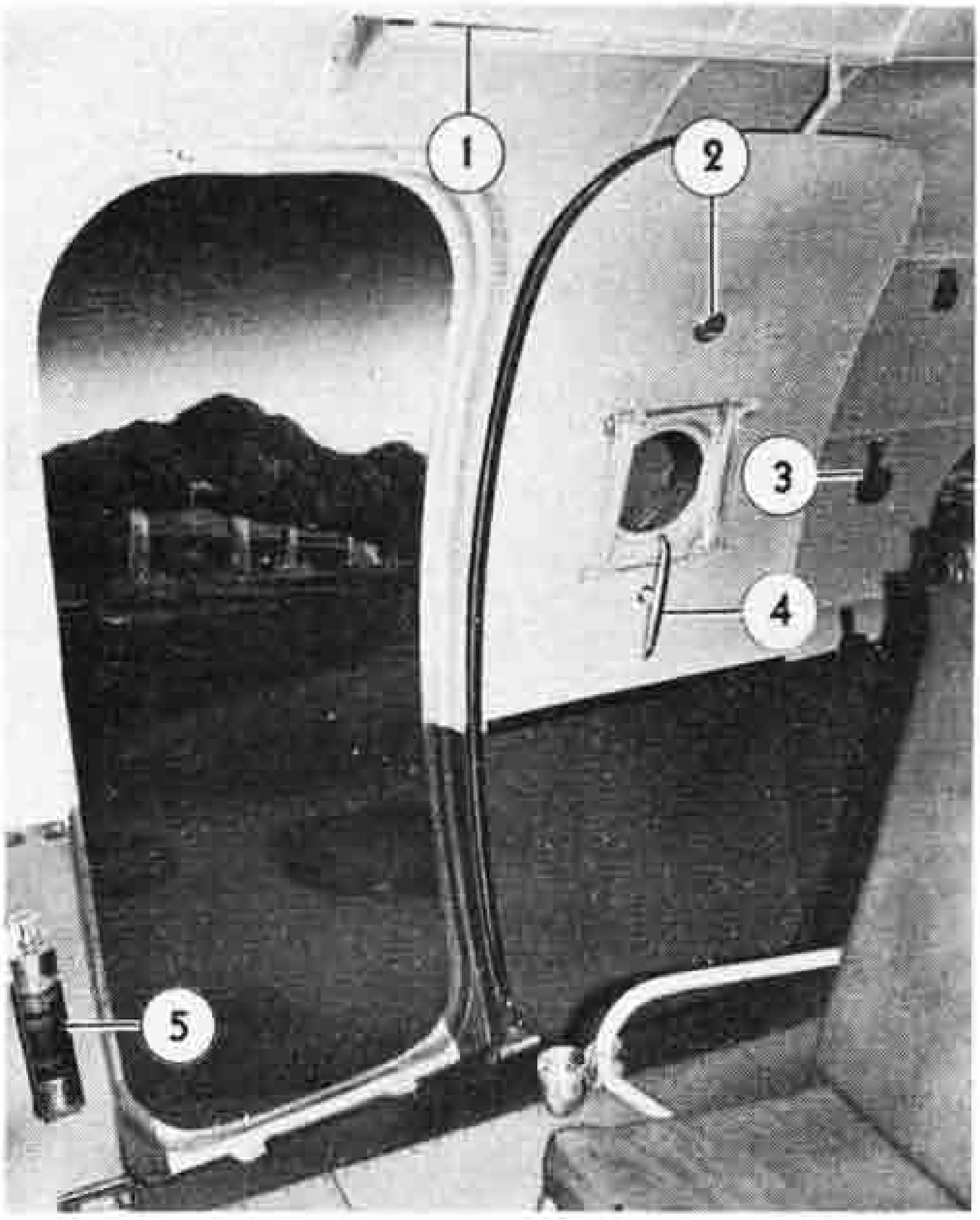
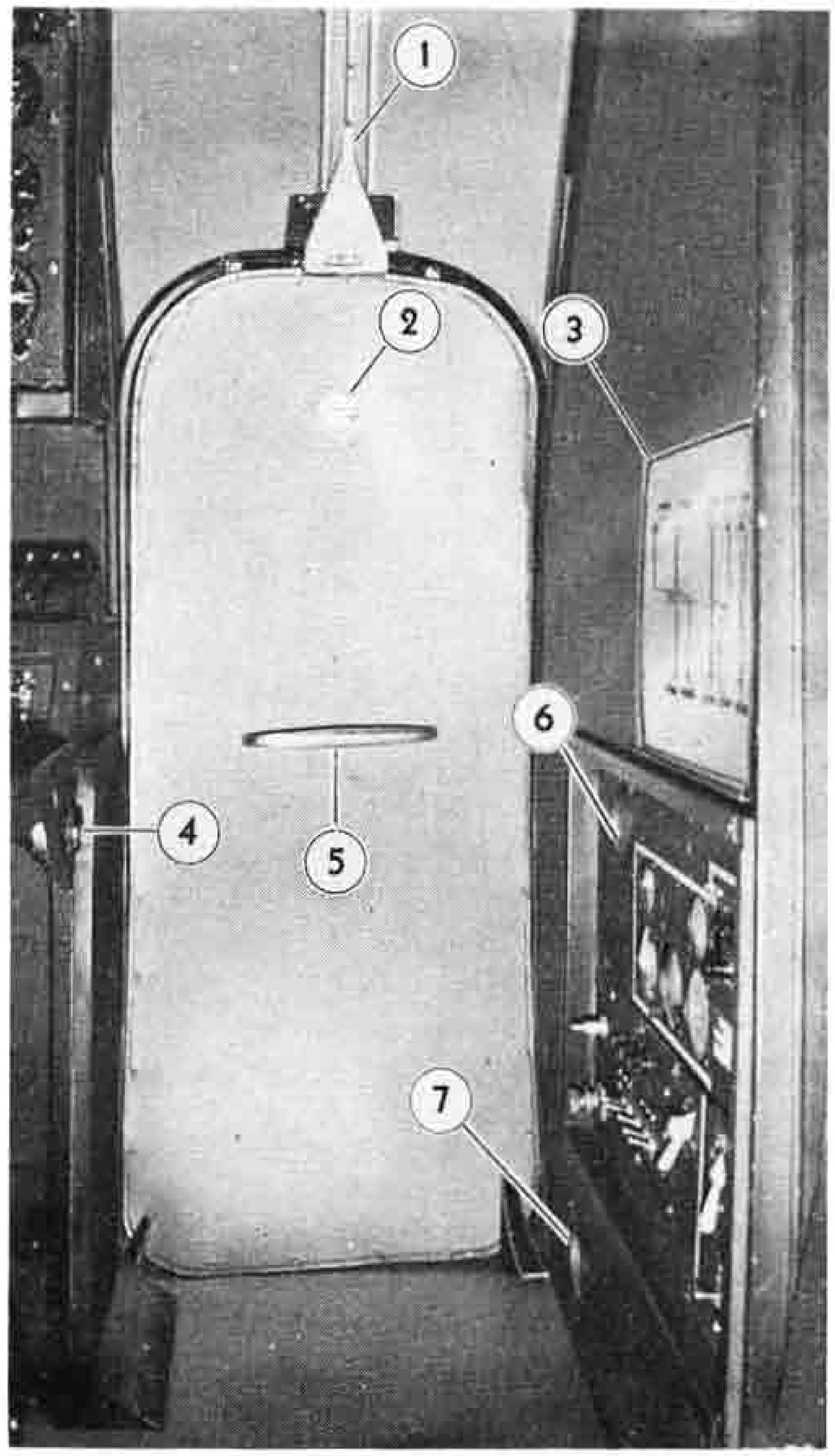


Figure 29 — Cabin Door

1. Cabin door upper track.
2. Cabin door lock.
3. Life raft stowage straps.
4. Cabin door handle.
5. Hand fire extinguisher.



1. Crew door track.
2. Crew door lock.
3. Simplified fuel system diagram.
4. Air conditioning control panel light.
5. Crew door handle.
6. Cabin air conditioning control panel.
7. Step light.

Figure 30 — Crew Door

Pilot

(3) Set parking brakes (figure 63-29) and have ground crew remove wheel chocks.

(4) Warning light switch (figure 24-10) TEST. Check that all hoods are off lights and check for burned out lights on fuel pressure (figure 35-2), hydraulic pressure (figure 36-4), door (figure 36-17),

Co-Pilot

(3) Brake selector lever (figure 4-16) EMERGENCY, and request pilot to set parking brake.

(4) Landing gear lever (figure 4-19) DOWN.

Engineer

(3) Load transfer switch (figure 22-10). Push button number 1 if external power source is plugged in, otherwise push button number 2 or number 3.

(4) Warning light switch (figure 22-15) TEST. Check that all hoods are off lights and check for burned out lights on nacelle fire (figures 6-20 and 36-2), vacuum pumps (figure 6-21), propeller pitch (figure

Pilot

landing gear (figure 4-15) and pitot heaters (figure 24-13) warning lights. Set switch to BRT or DIM.

(5) Controls booster levers (figure 4-1) ON.

(6) Mechanical elevator control (figure 1). PUSH to engage elevator booster.

(7) Elevator tab control lever (figure 4-22) MANUAL.

(8) Elevator and rudder booster emergency control switches (figure 4-14 and 20) OFF.

(9) Automatic pilot engaging levers (figure 4-6) OFF.

(10) Automatic pilot hydraulic pump motor switch (on airplanes 42-94549 and subsequent) OFF.

(11) Set altimeter (figure 35-5).

(12) Wind and set clock (figure 35-11) with navigator's chronometer.

(13) Static pressure selector valve (figure 35-14) PITOT TUBE.

(14) Turn and bank vacuum selector switch (figure 35-23) ENGINE PUMP.

(15) Vacuum pump selector (figure 63-30) LEFT or RIGHT.

(16) Instrument group vacuum selector (figure 63-31) BOTH.

Co-Pilot

(5) Set altimeter (figure 36-6).

(6) Wind and set clock (figure 36-13) with navigator's chronometer.

(7) Static pressure selector valve (figure 36-16) PITOT TUBE.

(8) Turn and bank vacuum selector switch (figure 36-23) ENGINE PUMP.

(9) Fuel dump valves (figure 24-1 and 24-3) CLOSED.

(10) Emergency fuel, engine and hydraulic oil shut-off valve (figure 24-2) OPEN (usually safetied in OPEN position).

Engineer

6-23), hydraulic pumps (figure 6-24), oil pressure (figure 5-12), fuel pressure (figure 5-17), cabin pressure (figure 66-5), cabin heater fire (figure 66-19), cabin heater ignitor (figure 66-20 and 66-21) and cabin heater fuel (figure 66-18 and 66-24), warning lights. Set switch to BRT or DIM.

(5) Generator switch bypass (figure 22-26) OFF (usually safetied in OFF position).

(6) Generator switches (figure 22-7 and 22-20) OFF until engines are started.

(7) Autosyn dynamotors switch (figure 22-3) 1 or 2.

(8) Upper and lower cowl flaps switches (figure 5-23 and 5-24) OPEN.

(9) Oil cooler switches (figure 5-25) AUTOMATIC.

(10) Propeller governor switches (figure 5-26) hold in INCREASE until propeller governor limit lights (figure 6-23) illuminate.

(11) Carburetor air levers (figure 5-18) COLD or set to FILTER in dusty air.

(12) Superchargers (figure 5-20) LOW.

(13) Mixture (figure 5-21) OFF.

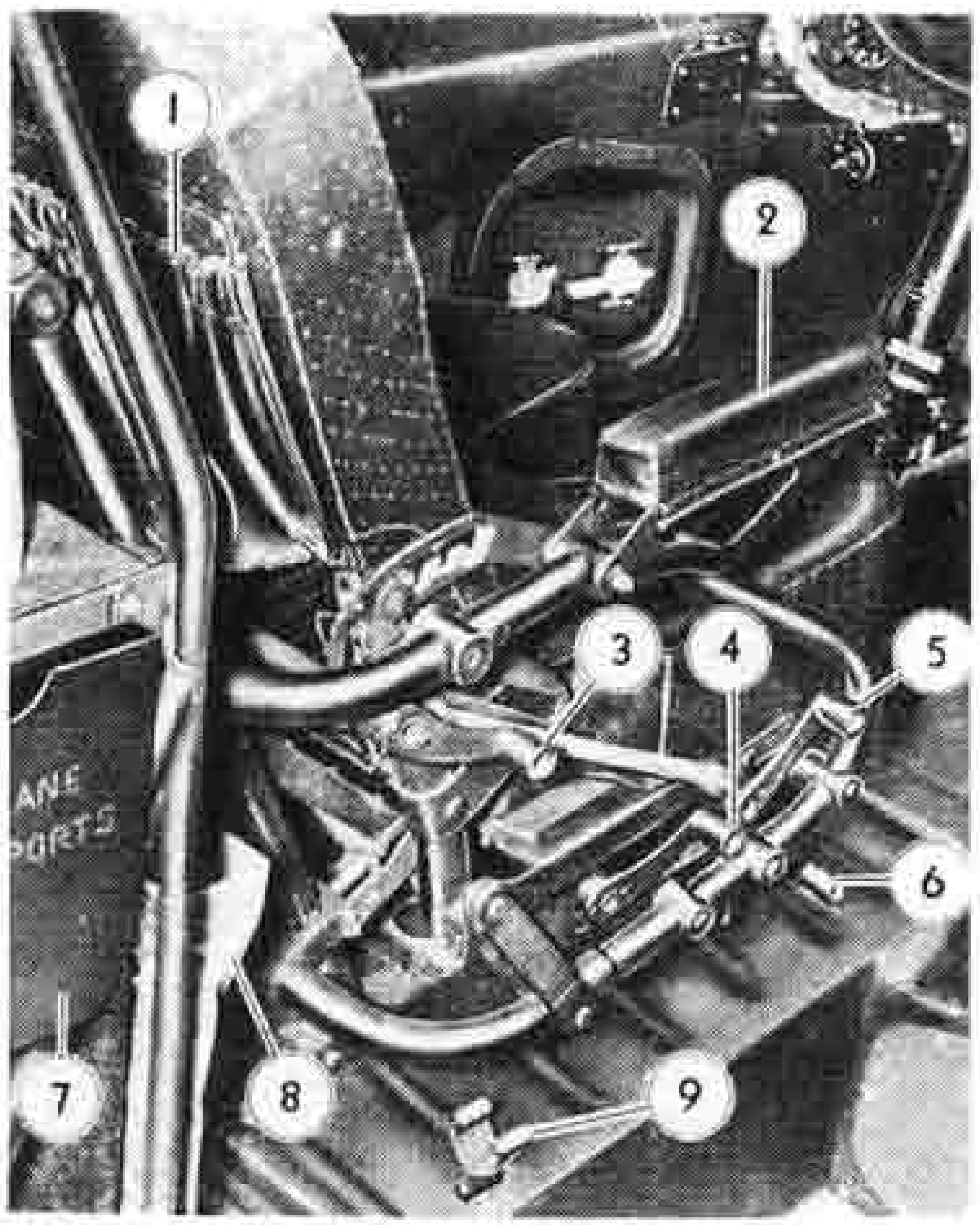
(14) Manual generator voltage switch rheostat (figure 6-7) NORMAL (usually safetied in NORMAL position).

(15) Hydraulic pump shut-off switches (figure 6-4) OPEN.

(16) Fuel cross transfer valves (figure 32-4) OFF.

(17) Carburetor vapor return switches (figure 5-27) OPEN.

Pilot | **Co-Pilot** | **Engineer**



1. Map stowage pocket.
2. Folding arm rest.
3. Seat back angle adjustment.
4. Seat height adjustment.
5. Seat angle adjustment (Omitted after second airplane).
6. Fore and aft adjustment.
7. Airplane reports holder.
8. Waste paper basket.
9. Flash light clip.

Figure 31 — Pilot's Seat

(18) Check quantities of fuel (figure 6-18), oil (figure 6-13), hydraulic fluid (figure 6-11), and anti-icer fluid (figure 6-10).

(19) Wind and set clock (figure 5-3) with navigator's chronometer.

(20) Set cylinder head temperature selector switch (figure 5-15) to "1."

(21) Set voltmeter selector switch (figure 22-19) to BAT 1, press load transfer switch No. 2 (figure 22-10), and note reading of voltmeter (figure 22-6). Set voltmeter selector switch to BAT 2, press load transfer switch No. 3, and note reading. Both readings should be 24 volts.

(22) Turn cabin lights switch (figure 22-14) ON.

(23) Set cabin pressurization controls as required. Refer to Section VII, paragraph 1, *c*.

b. SPECIAL CHECK FOR NIGHT FLYING.

Pilot

(1) Turn pilot's overhead panel light (figure 24-22) ON.

(2) Test operate pilot's chart light (figure 63-24).

(3) Test operate the landing lights (figure 24-12). (Not over 5 seconds on test.)

(4) Test operate the instrument lights (figure 24-7, 24-8, and 24-11).

(5) Test operate courtesy light (figure 24-15).

(6) Test operate navigation lights (figure 24-16 and 24-21).

(7) Test operate recognition lights (figure 4-12). (Not over 5 seconds on test.)

Co-Pilot

(2) Test operate copilot's chart light (figure 65-9).

Engineer

(1) Turn dome light (figure 22-4) ON.

(2) Turn desk light rheostat (figure 22-16) ON.

(3) Test operate instrument lights (figures 22-5, 22-17, 22-18, and 6-6).

(4) Test operate load transfer switch light (figure 22-22).

3. FUEL SYSTEM MANAGEMENT.

a. FUEL SYSTEM MANAGEMENT.—Take-off and land with each system operating independently, i.e., all tank shut-off valves (figure 5-22) ON and all fuel cross transfer valves (figure 32-4) OFF. When carrying less than 3200 U.S. gallons (2670 Imp. gallons) put equal quantities of fuel in each tank and operate each system independently. When more than 3200 U.S. gallons (2670 Imp. gallons) of fuel is carried, operate the two right-hand engines from the right-hand outboard tank until fuel quantities in both right-hand tanks are equalized. Repeat the fuel equalizing procedure for left-hand engine operation. Do not equalize fuel on both sides at once. When the fuel quantities in all tanks have been equalized, it will be possible to operate each fuel system independently for the rest of the flight.

b. CROSS FEED SYSTEM OPERATION. *(See figure 33.)*

(1) OPEN fuel shut-off valve (figure 5-22) and turn ON auxiliary fuel pump (figure 5-28) of system supplying fuel.

(2) OPEN cross transfer valve (figure 32-4) of system to supply fuel and of system or systems to receive fuel.

(3) CLOSE fuel shut-off valve and turn OFF auxiliary fuel pump of system or systems receiving fuel.

(4) Turn OFF auxiliary fuel pump of systems supplying fuel if the engine driven pumps will maintain 15 lb/sq in. fuel pressure.

NOTE

In level flight it is possible to operate all four engines from any one fuel tank at maximum cruising power up to approximately 8,000 feet without the fuel boost pump operating and approximately 15,000 feet with the fuel boost pump operating.

c. AUXILIARY FUEL PUMP OPERATION.—The auxiliary fuel pump switches (figure 5-28) should be turned ON during take-off, landing and at other times when the engine driven fuel pumps will not maintain 15 lb/sq in.

Pilot | *Co-Pilot* | *Engineer*

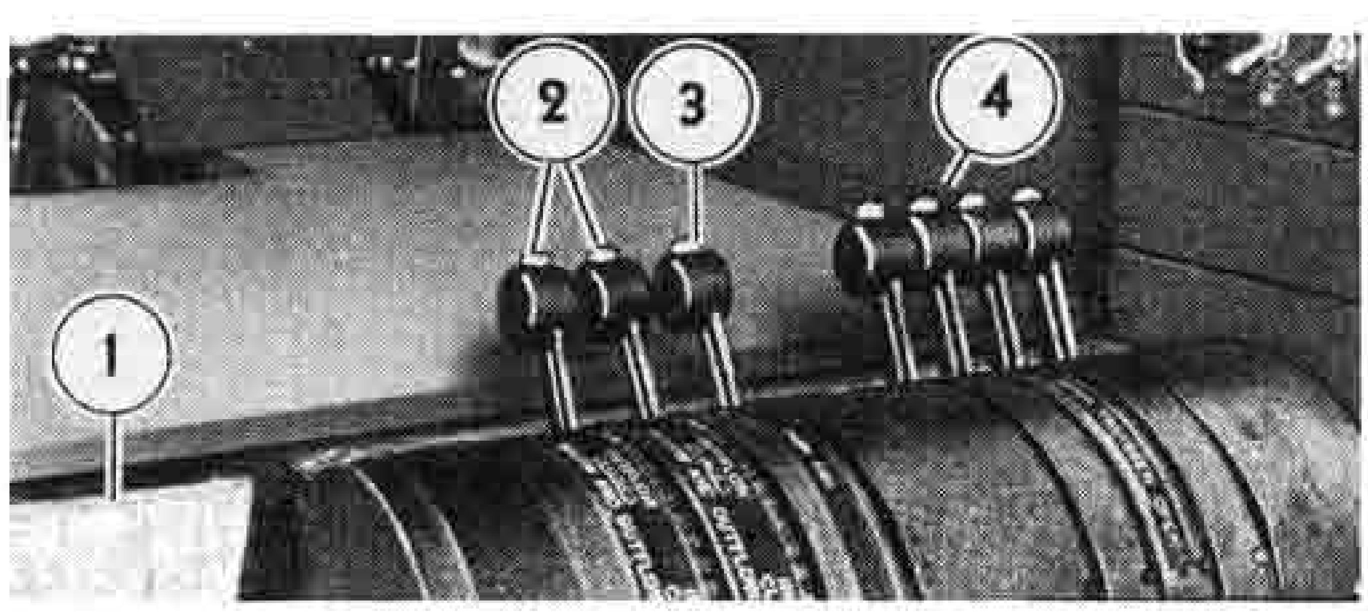
4. STARTING THE ENGINES.

Pilot

a. Check ignition OFF before propellers are pulled through.

Co-Pilot

a. Have a member of the ground crew plug in external supply of CO_2 (figure 28-4).



1. Rag bag.
2. Inflow and outflow manual valve controls.
3. Cabin fan control lever.
4. Fuel cross transfer valve controls.

Figure 32 — Flight Engineer's Floor Controls

Engineer

a. Suggested normal starting order 3, 4, 2, 1, to start engines away from cabin door first.

b. If engines have not been operated for more than one-half hour, have propellers pulled through by hand at least three blades.

c. Fuel shut-off valves (figure 5-22) ON.

d. Throttles (figure 5-14) $1/10$ OPEN. Mixture (figure 5-21) OFF.

e. Auxiliary fuel pumps (figure 5-28) ON. Check for 15-19 lb/sq in.

Pilot

f. Receive all clear signal from ground crew and inform flight engineer.

g. Master ignition switch (figure 24-24) ON.

h. Individual ignition switches (figure 24-23) to BOTH after engine has *turned at least three blades.*

NOTE: The ignition boosters are not retarded, hence the engines may kick back if the ignition is turned ON before the engines start turning over.

m. Close fuel, hydraulic and engine oil emergency shut-off valve (figure 24-2) of engine on fire.

n. If fire is still burning, direct ground crew member to turn on external CO_2 supply, if connected or pull fire extinguisher (figure 24-9), both if necessary.

NOTE: Be sure to replace CO_2 bottles before resuming operations.

Co-Pilot

f. Turn fire extinguisher selector (figure 24-5) to engine to be started.

Engineer

f. Starter switch (figure 22-13) to INERTIA after receiving all clear signal from pilot.

CAUTION: Flywheel accelerating time should not exceed 20 seconds. Energize the flywheel for all starts. If the engine fails to start within one minute, allow the starter to cool for that length of time.

g. Press primer button (figure 22-12) 2 to 5 seconds. Don't prime a warm engine.

h. Starter switch to DIRECT.

i. When the engine is running smoothly, place the mixture control (figure 5-21) to AUTO RICH and continue to prime only as required.

j. Quickly return mixture control to OFF if the engine does not continue to run or flooding will result.

k. Stop the engine if both front and rear oil pressure does not register within 10 seconds.

l. In case of nacelle fire, run up engine in an attempt to blow out fire. If this fails, stop engine by moving mixture control (figure 5-21) to OFF.

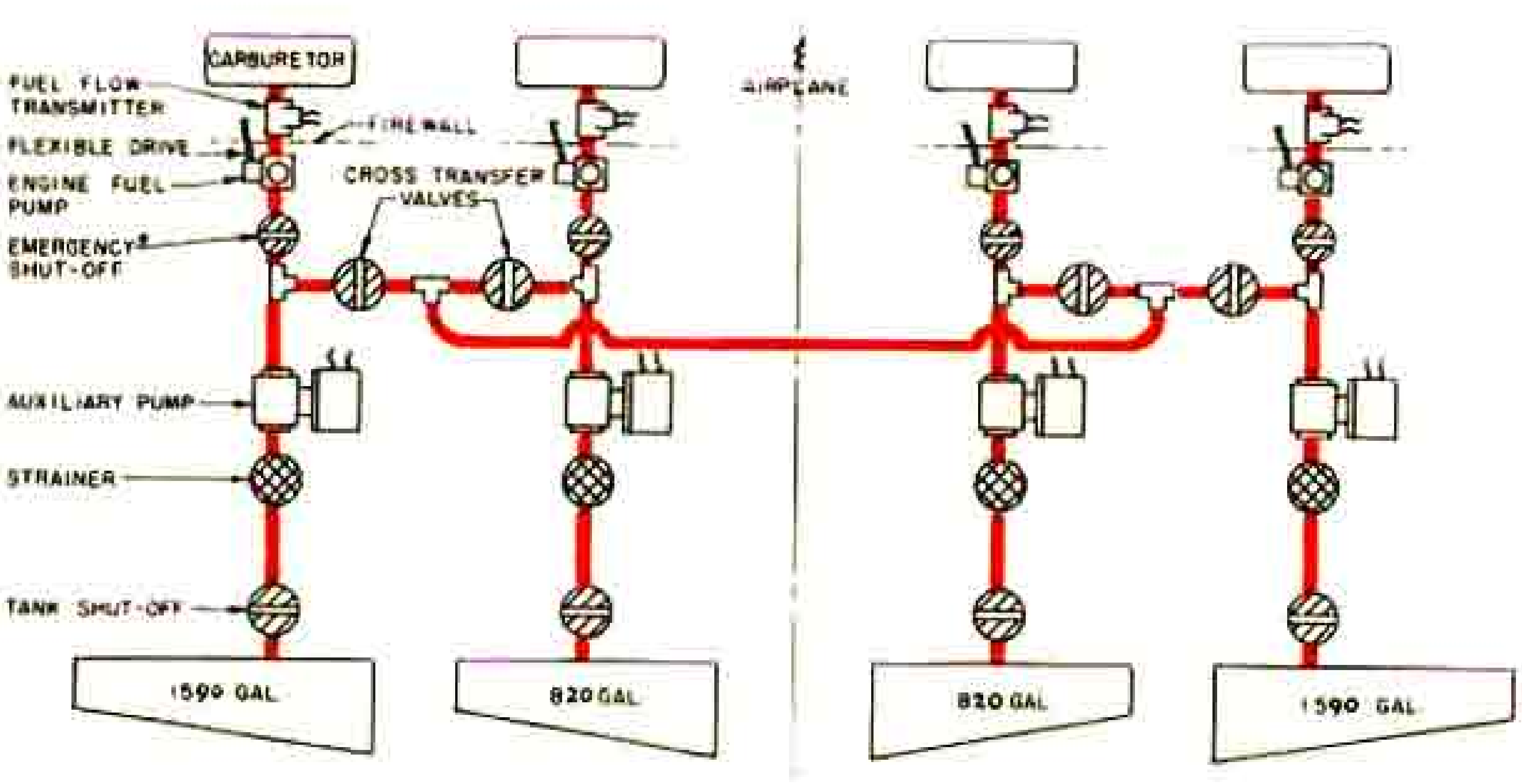
m. CLOSE cowl flaps of engine on fire.

o. Start other engines as outlined in paragraphs *b* to *n* above.

p. Generator switches (figure 22-7, 22-20) ON after all engines are started.

q. Push button number 5 (Normal Position) on load transfer switch (figure 22-10) before disconnecting external power source.

NOTE: If external power source is not available, set transfer switch to position 2 or 3, depending on which battery has the best charge. Start and WARM UP engine number 2 or 3 first, using the airplane's battery. Turn ON corresponding generator switch (figure 22-7 or 22-20). Open the throttle to 1700 rpm to cut in the generator and start the other engines in the normal manner. Turn ON other generator switch and set load transfer switch to Position 5.



*May not be installed in early airplanes.

Figure 33 — Simplified Fuel System Diagram

5. WARM-UP.

Pilot	Co-Pilot	Engineer
		a. Run the engines at 1000 rpm until the oil temperature reaches 75°C (167°F) or shows a definite increase (10°C or 18°F) and the oil pressure is steady. *b.* Leave engine cowl flaps open during warm-up. Closing the cowl flaps will not shorten the warm-up period and it may damage the engine. *c.* Auxiliary fuel pumps (figure 5-28) OFF (check for 16-19 lb/sq in. with engine driven pumps only).

6. EMERGENCY TAKE-OFF.

Pilot	Co-Pilot	Engineer
a. When necessary, take-off may be made without the normal engine and accessories ground test provided the rear oil pressure is steady above 60 lb/sq in. and oil flow has been indicated by a noticeable rise in oil temperature.		*a.* Start engines in normal manner. If the oil pressure falls back due to cold oil when the engine rpm is increased use oil dilution (figure 6-27) to correct the condition. Watch the oil pressure gages (figure 5-9 and 6-8) carefully, as over dilution and a low oil pressure is likely to result under these conditions.

7. ENGINE AND ACCESSORIES GROUND TEST.

Pilot	Co-Pilot	Engineer
	a. All warning lights except landing gear (figure 4-15) should be OFF.	*a.* All warning lights except cabin pressure (figure 66-5) should be OFF.
b. Suction gage (figure 35-16) 4 inches Hg.	*b.* Suction gage (figure 36-18) 4 inches Hg.	
	c. Check hydraulic system as follows:	*c.* Check each engine as follows:
	(1) Hydraulic system pressure (figure 36-24) 1700 lb/sq in.	(1) Supercharger (figure 5-20) to HIGH below 1200 rpm if two speed blower is installed.
	(2) Automatic pilot oil pressure (figure 36-25) 180 to 220 lb/sq in.	(2) Slowly advance throttle to 1800 rpm.
	(3) Emergency brake pressure (figure 36-26) 1700 lb/sq in.	(3) Supercharger to LOW firmly and without hesitation during shift. Note reduction in mani-

Pilot

(6) Check magnetos on request of flight engineer. Maximum normal drop is 100 rpm on going from both to one magneto.

d. Check the automatic pilot as follows:

(1) Uncage the bank and climb gyro by turning the caging knob (figure 34-21).

(2) Uncage the directional gyro by pulling out the caging knob (figure 34-18).

(3) Turn the speed control knobs (figure 34-11, -12, and -13) to "3".

(4) Align the indices by turning the aileron, elevator, and rudder control knobs. (See figure 34.)

(5) On airplanes Nos. 42-94549 and subsequent which have a separate automatic pilot hydraulic sys-

Co-Pilot

(4) Extend and retract flaps (figure 4-5).

d. Check wing and tail de-icers.

(1) Turn de-icer switch (figure 24-14) ON.

(2) Visually check operation.

(3) Check de-icer gage (figure 36-22). The following cycle is normal: 30 seconds suction at 4 to 5 in. Hg. 5 seconds pressure at 8 lb/sq in. and 5 seconds dormant at 0 lb/sq in.

Engineer

fold pressure indicating shift has been accomplished.

(4) Hold propeller governor switches (figure 5-26) in DECREASE position until propeller governor limit warning light (figure 6-23) illuminates. (Engine nose oil pressure will fluctuate while propeller pitch is changing.)

(5) Note 1100 rpm then hold propeller governor switch in INCREASE position until propeller pitch limit warning light illuminates again.

NOTE: This check is necessary to insure warm oil in the propeller dome and thus reduce the amount of surging with change in power.

(6) Increase to 2200 rpm but do not exceed 30 inches Hg. and request pilot to check magnetos. Engines must operate smoothly on either magneto.

(7) When not familiar with engine condition check take-off power —2800 rpm and 46 inches Hg.

CAUTION: Do not operate at this power for more than 2 or 3 seconds while standing still.

(8) Reduce throttle.

d. Notify pilot when all engines have been checked.

Pilot

tem, increase the speed of the right-hand inboard engine to 1000 rpm, check to see that the generator is ON, and move the automatic pilot hydraulic pump motor switch to ON. It is important that the generator be operating whenever the automatic pilot pump motor is ON to prevent excessive drain on the battery.

(6) Check the readings of the vacuum and pressure gages (figures 34-10 and 36-25). They should be 4 to 5 in. Hg and 180 to 220 lb/sq in. respectively.

(7) Engage the automatic pilot by slowly pulling the engaging levers (figure 4-6) aft.

NOTE: It is possible to engage the rudder, aileron, or elevator servo units individually by operating individual engaging levers (figure 4-6).

(8) Attempt to move each control surface manually. They should act as if locked. If any springiness is noticed, air is present in the system and it should be bled. The system may be bled by disengaging the automatic pilot and holding each control in each extreme position for about 30 seconds. While holding the control in the extreme position return the follow-up index to within approximately 1/4 inch of its neutral position. It may be necessary to repeat this procedure to remove the air if large quantities are present in the servos. After bleeding the system reengage the automatic pilot.

(9) Turn the rudder, aileron, and elevator control knobs (figure 34-3, -4, and -8), and note the response of the control surfaces.

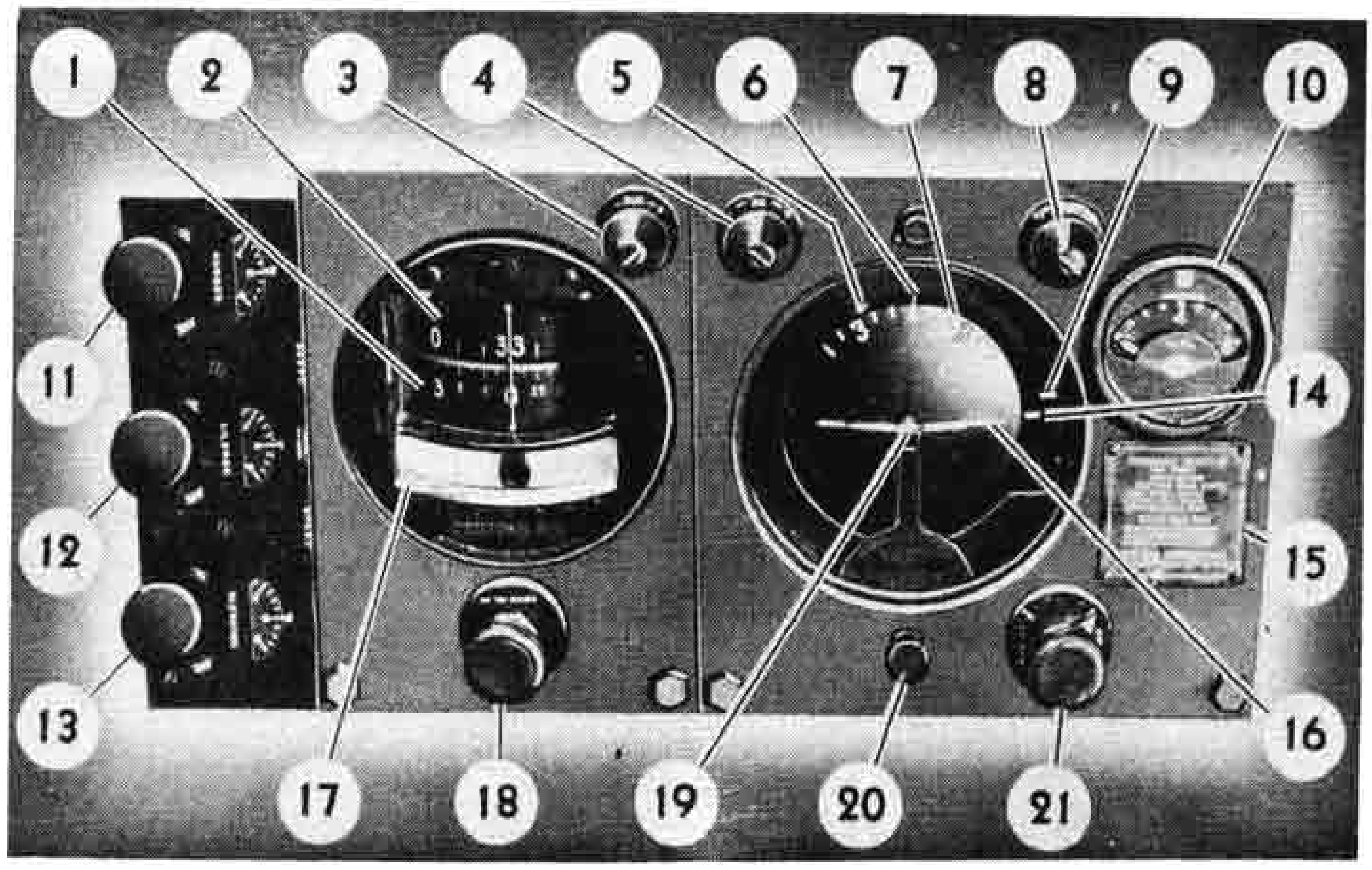
(10) Check the overpower valves by operating each surface manually against the automatic pilot.

(11) Disengage the automatic pilot; and if the airplane is equipped with a separate automatic pilot hydraulic system, move the pump motor switch to OFF.

e. Call control tower for clearance.

f. Signal ground crew to remove wheel chocks if still there.

Co-Pilot



1. Directional gyro card.
2. Rudder follow-up card.
3. Rudder knob.
4. Aileron knob.
5. Aileron follow-up index.
6. Bank index.
7. Banking scale.
8. Elevator knob.
9. Elevator follow-up index.
10. Vacuum gage.
11. Rudder speed control knob.
12. Aileron speed control knob.
13. Elevator speed control knob.
14. Elevator alignment index.
15. Instruction placard.
16. Horizon bar.
17. Ball bank indicator.
18. Directional gyro caging knob.
19. Miniature airplane.
20. Miniature airplane adjustment knob.
21. Bank and climb gyro caging knob.

Figure 34 — Automatic Pilot Controls

e. Door warning light (figure 36-17) OFF.

Engineer

e. If icing conditions prevail, set carburetor heat to HOT, until just before take-off.

Pilot — Co-Pilot — Engineer

8. TAXIING.

Pilot

a. In order to cut in the generators it is recommended that the airplane be taxied and steered with the inboard engines. Use the brakes only when necessary. If desired, or in an emergency, if the brakes should fail, the nose wheel steering mechanism should be used to steer the airplane. Avoid high speed taxiing and excessive movement of the nose wheel. The rolling inertia of the airplane resists turning and may cause sideway skipping of the nose wheel at high speed.

b. Avoid overheating the brakes. In making small radius turns, avoid locking the pivot wheels with resultant tearing of rubber. Allow the pivot wheels to roll. Use of brakes should be coordinated with applications of power to obtain the desired results.

c. The airplane has no tendency to ground loop and can be turned to either side while taxiing at a fast rate. However, the radius of turn must be lengthened as the speed increases. At 30 mph, the minimum allowable radius of turn is 120 feet and at 50 mph the minimum allowable radius of turn is 300 feet.

Co-Pilot

a. Watch hydraulic pressure and notify pilot if it drops below 1500 lb/sq in.

Engineer

a. Notify pilot if engine operation is not normal.

9. TAKE-OFF.

Pilot

a. Refer to the TAKE - OFF CLIMB AND LANDING CHART in Appendix I for take-off distance to be expected.

WARNING: Propellers of this airplane are limited to 500 take-offs per propeller. Maintain log books to indicate number of take-offs per propeller.

Co-Pilot

a. Recheck and set:

(1) Surface controls booster (figure 4-1) ON.

(2) If the airplane is equipped with a separate automatic pilot hydraulic system, check the system and bleed it, if necessary, as outlined in paragraphs 7 *d* (5), (7), and (8).

NOTE: When the check is completed leave the pump motor ON until the flight is completed or the automatic pilot is no longer needed. Whenever the pump is turned OFF air may accumulate in the system.

(2a) Automatic pilot engaging levers (figure 4-6) OFF.

Engineer

a. Recheck and set:

(1) Load transfer switch (figure 22-10) set to position number 5.

(2) Generator switches (figures 22-7 and 22-20) ON.

Pilot

Co-Pilot

(3) Door warning light (figure 36-17) OFF.

(4) Elevator tab control lever (figure 4-22) ELECT.

(5) Elevator tabs set 5° nose up.

(6) Wing Flaps (figure 4-5)—UP.

NOTE: Up to 60% flaps may be used to assist take-off if the airplane is heavily loaded or if the runway is short.

(7) Hydraulic pressure (figure 36-24) 1500 to 1700 lb/sq in.

DON'T RAISE YOUR WHEELS BEFORE LEAVING THE GROUND!

Engineer

(3) Carburetor heat (figure 5-18)—COLD, or FILTER in dusty air.

NOTE: If icing conditions exist, clear carburetor by a run-up with the carburetor heat on HOT, return control to COLD and request co-pilot to turn ON carburetor anti-icer during take-off if signs of carburetor icing appear.

(4) Superchargers (figure 5-20) LOW.

(5) Mixture (figure 5-21)—AUTOMATIC RICH.

(6) Fuel shut-off valves (figure 5-22)—ON.

(7) Fuel cross transfer valves (figure 32-4)—OFF.

(8) Carburetor vapor return switches (figure 5-27) OPEN.

(9) Cowl flaps (figure 5-23 and 5-24)—both upper and lower ½ open. In hot weather open all flaps fully. No buffeting will be experienced with fully open cowl flaps.

(10) Oil coolers (figure 5-25)—AUTOMATIC.

(11) Propeller governor switches (figure 5-26) INCREASE until propeller governor limit lights go ON.

(12) Auxiliary fuel pumps (figure 5-28)—ON.

Pilot

b. Close side window (figure 35-1).

c. Release parking brake and taxi into take-off position. Roll a few feet straight down the runway to straighten the nose wheel. Use all the available runway for take-off.

d. Hold airplane with brakes and advance throttles to 30 or 40 in. Hg.

e. Release brakes and advance throttles to 46″ Hg. Engine speed 2800 rpm maximum.

f. Keep airplane straight. Raise nose gear off ground at approximately 80 mph.

g. When airplane is clear of ground, direct co-pilot to retract landing gear.

h. When landing gear is up and locked, direct co-pilot to raise wing flaps if extended. Flaps retract slowly enough so that loss of lift is not dangerous.

Co-Pilot

b. Close side window (figure 65-1).

c. Elevator and rudder booster emergency control switches (figure 4-14 and 20) ON.

e. Watch manifold pressure gages and if the pressure falls off on any engine, inform the pilot and flight engineer.

g. Retract landing gear (figure 4-19) at command from pilot and place the lever in the NEUTRAL position.

h. Raise wing flaps (figure 4-5) at command from pilot.

Engineer

(13) Recommended cylinder head temperature (figure 5-4) between 180°C and 232°C (356°F and 450°F) at start of take-off run.

e. Watch cylinder head temperatures and open cowl flaps if 260°C (500°F) is exceeded.

f. Watch BMEP gages (figure 5-11) and be prepared to feather corresponding engine if conditions require such action.

10. ENGINE FAILURE DURING TAKE-OFF.

Pilot

a. Failure of an engine during take-off may not be noticed immediately except for a resultant swing. If a swing develops, and *there is room to close the throttles and stop the airplane,* this should be done.

Co-Pilot

a. Watch manifold pressures during take-off.

Engineer

a. Be prepared to feather an engine at command of pilot.

Pilot

b. If it is necessary to continue with take-off even though one engine has failed, hold the airplane straight by immediate application of rudder and necessary throttling of opposite engine if the airspeed is below the minimum for rudder control. (Approx. 110 mph for outboard engine failure.) Gain speed as rapidly as possible. See that the landing gear is up, or coming up, and direct flight engineer to feather the dead propeller. Retrim as necessary.

Co-Pilot

b. Check to see that gear is on the way up.

Engineer

b. Feather propeller at command of pilot. For detailed instructions for feathering and unfeathering the propellers, refer to Section IV, paragraph 9.

11. CLIMB.

Pilot

a. Direct flight engineer to take over engines.

b. Trim for best climbing airspeed. Refer to Take-off, Climb and Landing Chart in Appendix I.

Co-Pilot

a. Move the elevator and rudder booster emergency control switches to OFF.

Engineer

a. At command from pilot, reduce to power for climb. (Rated power or less, see Specific Engine Flight Chart in Section III.)

