RESTRICTED

DIST: 4, 5, 7, 8
FILE: BEGH

T. O. NO. 01-75FF-1

PILOT'S FLIGHT OPERATING INSTRUCTIONS

FOR

ARMY MODELS P-38H Series, P-38J-5 and F-5B-1

NOTE: This Technical Order replaces T. O. No. 01-75FF-1 dated June 25, 1943.

This publication shall not be carried in aircraft on combat missions or when there is a reasonable chance of its falling into the hands of the enemy.

MARSHALL-WHITE, CHICAGO
OCTOBER, 1943— 18,000

SEPTEMBER 25, 1943

Published by authority of the Commanding General, Army Air Forces.

THIS PUBLICATION MAY BE USED BY PERSONNEL RENDERING SERVICE TO THE UNITED STATES OR ITS ALLIES

Paragraph 5.*d.* of Army Regulation 380-5 relative to the handling of "restricted" printed matter is quoted below.

"*d.* Dissemination of restricted matter.—The information contained in restricted documents and the essential characteristics of restricted material may be given to *any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work*, but will not be communicated to the public or to the press except by authorized military public relations agencies."

This permits the issue of "restricted" publications to civilian contract and other accredited schools engaged in training personnel for Government work, to civilian concerns contracting for overhaul and repair of aircraft or aircraft accessories, and to similar commercial organizations.

LIST OF REVISED PAGES ISSUED

NOTE: A heavy black vertical line, to the left of the text on revised pages, indicates the extent of the revision. This line is omitted where more than 50 percent of the page is revised.

This issue contains no revisions.

ADDITIONAL COPIES of this publication may be secured on Requisition, AAF Form 102, as prescribed in AAF Regulations 15-102. Submit requisitions to: Commanding General, Air Service Command, Patterson Field, Fairfield, Ohio. Also, see T. O. No. 00-25-3 for details on distribution of Technical Orders. (Requests from Naval activities shall be submitted to: Chief of the Bureau of Aeronautics, Navy Department, Washington, D. C.)

CONTENTS

SECTION I

DESCRIPTION

SECTION II

PILOT OPERATING INSTRUCTIONS

SECTION III

FLIGHT OPERATING DATA

SECTION IV

EMERGENCY OPERATING INSTRUCTIONS

SECTION V

OPERATIONAL EQUIPMENT

APPENDIX I

APPENDIX II

FLIGHT OPERATING CHARTS, TABLES, CURVES, AND DIAGRAMS

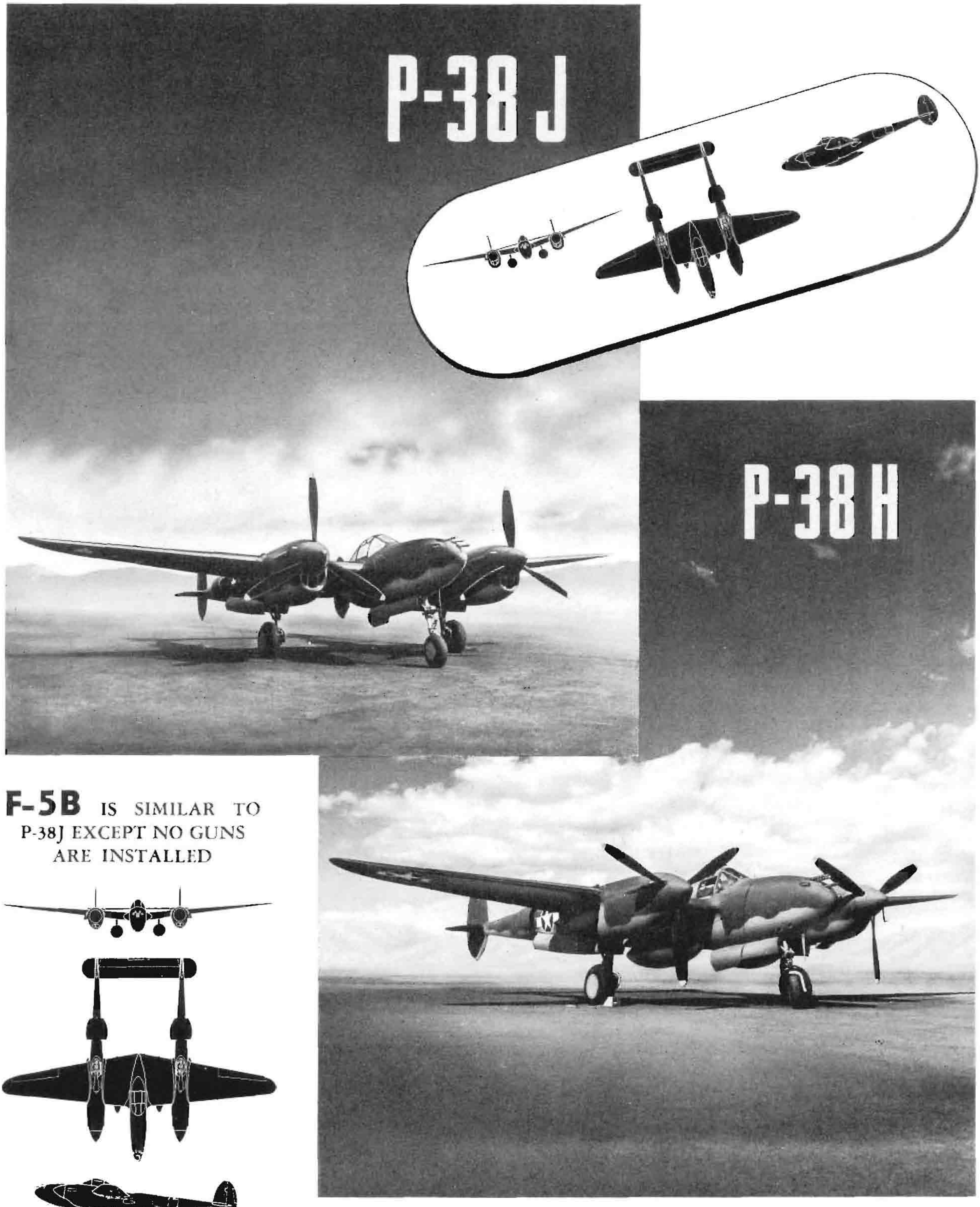


Figure 1 — The Airplane

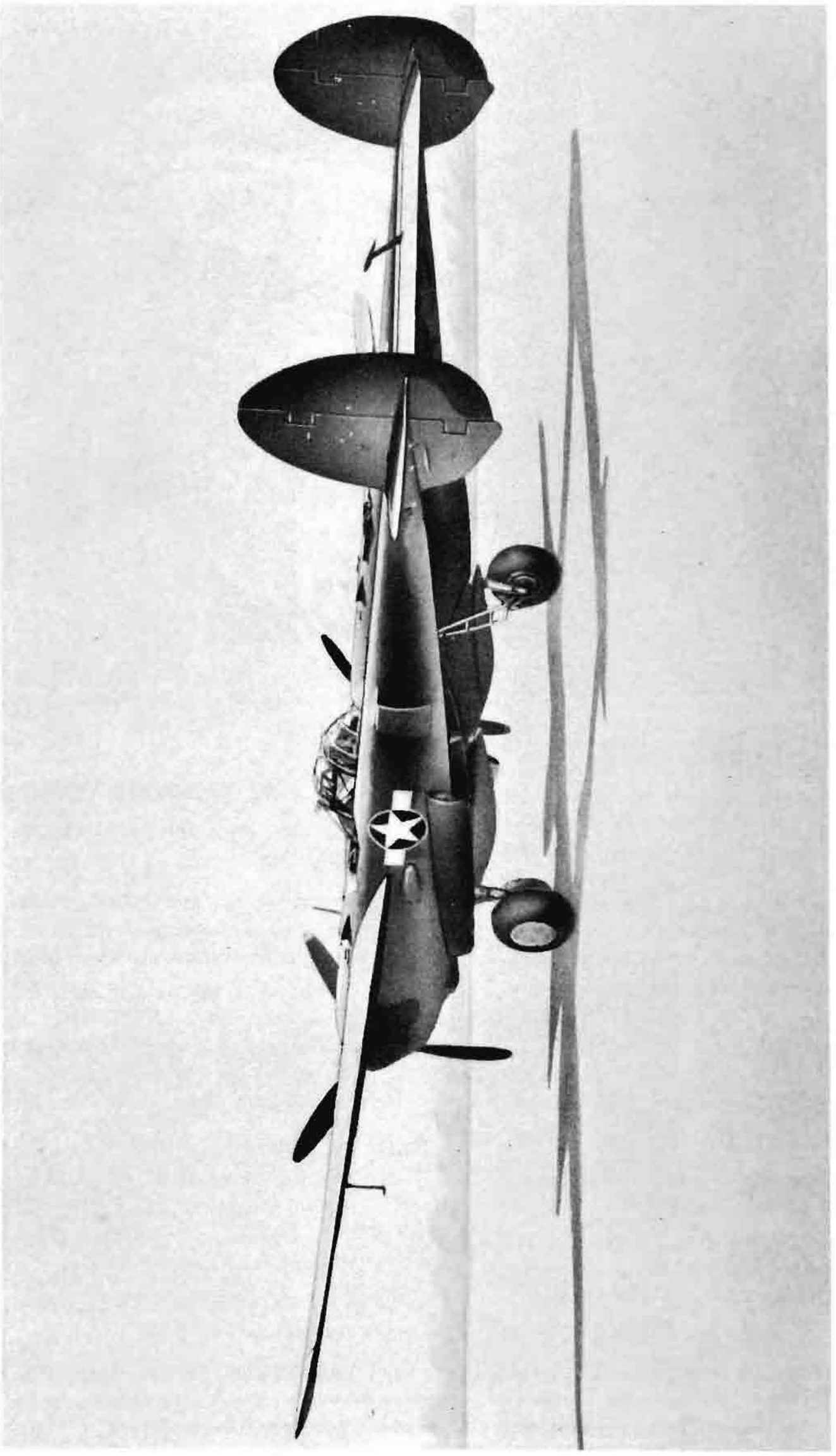
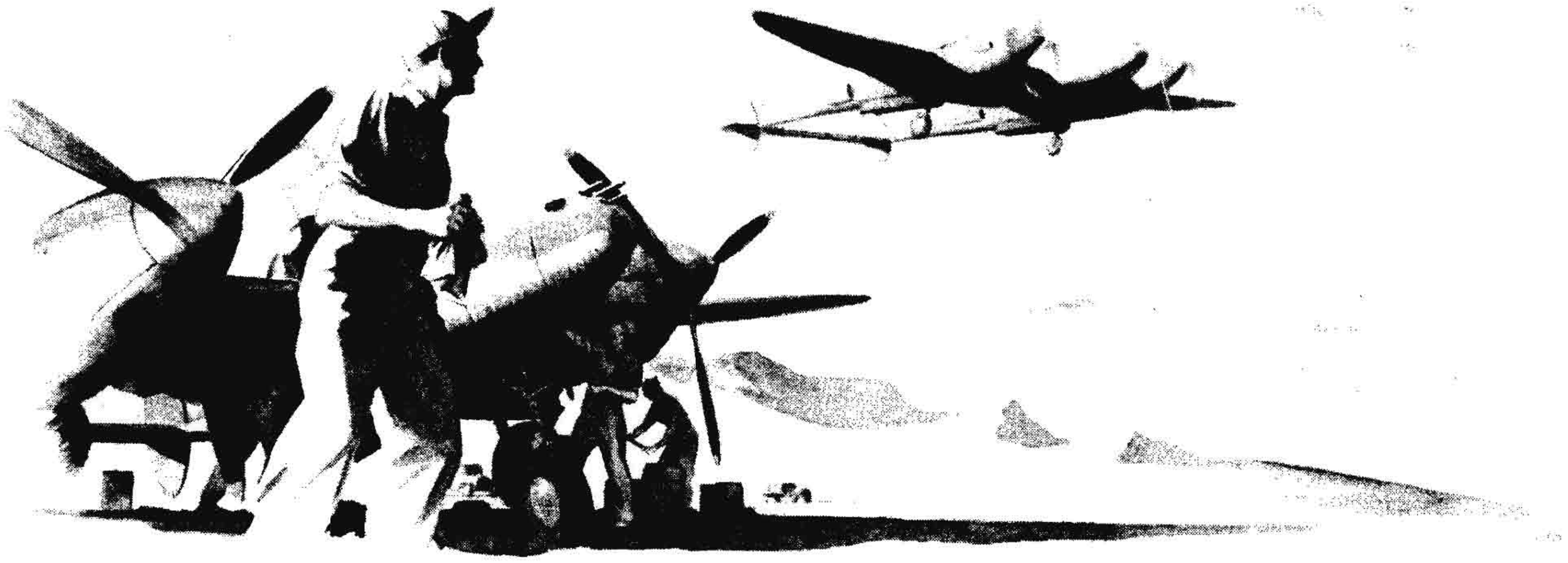


Figure 2—Three-Quarter Rear View of Complete Airplane



SECTION I

Description

1. GENERAL.

a. The P-38H, P-38J and F-5B airplanes are twin boomed, single seater, monoplanes manufactured by the Lockheed Aircraft Corporation and are powered by one V-1710-89 (right hand rotating) and one V-1710-91 (left hand rotating) Allison engine. P-38H and P-38J are fighter airplanes. The F-5B is a photographic airplane. The engines drive three bladed, constant speed, full feathering, Curtiss electric propellers. Hydraulically operated landing gear, flaps, brakes, and coolant shutters are provided. The approximate overall dimensions are as follows:

Length	37 feet 10 inches
Height	9 feet 9¾ inches
Span	52 feet 0 inches

b. FUEL, OIL, AND COOLANT.

Fuel.....Specification AN-VV-F-781 (Amendment No. 5 or better) (Octane 100)

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

Coolant.....Specification AN-E-2 (Ethylene Glycol)

c. The armament is mounted in the nose of the fuselage and armor protection is provided as shown in figure 3. Photographic airplanes are protected by armor the same as the fighters but all armament is replaced by cameras.

2. ENGINE AND PROPELLER CONTROL.

a. THROTTLE AND SUPERCHARGER CONTROL.

(1) The throttle is mechanically connected to the supercharger regulator so that control of the supercharger as a separate operation has been eliminated.

(2) Operation of the throttle control (figure 4-2) is the same as a conventional throttle except that the engine response is sluggish in the 2/3 to WIDE OPEN range. This sluggish response is due to the time required for the superchargers to reach their new speed.

b. MIXTURE CONTROLS.

(1) The mixture controls (figure 4-6) have four positions, FULL RICH, AUTO RICH, AUTO LEAN and CUTOFF. Operate as indicated in Section II and in the cruising charts in Appendix II.

c. PROPELLER CONTROLS.—Conventional electric propeller controls are installed.

(1) PROPELLER PITCH CONTROL LEVERS (figure 4-4) select the desired engine rpm for automatic constant speed propeller operation.

(2) PROPELLER SELECTOR SWITCHES *(figure 4-5)* have four positions.

(a) AUTO CONSTANT SPEED.—The propeller governors are in operation and engine speed will be maintained as set on the propeller pitch levers (figure 4-4.)

(b) FIXED PITCH.—Propeller pitch is fixed, engine speed depends upon power and airplane speed.

(c) INC RPM.—Propeller pitch decreases, engine speed increases.

(d) DEC RPM.—Propeller pitch increases, engine speed decreases.

(3) PROPELLER CIRCUIT BREAKERS.—Open, and the propeller pitch changing mechanism is inoperative, when the current required to operate the propellers becomes too high. When the circuit breakers open, the buttons (figure 4-9) pop up disclosing a red and white band on the buttons. They may be reset by pushing the buttons after allowing approximately 15 seconds for the switches to cool. Only the black portion of the buttons is visible when the circuit breakers are properly set.

(4) FEATHERING SWITCHES *(figure 4-13)* turn the propellers to their minimum drag position.

(5) WARNING LIGHTS *(figure 4-7)* are installed on P-38H only. They indicate when the propeller circuits are not properly set for take-off and landing, (i.e.) when the circuit breakers are open, or the selector switches are not set to AUTO CONSTANT SPEED. These lights, however, do not warn of an improperly set propeller pitch control.

(6) VERNIER KNOB *(figure 4-18)* provides for fine adjustment of the right-hand propeller pitch control when synchronizing the engines.

(7) FRICTION CONTROL *(figure 4-19)* may be adjusted to prevent the throttles and propeller pitch controls from vibrating out of position.

d. CARBURETOR AIR FILTER CONTROLS.

(1) This control is located behind the pilot seat on early airplanes. On airplanes serial 42-67702 and up, this control is located on the engine control stand (figure 4-8). The filters are to be used whenever dusty air conditions dictate, but since they reduce the critical altitude of the engines and reduce the maximum range obtainable, they should be used only when necessary.

e. COOLANT TEMPERATURE CONTROLS.

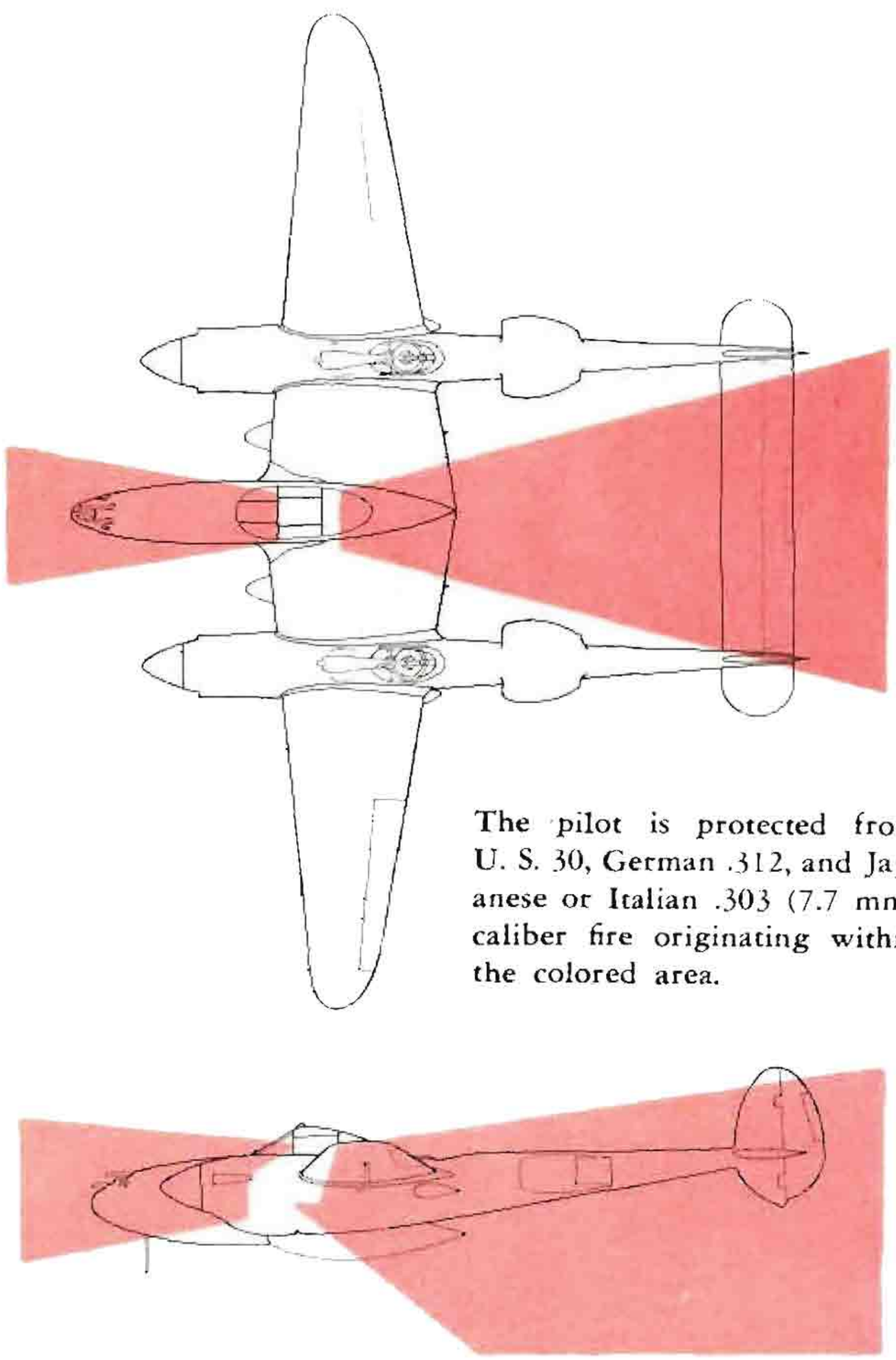
(1) Coolant temperature is automatically regulated between 101° C (flaps closed) and 121° C (flaps open) (214 to 250° F) with the coolant flap override switches set to OFF.