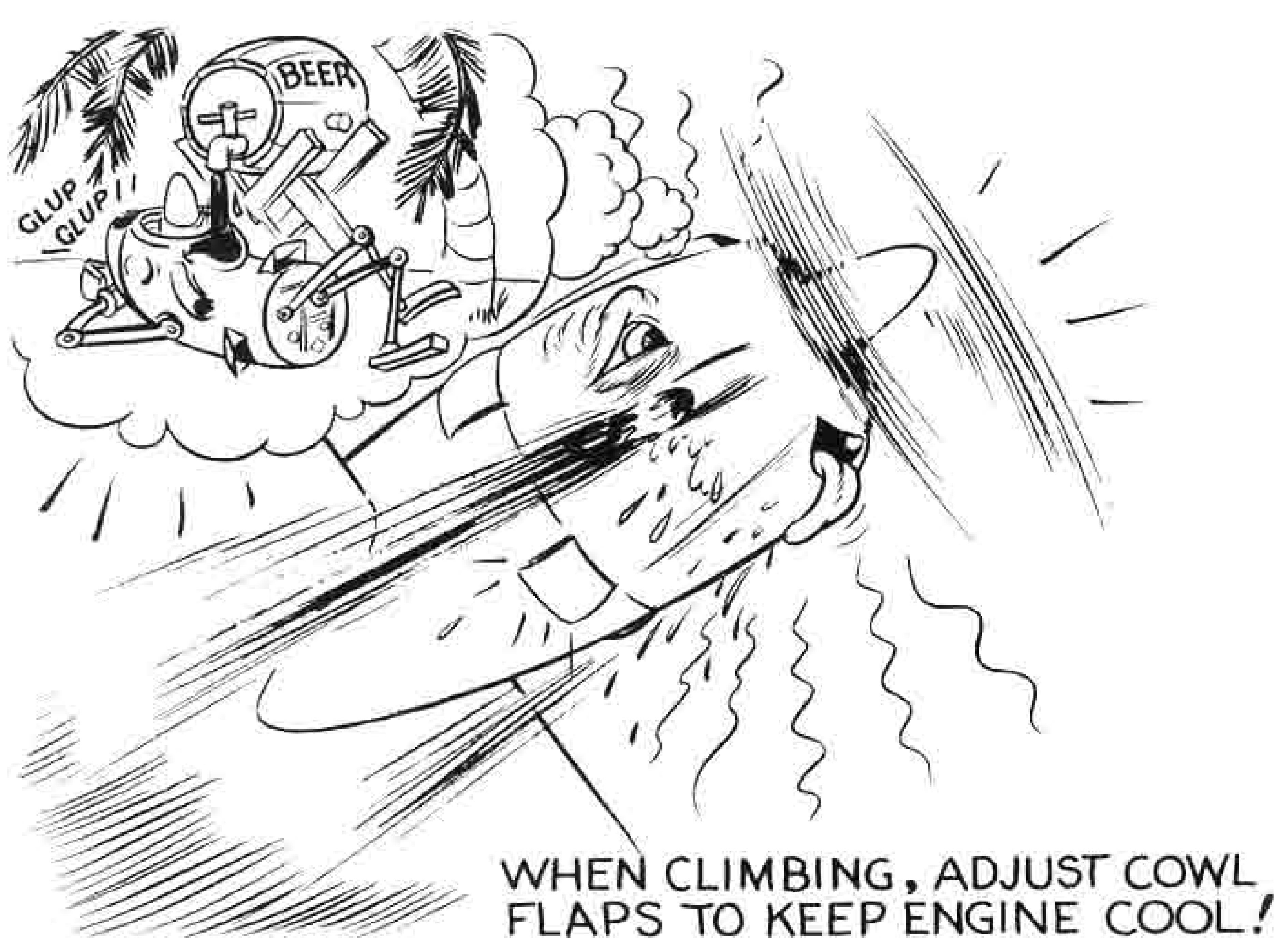
b. Always use AUTO RICH mixture for climb.

c. Watch cylinder head temperatures (figure 5-4) and if over 248°C (475°F) open cowl flaps more or if fully open request pilot to increase airspeed.

d. Shut the four auxiliary fuel pumps (figure 5-28) OFF if the engine pumps alone will maintain at least 16 lb/sq in. fuel pressure.

e. When climbing to high altitudes, shift supercharger to high blower at altitude given on Take-off, Climb and Landing Chart in Appendix I.

f. If desired turn on cabin pressurization equipment. Refer to Section VII, paragraph 1, *c.*



WHEN CLIMBING, ADJUST COWL FLAPS TO KEEP ENGINE COOL!

Pilot — *Co-Pilot* — *Engineer*

12. FLIGHT OPERATION.

a. When climb has been completed, level off and direct the flight engineer to reduce power to the cruising power required by the flight plan.

b. Engage automatic pilot if desired.

(1) Trim airplane to fly "hands off".

(2) See that speed control valves (figure 34-11, 34-12, and 34-13) are open. Set at 3 if best setting is not known.

NOTE: The speed valves control the rate at which the automatic pilot reacts to bring the airplane back on course. In general, the speed valves should be left wide open unless there is oscillation present in which case the valves should be closed sufficiently to stop the oscillation.

CAUTION: Turning any of the three speed valves to its OFF position locks the corresponding control surface in whatever position it happens to be and should be avoided.

(3) Set rudder follow-up card (figure 34-2) to match directional gyro card (figure 34-1) by turning rudder knob (figure 34-3) or the remote control for the rudder knob (figure 4-9) located on the pilot's control stand.

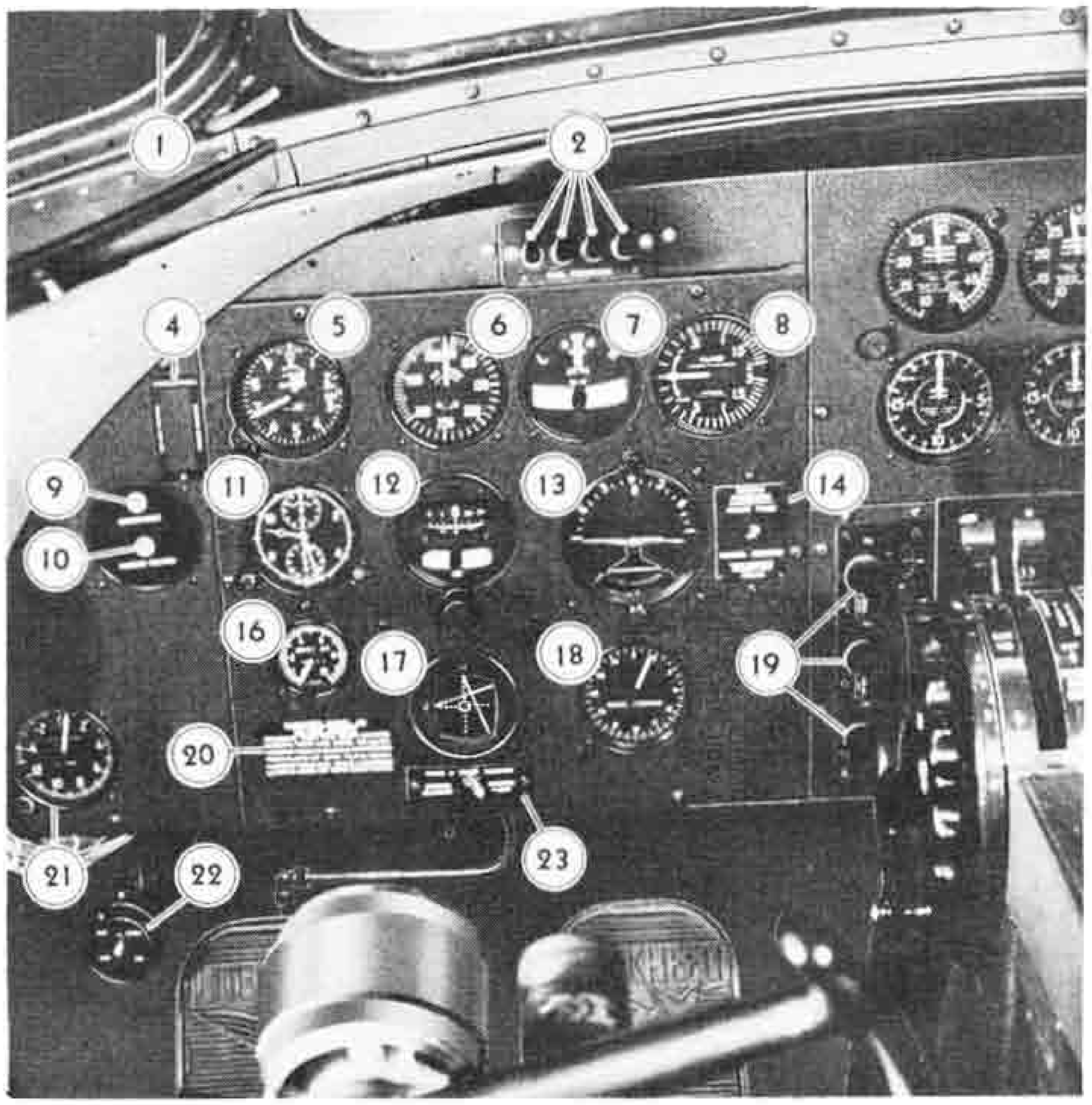
(4) Set aileron follow-up index (figure 34-5) to match bank index (figure 34-6) by turning aileron knob (figure 34-4).

(5) Set elevator follow-up index (figure 34-9) to match elevator alignment index (figure 34-14) by turning elevator knob (figure 34-8)

Engineer

a. At command of pilot, reduce manifold pressure and rpm to the cruising power.

b. Allow head temperatures to reduce to (or slightly below) 218°C (425°F) before closing cowl flaps. Adjust cowl flaps to maintain desired temperatures.



1. Sliding window (Open).
2. Fuel pressure warning lights.
3. (Deleted).
4. Airspeed correction card holder.
5. Altimeter.
6. Airspeed indicator.
7. Turn and bank indicator.
8. Rate of climb indicator.
9. Pilot's interphone call light.
10. Marker beacon indicator light.
11. Clock.
12. Direction indicator.
13. Gyro horizon.
14. Static pressure selector valve.
15. (Deleted).
16. Vacuum system suction gage.
17. Blind landing indicator.
18. Radio compass bearing indicator.
19. Automatic pilot speed control knobs.
20. Airspeed limitation placard.
21. Accelerometer.
22. Pilot's ventilating air valve.
23. Turn and bank vacuum selector valve.

Figure 35 — Pilot's Instrument Panel

Pilot

or the remote control for the elevator knob (figure 4-13) located on the pilot's control stand.

CAUTION: Do not align elevator follow-up index (figure 34-9) with horizon bar (figure 34-16) as relative movement between elevator alignment index (figure 34-14) and horizon bar is in opposite directions.

(6) Engage the automatic pilot slowly.

(7) To make course changes, rotate the rudder knob (figure 4-9) *slowly and smoothly*. If turning large amounts, set in bank with aileron knob (figure 34-4).

(8) Set the desired fore and aft attitude by rotating the elevator knob (figure 4-13).

CAUTION: Do not allow airplane to get too far out of trim. The automatic pilot can be overpowered by applying about twice the normal force on the controls.

e. If icing is likely to occur, watch ice detector located outside airplane just below side window. At the first signs of ice:

Co-Pilot

DON'T TRUST THE AUTOMATIC PILOT TOO FAR!

e. At command of pilot:

Engineer

c. Set mixture controls (figure 5-21) to CRUISE LEAN if allowable. Refer to the Specific Engine Flight chart in Section III.

d. When possible, obtain the desired cruising power in low blower. The high blower fuel consumption is slightly greater at equal powers.

e. Turn carburetor heat (figure 5-18) HOT at the first signs of carburetor ice.

NOTE: Use carburetor heat only when necessary to prevent carburetor ice.

Pilot	*Co-Pilot*	*Engineer*
(1) Instruct co-pilot to turn ON propeller anti-icer and if necessary the carburetor anti-icer.	(1) Turn propeller anti-icer (figure 65-3) full ON for a few seconds to thoroughly wet the blades, then back off to conserve the fluid supply.	
(2) Turn wing and tail de-icer (figure 24-14) ON. Do not exceed 275 mph while de-icer boots are ON.	(2) Turn carburetor anti-icer (figure 65-8) ON if the carburetor heat is not effective. Approximately ten seconds operation is usually sufficient to clear carburetor ice.	
(3) Turn windshield wiper (figure 24-18), windshield fan (figure 24-19) and/or anti-icer (figure 24-20) ON if needed.		
(4) Turn pitot heaters (figure 24-17) ON.		
NOTE: When windshield anti-icer is used, flow to pitot tube and antenna masts is reduced.		*f.* After 15 minutes of flight, equalize quantity of fuel in all tanks, if necessary. Refer to Section II, paragraph 3.

13. GENERAL FLYING CHARACTERISTICS.

a. CONTROLLABILITY.—The hydraulic boost control system makes the airplane easily controllable by one man in all allowable maneuvers. Normal turns may be made with the use of ailerons alone and satisfactory turns may be made with rudders alone although the resulting yaw may be unpleasant to the rear passengers. The airplane is controllable and handles well at low speeds down to and including the stall. Refer to Section IV, paragraph 6 for discussion of controllability when the control boost system has failed.

b. STABILITY. — The airplane has good stability characteristics. It is stable at all approved center of gravity positions 18% to 32% gear down.

c. TRIM CHARACTERISTICS.—Rudder and aileron trim tabs normally require adjustment only during partial engine failure. Elevator trim tabs require the normal small adjustments with changes in power, airspeed, and center of gravity position. There is little or no change in elevator trim up to approximately 60% flap extension. From 60% to 100% flaps the trim tabs should be adjusted slightly to hold the nose up.

d. CHANGING POWER IN FLIGHT.

(1) TO INCREASE POWER.

(a) Mixture (figure 5-21) AUTO RICH if maximum cruising power is to be exceeded (see Specific Engine Flight Chart in Section III).

(b) Propeller governor switches (figure 5-26). Hold in INCREASE until new rpm is reached. Speed changes approximately 100 rpm per second.

(c) Throttles (figure 5-14) to the new manifold pressure.

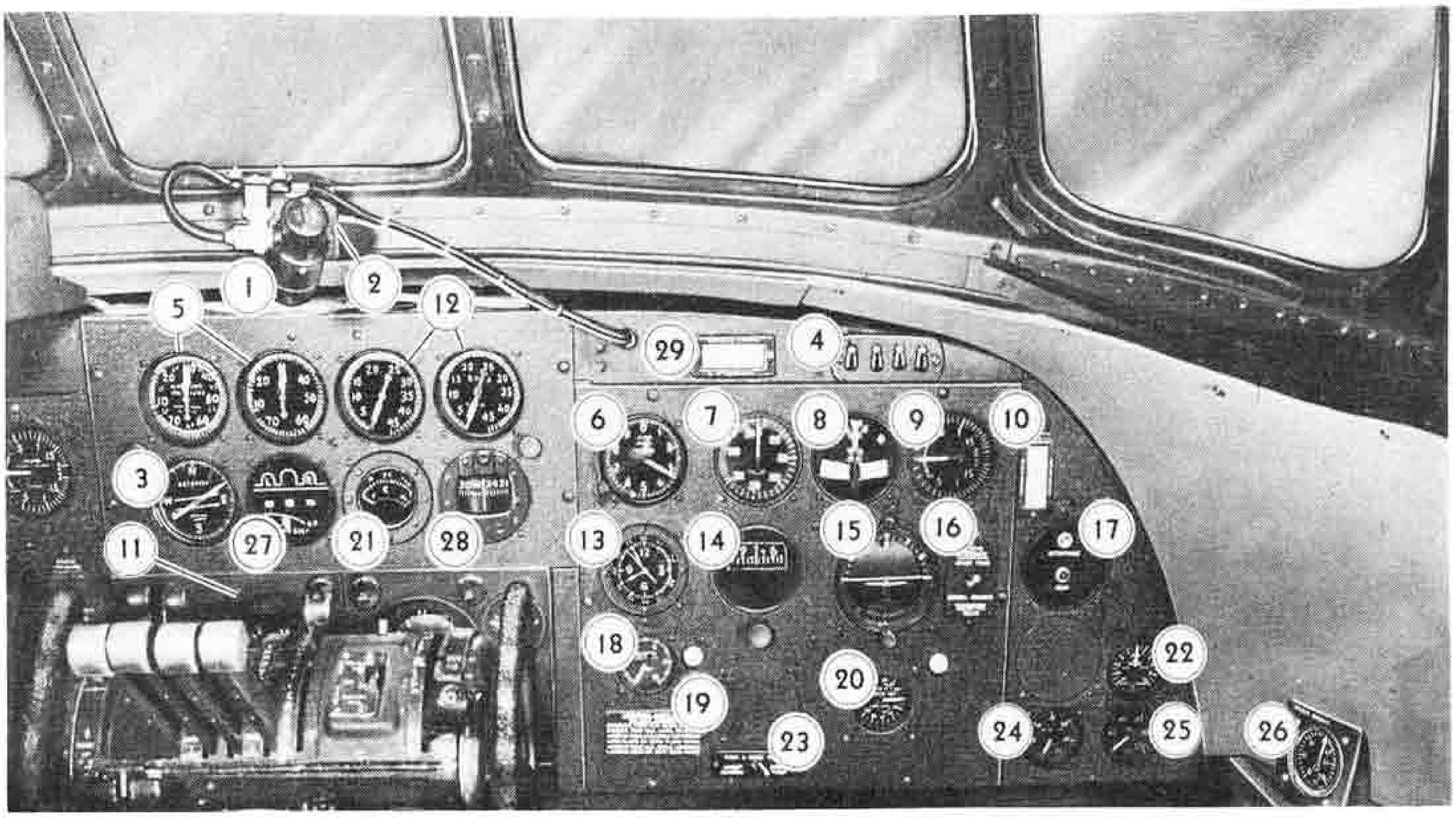
(2) TO DECREASE POWER.

(a) Throttles (figure 5-14) to the new manifold pressure.

(b) Propeller governor switches (figure 5-26). Hold in DECREASE until new rpm is reached.

(c) Re-adjust throttles if necessary.

(d) Mixture (figure 5-21) CRUISE LEAN if permissible.



1. Center instrument light.
2. Nacelle master fire warning light.
3. Remote compass indicator.
4. Hydraulic pump pressure warning lights.
5. Manifold pressure gages.
6. Altimeter.
7. Airspeed indicator.
8. Turn and bank indicator.
9. Rate of climb indicator.
10. Airspeed correction card holder.
11. Automatic pilot.
12. Tachometers.
13. Clock.
14. Direction indicator.
15. Gyro horizon.
16. Static pressure selector valve.
17. Interphone call light and cabin door light.
18. Vacuum system suction gage.
19. Airspeed limitation placard.
20. Elevator tab position indicator.
21. Free air temperature gage.
22. Wing de-icer gage.
23. Turn and bank vacuum selector valve.
24. Primary hydraulic system pressure gage.
25. Automatic pilot oil pressure gage.
26. Emergency brake hydraulic pressure gage.
27. Landing gear and flap position indicator.
28. Magnetic compass.
29. Compass correction card holder.

Figure 36 — Co-pilot's Instrument Panel

e. SUPERCHARGER OPERATION.

NOTE

The clutch mechanism for two speed blower operation has not been developed at time of writing, consequently no special limitations or instructions can be given at this time. The following instructions are generally applicable to the operation of any two speed blower. These instructions will be revised when complete information is available. Early airplanes are not equipped with two speed blowers.

(1) SHIFTING FROM *LOW* TO *HIGH* BLOWER.

(a) Partially close throttle (figure 5-14) so that the desired high blower manifold pressure will not be exceeded.

(b) Hold propeller governor switch (figure 5-26) to DECREASE to obtain 1500 to 1800 engine rpm.

(c) Set mixture control (figure 5-21) to AUTO RICH.

(d) Move supercharger control (figure 5-20) rapidly from LOW position to HIGH position and lock.

(e) Hold propeller governor switch to INCREASE to obtain desired rpm.

(f) Readjust throttle if necessary.

(g) Set mixture control to CRUISE LEAN if permissible.

(2) SHIFTING FROM *HIGH* TO *LOW* BLOWER.

(a) Set mixture control (figure 5-21) to AUTO RICH.

(b) Move supercharger control (figure 5-20) rapidly to LOW position and lock.

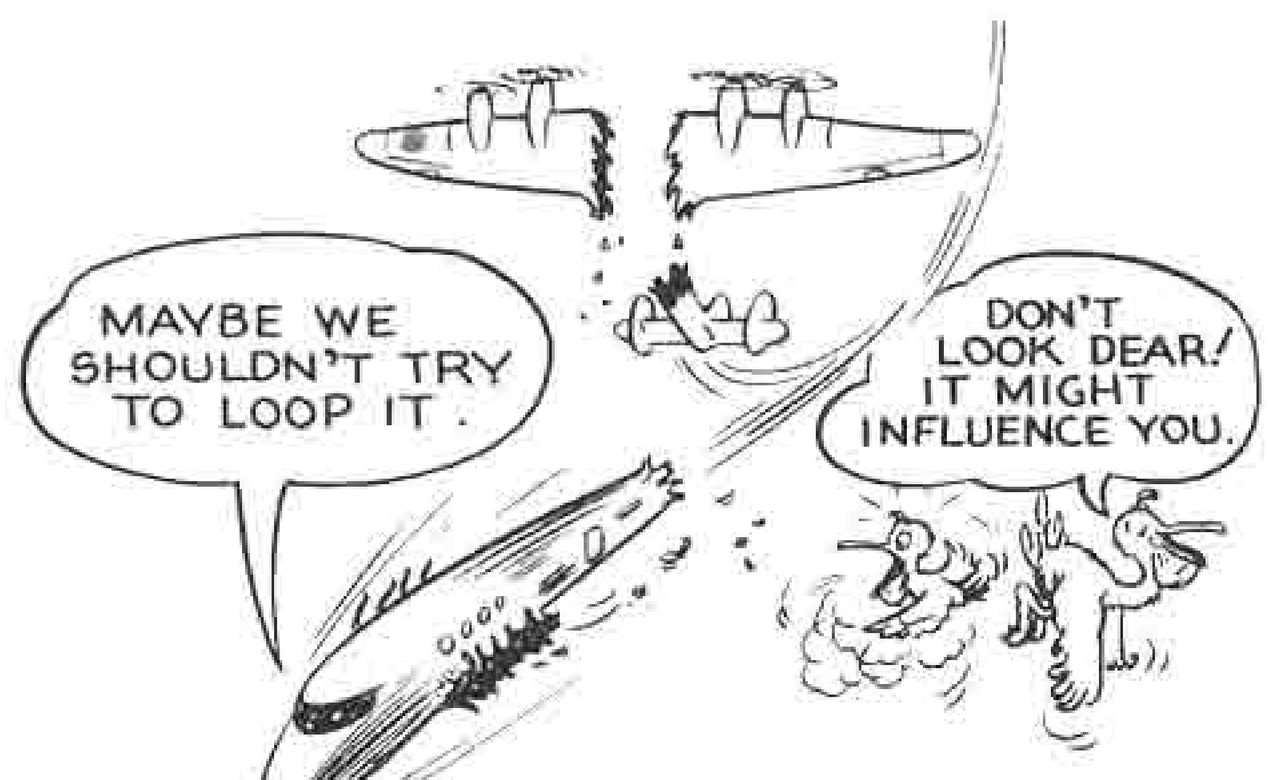
(c) Readjust rpm setting as necessary to obtain the desired power.

(d) Readjust throttle to obtain desired manifold pressure.

(e) Set mixture control to CRUISE LEAN if permissible.

(3) Blower ratio changes should not be made at intervals of less than five minutes in order to provide opportunity for dissipation of heat generated during clutch engagement.

(4) Since, for the same power, fuel economy is worse in high blower do not use high blower if the required power is available in low blower.



THIS IS NOT AN ACROBATIC AIRPLANE!

14. MANEUVERS PROHIBITED.

a. All acrobatics, spins, and banks in excess of 60 degrees.

b. Do not exceed the following accelerometer (figure 35-21) readings in banks or pullouts from a dive.

Gross Weight	*Maximum Allowable Accelerometer Reading*	
	PULLOUT	*PUSHOVER*
86,250	2.5	1.1
82,000	2.6	1.2
72,000	3.0	1.3
62,000	3.5	1.4

15. STALLS.

a. The stalling characteristics of this airplane are good. Sufficient warning is given of all stalls in the form of buffeting which first occurs five to ten mph above the stalling speed. The warning is given sooner with flaps up than with flaps down. There is little or no tendency to roll in any stall either with flaps and gear up or down or with power on or off. Aileron control is available at all speeds down to and including the stall. When the airplane is stalled it "mushes" straight forward. Occasionally a slight tendency to roll will be noticed. Use rudders to stop the roll. The nose will drop slightly and then come up again if an attempt is made to hold the airplane in the stall.

b. The approximate ship indicated stalling speeds with power off are as follows:

GROSS WEIGHT	*STALLING SPEEDS*	
	Gear and Flaps Down	*Gear Down and Flaps Up*
57,000	69	88
67,500	74	96

16. SPINS.

a. The airplane normally shows no tendency to spin from a stall or slow steeply banked turns and should not be intentionally forced into a spin under any condition. The airplane was not designed for the loads imposed on the structure during spin conditions, and structural failure will result if a spin is attempted.

17. ACROBATICS.

a. All acrobatics are strictly prohibited.

18. DIVING.

a. Due to the aerodynamic cleanliness of this airplane it picks up speed very rapidly in a dive and only very shallow diving angles are permissible without exceeding the maximum permissible indicated diving speed which is 364 mph (320 mph when de-icer boots are installed).

b. Trim changes experienced in a dive are quite normal.

c. Control forces are light considering the size of the airplane, hence, reasonable caution should be exercised in pulling out of a dive or in high speed maneuvers so as not to exceed allowable load factors.

Pilot | *Co-Pilot* | *Engineer*

19. NIGHT FLYING.

Pilot

a. Turn ON navigation, courtesy, instrument, and chart lights as mentioned in Section II, paragraph 2, *b.*

b. Operate recognition lights (figure 4-12) as required.

c. Pull landing flare releases (figure 24-4) located on pilot's overhead panel if flares are required. Two parachute flares are installed.

Engineer

a. Turn on instrument and desk lights as mentioned in Section II, paragraph 2, *b.*

20. APPROACH AND LANDING.

a. DESCENT.

Pilot

(1) Set altimeter (figure 35-5) to Kollsman reading of field.

(2) If cabin pressure controls are adjusted by the flight engineer, descent may be made at any rate not exceeding value calculated by flight engineer.

(a) If cabin is not pressurized do not exceed a rate of 400 to 600 ft min. for passenger comfort.

(3) Adjust automatic pilot for descent or disengage it. If the automatic pilot is disengaged and the airplane has a separate automatic pilot hydraulic system, turn OFF the pump motor.

(4) Never exceed an indicated air speed of 364 mph (320 mph with de-icer boots installed) in a glide.

NOTE: In cold weather, avoid overcooling the engines by descending with gear down, power on and at reduced airspeeds.

(5) Move throttles frequently to clear the engines and prevent the throttles from freezing if icing conditions exist.

(6) Notify radio operator to retract trailing antenna.

Co-Pilot

(1) Set altimeter (figure 36-6) to Kollsman reading of field.

(5) Operate carburetor anti-icers if there is any sign of carburetor iceing.

Engineer

(1) Set cabin altimeter (figure 66-3) to Kollsman reading of field.

(2) If cabin is pressurized, set the vertical speed knob (figure 66-7) as desired (400 to 600 ft. min. recommended) and set the pressure altitude knob (figure 66-6) to the Kollsman reading of field.

(a) Calculate maximum allowable rate of airplane descent. Refer to Section VII, paragraph 1, *b*, (3), *(c)*.

(3) Do not exceed cruising powers.

(4) CLOSE cowl flaps to maintain normal cylinder head temperatures.

(5) If danger of carburetor ice exists, set carburetor heat controls to HOT.

Pilot	*Co-Pilot*	*Engineer*
b. APPROACH.		
(1) Contact control tower by radio for landing clearance. **WARNING:** Do not land when there is more than 900 U. S. gallons (749 Imp. gallons) of fuel in either outboard tank.	(1) Hydraulic pressure 1500 to 1700 lb/sq in. **NOTE:** If hydraulic system has failed refer to Section IV, for emergency operation of flight controls, landing gear, flaps and brakes.	(1) Mixture—AUTO RICH.
	(2) Emergency brake pressure 1500 lb/sq in. **NOTE:** If emergency brake pressure is low, move brake selector lever (figure 4-16) to EMER for a few seconds to bring up the pressure. Return the brake lever to NORMAL.	(2) Supercharger—LOW.
(3) Disengage automatic pilot, and turn OFF pump motor if the airplane has a separate automatic pilot hydraulic system.	(3) Check to see that the hydraulic hand pump selector valve (figure 19-3) is FORWARD so that the brake accumulator may be pumped up in an emergency.	(3) Set fuel shut-off valves (figure 5-22) and fuel cross transfer valves (figure 32-4) to insure plenty of fuel for emergency takeoff. **NOTE:** If all tanks contain at least 50 gallons, set all fuel shut-off valves ON and all fuel cross transfer valves OFF.
(4) Reduce airspeed below 146 mph and direct co-pilot to extend landing gear.	(4) Extend landing gear when directed by pilot and leave the lever in the DOWN position. Note that landing gear indicator (figure 36-17) shows gear down and locked and warning lights (figure 4-15) are ON (green). If gear is not down and locked, the warning horn will sound if one throttle on each side of the airplane is closed.	
(5) Direct co-pilot to lower flaps 40%.	(5) Lower flaps as directed by pilot.	
(6) Adjust trim tabs as required, using electrical system.	(6) Turn wing de-icers OFF if operating.	
(7) Approach at 120 mph, power on or off; and when landing is assured, direct co-pilot to lower flaps completely.	(7) Lower flaps completely at command of pilot.	
	(8) Move the rudder and elevator booster emergency control switches to ON.	

Pilot | **Co-Pilot** | **Engineer**

c. LANDING.

Pilot: (1) Order co-pilot to call off airspeeds as required.

Co-Pilot: (1) Call off airspeeds when directed by pilot.

Engineer: (1) During final stages of approach set the propeller governors for maximum rpm.

Pilot: (2) Set the main wheels down first (approximately 100 mph) and hold the nose wheel off the ground until the speed reduces to 70 mph. Ease nose wheel to the ground and apply brakes smoothly and evenly. Do not apply brakes hard until nose wheel is on the ground. At all normal center of gravity positions the nose wheel can be kept off the ground with such ease that a deliberate attempt must be made to get the nosewheel on the ground soon enough so that brakes can be applied.

Pilot: (3) Order wing flaps raised as soon as the ship is practically stopped.

Co-Pilot: (3) Raise wing flaps when directed by pilot.

Engineer: (3) Set cowl flaps full open.

Pilot: (4) When taxiing is completed, place chocks under wheels, but do not set the parking brakes until they are cool. (Cool enough to touch.)

Co-Pilot: (4) Move the elevator and rudder booster emergency control switches to OFF.

d. APPROACH AND LANDING WITH PARTIAL ENGINE FAILURE.

Pilot: (1) With three engines operating or with one engine on each side operating land in the normal manner.

Co-Pilot: (1) Follow through on the controls with the pilot and be prepared to assist if necessary.

Pilot: (2) With only one engine or with two engines on one side operating, it is not possible to maintain altitude with both gear and flaps extended. Directional control is impossible below 125 mph with two engines on one side operating at take-off power and the other two propellers feathered.

Engineer: (2) Watch carefully for signs of carburetor icing or other irregular operation and take corrective measures if necessary.

Pilot	*Co-Pilot*	*Engineer*
NOTE: If engines number 3 and 4 are dead, the emergency landing gear extension, flap extension and brake systems must be used. If engine number 1 and/or number 2 are dead it may be possible to use the normal landing gear and flap extension systems if no maneuvers are attempted so that the control boosters do not demand hydraulic power.		
(3) Direct co-pilot to lower landing gear.	(3) Lower landing gear at command of pilot. Use emergency extension system if necessary.	
(4) Direct co-pilot to lower flaps 50%.	(4) Lower flaps at command of pilot. Direct another crew member to operate emergency flap extension system if necessary.	
(5) Get in good position for a normal approach. Crank the rudder tabs back to zero. Regulate glide path with power from live engines and remaining flap travel.	(5) Stand by to lower flaps at command of pilot.	
(6) When approach is assured, have the co-pilot extend flaps completely if hydraulic operation is still available. Close throttles and proceed with a normal landing.	(6) Lower flaps completely if directed by pilot.	

e. CROSS WIND LANDING.

Pilot	*Co-Pilot*	*Engineer*
(1) Make approach slightly lower and longer than normal in order to allow time to establish a heading that gives a ground track in line with the runway.	(1) Same as normal landing.	(1) Same as normal landing.
(2) Keep the wings level. No skidding necessary.		
(3) Just prior to ground contact, align airplane with runway.		
(4) Land with nose wheel close to ground and immediately after landing, lower nose wheel to ground and apply brakes to decrease the roll.		

Pilot | **Co-Pilot** | **Engineer**

Pilot

NOTE: This procedure will make it easier to keep the airplane from turning into the wind.

f. EMERGENCY TAKE-OFF IF LANDING IS NOT COMPLETED.

Pilot

(1) Open throttles to take-off manifold pressure. Be prepared to counteract a strong nose-up tendency caused by application of power.

(2) As soon as airspeed is above 120 mph and all obstacles are cleared, direct co-pilot to raise flaps. Keep airspeed under 146 mph until flaps are completely retracted.

Co-Pilot

(1) Raise landing gear.

(2) Retract flaps as directed by pilot. Flaps retract slowly enough so that loss of lift is not dangerous.

Engineer

(1) Open cowl flaps.

(2) Adjust power as directed by pilot.

21. STOPPING THE ENGINES.

Co-Pilot

a. Move brake lever to EMER and check for 1700 lb/sq in. emergency brake pressure.

d. When engines stop turning, move individual and master ignition switches to OFF.

Engineer

a. OPEN the cowl flaps and idle engines at 600 to 800 rpm until cylinder head temperatures are below 149° C (300° F).

b. Stop engine in normal manner. Increase engine speed to 1000 to 1200 rpm and hold for one-half minute to obtain optimum scavenging of engine oil and pull mixture control to OFF.

c. If air temperature is expected to be below 5° C (40° F.) at next start, operate oil dilution system in accordance with procedure given in Section IX, paragraph 6.

22. BEFORE LEAVING PILOT'S COMPARTMENT.

Pilot

a. Leave control boost levers (figure 4-1) ON to act as a gust lock.

b. All radio equipment OFF.

c. Set parking brake or have wheels chocked. Moor the airplane if weather conditions make it advisable (refer to figure 37).

d. If abandoning airplane in enemy territory, press the IFF radio destructor buttons (figure 63-26) and use the incendiary grenade stowed under the pilot's seat.

Co-Pilot

a. Turn all switches OFF.

c. Check brake selector lever to EMERGENCY.

Engineer

a. Turn all valves and switches OFF.

b. Cowl flaps may be closed when cylinder head temperatures are below 120° C (248° F).

c. Have landing gear pins and pitot tube covers installed before leaving vicinity of airplane.

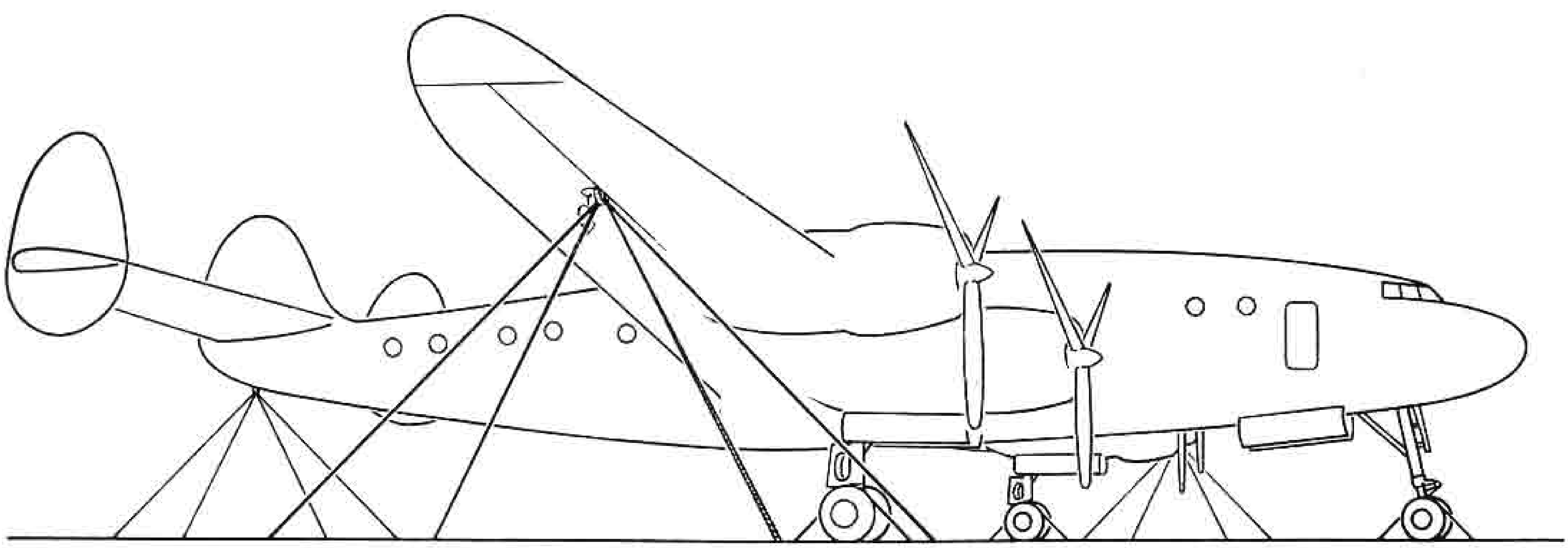
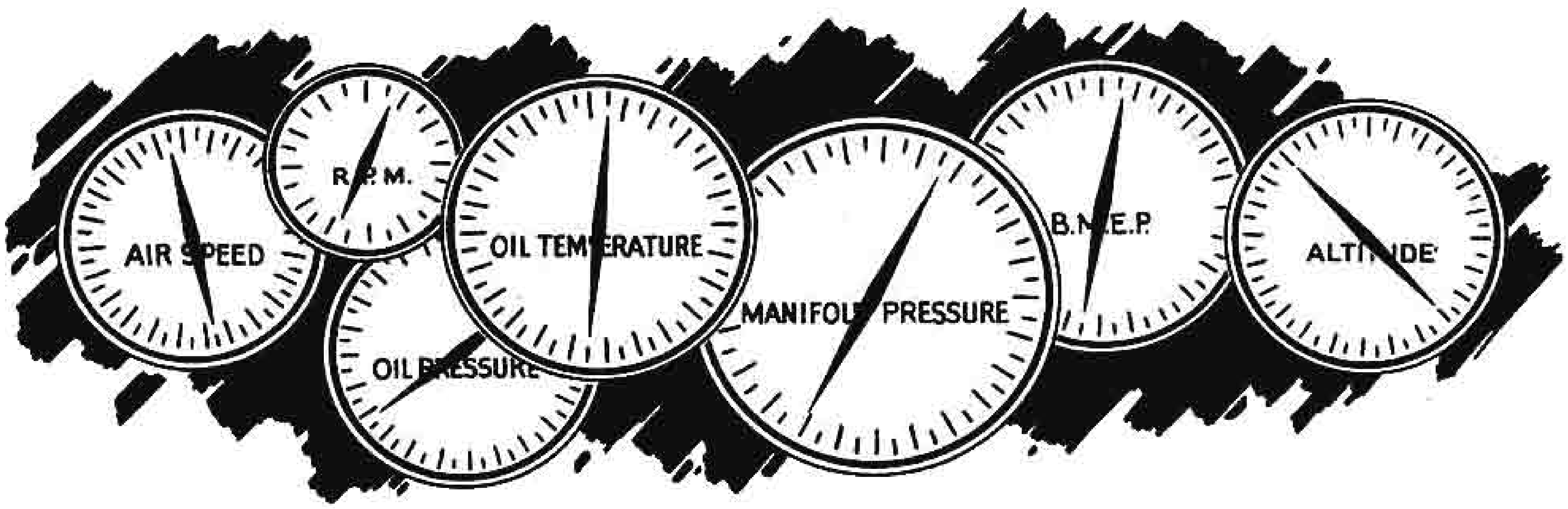


Figure 37 — Mooring Diagram

SECTION III



Operating Data

1. AIRSPEED LIMITATIONS.

Condition	*Maximum Allowable Indicated Airspeed*
Diving (if de-icer boots are not installed)	364 mph
De-icer boots operating	275 mph
De-icer boots not operating	320 mph
Level flight—72,000 lbs gross weight	310 mph
Level flight—82,000 lbs gross weight	285 mph
Landing gear extended	146 mph
Flaps extended	146 mph
Retracting flaps from beyond 85% extension with emergency system (airplanes AC 43-10309 and AC 43-10310 only)	120 mph
Landing lights extended	140 mph
Dumping fuel	160 mph

2. AIRSPEED CORRECTION TABLE.

The following corrections are for pitot location only and do not include instrument error.

SHIP INDI-CATED AIRSPEED	*CORRECTED AIRSPEEDS*			
	Weight — 86,250 lb		*Weight — 55,000 lb*	
	Gear & Flaps Up	*Gear & Flaps Down*	*Gear & Flaps Up*	*Gear & Flaps Down*
80	...	...	...	82
90	...	93	91	92
100	...	103	102	101
120	122	122	122	120
140	143	141	141	138
160	162	...	160	...
180	181	...	180	...
200	201	...	199	...
220	220	...	218	...
240	239	...	238	...
260	258	...	257	...
280	278	...	277	...
300	397	...	296	...
320	316	...	316	...

3. BALANCE COMPUTER DESIGNATIONS.

Cox and Stevens load adjuster or Librascope.

FORM ASC-512A

AIRPLANE MODELS: C-69

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS: R-3350-35

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	REAR OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F	FRONT OIL PRESSURE (LB/SQ. IN.)	
DESIRED	16-18	70	85	185	—	—	40	
MAXIMUM	19	80	95	203	—	—	60	
MINIMUM	16	60	40	105	—	—	30	
IDLING	15	25	—	—	—	—	—	

MAX. PERMISSIBLE DIVING RPM: 3000

CONDITION	ALLOWABLE OIL CONSUMPTION	
NORMAL RATED (MAX. CONT.)	27 U.S.QT/HR	45 IMP.PT/HR
MAX. CRUISE	14 U.S.QT/HR	23 IMP.PT/HR
MIN. SPECIFIC	U.S.QT/HR	IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1120 or 1100A

SUPERCHARGER TYPE: GEAR-DRIVEN SINGLE-STAGE (SINGLE-SPEED)

FUEL GRADE: 100/130 Spec. No. AN-F-28

OPERATING CONDITION	RPM	MANI-FOLD PRESS.	BMEP	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.	FUEL FLOW (GAL/HR/ENG.) IMP.	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	2800	46.0	186	2200		SEA LEVEL			AUTO RICH	288	240	260	500	5
WAR EMERGENCY														
MILITARY	2600	45.0	200	2200	5000*				AUTO RICH	288	240	260	500	5
NORMAL RATED (MAX. CONT.)	2400	41.2	197	2000	5000*				AUTO RICH	248	206	232	450	NO LIMIT
MAXIMUM CRUISE	2200	29.0	140	1300	12500*				AUTO LEAN	103	86	232	450	NO LIMIT
MINIMUM SPECIFIC CONSUMPTION	1600	27.0	125	850	9500*				AUTO LEAN	65	54	232	450	NO LIMIT
	1400	30.0	132	780	5000*				AUTO LEAN	59	49	232	450	NO LIMIT
	1300	27.5	119	700	7500*				AUTO LEAN	54	45	232	450	NO LIMIT

REMARKS: *ENGINE MAY BE EQUIPPED WITH –13 OR –35 SUPERCHARGER IMPELLERS. FOR THE SAME THROTTLE POSITIONS WHEN OPERATING NEAR FULL THROTTLE, THE –13 IMPELLER WILL GIVE 1 TO 3 INCHES HG HIGHER MANIFOLD PRESSURE THAN THE –35 IMPELLER. THE CRITICAL ALTITUDES GIVEN ON THIS CHART ARE BASED ON THE –35 IMPELLER. ON AIRPLANES WITH ENGINES CONTAINING BOTH TYPES OF IMPELLERS, THE THROTTLES SHOULD BE ADJUSTED TO OBTAIN THE SAME BMEP ON ALL ENGINES, PROVIDED THE MANIFOLD PRESSURE LIMITS ARE NOT EXCEEDED. (THE TYPE OF IMPELLER INSTALLED MAY BE DETERMINED FROM WRIGHT.)

FORM ASC-512A

AIRPLANE MODELS C-69

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS R-3350-35

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	REAR OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F	FRONT OIL PRESSURE (LB/SQ. IN.)	
DESIRED	16-18	70	85	185	—	—	40	
MAXIMUM	19	80	95	203	—	—	60	
MINIMUM	16	60	40	105	—	—	30	
IDLING	15	25	—	—	—	—	—	

MAX. PERMISSIBLE DIVING RPM: 3000

CONDITION	ALLOWABLE OIL CONSUMPTION
NORMAL RATED (MAX. CONT.)	.27 U.S.QT/HR .45 IMP.PT/HR
MAX. CRUISE	.14 U.S.QT/HR .23 IMP.PT/HR
MIN. SPECIFIC	.... U.S.QT/HR .... IMP.PT/HR

OIL GRADE: (S) 1120 (W) 1120 or 1100A

SUPERCHARGER TYPE: GEAR-DRIVEN SINGLE-STAGE (SINGLE-SPEED)

FUEL GRADE: 100/130 Spec. No. AN-F-28

OPERATING CONDITION	RPM	MANI-FOLD PRESS.	BMEP	HORSE-POWER	CRITICAL ALTITUDE WITH RAM	CRITICAL ALTITUDE NO RAM	BLOWER	USE LOW BLOWER BELOW:	MIXTURE CONTROL POSITION	FUEL FLOW (GAL/HR/ENG.) U.S.	FUEL FLOW IMP.	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	2800	46.0	186	2200		SEA LEVEL			AUTO RICH	288	240	260	500	5
WAR EMERGENCY														
MILITARY	2600	45.0	200	2200	5000*				AUTO RICH	288	240	260	500	5
NORMAL RATED (MAX. CONT.)	2400	41.2	197	2000	5000*				AUTO RICH	248	206	232	450	NO LIMIT
MAXIMUM CRUISE	2200	29.0	140	1300	12500*				AUTO LEAN	103	86	232	450	NO LIMIT
MINIMUM SPECIFIC CONSUMPTION	1600	27.0	125	850	9500*				AUTO LEAN	65	54	232	450	NO LIMIT
	1400	30.0	132	780	5000*				AUTO LEAN	59	49	232	450	NO LIMIT
	1300	27.5	119	700	7500*				AUTO LEAN	54	45	232	450	NO LIMIT

REMARKS: *ENGINE MAY BE EQUIPPED WITH —13 OR —35 SUPERCHARGER IMPELLERS. FOR THE SAME THROTTLE POSITIONS WHEN OPERATING NEAR FULL THROTTLE, THE —13 IMPELLER WILL GIVE 1 TO 3 INCHES HG HIGHER MANIFOLD PRESSURE THAN THE —35 IMPELLER. THE CRITICAL ALTITUDES GIVEN ON THIS CHART ARE BASED ON THE —35 IMPELLER. ON AIRPLANES WITH ENGINES CONTAINING BOTH TYPES OF IMPELLERS, THE THROTTLES SHOULD BE ADJUSTED TO OBTAIN THE SAME BMEP ON ALL ENGINES, PROVIDED THE MANIFOLD PRESSURE LIMITS ARE NOT EXCEEDED. (THE TYPE OF IMPELLER INSTALLED MAY BE DETERMINED FROM WRIGHT.)

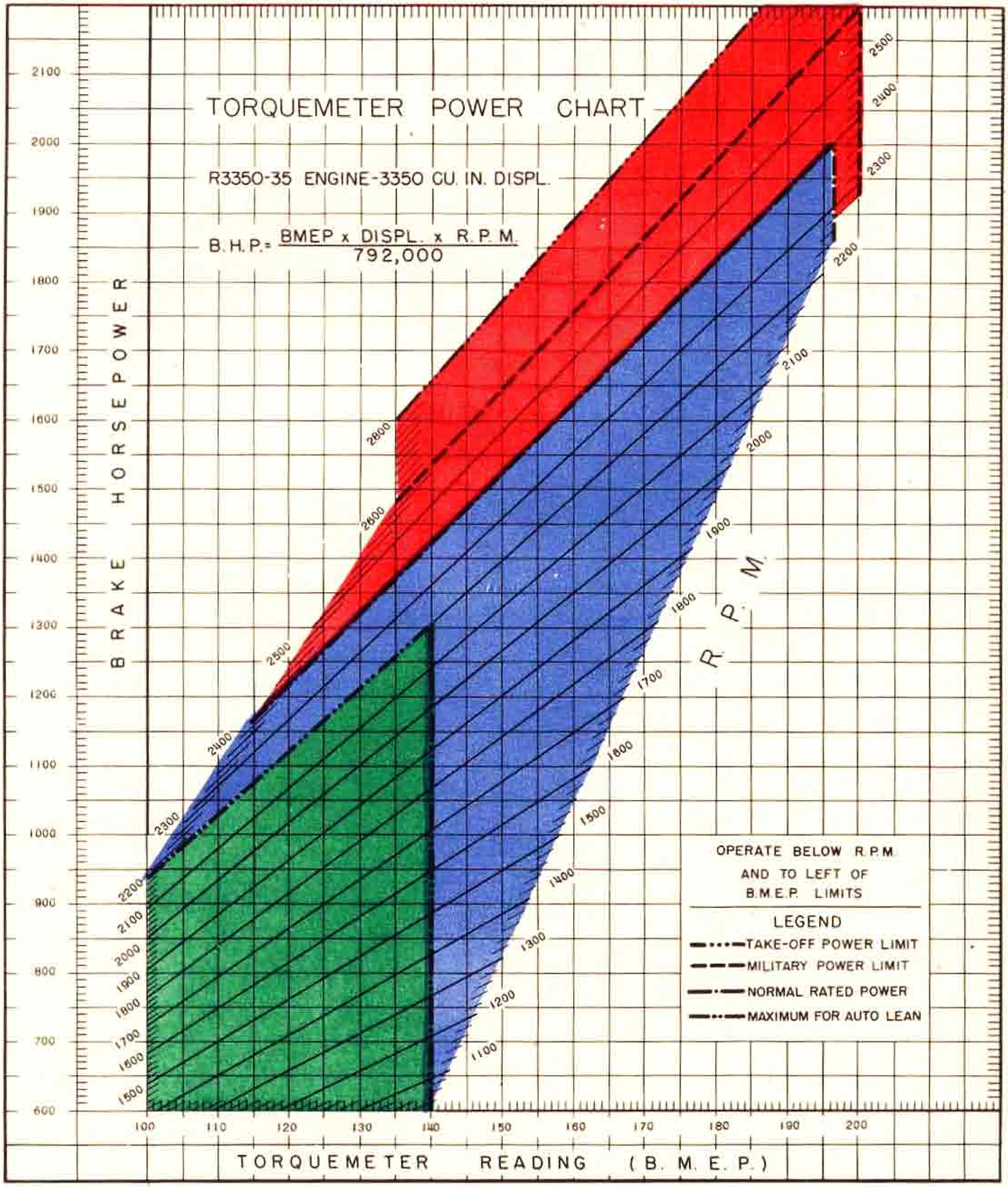

TORQUEMETER POWER CHART
R3350-35 ENGINE-3350 CU. IN. DISPL.
B.H.P.= BMEP x DISPL. x R.P.M. / 792,000
BRAKE HORSEPOWER
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
TORQUEMETER READING (B. M. E. P.)
100
110
120
130
140
150
160
170
180
190
200
R. P. M.
OPERATE BELOW R.P.M. AND TO LEFT OF B.M.E.P. LIMITS
LEGEND
TAKE-OFF POWER LIMIT
MILITARY POWER LIMIT
NORMAL RATED POWER
MAXIMUM FOR AUTO LEAN

Figure 38

SECTION IV

NOW BOYS, LETS NOT GET EXCITED !

Emergency Operating Instructions

1. VACUUM SYSTEM FAILURE.

a. VACUUM SYSTEM WARNING.—Vacuum gages on the pilot's and co-pilot's instrument panels should read between four and five inches of Hg for efficient operation of the gyro instruments. Loss of vacuum by any pump will be indicated by its corresponding vacuum warning light (purple) (figure 6-21) on the flight engineer's upper panel.

(1) If a light glows, notify the pilot. The pilot should turn the vacuum pump selector valve (figure 63-30) to insure that the gyro instruments are operating on two good pumps.

(2) If two lights glow (one on each side) notify the pilot. The pilot will isolate either his or the co-pilot's instruments by means of the instrument group selector valve (figure 63-31) if the suction gage reads lower than four in. of Hg.

b. TURN AND BANK VACUUM.—Check whichever vacuum gage is in use (figure 35-16 or figure 36-18) for four to five inches of Hg. If less, put the corresponding turn and bank vacuum switch (figure 35-23 or figure 36-23) on ENGINE BLOWER. The pilot's turn and bank indicator will then draw vacuum from the cabin supercharger on engine No. 1; the co-pilot's from the cabin supercharger on engine No. 4.

c. DE-ICER BOOT SHUT-OFF.—If, at any time, instrument vacuum cannot be maintained, turn the de-icer boot suction valve under the navigator's table (figure 43-22) OFF, a boot might be leaking. If the de-icer boot suction valve is turned OFF watch de-icers and do not attain high airspeeds as the boots might inflate.

2. HYDRAULIC SYSTEM FAILURE.

a. LOW PRESSURE WARNING.—Hydraulic pressure (blue) warning lights (figure 6-24 and figure 36-4) will glow at about 1325 lb sq in. Check the gage (figure 36-24).

NOTE

When landing gear or flaps are operating, the hydraulic warning lights may glow.

b. TROUBLE SHOOTING.—On long distance operation it is advisable to carry an extra supply of hydraulic fluid. This may be used in the following manner to locate and isolate a hydraulic leak.

(1) If one hydraulic pressure warning light glows, turn off the supply to that pump by means of its corresponding hydraulic pump shut-off valve. (Figure 6-4.)

(2) If two lights on one side glow, turn off both pumps. The hydraulic fluid has been drained from that side of the hydraulic reservoir.

(a) If it is the primary side (pumps No. 1 and No. 2) pump hydraulic fluid from the emergency supply into the primary side of the hydraulic reservoir by means of the emergency filler pump (figure 39) until the quantity gage (figure 6-11) indicates fluid in the tank. Any crew member who is unoccupied can do this and another can signal him when enough fluid has entered the tank.

NOTE

The hydraulic reservoir is divided into two halves by a baffle plate. Since the hand pump delivers fluid to the side of the tank being used, it may take approximately 15 strokes or more to cause overflow into the other side. The

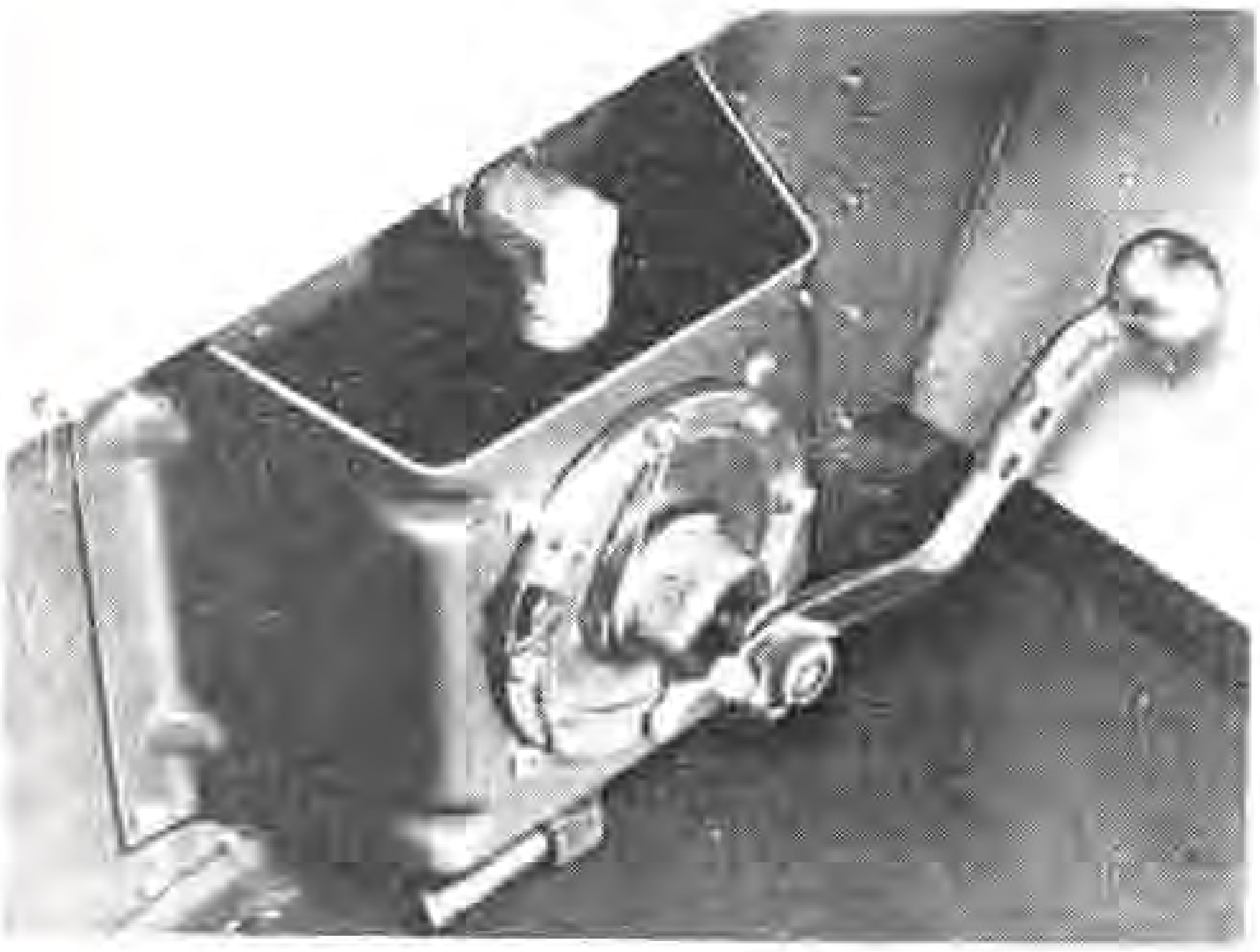


Figure 39 — Emergency Filler Pump

hydraulic fluid quantity gage (figure 6-11) is located on the primary side of the baffle plate. If the gage doesn't indicate after pumping in approximately $2\frac{1}{2}$ gallons, it is probable that the fluid is leaking out of the tank faster than it can be pumped in.

1. Watch the quantity gage. If it drops with both pumps off, the leak is in the suction line of either No. 1 or No. 2 pump (between the tank and the shut-off valve). Leave the pumps off entirely; the secondary system will supply pressure for control boost.

2. If the gage does not drop with the pumps off, turn on pump No. 1. If the gage still does not drop the leak is in the No. 2 pump line (between the pump shut-off solenoid valve and check valve).

3. If the gage drops on pump No. 1, turn it off and try pump No. 2. If the gage does not drop, leave as is. The leak is on the pressure side of pump No. 1 (between the pump shut-off solenoid valve and check valve). If the gage still drops, the leak is in the booster system (beyond the check valve).

4. Disengage and engage the control boosters (elevator, rudder and aileron) one at a time until the gage stops dropping. If the gage still drops, the leak cannot be isolated.

5. Inspect the rear cargo compartment for leaks.

(b) If it is the secondary side (pumps No. 3 and No. 4) pump hydraulic fluid from the emergency supply into the secondary side of the reservoir. Turn on pump No. 3 and wait for the pressure warning light to go out and stay out. If it does, leave as is. The leak is on the side of the No. 4 pump. If the light glows again, turn No. 3 pump off, pump more fluid into the reservoir and try again using No. 4 pump. If No. 4 light stays off, leave as is. The leak is on the side of the No. 3 pump (between the pump shut-off solenoid and check valve). If No. 4 light will not stay off, try the following, one at a time:

1. Automatic pilot (figure 4-6) OFF.

2. Cabin fan (figure 32-3) OFF.

3. Brake selector valve (figure 4-16) in EMERGENCY. (Assuming lever was in NORMAL position.)

4. If the above does not isolate the leak, turn the pumps OFF and prepare to use the emergency hand pump and emergency flaps on landing. If it is a slow leak, it may be desirable to save the pumps for landing gear operation as follows:

a. Pump 30 full cycles (60 strokes on double action pump) into the reservoir and turn ON the pumps for three seconds every thirty minutes. This should keep the pumps from freezing.

b. When ready to extend the landing gear, turn the pumps ON, put the landing gear lever down and pump fluid into the system until the landing gear is down and locked.

(3) If two lights on opposite side glow, turn OFF corresponding pumps.

(4) If three lights glow, turn OFF those pumps. The hydraulic fluid has been drained from the "two light" side of the reservoir. Investigate as in Paragraph 2, *b*, (2), *(a)*, or Paragraph 2, *b*, (2), *(b)* above.

(5) If all lights glow, turn OFF all pumps and use manual flight control as explained in Par. 6 below if necessary while trimming the airplane. Investigate as in Par. 2, *b*, (2), *(a)* and Par. 2, *b*, (2), *(b)* above.

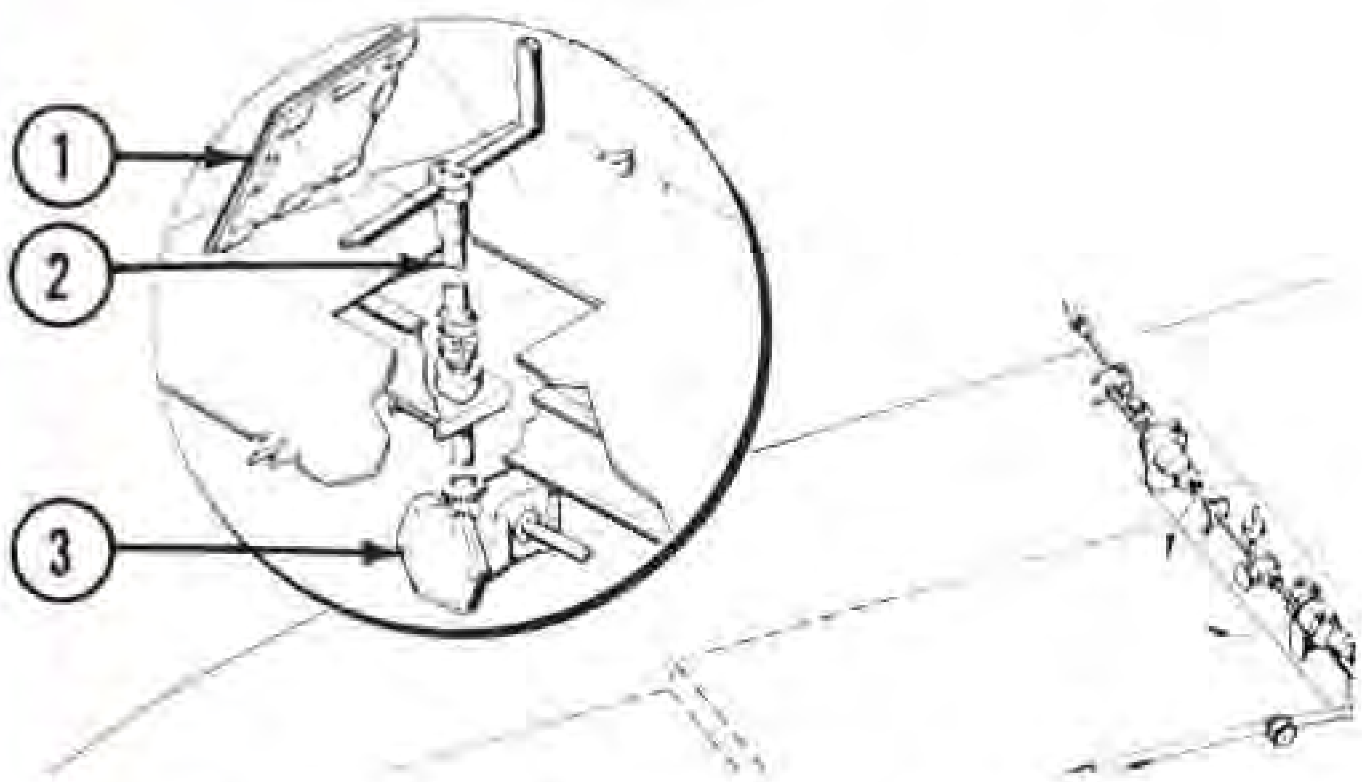


Figure 40—Emergency Flap Control

1. Emergency drive access panel.
2. Emergency flap drive handle.
3. Emergency drive unit.

3. EMERGENCY FLAP OPERATION.

a. The flaps are extended manually by means of the crank which is stowed on the rear wall of the navigator's compartment. The point of application of the crank is under the fifth row of seats from the front of the passenger compartment. Remove the floor panel, open the by-pass valve and apply the crank to the fitting provided. Approximately 600 turns are required to extend full flaps. Have a crew member relay signals from the pilot for the desired amount of flap travel.

CAUTION

Do not extend flaps above 146 mph. When landing with emergency flaps, do not exceed 80 percent extension until landing is assured as it will be impossible to retract the flaps from beyond 80 percent at 120 mph or more.

4. EMERGENCY BRAKE OPERATION.

a. If the emergency brake accumulators were charged from the main hydraulic system pressure before hydraulic failure occurred, no further action is necessary except to place the brake selector valve (figure 4-16) in the EMERGENCY position for landing. If not, put the lever in emergency position and check that the hand pump selector valve lever (figure 19-3) is FORWARD. Pump until the emergency brake pressure gage (figure 19-1) reads about 1700 lb/sq in. This will allow five or six complete applications of the brakes. If more is needed, the co-pilot should continue pumping during the landing run.

NOTE

The emergency hand pump draws fluid from the primary side of the hydraulic system reservoir when used to operate the brakes. If the hydraulic pressure warning lights indicate that the fluid has been drained from this side (as explained in Par. 2 of this section) pump in fluid from the emergency supply.

5. EMERGENCY LANDING GEAR OPERATION.

a. Turn the two right-hand hydraulic pump shut-off valves (figure 6-4) OFF. Set the landing gear control (figure 4-19) to DOWN. Pull the hand pump selector valve lever (figure 19-3) BACK and pump until the landing gear lights (figure 4-15) glow. It will require approximately 5 to 6 minutes at 60 cycles per minute to pump the landing gear down with the emergency hand pump.

NOTE

The emergency hand pump draws fluid from a separate emergency hydraulic reservoir when used to operate the landing gear.

6. FAILURE OF CONTROL SURFACE BOOSTER.

a. Failure of the control surface boost system will be noticed by a stiffening of the controls. If the elevator or rudder booster system fails, move the emergency control switch (figure 4-14 or -20) for the affected system to ON. Do not disengage the booster unless the emergency system fails. If the aileron booster system fails disengage it.

b. To disengage the rudders and ailerons from the boost system, pull the two levers (figure 4-1) BACK.

c. To shift the elevator control from the boost system to manual operation, pull the handle (figure 1) UP. This operation shifts a linkage in the tail cone such that full movement of the control column moves the elevator only about a third of its normal travel. It also bypasses the elevator booster cylinder. The reduced elevator travel is sufficient for all normal maneuvers and for landing at higher than minimum speed.

d. Inasmuch as the pilot contributes but a small percentage of the total force required to operate the surface controls (the hydraulic system contributing the rest) it is obvious that if the booster system fails, full deflection of the surfaces can't be obtained even at very low airspeed. No particular risk is involved if the booster system fails because the ship can be flown very nicely with the assistance of the tabs and can be landed by the procedure outlined herein. Assuming complete failure of the booster system, several things should be kept in mind. Most important of these are:

(1) With the elevator gear shifter handle in the manual position only 15° up elevator are available. This is enough elevator to land safely at about 100 mph but it is not enough to flare from a power off approach. A fairly flat approach must be made at about 120 mph using low power. The throttle must not be closed until the ship is within a few feet of the ground. As a matter of fact, the throttles need not be closed until the ship is on the ground.

(2) The optimum flap setting is 60 percent. This permits a slow enough landing and minimizes adverse trim effects due to power.

(3) Application of power causes a strong nosing up tendency. This is a very favorable circumstance because during the approach it may be necessary to use this to raise the nose. The only undesirable effect of this is that if the landing is missed and full power is applied, the pilot must use considerable push on the wheel to keep the nose from coming up too much. However, the pilot can resist this force until the airplane is trimmed by means of the electric elevator tabs.

(4) Landings with elevator booster out should not be attempted until the C. G. has been shifted to 23% — 30% gear down and preferably between 25% and 29%. The forward C. G. position is limited by inability to flare for landing because of reduced elevator travel. The rearward position is limited by the possibility of running out of down elevator in case full power is applied while at low airspeed in rough air.

(5) The airplane should be as light as possible for this type of landing.

e. As the final approach is made, the ship should be trimmed frequently so as to reduce to a minimum the elevator force required during the final flare. Differential use of power is quite effective for directional and lateral control. Aileron forces are heavy but by using two hands on the wheel reasonable control exists. Rudder control is heavy also. It is desirable to set the power such that a shallow approach is made at about 120 mph. The power should be kept as constant as possible because this will keep trim conditions constant. It has been found desirable to have the co-pilot manipulate the throttles during the final approach so that the pilot can use both hands on the wheel. Acting upon instructions from the pilot, the co-pilot can gradually throttle back as the ground is neared and cut the throttles completely as the ship lands. Once the ship is on the ground, the nose wheel should be set down as gently as possible. Naturally it is more difficult to keep the nose wheel off the ground because only 1/3 of the normal up elevator angle is available.

(1) The above procedure has been found to be successful for emergency landing without any boost. Flight crews are advised to practice this type of landing so that if the emergency ever should arise, they would be capable of dealing with it even under adverse conditions. As the first step in practicing for this emergency pilots are advised to simulate the recommended approach with all boosters operating and to land at about 100 mph with as small amount of elevator as possible. Except for stick position and stick force, this condition represents the actual landing with the elevator in manual.

7. CABIN PRESSURIZING SYSTEM FAILURE.

a. LOSS OF CABIN PRESSURE.—If the cabin low pressure warning light (figure 66-5) glows, make sure it is not due to an altitude difference, between the cabin and the airplane, greater than the allowable (as explained in Section VII, paragraph 1, *b,* (1)) or due to the intentional re-setting of the pressure altitude control (figure 66-6) to a lower altitude (as explained in Section VII, paragraph 1, *b,* (6) *(a)*).

b. If not due to the above reasons the following are the most likely causes for the loss of cabin pressure together with recommended operations to correct the situation.

(1) CABIN PRESSURE REGULATING VALVES STUCK.

(a) Move one of the pressure regulating valve manual controls (figure 32-2) to the CLOSED (center) position.

(b) If the cabin altimeter (figure 66-3) still shows a rise in cabin altitude return the control to the AUTOMATIC (forward) position and move the other control to the CLOSED (center) position.

(c) If the cabin altitude is still rising, move the first control *slowly towards* the CLOSED (center) position until the cabin altitude starts to go down to desired altitude at a comfortable rate, and refer to paragraph 7, *c* below for further instructions. If, with both manual controls in the CLOSED (center) position, the cabin altitude is still rising the trouble is due to either malfunctioning cabin superchargers or a large cabin leak. Move the supercharger flow controls (figure 66-12) toward MAX until the cabin altitude stops rising.

(2) MALFUNCTIONING CABIN SUPERCHARGERS

(a) Check that the outboard engines are operating at at least 1800 rpm.

(b) Turn the supercharger suction gage selector valve (figure 66-17) to L.H. DUCT FLOW and then R.H. DUCT FLOW. This reading will give an indication of the flow in the duct. The reading normally should be from 2 to $4\frac{1}{2}$ inches of mercury on the suction gage (figure 66-4). If either reading is below one in. Hg set the corresponding outflow and inflow valves manual control (figure 32-2) to DUMP (full rear) position to by-pass the air from that supercharger overboard. This will also lock an inflow check valve in the closed position to positively prevent reverse flow through that supercharger.

(3) FUSELAGE LEAKAGE. — If none of the above operations have stopped the rise in cabin altitude look for a cabin leak. A hissing noise will be heard near any leak. Check the auxiliary ventilation control (figure 66-16) in the CLOSED position. Check doors, emergency exits, drift signal chute, Very pistol mount, wash basin drains and cargo doors. Remove the panels above each toilet and make sure the emergency relief valves (figure 69) are seated.

c. Move the cabin altitude control knob (figure 66-6) to its extreme position each way and reset to the desired position to free any stickiness that might have developed. Move one pressure regulating valve manual control (figure 32-2) towards AUTOMATIC (forward) to see if the pressure altitude control has taken over.

8. ELECTRICAL SYSTEM FAILURE.

a. FUSES. — Upon failure of any electrical equipment, check the fuse controlling that circuit and replace it if necessary. There are seven fuse locations in the airplane and spare fuses are provided on fuse box covers. Each fuse is coded to show the circuit protected and the size of fuse required. The fuses are located as follows:

(1) On the forward side of the flight engineer's electrical panel (figure 22).

(2) On the inboard side of the flight engineer's electrical panel (figure 22-1).

(3) Over the bank of switches on the flight engineer's desk (figure 5).

(4) On the air conditioning panel (figures 66-14 and 66-15).

(5) On the box located on wall below and to left of radio operator's table (figure 61).

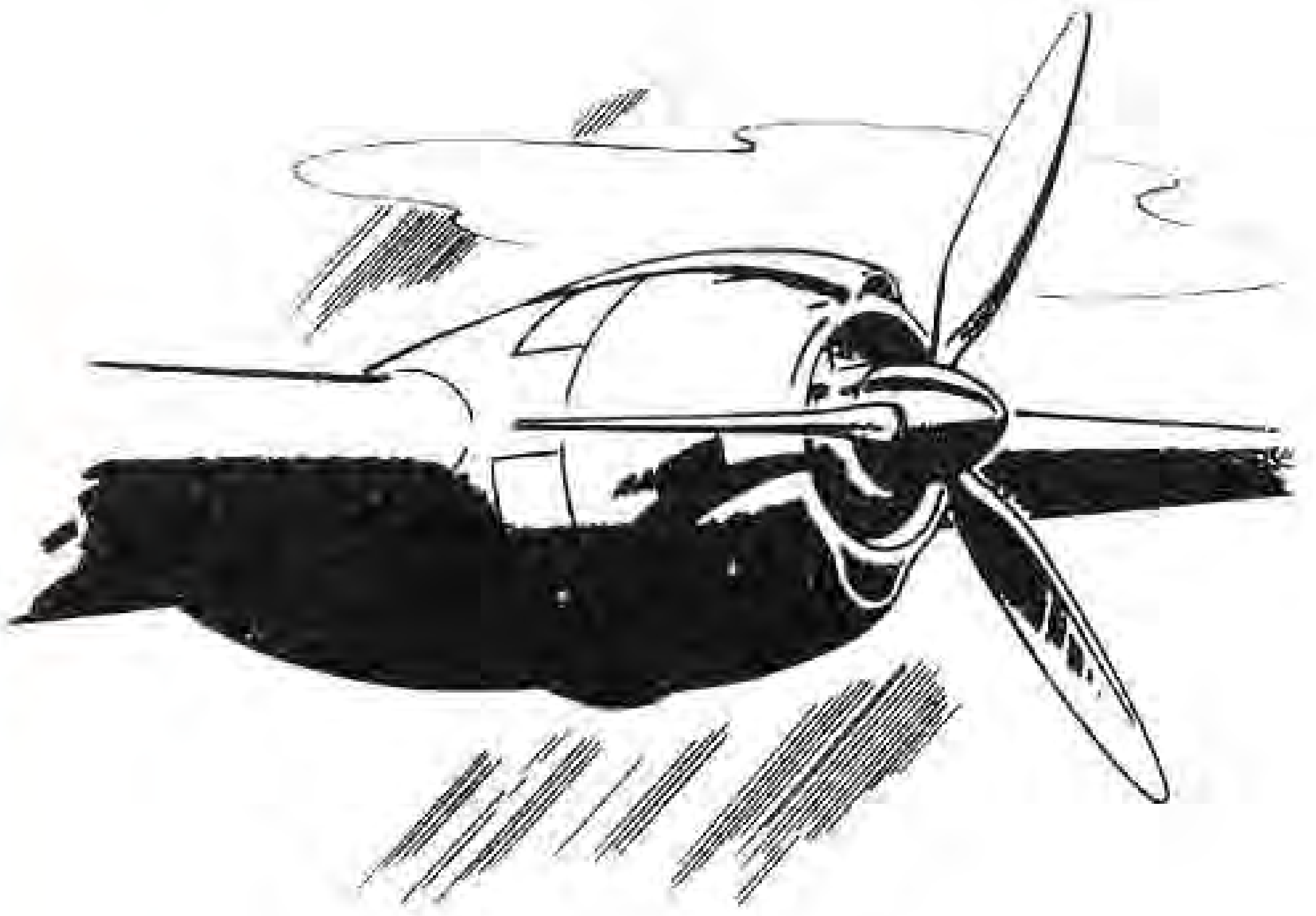
(6) On equipment on radio rack (figure 60).

(7) Under cover plate on cabin door switch panel (figure 49).

b. AUTOSYN DYNAMOTOR FAILURE.—If one dynamotor fails set the dynamotor switch (figure 22-3) to turn on the other. Failure of the dynamotor will be indicated by failure of the fuel flow meters (figure 5-7), the BMEP gages (figure 5-11), the oil pressure gages (figures 5-9 and 6-8), the fuel pressure gages (figure 5-16), the hydraulic system pressure gage (figure 36-24), the remote indicating compass (figure 36-3), the driftmeter (figure 45-11) and the fluorescent light on the navigator's table.

CAUTION

When a dynamotor fails, the autosyn instruments will not return to zero.



9. ENGINE FAILURE DURING FLIGHT.

a. STOPPING THE ENGINE.

(1) Retard throttle on dead engine (figure 5-14).

(2) Push dead engine feathering button (figure 6-9).

(3) Place mixture control (figure 5-21) in IDLE CUT-OFF.

(4) Move engine fuel emergency shut-off valve (figure 5-22) to OFF.

(5) Shut OFF auxiliary fuel pump (figure 5-28).

(6) Close cowl flaps (figures 5-23 and 5-24).

NOTE

If the shut-down is for practice purposes, neglect the following steps. Restart according to instructions in paragraph 9, *b*, below. Restart before the oil temperature becomes dangerously low. During cold weather, be careful of congealing oil in the propeller hub. If the shut-down is permanent, proceed as follows:

(7) Ignition switch (figure 24-23) OFF when engine stops.

(8) Cowl flaps (figures 5-23 and 5-24) 1/4 OPEN for minimum drag. (This is the faired position.)

(9) Trim airplane as necessary. Remember it is always safer to make turns away from the dead engine. Turns made into the dead engine should be of large radius and should not be attempted at slow speeds.

(10) Fuel, hydraulic, and engine oil shut-off valves (figure 24-2) CLOSED.

(a) FUEL DISTRIBUTION. — If engine fuel shut-off valves are incorporated, use any fuel tank as desired. If these valves are not installed and if the shut-down was due to fire, or if it is known that a dangerous leak exists in the fuel line of the dead engine, turn the tank shut-off valve (figure 5-22) OFF and do not attempt to use the fuel in that tank. If no danger exists, use the fuel in the tank as desired to operate the other engine.

(11) Check the oil cooler flap control (figure 5-25) in AUTOMATIC.

(12) Change the vacuum pump selector valve (figure 63-30), the instrument group selector valve (figure 63-31) or the turn and bank selector valves (figures 35-23 and 36-23) if necessary, to maintain four to five inches of Hg for vacuum instrument operation.

(13) Refer to the three engine or two engine Flight Operation Instruction Chart in Appendix II and replan the flight accordingly.

b. RE-STARTING THE ENGINE.

(1) PREPARING THE ENGINE FOR STARTING.

(a) Check cowl flaps (figures 5-23 and 5-24) CLOSED.

(b) Check tank shut-off valve (figure 5-22) ON.

(c) Check fuel cross-transfer valve (figure 32-4) OFF.

(d) Auxiliary fuel pump (figure 5-28) ON if altitude requires.

(e) Check fuel, hydraulic and engine oil shut-off valves (figure 24-2) ON.

(f) Check oil cooler flap switch (figure 5-25) in AUTOMATIC.

(g) Hold propeller governor switch (figure 5-26) in DECREASE rpm until the propeller warning light (figure 6-23) glows.

(h) Throttle (figure 5-14) 1/10 to 1/4 OPEN depending on the altitude.

(i) Ignition (figures 24-23 and 24-24) ON. If the engine has not been operated for 1/2 hour do not turn on the switch until the engine has made several revolutions during unfeathering to prevent engine damage due to possible liquid accumulation in the lower cylinders.

(2) STARTING THE ENGINE.

(a) PRESS and HOLD the propeller feathering button (figure 6-9) until rpm reads 800 to 1000.

(b) Mixture control (figure 5-21) to AUTO RICH. (Ignition switch must be ON first.)

(c) Make sure the oil temperatures (figure 6-12) and oil pressures (figures 5-9 and 6-8) are within operating limits before synchronizing with other engines.

10. FIRES IN FLIGHT.

a. FIRE LOCATION.—Determine the location of the fire either by observation or by one of the following warning systems:

(1) Nacelle fire warning lights (figure 6-20 and figure 36-2) on the flight engineer's and pilot's instrument panels.

(2) Blower section fire indicators (figure 5-1) on the flight engineer's panel. Induction passage fires are also indicated by the loss of engine power (tendency to yaw and drop in manifold pressure) and the failure to respond to throttle opening. When this type of fire does occur, it will usually be after a noticeable backfire.

(3) Heater fire warning lights (figure 66-19) on the air conditioning panel.

b. HEATER FIRES.—If a heater fire warning light glows:

(1) Turn the heater master switch (figure 66-23) OFF.

(2) TURN and PULL the corresponding CO_2 valve (figure 66-29).

(3) Re-start the *other* heater after the fire warning light turns off.

c. NACELLE FIRES.—If a nacelle fire warning light glows and circumstances advise stopping the engine, proceed as follows:

(1) Throttle (figure 4-14) CLOSED.

(2) Push the propeller feathering button (figure 6-9).

(3) Mixture (figure 5-21) OFF.

(4) Fuel tank shut-off valve (figure 5-22) OFF.

(5) Boost pump (figure 5-28) OFF.

(6) After the propeller has completely feathered, turn the fuel, oil, and hydraulic oil shut-off valve (figure 24-2) OFF.

(7) Ignition (figure 24-24) OFF.

(8) Cowl flaps (figures 5-23 and 5-24) OPEN.

(9) Set the fire extinguisher selector valve (figure 24-5) and pull one handle (figure 24-9).

NOTE

Do not attempt to divide the charge of one bottle between two engines.

(10) The pilot or copilot will inform the flight engineer as to the results obtained with the first CO_2 bottle and advise pulling the second charge if necessary.

(11) Open the emergency exits, lower the landing gear, and land as soon as possible in order to determine the cause of the fire and correct the condition before continuing the flight.

d. INDUCTION PASSAGE FIRES.—If a fire is indicated by the blower section indicators or by engine performance, proceed as follows:

(1) Throttle (figure 4-14) CLOSED.

NOTE

Do not feather the propeller. Allow it to windmill at high speed.

(2) Mixture (figure 5-21) OFF.

(3) Set the fire extinguisher selector valve (figure 24-5) and pull one of the discharge handles (figure 24-9).

(4) If the fire continues for more than 10 or 12 seconds, feather the propeller.

e. ELECTRICAL FIRES.—In case of an electrical fire, it is often best to wait until the fuse blows. If the fire is persistent with heavy current involved, turn the airplane master switch (figure 6-3) OFF. After the fire has been extinguished, break the short circuit and return the airplane master switch to ON.

f. CABIN FIRES.

(1) CARBON DIOXIDE FIRE EXTINGUISHERS.—If the cabin is pressurized, use the CO_2 fire extinguishers. One is located in the flight station (figure 20-1) and the other is located on the forward wall of the passenger compartment (figure 60-1). Aim the nozzle at the base of the fire. No ill effects will come from breathing the gas. Avoid contact with the horn or chemical itself, as it is at extremely low temperature and may cause severe burns.

(2) CARBON TETRACHLORIDE FIRE EXTINGUISHER.—If the cabin is not pressurized, the carbon tetrachloride fire extinguisher may be used. One is located at the cabin door (figure 56-16). This extinguisher works well on burning fabric. Carbon Tetrachloride fumes (from the extinguisher) if breathed in too large a quantity, produce an anesthetic effect. Car-

bon Tetrachloride (when sprayed on fire) produces a poisonous gas known as Phosgene. Inhalation of a sufficient quantity may prove fatal. Stand back as far as possible when using the carbon tetrachloride fire extinguisher. Ventilate the cabin after the fire is extinguished. Open the auxiliary ventilation system (figure 66-16). Open the pilot's and co-pilot's sliding windows. Open an emergency exit or the cabin door if necessary to produce sufficient draft for ventilation.

g. AIRPLANE MASTER SWITCH. — This switch (figure 6-3) should be pushed FORWARD just prior to a crash landing to minimize the fire hazard from the electrical system.

11. GROUND LANDING WITH WHEELS RETRACTED.

a. If forced to land where no prepared runway is available, it will be better, in most cases, to land with the wheels retracted.

b. USE OF POWER.—Power is valuable when controlling the airplane at low speeds.

(1) If the landing is caused by fuel shortage, land before the tanks are completely dry.

(2) If the landing is not caused by fuel shortage it may be desirable to dump the fuel in accordance with paragraph 12 of this section and land before the reserve is used up. If the fuel was dumped, be sure the controls are moved to CLOSE just before landing.

c. HYDRAULIC SYSTEM FAILURE.—If the landing gear cannot be lowered due to failure of the main hydraulic system, every effort should be made to pump the gear down to the locked position with the emergency hand pump.

NOTE

It takes a long time (5 or 6 minutes or more) to pump the gear down with the hand pump. DON'T GIVE UP.

d. LANDING.—Bring the airplane in tail low and as slow as possible. Use approximately 80% flaps. If landing in enemy territory, push the IFF radio destructor buttons (figure 63-26) and use the incendiary grenade before leaving the airplane. If landing in friendly territory, pull the recognition radio plug, on the radio rack, just before contact to save the equipment from destruction.

(1) Mixture controls (figure 5-21) OFF.

(2) Master ignition switch (figure 24-24) OFF.

(3) Airplane master switch (figure 6-3) OFF.

12. DUMPING FUEL.

If it is necessary to dump fuel proceed as follows:

a. See that the flaps are fully retracted.

b. Turn OFF all radio equipment.

c. Reduce the air speed to 160 mph or less.

WARNING

Failure to follow the above steps may result in an explosion or fire.

d. Move the dump controls (figures 24-1 and 24-3) to OPEN. Fuel will be discharged from each chute at the approximate rate of 190 gallons per minute, but the tanks will not be drained. (70 gallons will be left in each inboard tank and 30 gallons in each outboard tank.)

e. When all of the fuel possible or the desired quantity has been dumped, move the controls against the stops at the intermediate position. This should close the valves. Wait about 10 seconds for the fuel to drain from the chutes and then move the controls to CLOSE in order to seat the valves as tightly as possible. Return the controls to the intermeditae position. This will partially extend the chutes and permit any fuel that may leak through the valves to drain to the outside.

NOTE

After landing instruct the ground crew to inspect the dump valves for leaks and reseal them if necessary.

13. EMERGENCY EXIT.

a. GENERAL. — Circumstances at the moment of abandoning the airplane may alter the exit procedure. In the following discussion, it is assumed that the passengers are provided with parachutes. Provisions are made for stowing parachutes for nine crew members above the upper cargo compartment (figure 43-8).

b. DE-PRESSURIZING THE CABIN. — If the airplane is pressurized it will be necessary to de-pressurize before any exit can be opened. The following methods are listed in the order of their preference.

(1) Bring the airplane down to the altitude of the cabin; 8,000 feet or lower if possible. This will eliminate the effect of rarified atmosphere on inexperienced passengers.

(2) If the airplane is under control and circumstances call for de-pressurizing more rapidly bring the cabin altitude up to the airplane altitude by setting the pressure altitude control (figure 66-6) and the vertical speed control (figure 66-7) to the most comfortable rate dictated by the emergency involved, and at the same time lower the airplane altitude to that of the cabin. This procedure is dangerous if the cabin altitude gets above 15,000 feet unless a method is available for providing the passengers with oxygen.

(3) If the airplane is out of control and circumstances call for de-pressurizing as quickly as possible, proceed as follows:

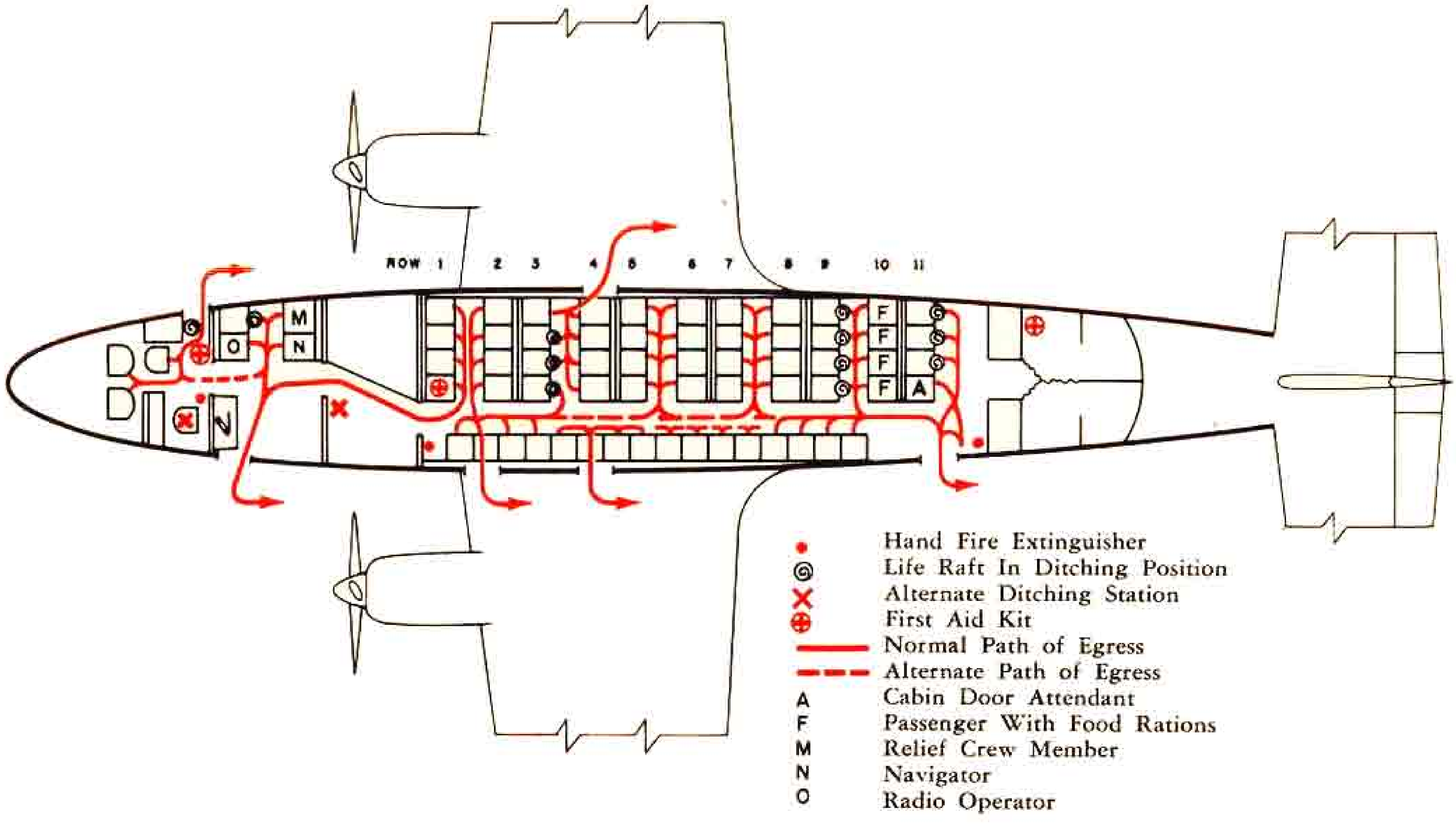


Figure 41 — Emergency Exit Diagram

(a) Outflow valve control (figure 66-10) OPEN, and vertical speed control (figure 66-7) to MAXIMUM.

(b) Auxiliary ventilation control (figure 66-16) OPEN.

(c) Outflow and inflow valves manual control (figure 32-2) INFLOW CLOSED (rear position).

c. EXITS.

(1) GENERAL. — On all but the first two airplanes, three emergency exits are provided in the main cabin and one at the navigator's station in addition to the cabin door and crew door. The first two airplanes (serials 43-10309 and 43-10310) have only two emergency exits in the main cabin. The operation of all emergency exits is identical: TURN THE RED HANDLE CLOCKWISE AND PULL HARD.

(2) EXIT.—The pilot should trim the airplane at a low speed to facilitate exit. Head the airplane toward uninhabited territory if possible.

(a) If the airplane is under control all persons should leave by the cabin door.

(b) If a more rapid exit is necessary, the cabin door and the three cabin emergency exits should be used.

(c) If the emergency requires that the navigator's emergency exit and the crew door be used, both inboard engines must be feathered and extreme care must be taken to avoid striking the propeller blades.

14. DITCHING (FORCED LANDING ON WATER).

a. GENERAL.—The following is a suggested procedure for ditching. Actual circumstances may alter the procedure.

b. AVOIDANCE OF DITCHING.—A thorough understanding of the fuel system and its operation will often avoid the necessity of ditching. Refer to the two, three and four engine flight operation chart for maximum range and fuel economy.

c. DITCHING DRILL. — Practice makes perfect. A ground rehearsal of the following will save time and trouble during the actual ditching operation:

(1) Signals.

(2) Duties Prior to Ditching.

(3) Preparation for Exit.

(4) Taking Stations.

(5) Exit.

d. SIGNALS.—Pre-determined signals may be given on the interphone, the call lights, or both.

(1) FIRST SIGNAL.—If ditching is deemed necessary, the pilot will notify all crew members and give them an estimate of the time remaining before actual contact is expected.

(2) SECOND SIGNAL. — At least three minutes before contact is expected, the pilot will give the signal for all to take their ditching stations.

(3) THIRD SIGNAL.—Approximately 30 seconds before actual contact is expected the pilot will give the signal for all to brace themselves for the impact.

e. DUTIES PRIOR TO DITCHING.

(1) RADIO OPERATOR. — Send distress signals first on GROUP frequency then change over to the designated distress frequency. Transmit time, position, course, altitude, ground speed and estimated position of landing. Send distress signals even when ditching is not absolutely certain. It is better to make a distress call than to remain silent. A distress call can always be cancelled when no longer applicable and, of course this must be done.