(2) The override switches (figure 6-13) may be operated to fully OPEN or fully CLOSE the flaps in the event that the regulators fail to maintain the above temperatures. It is not possible to set the coolant flap to any position except full OPEN or full CLOSE when using the override switches. If hydraulic pressure fails completely, the flaps will assume a faired (mid) position.

f. OIL TEMPERATURE CONTROLS.

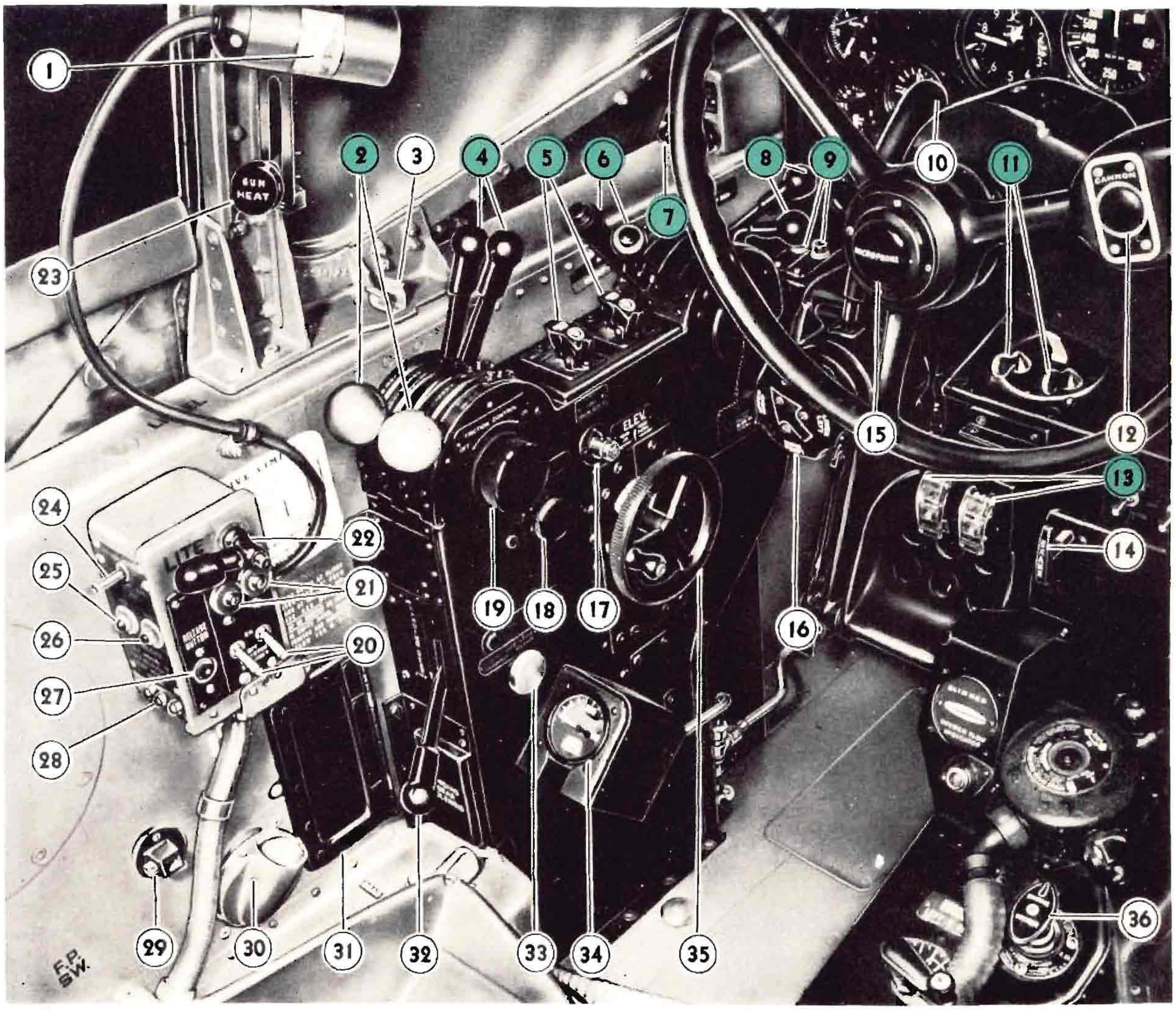
(1) Oil temperature is automatically regulated between 75° C (flaps closed) and 95° C (flaps open) (167° to 203° F) with the oil cooler flap switches (figure 6-17) set to AUTOMATIC.

(2) The oil cooler flap switches have four positions, AUTOMATIC, OFF, OPEN, and CLOSE. They may be operated to place and hold the flaps in any position in the event the regulators fail to maintain the above temperatures.



The pilot is protected from U. S. 30, German .312, and Japanese or Italian .303 (7.7 mm) caliber fire originating within the colored area.

Figure 3 — Armor Protection



1. Spotlight (normal position).
2. Throttles.
3. Surface controls lock clip.
4. Propeller pitch controls.
5. Propeller selector switches.
6. Mixture controls.
7. Propeller warning lights (P-38H only)
8. Carburetor air filter control (airplane 42-67702 and up) (control not used on earlier airplanes).
9. Propeller circuit breaker buttons.
10. Gun charger handle.
11. Ignition switches.
12. Cannon trigger button. (Machine gun button on forward side of wheel.)
13. Propeller feathering switches.
14. Parking brake handle.
15. Microphone button (under left thumb on P-38J and F-5B).
16. Gun charging selector knob.
17. Landing gear warning light.
18. Propeller pitch vernier knob.
19. Friction control.
20. Bomb or tank selector switches.
21. Bomb or tank indicator lights.
22. Cockpit light.
23. Gun (or camera) compartment heat control.
24. Arm-safe switch.
25. Arming indicator light.
26. Safe indicator light.
27. Bomb or tank release button.
28. Spare indicator lights.
29. Spotlight alternate position socket.
30. Cockpit ventilator control.
31. Gun sight dark glass stowage.
32. Landing gear control handle.
33. Landing gear control release.
34. Oxygen pressure gage.
35. Elevator tab control.
36. Engine primer.

Figure 4 — Cockpit, Left-hand Side

3. FUEL SYSTEM.

(See figure 9.)

a. Fuel pressure (figure 7-4), normally 14 to 18 lb/sq in., is supplied by one engine driven pump and one electric pump for each engine. The electric pumps (figure 10-4) should be turned ON during take-off and landing, and at altitude (usually above 12000 feet) if the fuel pressure drops below 14 lb/sq in.

b. FUEL QUANTITY GAGES *(figure 7-16)* indicate for the four wing tanks only. The quantity in the droppable tanks must be estimated from the time of flight and the hourly fuel consumption as indicated in the charts in Appendix II.

4. OIL SYSTEM.

(See figure 15.)

5. RETRACTABLE LANDING GEAR CONTROL.

(See figure 13.)

a. The landing gear lever (figure 4-32) controls the extension and retraction of all three wheels. A lock on the lever prevents its being moved out of the DOWN position when the airplane is on the ground (when the left main shock strut is compressed). If this lock fails, or if it is necessary to retract the gear on the ground due to engine failure at take-off, it may be released by rotating the landing gear control release knob (figure 4-33) in a counter-clockwise direction. The landing gear position is indicated on the instrument panel (figure 7-19). A warning horn and light (figure 4-17) are provided which operate when either throttle is closed if the gear is not down and locked: P-38J and F-5B airplanes are not equipped with the warning horn.

6. FLAP CONTROL.

(See figure 13.)

a. Flap action is controlled by the lever (figure 5-2) on the right-hand side of the cockpit, and flap position is indicated on the instrument panel (figure 7-19). When the lever is placed to UP or DOWN, the flaps will automatically stop at their end position. The lever should be returned to CLOSED as soon as the end position is reached. The control will not go to the down position until the trigger on the lever is lifted through the notch just forward of the closed position.

NOTE

When using maneuvering flaps, the flap lever must be left in the maneuver position. If it is moved even slightly forward and then returned to maneuver the flaps will extend completely. This condition is corrected on airplanes 42-66750 and up.

7. HYDRAULIC SYSTEM.

(See figure 11.)

a. Normal system pressure (figure 7-11) is between 1200 and 1350 lb/sq in. See Section IV, paragraph 1, for emergency operation in case of failure of the system.

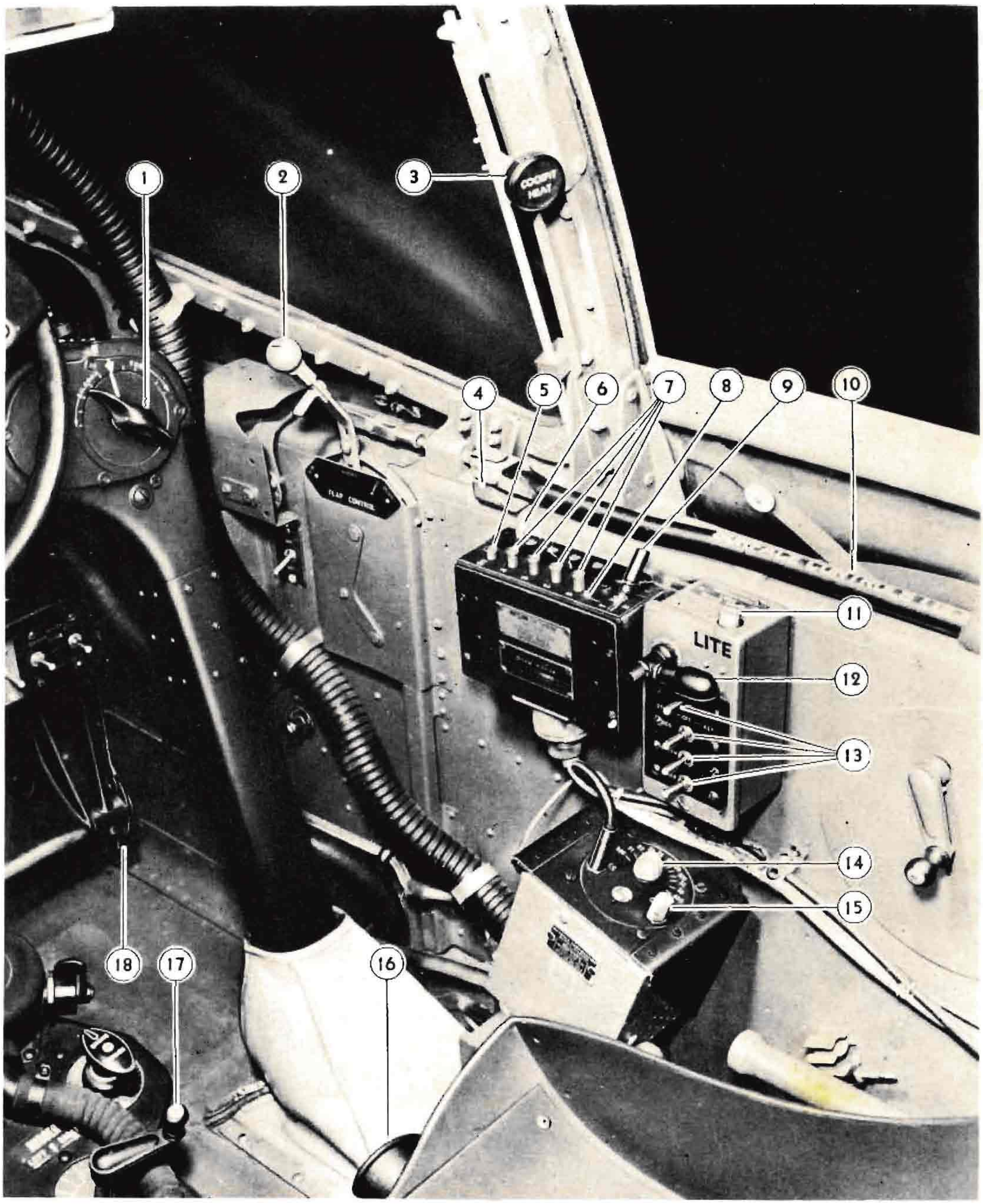
b. There are three separate systems of operation for the hydraulic equipment in this airplane.

(1) The normal system operates all the hydraulic equipment (except brakes) using power from the engine driven pumps and fluid from the TOP half of the main hydraulic reservoir.

(2) The auxiliary system operates the same equipment and uses the same lines as the normal system. It functions exactly like the normal system except the hand hydraulic pump furnishes the power and the fluid comes from the BOTTOM of the main hydraulic reservoir. When using the auxiliary system the hand pump source selector valve (figure 14-4) is UP and the bypass valve (figure 14-3) is OPEN.

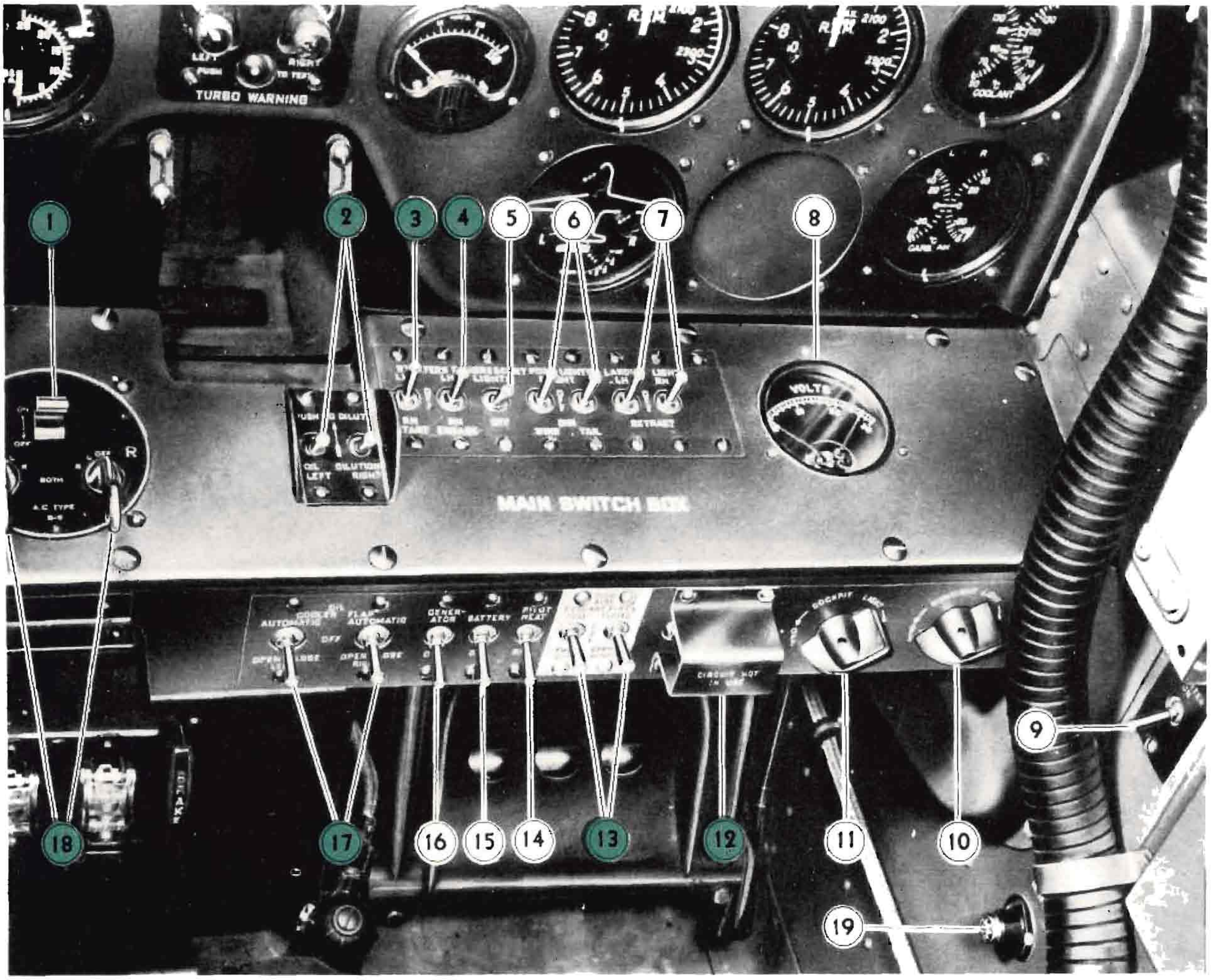
NOTE

It will be impossible to build up pressure with the hand pump unless the coolant override switches are OFF. This is due to a fixed bleed in the system when the switches are in the override position.



1. Aileron tab control.
2. Flap control lever.
3. Cockpit heat control.
4. Surface controls lock guide angle.
5. Radio OFF push button.
6. Indicator light dimming lever.
7. Frequency selector push buttons.
8. Selector lock lever.
9. Selector switch.
10. Surface controls lock (stowed).
11. Recognition light keying switch.
12. Cockpit light.
13. Recognition light switches.
14. Detrola receiver tuning knob.
15. Detrola receiver volume control.
16. Pilot's relief tube.
17. Rudder trim tab control.
18. Rudder pedal adjustment lever.

Figure 5 — Cockpit, Right-hand Side



1. Ignition master switch.
2. Oil dilution switches.
3. Starter switch.
4. Engage switch.
5. Fluorescent light switch.
6. Position light switches.
7. Landing light switches (left-hand only on P-38J and F-5B).
8. Voltmeter.
9. Inverter switch (P-38H).
10. Gun sight light rheostat.
11. Cockpit light rheostat.
12. Intercooler flap switches. (P-38J and F-5B) Circuit not in use on P-38H.
13. Coolant flap override switches.
14. Pitot heat switch.
15. Battery switch.
16. Generator switch.
17. Oil cooler flap switches.
18. Ignition switch.
19. Inverter warning light (P-38H).

Figure 6 — Main Switch Box

(3) The emergency system operates from a separate reservoir and through separate lines using the hand pump for power. THE ONLY PURPOSE OF THIS SYSTEM IS TO EXTEND THE LANDING GEAR IN CASE OF COMPLETE FAILURE OF THE OTHER TWO SYSTEMS. When using the emergency system the hand pump source selector valve (figure 14-4) is DOWN and the bypass valve (figure 14-3) is CLOSED. (Later airplanes have the bypass valve incorporated in the source selector valve.)

c. Brakes are not connected to the main hydraulic system. No emergency braking system is provided. See figure 12 for brake system diagram.

8. HEATING AND VENTILATION.

(See figure 18.)

a. COCKPIT HEAT is supplied by an intensifier tube in the right engine exhaust and controlled by a knob (figure 5-3) on the right windshield support. Heat outlets are arranged to supply warm air to the windshield and removable hatch. The foot heat outlet may be closed off by operating the heat control (figure 18-5) on the floor under the right foot.

b. VENTILATING AIR enters from the left wing-fuselage fillet. The rate of flow may be varied by rotating the ventilator (figure 4-30) as desired.

c. ARMAMENT OR CAMERA COMPARTMENT HEAT is supplied by an intensifier tube in the left engine exhaust. The heat control (figure 4-23) on the left windshield support is used to turn the heat on and off.

9. ELECTRICAL SYSTEM.

a. The 24 volt electrical system is powered by a generator on the left engine and a battery in the left boom. (F-5B camera airplanes have a generator on each engine, controlled by separate switches located near the ammeters, and a battery in the nose compartment.) The battery switch (figure 6-15) cuts out the battery, leaving the rest of the system operating on the generator. The generator switch (figure 6-16) cuts out the generator, allowing the system to draw from the battery only. The ignition master switch (figure 6-1) has no effect upon the electrical system, but cuts out the ignition to both engines.

b. LIGHTS.

(1) LANDING LIGHT is located under the left wing (both wings on P-38H) and controlled by switch(es) (figure 6-7) on the main switch box. With the switch(es) ON the lights extend and turn on. On P-38H airplanes with the switches OFF the lights turn off, but remain extended. On P-38J and F-5B airplanes with the switch OFF the lights remain ON and the lights remain extended. Never fly above 140 MPH unless the landing light switches are in the RETRACT position.

(2) RECOGNITION LIGHTS. — One or two (white) upward and three (red, green and amber) downward lights are controlled by switches on the right-hand side of the cockpit. To operate turn the selector switches (figure 5-13) to STEADY, or turn the selector switches to KEY and press the keying switch button (figure 5-11).

CAUTION

It is possible to burn the plastic lenses of the downward recognition lights by operating them for more than thirty seconds while on the ground. Make all ground operation as short as possible.

(3) POSITION LIGHTS are controlled by switches (figure 6-6) on the main switch box. Bright, dim and off positions are provided.

(4) COCKPIT LIGHTS *(figures 5-12 and 4-22)* are controlled by a rheostat (figure 6-11) on the main switch box and a switch on the lights themselves.

(5) FLUORESCENT INSTRUMENT LIGHTS are mounted on the forward side of the control column and turned on by a switch (figure 6-5) on the main switch box. Light intensity is regulated by twisting the ends of the lighting unit.

(6) SPOTLIGHT *(figure 4-1)* is normally on the left windshield support. An alternate position (figure 10-1) is provided over the fuel tank selector valves. The spotlight switches are located on the light, and the beam may be focused by sliding the screw head forward and aft in its slot.

c. INVERTER.—On P-38H airplanes the inverter is turned on by the switch (figure 6-9) under the flap lever. It supplies 400 cycle alternating current which is used to operate the fluorescent lights and the remote indicating compass. A warning light (figure 6-19) glows when the inverter is not operating. The operation of this light indicates failure of the inverter and consequent failure of the compass and fluorescent lights.

(1) On P-38J and F-5B airplanes the inverter operates only the compass and is turned on by a switch on the main switch box labeled COMPASS; ON-OFF. No warning light is installed.

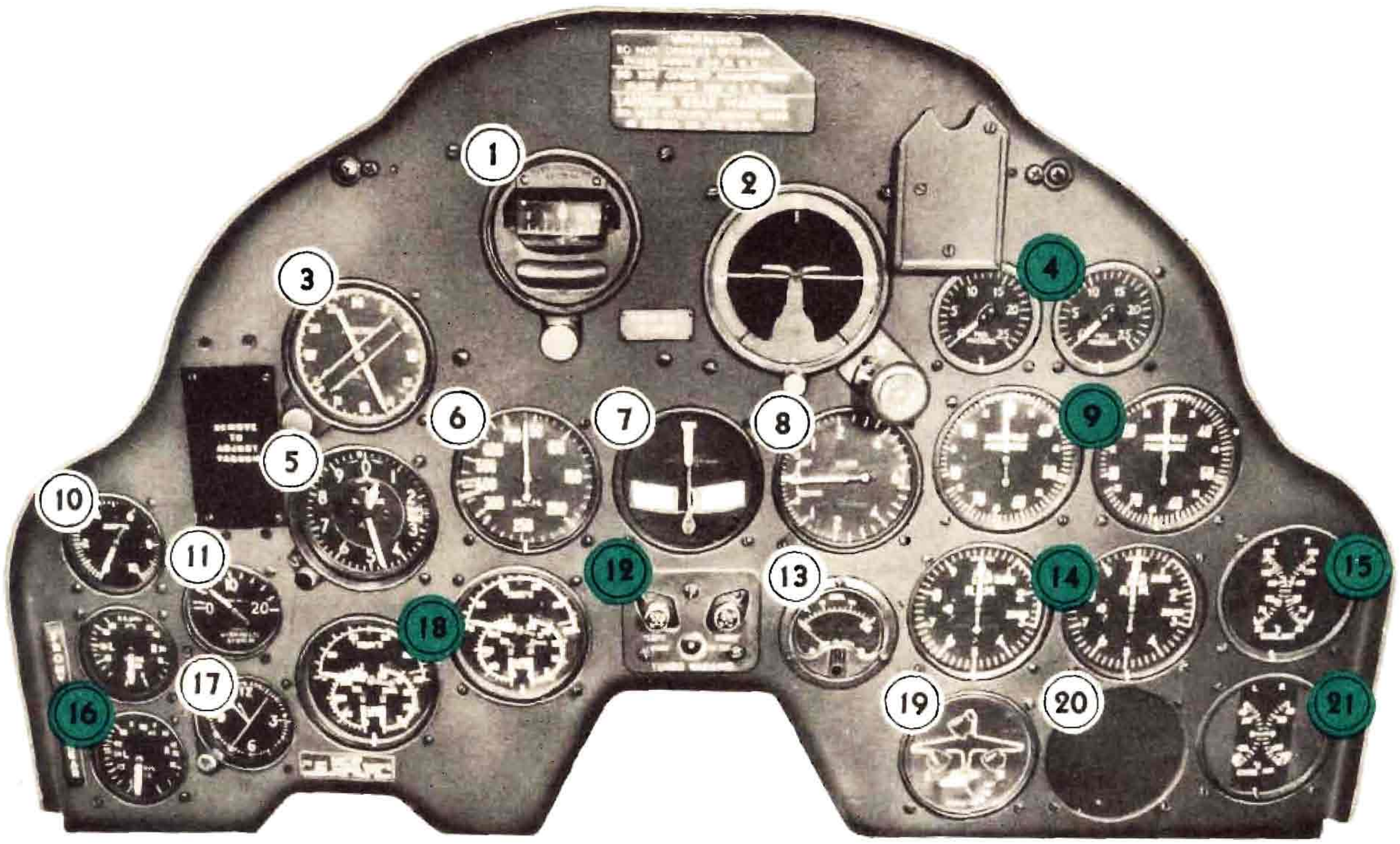
10. PILOT COMFORT.

a. RUDDER PEDAL ADJUSTMENT is obtained by pushing or pulling the small lever (figure 5-18) on the outboard corner of each pedal and moving the pedals to suit. Care must be taken to insure that both pedals are adjusted equally.

b. SEAT ADJUSTMENT is obtained by lifting the small lever (figure 14-1) on the right side of the seat and raising or lowering the seat as required. Release the lever and make sure that the seat is firmly locked in the new position. Normally the seat will be adjusted to the height which will make the reflection of the gun sight light easily visible.

c. SHOULDER HARNESS should be worn at all times. It will be impossible to lean forward unless the harness lever (figure 10-6) on the left side of the pilot's seat is raised. The harness lock will re-engage as soon as an upright position is resumed.

d. PILOT'S RELIEF TUBE *(figure 5-16).*



1. Directional gyro.
2. Gyro horizon.
3. Compass indicator.
4. Fuel pressure gages.
5. Altimeter.
6. Airspeed indicator.
7. Turn and bank indicator.
8. Rate of climb indicator.
9. Manifold pressure gages.
10. Suction gage.
11. Hydraulic pressure gage.
12. Turbo overspeed warning lights.
13. Ammeter.
14. Tachometers.
15. Coolant temperature indicator.
16. Fuel quantity gages.
17. Clock.
18. Combination oil pressure and temperature gages (fuel pressure indicator not connected).
19. Flap and landing gear position indicator.
20. Space for BC-608 Contactor.
21. Carburetor air temperature indicator.

Figure 7 — Instrument Panel

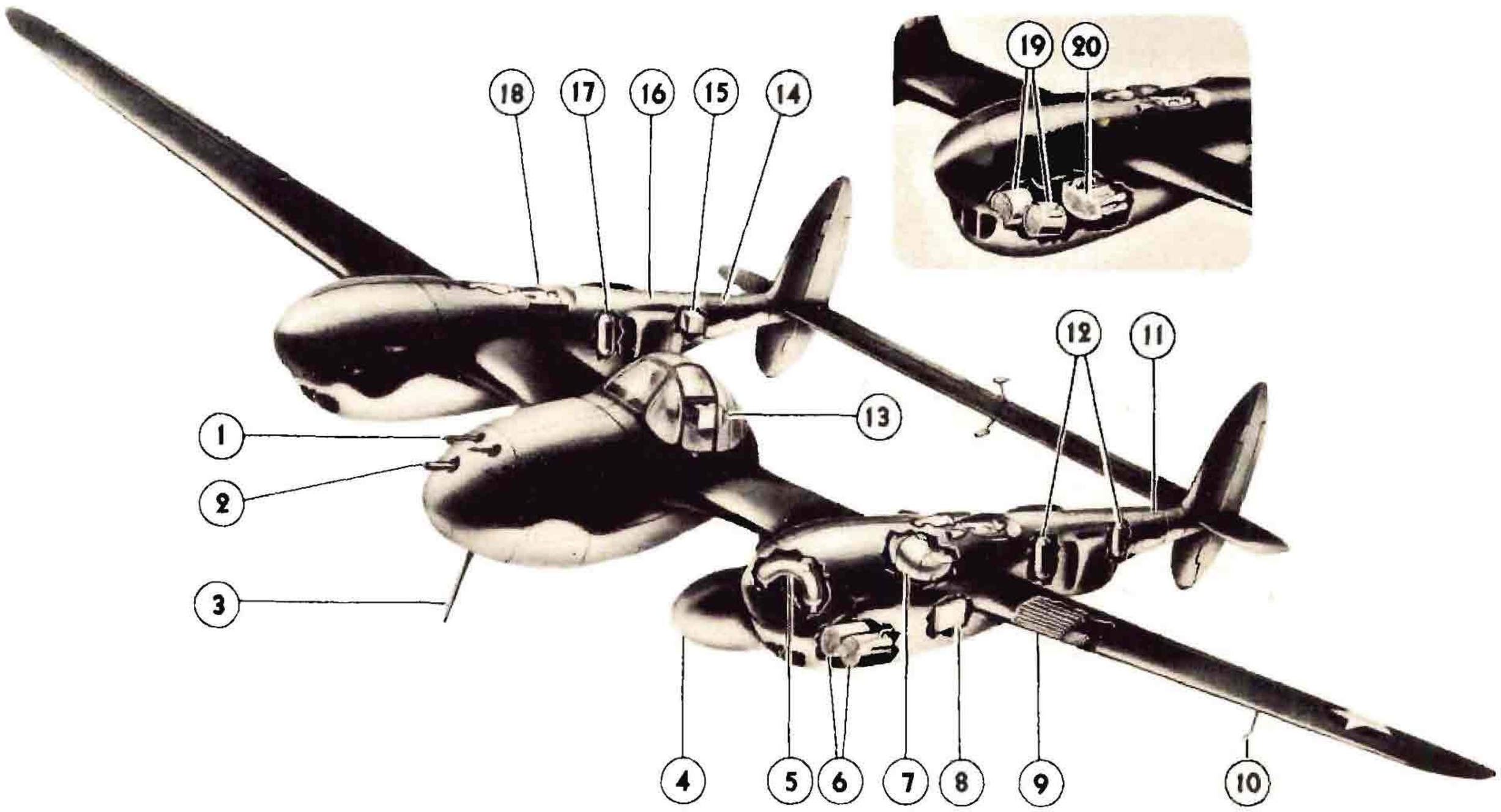


Figure 8 — Airplane Content Diagram

1. .50 caliber machine guns.
2. 20 mm cannon.
3. Antenna mast.
4. Droppable fuel tank.
5. Coolant tank.
6. Oil cooler radiators (P-38H)
7. Oil tank.
8. Carburetor air filter.
9. Carburetor air intercooler (P-38H).
10. Airspeed pitot.
11. Battery compartment door.
12. Oxygen bottles.
13. Radio equipment.
14. Baggage compartment door.
15. Recognition radio.
16. Coolant radiators.
17. Oxygen bottle.
18. Turbo supercharger.
19. Oil cooler radiators (P-38J and F-5B).
20. Carburetor air intercooler (P-38J and F-5B).

11. MISCELLANEOUS.

a. FIRST AID KIT is located behind the pilot's seat on the right-hand side.

b. VERY PISTOL is carried in the top of the canopy, behind and above the pilot's left shoulder. Cartridges are located nearby.

c. MAP CASE is located behind the pilot's right shoulder.

d. EMERGENCY RATIONS, if any, will be carried in the baggage compartment.

e. INCENDIARY GRENADE is stowed behind the seat of airplanes serial 42-66702 and up. When a forced landing is made in enemy territory, the airplane may be destroyed by throwing the grenade at the airplane from a safe distance.