(2) FLIGHT ENGINEER.

(a) Adjust power.

(b) Unpressurize cabin.

(c) Auxiliary ventilation control (figure 66-16) CLOSED.

(d) Cabin fan (figure 32-3) OFF.

(e) Outflow and inflow valves manual controls (figure 32-2) INFLOW CLOSED (rear position).

(f) Cabin heater master switch (figure 66-23) OFF.

(g) Dump fuel if directed by pilot. (See Section IV, paragraph 12.)

(3) NAVIGATOR.—Give pilot and radio operator the course, position, estimated position of landing, ground speed, velocity and direction of wind and surface conditions. Drop a drift signal if surface wind direction is not known.

(4) CO-PILOT.—Stand by to assist pilot if necessary.

(5) PILOT.—Determine whether or not to dump fuel, equipment and cargo and direct the crew accordingly. Save enough fuel for the landing operation as power will be very helpful to control the approach.

f. PREPARATION FOR EXIT.

(1) NAVIGATOR.—Remove life raft from under navigator's table and fold table down. Remove Very pistol (figure 45-9) and signals (figure 45-8) from wall.

(2) RELIEF CREW.—One relief crew member will procure two first aid kits. One over the air conditioning panel and one on the forward wall of the main cabin.

(3) CABIN DOOR ATTENDANT. — A member of the relief crew or other person designated by the pilot, will act as cabin door attendant as follows:

(a) Procure the first aid kit from the wall of the men's lounge (figure 58-4), the emergency food rations from the food locker (if provided) and the emergency radio located just forward of the main cabin door and distribute them to the passengers in row 10 (figure 41).

1. Navigator's oxygen outlet.
2. Aperiodic compass.
3. Escape hatch.
4. Navigator's table (folded).
5. Astrograph stowage box.
6. Escape hatch release handle.

Figure 42 — Navigator's Escape Hatch

(b) The cabin door attendant will need seat 1 row 11 to be near the cabin door and interphone. If all seats are occupied, instruct the passenger in that seat to go forward and sit in the relief crew compartment.

(c) One life raft from the cabin wall should be sent forward for those leaving by the crew door. Distribute the other ten life rafts as shown in figure 41. Instruct the passengers to hold the raft end up on the floor so that the force of impact will be taken by the seat. Explain how to inflate the rafts and warn them not to inflate rafts until they have been removed from the airplane.

(d) Open the crew and main doors and all emergency exits to prevent them from jamming during the impact of landing. Place the emergency exit hatches in the upper cargo compartment or lavatory or throw them out the main cabin door. Instruct passengers who will leave through the emergency exits to face aft and put a leg through the exit first. Leaving head first from the emergency exits may lead to injury since the wing is just below.

(e) Instruct all passengers not to stand up after the first impact, but to wait for the long heavy stop which indicates the ship is down to stay.

g. TAKING STATIONS. — At a pre-determined signal from the pilot all persons will take their ditching stations immediately and fasten safety belts. The cabin door attendant will take his seat (with earphones on since they are of ample length to reach) and inform the pilot that the cabin is ready. Since the passengers have no way of telling when to expect the impact, the cabin door attendant should shout "Brace" so that the passengers will not have to hold themselves tense for too long a time.

h. MAKING THE LANDING.

(1) WIND AND SURFACE CONDITIONS.—A calm sea makes judgment of altitude deceptive; ripples make it easier. Waves give a good indication of the wind direction. A swell does not necessarily move with the wind.

(2) LANDING.—Be sure the landing gear is up. Use medium flaps (60% to 80%) to avoid too steep an approach. Land in a three point attitude and as slow as possible. If the ship bounces, hold the nose up. Always ditch along the swells as near into the wind as possible unless there is a very strong cross wind. When ditching across a swell, put the airplane down on an upslope toward the top. Use power to flatten the approach as much as possible. Remember, engine power is a valuable aid in picking a good wave to land on and in lowering the landing speed.

i. EXIT.

(1) CABIN DOOR ATTENDANT.—Stand by the phone and direct traffic from the cabin as in figure 41. Passengers in seats 9 to 12 on the left side and in rows 5, 6, 7, and 8 will choose either of the four cabin exits depending on which is the least crowded.

(2) NAVIGATOR. — Leave through navigator's escape hatch with the life raft. Others follow as in figure 41.

(3) FLIGHT ENGINEER.—Leave through crew door with the life raft.

j. OUTSIDE.

(1) If the landing has been made into the wind, all life rafts should float toward the tail so that boarding should not be difficult. Do not jump into life rafts as they may be damaged. Tie the rafts together but never to the ship.

(2) Do not get wetter than absolutely necessary. Wet clothing must not be taken off. It is far warmer with wet clothes on than off. In hot weather this may not apply, but then the body should be protected from the sun.

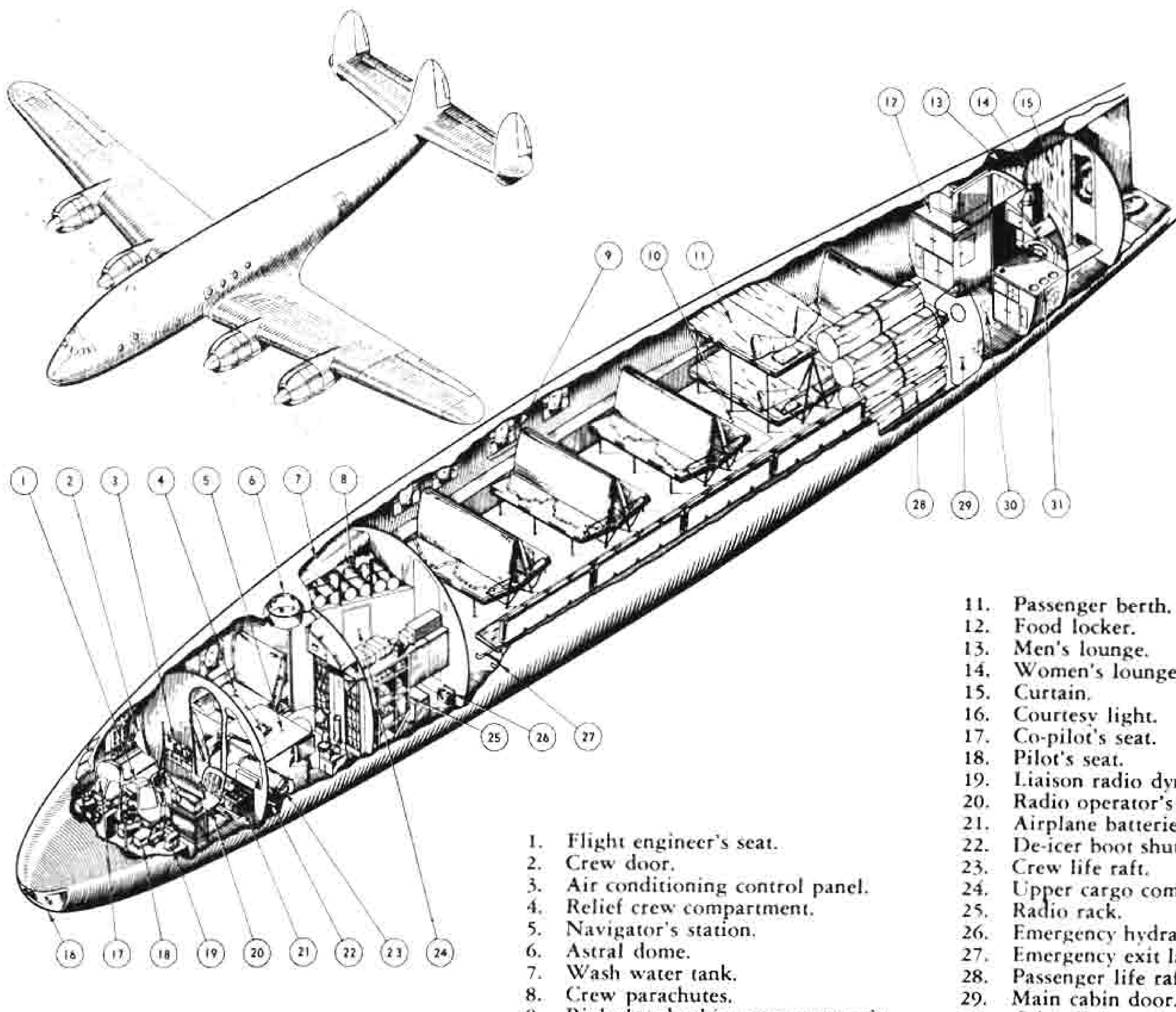
(3) If the airplane floats, stay close by to increase the chance of being spotted.

(4) EMERGENCY RADIO.—The radio operator will operate the radio according to the directions furnished with it.

(5) The pilot will ration the emergency food carefully.

SECTION V

Remote Compartments



1. Flight engineer's seat.
2. Crew door.
3. Air conditioning control panel.
4. Relief crew compartment.
5. Navigator's station.
6. Astral dome.
7. Wash water tank.
8. Crew parachutes.
9. Right hand cabin emergency exit.
10. Rear cargo compartment access door.
11. Passenger berth.
12. Food locker.
13. Men's lounge.
14. Women's lounge.
15. Curtain.
16. Courtesy light.
17. Co-pilot's seat.
18. Pilot's seat.
19. Liaison radio dynamotor.
20. Radio operator's seat.
21. Airplane batteries.
22. De-icer boot shut-off valve.
23. Crew life raft.
24. Upper cargo compartment door.
25. Radio rack.
26. Emergency hydraulic filler pump.
27. Emergency exit ladder.
28. Passenger life rafts.
29. Main cabin door.
30. Cabin light switch panel.
31. Galley.

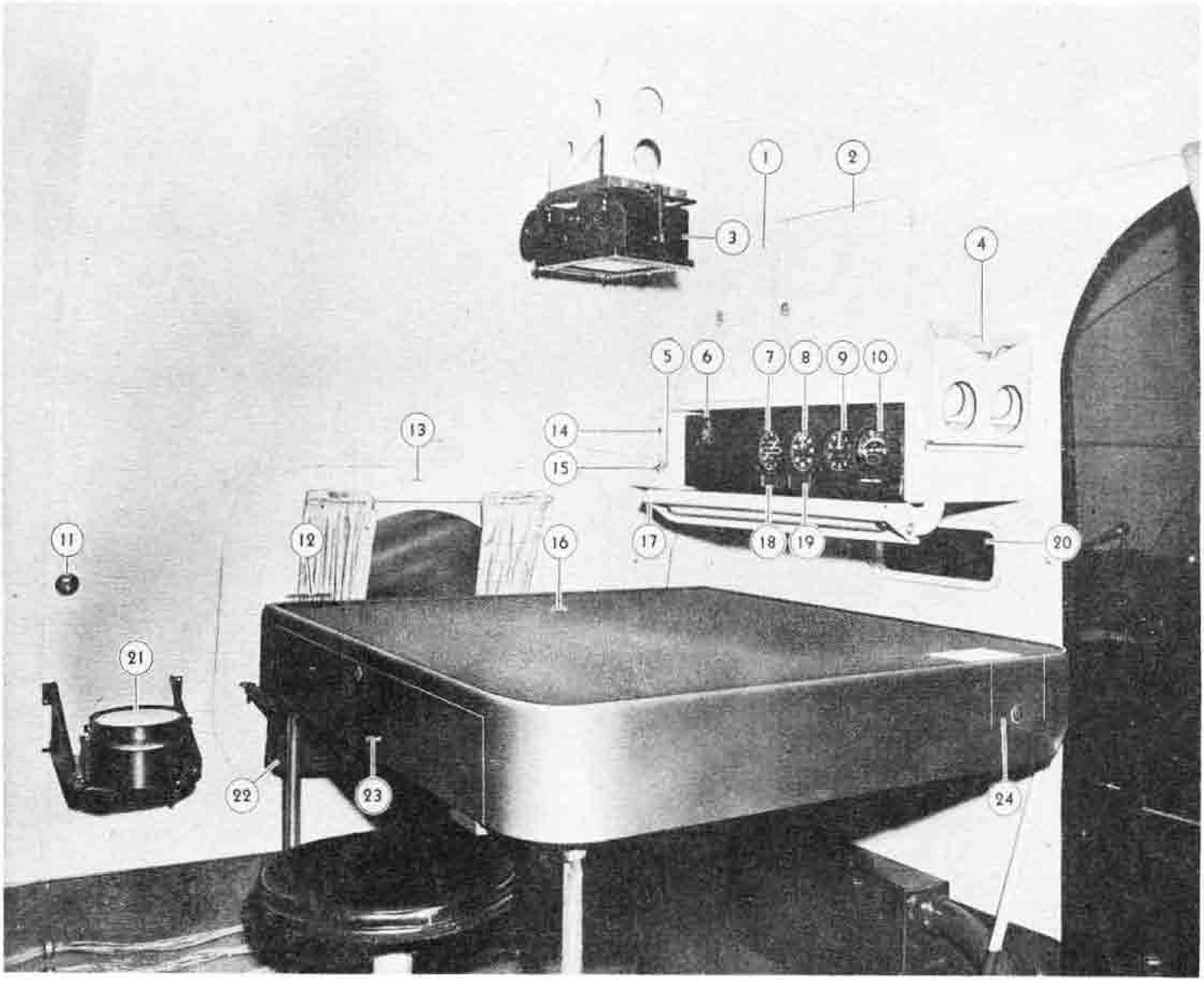
Figure 43 — Fuselage Interior

1. NAVIGATOR'S STATION.

a. The navigator is located on the left side of the airplane in a compartment directly behind the flight station. Figures 42, 44, 45 and 46 illustrate the equipment provided. A light-proof curtain covers the passage way to the flight station. A hole in the forward bulkhead (figure 44-20) allows direct contact with the radio operator.

b. EMERGENCY EXIT.—Remove three pins (one in the wall and two in the floor) and lower the table to gain access to the emergency exit (figure 42-3). To remove the exit, turn the handle clockwise and pull hard (figure 42-6). A life raft is located under the table.

c. PYROTECHNICS.—A mount is installed in the ceiling for firing the Very pistol (figure 45-9) in flight while the cabin is pressurized. 12 day and 12 night drift signals (figure 45-10) are stowed on the bulkhead aft of the navigator's seat. The drift signal chute (figure 45-12) is provided with a sealed chamber that will allow operation while the cabin is pressurized. To operate,



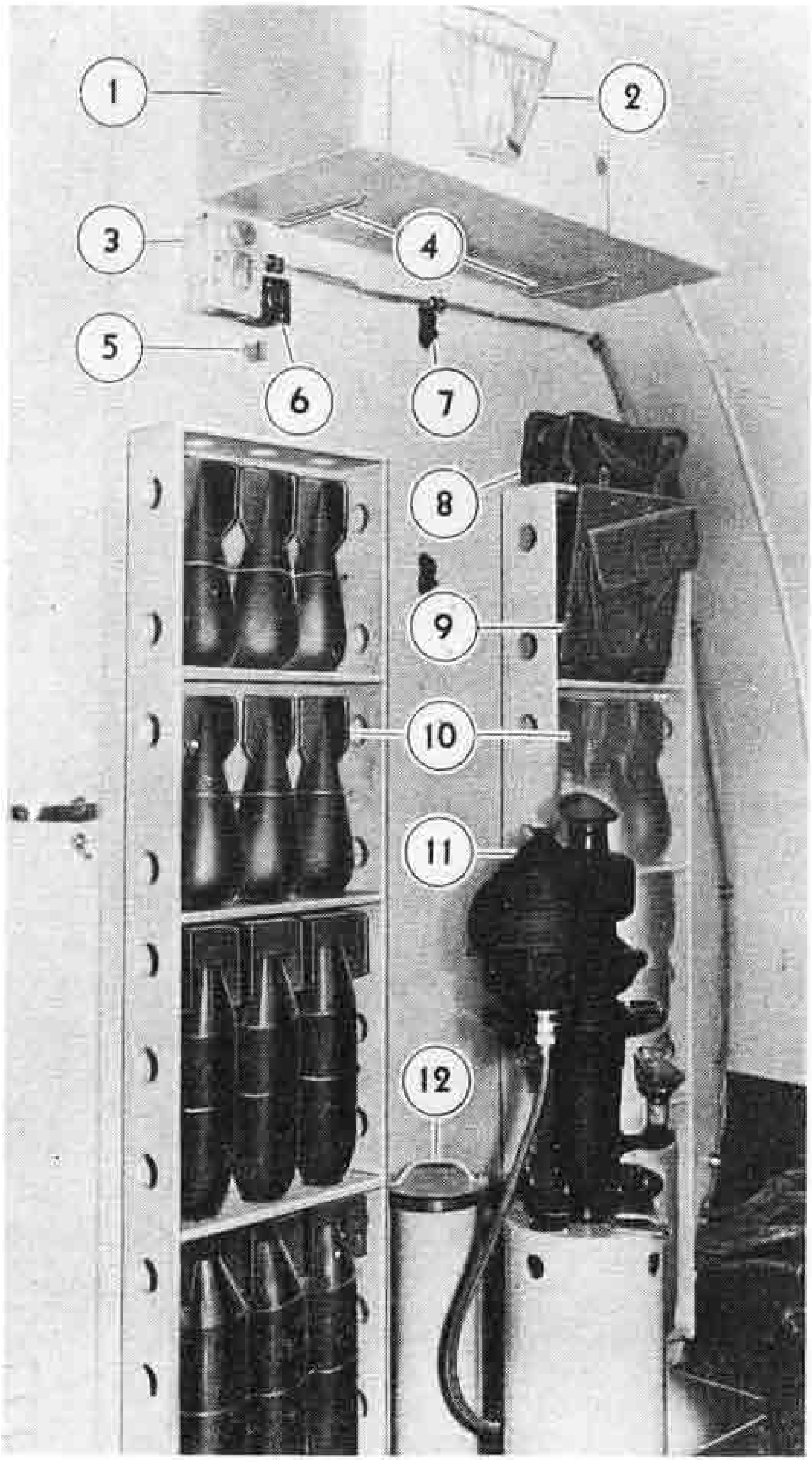
1. Cabinet.
2. Cabinet with lock.
3. Astrograph.
4. Data holder.
5. Table light switch.
6. Clock.
7. Remote reading compass indicator.
8. Airspeed indicator.
9. Altimeter.
10. Free air temperature.
11. Navigator's oxygen outlet.
12. Pencil holder.
13. Navigator's escape hatch.
14. Navigator's call light.
15. Dome light switch.
16. Navigator's table.
17. Table light.
18. Compass correction card holder.
19. Airspeed indicator correction card holder.
20. Message hole.
21. Aperiodic compass.
22. Waste paper basket.
23. Map drawer.
24. Chronometer.

Figure 44 — Navigator's Station

pull off the cover, place the drift signal in the chute, replace the cover and pull the slide located near the floor.

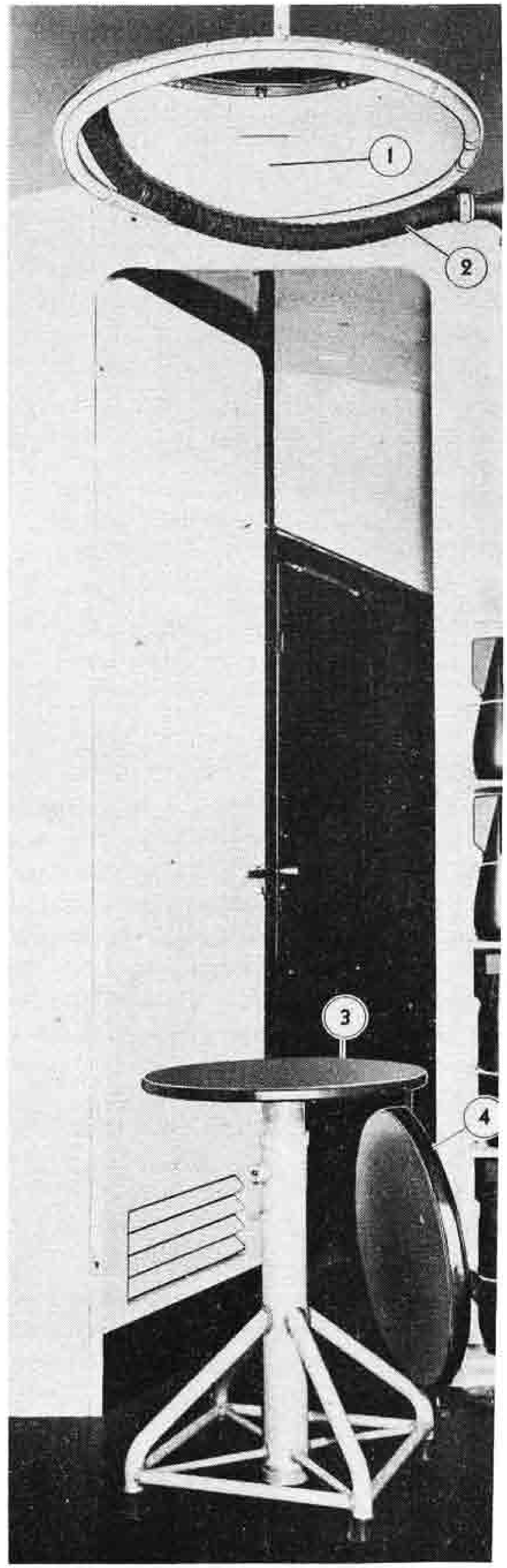
d. INTERPHONE JACK BOX. — The navigator plugs his headset and microphone into the jack box on the rear wall of his compartment (figure 45-3). The command and liaison positions of the interphones selector switch will receive only. The call button (figure 45-6) turns on a call light on the pilot's and co-pilot's instrument panel. The navigator's call light (figure 44-14) is in turn operated by the co-pilot.

e. ASTRAL DOME. — The navigator's stool can be attached to the floor and used as a platform under the astral dome (figure 46). The door leading aft to the passengers compartment is lockable from the navigator's side.



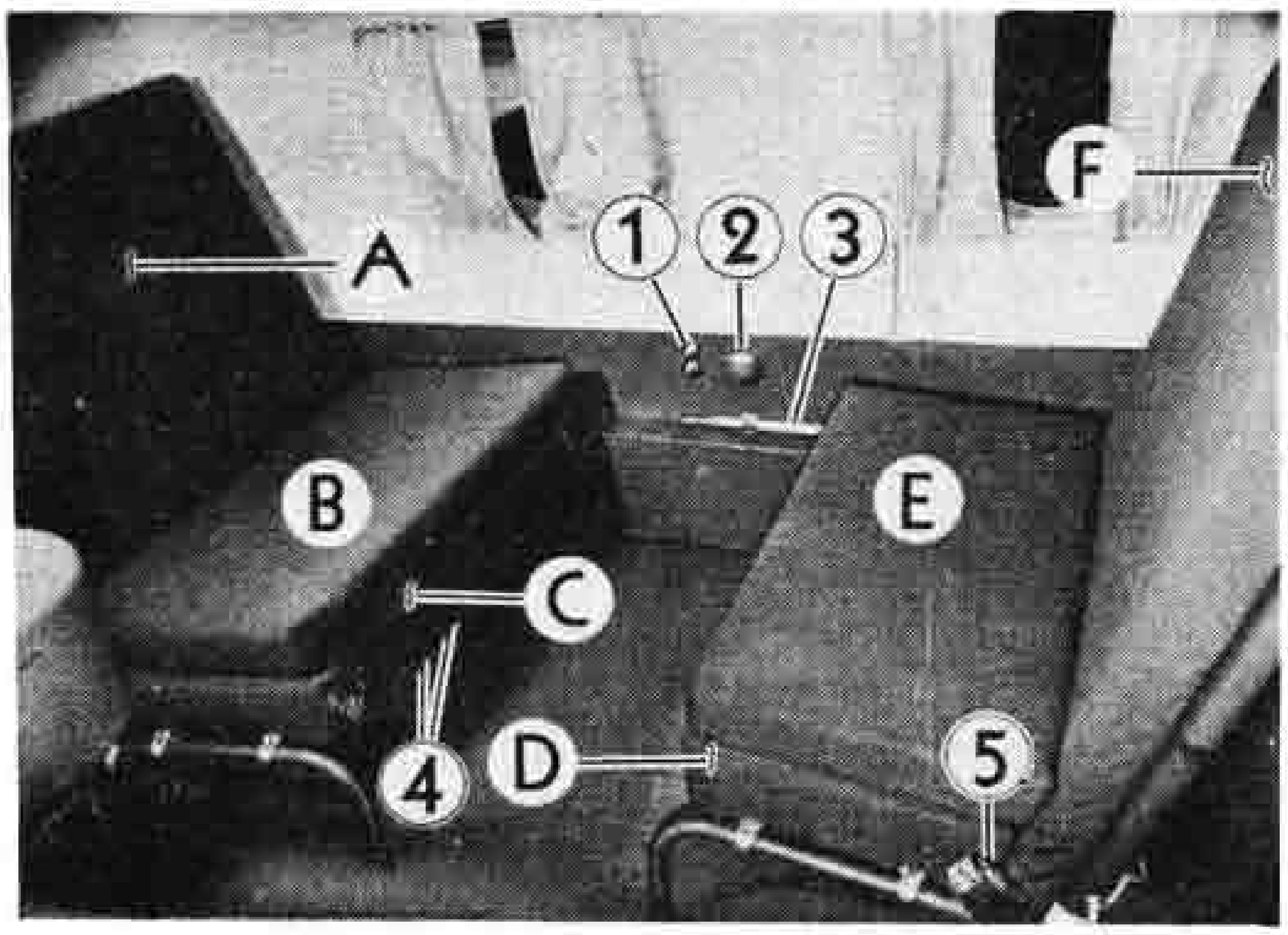
1. Cabinet.
2. Rag bag.
3. Navigator's interphone jack box.
4. Holder for spare navigator's table lamp.
5. Navigator's phone hook.
6. Navigator's call button.
7. Cap holder.
8. Very pistol ammunition case.
9. Very pistol holster.
10. Drift signals.
11. Driftmeter.
12. Drift signal chute.

Figure 45 — Navigator's Equipment



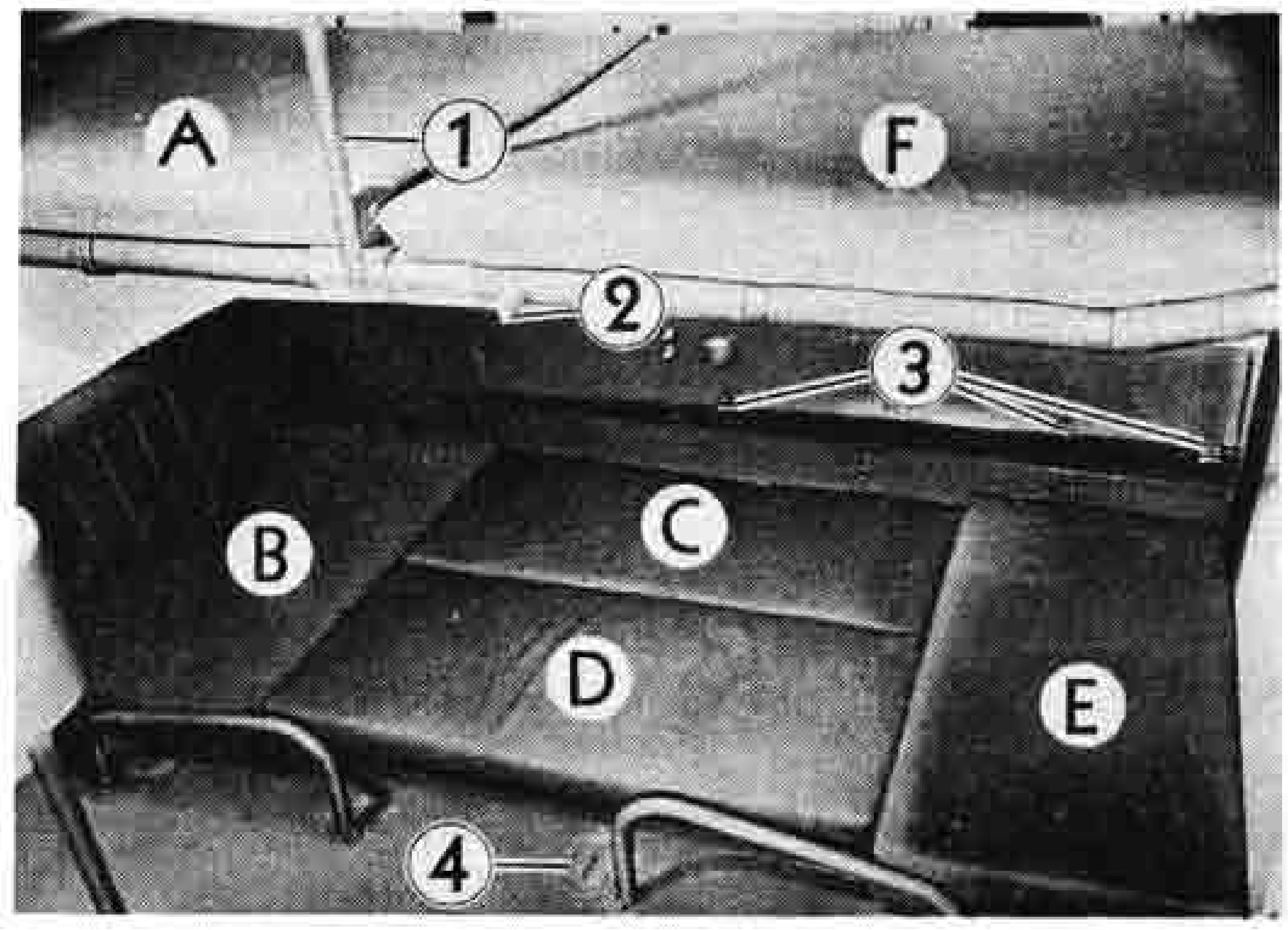
1. Astro compass bracket
2. Warm air tube.
3. Navigator's stool.
4. Cushion.

Figure 46 — Astral Dome



1. Oxygen outlets.
2. Ash tray.
3. Berth supports stowed.
4. Lower berth support brackets.
5. Safety belt in seat position.

Figure 47 — Crew Seats



1. Berth support installed.
2. Safety belt hook.
3. Berth support stowage clips.
4. Lower berth safety belt hook.

Figure 48 — Crew Berths

2. RELIEF CREW COMPARTMENT.

a. The relief crew is stationed on the right side of the airplane in the same compartment as the navigator. Seats for four will make up into two extra wide berths. Re-arrangement of the cushions from seat to berth position is illustrated in figures 47 and 48. Proceed as follows:

(1) Remove B and E.

(2) Place C and D in berth position.

(3) Swing A and F to berth position and install two ceiling supports (figure 47-3).

(4) Place B and E in berth position.

(5) Change safety belts to berth position.

3. PASSENGER COMPARTMENT.

a. GENERAL.—This compartment extends from the upper cargo compartment aft to the pressure bulkhead and includes the food locker and lounges.

b. CABIN DOOR SWITCH PANEL.—This panel is located to the right on entering (figure 49). Switches are provided for the galley, aisle, lounge, and cabin lights. A crew call button and light, microphone hook, microphone jack and earphone jack are also provided. Spare fuses are located behind the switch panel which must be unscrewed to allow fuse replacement.

c. SEATS AND BERTHS.—Seats are provided for 60 passengers. Eleven four-place seats on the right side of the aisle face alternately fore and aft (figure 50) and fold to make 22 berths (figure 51). If cargo is to be carried, the seats may be folded to cargo position (figure 53), or removed from the airplane. Four four-place seats on the left side of the aisle (figure 50) face inboard and can be folded up (figure 51) or removed from the airplane when not in use. Safety belts are provided for all seats and berths.

(1) CHANGING SEATS TO BERTHS. — Two men are required to change the seats to berths.

(a) Hold the back of the seat up to berth position.

(b) Pull the pin (figure 54-3) and telescope the center leg (figure 55-7) to the short position.

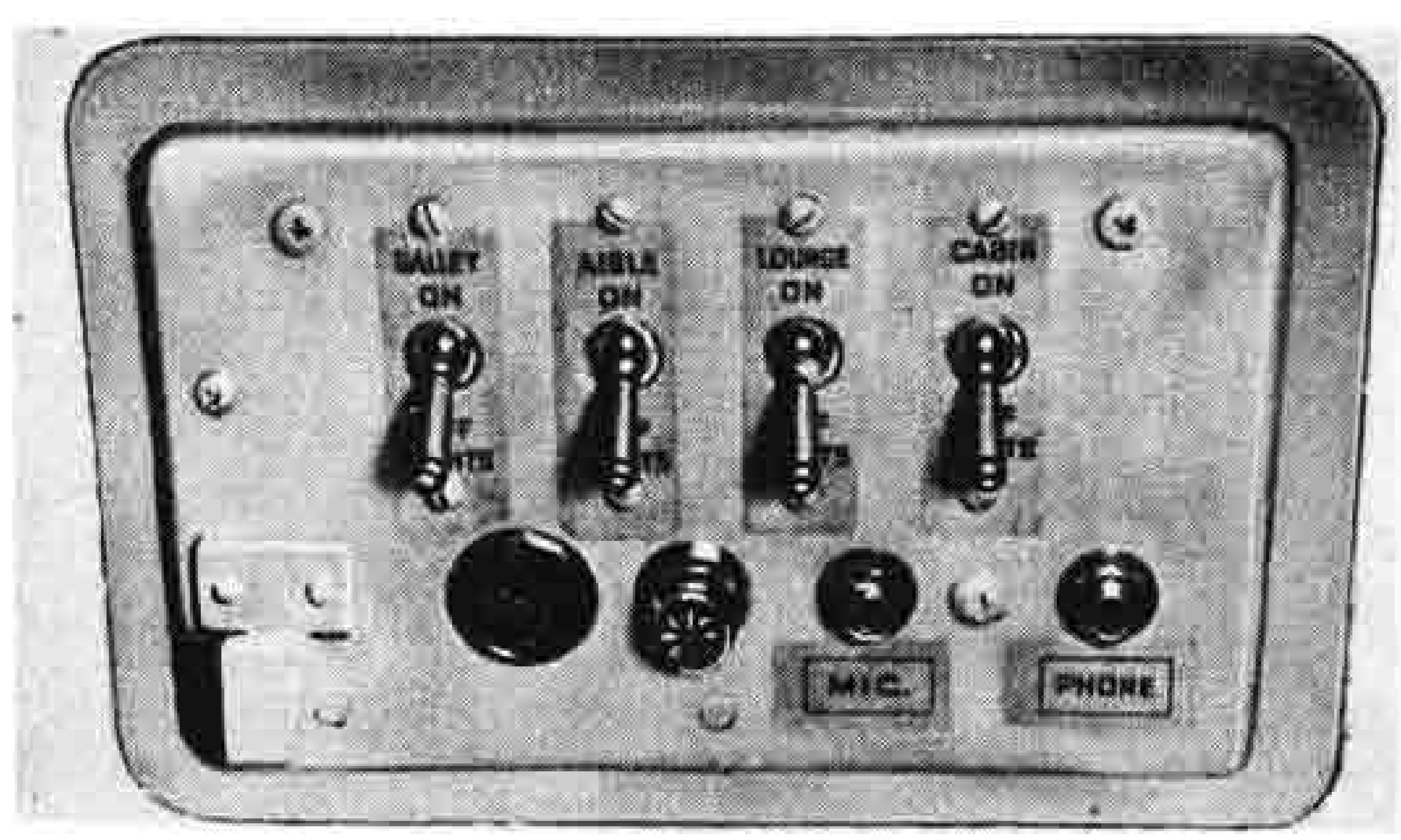


Figure 49 — Cabin Light Switch Panel

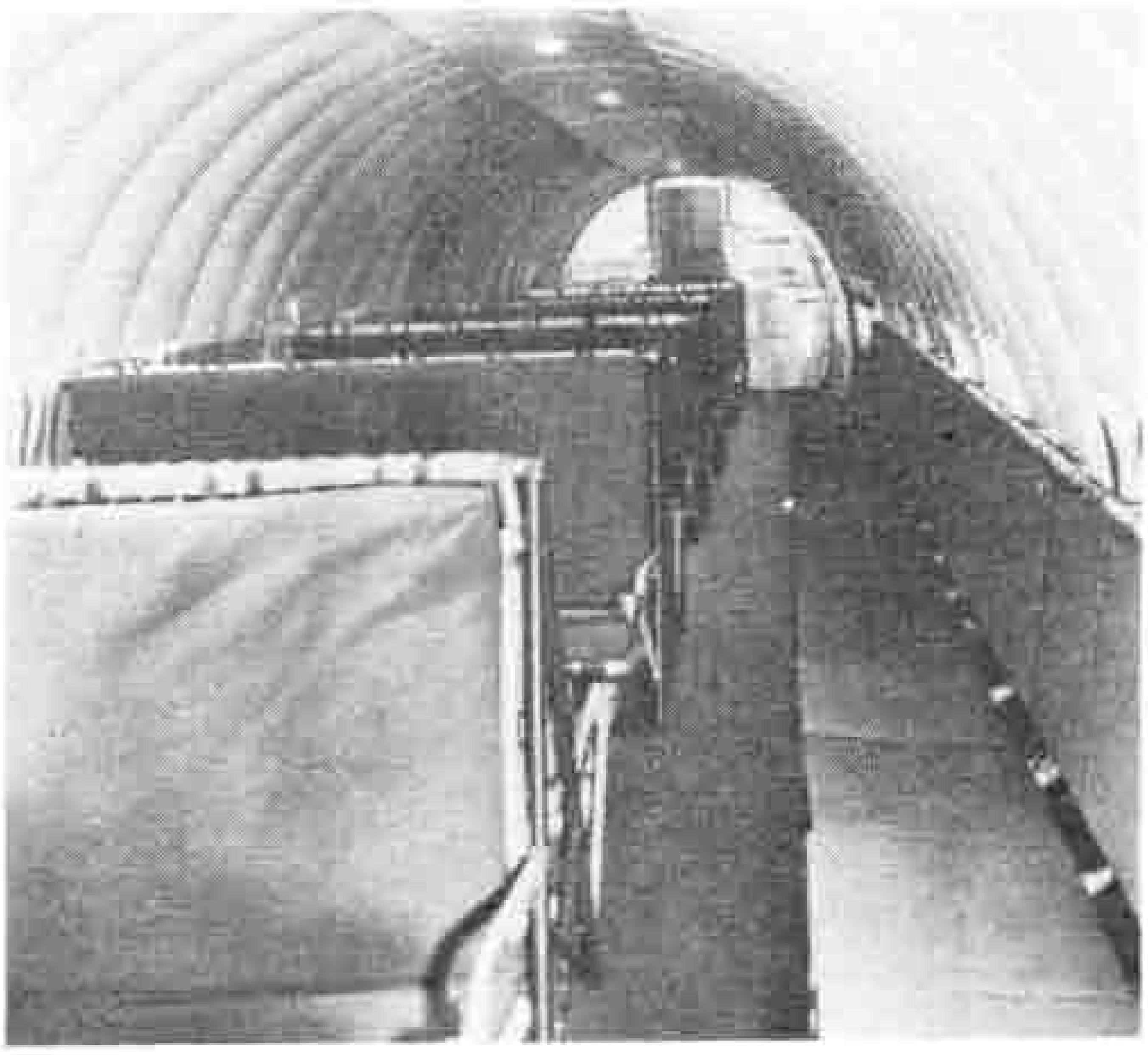


Figure 50 — Passenger Compartment (Day)

(c) Telescope the other two legs to the short position.

(d) Pull the pin (figure 53-11) by means of the strap provided and lower the seat to berth position. Release the pin and make sure it enters the hole provided for berth position.

(e) Replace the pin (figure 54-3) in the front center leg.

(f) Remove the two supports from their stowage place at the bottom of the seat back frame and install them in the holes provided (figure 53-4 and 53-7).

(g) Re-locate the safety belts from the seat to the berth position.