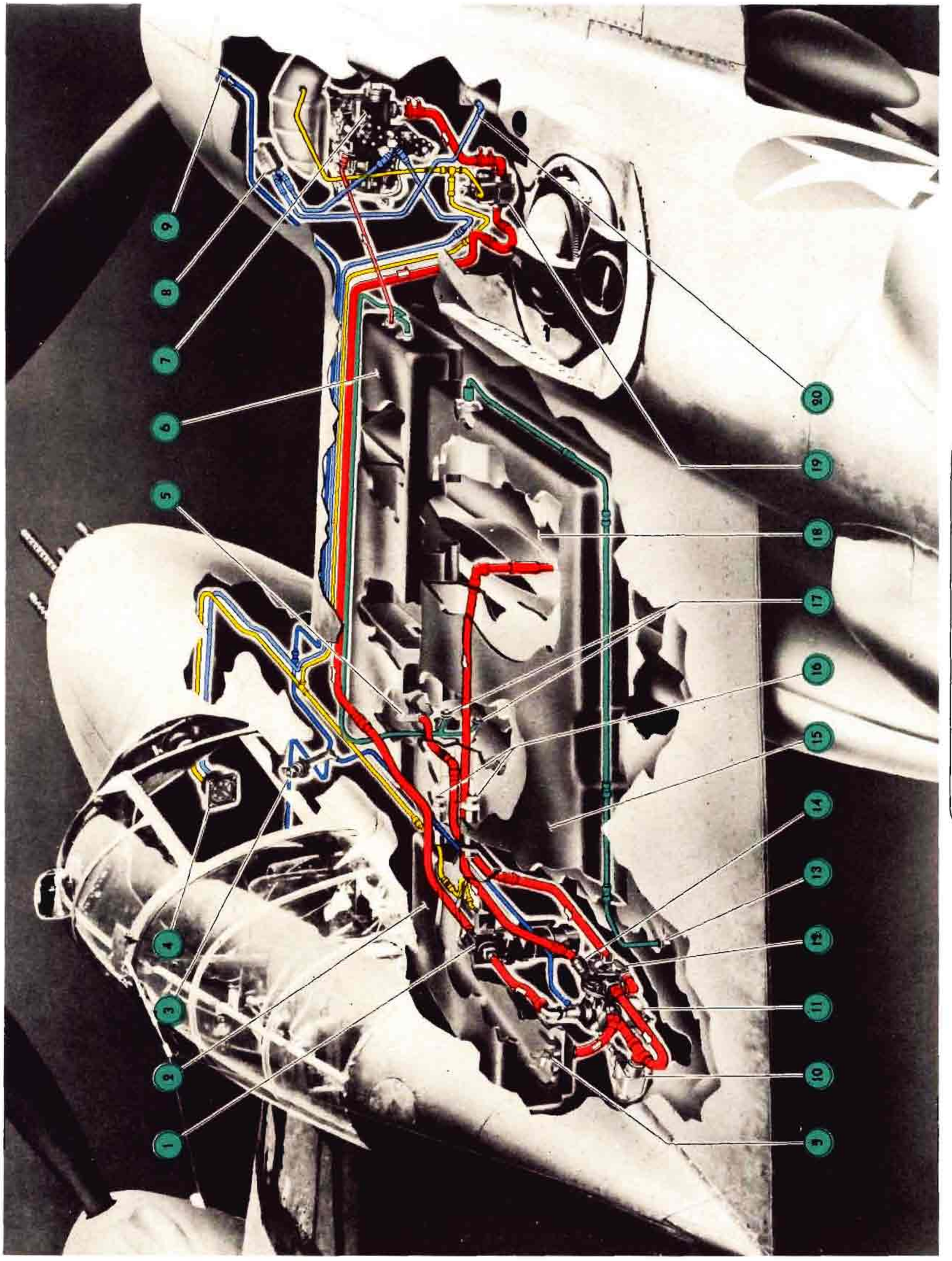


Figure 9—Fuel System Diagram

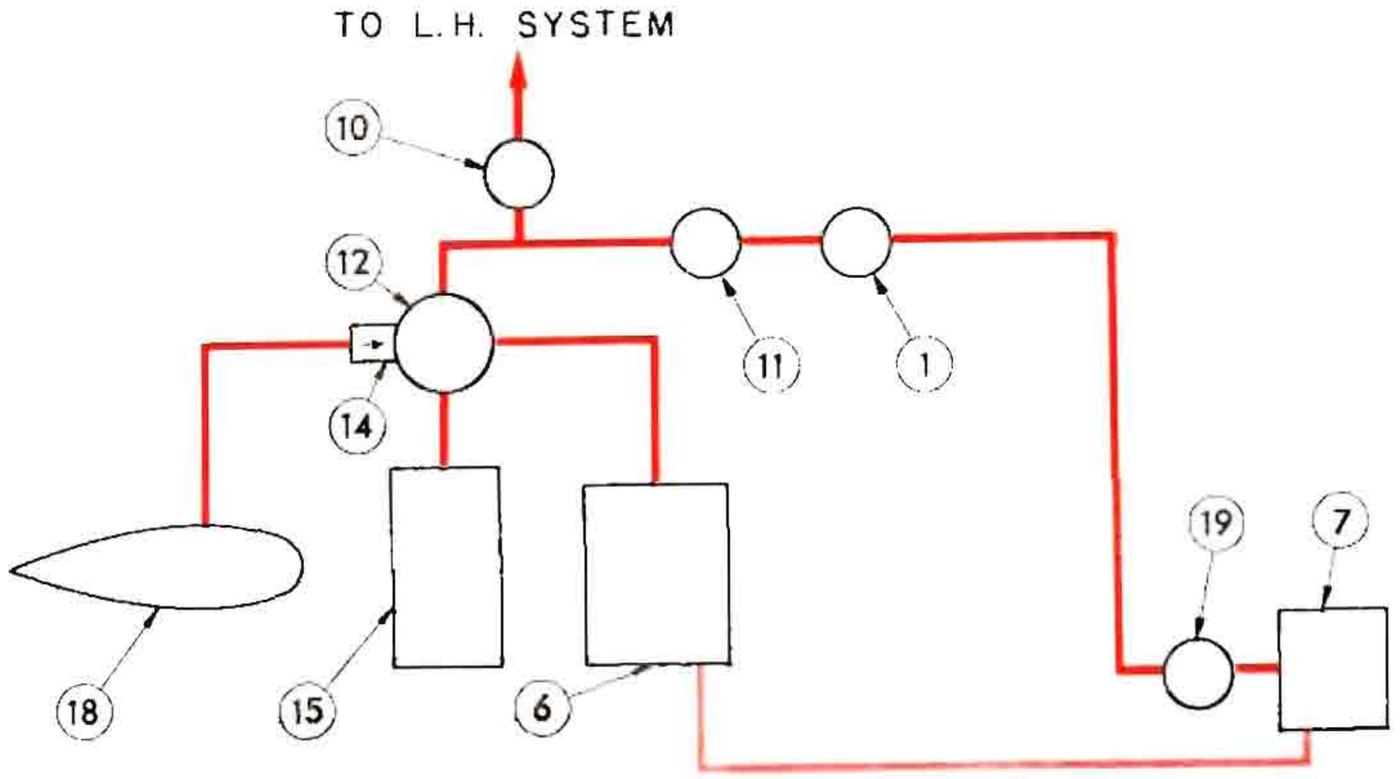


Figure 9A — Simplified Fuel System Diagram

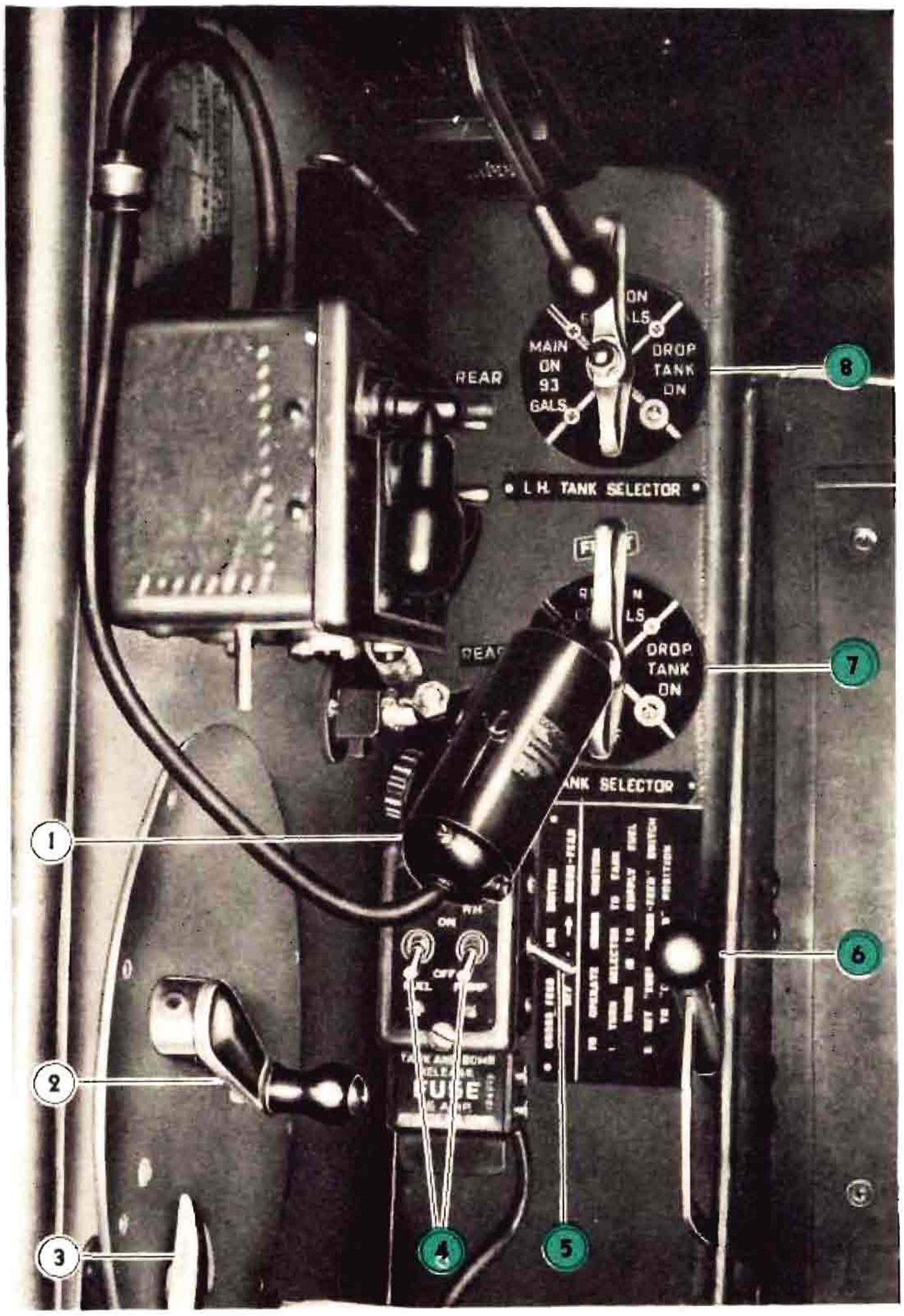


Figure 10 — Fuel System Controls

1. Spotlight (in alternate position).
2. Left window crank.
3. Window crank ratchet handle.
4. Electric fuel pump switches.
5. Cross feed switch.
6. Shoulder harness release.
7. Right hand tank selector valve.
8. Left hand tank selector valve.

KEY TO FIGURE 9 AND 9A

1. Electric fuel pump.
2. Surge tank (considered part of main tank).
3. Engine priming pump.
4. Fuel pressure gage.
5. Outlet from tank.
6. Reserve tank (capacity 60 U.S. gal., 50 Imperial gal.).
7. Carburetor.
8. Oil dilution valve.
9. Line to engine primer distributor.
10. Crossfeed valve.
11. Fuel filter.
12. Tank selector valve.
13. Main tank vent.
14. Check valve.
15. Main tank (capacity 93 U.S. gal., 77 Imperial gal.).
16. Passages between main tank and surge tank.
17. Reserve tank vent.
18. Droppable tank (capacity 165 U.S. gal., 137 Imperial gal.). Or (325 U.S. gal., 271 Imperial gal.).
19. Engine driven fuel pump.
20. Oil dilution line (injects fuel into oil system).

Main Fuel Lines.

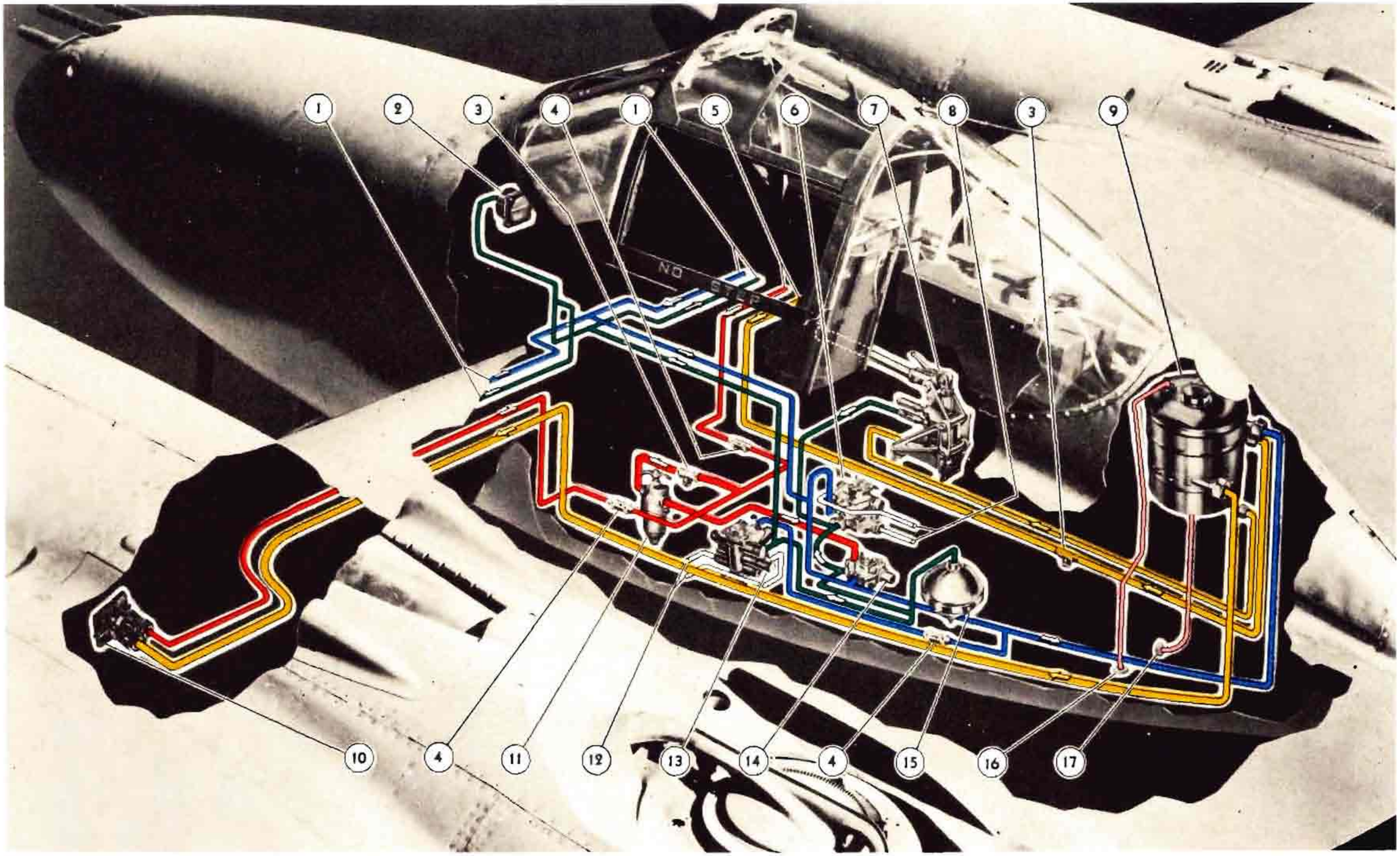
Fuel Pressure Balance Lines.

Engine Primer Lines.

Fuel Pressure Lines.

Vapor Return Lines. (Approximately 1 qt. per hour.)

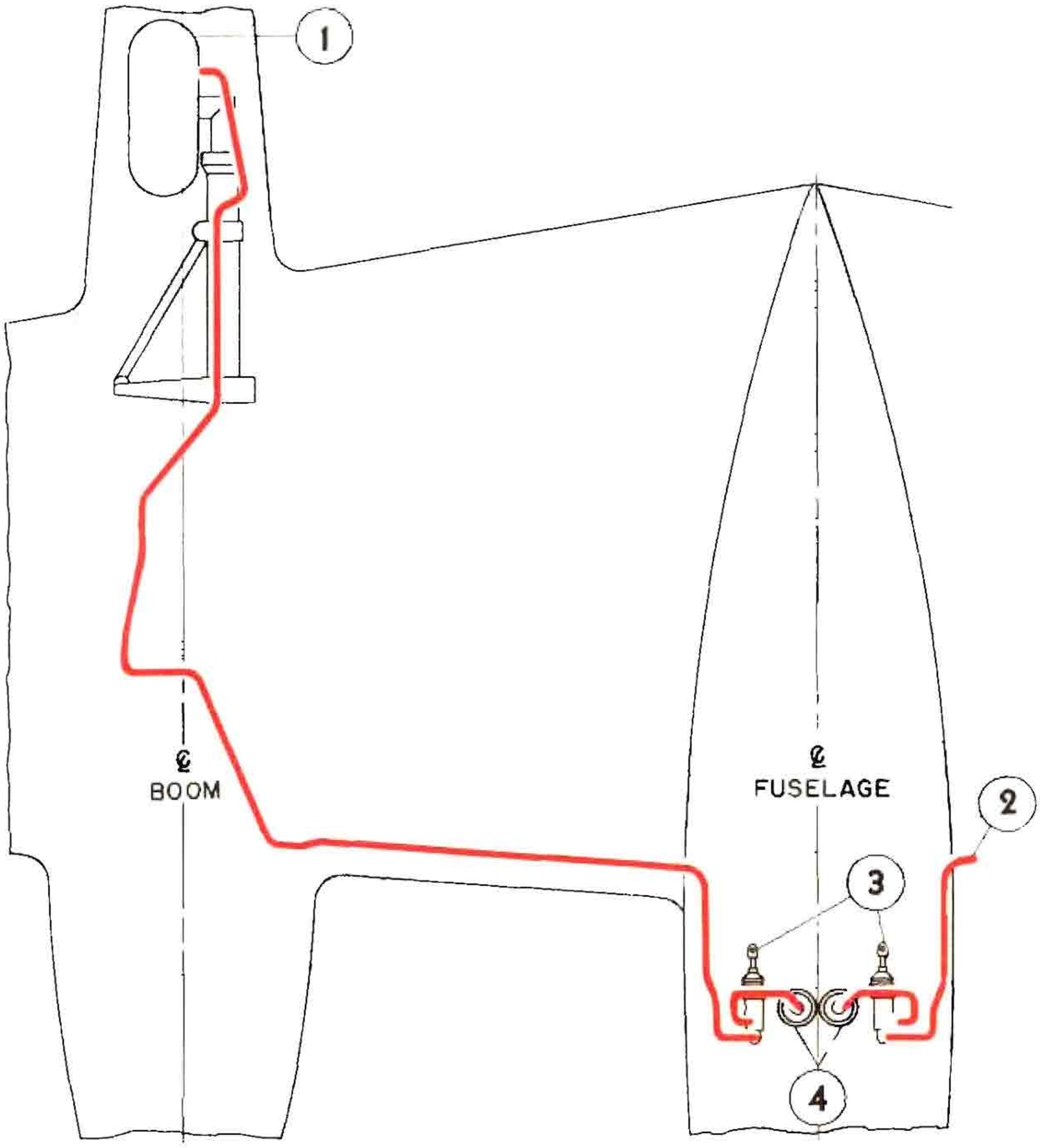
Fuel Tank Vent Lines.



Pump Pressure.
Return to Reservoir.
Pump Suction.
System Pressure.
Tank Drain or Vent.

1. To coolant flaps (see figure 16).
2. Hydraulic pressure gage.
3. Ground test connection.
4. Check valve.
5. To right hand engine pump.
6. Flap control valve.
7. Emergency hand pump.
8. To flap system (see figure 13).
9. Main hydraulic reservoir.
10. Engine driven pump.
11. Hydraulic fluid filter.
12. To landing gear (see figure 13).
13. Landing gear control valve.
14. System pressure regulator.
15. Hydraulic pressure accumulator.
16. Vent to atmosphere.
17. Main reservoir drain.

Figure 11 — Basic Hydraulic System Diagram



1. Main landing gear wheel and brake.
2. To left hand gear.
3. Brake cylinders.
4. Hydraulic fluid reservoirs.

Figure 12 — Brake System Diagram

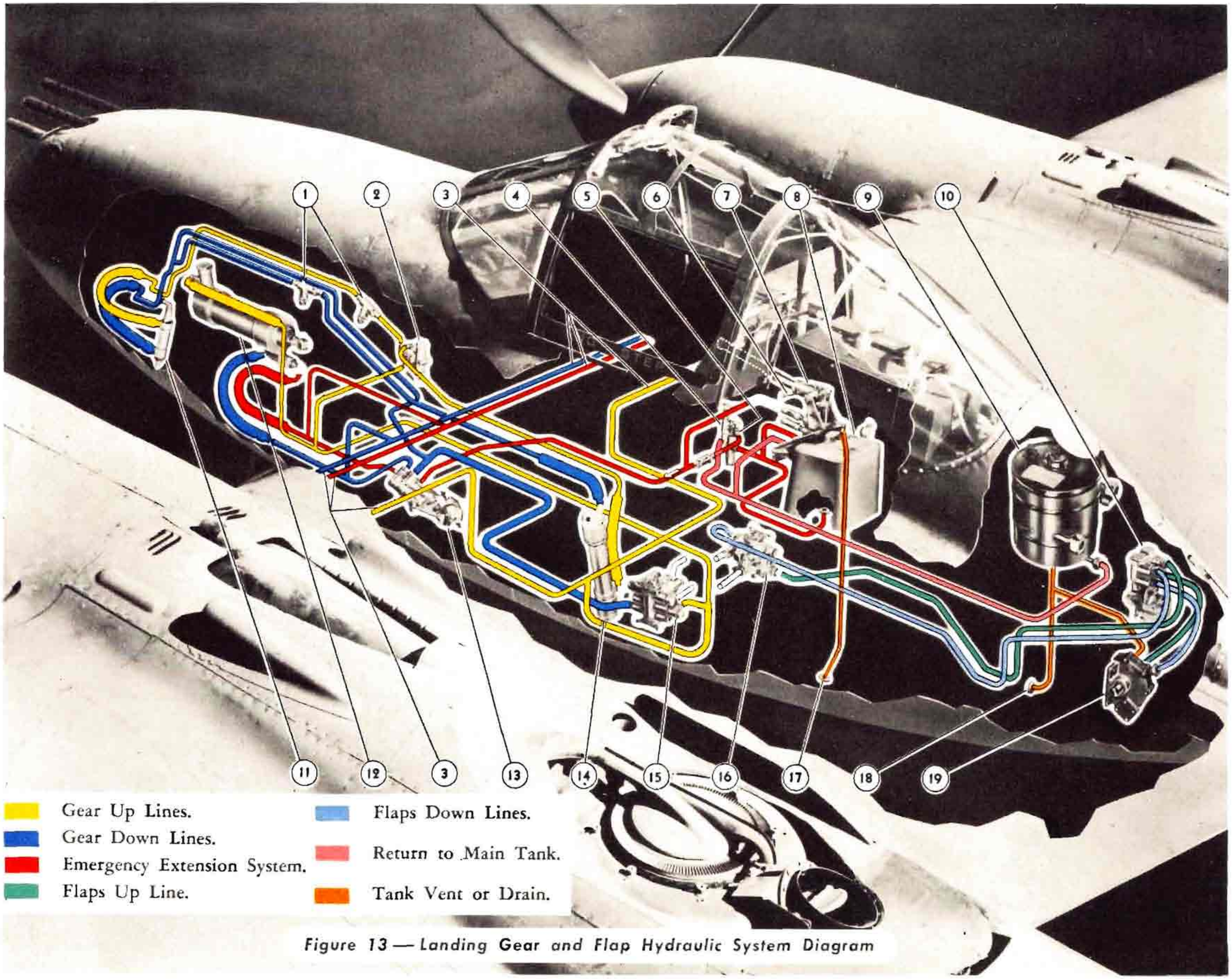


Figure 13 — Landing Gear and Flap Hydraulic System Diagram

KEY TO FIGURE 13

1. Combination check and relief valve. (Allows free flow in one direction, high pressure flow in the other direction.)
2. Sequence valve (open only when wheel is UP).
3. Lines to main landing gear system.
4. Emergency extension bypass valve.
5. Pressure relief valve.
6. Source selector valve (DOWN position).
7. Emergency hand pump.
8. Emergency extension reservoir.
9. Main hydraulic reservoir.
10. Automatic flap stop valve (stops flaps at UP, DOWN, or MANEUVER depending on setting of control lever).
11. Landing gear door locking cylinder.
12. Landing gear extension cylinder (down-lock built in).
13. Landing gear uplock.
14. Landing gear door cylinder.
15. Landing gear control valve.
16. Flap control valve.
17. Vent to atmosphere.
18. Main reservoir drain.
19. Flap motor and gear box.

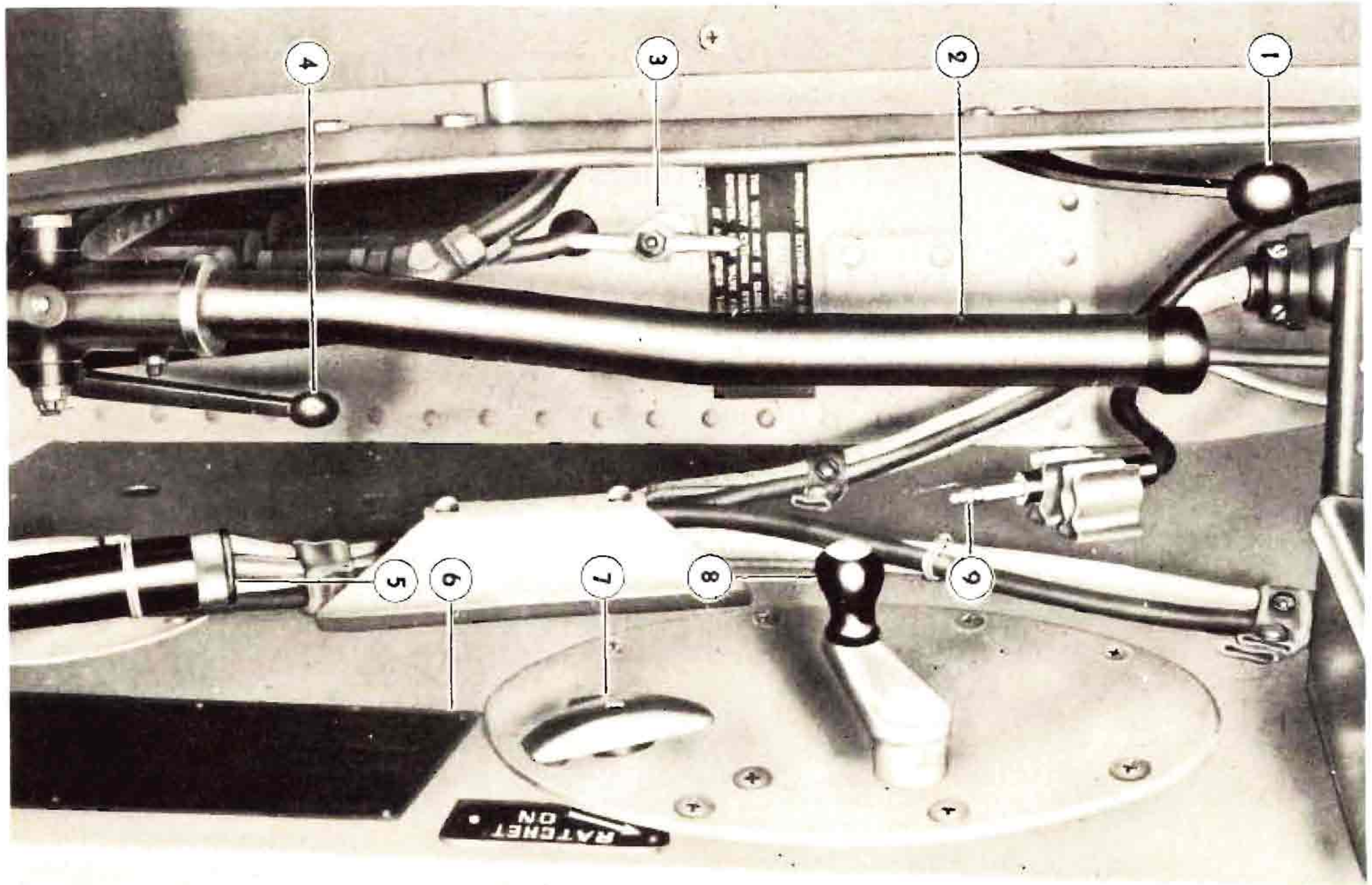


Figure 14 — Emergency Hydraulic Pump

1. Seat adjustment release handle.
2. Hand pump handle.
3. Emergency extension bypass valve.
4. Source selector valve handle.
5. Radio jack (stowed position).
6. Emergency extension procedure placard.
7. Window ratchet.
8. Right hand window crank.
9. Radio jack.

1. Automatic oil temperature regulator.
2. Line to oil pressure gage.
3. Oil Tank (capacity 13 U.S. gal., 11 Imperial gal.).
4. Supercharger regulator.
5. Vents to atmopshere.
6. Oil from engine.
7. Oil cooling radiators.
8. Oil to engine.

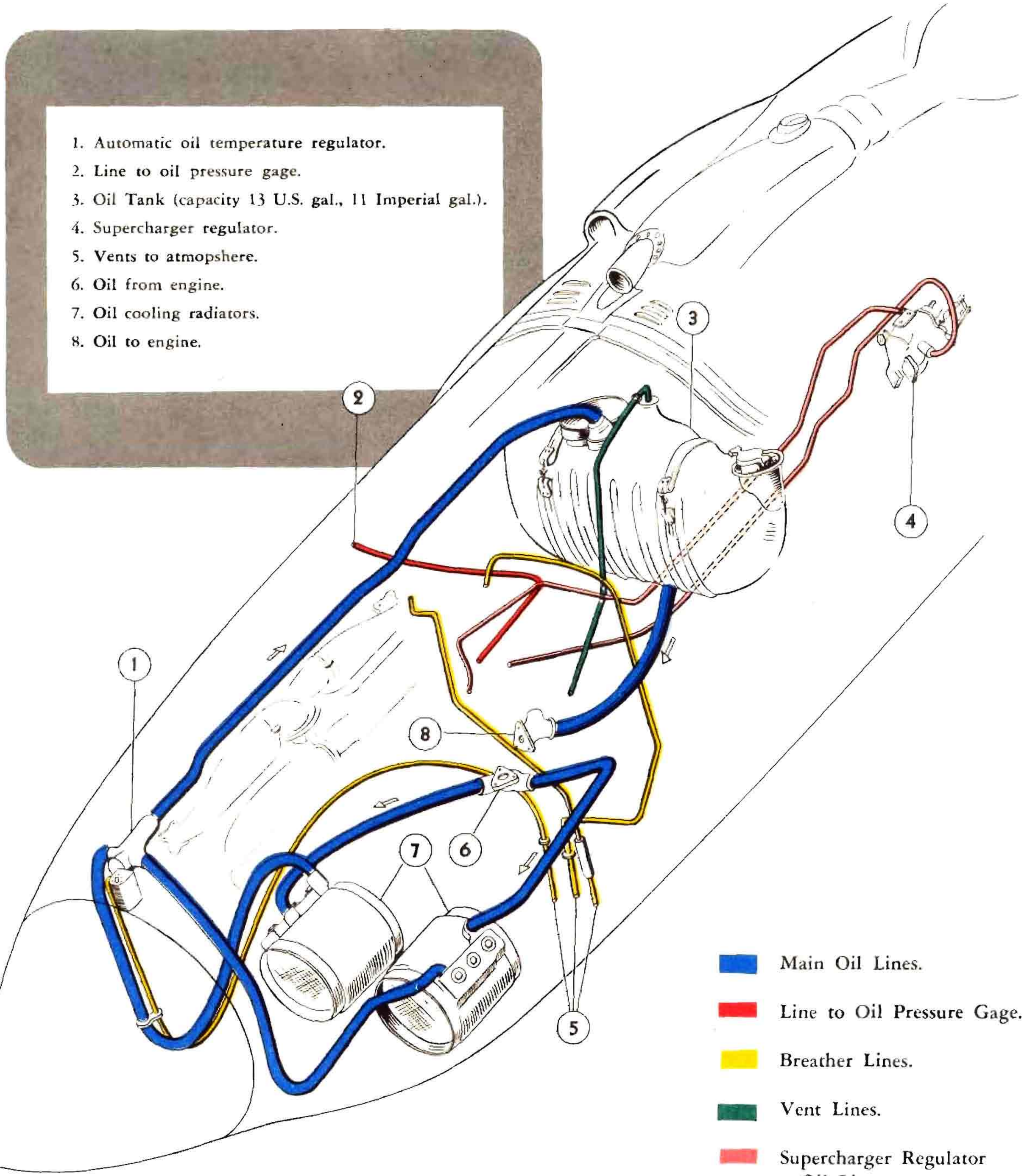
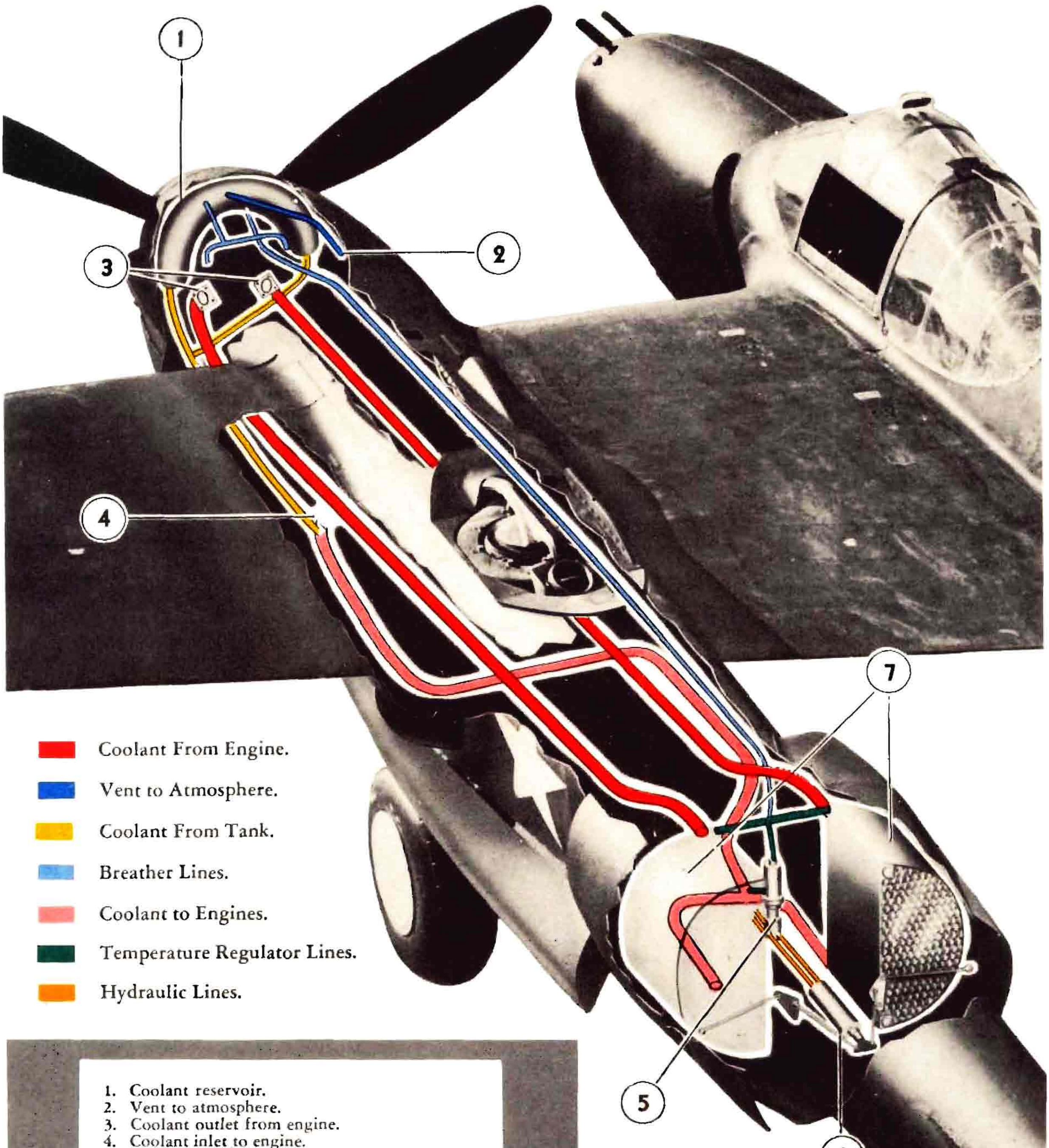
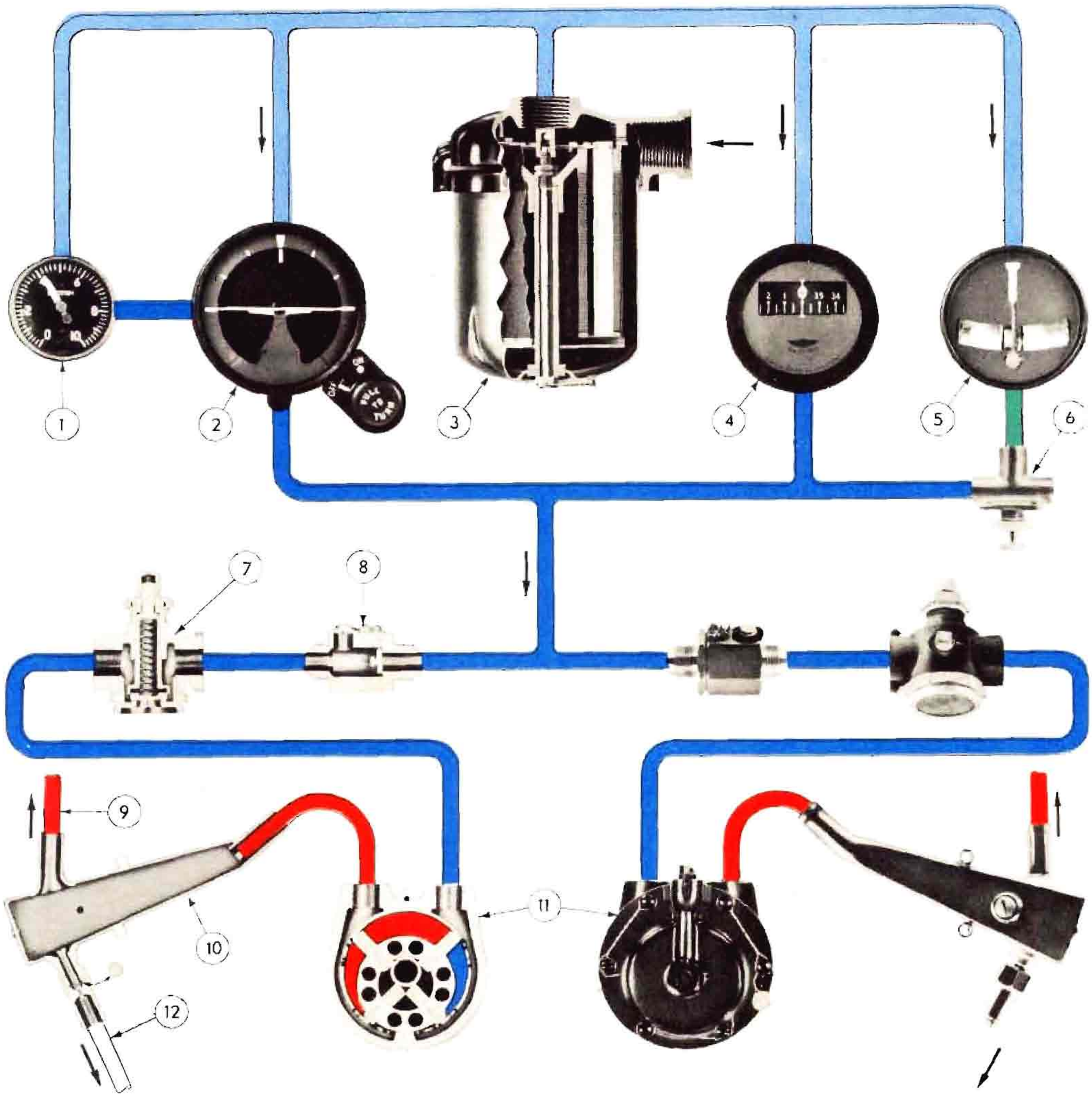


Figure 15 — Oil System Diagram



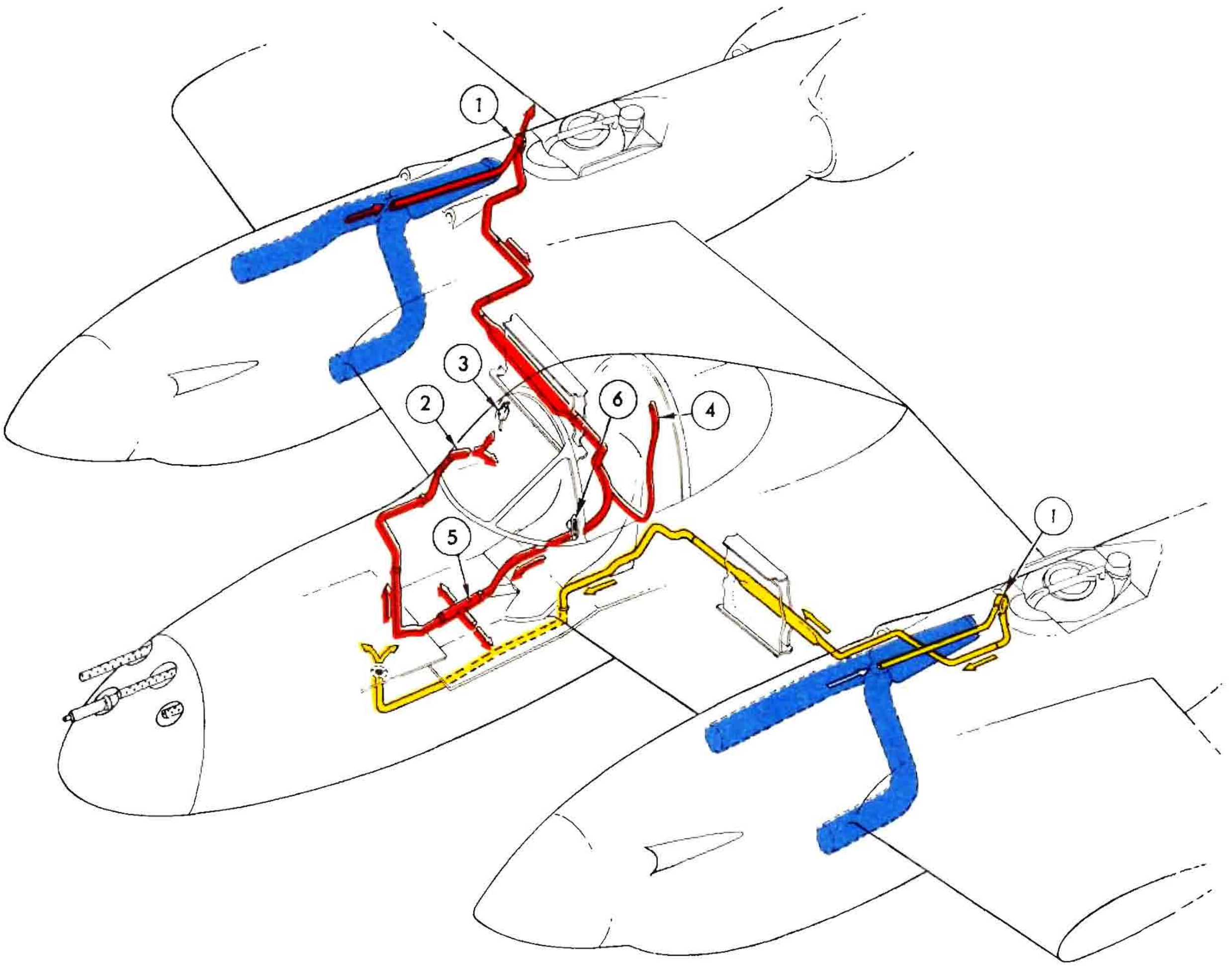
1. Coolant reservoir.
2. Vent to atmosphere.
3. Coolant outlet from engine.
4. Coolant inlet to engine.
5. Automatic temperature regulator.
6. Coolant radiator exit flap hydraulic cylinder.
7. Coolant radiators.