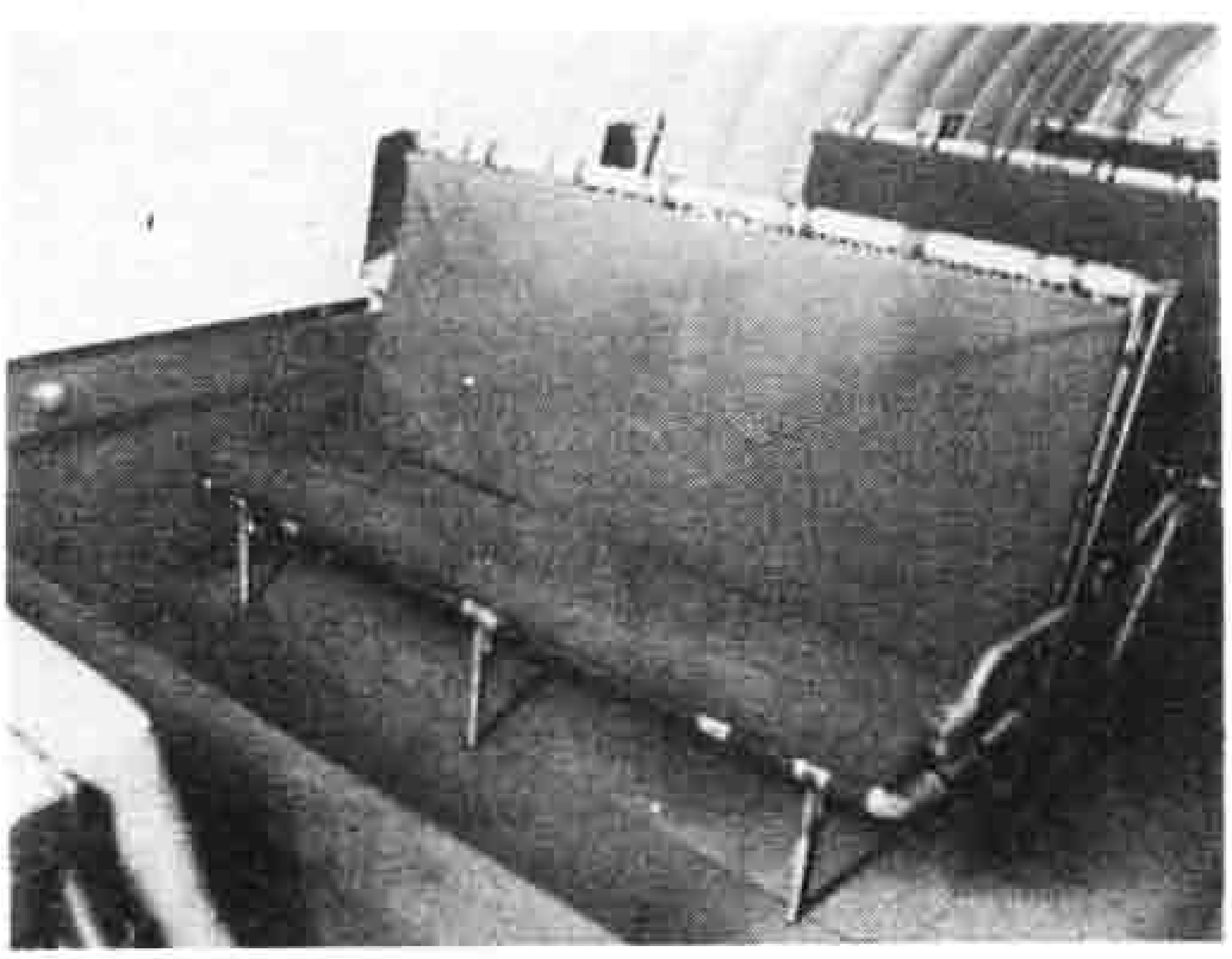
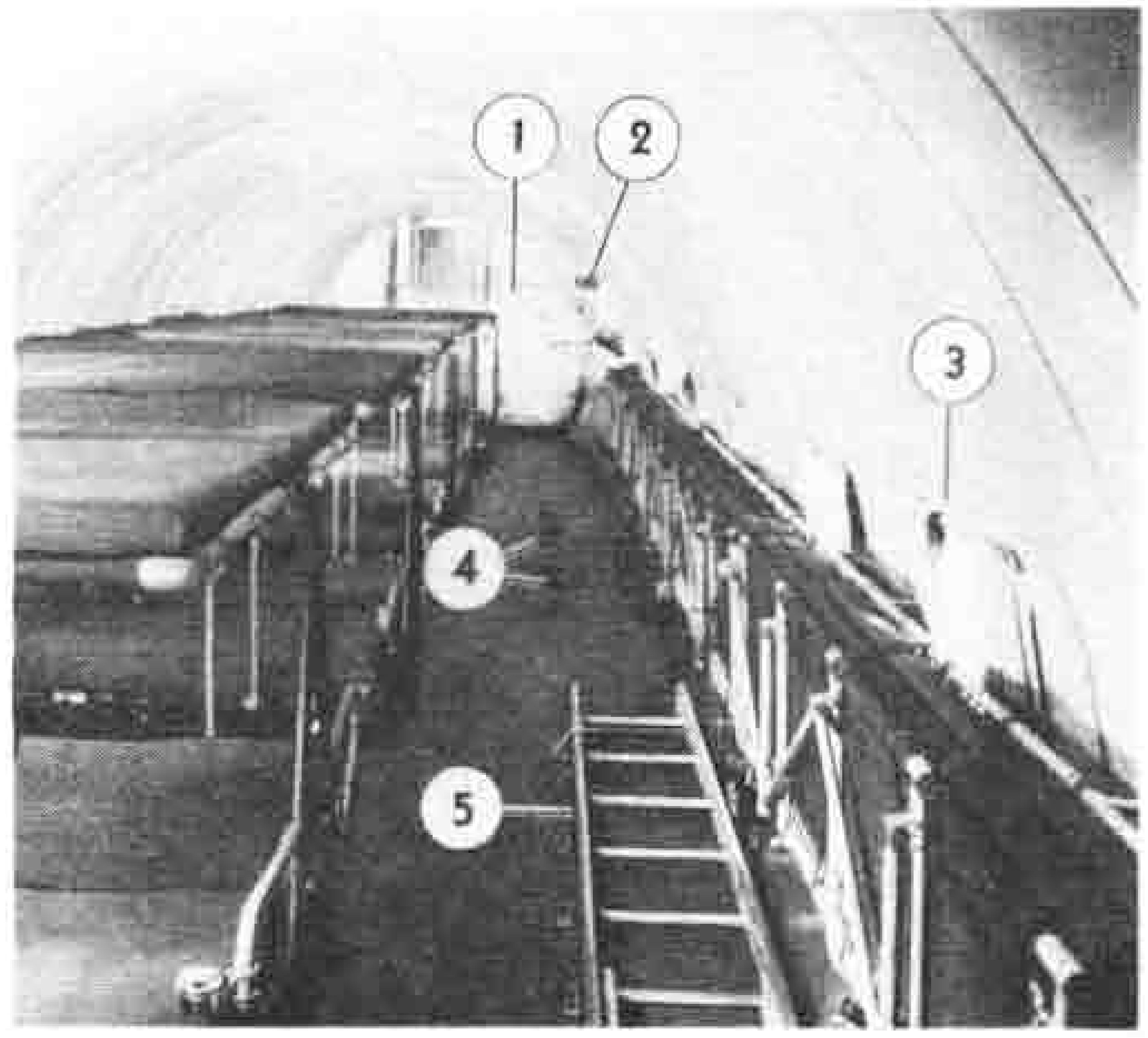
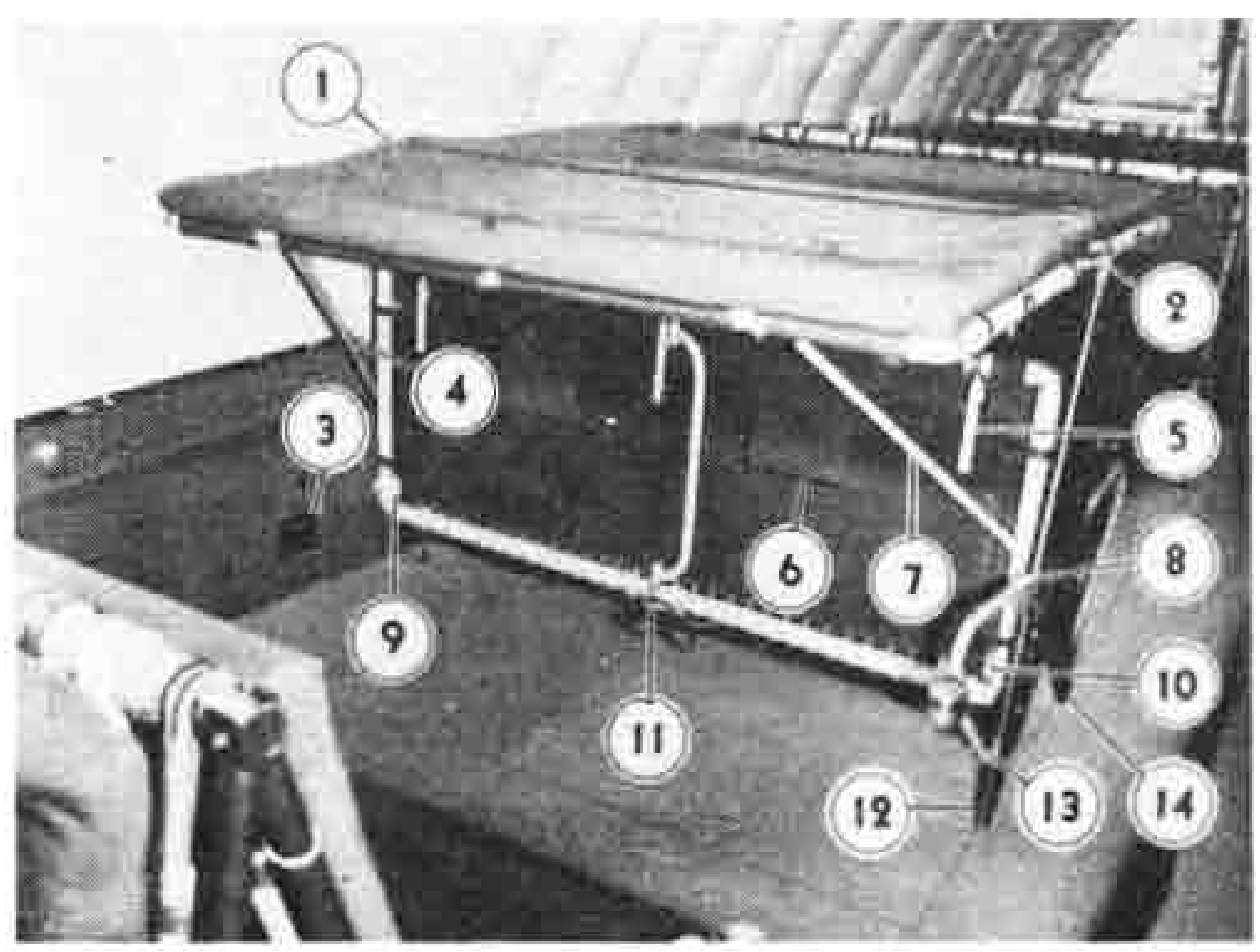


Figure 52 — Passenger Seats



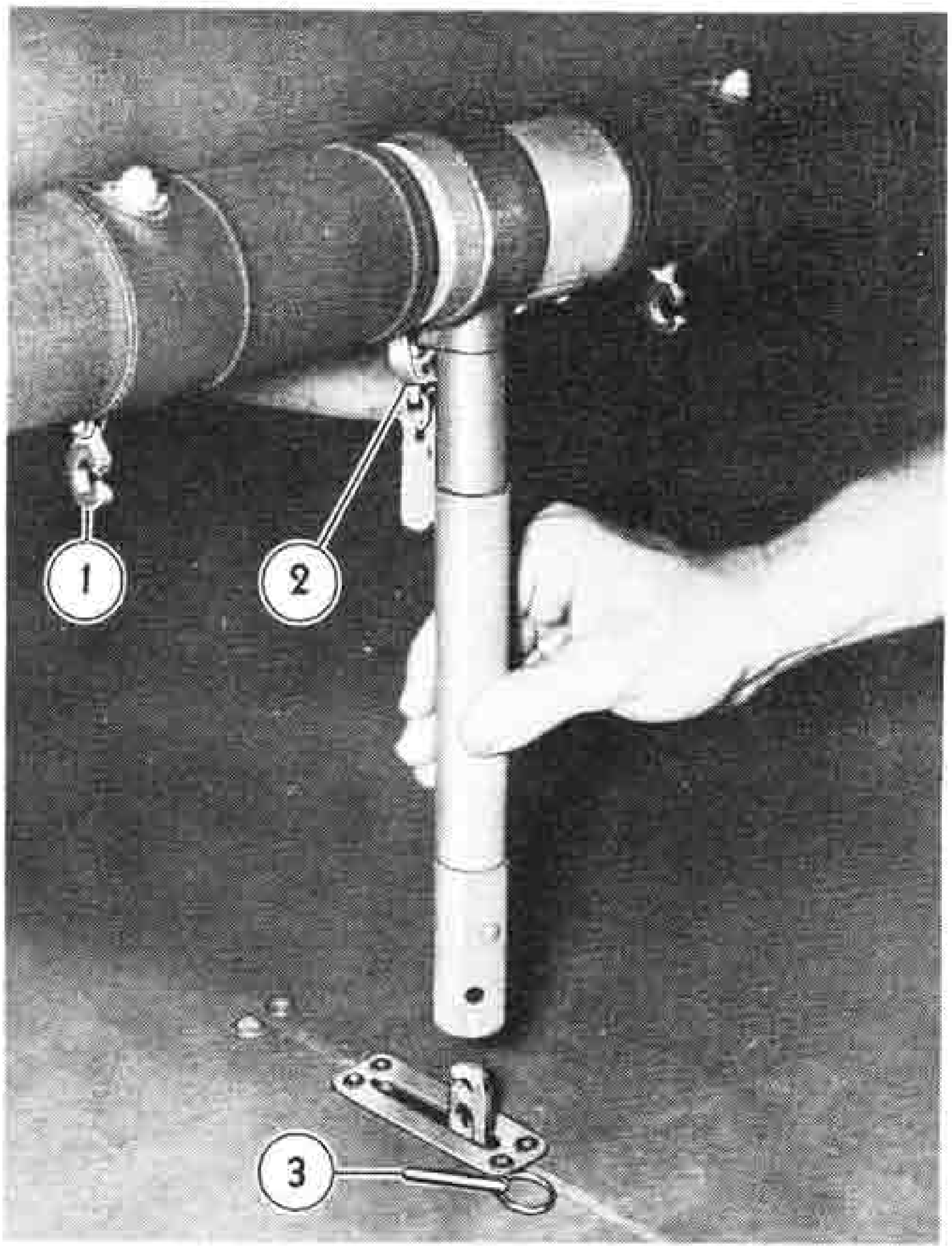
1. Food locker.
2. Life raft stowage straps.
3. Typical cabin escape hatch.
4. Life raft stowage straps.
5. Emergency exit ladder.

Figure 51 — Passenger Compartment (Night)



1. Berth removal pin.
2. Berth removal pin.
3. Ventilating air exit.
4. Berth support.
5. Seat leg folded.
6. Air sickness receptacle holder.
7. Berth support.
8. Seat arm removal pin.
9. Seat removal pin.
10. Seat removal pin.
11. Seat rear support pin.
12. "A" frame removal pin.
13. Seat arm removal pin.
14. "A" frame removal pin.

Figure 53 — Seats In Cargo Position



1. Berth position safety belt hook.
2. Seat leg folding pin.
3. Floor pin.

Figure 54 — Passenger Seat Leg

(2) TO PUT SEATS IN CARGO POSITION.

(a) Hold the back of the seat up to berth position.

(b) Pull the pin (figure 54-3).

(c) Pull the pin (figure 53-11) and raise the seat to cargo position (figure 53).

(d) Pull the pin (figure 54-2) at each leg and rotate the legs down (figure 53-5).

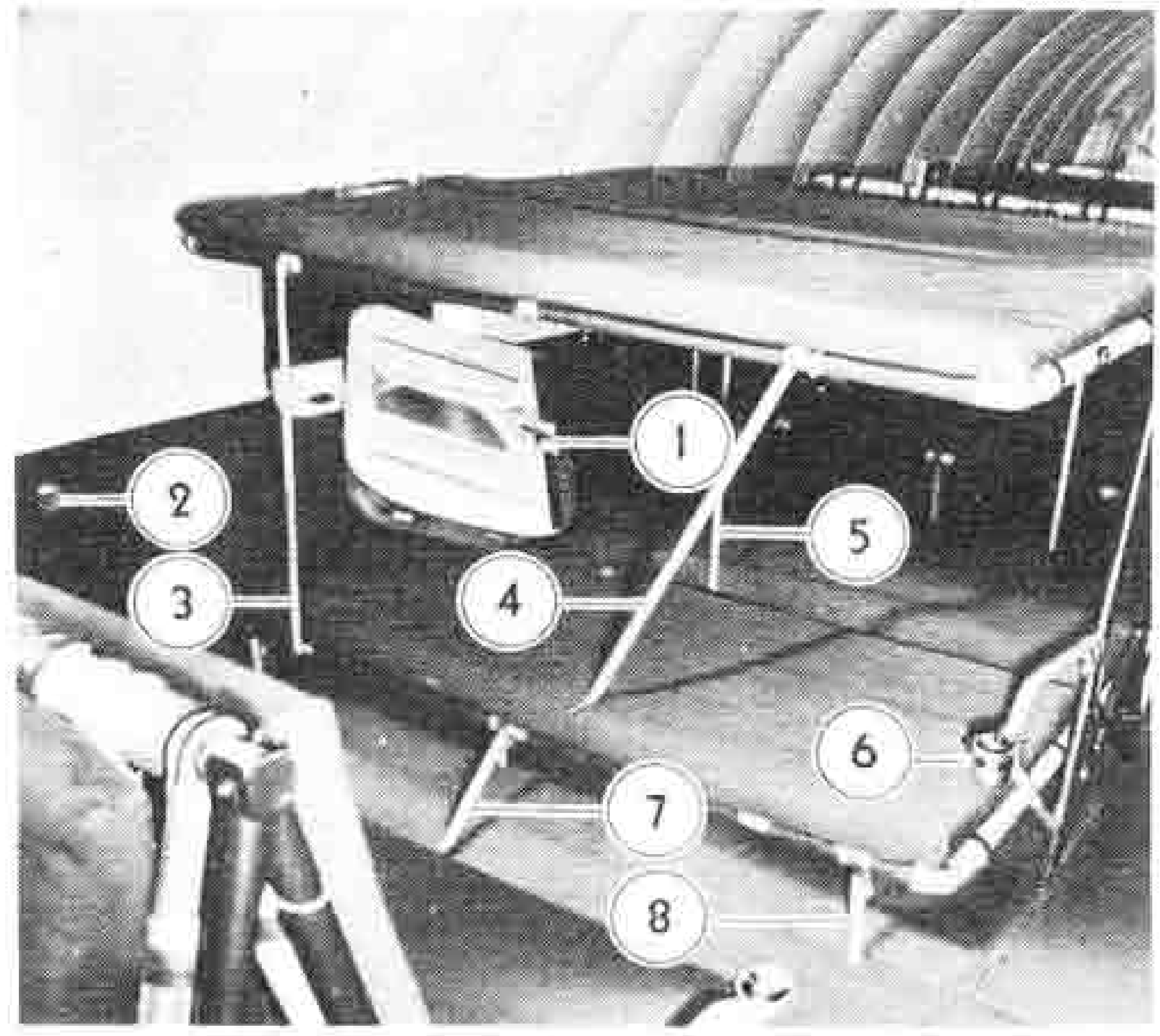
(e) Remove the two supports from their stowage place at the bottom of the seat back frame and install them in the holes provided (figures 53-4 and 53-7).

(3) TO REMOVE SEATS FROM THE AIRPLANE.

(a) Repeat steps *(a)*, *(b)*, and *(c)* of paragraph 3., *c.*, (2) above.

(b) Pull two pins (figure 53-9 and 53-10) and remove the seat.

(c) Pull two pins and remove the center support tube (figure 55-5).



1. Cabin escape hatch handle.
2. Ash tray.
3. Berth support installed.
4. Berth support semi-installed.
5. Berth center support.
6. Ash tray.
7. Seat leg extended.
8. Seat leg in berth position.

Figure 55 — Passenger Berths

(d) Pull the two pins that attach the two safety wires to the "A" frames.

(e) Pull two pins (figure 53-1 and 53-2) and remove two seat backs together.

(f) Pull two pins (figure 53-8 and 53-13) and remove the arm rest.

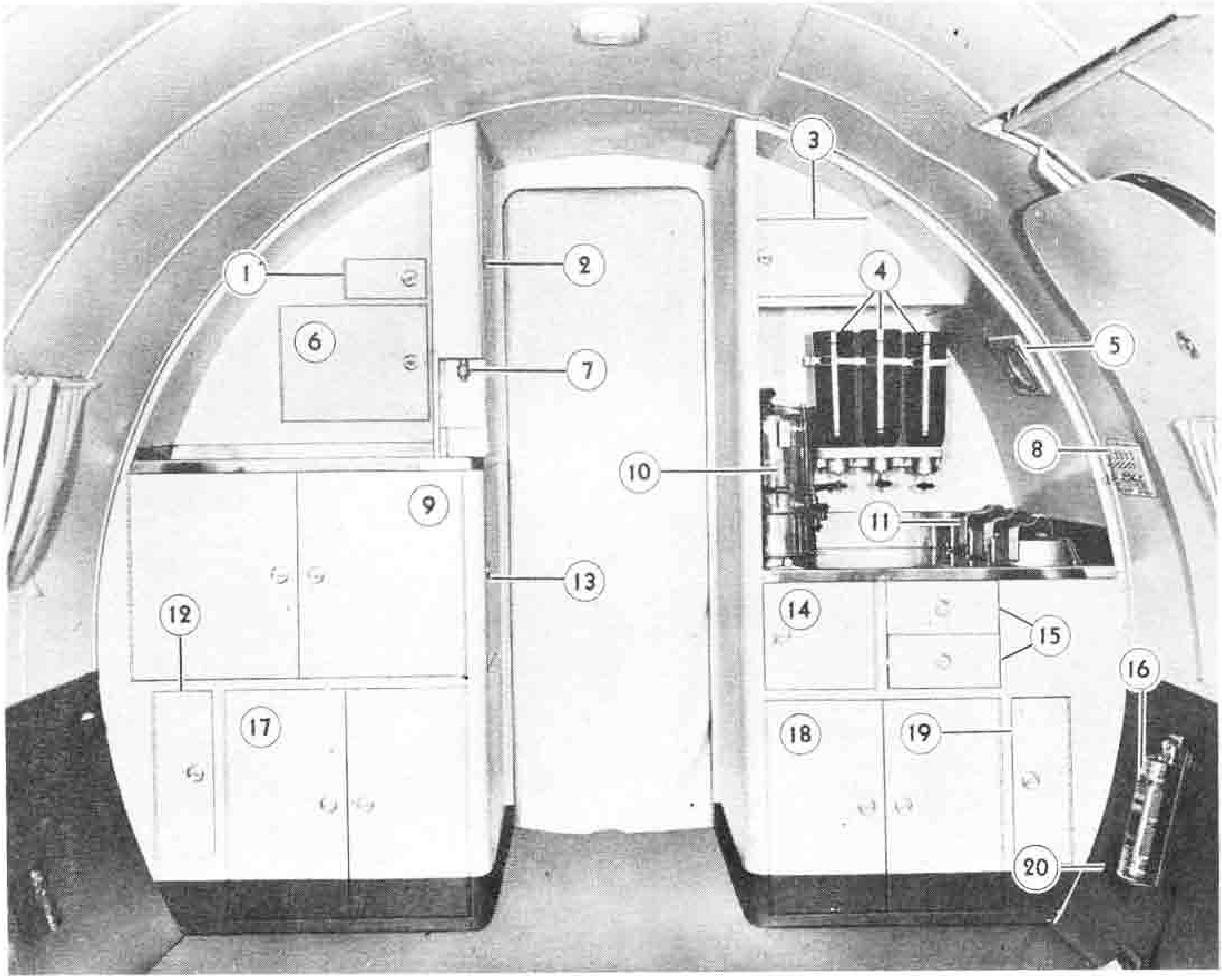
(g) Pull two pins (figure 53-12 and 53-14) and remove the "A" frame.

(4) To fold the side seats up, remove the pins that attach the legs to the floor and raise the seats. Straps are provided to hold the seats in the folded position.

(5) To fold the side seat backs down, simply pull them loose from the spring clips.

(6) To remove the side seats from the airplane, fold the seat backs down and remove the five seat bolts.

d. EMERGENCY EQUIPMENT. — Two fire extinguishers are provided; one at the cabin door (figure 56-16) and the other at the front of the cabin (figure 60-1). One emergency exit ladder is stowed under the side seats (figure 51-5). A first aid kit (figure 58-4) is located on the forward wall of the men's lounge. Provisions are made for stowing 11 life rafts and one SCR 578 portable transmitter near the cabin door.



1. Dry ice compartment.
2. Drinking water tank.
3. Utensil stowage.
4. Thermos bottles (ready to serve).
5. Galley light and coffee urn plug.
6. Cold storage.
7. Drinking water faucet.
8. Cabin light switch panel.
9. Box lunch stowage.
10. Coffee urn.
11. Food thermos jugs.
12. Thermos bottle stowage.
13. Used drinking cup container and waste water.
14. Waste food container.
15. Knives, forks and spoons.
16. Hand fire extinguisher.
17. Box lunch stowage.
18. Food thermos jug stowage.
19. Thermos bottle stowage.
20. Ventilating air exit.

Figure 56 — Food Locker

NOTE

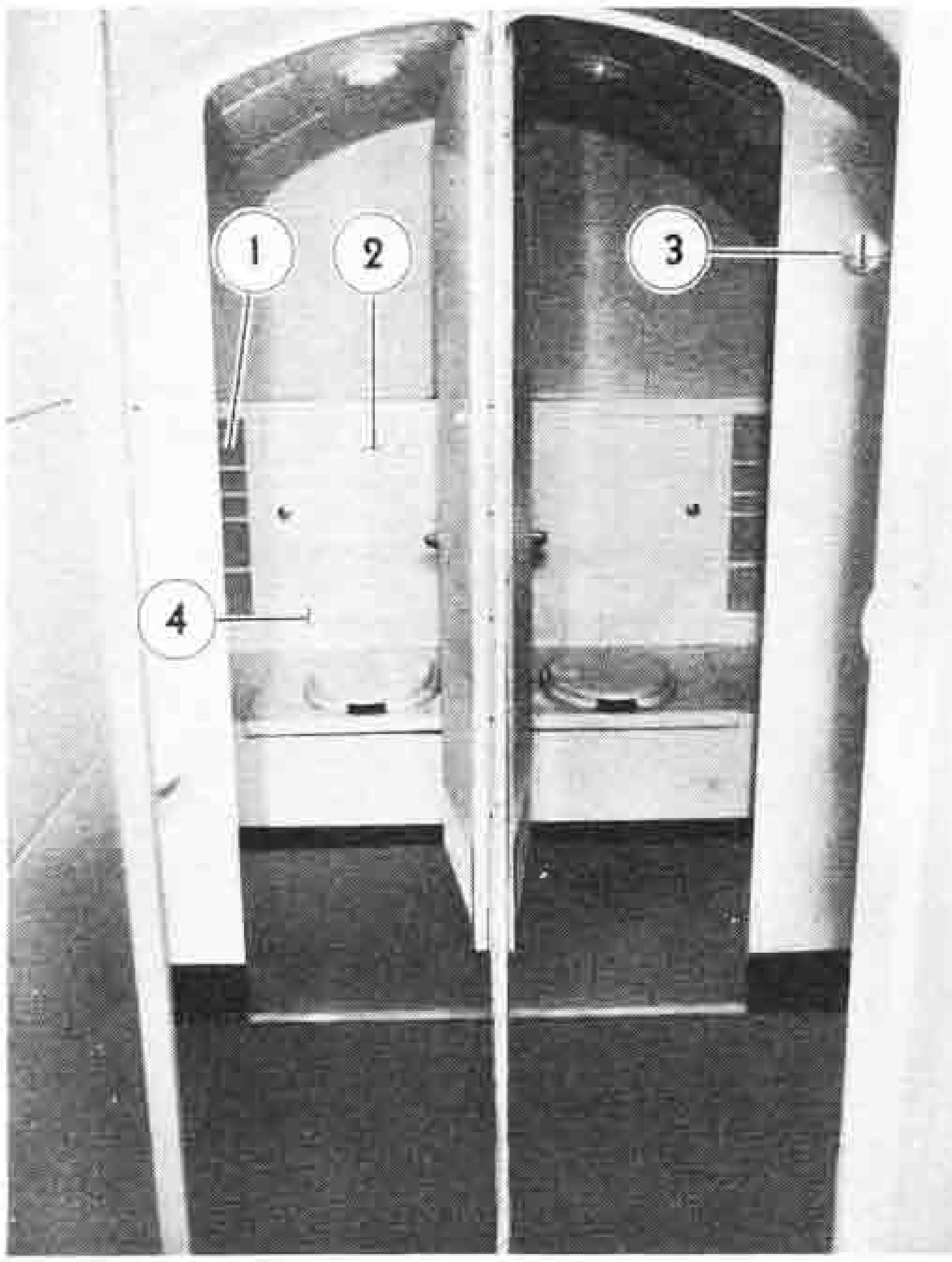
On the first two airplanes (Serials 43-10309 and 43-10310) this transmitter is stowed on the floor under the radio rack.

e. EMERGENCY EXITS.—In addition to the main door, three emergency exits are located in the passenger compartment. All exits pull in by means of the handle (figure 55-1). Pull the seat backs down to remove the left hand exits.

NOTE

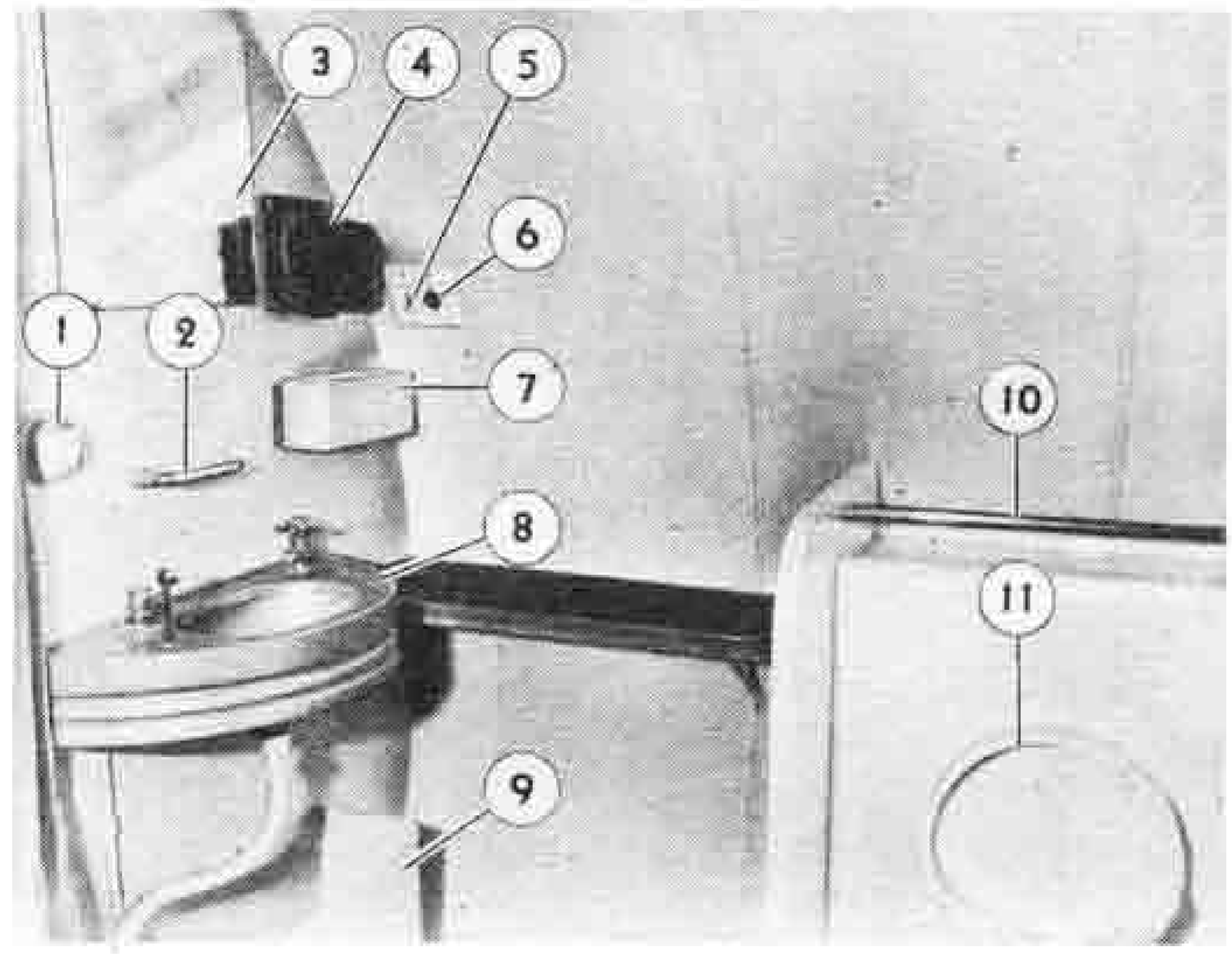
On the first two airplanes (Serials 43-10309 and 43-10310) only two emergency exits are provided in the passenger compartment. It is necessary to raise two seat backs to berth position and insert the tube supports before the right hand exit can be removed (figure 55).

f. MISCELLANEOUS EQUIPMENT. — Black-out curtains are provided for all windows. Ash trays are



1. Ventilating air exit.
2. Toilet article stowage.
3. Coat hook.
4. Right hand cabin air relief valve panel.

Figure 57 — Lavatories



1. Ash tray.
2. Hand hold.
3. Mirror.
4. First aid kit.
5. Light switch.
6. Electric razor plug (24 volt).
7. Paper towels.
8. Wash basin.
9. Used towel container.
10. Hand hold.
11. Urinal.

Figure 58 — Men's Lounge

provided along the aisle and right wall. Air sickness receptacle holders (figure 53-6) are located under the seats.

g. FOOD LOCKER. *(Figure 56).*—Provision is made for stowing 60 lunch boxes, 6 one-gallon thermos jugs, 12 two-quart thermos bottles, cups, knives, forks and spoons. Means are provided for boiling two gallons of water and for keeping one gallon of coffee hot. Five gallons of drinking water with paper cups are provided.

h. LOUNGES. *(Figure 58).*—Behind the food locker are located two lounges, each having a separate toilet. Wash basins, soap and towel dispensers, coat hangers, mirrors, electric razor plugs (24 volt) and lights are provided. Waste water from the wash basins drains overboard or into a ten-gallon tank if the drain freezes. The basin drain plug is spring loaded in the closed position to act as a pressure seal.

4. CARGO COMPARTMENTS.

a. UPPER CARGO COMPARTMENT.—This compartment (figure 43-24) is located on the right hand side of the airplane opposite the radio rack. Coat hangers, hat clips and a ceiling light are provided. A 40-gallon wash water tank (figure 43-7) and space for nine crew parachutes (figure 43-8) are provided above the cargo space. The tank supplies the lounges and is fillable from the nose wheel well. A sight gage is provided on the tank. The oxygen (figure 70) and CO_2 (figure 28) supply bottles are permanently installed in this cargo compartment. The compartment is enclosed and a lockable screen door is provided.

b. MAIN CARGO COMPARTMENTS.—Two main cargo compartments are located in the bottom of the fuselage. Engine covers and mooring equipment are stowed in the front cargo compartment.

(1) CARGO DOORS.—The forward cargo compartment is entered through a door in the nose wheel well. The rear cargo compartment is entered through a door in the bottom of the fuselage. Both doors open inward. Push the doors full open and turn the handle to hold. The doors are lockable from the outside with a key and are unlockable from the inside without a key.

(2) LIGHTS.—Cargo compartment lights turn on automatically when the doors are opened.

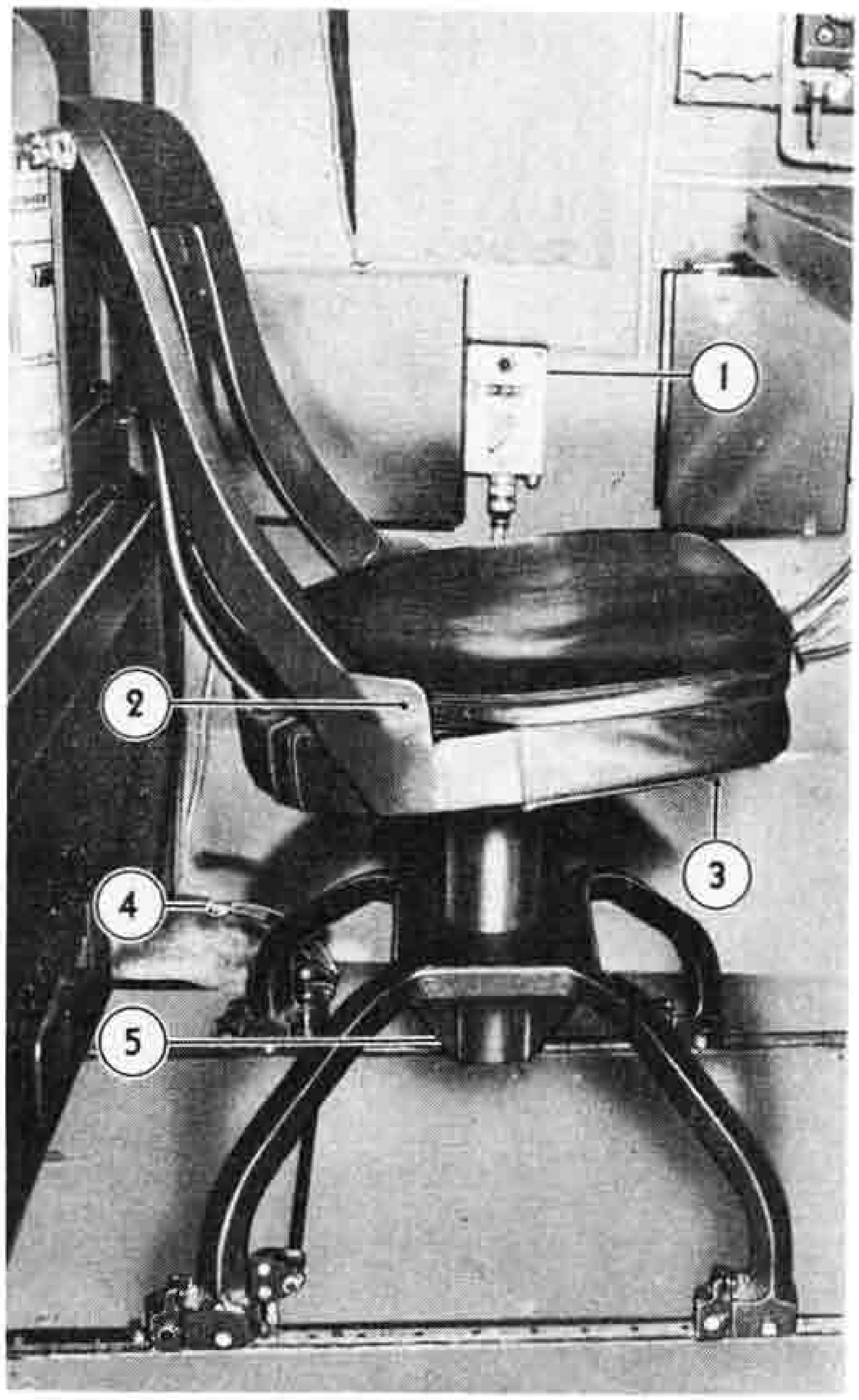
(3) EMERGENCY ENTRANCE.—Two removable floor panels are provided, one in the main cabin floor

(figure 43-10) and one in the navigator's compartment, to gain entrance to the cargo compartments during flight.

5. RADIO OPERATOR'S STATION.

a. The radio operator's station is located in the flight station directly behind the pilot. The radio master switch (figure 20-2) is located directly behind the operator. Figures 61 and 62 illustrate the equipment provided. Refer to Section VI, "Operation of Communication Equipment" for further information.

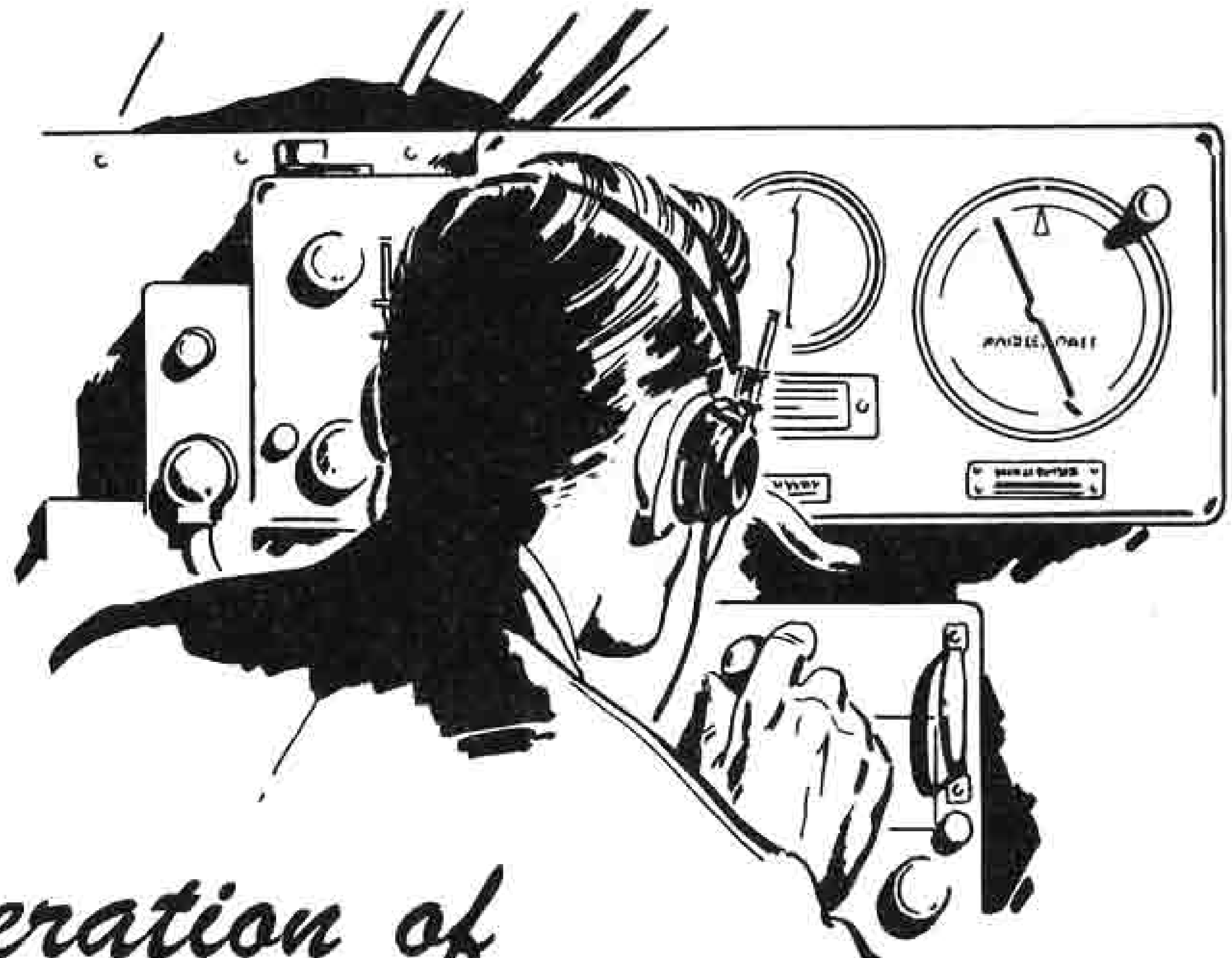
b. RADIO OPERATOR'S SEAT. *(Figure 59).*—This seat and the flight engineer's seat are identical. To roll the seat on its track, lift the handle (figure 59-4). To rotate the seat, lift the handle (figure 59-3). To adjust the seat height, pull the pin from the center post (figure 59-5) and raise or lower the seat. A safety belt attachment is provided (figure 59-2).



1. Trailing antenna reel control.
2. Safety belt attachment.
3. Seat rotation adjustment.
4. Fore and aft adjustment.
5. Seat height adjustment.

Figure 59 — Radio Operator's Seat

SECTION VI



Operation of Communication Equipment

1. BASIC EQUIPMENT.

Name	*Model*	*Operated by*
H.F. Command	AN/ARC-9	Pilot or Co-pilot
V.H.F. Command	AN/ARC-3	Pilot or Co-pilot
Liaison	AN/ARC-8	Radio Operator, Pilot, and Co-pilot
Automatic Radio Compass	AN/ARN-7	Pilot, Co-pilot and Navigator
Manual Radio Compass	AN/ARN-11	Pilot or Co-pilot
Marker Beacon Receiver	RC-193	Pilot or Co-pilot
Instrument Approach Receiver	RC-103; AN/ARN-5	Pilot or Co-pilot
Radio Altimeter	SCR-718	Navigator
Recognition Radio	SCR-695	Radio Operator
Interphone		All Crew Members
Navigation Equipment	AN/APN-9	Navigator

2. RADIO MASTER SWITCH.

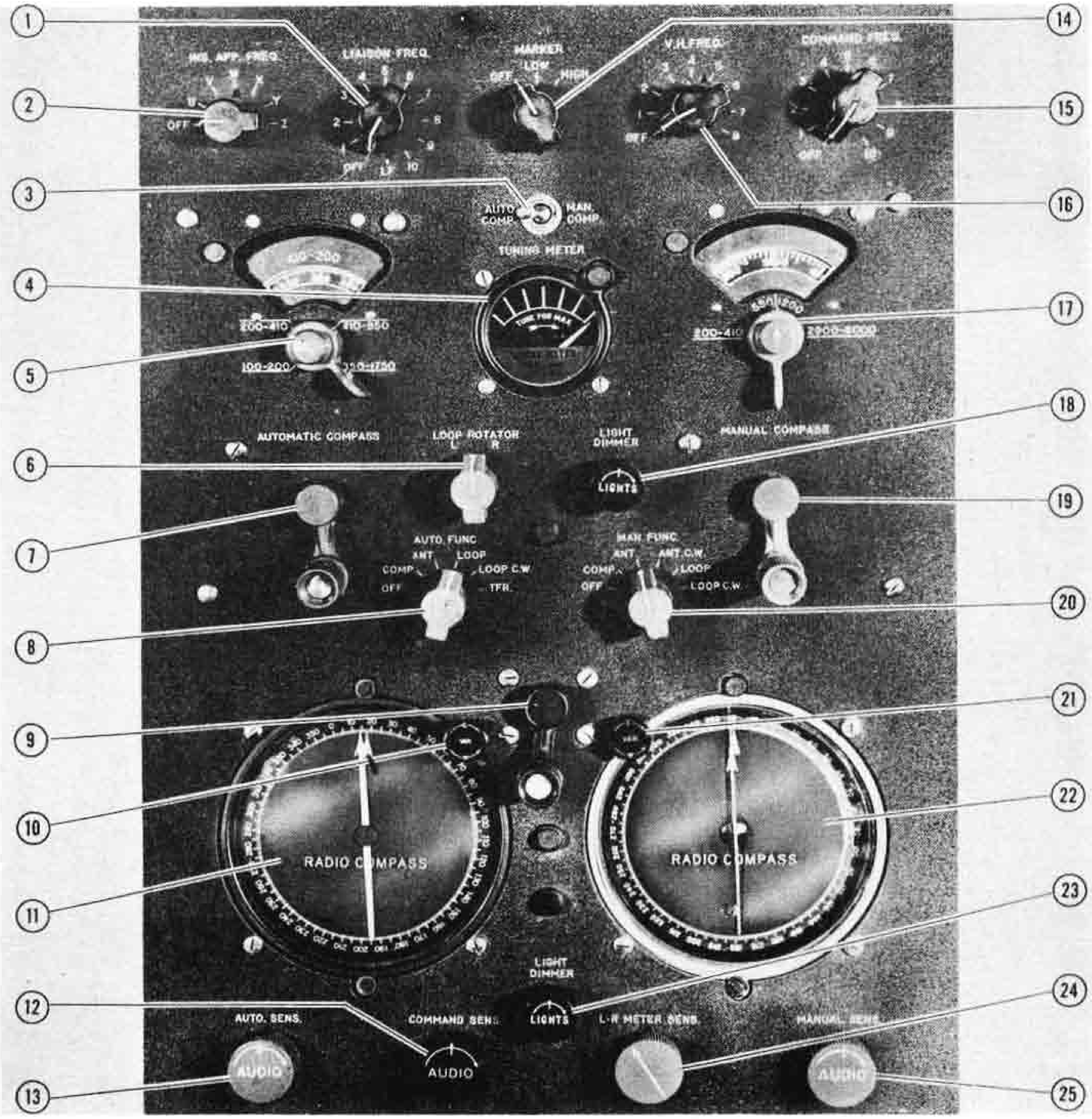
The radio master switch (figure 20-2) must be ON to operate any of the radio or interphone equipment with the exception of the "IFF" radio destructor unit.

3. OPERATION OF EQUIPMENT.

a. H.F. COMMAND (AN/ARC-9).—All controls for the high frequency command set are located on the pilot's overhead panel (figure 60). There are ten pre-tuned frequencies on both the transmitter and receiver which may be selected by turning the frequency selector switch (figure 60-15) to any one of its ten positions.

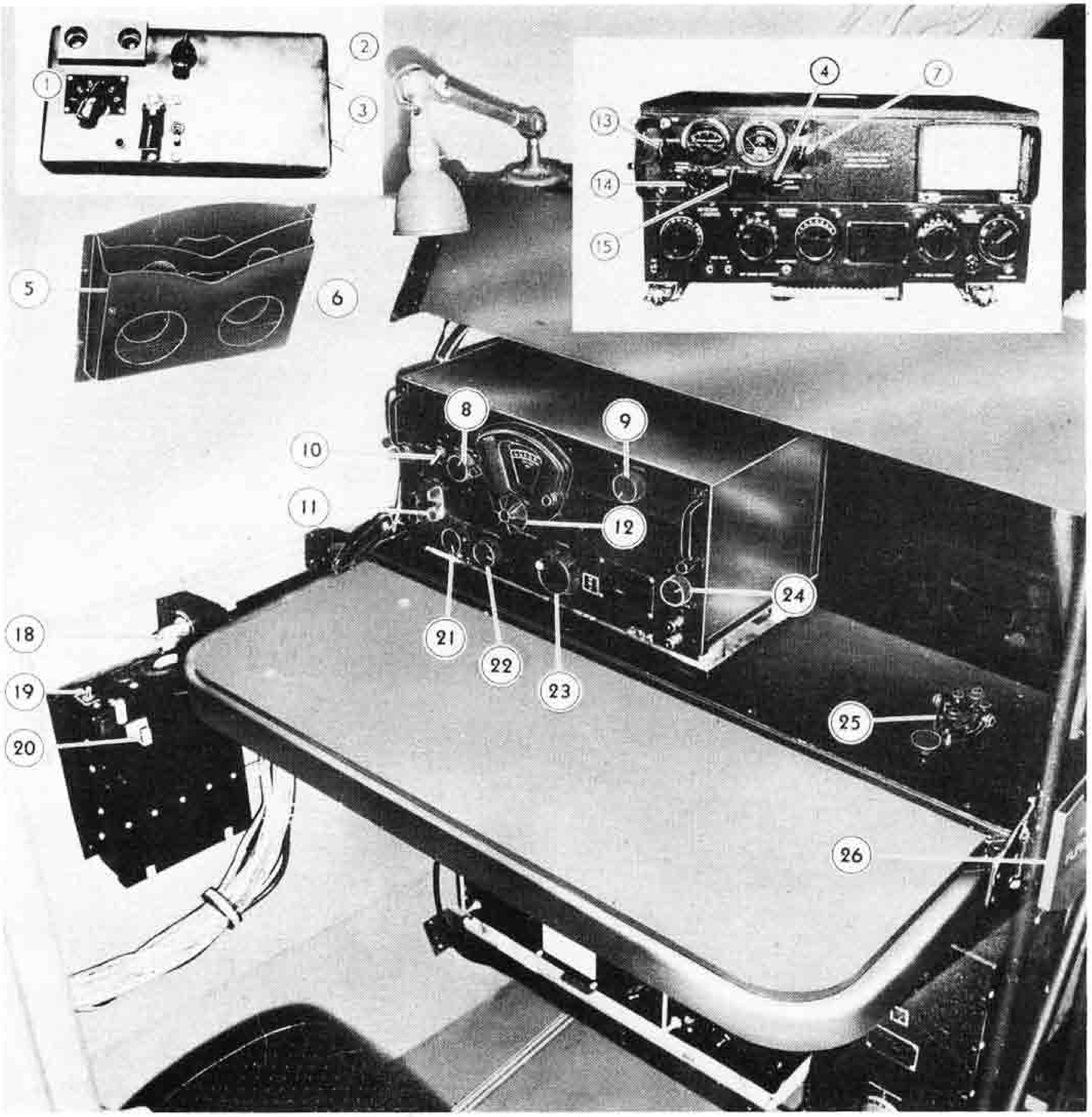
(1) To turn the H.F. Command radio ON, set the frequency selector switch (figure 60-15) to the desired frequency and wait approximately one minute for the set to warm up. Adjust the command AUDIO control (figure 60-12) to the desired volume.