Figure 16 — Coolant System Diagram



1. Suction gage.
2. Gyro horizon.
3. Air filter.
4. Directional gyro.
5. Turn and bank indicator.
6. Turn and bank vacuum regulator.
7. System vacuum regulator.
8. Backfire relief valve.
9. Air outlet (to atmosphere).
10. Oil separator.
11. Vacuum pumps.
12. Oil return to engine.

Figure 17 — Vacuum System Diagram



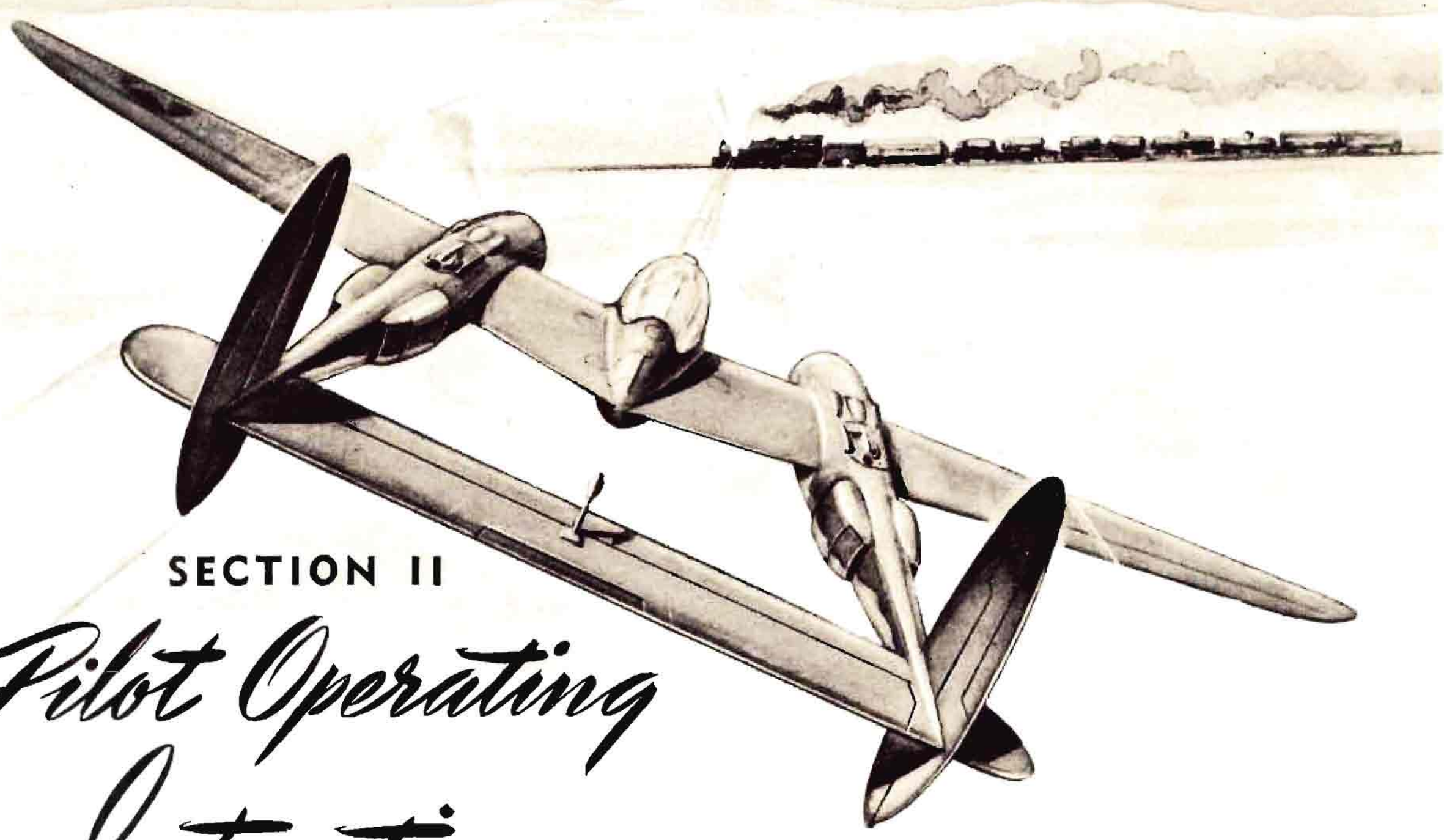
Exhaust Manifold.

Cockpit Heat Lines.

Armament Heat Lines.

1. Heat bypass (shutoff) valve.
2. Windshield defroster tube.
3. Cockpit heat control.
4. Flexible hatch defroster tube.
5. Foot heat shutoff valve.
6. Gun (or camera) heat control.

Figure 18 — Heating System Diagram



SECTION II

Pilot Operating Instructions

1. FLIGHT RESTRICTIONS.

a. MANEUVERS PROHIBITED.

(1) Snap rolls and intentional spins.

(2) Continuous inverted flight.

(3) Do not exceed the airspeed or accelerations given on the DIVE LIMITS placard which is posted in the cockpit of each airplane. Do not exceed 3.5 G's negative acceleration.

(4) Do not exceed 250 mph with 300 gallon drop tanks installed.

b. Extreme care must be taken during acrobatic maneuvers which require a downward recovery. Acrobatics should not be attempted at altitudes below 10,000 feet.

2. BEFORE ENTERING THE COCKPIT.

a. Check the loading of the airplane with the applicable weight and balance chart in Appendix II. Determine the approximate take-off weight and the center of gravity position.

WARNING

Dangerous instability exists when the center of gravity is aft of 32% mac. (32% gear up corresponds to 28.5% gear down). Under these tail heavy conditions, full down elevator will be required to prevent stalling the airplane if the speed is allowed to drop below 90 mph indicated with flaps down, power on, and gear up.

NOTE

Tail heavy conditions may be relieved by lowering the landing gear.

b. Check that the cannon and machine guns have been charged and that the radio transmitters have been tuned to the proper frequencies.

c. Access to the airplane is by means of the retractable ladder on the rear of the fuselage (figure 19-5). Push the up-lock release (figure 19-2) and raise the handle (figure 19-4) to a vertical position. Force the handle down until the ladder locks in the position shown. To retract the ladder, push the down-lock release (figure 19-3) and pull the handle straight up until the ladder stows in place, then swing the handle forward, flush with the fuselage contour, and press firmly into place. A flush, hinged handhold (figure 19-1) is built into the left side of the fuselage.

(1) To open the top hatch, turn the two releases (figure 20-1 and 20-9) on the top of the windshield and rotate the hatch backward.

3. ON ENTERING THE COCKPIT.

a. CHECK FOR ALL FLIGHTS.

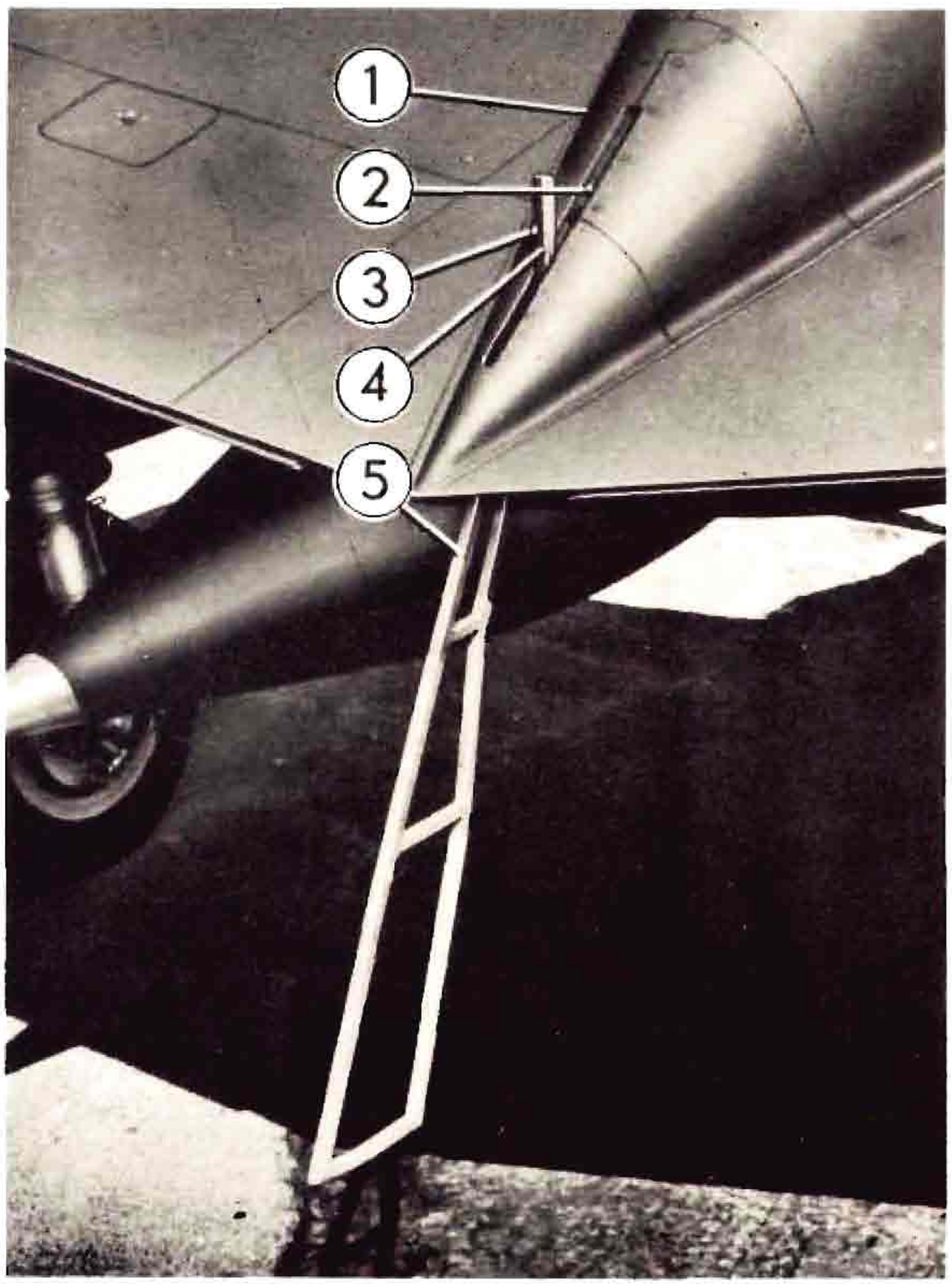
(1) Crossfeed switch (figure 10-4) OFF.

(2) Tank selector valves (figure 10-7, 10-8) RESERVE ON.

(3) Oxygen pressure (figure 4-34) 400 to 450 lb/sq in.

(4) Turn the bomb selector switches (figure 4-20) ON and the arming switch (figure 4-24) to SAFE so that tanks or bombs may be dropped quickly in the event of engine failure at take-off.

(5) Throttles (figure 4-2) 1/10 OPEN.



1. Flush type handhold.
2. Up lock release.
3. Down lock release.
4. Ladder lever.
5. Ladder.

Figure 19—Access Ladder

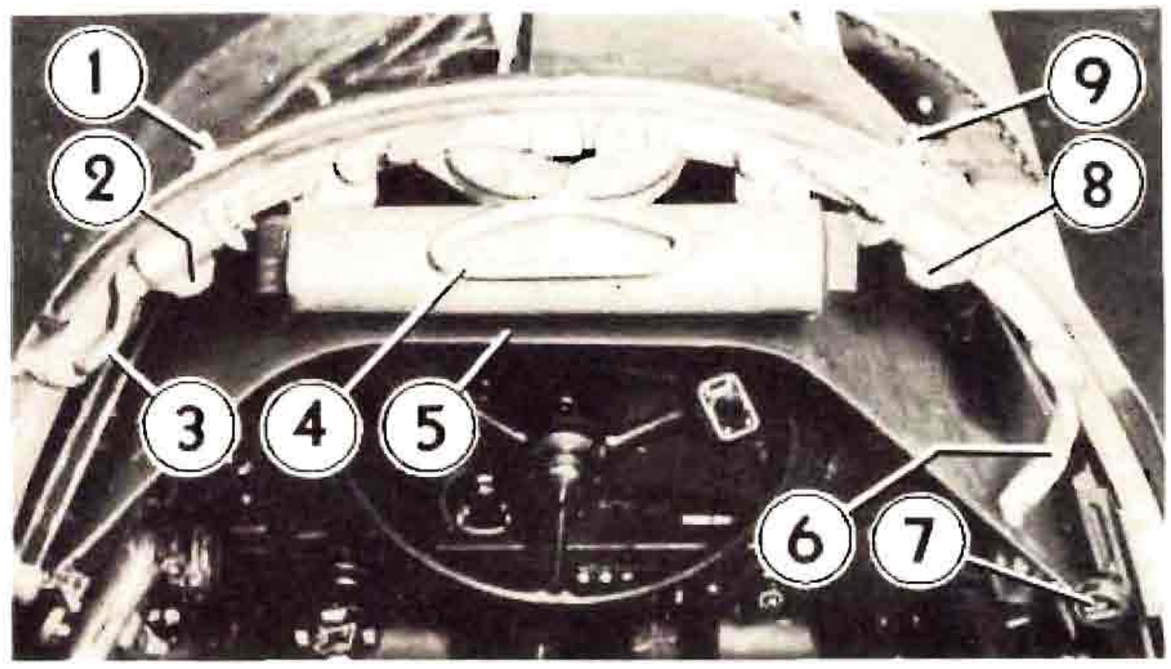


Figure 20—Hatch Controls

1. Exterior hatch release.
2. Left latch release.
3. Left latch handle (locked position).
4. Emergency hatch release.
5. Glare shield.
6. Right latch handle (unlocked position).
7. Cockpit heat control.
8. Right latch release.
9. Exterior hatch release.

(6) Propeller pitch control (figure 4-4) INC RPM. (Full forward.)

(7) Propeller selector switches (figure 4-5) AUTO CONSTANT SPEED.

(8) PUSH propeller circuit breakers (figure 4-9).

(9) Propeller feathering switches (figure 4-13) NORMAL.

(10) Mixture (figure 4-6) CUTOFF.

(11) Oil cooler flap switches (figure 6-17) AUTOMATIC.

(12) Generator switch (figure 6-16) OFF until engines are started.

(13) Battery switch (figure 6-15) OFF if battery cart is used. ON if cart is not used.

(14) Coolant flap override switches (figure 6-13) OFF.

(15) Intercooler flaps (figure 6-12) CLOSED. (If installed.)

(16) Check gunsight light (figure 6-10) operation and adjust the seat so that the sight reflection is easily visible.

(17) Inverter switch (figure 6-9) (or compass switch on main switch box) ON.

(18) Contactor heater ON if contactor is to be used during the flight.

(19) Armament switch (on control column or control wheel) OFF.

(20) Check fuel quantity (figure 7-16).

(21) PUSH button (figure 7-12) to test turbo warning lights.

(22) Carburetor air filters (figure 4-8, or behind pilot's seat) AS REQUIRED.

NOTE

The use of carburetor air filters reduces the critical altitude and range of the airplane and should be avoided in clear air.

(23) Set clock and altimeter.

b. SPECIAL CHECK FOR NIGHT FLYING.—Test operate.

(1) Landing lights (figure 6-7) (Not more than 5 seconds for test).

(2) Recognition lights (figure 5-13) (Not more than 30 seconds on ground).

(3) Cockpit lights (figure 6-11).

(4) Fluorescent lights (figure 6-5).

(5) Position lights (figure 6-6).

(6) Spot light (figure 4-1).

4. FUEL SYSTEM MANAGEMENT.

a. NORMAL USE.

(1) Warm up, take-off and fly for the first 15 minutes on RESERVE tanks. (This is to allow space in the reserve tanks for the vapor return from the carburetors.) Switch both engines to the *left* drop tank until almost dry, then shift to *right* drop tank. (Hourly fuel consumption may be determined from the charts in Appendix II, no fuel gage is installed in the drop tanks.) Switch both selector valves to MAIN ON. Do not drop external tanks unless necessary for increased range or engaging in combat. Burn out main tanks and switch back to RESERVE for the remainder of the flight.

NOTE

Never exceed 250 mph with 300 gallon drop tanks installed.

(2) When flying above 12000 feet altitude, it may be necessary to operate the electric fuel pumps (figure 10-4) to maintain the required 14 to 18 lb/sq in. fuel pressure.

(3) To release droppable fuel tanks:

(a) Flaps and gear UP.

(b) Tank selector valves (figure 10-7, 10-8) to MAIN or RESERVE.

(c) Arming switches (figure 4-24) to ARM or SAFE.

(d) Selector switches (figure 4-20) ON for tank(s) to be dropped.

(e) Press the release button (figure 4-27) while flying at an angle not greater than 30° from the horizontal.

(f) Full fuel tanks may be dropped without danger at airspeeds up to 400 mph. Empty 150 gallon tanks should be dropped only while flying at an airspeed of 160 mph or less.