(2) Any crew member except the flight engineer may use the command radio, after it has been turned on, by turning his H.F. Command receiver selector switch (figure 62-8) to H.F. COMM. and by turning his microphone switch (figure 62-3) to H.F. COMMAND.



1. Liaison radio frequency selector switch.
2. Instrument approach frequency switch.
3. Tuning meter selector switch.
4. Tuning meter.
5. Automatic compass band selector.
6. Automatic compass loop control.
7. Automatic compass tuning crank.
8. Automatic compass antenna selector switch.
9. Manual compass loop crank.
10. Automatic compass E-W variation control.
11. Automatic compass loop indicator.
12. H.F. command receiver audio control.
13. Automatic compass audio control.
14. Marker beacon switch.
15. H.F. command radio frequency selector switch.
16. V.H.F. command radio frequency selector switch.
17. Manual compass band selector.
18. Dial light rheostat.
19. Manual compass tuning crank.
20. Manual compass antenna selector switch.
21. Manual compass E-W variation control.
22. Manual compass loop indicator.
23. Dial light rheostat.
24. L-R meter sensitivity control.
25. Manual compass audio control.

Figure 60 — Pilot's Overhead Radio Control Panel



1. IFF radio controls.
2. Liaison transmitter monitor switch.
3. Desk light switch.
4. Liaison transmitter power level switch.
5. Data holder.
6. Desk light.
7. Liaison transmitter emission switch.
8. Liaison receiver crystal control.
9. Liaison receiver dial light rheostat.
10. Liaison receiver CW switch.
11. Liaison receiver on-off switch.
12. Liaison receiver band switch.
13. Liaison transmitter station selector switch.
14. Liaison transmitter channel selector switch.
15. Liaison transmitter metered circuit selector switch.
16. (Deleted).
17. (Deleted).
18. Oxygen outlet.
19. Antenna transfer switch.
20. Phone hook.
21. Liaison receiver volume control.
22. Liaison receiver beat frequency control.
23. Liaison receiver tuning control.
24. Liaison receiver antenna alignment control.
25. Transmitter key.
26. Airplane flight report holder.

Figure 61 — Radio Operator's Station

b. V.H.F. EQUIPMENT (AN/ARC-3). — All controls for the V.H.F. radio are located on the pilot's overhead panel (figure 60). There are eight pre-tuned frequencies for the transmitter and receiver, any one of which may be selected by turning the V.H.F. frequency switch (figure 60-16) to one of its eight positions.

(1) To turn the V.H.F. equipment ON, set the V.H.F. frequency selector switch (figure 60-15) to the desired channel and wait for the equipment to warm up.

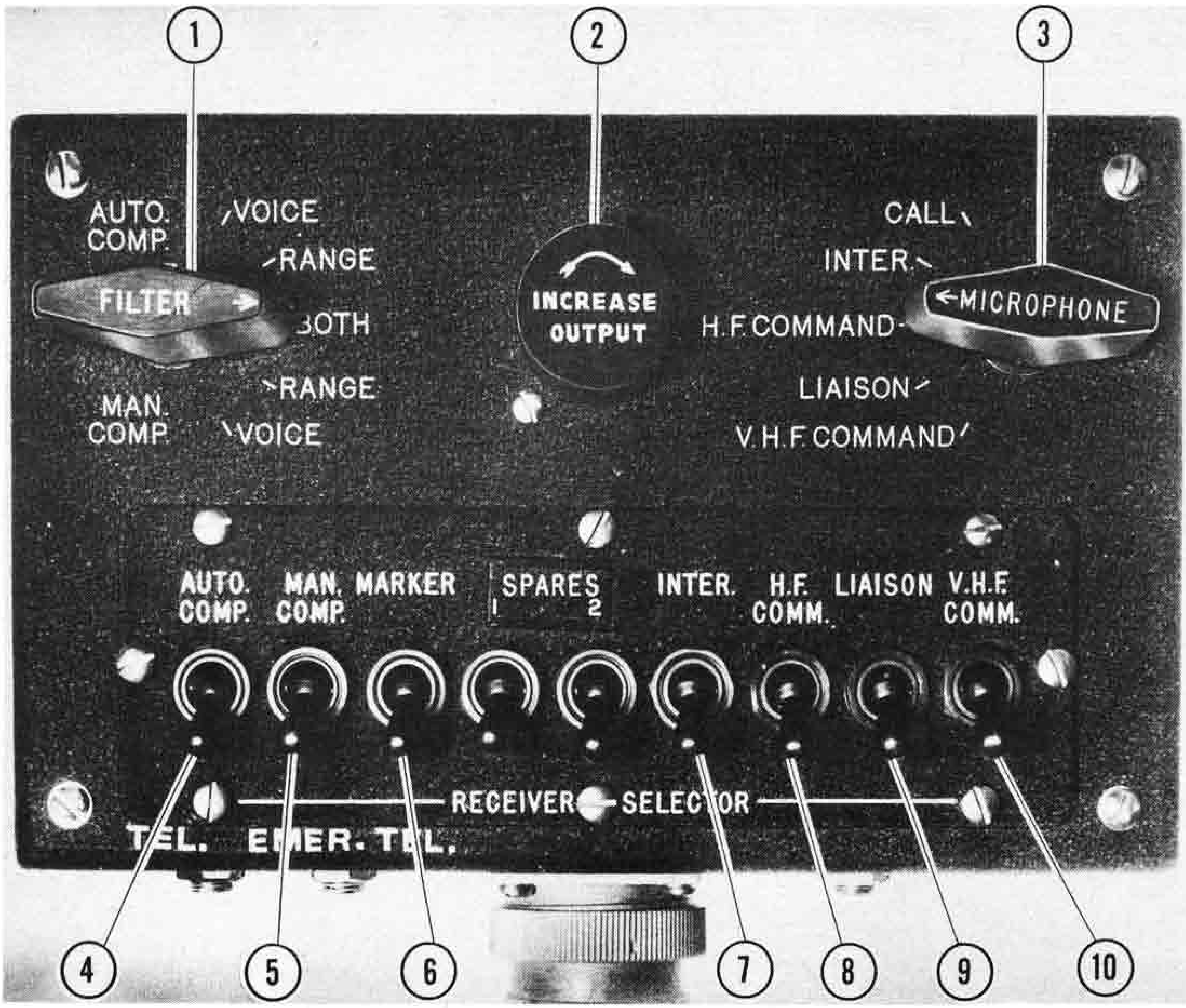
NOTE

There is no separate volume control for this set.

The master volume control (figure 62-2) on each audio selector box may be used as required.

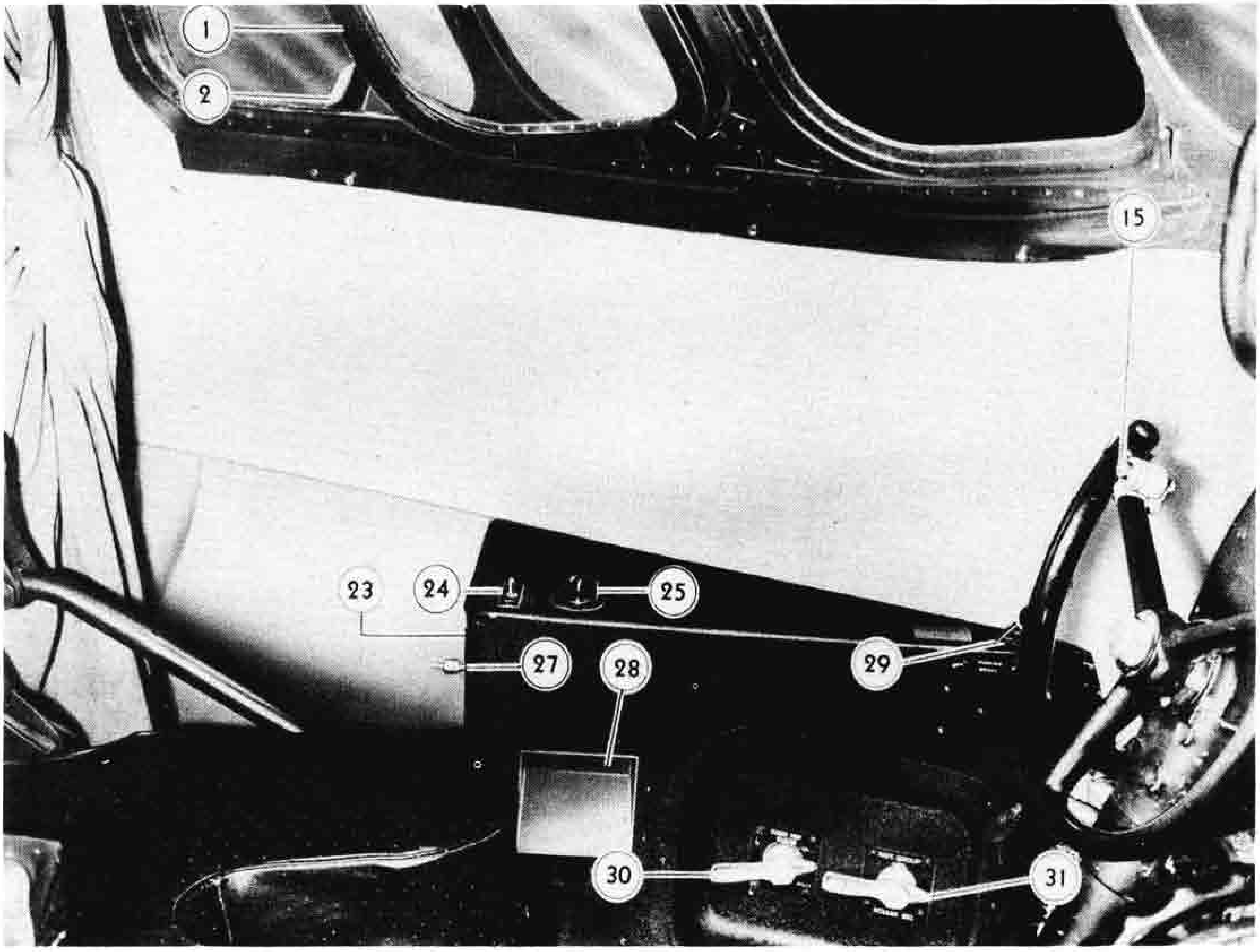
(2) Any crew member except the flight engineer may use the V.H.F. equipment, after it has been turned on, by setting his V.H.F. receiver selector switch (figure 62-10) to V.H.F. COMM. and turning his microphone switch (figure 62-3) to V.H.F. COMMAND

c. LIAISON SET (AN/ARC-8).—This radio equipment may be controlled from the flight station after the main control settings have been made by the radio operator.



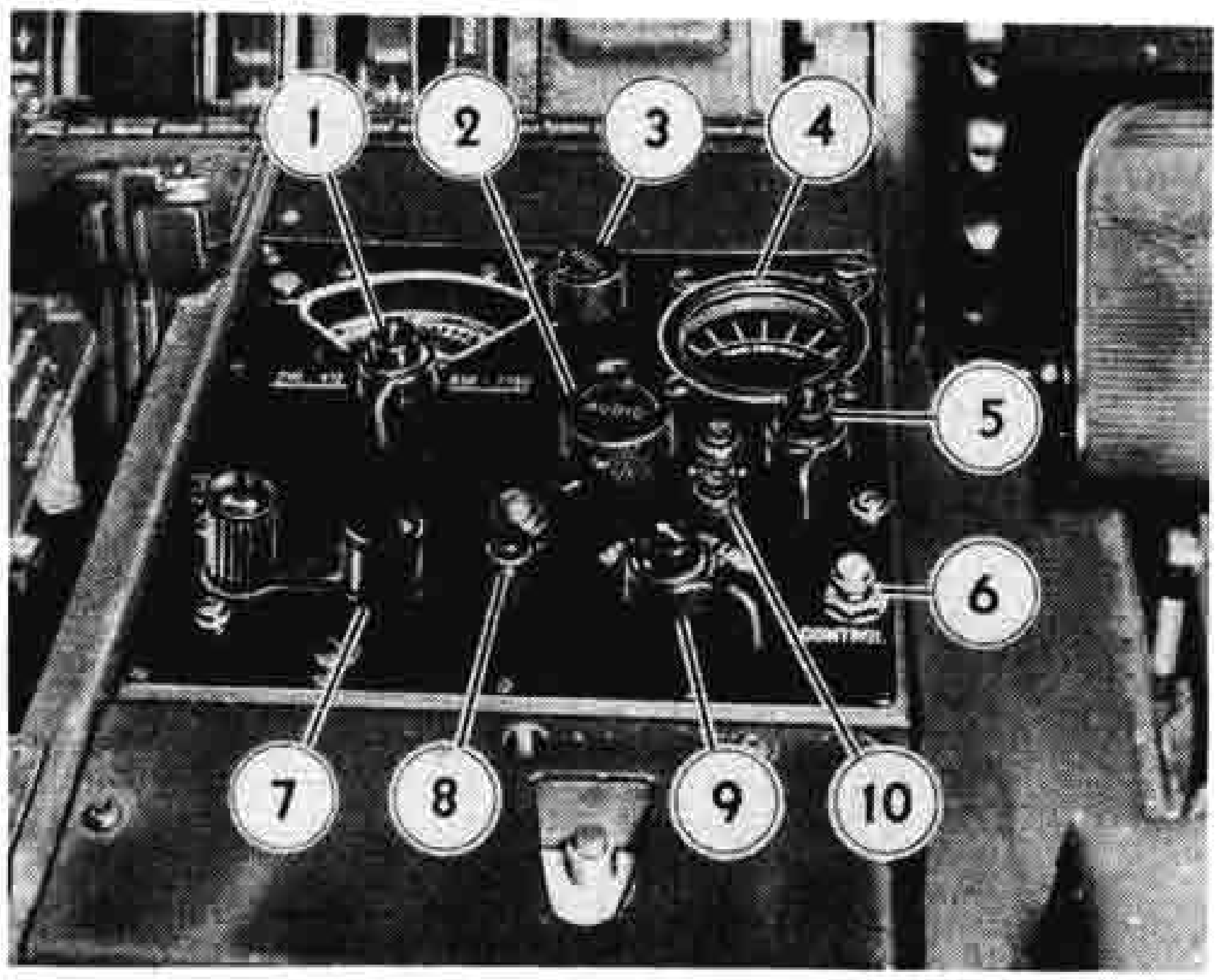
1. Filter selector switch.
2. Volume control.
3. Microphone selector switch.
4. Automatic compass selector switch.
5. Manual compass selector switch.
6. Marker beacon selector switch.
7. Interphone selector switch.
8. H.F. command receiver selector switch.
9. Liaison receiver selector switch.
10. V.H.F. command receiver selector switch.

Figure 62—Audio Selector Box



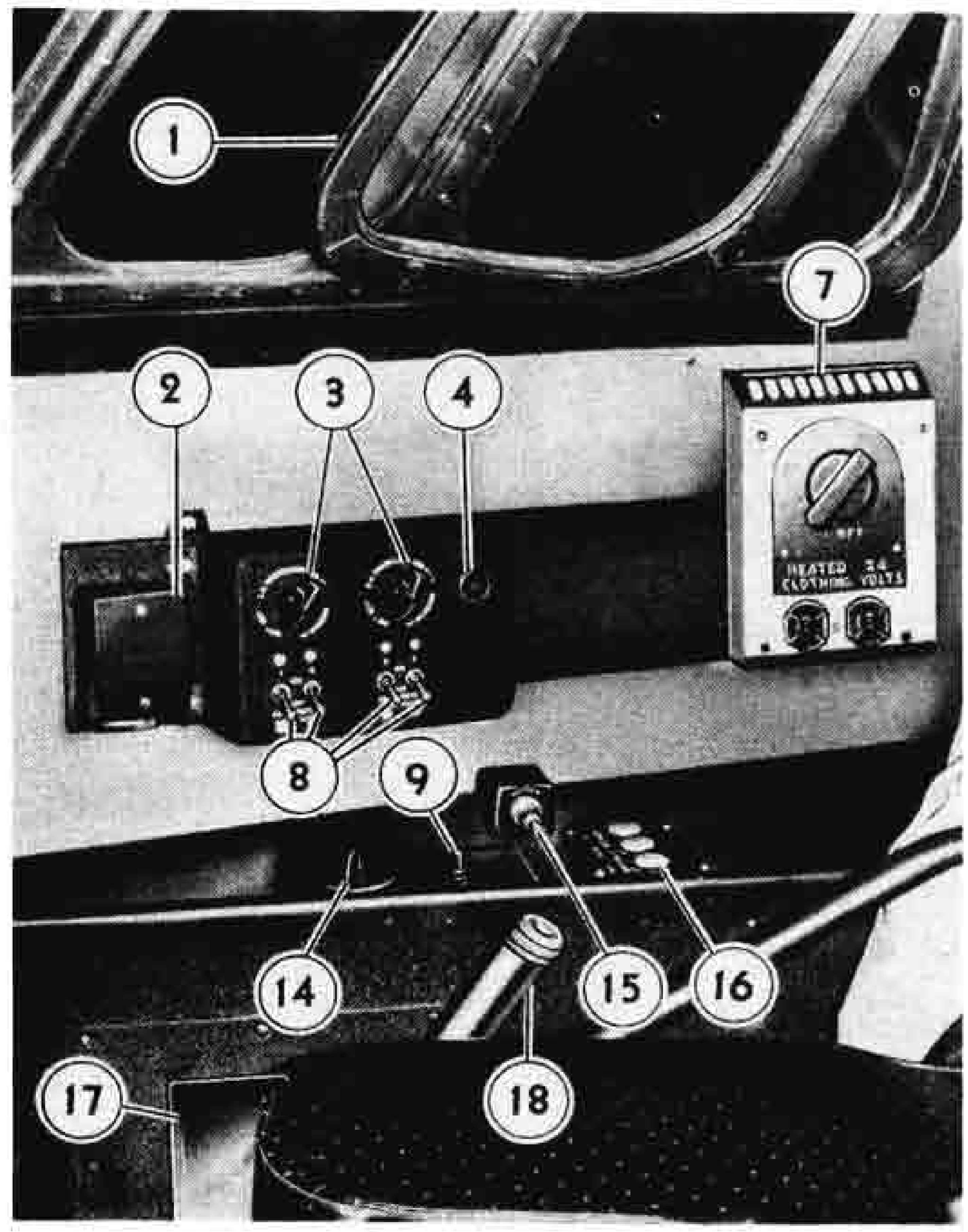
1. Sliding window.
2. Ice detector.
3. (Deleted).
4. (Deleted).
5. (Deleted).
6. (Deleted).
7. (Deleted).
8. (Deleted).
9. (Deleted).
10. (Deleted).
11. (Deleted).
12. (Deleted).
13. (Deleted).
14. (Deleted).
15. Microphone switch button.
16. (Deleted).
17. (Deleted).
18. (Deleted).
19. (Deleted).
20. (Deleted).
21. (Deleted).
22. (Deleted).
23. Windshield anti-icer controls.
24. Chart light switch.
25. Chart light rheostat.
26. (Deleted).
27. Pilot's oxygen outlet.
28. Rag holder
29. Parking brake lever.
30. Vacuum pump selector valve.
31. Instrument group vacuum selector valve.

Figure 63 — Pilot's Side Panel



1. Band selector.
2. Audio (volume) control.
3. Dial lights switch rheostat.
4. Tuning meter.
5. Loop antenna control.
6. Control button (not used).
7. Tuning crank.
8. Control light (not used).
9. Antenna selector switch.
10. Spare lights.

Figure 64 — Radio Compass



1. Sliding window.
2. Junction box.
3. Propeller anti-icer controls.
4. Co-pilot's call button.
5. (Deleted).
6. (Deleted).
7. Heated clothing outlet.
8. Carburetor anti-icer switches.
9. Chart light switch.
10. (Deleted).
11. (Deleted).
12. (Deleted).
13. (Deleted).
14. Chart light rheostat.
15. Co-pilot's oxygen outlet.
16. Windshield anti-icer controls.
17. Rag bag.
18. Emergency hydraulic hand pump.

Figure 65 — Co-pilot's Side Panel

SECTION VII

Cabin Pressurizing, Heating, and Ventilating

1. CABIN PRESSURIZING SYSTEM.
(Figure 67.)

a. GENERAL.—The cabin pressurizing system is controlled by the flight engineer. For all normal operation the equipment functions automatically and little adjustment of the controls is required. The cabin pressurizing system consists of the following main functional units:

(1) One cabin pressure control unit (figure 67-4) located on the air conditioning panel to the right of the flight engineer's station.

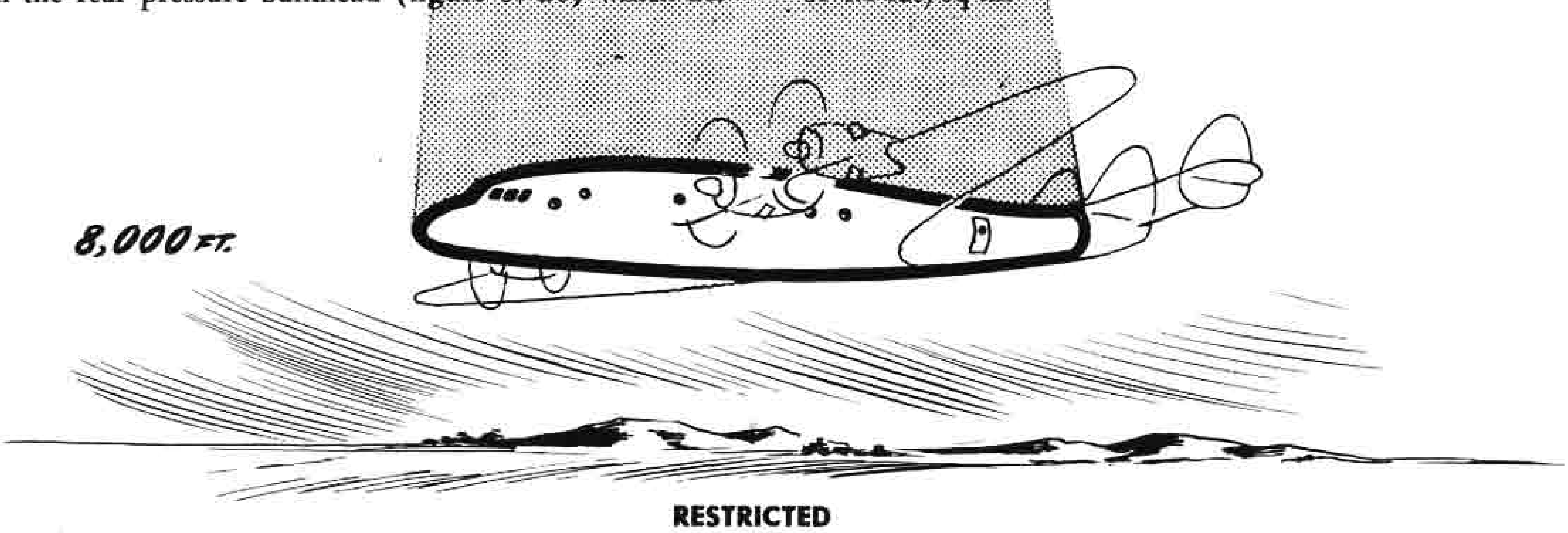
(2) Two engine driven centrifugal superchargers (figure 67-16) located behind the fire wall in the outboard nacelles.

(3) Two cabin outflow valves (figure 67-19) located in the rear cargo compartment which act as pressure regulators in valving air out of the cabin at the proper rate.

(4) Two automatic emergency relief valves, located on the rear pressure bulkhead (figure 67-26) which act both ways. When the internal pressure of the cabin is 4.15 lbs/sq in. greater than the outside pressure, these valves will allow air to escape from the cabin. When the outside pressure is 0.05 lbs/sq in. greater than the inside pressure, these valves will allow air to enter the cabin. These valves are normally closed.

b. CABIN PRESSURE CONTROL UNIT.

(1) PRESSURE ALTITUDE CONTROL. *(Figure 66-6.)*—This knob controls the cabin pressure (altitude). The dial reads from sea level to 15,000 feet. Below 5,000 feet the dial is graduated in inches of Hg. so that in landing, the flight engineer may bring the cabin altitude down to the Kollsman reading of the field if desired. The cabin pressure control unit should maintain the desired cabin altitude to within ± 300 feet of the setting of this knob. The following table gives the lowest cabin altitude obtainable with a given airplane altitude based upon a maximum allowable cabin differential pressure of 4.1 lbs/sq in.



Airplane Altitude	*Cabin Altitude*
Sea Level	Sea Level
8,800	Sea Level
10,000	1,000
15,000	4,750
20,000	8,200
25,000	11,400
30,000	14,500

(2) SUPERCHARGER FLOW CONTROL. *(Figure 66-12.)*—This knob controls the output of the cabin superchargers and is usually set at NORMAL. MAXIMUM position is used in case of an emergency such as a large cabin leak or malfunction of a pressure regulating valve. In cold weather, this control may also be used to increase the flow of warm air from the cabin heaters.

(3) VERTICAL SPEED CONTROL. *(Figure 66-7.)*

(a) GENERAL.—This control affords a greater degree of passenger comfort by allowing a slower rate of change of cabin pressure (altitude) than that experienced by the airplane. The range of adjustment available is from approximately 200 ft/min. to approximately 2,000 ft/min. 400 ft/min. to 600 ft/min. is a recommended maximum for passenger comfort. Close adjustment of the desired rate is obtained during flight by referring to the cabin rate of climb indicator (figure 66-9). Experience will determine the proper setting of the knob before take-off. The following examples will help explain the operation of this control:

(b) ASCENT. — Assume the airplane climbs from sea level to 10,000 feet at a rate of 1,000 ft/min. The flight engineer desires that the cabin rate of climb shall not exceed 400 ft/min. and that the cabin pressure altitude shall not exceed 8,000 feet. With the vertical speed control and the pressure altitude control set accordingly, the cabin will reach an apparent altitude of 8,000 feet in 20 minutes and remain there. The airplane, however, will have passed 8,000 feet eight minutes after take-off.

(c) DESCENT.—Upon descending, use is made of the difference between the airplane altitude (A_a) and the cabin altitude (A_c) above the field so that at different rates of descent, both cabin and airplane will reach the altitude of the field together. The altitudes A_a and A_c may be found by setting both the airplane altimeter and the cabin altimeter (figure 66-3) to the Kollsman number of the field. The cabin rate of descent (R_c) is set on the vertical speed control by the flight engineer. The maximum allowable airplane rate of descent (R_a) can be computed by the simple equation:

$$R_a = \frac{A_a \; R_c}{A_c}$$

Example: $A_a = 20{,}000$ feet above the field.
$A_c = 8{,}000$ feet above the field.
R_c set at 600 ft/min.

then $R_a = \dfrac{20{,}000 \times 600}{8000} = 1{,}500$ ft/min.

This is the maximum rate at which the pilot should descend to insure that the airplane altitude does not overtake the cabin altitude during the descent. If this should happen, the cabin relief valves will allow air to enter the cabin and both airplane and cabin will descend together which might prove uncomfortable to an inexperienced passenger. A slower descent or even leveling out is permissible since the cabin altitude will descend until a pressure difference of 4.1 lbs/sq in. is reached and remain there until a further change in the airplane altitude is made.

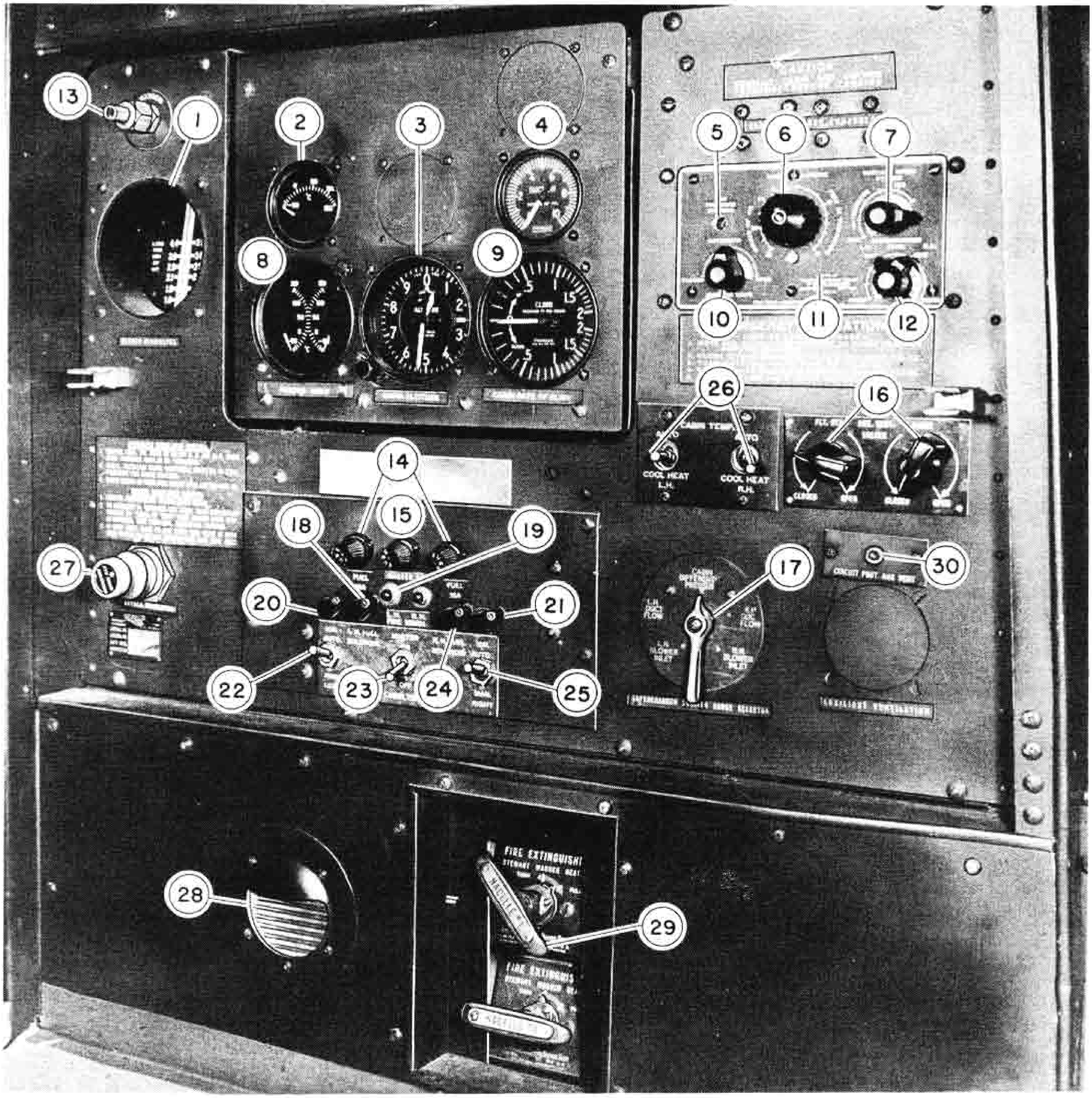
NOTE

When operating at less than maximum differential pressure it is possible to start the cabin altitude down before the airplane starts to descend. Thus if there are mountains near the airport it will not be necessary to wait until the airplane can start descending to start the cabin altitude descending.

(4) PNEUMATIC OUTFLOW (PRESSURE REGULATING) VALVE CONTROL. *(Figure 66-10.)*—This control should be set on AUTOMATIC at all times. When set on AUTOMATIC, the control operates through the vertical speed control and will not allow the cabin altitude to change at a rate greater than set on the vertical speed control (figure 66-7). The OPEN position is used in an emergency when it is necessary to depressurize as quickly as possible. The CLOSED position may be used to close both outflow (pressure regulating) valves in case of a cabin leak or malfunction of an outflow valve.

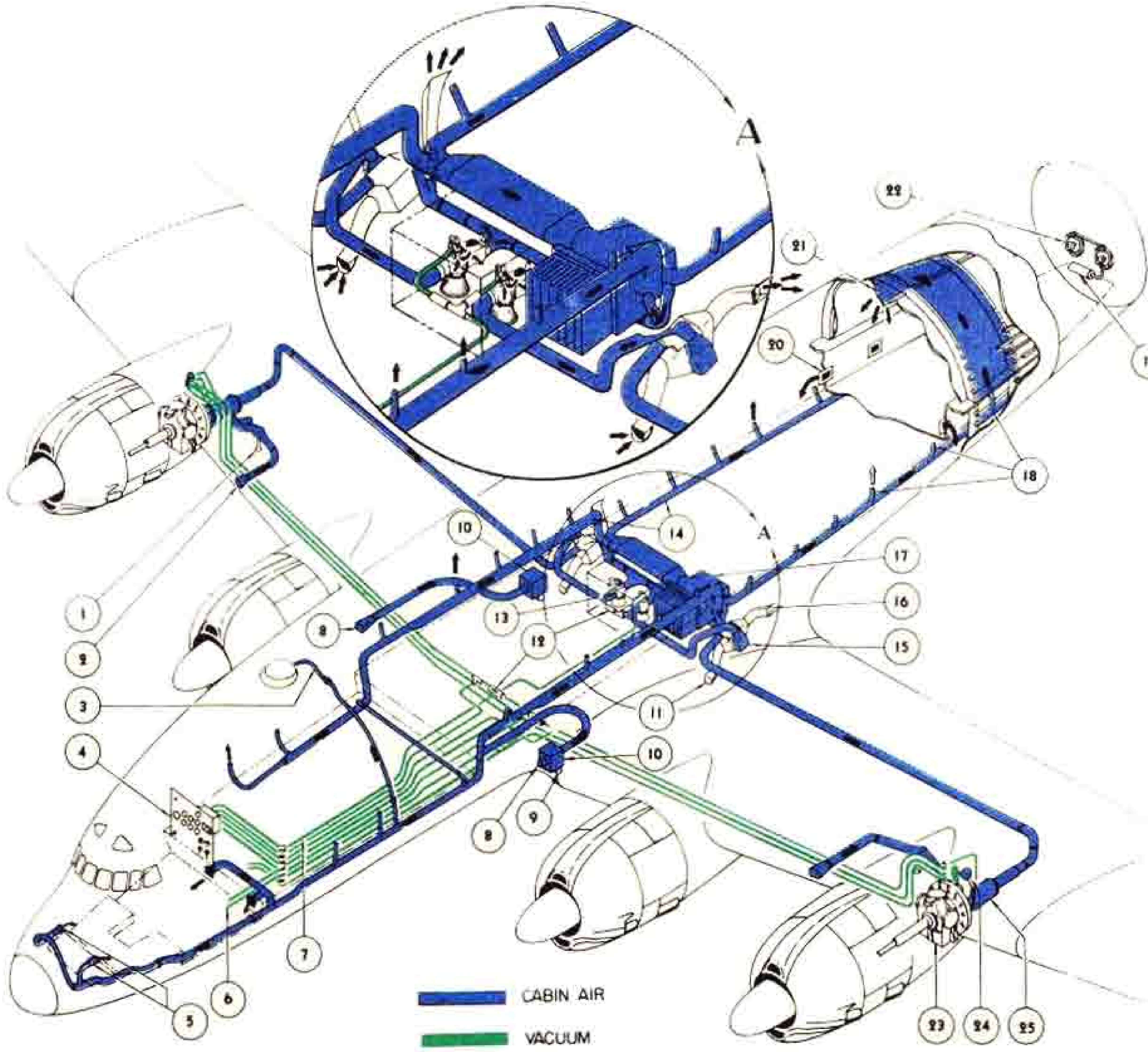
(5) PRESSURE REGULATING VALVE MANUAL CONTROLS. *(Figure 32-2.)*—These controls are located to the left of the flight engineer. Each lever operates one pressure regulating valve as follows:

(a) BOTH OPEN (Forward Position).—This is the normal operating position when using the pressurizing system or when cabin heat is desired. All supercharger air enters the cabin and the pressure regulating valves operate automatically. This position must also be used on the ground or during flight to obtain warm air from the cabin heaters.



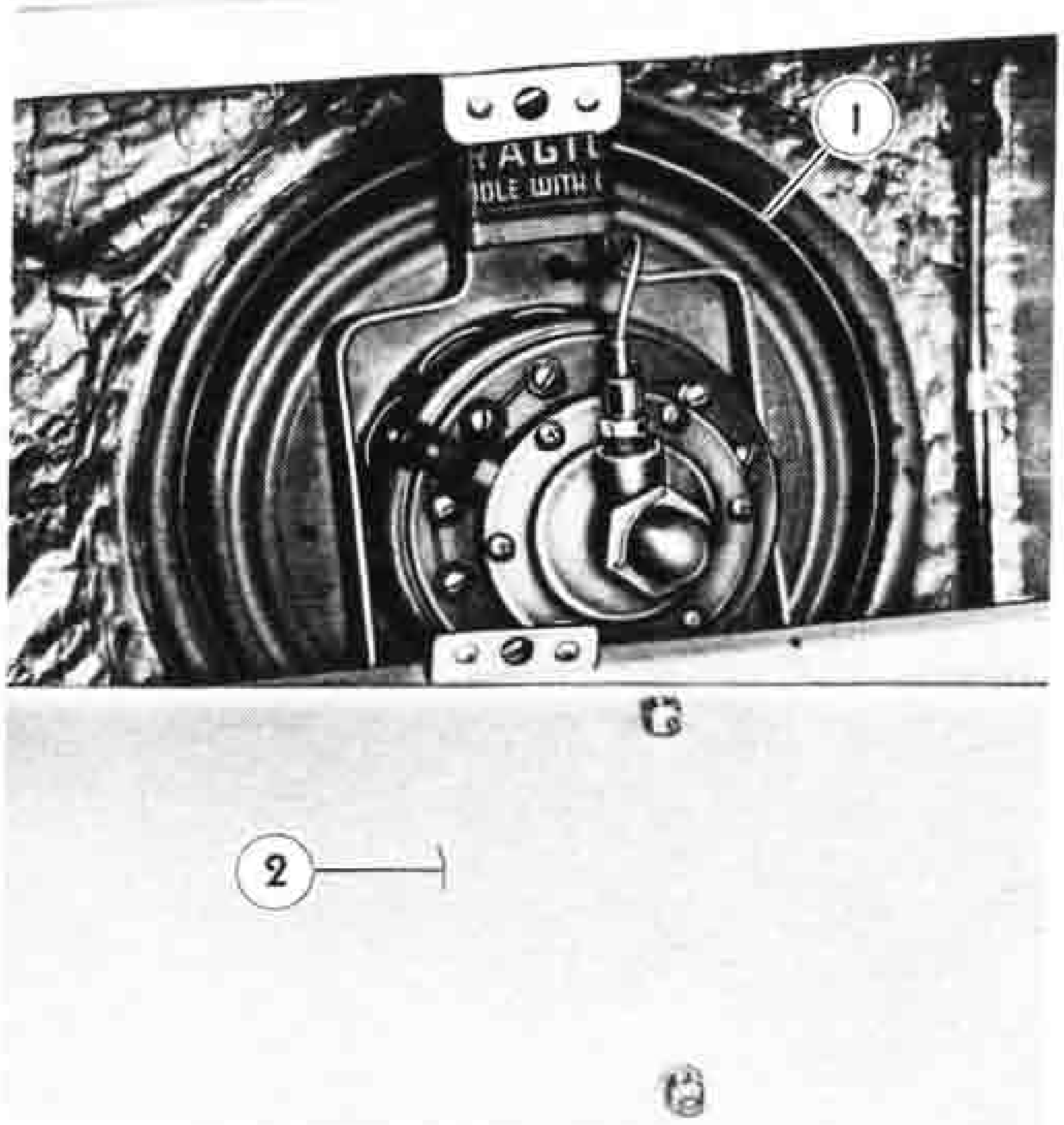
1. Oxygen flow meter.
2. Cabin temperature gage.
3. Cabin altimeter.
4. Suction gage.
5. Cabin low pressure warning light.
6. Pressure altitude control.
7. Vertical speed control.
8. Heater duct temperature gage.
9. Cabin rate of climb.
10. Pneumatic outflow valve control (pressure regulating).
11. Pressurizing control panel.
12. Cabin supercharger flow control.
13. Flight engineer's oxygen outlet.
14. Heater fuel valve fuses.
15. Cabin heater master fuse.
16. Auxiliary ventilation controls.
17. Supercharger suction gage selector.
18. Left-hand fuel solenoid indicator light.
19. Cabin heater fire warning lights.
20. Left-hand heater ignitor indicator light.
21. Right-hand heater ignitor indicator light.
22. Left-hand heater ignitor switch.
23. Cabin heater master switch.
24. Right-hand fuel solenoid indicator light.
25. Right-hand heater ignitor switch.
26. Cabin temperature control switches.
27. Oxygen flow regulator.
28. Crew door step light.
29. Cabin heater fire extinguisher controls.
30. Auxiliary ventilation circuit protector.

Figure 66 — Air Conditioning Control Panel



1. Water separator.
2. Cabin air intake.
3. Astral dome air duct.
4. Air conditioning and cabin pressurizing control panel.
5. Pilot and co-pilot's air ducts.
6. Emergency vacuum source lines.
7. Vacuum control lines.
8. Auxiliary ventilation intakes (2)
9. Auxiliary ventilation valve actuating motor.
10. Auxiliary ventilation valves (2)
11. Cabin intercooler intake scoop.
12. Check valve.
13. Right-hand outflow valve.
14. Right-hand cabin air distribution duct.
15. Cabin air intercooler.
16. Cabin intercooler exit flap.
17. Cabin fan.
18. Cabin air entrance ducts.
19. Cabin pressure relief valve actuating motor.
20. Cabin air exit duct.
21. Cabin air ceiling grill.
22. Cabin pressure emergency relief valve.
23. Left-hand cabin supercharger.
24. Auxiliary air intake.
25. Left-hand Stewart Warner gasoline heater.

Figure 67 — Cabin Pressurizing and Ventilating System



1. Relief valve seat.
2. Relief valve panel.

Figure 68—Cabin Air Relief Valve

(b) OUTFLOW (PRESSURE REGULATING VALVE) CLOSED (Center Position).—This is an emergency position. All supercharger air enters the cabin but none is allowed to escape through the outflow (pressure regulating) valves. Use this position as explained in Section IV, paragraph 7, if loss of cabin pressure occurs.

NOTE

Do not move both controls to the center position except in an emergency such as a large cabin leak.

(c) DUMP (Rear Position). — This is the unpressurized position. All supercharger air is dumped overboard before entering the cabin. On a dusty field this position should be used on the ground while taxiing and taking off to prevent dust blowing into the cabin. Use this position also while flying unpressurized in warm weather to keep the cabin as cool as possible.

(6) LOW PRESSURE WARNING LIGHT. *(Fig. 66-5.)*—This light will glow if the cabin altitude exceeds the setting of the pressure altitude control by from 500 to 1000 ft. This may occur for the following reasons:

(a) Pressure altitude control (figure 66-6) intentionally set below the cabin altitude (as in landing). This does not indicate trouble. When the cabin altitude reaches the lower altitude of the control setting, the light will go out.

(b) Airplane is above the maximum altitude at which the cabin outflow (pressure regulating) valves are allowed to hold the pressure set on the pressure altitude control. Refer to paragraph 1, *b*, (1) of this section for table of maximum allowable difference of altitude between the airplane and the cabin. To remedy, turn the pressure altitude control knob up slowly until the light goes out, or lower the airplane altitude.

(c) LOSS OF CABIN PRESSURE.—See Section IV, paragraph 7 "Cabin Pressurizing System Failure".

c. OPERATION OF THE CABIN PRESSURIZING SYSTEM.

(1) BEFORE TAKE-OFF.

(a) Pressure regulating manual control (figure 32-2).—Both in DUMP (rear position).

(b) Auxiliary ventilation control (figure 66-16).—To OPEN or CLOSE (depending on outside air temperature).

(c) Supercharger flow control (figure 66-12).—Both to NORMAL.

(d) Set the vertical speed control (figure 66-7) as desired (400 to 600 ft/min. recommended for passenger comfort).

(e) Pressure altitude control (figure 66-6) to cabin altitude desired in flight (8,000 to 10,000 feet normal).

(f) Outflow (pressure regulating) valve control (figure 66-10) AUTOMATIC.

(2) AFTER TAKE-OFF WHEN READY TO PRESSURIZE:

(a) Auxiliary ventilation controls (figure 66-16) CLOSED.

(b) Pressure regulating valve manual control (figure 32-2).—AUTOMATIC. Move one control to this position, then wait 30 to 60 seconds before moving the other.

(c) Following the above operation the cabin pressurizing equipment will function automatically and no further operations are required unless it is desired to

change the cabin altitude or unless an emergency arises. See Section IV, paragraph 7 for emergency operating instructions.

(3) BEFORE LANDING.—Refer to paragraph 1, *b*, (3), *(c)* above and set the pressure altitude control (figure 66-6) accordingly. Always equalize the cabin and outside pressure before landing. Turn the supercharger suction gage selector (figure 66-17) to CABIN DIFFERENTIAL PRESSURE and see that the suction gage (figure 66-4) reads ZERO. Set the outflow (pressure regulating) valves (figure 66-10) to OPEN if necessary to remove any remaining pressure. One supercharger should be dumped at 2000 ft. above the field, and the other should be dumped at 1000 ft.

2. HEATING SYSTEM.

a. GENERAL.—Normal operation of the heating system is automatic. The system consists of the following main functional units:

(1) Two Stewart Warner gasoline heaters located in the outboard nacelles. These heaters burn a small part of the fuel vapor from the engine induction system and exhaust back into the induction system. Each heater is equipped with one automatic and one manual ignitor and an electric motor driven valve for control of the fuel flow. Warm air from the heaters is forced into the cabin by the cabin superchargers, therefore, the inflow and outflow manual valve controls (figure 32-2) must be in the BOTH OPEN (forward position) and the outboard engines must be operating to obtain heat.

(2) Two automatic cabin air coolers (intercoolers).

(3) One cabin thermostat which controls both heaters and coolers.

b. OPERATION OF THE CABIN HEATING SYSTEM.

CAUTION

Safety First—The heaters should be OFF during take-off and landing. Re-start them after take-off or landing if required.

(1) AUTOMATIC OPERATION.

(a) Pressure regulating manual controls (figure 32-2) both in BOTH OPEN (forward position).

(b) Cabin temperature control switches (figure 66-26) both on AUTOMATIC.

(c) Master temperature switch (fig. 66-23) ON.

NOTE

When the master temperature switch is turned ON, both the ignitor and fuel solenoid lights (green) (figure 66-20, 66-21, 66-18 and 66-24) will glow within one or two minutes. (Check the lights with the test switch (figure 22-4) if they do not.) When the heaters are ignited, the ignitor lights will go out. If, at any time, no further heat is required, the cabin thermostat will close the fuel valve and the fuel lights (figure 66-18 and 66-24) will go out.

WARNING

In case of a fire in an outboard nacelle, turn the master temperature switch OFF and pull the heater fire extinguisher control (figure 66-29).

(2) MANUAL OPERATION.

(a) MANUAL IGNITOR.—If an ignitor light does not glow when the master temperature switch (figure 66-23) is turned ON, or if a heater duct temperature (figure 66-8) drops it may indicate that an automatic ignitor has burned out.

1. Check the light with the test switch (figure 22-4).

2. Make sure the reason is not due to the cabin temperature being at or near 70° F. At this temperature, the thermostat will not allow the heater to turn on automatically.

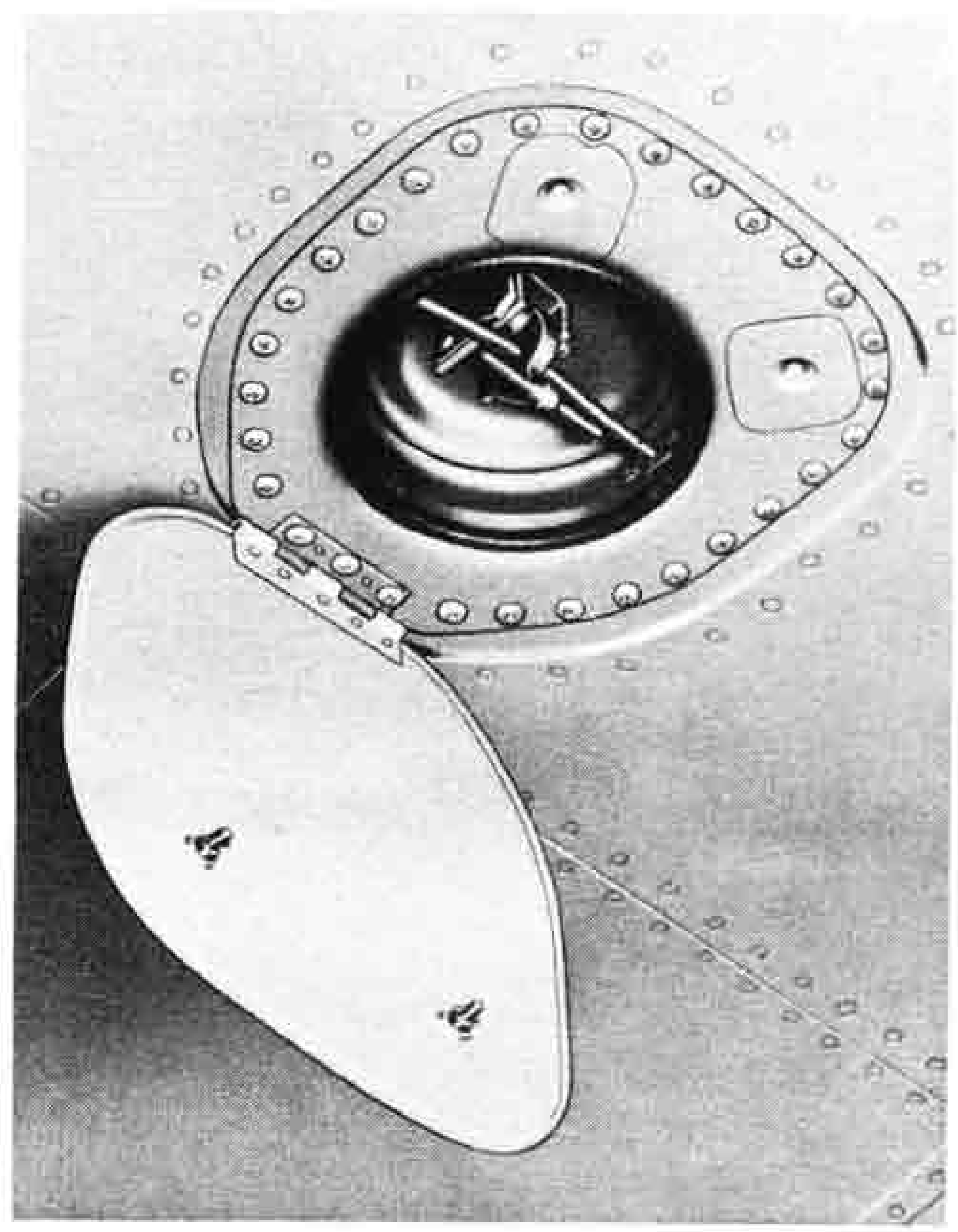


Figure 69—Cabin Air Ground Attachment

3. Hold the ignitor switch (figure 66-22 or 66-25) on MANUAL until the heater duct temperature (figure 66-8) rises. The ignitor light will not operate when the manual ignitor is used.

(b) MANUAL TEMPERATURE CONTROL.—In case of cabin thermostat failure, increase or decrease the cabin temperature by holding the cabin temperature control switches (figure 66-26) momentarily to HEAT or COOL and return to NEUTRAL position. Watch the heater duct temperature (figure 66-8) for temperature change.

(c) SUPERCHARGER FAILURE. — In case of an outboard engine or cabin supercharger failure, put that cabin temperature control switch (figure 66-26) in the COOL position and leave it there to make certain the heater is OFF.

3. VENTILATING SYSTEM.

a. GENERAL.—During normal operation with the pressure regulating valve manual control (figure 32-2) in the AUTOMATIC (forward) position, the cabin superchargers are pumping more air into the cabin than is required to maintain the cabin pressure altitude. The pressure regulating valves are always valving this air overboard. As a result, the cabin air is being continually refreshed. Distribution of air is illustrated in figures 67 and 68.

b. AUXILIARY VENTILATION SYSTEM.—This system is provided for use in hot weather when the cabin pressurizing system is not operating. This system should not be used when cabin heat is desired. During cold weather, it is possible to heat the cabin with the cabin heaters while on the ground if the outboard engines are operating. In order not to lose this heat during the take-off when the heaters are off, the auxiliary ventilation control (figure 66-16) may be CLOSED. During warm weather, the take-off should be made with the auxiliary ventilation control (figure 66-16) OPEN and the pressure regulating valve manual controls (figure 32-2) in the DUMP (rear) position for coolest operation.

(1) OPERATION.—The auxiliary ventilation controls (figure 66-16) open an air valve and vent electrically. A separate control is provided for the cockpit and cabin. The inlet air valves may be modulated by the rheostat controls on the station 260 instrument panel, to increase or decrease the air flow through either system. Both systems must be closed for pressurization. The controls should be operated slowly in order to prevent sudden changes in cabin pressure.

c. CABIN FAN.—This fan is located in the rear cargo compartment. The fan includes a dust filter and is driven by a hydraulic motor. Control is by a lever located to the left of the flight engineer (figure 32-3). Turn the fan ON to maintain air circulation while operating on either the cabin pressurizing system or the auxiliary ventilation system. Make sure the fan is ON when using the cabin heaters.

SECTION VIII

Oxygen System

1. GENERAL.

a. The oxygen system in this airplane is installed for emergency rather than normal operation. Since the passengers are not normally supplied with oxygen, full use of the crew's supply is not expected. Should the cabin pressure system become inoperative, however, it would be possible to operate at an altitude requiring oxygen for the crew but not for the passengers.

2. EQUIPMENT.

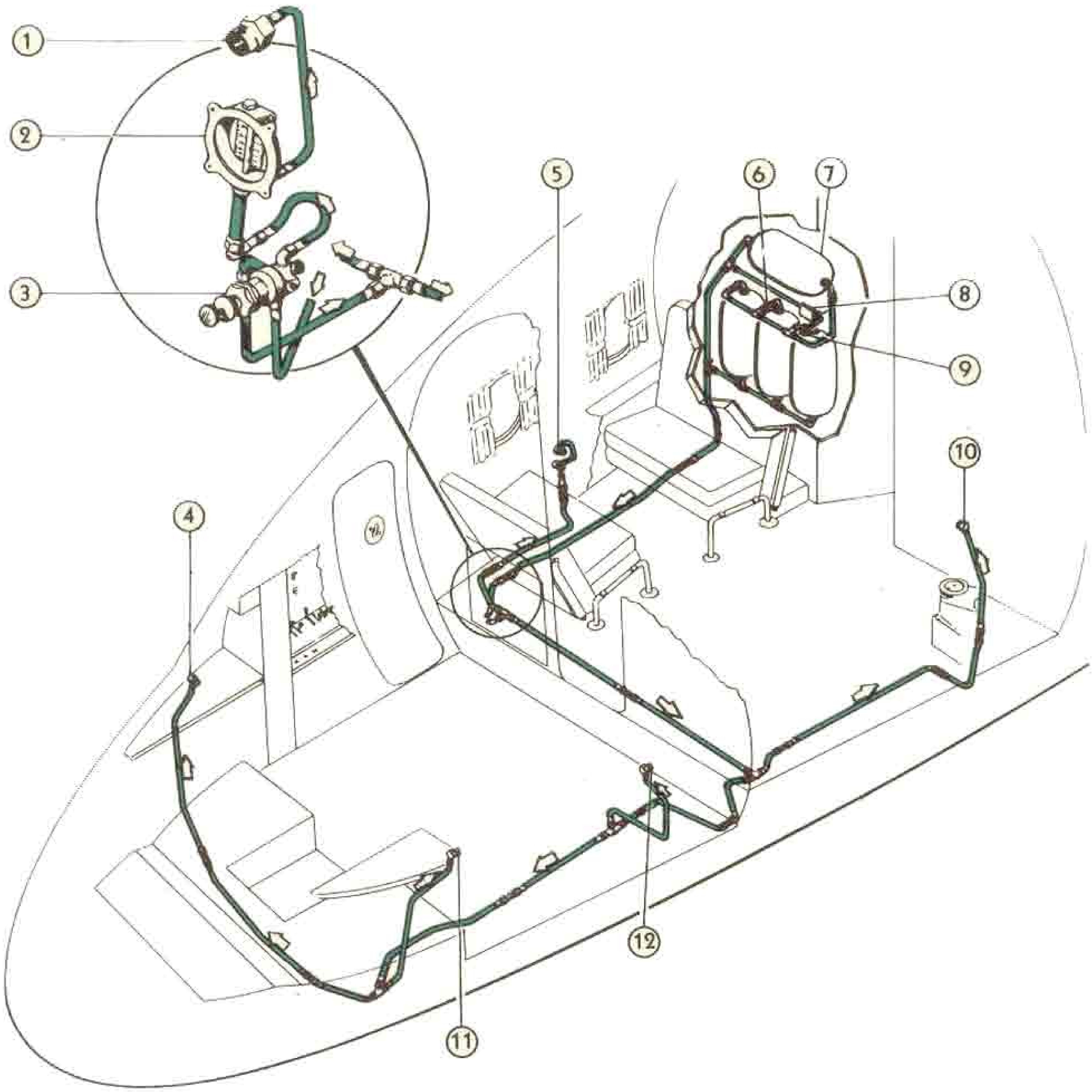
a. Four type G-1 low pressure bottles located in the upper cargo compartment supply seven outlets (figure 70). A flow meter (figure 66-1) and regulator (figure 66-27) are provided on the air conditioning panel.

(1) CHARGING THE CYLINDERS.—A filler valve and pressure gage are located on the rear wall of the relief crew compartment. A British adapter is also provided. Fill the cylinders slowly to 400 lbs/sq in. If the cylinders are filled too rapidly, they will become warm, and will not be fully charged when the gage reads 400 lbs/sq in.

3. OPERATION.

a. Regulation of the oxygen flow is normally a duty of the flight engineer. The flow meter is calibrated in feet of altitude for both the active and inactive condition. If all members of the crew are seated at their stations performing normal operations, adjust the flow meter to read the altitude of the airplane on the inactive scale. This setting will meter the proper amount of oxygen to all stations. If one or more members of the crew are active, the flow meter must be adjusted to the altitude of the airplane on the active scale. This setting will meter more oxygen than is necessary to the inactive crew members, but it is necessary to insure adequate flow for the active crew member. Change the setting of the regulator if the cabin altitude changes. The following table indicates the approximate hours duration of the oxygen supply when the cylinders are fully charged.

Altitude (thousands)	7 *Men Active*	7 *Men Inactive*	5 *Men Active*	5 *Men Inactive*
16 to 20	4 1/3	7 3/4	6	11
21 to 25	3 1/2	6	5	8 1/3
26 to 30	3	4 1/2	4 1/4	6 1/2



1. Flight engineer's outlet.
2. Oxygen flow meter.
3. Oxygen flow regulator.
4. Co-pilot's outlet.
5. Relief crew's outlets.
6. Check valves.
7. Oxygen bottle.
8. Filler valve with British adapter.
9. Oxygen bottle pressure gage.
10. Navigator's outlet.
11. Pilot's outlet.
12. Radio operator's outlet.

Figure 70—Oxygen System

SECTION IX

Extreme Weather Operation

1. COLD WEATHER OPERATION.

a. DESCRIPTION.

(1) GENERAL.—The following items have been provided on this airplane to facilitate operation in cold weather.

(2) OIL DILUTION SYSTEM.—Four switches (figure 6-27) controlling the oil dilution system are located on the Flight Engineer's overhead panel. Each engine has an independent oil dilution system, thus, the engines may be diluted selectively or simultaneously. If it is anticipated that the temperature at the next start will be below 5 °C. (40 °F.) the oil systems should be diluted before stopping the engines.

(3) CARBURETOR HEATERS.—Four carburetor heat control levers (figure 5-18) are located on the Flight Engineer's control stand. These levers control hot air muff valves which are designed to give a temperature rise of at least 32 °C. (90 °F.) with a 5 °C. (40 °F.) outside air temperature at 65% or greater engine power. The carburetor heat controls may be set as required to obtain the desired carburetor air temperature. Danger of detonation exists if carburetor air temperatures are allowed to go above 40° C (104° F).

(4) CARBURETOR ANTI-ICERS. — Carburetor anti-icers, operated by switches (figure 65-8) on the co-pilot's side panel, are provided to clear the carburetor of ice which has already formed and to prevent the formation of ice in the event the carburetor heaters are ineffective or inoperative. Approximately 10 seconds operation is usually sufficient to clear the ice from a carburetor.

(5) CARBURETOR AIR THERMOMETERS.—Carburetor air temperature gages (figure 5-6) are located on the Flight Engineer's instrument panel to indicate icing possibilities in the carburetor.

(6) PROPELLER ANTI-ICERS. — One electric pump located in each outboard engine nacelle delivers anti-icer fluid to the propellers on that side. Two rheostats (figure 65-3) are provided on the co-pilot's side panel for controlling the anti-icer pumps. The rheostats should be turned full *ON* for a few seconds to wet the blades thoroughly, then backed off to conserve the fluid supply.

(7) WINDSHIELD ANTI-ICERS, WIPER AND AIR BLAST.—A separate electric pump located in the forward baggage compartment supplies anti-icer fluid to the windshield. The pump is controlled by a switch (figure 24-20) on the pilot's overhead panel. Three needle control valves (figure 63-23), controlling the quantity of fluid flow to the pilot's windshields, are located on the aft end of the pilot's side shelf and the three needle control valves (figure 65-16), controlling the quantity of fluid flow to the co-pilot's windshields, are located on the co-pilot's side shelf. One centrifugal blower, controlled by a switch (figure 24-19) on the pilot's overhead panel, forces dried cabin air between the windshield glass panels to eliminate frost or fog. Two electric windshield wipers are controlled by one switch (figure 24-18) on the pilot's overhead panel. Do not operate wipers on dry glass.

(8) ICE DETECTOR.—A short strut (figure 63-2) is provided on the left side of the fuselage within easy view of the pilot for the purpose of ice detection. If ice forms on this easily visible strut, ice will also form on the wings, tail and propellers.

(9) ANTENNA MAST ANTI-ICER, PITOT ANTI-ICER AND PITOT HEAT.—The antenna mast and the two pitot static heads are supplied with anti-icer fluid by the same pump which supplies the windshield anti-icer and are controlled by the same switch. Both pitot heads incorporate a heater element which is operated by a switch (figure 24-17) on the pilot's overhead panel. Burn-out warning lights (figure 24-13) are provided over each switch.

(10) ANTI-ICER FLUID SUPPLY.—Isopropyl alcohol is used for anti-icer fluid and the supply is stored in two 20 gallon tanks, one located in each outboard engine nacelle.

(11) WING AND TAIL DE-ICERS.—De-icer boots are provided for the wing and tail (figure 25). They are turned *ON* by a switch (figure 24-14) located on the pilot's overhead panel.

(12) SNOW AND ICE TREAD TIRES.—Snow and ice tread tires, if available, will be installed at the discretion of the Engineering Officer. These tires are provided with metal cleats to assure traction when the airplane is operating from snow or ice-covered flying fields. Snow and ice tread tires should not be used on the nose wheels.

CAUTION

Care must be observed when landing on snow or ice-covered fields with ordinary tires installed. The pilot should, if possible, allow the airplane to roll to a stop rather than apply the brakes. Application of the brakes builds up a friction between the snow and the tires; the snow melts, then freezes into a glaze on the tires and there is a danger of the airplane skidding.

(13) OIL IMMERSION HEATERS.—The oil tank filler necks, located on the top of each engine nacelle, allow the immersion of flexible type electric heaters for ground heating of cold oil. Normally oil immersion heaters are not necessary but when difficulties are encountered with full dilution they should be installed immediately after landing and before the oil has cooled. The oil tanks must be full enough to completely submerge the heaters without allowing the heater element to touch the bottom of the tank. It is recommended that heaters with perforated shielding around the element, designed for use in self sealing tanks, be used to prevent damage to the tank sealing compound.

(14) ENGINE AND PROPELLER COVERS.—Water-proof engine and propeller covers, if available, should be stowed in the forward baggage compartment.

(15) MOORING EQUIPMENT.—Mooring equipment is furnished with each airplane and should be stowed in the forward baggage compartment.

b. OPERATION.

(1) PREPARATION FOR FLIGHT.

(a) Inspect the airplane to make sure that snow, frost or ice has not accumulated. Pay particular attention to the space between movable control surfaces and the main surfaces to which they are attached. Remove any accumulation by brushing or applying heat.

(b) If the airplane has been idle for many hours in very cold weather, the engines and propeller domes should be warmed with portable ground heaters. External heat should be applied when outside temperatures are below 0°C. (32°F.). Precautions should be taken to prevent the accidental ignition of gasoline vapors from the engine breathers.

(c) Remove ice and frost from the propellers. Move the propellers by hand at least two revolutions to check for freeness and to assure that there is no binding due to cold oil or differential expansion of adjacent engine parts. When the engines and propellers are sufficiently warm for engine starting, the propellers should not be excessively hard to rotate.

(d) Always use an external power source for starting and for running the engines or operating electrical equipment on the ground. The chances of starting without an external power source are remote and the chances of damaging the batteries are excellent.

(2) ENGINE STARTING.

(a) Assuming that proper oil dilution procedure was accomplished at the last engine shut-down, the normal engine starting procedure as outlined in Section II should be used. If the oil was not properly diluted when the engine was stopped, starting oil pressures may be extremely high or may fluctuate or fall off when the rpm is increased. If this condition is evident, engines should be run slowly until the oil pressures are normal.

Note

If the engines show no sign of warming up after a reasonable amount of slow running, they should be shut down and warmed with an external heat supply before restarting.

(b) During engine warm-up.—When the outboard engines are running, turn on the cabin heat according to instructions given in Section VII. Operate all flight control surfaces, control tabs, and flaps through two or three cycles to insure freedom of movement. Shift to manual elevator control two or three

times. Check the operation of the windshield and propeller anti-icers, windshield wiper, pitot heaters, de-icer boots (if installed) and the windshield driers *ON*.

CAUTION

Pitot heater elements will burn out if turned *ON* for more than 30 seconds while on the ground.

(c) Keep the cowl flaps full open during engine warm-up. Recommended cylinder head temperatures, at the start of the take-off run is between 180° C. and 232° C. (355° F. and 450° F.).

(d) During warm-up, the propeller governor *INC* and *DEC* switches should be operated throughout the entire range to assure the propeller mechanism a supply of warm oil.

(3) TAKE-OFF.

(a) If deep, heavy snow interferes with the take-off, but permits the airplane to taxi, move slowly up and down the take-off course several times to pack down a runway before attempting the actual take-off. The depth and hardness of the snow, together with the wheel size, will determine whether or not a take-off is practical.

(b) Do not take off with snow, ice or frost on the wings. Even loose snow cannot be depended upon to blow off, and only a thin frost layer is necessary to cause loss of lift and unusual flying characteristics. Under some conditions it may be necessary to taxi out to the take-off position before removing the protective covers from the flight surfaces, since frost formations can be very rapid.

(c) When taking off or landing on a narrow strip of clear ice, cross winds are particularly dangerous because of poor maneuverability caused by lack of traction. If the wind is gusty, the airplane may be blown completely off the ice before control can be regained.

(d) Regardless of the degree of cold weather encountered, take-off should be made with cowl flaps open. The hazard of taking off with partially closed cowl flaps is too great to risk and there is no possibility of the engines cooling off excessively during the take-off and rated power climb.

(e) The carburetor heat control should not normally be used during take-off. Under icing conditions, carburetor heat may be used immediately before take-off to insure that all ice is eliminated from the induction system. Immediately after take-off, when power is reduced, the carburetor heat controls may be placed in the position desired.

Note

When take-off is being made at air temperatures below —20° C. (—4° F.), enough carburetor heating may be used to give a carburetor air temperature of about 15° C. (59° F.) at full power.

(4) DURING FLIGHT.

(a) The formation of ice on the airplane may be expected with outside air temperatures below 36° F. in the presence of visible moisture such as fog, rain or mist. Icing will be accelerated in the presence of snow or sleet. The ice detector strut, visible to the left side of the pilot, will provide immediate indication of incipient ice formation.

(b) The pitot heaters should be turned on immediately when icing conditions are suspected, before actual icing occurs.

(c) The propeller anti-icers are designed to *prevent* rather than to *remove* ice formation and, therefore, should be turned before the ice formation starts. After the propeller blades are wet, the control may be turned down to conserve the fluid supply.

(d) Windshield anti-icers, windshield fan and wipers may be used as needed.

(e) The use of the wing and tail de-icers is dependent on conditions and the type of ice being formed. In general it is considered good practice to allow the deposit of 1/8 inch of ice on the boots before inflation is started. Operation may then be used intermittently with the cycle of operation dependent on the rapidity of ice formation.

Note

If continuous operation of the boots is used, care must be taken to prevent new ice formation over cracked ice, thus allowing the boots to pulsate inefficiently under a layer of ice.

(f) The carburetor anti-icers should be used only to remove ice that has formed in the carburetor. It should be considered only as a supplement to the carburetor hot air control.

(g) Carburetor icing is less likely to occur under extreme conditions of cold than when the free air temperature is between —17°C. and 16°C. (19°F. and 61°F.). A safe rule to follow is to keep the carburetor temperature between 15°C. and 40°C. (60°F. and 104°F.). It is good practice to apply carburetor heat one or two minutes every half hour during flight to preclude the possibility of carburetor icing.

(b) Propeller speed should be increased by 200 rpm every half hour to assure continued governing at extreme low temperatures. Return to desired cruising rpm as soon as the tachometer shows that the governor is functioning.

(5) LANDING.

(a) Temperature inversions are common in winter, and the ground air may be 15°C. to 30°C. (27°F. to 54°F.) colder than at altitude. Therefore, care must be taken to avoid excessive cooling when letting down. The approach should be made with gear down, power on, and flaps partially extended to reduce the air speed. The cowl flaps should be CLOSED to maintain normal cylinder head temperatures. The carburetor heat controls should be set to HOT. Turn de-icer boots OFF.

NOTE

Set carburetor heat controls to COLD immediately if power must be applied due to a mislanding.

(b) Brakes should be used sparingly and not until absolutely necessary after setting the airplane down.

(c) Set cowl flaps to full OPEN as soon as the airplane is landed.

(d) When the airplane has reached the parking area, place chocks under the wheels, do not set the parking brakes until they are cool enough to touch.

(6) AFTER LANDING.

(a) Oil Dilution.—The oil dilution system is installed primarily to facilitate the starting of cold engines. Before stopping the engines, when a cold weather start is anticipated, dilute the engines as follows:

1. Idle the engine until the oil temperature falls to about 40°C. (104°F.).

Note

The fuel used by the oil dilution system is taken from the suction side of the engine-driven fuel pump.

2. Dilute at idling speed (1000-1200 rpm). Avoid spark plug fouling. A short acceleration period of 10 seconds at the end of the dilution run is usually sufficient to clear the spark plugs.

3. Maintain an oil temperature of less than 50°C. (122°F.) and an oil pressure above 15 pounds per square inch. If the oil temperature rises above, or the oil pressure falls below these limits, shut down and allow the engine to cool.

4. If the air temperature is expected to be between 4° C. and —12° C. (40° F. and 10° F.) the dilution time should be at least 4 minutes. If colder weather is anticipated at the next start, refer to the table below for dilution time.

OIL DILUTION TABLE

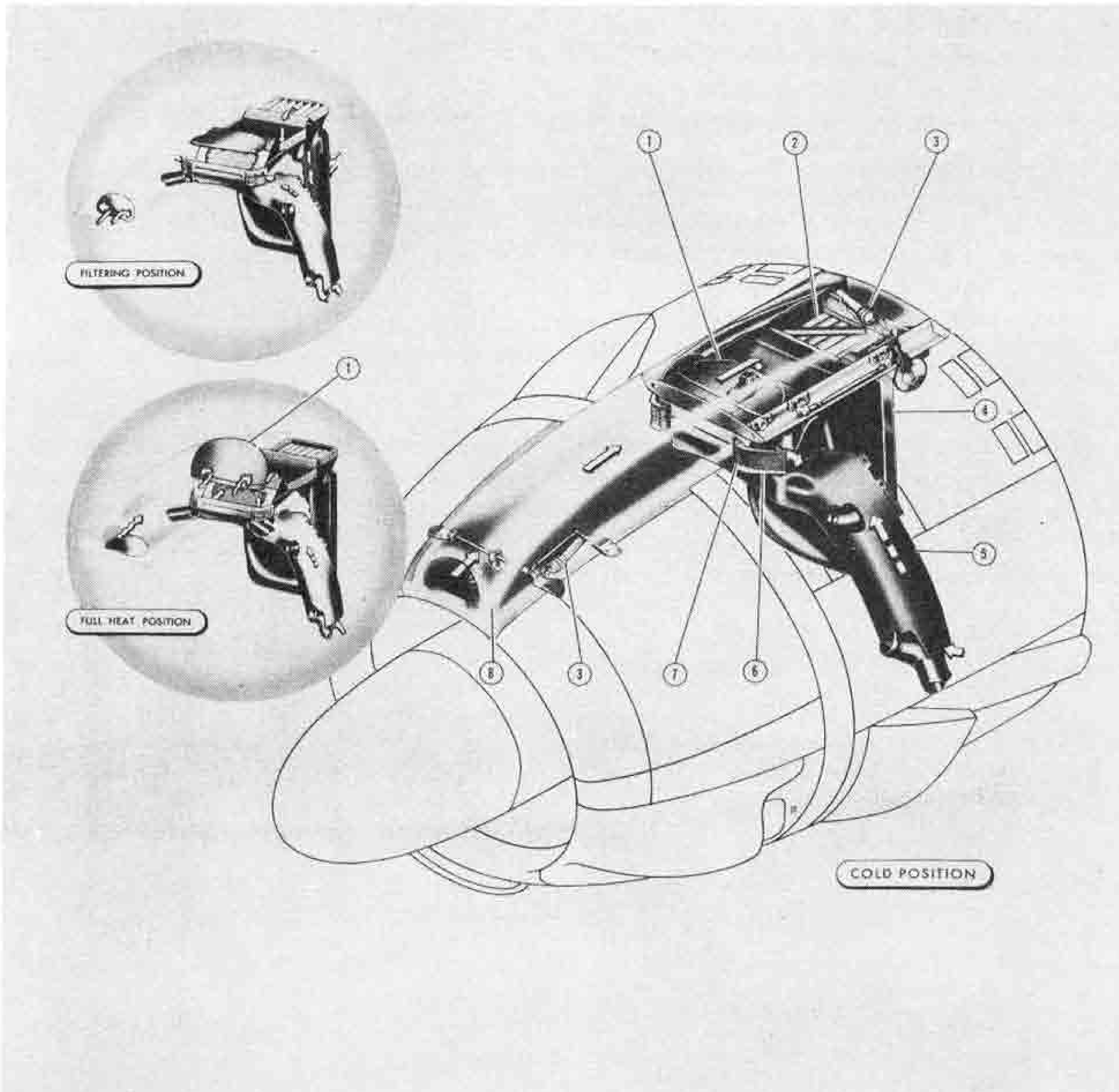
Anticipated Ground Temp.	*Time, Minutes.*
4° to —12°C. (40° to +10°F.)	4
—12° to —29°C. (+10° to —20°F.)	6
—29° and below (—20° and below)	9

HOLD DILUTION SWITCH *ON* FOR INDICATED TIME, STOP ENGINE, RELEASE DILUTION SWITCH.

5. To properly dilute the oil in the propeller domes, the propeller *INC* and *DEC* control should be operated throughout its complete range several times. Since this airplane is equipped with Hamilton Standard Hydromatic propellers, the propeller feathering button should be depressed near the end of the dilution period, long enough to give a maximum drop of 400 rpm, then pulled out. Repeat this operation several times. This will displace the undiluted oil from the feathering lines which would congeal and prevent feathering, and will provide diluted oil from the hopper so that emergency feathering may be accomplished under extreme cold weather conditions.

6. A complete redilution of the engine is required only after one half hour or more of engine operation at normal operating temperatures, as this is the time required to boil off the gasoline.

(b) If the airplane is to remain on the ground for an extended period of time, the batteries should be removed and placed in a heated shelter, maintained at a temperature of 20° C. (68° F.). The batteries must be serviced in a warm place and the charge maintained



1. Preheat control door	5. Carburetor preheat shroud
2. Filter shutter	6. Preheat bypass door
3. Actuating cylinder	7. Spring (bypass door)
4. Carburetor air filter duct	8. Forward door

Figure 71 — Carburetor Heating System Diagram

at a specific gravity between 1.275 and 1.300 at normal room temperature. If the batteries fall below a specific gravity of 1.240, they must be replaced. To further conserve the batteries, all ground runs of electrical equipment must be made using an external power source, if available.

(c) Parking and Mooring.—In parking the airplane on snow or ice, it is essential to provide a layer of fabric, grass, straw, green boughs, or other insulating material under the wheels to prevent them from freezing into the surface. Lack of such precautions frequently results in tearing off large chunks of rubber from the tires when the airplane is moved.

(d) Frost Prevention for Windows.—When the airplane is parked for the night, both doors should be left partly open. This is to permit the circulation of air inside the airplane, and to prevent frosting of the windows which is certain to occur in cold weather if no circulation of air is permitted.

2. DESERT OPERATION.

a. DESCRIPTION.

(1) CARBURETOR AIR FILTERS.—Carburetor air filters are installed in the right firewall door of each engine nacelle. The filters are controlled by the same levers which control the carburetor heaters.

b. OPERATION.

(1) The carburetor air filters are placed in operation by pushing the carburetor heat control lever approximately 10° past the COLD position to FILTER.

Note

A wire guard prevents the levers from being accidentally placed in FILTER when COLD is desired. This wire guard must be raised before the levers can be placed in FILTER.

(2) The effect on engine operation when using air filters is merely equivalent to closing the throttle slightly. This means that for altitudes less than critical, where manifold pressure limits prevent full throttle opening, the filter has no effect on engine power output or airplane performance.

c. AFTER LANDING.

(1) Install engine covers as soon as possible and secure tightly.

(2) Close all doors and windows securely when parking the airplane under desert conditions.

APPENDIX I

Flight Operating Charts

1. FLIGHT PLANNING.

a. The following outline may be used as a guide to assist personnel in the use of the FLIGHT OPERATION INSTRUCTION CHART for flight planning purposes.

(1) If the flight plan calls for a continuous flight where the desired cruising power and air speed are reasonably constant after take-off and climb to 5,000 feet, the fuel required and flight time may be computed as a "single-section flight."

(a) Within the limits of the airplane, the fuel required and flying time for a given mission depend largely upon the speed desired. With all other factors remaining equal in an airplane, speed is obtained at a sacrifice of range, and range is obtained at a sacrifice of speed. The speed is usually determined after considering the urgency of the flight plotted against the range required. The time of take-off is adjusted so as to have flight arrive at its destination at the predetermined time.

(b) Select the FLIGHT OPERATION INSTRUTION CHART corresponding to the weight of the airplane. Locate the largest figure entered under gph (gallons per hour) in column 1 on the lower half of the chart. Multiply this figure by the number and/or fraction of hours desired for reserve fuel. Add the resulting figure to the number of gallons set forth in footnote No. 2, and subtract the total from the amount of fuel in the airplane prior to starting the engines. The figure obtained as a result of this computation will represent the amount of gasoline available and applicable for flight planning purposes on the "Range in Air Miles" section of the FLIGHT OPERATION INSTRUCTION CHART.

(c) Select a figure in the fuel column equal to, or the next entry less than, the available amount of fuel in the airplane as determined in paragraph *(b)* above. Move horizontally to the right or left and select a figure equal to, or the next entry greater than the air miles (with no wind) to be flown. Operating values contained in the column number in which this figure appears, represent the highest cruising speed possible at the range desired; however, the airplane may be operated in accordance with values contained under OPERATING DATA in any column of a higher number with the flight plan being completed at a sacrifice of speed but at an increase in fuel economy.

(d) Using the same column number selected by application of instructions contained in the preceding paragraph, read the gallons per hour given at the altitude to be flown and divide this figure into the number of gallons available for cruising, as determined in paragraph *(b)* above. This will give the calculated flight duration in hours, which can then be converted into hours and minutes and deducted from the desired arrival time at destination in order to obtain the take-off time (without consideration for wind). To allow for wind, determine the calculated ground speed by dividing the flight duration in hours into the range selected in paragraph *(c)* and calculate a new corrected ground speed with the aid of a navigator's triangle of velocities.

(e) The airplane and engine operating values listed below "Operating Data" in any column except I are calculated to give constant miles per gallon at any altitude listed. Therefore, the airplane may be operated at any altitude and at the corresponding set of values given so long as they are in the same range column.

(f) The flight plan may be readily changed at any time enroute, and the chart will show the balance of range at various cruising powers by following the "Instructions for Using Chart" printed on each page.

(g) In using the FLIGHT OPERATION INSTRUCTION CHARTS set the propeller governors to give the desired rpm and open the throttle to give the desired indicated air speed. Use the manifold pressure only as an approximate value for reference.

(2) If the original flight plan calls for a mission requiring changes in power, speed, or gross load, in accordance with "GR. WT," increments shown in the series of "FLIGHT OPERATION INSTRUCTION CHARTS" provided, the total flight should be broken down into a series of individual short flights, each computed as outlined in paragraph (1), and then added together to make up the total flight and its requirements.

b. MAXIMUM RANGE OPERATION.—Use one of the six MAXIMUM RANGE CRUISING CHARTS:

(1) Select the chart nearest to the altitude called for on the flight plan.

(2) Determine the take-off gross weight and on the chart selected use the horizontal column of figures on the lower part of the chart corresponding most closely to the take-off gross weight. These figures will give the elapsed time, range covered and fuel consumed during the flight.

(3) At the start of the flight use the column of figures at the top of the chart corresponding to the take-off gross weight. Set the engine speed to the value shown, open the throttle to obtain the required BMEP and hand lean the mixture to obtain the fuel flow meter reading shown.

(4) Change the rpm, BMEP and mixture setting as the flight progresses, using the time intervals given in the "elapsed time" line in the lower part of the chart.

NOTE: Allow 200 gallons of fuel for warm-up, take-off and climb.

AAFMC-527
4-1-44

AIRCRAFT MODEL(S)
C-69

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S)
R3350-35A

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND		HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
			AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	M.P.H.	KTS.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
70,000	0		1330	2035	1515	2310	1985	3000	1410	2120	1640	2430	2180	3200	1740	2450	2060	2850	2890	3920
	17		935	1435	1085	1650	1445	2190	995	1495	1170	1740	1590	2330	1225	1725	1470	2040	2110	2850
	34		605	930	720	1100	985	1490	640	965	780	1155	1080	1585	795	1120	975	1355	1435	1940
	51		340	520	425	645	600	910	360	540	460	680	660	970	445	630	575	800	875	1185
80,000	0		1780	2740	2060	3140	2720	4280	1950	2910	2270	3340	3040	4600	2530	3490	3060	4140	4350	5910
	17		1285	1980	1515	2300	2020	3180	1410	2100	1660	2450	2260	3420	1830	2515	2250	3035	3240	4400
	34		865	1330	1040	1580	1420	2230	945	1410	1140	1685	1590	2400	1225	1690	1550	2090	2280	3090
	51		520	795	650	985	915	1435	570	845	710	1050	1025	1550	735	1015	960	1300	1460	1990
93,000	0		2550	3910	2970	4510	3910	6040	2850	4210	3330	4870	4520	6650	4000	5360	4820	6390	7340	9450
	17		1890	2895	2230	3390	2980	4600	2105	3115	2500	3660	3440	5060	2960	3970	3630	4790	5600	7210
	34		1315	2020	1585	2410	2160	3340	1470	2170	1780	2600	2500	3680	2060	2760	2580	3410	4050	5240
	51		835	1285	1040	1585	1460	2260	935	1380	1175	1720	1685	2480	1310	1760	1700	2240	2740	3530

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 40%
OPTIMUM TAKE-OFF WITH 2800 RPM, 46 IN. HG. AND 60% FLAP IS 80% OF CHART VALUES
DATA AS OF 12-19-44   BASED ON: FLIGHT TEST (REF. L.R. 4910)

CLIMB DATA (FULL OPEN COWL FLAPS)

GROSS WEIGHT LB.	AT SEA LEVEL				AT 5000 FEET					AT 10,000 FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS			MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED
70,000	160	139	2040	150	155	135	1825	2.45	186	145	126	1320	5.7	224
80,000	165	143	1695	150	158	137	1500	3.10	199	150	130	1030	7.1	242
93,000	176	153	1290	150	168	146	1120	4.10	210	160	139	715	9.6	275

GROSS WEIGHT LB.	AT 15,000 FEET					AT FEET					AT FEET				
	BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL		BEST I.A.S.		RATE OF CLIMB F.P.M.	FROM SEA LEVEL	
	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED	MPH	KTS		TIME MIN.	FUEL USED
70,000	140	122	870	10.3	267	135	117	430	18.3	327					
80,000	143	124	620	13.3	299	136	118	225	26.0	395					
93,000	152	132	355	19.3	364										

POWER PLANT SETTINGS: (DETAILS ON FIG. SECTION III):
FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE
DATA AS OF 12-19-44   BASED ON: FLIGHT TEST (REF. L.R. 4910)

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH				HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
	POWER OFF		POWER ON		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET		AT SEA LEVEL		AT 3000 FEET		AT 6000 FEET	
	MPH	KTS	MPH	KTS	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.
55,000	100	87	100	87	975	2280	1055	2400	1140	2580	1090	2365	1165	2535	1260	2640	2940	4220	3200	4560	3480	4910
75,000	115	100	115	100	1225	2760	1320	2970	1430	3140	1370	2930	1490	3110	1600	3290	3780	5350	4150	5750	4490	6110

DATA AS OF 12-19-44   BASED ON: FLIGHT TEST (REF. L.R. 4910)
OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

20,000

LEGEND

I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

TAKE-OFF, CLIMB & LANDING CHART

AAFMC-527 8-1-44

AIRCRAFT MODEL(S) C-69

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODEL(S) R3350-35A

TAKE-OFF DISTANCE FEET

GROSS WEIGHT LB.	HEAD WIND M.P.H.	HEAD WIND KTS.	HARD SURFACE RUNWAY AT SEA LEVEL GROUND RUN	TO CLEAR 50' OBJ.	AT 3000 FEET GROUND RUN	TO CLEAR 50' OBJ.	AT 6000 FEET GROUND RUN	TO CLEAR 50' OBJ.	SOD-TURF RUNWAY AT SEA LEVEL GROUND RUN	TO CLEAR 50' OBJ.	AT 3000 FEET GROUND RUN	TO CLEAR 50' OBJ.	AT 6000 FEET GROUND RUN	TO CLEAR 50' OBJ.	SOFT SURFACE RUNWAY AT SEA LEVEL GROUND RUN	TO CLEAR 50' OBJ.	AT 3000 FEET GROUND RUN	TO CLEAR 50' OBJ.	AT 6000 FEET GROUND RUN	TO CLEAR 50' OBJ.
70,000	0		1330	2035	1515	2310	1985	3000	1410	2120	1640	2430	2180	3200	1740	2450	2060	2850	2890	3920
	17		935	1435	1085	1650	1445	2190	995	1495	1170	1740	1590	2330	1225	1725	1470	2040	2110	2850
	34		605	930	720	1100	985	1490	640	965	780	1155	1080	1585	795	1120	975	1355	1435	1940
	51		340	520	425	645	600	910	360	540	460	680	660	970	445	630	575	800	875	1185
80,000	0		1780	2740	2060	3140	2720	4280	1950	2910	2270	3340	3040	4600	2530	3490	3060	4140	4350	5910
	17		1285	1980	1515	2300	2020	3180	1410	2100	1660	2450	2260	3420	1830	2515	2250	3035	3240	4400
	34		865	1330	1040	1580	1420	2230	945	1410	1140	1685	1590	2400	1225	1690	1550	2090	2280	3090
	51		520	795	650	985	915	1435	570	845	710	1050	1025	1550	735	1015	960	1300	1460	1990
93,000	0		2550	3910	2970	4510	3910	6040	2850	4210	3330	4870	4520	6650	4000	5360	4820	6390	7340	9450
	17		1890	2895	2230	3390	2980	4600	2105	3115	2500	3660	3440	5060	2960	3970	3630	4790	5600	7210
	34		1315	2020	1585	2410	2160	3340	1470	2170	1780	2600	2500	3680	2060	2760	2580	3410	4050	5240
	51		835	1285	1040	1585	1460	2260	935	1380	1175	1720	1685	2480	1310	1760	1700	2240	2740	3530

NOTE: INCREASE CHART DISTANCES AS FOLLOWS: 75°F + 10%; 100°F + 20%; 125°F + 30%; 150°F + 60%

OPTIMUM TAKE-OFF WITH 2800 RPM, 46 IN. HG. AND 60% FLAP IS 80% OF CHART VALUES

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4910)

CLIMB DATA (FULL OPEN COWL FLAPS)

GROSS WEIGHT LB.	AT SEA LEVEL BEST I.A.S. MPH	KTS	RATE OF CLIMB F.P.M.	GAL. OF FUEL USED	AT 5000 FEET BEST I.A.S. MPH	KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FUEL USED	AT 10,000 FEET BEST I.A.S. MPH	KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FUEL USED	AT 15,000 FEET BEST I.A.S. MPH	KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FUEL USED	AT FEET BEST I.A.S. MPH	KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FUEL USED	AT FEET BEST I.A.S. MPH	KTS	RATE OF CLIMB F.P.M.	FROM SEA LEVEL TIME MIN.	FUEL USED
70,000	160	139	2040	150	155	135	1825	2.45	186	145	126	1320	5.7	224	140	122	870	10.3	267	135	117	430	18.3	327					
80,000	165	143	1695	150	158	137	1500	3.10	199	150	130	1030	7.1	242	143	124	620	13.3	299	136	118	225	26.0	395					
93,000	176	153	1290	150	168	146	1120	4.10	210	160	139	715	9.6	275	152	132	355	19.3	364										

POWER PLANT SETTINGS: (DETAILS ON FIG. SECTION III):

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4910)

FUEL USED (U.S. GAL.) INCLUDES WARM-UP & TAKE-OFF ALLOWANCE

LANDING DISTANCE FEET

GROSS WEIGHT LB.	BEST IAS APPROACH POWER OFF MPH	KTS	POWER ON MPH	KTS	HARD DRY SURFACE AT SEA LEVEL GROUND ROLL	TO CLEAR 50' OBJ.	AT 3000 FEET GROUND ROLL	TO CLEAR 50' OBJ.	AT 6000 FEET GROUND ROLL	TO CLEAR 50' OBJ.	FIRM DRY SOD AT SEA LEVEL GROUND ROLL	TO CLEAR 50' OBJ.	AT 3000 FEET GROUND ROLL	TO CLEAR 50' OBJ.	AT 6000 FEET GROUND ROLL	TO CLEAR 50' OBJ.	WET OR SLIPPERY AT SEA LEVEL GROUND ROLL	TO CLEAR 50' OBJ.	AT 3000 FEET GROUND ROLL	TO CLEAR 50' OBJ.	AT 6000 FEET GROUND ROLL	TO CLEAR 50' OBJ.
55,000	100	87	100	87	975	2280	1055	2400	1140	2580	1090	2365	1165	2535	1260	2640	2940	4220	3200	4560	3480	4910
75,000	115	100	115	100	1225	2760	1320	2970	1430	3140	1370	2930	1490	3110	1600	3290	3780	5350	4150	5750	4490	6110

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4910)

OPTIMUM LANDING IS 80% OF CHART VALUES

REMARKS:

NOTE: TO DETERMINE FUEL CONSUMPTION IN BRITISH IMPERIAL GALLONS, MULTIPLY BY 10, THEN DIVIDE BY 12

20,000

LEGEND

I.A.S. : INDICATED AIRSPEED
M.P.H. : MILES PER HOUR
KTS. : KNOTS
F.P.M. : FEET PER MINUTE

TAKE-OFF, CLIMB & LANDING CHART

AAFMC-528
6-1-44

AIRCRAFT MODEL (S) C-69

ENGINE (S): R3350-35A

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 93,000 TO 90,000 POUNDS

EXTERNAL LOAD ITEMS NONE

NUMBER OF ENGINES OPERATING: 4

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)
WAR EMERG.	NOT APPLICABLE							
MILITARY POWER	2600	45		AUTO RICH	5 MIN.	260 deg C	1152	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING [1]

COLUMN I STATUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II STATUTE	COLUMN II NAUTICAL	COLUMN III STATUTE	COLUMN III NAUTICAL	COLUMN IV STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V STATUTE	COLUMN V NAUTICAL
1550	1346	4800	2320	2015	3170	2753	3620	3143	4800	3950	3430
1420	1233	4400	2120	1841	2900	2518	3310	2874	4400	3590	3117
1290	1120	4000	1930	1676	2630	2284	2990	2596	4000	3230	2805
1160	1107	3600	1730	1502	2360	2049	2690	2336	3600	2870	2492
1030	894	3200	1540	1337	2100	1824	2370	2058	3200	2540	2206
900	781	2800	1340	1164	1830	1589	2060	1789	2800	2200	1910
770	669	2400	1150	999	1570	1363	1760	1528	2400	1870	1624
640	556	2000	960	834	1300	1129	1450	1259	2000	1530	1329
510	443	1600	760	660	1040	903	1150	999	1600	1050	912
380	330	1200	570	495	780	677	860	747	1200	920	799
260	226	800	380	330	520	451	570	495	800	610	530

Column I: MAXIMUM CONTINUOUS. Column II: (.500 STAT. (NAUT.) MI./GAL.). Column III: (.680 STAT. (NAUT.) MI./GAL.). Column IV: (.730 STAT. (NAUT.) MI./GAL.). Column V: MAXIMUM AIR RANGE.