WARNING

EMPTY 300 GALLON TANKS ARE TO BE DROPPED ONLY IN AN EMERGENCY as the tanks may hit the airplane when released. Consequently, it is necessary to slow the airplane down to 120 mph with gear and flaps up to avoid serious damage.

b. LONG RANGE FERRY FLIGHT.

(1) Whenever flying with droppable tanks, it is advisable to operate both engines from the LEFT drop tank until empty then shift both engines to the right drop tank. If necessary the left tank may be dropped as soon as it is empty and will then be carried only half as far as if each engine were operated from its own tank.

c. CROSS FEED OPERATION.

(1) The two fuel systems are connected by an electrically operated "crossfeed" valve which makes it pos-

sible to operate either engine from any tank. When prolonged single engine flight makes it necessary to use fuel from the dead engine side, or when operating both engines from one drop tank, operate as follows:

(a) Set tank selector valve to the tank to supply fuel.

(b) Turn crossfeed switch (figure 10-5) to CROSSFEED.

(c) Turn other tank selector valve OFF.

5. STARTING ENGINES.

NOTE

Engine fire extinguishers are NOT installed in this airplane. Strict adherence to the following instructions as to mixture control positions will reduce the possibility of fire. If fire does occur, cut off mixture control, electric fuel pump, and ignition to that engine.

a. With ignition OFF, turn the engines over by hand two or three revolutions if they have been idle for more than three hours.

b. Check operation of electric fuel pumps (figure 10-4). Pressure 15 to 16 lb/sq in. with engines not operating. Turn pumps OFF.

c. Prime the left engine 2 to 4 strokes.

NOTE

Push primer handle (figure 4-36) down and turn 90° to unlock.

d. Ignition master switch (figure 6-1) ON.

e. Left ignition (figure 4-11) BOTH.

f. Hold the starter switch (figure 6-3) to LH (left-hand) until the inertia starter has reached maximum rpm.

g. Engage switch (figure 6-4) to LH, still holding starter switch to LH, and prime as necessary.

h. As soon as the engine definitely fires, place the mixture control (figure 4-6) to AUTO RICH.

NOTE

It may be necessary to operate the electric fuel pumps for a short while if the engine driven pumps do not build up pressure immediately.

CAUTION

Due to the fire hazard, electric fuel pumps must not be operated unless the mixture is in CUTOFF or unless the engine is running.

i. Return the mixture control to CUTOFF if the engine does not continue to run.

j. STOP THE ENGINE IF OIL PRESSURE DOES NOT REGISTER WITHIN 30 SECONDS.

k. Start the right-hand engine in the same manner.

l. Turn generator switch (figure 6-16) ON.

m. Lock the primer pump DOWN.

n. Battery switch (figure 6-15) ON before disconnecting the battery cart.

NOTE

If battery power is not sufficient for starting, use the inertia starter hand crank or an external energizer.

6. ENGINE WARM-UP.

a. Keep the rpm under 1400 until the oil temperature reaches 40°C (105°F) or shows a definite increase (10°C) (18°F) and the oil pressure is steady below 75 lb/sq in.

b. Make a radio check with the control tower, or another airplane while the engines are warming.

7. EMERGENCY TAKE-OFF.

a. When necessary, take-off may be made without the normal engine and accessories ground tests *provided* that the oil pressure is steady below 85 lb/sq in. and that the oil temperature has shown a definite increase (at least 10°C) (18°F) since starting. Use the oil dilution system to reduce the oil pressure if necessary.

b. Overdilution is likely to result from diluting the oil in a cold engine. If dilution is necessary during warm-up, oil pressure should be carefully watched during the remainder of warm-up and take-off to insure that overdilution has not occurred.

8. ENGINE AND ACCESSORIES OPERATION GROUND TEST.

a. Extend and retract the flaps (figure 5-2) to check the hydraulic system. 15 to 20 seconds is normal extension time at 1400 rpm, 25 seconds if one engine pump is dead.

b. Normal fuel pressure (figure 7-4) 14 to 18 lb/sq in. Idling 10 lb/sq in. Check for normal pressure with electric fuel pumps OFF.

c. Increase rpm to 2300.

(1) Check propeller pitch control levers, (figure 4-4), DEC RPM then INC RPM (full forward).

(2) Check propeller selector switches (figure 4-5)

DEC RPM then INC RPM, then return to AUTO CONSTANT SPEED. Note that propeller warning lights (on P-38H only) glow when selector switches are out of AUTO CONSTANT SPEED.

(3) Check magnetos. Maximum normal drop, 100 rpm on going from both to either magneto. *Engine must run smoothly on either magneto.*

(4) With the generator switch(es) ON check the voltmeter (figure 6-8) for approximately 28 volts and the ammeter (figure 7-13) for charge. On F-5B airplanes, check voltage at both generators by turning the voltmeter selector switch to L then R.

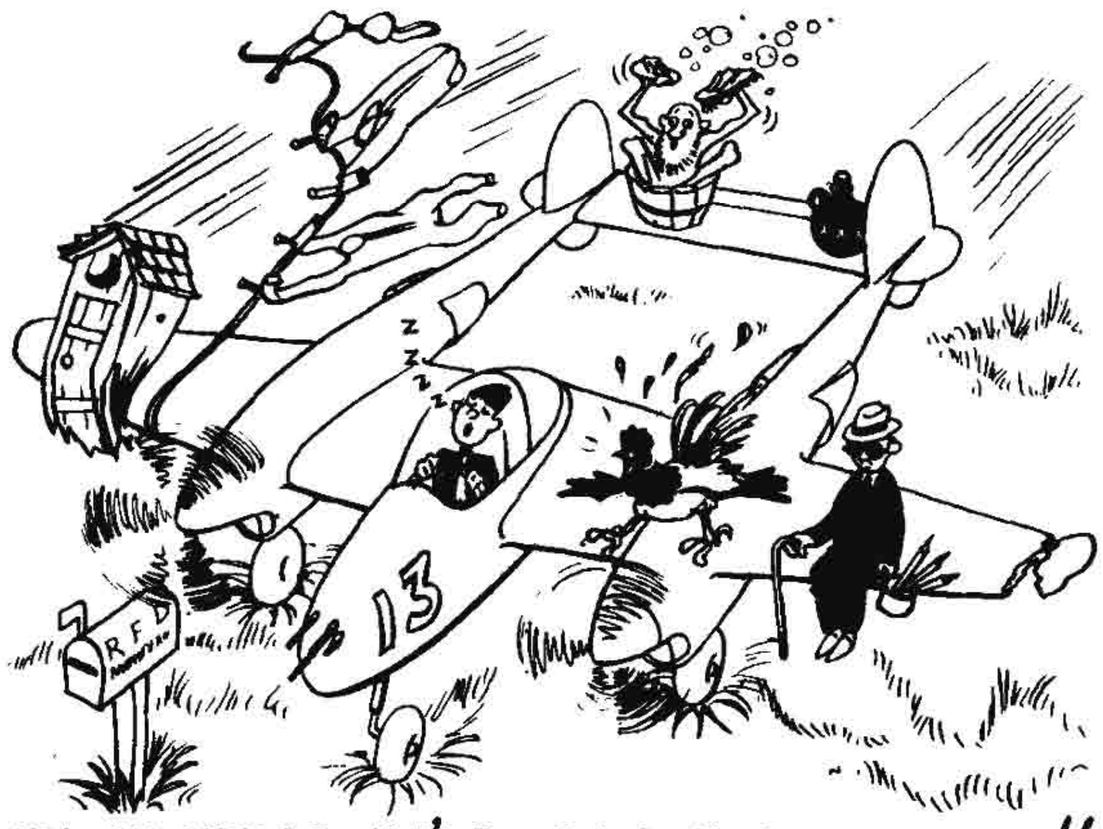
(5) Check intercooler flaps OPEN (if installed) and check operation of superchargers by opening throttles individually to take-off power (see specific engine chart in Section III).

NOTE

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

9. TAXIING INSTRUCTIONS.

The airplane taxis easily, use differential throttle control for turning and save the brakes. There is no danger of nose over or ground loop should it become necessary to turn sharply or to apply full brakes. Forward visibility is good.



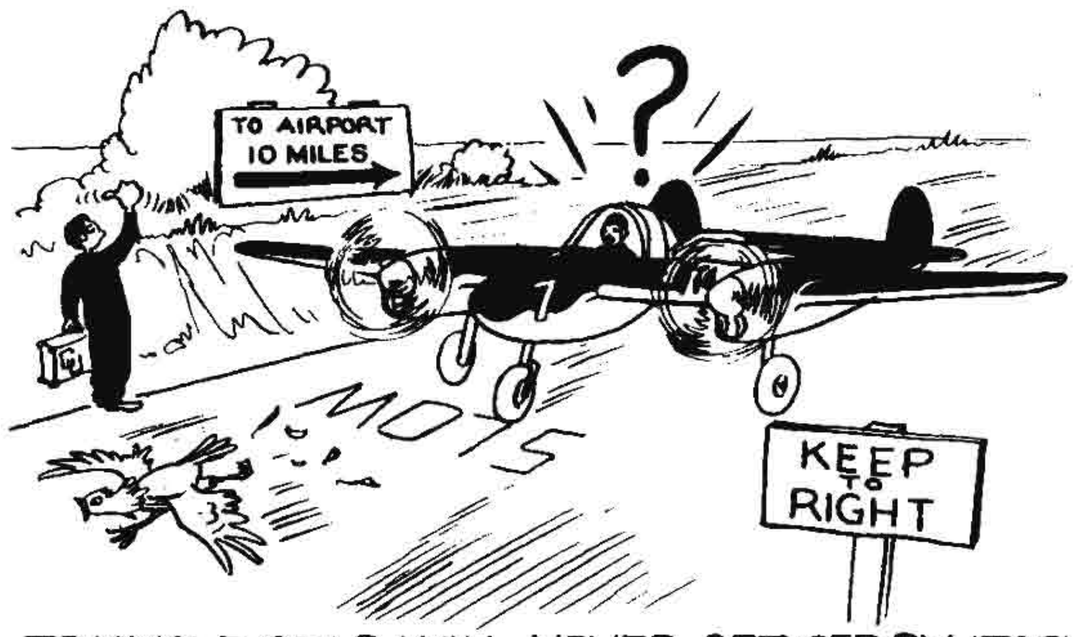
WATCH WHERE YOU'RE GOING WHEN TAXIING!!

10. TAKE-OFF.

Roll a few feet *straight* down the runway so that the nose wheel will be in line when power is applied. Maximum performance take-offs require holding the airplane with brakes at the end of the runway until engine power reaches the desired setting. Because of the tricycle gear, there is no tendency for the airplane to take-off by itself, no feeling of lightness as take-off speed is reached. Start to ease the wheel back at about 70 mph, then at 90 or 100 lift the airplane into the air.

NOTE

The top hatch must be locked in place and the side windows should be cranked (figure 10-2, 14-8) closed with the ratchets (figure 10-3, 14-7) on. Open side windows will cause buffeting of the tail section.



TRICYCLE GEAR WILL NEVER GET OFF BY ITSELF
... TRY LIFTING THE NOSE AT 70 PER!

a. Propeller pitch levers (figure 4-4) INC RPM (full forward).

b. Propeller selector switches (figure 4-5) AUTO CONSTANT SPEED.

c. Mixture (figure 4-6) AUTO RICH.

d. Tank selector valves (figure 10-7 and 10-8) RESERVE ON (preferred).

e. Wing flaps UP and lever (figure 5-2) CLOSED. (Up to ½ flaps may be used for short take-off run.)

f. Controls free.

g. Generator switch(es) (figure 6-16) ON.

h. Intercooler flaps (figure 6-12) OPEN (if installed).

i. Electric fuel pumps (figure 10-4) ON.

j. Rudder, elevator and aileron tabs ZERO.

k. Hatch locked in place and side windows CLOSED.

l. Hold brakes, open throttles to 46" Hg. 3000 rpm.

m. Release brakes, keep manifold pressure below 54" Hg.

CAUTION

Be prepared to reduce power immediately to prevent uncontrollable yaw and roll in case of engine failure on take-off.

n. Landing gear UP as soon as practical after leaving the ground.

NOTE

It is important that the gear be retracted immediately after the airplane is off the ground so that the flight may be safely continued in the event of engine failure after take-off.

o. Reduce power to 43" Hg. 2600 rpm after clearing all obstacles.

11. ENGINE FAILURE DURING TAKE-OFF.

a. If one engine fails before leaving the ground, close both throttles immediately and apply full brakes. If it is going to be impossible to stop on the airport, retract the gear and slide in.

b. If one engine fails after leaving the ground, but before the safe single engine speed (120 mph) has been reached, close both throttles and LAND STRAIGHT AHEAD. Retract the gear if you are running out of airport.

c. If one engine fails after reaching the safe speed of 120 mph and after the gear has started up.

(1) Reduce power enough to regain control, then apply power gradually and hold enough rudder to prevent the airplane from skidding. Raise the wing on the dead engine side to assist in preventing the skid.

(2) Release drop tanks or bombs if circumstances dictate.

(3) Trim rudder tabs.

(4) Feather the dead engine's propeller.

NOTE

Do not apply so much power that the airplane cannot be held straight with the rudder. 45" Hg. at 3000 rpm should be enough to accelerate the airplane to a good single engine climbing speed of 165 mph.

(5) Set the mixture on the dead engine to CUT OFF.

(6) Turn OFF electric fuel pump of dead engine.

(7) Circle the field and land. Make all turns with the *dead* engine on the *outside* of the turn. See Section II, paragraph 19 *d* for single engine landing.

12. CLIMB.

a. Mixture (figure 4-6) AUTO RICH.

b. Intercooler flaps (figure 6-12) OPEN. (If installed.)

c. Refer to the climb chart in Appendix II for the best climbing speeds at different weights, powers and altitudes. 160 mph is the average best-climbing-speed at sea level.

d. On P-38H airplanes, carburetor air temperature is critical in a high power climb between 15000 and 25000 feet. Above 25000 feet turbo supercharger overspeed is critical. Excessive temperatures will cause detonation, and very rough engine operation resulting in loss of power and probable engine damage.

(1) On P-38J and F-5B airplanes *with intercooler flaps OPEN,* the manifold pressure is limited by the rating of the engine up to 25000 feet. Above 25000 feet, turbo supercharger overspeed is again critical.

e. The following maximum manifold pressures are to be used for "war emergency" only. Never exceed 60" Hg. Above 25000 feet these limits indicate the approximate values at which the turbo warning lights should burn in a climb. In level flight it should be possible to carry the manifold pressures shown below to slightly higher altitudes.

Altitude Feet	*P-38H*		*P-38J and F-5B*
	B-13 turbo	*B-33 turbo*	*B-33 turbo*
up to 15000	60	60	60
20000	55	55	60
25000	45	48	60
30000	35	40	50
35000	30	35	41
40000	20	30	33

Early P-38H airplanes are equipped with type B-13 turbos. P-38H airplanes above serial 42-66727, and P-38J and F-5B airplanes are equipped with type B-33 turbos.

f. Refer to the Specific Engine Flight Chart in Section III for power time limitations.

g. Refer to the Climb Chart in Appendix II for rate of climb. Note correction to be made during hot weather.

13. GENERAL FLYING CHARACTERISTICS.

a. Due to the counter-rotating propellers, there is no noticeable torque effect in any two engine flying with this airplane. Rudder and aileron trim tab settings do not require adjustment due to changes in speed and power.

b. TO INCREASE POWER IN FLIGHT.

(1) Mixture (figure 4-6) AUTO RICH if maximum cruising power is to be exceeded (see Specific Engine Flight Chart in Section III).

(2) Propeller pitch controls (figure 4-4) to the new rpm.

(3) Throttles (figure 4-2) to the new manifold pressure.

c. TO DECREASE POWER IN FLIGHT.

(1) Throttles (figure 4-2) to the new manifold pressure.

(2) Propeller pitch controls (figure 4-4) to the new rpm.

(3) Re-adjust the throttles.

(4) Mixture (figure 4-6) AUTO LEAN if permissible.

d. The turbo superchargers in this airplane are controlled by the same levers which operate the throttles. Turbo overspeed is indicated by the warning lights (figure 7-12). Rated turbo speed is 24,000 rpm and overspeed turbo speed is 26,400 rpm allowed for 5 minutes. The warning lights start to flicker at 25,600 turbo rpm and burn continuously at 26,400 turbo rpm. Operation within the flickering range is permissible only during "war emergencies" and the throttles must be retarded when the flicker changes to continuous burning.

e. On P-38J and F-5B airplanes intercooler flaps should be open for take-off and climb and nearly closed at all other times. Carburetor air temperature should not be allowed to exceed 45°C (113°F). P-38H airplanes are not equipped with intercooler flaps.

f. Flight operations should be planned from the Flight Operations Instructions Charts in Appendix II. When using these charts, make sure that the chart being used is applicable to the airplane. Charts are clearly marked to indicate the airplane model, the weight, and the external load items carried. If the weight or external load is to be changed during the flight, charts should be used with this in mind.

g. The airplane is stable at all normal speeds. It becomes slightly nose heavy when flaps and landing gear are extended. Release of droppable fuel tanks causes no noticeable change. Two engine cruising below 170 mph indicated is not recommended as the airplane requires more attention and range is not increased by flying below this speed.

14. STALLS.

a. With power OFF, the airplane stalls at the following indicated speeds at the gross weight noted:

	15000 lb.	*17000 lb.*	*19000 lb.*
Flaps and gear UP	94 mph	100 mph	105 mph
Flaps and gear DOWN	69 mph	74 mph	78 mph

b. As stalling speed is approached, the center section stalls first with noticeable shaking of the airplane and the ailerons stay unstalled and effective.

c. In either power on or power off stalls with flaps and landing gear up, the airplane "mushes" straight forward in a well controlled stall. With flaps and gear down, there appears to be a slight tendency for one wing to drop, however, there is no tendency to spin. Under these conditions, the nose drops slightly and, as the speed increases, the wing will come up.

d. The stall should be practiced so the pilot may know the feel of the controls near the stall and the indicated stalling speed of the airplane.

15. SPINS.

Deliberate spinning is prohibited because the spin tends to flatten out after two or three turns. When this occurs, the controls are forced back and engine power must be used to help get the wheel forward. Before flattening out, normal recovery may be made without power. Recovery is made by easing the wheel forward and applying full opposite rudder.

16. ACROBATICS.

a. Although such maneuvers as loops, Immelmanns, and rolls are permitted with this airplane, the pilot is cautioned to exercise extreme care in acrobatic maneuvers which require a downward recovery. In general, acrobatics should *not* be attempted at altitudes below 10000 feet until the pilot becomes familiar with the speed at which the airplane can gain and lose altitude.