I R.P.M.	I M.P. INCHES Hg	I MIXTURE	I APPROX. TOT. GPH	I T.A.S. MPH	I T.A.S. KTS.	PRESS ALT. FEET	II R.P.M.	II M.P. INCHES Hg	II MIXTURE	II TOT. GPH	II T.A.S. MPH	II T.A.S. KTS.	III R.P.M.	III M.P. INCHES Hg	III MIXTURE	III TOT. GPH	III T.A.S. MPH	III T.A.S. KTS.
						40000												
						35000												
						30000												
						25000												
						20000												
						15000												
						10000	2350	33.5	A.R.	600	302	262	2200	29.5	A.L.	400	273	237
2400	41.0	A.R.	890	315	274	5000	2250	33.5	A.R.	561	280	243	2200	30	A.L.	375	255	221
2400	42.5	A.R.	890	300	260	S.L.	2230	34	A.R.	514	257	223	2000	32.5	A.L.	345	231	201

IV R.P.M.	IV M.P. INCHES Hg	IV MIXTURE	IV TOT. GPH	IV T.A.S. MPH	IV T.A.S. KTS.	PRESS ALT. FEET	V R.P.M.	V M.P. INCHES Hg	V MIXTURE	V TOT. GPH	V T.A.S. MPH	V T.A.S. KTS.
						40000						
						35000						
						30000						
						25000						
						20000						
						15000	2000	24.5	A.L.	313	247	214
2100	28.5	A.L.	358	261	227	10000	1800	28.0	A.L.	300	237	206
2000	29	A.L.	328	239	207	5000	1600	30.0	A.L.	278	220	191
1800	29	A.L.	285	208	181	S.L.	1460	33.0	A.L.	242	191	166

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE TAKE-OFF & CLIMB CHARTS) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 92,000 LB. GROSS WEIGHT WITH 3200 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 210 GAL.) TO FLY 2100 STAT. AIRMILES AT 5000 FT. ALTITUDE MAINTAIN 2200 RPM AND 30 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S. GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4910)

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

FLIGHT OPERATING INSTRUCTION CHART (SHEET 1 OF 4 SHEETS)

AAFMC-528
4-1-44

AIRCRAFT MODEL(S)
C-69

ENGINE(S): **R3350-35A**

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: **93,000** TO **90,000** POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: **4**

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)
WAR EMERG.	NOT APPLICABLE							
MILITARY POWER	2600	45		AUTO RICH	5 MIN.	260 deg C	1152	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT **RANGE** VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I RANGE IN AIRMILES STATUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
1550	1346	4800	2320	2015	3170	2753	3620	3143	4800	3950	3430
1420	1233	4400	2120	1841	2900	2518	3310	2874	4400	3590	3117
1290	1120	4000	1930	1676	2630	2284	2990	2596	4000	3230	2805
1160	1107	3600	1730	1502	2360	2049	2690	2336	3600	2870	2492
1030	894	3200	1540	1337	2100	1824	2370	2058	3200	2540	2206
900	781	2800	1340	1164	1830	1589	2060	1789	2800	2200	1910
770	669	2400	1150	999	1570	1363	1760	1528	2400	1870	1624
640	556	2000	960	834	1300	1129	1450	1259	2000	1530	1329
510	443	1600	760	660	1040	903	1150	999	1600	1050	912
380	330	1200	570	495	780	677	860	747	1200	920	799
260	226	800	380	330	520	451	570	495	800	610	530

MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	PRESS ALT. FEET	(.500 STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	(.680 STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
						40000												
						35000												
						30000												
						25000												
						20000												
						15000												
						10000	2350	33.5	A.R.	600	302	262	2200	29.5	A.L.	400	273	237
2400	41.0	A.R.	890	315	274	5000	2260	33.5	A.R.	561	280	243	2200	30	A.L.	375	255	221
2400	42.5	A.R.	890	300	260	S.L.	2230	34	A.R.	514	257	223	2000	32.5	A.L.	345	231	201

PRESS ALT. FEET	(.730 STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
40000												
35000												
30000												
25000												
20000												
15000							2000	24.5	A.L.	313	247	214
10000	2100	28.5	A.L.	358	261	227	1800	28.0	A.L.	300	237	206
5000	2000	29	A.L.	328	239	207	1600	30.0	A.L.	278	220	191
S.L.	1800	29	A.L.	285	208	181	1460	33.0	A.L.	242	191	166

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE TAKE-OFF & CLIMB CHARTS) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 92,000 LB. GROSS WEIGHT WITH 3200 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 210 GAL.) TO FLY 2100 STAT. AIRMILES AT 5000 FT. ALTITUDE MAINTAIN 2200 RPM AND 30 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

- ALT. : PRESSURE ALTITUDE
- M.P. : MANIFOLD PRESSURE
- GPH : U.S.GAL. PER HOUR
- TAS : TRUE AIRSPEED
- KTS. : KNOTS
- S.L. : SEA LEVEL
- F.R. : FULL RICH
- A.R. : AUTO-RICH
- A.L. : AUTO-LEAN
- C.L. : CRUISING LEAN
- M.L. : MANUAL LEAN
- F.T. : FULL THROTTLE

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4910)

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

AAFMC-528 4-1-44

AIRCRAFT MODEL(S)
C-69

ENGINE(S): R3350-35A

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 90,000 TO 80,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 4

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	NOT APPLICABLE						
MILITARY POWER	2600	45		AUTO RICH	5 MIN.	260 deg C	1152

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]

COLUMN I RANGE IN AIRMILES STAUTE	COLUMN I NAUTICAL	FUEL U.S. GAL.	COLUMN II RANGE IN AIRMILES STATUTE	COLUMN II NAUTICAL	COLUMN III RANGE IN AIRMILES STATUTE	COLUMN III NAUTICAL	COLUMN IV RANGE IN AIRMILES STATUTE	COLUMN IV NAUTICAL	FUEL U.S. GAL.	COLUMN V RANGE IN AIRMILES STATUTE	COLUMN V NAUTICAL
1560	1355	4800	2320	2015	3190	2770	3660	3178	4800	4010	3482
1430	1242	4400	2130	1850	2920	2536	3340	2900	4400	3650	3170
1300	1129	4000	1930	1676	2640	2293	3030	2631	4000	3290	2857
1160	1007	3600	1740	1511	2370	2058	2710	2353	3600	2930	2544
1030	894	3200	1540	1337	2100	1824	2400	2084	3200	2570	2232
900	782	2800	1350	1172	1840	1598	2090	1815	2800	2240	1945
770	669	2400	1150	999	1570	1363	1785	1550	2400	1900	1650
640	556	2000	960	834	1310	1138	1490	1294	2000	1570	1363
510	443	1600	770	669	1040	903	1170	1016	1600	1230	1068
390	339	1200	570	495	780	677	880	764	1200	930	808
260	226	800	380	330	520	452	580	504	800	620	538

MAXIMUM CONTINUOUS (Column I)

PRESS ALT. FEET	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH.	APPROX. T.A.S. MPH.	APPROX. T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000						
10000						
5000	2400	41.0	A.R.	890	317	275
S.L.	2400	42.5	A.R.	890	301	261

COLUMN II (.504 STAT. (NAUT.) MI./GAL.); COLUMN III (.686 STAT. (NAUT.) MI./GAL.)

PRESS ALT. FEET	II R.P.M.	II M.P. INCHES Hg	II MIX-TURE	II TOT. GPH.	II T.A.S. MPH.	II T.A.S. KTS.	III R.P.M.	III M.P. INCHES Hg	III MIX-TURE	III TOT. GPH.	III T.A.S. MPH.	III T.A.S. KTS.
40000												
35000												
30000												
25000												
20000												
15000												
10000	2300	33.5	A.R.	600	302	262	2200	30	A.L.	405	276	240
5000	2250	33	A.R.	558	281	244	2100	30.5	A.L.	380	256	222
S.L.	2250	33.5	A.R.	512	258	224	2000	32.5	A.L.	345	234	203

COLUMN IV (.770 STAT. (NAUT.) MI./GAL.); COLUMN V MAXIMUM AIR RANGE

PRESS ALT. FEET	IV R.P.M.	IV M.P. INCHES Hg	IV MIX-TURE	IV TOT. GPH.	IV T.A.S. MPH.	IV T.A.S. KTS.	V R.P.M.	V M.P. INCHES Hg	V MIX-TURE	V TOT. GPH.	V T.A.S. MPH.	V T.A.S. KTS.
40000												
35000												
30000												
25000												
20000												
15000	2200	26.5	A.L.	350	276	240	1980	24	A.L.	302	245	213
10000	2000	27.5	A.L.	325	254	221	1750	27	A.L.	288	234	203
5000	1850	28.5	A.L.	295	230	200	1550	30	A.L.	268	218	189
S.L.	1650	30.5	A.L.	250	192	167	1400	32	A.L.	216	190	165

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE TAKE-OFF & CLIMB CHARTS) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 85,000 LB. GROSS WEIGHT WITH 4400 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 360 GAL.) TO FLY 3200 STAT. AIRMILES AT 15,000 FT. ALTITUDE MAINTAIN 2200 RPM AND 26.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 12-19-44

BASED ON: FLIGHT TEST (REF. L.R. 4910)

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

FLIGHT OPERATING INSTRUCTION CHART (SHEET 2 OF 4 SHEETS)

AAFMC-528 8-1-44

AIRCRAFT MODEL(S) **C-69**

ENGINE(S): **R3350-35A**

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: **90,000** TO **80,000** POUNDS

EXTERNAL LOAD ITEMS **NONE**

NUMBER OF ENGINES OPERATING: **4**

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)
WAR EMERG.	NOT APPLICABLE							
MILITARY POWER	2600	45		AUTO RICH	5 MIN.	260 deg C	1152	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND).[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STAUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING[1]								
1560	1355	4800	2320	2015	3190	2770	3660	3178	4800	4010	3482
1430	1242	4400	2130	1850	2920	2536	3340	2900	4400	3650	3170
1300	1129	4000	1930	1676	2640	2293	3030	2631	4000	3290	2857
1160	1007	3600	1740	1511	2370	2058	2710	2353	3600	2930	2544
1030	894	3200	1540	1337	2100	1824	2400	2084	3200	2570	2232
900	782	2800	1350	1172	1840	1598	2090	1815	2800	2240	1945
770	669	2400	1150	999	1570	1363	1785	1550	2400	1900	1650
640	556	2000	960	834	1310	1138	1490	1294	2000	1570	1363
510	443	1600	770	669	1040	903	1170	1016	1600	1230	1068
390	339	1200	570	495	780	677	880	764	1200	930	808
260	226	800	380	330	520	452	580	504	800	620	538

PRESS ALT. FEET	MAXIMUM CONTINUOUS R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000						
10000						
5000	2400	41.0	A.R.	890	317	275
S.L.	2400	42.5	A.R.	890	301	261

PRESS ALT. FEET	(.504 STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000						
10000	2300	33.5	A.R.	600	302	262
5000	2250	33	A.R.	558	281	244
S.L.	2250	33.5	A.R.	512	258	224

PRESS ALT. FEET	(.686 STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000						
10000	2200	30	A.L.	405	276	240
5000	2100	30.5	A.L.	380	256	222
S.L.	2000	32.5	A.L.	345	234	203

PRESS ALT. FEET	(.770 STAT. (NAUT.) MI./GAL.) R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000	2200	26.5	A.L.	350	276	240
10000	2000	27.5	A.L.	325	254	221
5000	1850	28.5	A.L.	295	230	200
S.L.	1650	30.5	A.L.	250	192	167

PRESS ALT. FEET	MAXIMUM AIR RANGE R.P.M.	M.P. INCHES Hg	MIXTURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
40000						
35000						
30000						
25000						
20000						
15000	1980	24	A.L.	302	245	213
10000	1750	27	A.L.	288	234	203
5000	1550	30	A.L.	268	218	189
S.L.	1400	32	A.L.	216	190	165

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE TAKE-OFF & CLIMB CHARTS) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 85,000 LB. GROSS WEIGHT WITH 4400 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 360 GAL.) TO FLY 3200 STAT. AIRMILES AT 15,000 FT. ALTITUDE MAINTAIN 2200 RPM AND 26.5 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL.PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL
F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4910)

RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

AAFMC-52B
8-1-44

AIRCRAFT MODEL(S)
C-69

ENGINE(S): R3350-35A

FLIGHT OPERATION INSTRUCTION CHART

CHART WEIGHT LIMITS: 70,000 TO 60,000 POUNDS

EXTERNAL LOAD ITEMS
NONE

NUMBER OF ENGINES OPERATING: 4

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.	FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)
WAR EMERG.	NOT APPLICABLE							
MILITARY POWER	2600	45		AUTO RICH	5 MIN.	260 deg C	1152	

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING (1) MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)(1). TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING (1)

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STAUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
920	799	2800	1370	1190	1890	1641	2200	1910	2800	2520	2188
780	677	2400	1170	1016	1620	1407	1890	1641	2400	2160	1876
650	564	2000	980	851	1350	1172	1570	1363	2000	1800	1563
520	452	1600	780	677	1080	938	1260	1094	1600	1440	1250
390	339	1200	590	512	810	703	940	816	1200	1080	938
260	226	800	390	339	540	469	630	547	800	720	625
130	113	400	200	174	270	234	310	269	400	360	313

MAXIMUM CONTINUOUS						PRESS	(.515 STAT. (NAUT.) MI./GAL.)						(.711 STAT. (NAUT.) MI./GAL.)						(.828 STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	APPROX. T.A.S. MPH	APPROX. T.A.S. KTS.
						40000																			40000						
						35000																			35000						
						30000																			30000						
						25000																			25000						
						20000							2400	23	A.R.	429	305	265							20000						
						15000													2200	26	A.L.	346	287	249	15000	1760	23	A.L.	268	250	217
						10000	2300	33.5	A.R.	600	311	270	2200	30	A.L.	405	287	249	2000	27	A.L.	319	264	229	10000	1530	26	A.L.	238	226	196
2400	41.0	A.R.	890	323	280	5000	2250	33	A.R.	558	287	249	2100	30	A.L.	374	266	231	1800	29	A.L.	290	240	208	5000	1400	29	A.L.	218	207	180
2400	42.5	A.R.	890	306	266	S.L.	2250	34	A.R.	516	266	231	2000	32	A.L.	340	245	213	1650	31	A.L.	258	213	185	S.L.	1400	31	A.L.	200	188	163

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE TAKE-OFF & CLIMB CHARTS) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED.

EXAMPLE

AT 70,000 LB. GROSS WEIGHT WITH 2800 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 280 GAL.) TO FLY 2500 STAT. AIRMILES AT 15,000 FT. ALTITUDE MAINTAIN 1760 RPM AND 23 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT. : PRESSURE ALTITUDE
M.P. : MANIFOLD PRESSURE
GPH : U.S.GAL. PER HOUR
TAS : TRUE AIRSPEED
KTS. : KNOTS
S.L. : SEA LEVEL

F.R. : FULL RICH
A.R. : AUTO-RICH
A.L. : AUTO-LEAN
C.L. : CRUISING LEAN
M.L. : MANUAL LEAN
F.T. : FULL THROTTLE

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4916) RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

FLIGHT OPERATING INSTRUCTION CHART (SHEET 4 OF 4 SHEETS)

AAFMC-528 8-1-44

AIRCRAFT MODEL(S) C-69 ENGINE(S): R3350-35A	FLIGHT OPERATION INSTRUCTION CHART CHART WEIGHT LIMITS: 70,000 TO 60,000 POUNDS	EXTERNAL LOAD ITEMS NONE NUMBER OF ENGINES OPERATING: 4

LIMITS	R.P.M.	M.P. IN.HG.	BLOWER POSITION	MIXTURE POSITION	TIME LIMIT	CYL. TEMP.	TOTAL G.P.H.
WAR EMERG.	NOT APPLICABLE						
MILITARY POWER	2600	45		AUTO RICH	5 MIN.	260 deg C	1152

FOR DETAILS SEE POWER PLANT CHART (FIG. SECT. III)

INSTRUCTIONS FOR USING CHART: SELECT FIGURE IN FUEL COLUMN EQUAL TO OR LESS THAN AMOUNT OF FUEL TO BE USED FOR CRUISING[1] MOVE HORIZONTALLY TO RIGHT OR LEFT AND SELECT RANGE VALUE EQUAL TO OR GREATER THAN THE STATUTE OR NAUTICAL AIR MILES TO BE FLOWN. VERTICALLY BELOW AND OPPOSITE VALUE NEAREST DESIRED CRUISING ALTITUDE (ALT.) READ RPM, MANIFOLD PRESSURE (M.P.) AND MIXTURE SETTING REQUIRED.

NOTES: COLUMN I IS FOR EMERGENCY HIGH SPEED CRUISING ONLY. COLUMNS II, III, IV AND V GIVE PROGRESSIVE INCREASE IN RANGE AT A SACRIFICE IN SPEED. AIR MILES PER GALLON (MI./GAL.) (NO WIND), GALLONS PER HR. (G.P.H.) AND TRUE AIRSPEED (T.A.S.) ARE APPROXIMATE VALUES FOR REFERENCE. RANGE VALUES ARE FOR AN AVERAGE AIRPLANE FLYING ALONE (NO WIND)[1] TO OBTAIN BRITISH IMPERIAL GAL. (OR G.P.H.): MULTIPLY U.S. GAL. (OR G.P.H.) BY 10 THEN DIVIDE BY 12.

COLUMN I		FUEL	COLUMN II		COLUMN III		COLUMN IV		FUEL	COLUMN V	
RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES		RANGE IN AIRMILES		RANGE IN AIRMILES		U.S.	RANGE IN AIRMILES	
STAUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL	GAL.	STATUTE	NAUTICAL
			SUBTRACT FUEL ALLOWANCES NOT AVAILABLE FOR CRUISING [1]								
920	*799*	2800	1370	*1190*	1890	*1641*	2200	*1910*	2800	2520	*2188*
780	*677*	2400	1170	*1016*	1620	*1407*	1890	*1641*	2400	2160	*1876*
650	*564*	2000	980	*851*	1350	*1172*	1570	*1363*	2000	1800	*1563*
520	*452*	1600	780	*677*	1080	*938*	1260	*1094*	1600	1440	*1250*
390	*339*	1200	590	*512*	810	*703*	940	*816*	1200	1080	*938*
260	*226*	800	390	*339*	540	*469*	630	*547*	800	720	*625*
130	*113*	400	200	*174*	270	*234*	310	*269*	400	360	*313*

MAXIMUM CONTINUOUS						PRESS	(.515 STAT. (NAUT.) MI./GAL.)						(.711 STAT. (NAUT.) MI./GAL.)					
R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
						40000												
						35000												
						30000												
						25000												
						20000							2400	23	A.R.	429	305	*265*
						15000												
						10000	2300	33.5	A.R.	600	311	*270*	2200	30	A.L.	405	287	*249*
2400	41.0	A.R.	890	323	*280*	5000	2250	33	A.R.	558	287	*249*	2100	30	A.L.	374	266	*231*
2400	42.5	A.R.	890	306	*266*	S.L.	2250	34	A.R.	516	266	*231*	2000	32	A.L.	340	245	*213*

(.828 STAT. (NAUT.) MI./GAL.)						PRESS	MAXIMUM AIR RANGE					
R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.	ALT. FEET	R.P.M.	M.P. INCHES Hg	MIX-TURE	APPROX. TOT. GPH	T.A.S. MPH	T.A.S. KTS.
						40000						
						35000						
						30000						
						25000						
						20000						
2200	26	A.L.	346	287	*249*	15000	1760	23	A.L.	268	250	*217*
2000	27	A.L.	319	264	*229*	10000	1530	26	A.L.	238	226	*196*
1800	29	A.L.	290	240	*208*	5000	1400	29	A.L.	218	207	*180*
1650	31	A.L.	258	213	*185*	S.L.	1400	31	A.L.	200	188	*163*

SPECIAL NOTES

(1) MAKE ALLOWANCE FOR WARM-UP, TAKE-OFF & CLIMB (SEE TAKE-OFF & CLIMB CHARTS) PLUS ALLOWANCE FOR WIND, RESERVE AND COMBAT AS REQUIRED

EXAMPLE

AT 70,000 LB. GROSS WEIGHT WITH 2800 GAL. OF FUEL (AFTER DEDUCTING TOTAL ALLOWANCES OF 280 GAL.) TO FLY 2500 STAT. AIRMILES AT 15,000 FT. ALTITUDE MAINTAIN 1760 RPM AND 23 IN. MANIFOLD PRESSURE WITH MIXTURE SET: A.L.

LEGEND

ALT.	: PRESSURE ALTITUDE	F.R.	: FULL RICH
M.P.	: MANIFOLD PRESSURE	A.R.	: AUTO-RICH
GPH	: U.S. GAL. PER HOUR	A.L.	: AUTO-LEAN
TAS	: TRUE AIRSPEED	C.L.	: CRUISING LEAN
KTS.	: KNOTS	M.L.	: MANUAL LEAN
S.L.	: SEA LEVEL	F.T.	: FULL THROTTLE

DATA AS OF 12-19-44 BASED ON: FLIGHT TEST (REF. L.R. 4910) RED FIGURES ARE PRELIMINARY DATA, SUBJECT TO REVISION AFTER FLIGHT CHECK

MAXIMUM RANGE CRUISING CHARTS

SEA LEVEL

GROSS WEIGHT	LBS.	82,000	79,000	76,000	73,000	70,000	67,000	64,000	61,000	58,000	55,000	53,200
SHIP I.A.S.	MPH.	190	188	187	185	184	183	183	182	181	180	180
SHIP I.A.S.	*KNOTS*	*165*	*163*	*162*	*161*	*160*	*159*	*159*	*158*	*157*	*156*	*156*
ENGINE SPEED	RPM	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
B.M.E.P. (APPROX.)	LB/SQ.IN.	130	125	120	115	111	107	103	100	96	93	91
MAN. PR. (APPROX.)	IN. HG.	29	29	28	27	27	26	26	25	25	24	24
†MIXTURE		H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L
FLOW METER READING	LBS./HOUR	309	294	284	275	267	261	254	248	243	237	234
FUEL FLOW (4 ENG.)	U.S. G.P.H.	204	196	189	183	178	174	169	165	162	158	156

82000 LB.*	ELAPSED TIME	HOURS-MIN.	2:25	5:00	7:35	10:20	13:10	16:00	19:00	22:00	25:05	26:55
	RANGE COVERED	STATUTE MILES	420	850	1290	1750	2210	2690	3170	3660	4160	4470
	RANGE COVERED	*NAUTICAL MILES*	*360*	*740*	*1120*	*1520*	*1920*	*2330*	*2750*	*3180*	*3610*	*3880*
	FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	4000	4500	4800
79000 LB.*	ELAPSED TIME	HOURS-MIN.		2:30	5:10	7:55	10:40	13:35	16:30	19:30	22:35	24:30
	RANGE COVERED	STATUTE MILES		430	870	1330	1790	2270	2750	3240	3740	4050
	RANGE COVERED	*NAUTICAL MILES*		*370*	*760*	*1150*	*1560*	*1970*	*2390*	*2820*	*3250*	*3520*
	FUEL CONSUMED	U.S. GALLONS		500	1000	1500	2000	2500	3000	3500	4000	4300
76000 LB.*	ELAPSED TIME	HOURS-MIN.			2:40	5:20	8:10	11:00	14:00	17:00	20:05	22:00
	RANGE COVERED	STATUTE MILES			440	900	1360	1840	2320	2810	3310	3620
	RANGE COVERED	*NAUTICAL MILES*			*390*	*780*	*1180*	*1590*	*2010*	*2440*	*2880*	*3140*
	FUEL CONSUMED	U.S. GALLONS			500	1000	1500	2000	2500	3000	3500	3800
73000 LB.*	ELAPSED TIME	HOURS-MIN.				2:45	5:30	8:25	11:20	14:20	17:25	19:20
	RANGE COVERED	STATUTE MILES				450	920	1390	1880	2370	2870	3180
	RANGE COVERED	*NAUTICAL MILES*				*390*	*800*	*1210*	*1630*	*2060*	*2490*	*2760*
	FUEL CONSUMED	U.S. GALLONS				500	1000	1500	2000	2500	3000	3300
70000 LB.*	ELAPSED TIME	HOURS-MIN.					2:50	5:40	8:40	11:40	14:45	16:35
	RANGE COVERED	STATUTE MILES					460	940	1420	1910	2420	2720
	RANGE COVERED	*NAUTICAL MILES*					*400*	*820*	*1240*	*1660*	*2100*	*2300*
	FUEL CONSUMED	U.S. GALLONS					500	1000	1500	2000	2500	2800
67000 LB.*	ELAPSED TIME	HOURS-MIN.						2:55	5:50	8:50	11:55	13:50
	RANGE COVERED	STATUTE MILES						480	960	1450	1950	2260
	RANGE COVERED	*NAUTICAL MILES*						*410*	*830*	*1260*	*1690*	*1960*
	FUEL CONSUMED	U.S. GALLONS						500	1000	1500	2000	2300

†HAND LEAN MIXTURE TO OBTAIN FUEL FLOW METER READING SHOWN UNDER APPLICABLE GROSS WEIGHT.

*TAKE OFF GROSS WEIGHT, LBS.

NOTE: 200 GALLONS OF FUEL SHOULD BE ALLOWED FOR WARM-UP, TAKE-OFF AND CLIMB. RANGE IS CALCULATED TO BE 10% CONSERVATIVE AND IS BASED ON ZERO HEAD WIND.

MAXIMUM RANGE CRUISING CHARTS

3000 FT.

GROSS WEIGHT	LBS.	82,000	79,000	76,000	73,000	70,000	67,000	64,000	61,000	58,000	55,000	53,200
SHIP I.A.S.	MPH	188	186	185	183	182	181	181	180	179	179	178
SHIP I.A.S.	*KNOTS*	163	162	161	159	158	157	157	156	155	155	155
ENGINE SPEED	RPM	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
B.M.E.P. (APPROX.)	LB/SQ. IN.	133	129	124	119	114	110	106	102	99	95	93
MAN. PR. (APPROX.)	IN. HG.	28	28	27	27	26	26	25	25	24	24	23
†MIXTURE		H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L
FLOW METER READING	LB/HOUR	315	302	291	282	273	266	258	252	246	242	239
FUEL FLOW (4 ENG.)	U.S. G.P.H.	210	201	194	188	182	177	172	168	164	161	159

(NO WIND)

82000 LB.*	ELAPSED TIME	HOURS-MIN.	2:25	4:50	7:25	10:05	12:50	15:40	18:35	21:30	24:35	26:25
	RANGE COVERED	STATUTE MILES	420	860	1300	1760	2230	2710	3210	3710	4220	4530
	RANGE COVERED	*NAUTICAL MILES*	370	740	1130	1530	1940	2360	2780	3220	3670	3940
	FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	4000	4500	4800
79000 LB.*	ELAPSED TIME	HOURS-MIN.		2:30	5:00	7:40	10:25	13:15	16:10	19:10	22:10	24:00
	RANGE COVERED	STATUTE MILES		440	880	1340	1810	2390	2780	3290	3800	4110
	RANGE COVERED	*NAUTICAL MILES*		380	770	1160	1570	1990	2420	2850	3300	3570
	FUEL CONSUMED	U.S. GALLONS		500	1000	1500	2000	2500	3000	3500	4000	4300
76000 LB.*	ELAPSED TIME	HOURS-MIN.			2:35	5:15	8:00	10:50	13:40	16:40	19:40	21:35
	RANGE COVERED	STATUTE MILES			450	910	1380	1860	2350	2850	3360	3680
	RANGE COVERED	*NAUTICAL MILES*			390	790	1200	1610	2040	2480	2920	3190
	FUEL CONSUMED	U.S. GALLONS			500	1000	1500	2000	2500	3000	3500	3800
73000 LB.*	ELAPSED TIME	HOURS-MIN.				2:40	5:25	8:15	11:10	14:05	17:10	19:00
	RANGE COVERED	STATUTE MILES				460	930	1410	1700	2410	2920	3230
	RANGE COVERED	*NAUTICAL MILES*				400	810	1230	1650	2090	2530	2810
	FUEL CONSUMED	U.S. GALLONS				500	1000	1500	2000	2500	3000	3300
70000 LB.*	ELAPSED TIME	HOURS-MIN.					2:45	5:35	8:30	11:25	14:30	16:20
	RANGE COVERED	STATUTE MILES					470	950	1440	1950	2460	2770
	RANGE COVERED	*NAUTICAL MILES*					410	830	1250	1690	2140	2410
	FUEL CONSUMED	U.S. GALLONS					500	1000	1500	2000	2500	2800
67000 LB.*	ELAPSED TIME	HOURS-MIN.						2:50	5:45	8:40	11:45	13:35
	RANGE COVERED	STATUTE MILES						480	970	1480	1990	2300
	RANGE COVERED	*NAUTICAL MILES*						420	850	1280	1730	2000
	FUEL CONSUMED	U.S. GALLONS						500	1000	1500	2000	2300

†HAND LEAN MIXTURE TO OBTAIN FUEL FLOW METER READING SHOWN UNDER APPLICABLE GROSS WEIGHT.

*TAKE OFF GROSS WEIGHT, LBS.

NOTE: 200 GALLONS OF FUEL SHOULD BE ALLOWED FOR WARM-UP, TAKE-OFF AND CLIMB. RANGE IS CALCULATED TO BE 10% CONSERVATIVE AND IS BASED ON ZERO HEAD WIND.

MAXIMUM RANGE CRUISING CHARTS

6000 FT.

GROSS WEIGHT	LBS.	82,000	79,000	76,000	73,000	70,000	67,000	64,000	61,000	58,000	55,000	53,200
SHIP I.A.S.	MPH	186	184	183	181	180	179	179	178	177	176	176
SHIP I.A.S.	*KNOTS*	162	160	159	157	156	155	155	155	154	153	153
ENGINE SPEED	RPM	1350	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
B.M.E.P. (APPROX.)	LB/SQ. IN.	133	133	127	122	118	113	109	105	101	97	95
MAN. PR. (APPROX.)	IN. HG.	27	27	27	26	26	25	24	24	23	23	23
†MIXTURE		H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L
FLOW METER READING	LBS./HOUR	324	311	299	288	279	272	263	257	251	245	240
FUEL FLOW (4 ENG.)	U.S. G.P.H.	216	207	199	192	186	181	175	171	167	163	160

Take-off weight			79,000	76,000	73,000	70,000	67,000	64,000	61,000	58,000	55,000	53,200
82000 LB.*	ELAPSED TIME	HOURS-MIN.	2:20	4:45	7:15	9:50	12:30	15:15	18:10	21:05	24:05	26:55
	RANGE COVERED	STATUTE MILES	420	860	1310	1780	2260	2750	3250	3760	4280	4600
	RANGE COVERED	*NAUTICAL MILES*	370	750	1140	1540	1960	2380	2820	3260	3720	4000
	FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	4000	4500	4800
79000 LB.*	ELAPSED TIME	HOURS-MIN.		2:25	4:55	7:30	10:10	13:00	15:50	18:45	21:45	23:35
	RANGE COVERED	STATUTE MILES		440	890	1350	1830	2320	2820	3330	3860	4180
	RANGE COVERED	*NAUTICAL MILES*		380	770	1180	1590	2020	2450	2900	3350	3630
	FUEL CONSUMED	U.S. GALLONS		500	1000	1500	2000	2500	3000	3500	4000	4300
76000 LB.*	ELAPSED TIME	HOURS-MIN.			2:30	5:05	7:45	10:35	13:25	16:20	19:20	21:10
	RANGE COVERED	STATUTE MILES			450	920	1400	1890	2390	2900	3420	3740
	RANGE COVERED	*NAUTICAL MILES*			390	800	1210	1640	2070	2520	2970	3250
	FUEL CONSUMED	U.S. GALLONS			500	1000	1500	2000	2500	3000	3500	3800
73000 LB.*	ELAPSED TIME	HOURS-MIN.				2:35	5:15	8:05	10:55	13:50	16:50	18:40
	RANGE COVERED	STATUTE MILES				470	940	1430	1930	2450	2970	3290
	RANGE COVERED	*NAUTICAL MILES*				400	820	1240	1680	2120	2580	2860
	FUEL CONSUMED	U.S. GALLONS				500	1000	1500	2000	2500	3000	3300
70000 LB.*	ELAPSED TIME	HOURS-MIN.					2:40	5:25	8:20	11:15	14:15	16:05
	RANGE COVERED	STATUTE MILES					480	970	1470	1980	2500	2820
	RANGE COVERED	*NAUTICAL MILES*					420	840	1280	1720	2170	2450
	FUEL CONSUMED	U.S. GALLONS					500	1000	1500	2000	2500	2800
67000 LB.*	ELAPSED TIME	HOURS-MIN.						2:45	5:35	8:35	11:35	13:25
	RANGE COVERED	STATUTE MILES						490	990	1500	2030	2350
	RANGE COVERED	*NAUTICAL MILES*						430	860	1300	1760	2040
	FUEL CONSUMED	U.S. GALLONS						500	1000	1500	2000	2300

†HAND LEAN MIXTURE TO OBTAIN FUEL FLOW METER READING SHOWN UNDER APPLICABLE GROSS WEIGHT.

*TAKE OFF GROSS WEIGHT, LBS.

NOTE: 200 GALLONS OF FUEL SHOULD BE ALLOWED FOR WARM-UP, TAKE-OFF AND CLIMB. RANGE IS CALCULATED TO BE 10% CONSERVATIVE AND IS BASED ON ZERO HEAD WIND.

MAXIMUM RANGE CRUISING CHARTS

9000 FT.

GROSS WEIGHT	LBS.	82,000	79,000	76,000	73,000	70,000	67,000	64,000	61,000	58,000	55,000	53,200
SHIP I.A.S.	MPH	184	182	181	179	178	177	177	176	175	175	174
SHIP I.A.S.	*KNOTS*	*160*	*158*	*157*	*155*	*155*	*154*	*154*	*153*	*152*	*152*	*151*
ENGINE SPEED	RPM	1400	1350	1300	1300	1300	1300	1300	1300	1300	1300	1300
B.M.E.P. (APPROX.)	LBS/SQ. IN.	132	131	131	126	121	116	112	108	104	100	98
MAN. PR. (APPROX)	IN. HG.	25	26	26	25	25	24	24	23	23	22	22
†MIXTURE		H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L
FLOW METER READING	LBS./HOUR	335	320	308	296	287	278	269	261	255	249	246
FUEL FLOW (4 ENG.)	U.S. G.P.H.	223	213	205	197	191	185	179	174	170	166	164

82000 LB.*	ELAPSED TIME	HOURS-MIN.	2:15	4:35	7:00	9:35	12:10	14:55	17:40	20:35	23:35	25:20
	RANGE COVERED	STATUTE MILES	420	860	1320	1790	2270	2770	3270	3790	4320	4650
	RANGE COVERED	*NAUTICAL MILES*	*370*	*750*	*1150*	*1550*	*1970*	*2400*	*2840*	*3290*	*3760*	*4040*
	FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	4000	4500	4800
79000 LB.*	ELAPSED TIME	HOURS-MIN.		2:20	4:45	7:20	9:55	12:40	15:25	18:20	21:20	23:10
	RANGE COVERED	STATUTE MILES		440	890	1360	1850	2340	2850	3370	3900	4230
	RANGE COVERED	*NAUTICAL MILES*		*380*	*780*	*1180*	*1600*	*2030*	*2470*	*2930*	*3390*	*3670*
	FUEL CONSUMED	U.S. GALLONS		500	1000	1500	2000	2500	3000	3500	4000	4300
76000 LB.*	ELAPSED TIME	HOURS-MIN.			2:25	5:00	7:35	10:20	13:05	16:00	19:00	20:45
	RANGE COVERED	STATUTE MILES			450	920	1410	1900	2410	2930	3460	3790
	RANGE COVERED	*NAUTICAL MILES*			*390*	*800*	*1220*	*1650*	*2090*	*2540*	*3010*	*3290*
	FUEL CONSUMED	U.S. GALLONS			500	1000	1500	2000	2500	3000	3500	3800
73000 LB.*	ELAPSED TIME	HOURS-MIN.				2:30	5:10	7:55	10:40	13:35	16:35	18:20
	RANGE COVERED	STATUTE MILES				470	950	1450	1950	2480	3010	3330
	RANGE COVERED	*NAUTICAL MILES*				*410*	*830*	*1260*	*1700*	*2150*	*2610*	*2890*
	FUEL CONSUMED	U.S. GALLONS				500	1000	1500	2000	2500	3000	3300
70000 LB.*	ELAPSED TIME	HOURS-MIN.					2:40	5:20	8:10	11:00	14:00	15:50
	RANGE COVERED	STATUTE MILES					480	980	1490	2010	2540	2860
	RANGE COVERED	*NAUTICAL MILES*					*420*	*850*	*1290*	*1740*	*2200*	*2490*
	FUEL CONSUMED	U.S. GALLONS					500	1000	1500	2000	2500	2800
67000 LB.*	ELAPSED TIME	HOURS-MIN.						2:45	5:30	8:25	11:20	13:10
	RANGE COVERED	STATUTE MILES						500	1000	1520	2050	2380
	RANGE COVERED	*NAUTICAL MILES*						*430*	*870*	*1320*	*1780*	*2070*
	FUEL CONSUMED	U.S. GALLONS						500	1000	1500	2000	2300

†HAND LEAN MIXTURE TO OBTAIN FUEL FLOW METER READING SHOWN UNDER APPLICABLE GROSS WEIGHT.

*TAKE OFF GROSS WEIGHT, LBS.

NOTE: 200 GALLONS OF FUEL SHOULD BE ALLOWED FOR WARM-UP, TAKE-OFF AND CLIMB. RANGE IS CALCULATED TO BE 10% CONSERVATIVE AND IS BASED ON ZERO HEAD WIND.

MAXIMUM RANGE CRUISING CHARTS

12,000 FT.

GROSS WEIGHT	LBS.	82,000	79,000	76,000	73,000	70,000	67,000	64,000	61,000	58,000	55,000	53,200
SHIP I.A.S.	MPH	182	180	179	177	176	175	175	174	173	173	172
SHIP I.A.S.	*KNOTS*	*158*	*156*	*155*	*154*	*153*	*152*	*152*	*151*	*150*	*150*	*149*
ENGINE SPEED	RPM	1450	1450	1400	1300	1300	1300	1300	1300	1300	1300	1300
B.M.E.P. (APPROX.)	LBS./SQ. IN.	133	127	126	131	125	120	115	111	106	102	100
MAN. PR. (APPROX.)	IN. HG.	24	24	24	24	24	24	23	23	22	22	22
† MIXTURE		H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L
FLOW METER READING	LBS./HOUR	347	332	318	306	294	285	276	267	260	254	249
FUEL FLOW (4 ENG.)	U.S. G.P.H.	231	221	212	204	196	190	184	178	173	169	166

82000 LB.*

ELAPSED TIME	HOURS-MIN.	2:10	4:25	6:50	9:15	11:50	14:40	17:10	20:00	22:55	24:40
RANGE COVERED	STATUTE MILES	430	870	1320	1800	2280	2790	3300	3830	4370	4700
RANGE COVERED	*NAUTICAL MILES*	*370*	*750*	*1150*	*1560*	*1980*	*2420*	*2870*	*3320*	*3790*	*4080*
FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	4000	4500	4800

79000 LB.*

ELAPSED TIME	HOURS-MIN.	2:15	4:40	7:05	9:40	12:20	15:00	17:50	20:45	22:30
RANGE COVERED	STATUTE MILES	440	900	1370	1860	2360	2870	3400	3940	4280
RANGE COVERED	*NAUTICAL MILES*	*380*	*780*	*1190*	*1610*	*2050*	*2500*	*2960*	*3430*	*3710*
FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	4000	4300

76000 LB.*

ELAPSED TIME	HOURS-MIN.	2:20	4:50	7:25	10:00	12:45	15:35	18:30	20:15
RANGE COVERED	STATUTE MILES	460	930	1420	1920	2430	2960	3500	3840
RANGE COVERED	*NAUTICAL MILES*	*400*	*810*	*1230*	*1670*	*2110*	*2570*	*3040*	*3330*
FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	3800

73000 LB.*

ELAPSED TIME	HOURS-MIN.	2:30	5:00	7:40	10:25	13:15	16:05	17:55
RANGE COVERED	STATUTE MILES	470	960	1460	1980	2500	3050	3380
RANGE COVERED	*NAUTICAL MILES*	*410*	*830*	*1270*	*1720*	*2170*	*2640*	*2930*
FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3300

70000 LB.*

ELAPSED TIME	HOURS-MIN.	2:35	5:10	7:55	10:45	13:40	15:25
RANGE COVERED	STATUTE MILES	490	990	1500	2030	2570	2910
RANGE COVERED	*NAUTICAL MILES*	*420*	*860*	*1310*	*1760*	*2230*	*2520*
FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	2800

67000 LB.*

ELAPSED TIME	HOURS-MIN.	2:40	5:25	8:10	11:05	12:55
RANGE COVERED	STATUTE MILES	500	1020	1550	2090	2420
RANGE COVERED	*NAUTICAL MILES*	*440*	*880*	*1340*	*1810*	*2100*
FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2300

†HAND LEAN MIXTURE TO OBTAIN FUEL FLOW METER READING SHOWN UNDER APPLICABLE GROSS WEIGHT.

*TAKE OFF GROSS WEIGHT, LBS.

NOTE: 200 GALLONS OF FUEL SHOULD BE ALLOWED FOR WARM-UP, TAKE-OFF AND CLIMB. RANGE IS CALCULATED TO BE 10% CONSERVATIVE AND IS BASED ON ZERO HEAD WIND.

MAXIMUM RANGE CRUISING CHARTS

15,000 FT.

GROSS WEIGHT	LBS.	82,000	79,000	76,000	73,000	70,000	67,000	64,000	61,000	58,000	55,000	53,200
SHIP I.A.S.	MPH	180	178	177	175	174	173	173	172	171	171	170
SHIP I.A.S.	*KNOTS*	*156*	*155*	*154*	*152*	*151*	*150*	*150*	*149*	*149*	*149*	*148*
ENGINE SPEED	RPM	1600	1550	1500	1500	1450	1400	1400	1350	1300	1300	1300
B.M.E.P. (APPROX.)	LBS./SQ. IN.	125	123	121	116	116	114	110	109	109	105	103
MAN. PR.	IN. HG.	22	22	22	22	21	21	21	21	21	21	20
†MIXTURE		H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L	H-L
FLOW METER READING	LBS./HOUR	362	342	327	314	302	291	281	272	264	258	255
FUEL FLOW (4 ENG.)	U.S. G.P.H.	241	228	218	209	201	194	187	181	176	172	170

82000 LB.*											
ELAPSED TIME	HOURS-MIN.	2:05	4:15	6:35	8:55	11:25	14:00	16:40	19:25	22:15	24:00
RANGE COVERED	STATUTE MILES	430	870	1330	1800	2290	2800	3320	3860	4410	4750
RANGE COVERED	*NAUTICAL MILES*	*370*	*750*	*1150*	*1570*	*1990*	*2430*	*2880*	*3350*	*3830*	*4120*
FUEL CONSUMED	U.S. GALLONS	500	1000	1500	2000	2500	3000	3500	4000	4500	4800

79000 LB.*											
ELAPSED TIME	HOURS-MIN.		2:10	4:30	6:55	9:25	12:00	14:40	17:25	20:15	22:00
RANGE COVERED	STATUTE MILES		440	900	1380	1870	2370	2900	3430	3980	4320
RANGE COVERED	*NAUTICAL MILES*		*380*	*780*	*1200*	*1620*	*2060*	*2510*	*2980*	*3460*	*3750*
FUEL CONSUMED	U.S. GALLONS		500	1000	1500	2000	2500	3000	3500	4000	4300

76000 LB.*											
ELAPSED TIME	HOURS-MIN.			2:20	4:40	7:10	9:45	12:25	15:12	18:00	19:45
RANGE COVERED	STATUTE MILES			460	930	1420	1930	2450	2990	3540	3880
RANGE COVERED	*NAUTICAL MILES*			*400*	*810*	*1240*	*1680*	*2130*	*2600*	*3070*	*3370*
FUEL CONSUMED	U.S. GALLONS			500	1000	1500	2000	2500	3000	3500	3800

73000 LB.*											
ELAPSED TIME	HOURS-MIN.				2:25	4:55	7:30	10:10	12:55	15:45	17:30
RANGE COVERED	STATUTE MILES				480	970	1470	1990	2530	3080	3420
RANGE COVERED	*NAUTICAL MILES*				*410*	*840*	*1280*	*1730*	*2200*	*2670*	*2970*
FUEL CONSUMED	U.S. GALLONS				500	1000	1500	2000	2500	3000	3300

70000 LB.*											
ELAPSED TIME	HOURS-MIN.					2:30	5:05	7:45	10:30	13:20	15:05
RANGE COVERED	STATUTE MILES					490	1000	1520	2060	2600	2940
RANGE COVERED	*NAUTICAL MILES*					*430*	*870*	*1320*	*1790*	*2260*	*2560*
FUEL CONSUMED	U.S. GALLONS					500	1000	1500	2000	2500	2800

67000 LB.*											
ELAPSED TIME	HOURS-MIN.						2:35	5:15	8:00	10:50	12:35
RANGE COVERED	STATUTE MILES						510	1030	1570	2110	2450
RANGE COVERED	*NAUTICAL MILES*						*440*	*890*	*1360*	*1840*	*2130*
FUEL CONSUMED	U.S. GALLONS						500	1000	1500	2000	2300

†HAND LEAN MIXTURE TO OBTAIN FUEL FLOW METER READING SHOWN UNDER APPLICABLE GROSS WEIGHT.

*TAKE OFF GROSS WEIGHT, LBS.

NOTE: 200 GALLONS OF FUEL SHOULD BE ALLOWED FOR WARM-UP, TAKE-OFF AND CLIMB. RANGE IS CALCULATED TO BE 10% CONSERVATIVE AND IS BASED ON ZERO HEAD WIND.