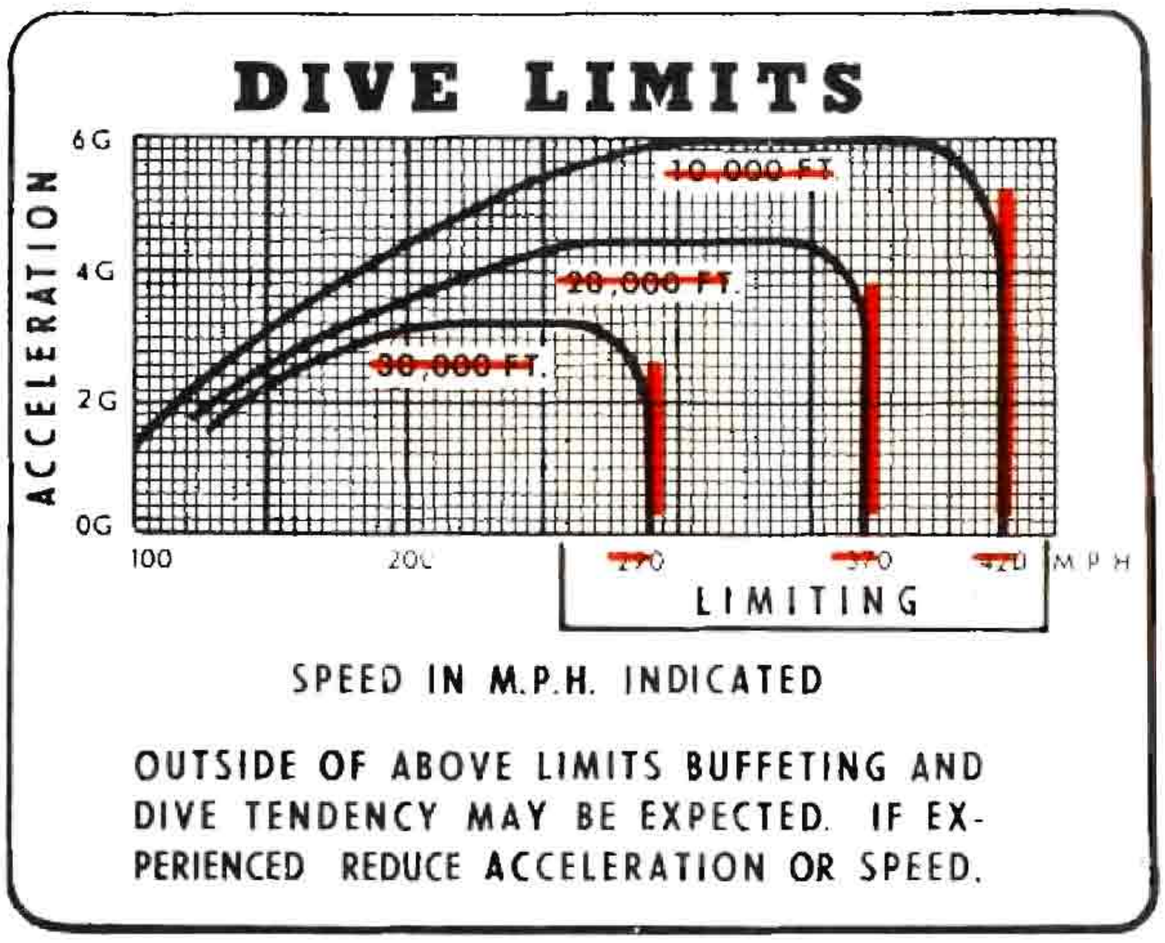


Figure 21—Dive Placard

17. DIVING.

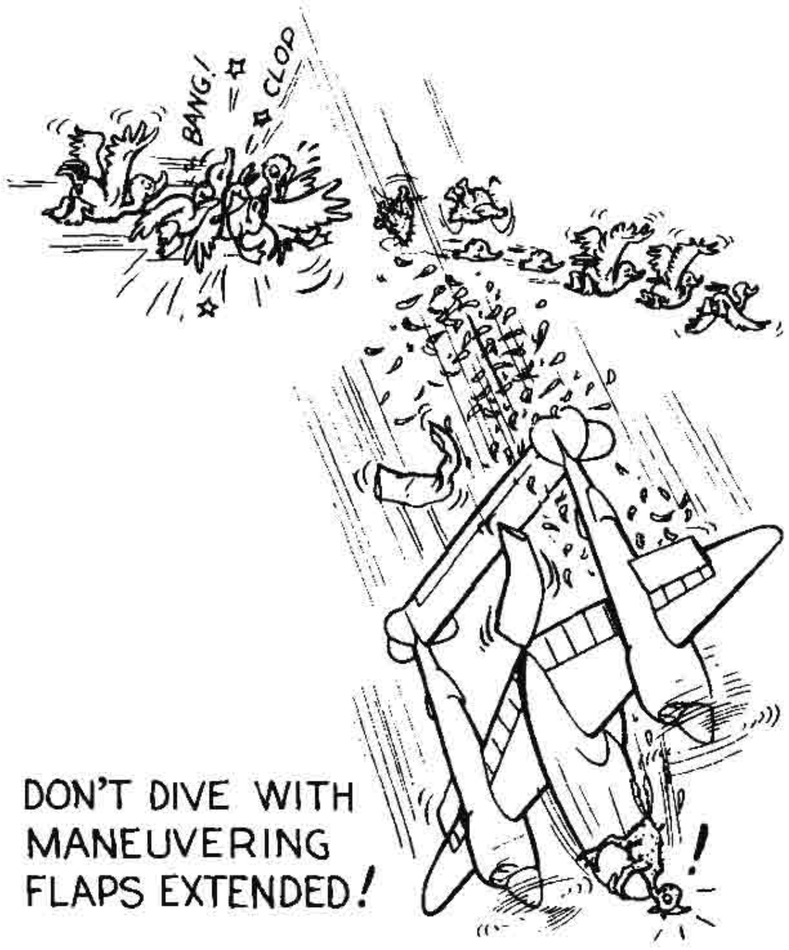
NOTE

MANIFOLD PRESSURE MUST BE KEPT AT 20" HG. OR ABOVE DURING DIVES, TO PREVENT POSSIBLE MALFUNCTIONING OR MISSING OF ENGINES WHEN THROTTLES ARE OPENED AFTER THE PULLOUT FROM THE DIVE.

a. The diving speed is restricted as indicated on the placard (figure 21)—a copy of which is posted in the cockpit of each airplane. As the airplane approaches the critical speed, it becomes rapidly nose heavy and starts to buffet as if it were about to stall. If this condi-

tion is allowed to develop, the nose heavy condition will become more pronounced, and it will be very difficult to pull out.

b. The speed at which this phenomenon occurs depends upon the altitude and the acceleration (or G's) which is being applied in a pullout. Figure 21 shows the placard consisting of three curves of indicated airspeed plotted against acceleration and indicates the safe range at the altitudes shown on each curve.



c. For example: If a straight dive is made in excess of 370 mph (indicated) at 20,000 feet, the airplane will become nose heavy and start to buffet. Or if a pullout of over 4.5 G's is made at 300 mph and 20,000 feet, the same condition will be evident.

d. When the above conditions are noticed, THE FOLLOWING ACTION SHOULD BE TAKEN IMMEDIATELY.

(1) In accelerated maneuvers (dive pullouts or steep turns) buffeting may be stopped by reducing the acceleration.

(2) In steady dives at high speed, buffeting may be stopped by reducing the airplane speed and pulling out using minimum acceleration. Any acceleration will tend to increase the buffeting.

(a) Throttles CLOSED.

(b) Use the elevator tab (figure 4-35) if necessary to assist recovery.

WARNING

Elevator tab must be used with care in order to prevent an extreme tail heavy condition after the buffeting stops.

18. NIGHT FLYING.

a. Very little light need be used for normal cruising flight. Fluorescent lights (figure 6-5) should be dimmed down until the instruments are barely visible (all instrument dials are coated with phosphorescent paint). This will enable the eyes to become accustomed to the darkness. The instrument glare shield should be installed for all night flying.

b. When more light is needed, cockpit lights (figure 6-11) may be turned on, or the spotlight (figure 4-1) may be focused on any point where local light is desired and adjusted to the required brilliancy.

c. Position lights are turned on by a switch (figure 6-6) on the main switch box.

d. Landing lights (figure 6-7) may be used for takeoff and landing. They should not, however, be extended at any time when the airspeed is greater than 140 mph.

e. Recognition lights may be used as required.

19. APPROACH AND LANDING.

a. The landing technique is similar to that for a conventional landing geared airplane and the landing attitude is about the same; i.e., main wheels first, tail slightly down.

NOTE

Extreme tail low landings, possible only with flaps UP, may cause the fins to strike the runway.

(1) With the gear DOWN and flaps at MANEUVER, start the approach at 120 mph indicated airspeed. When the approach is assured, put the flaps all the way down, come over the fence at 110 mph, flare off to about 80 mph and wait for contact.

(2) If, for some reason, the flaps won't come down, bring it in a little faster and allow for more flare off and a flatter gliding angle.

b. NORMAL LANDING.

(1) Tank selector valves (figure 10-7, 10-8) to MAIN or RESERVE, whichever contains the most fuel.

(2) Mixture controls (figure 4-6) AUTO RICH.

(3) Propeller pitch levers (figure 4-4) to about 2600 rpm position.

(4) Electric fuel pumps (figure 10-4) ON.

(5) Landing gear (figure 4-32) DOWN (not over 175 mph.).

(6) Pump the toe brake pedals a few times to insure that brakes are working.

(7) Wing flaps (figure 5-2) DOWN (not over 150 mph).

NOTE

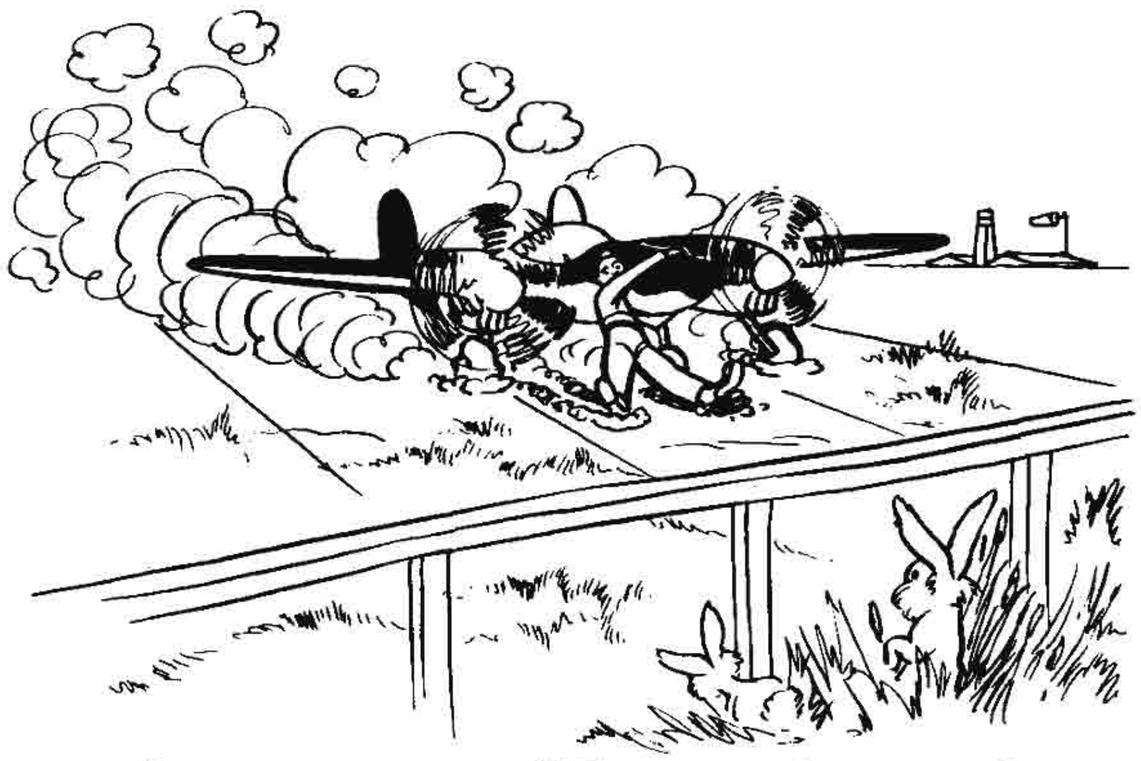
Lift the trigger through the quadrant notch to place lever to DOWN.

(8) Intercooler flaps (figure 6-12) CLOSED. (If installed.)

(9) Flaps UP before taxiing.

c. CROSS WIND LANDING.

(1) Same as the normal landing. The tricycle gear reduces danger from landing in a reasonably strong cross wind. If the drift seems excessive, the up-wind wing may be lowered until just before contact.



IF HE'DA LANDED AT 85, INSTEAD OF 120 . . .

d. SINGLE ENGINE LANDING.

(1) The main differences between the single engine landing and two engine landing are that the airplane can not maintain altitude in flying on one engine with both flaps and the landing gear fully extended; and that directional control is impossible below 120 mph with one engine operating at more than 45" Hg and 3000 rpm.

(a) Keep the airspeed above 120 mph until the landing is absolutely assured.

(2) Put the gear down first.

(3) When in a good position for a normal approach, put the flaps only ½ down.

(4) Crank the rudder tabs back to zero and regulate the gliding angle by using the remaining flap travel and power from the live engine.

(5) When the approach is assured, close the throttle, put the flaps all the way down and proceed with a normal landing.

e. TAKE-OFF IF LANDING IS NOT COMPLETED.

(1) Open throttles to take-off stop and after propeller rpm has stabilized, push propeller pitch control forward to take-off position.

CAUTION

Pull the airplane up in a climb sufficient to stay below 150 mph indicated airspeed until the flaps are retracted.

(2) Retract flaps and proceed in take-off technique as outlined in paragraph Section II paragraph 9.

20. STOPPING OF ENGINES.

a. If a cold weather (0°C or 32°F) start is anticipated, the oil system should be diluted before stopping the engines. Idle the engines until oil temperature is below 70°C (158°F), adjust the throttles to approximately 1000 rpm, hold the oil dilution switches (figure 6-2) ON for 4 minutes, pull the mixture controls (figure 4-6) to CUTOFF and release the oil dilution switches after the engines stop turning.

b. If the oil temperature is above 40°C (104°F) upon completion of the diluting process, the engine should be shut down and allowed to cool until the oil temperature is below 40°C. The engine should then be restarted and the same diluting process repeated. This will avoid the possibility of evaporation due to the high temperature nullifying the effect of the first dilution.

c. If oil dilution is not necessary, set the mixture controls to CUTOFF at 1200 rpm.

d. After the engines stop turning, turn the ignition switches (figure 6-18, 6-1) OFF and leave the mixture in CUTOFF.

21. BEFORE LEAVING THE COCKPIT.

a. Turn all switches and valves OFF.

b. Lock the controls.

(1) To set surface controls lock (figure 5-10), put rudders in neutral, push the right end of the locking tube forward of the guide angle (figure 5-4) and place the left end of the locking tube in the clip provided (figure 4-3). Strap control wheel to center of surface control lock.

c. Set the parking brake:

(1) Apply the toe brakes, pull the parking brake handle (figure 4-14) out and release the toe brakes.

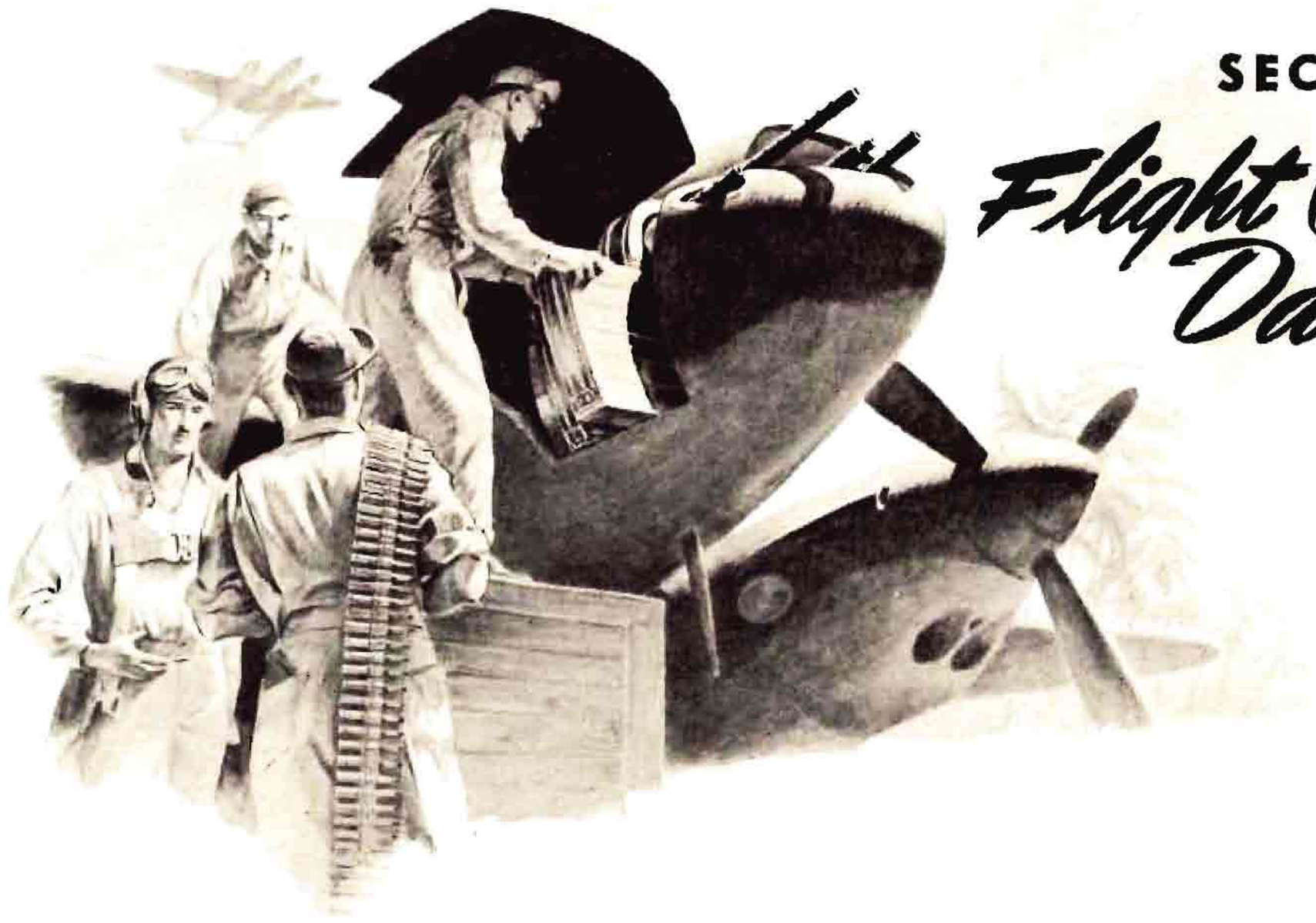
NOTE

Do not set the parking brake while the brake drums are hot.

22. TIEING DOWN.

a. This airplane is secured by ropes which are passed through tie down lugs on each landing gear shock strut and tied to stakes firmly anchored to the ground. Stakes and ropes are provided in the mooring kit which is stowed in the baggage compartment when the airplane leaves the factory.

(1) If extreme conditions are encountered, ropes may be tied around the tail end of each boom and secured to some solid anchor point.



SECTION III

Flight Operating Data

1. AIRSPEED LIMITATIONS.

Condition	*Maximum allowable airspeed (indicated)*	*Condition*	*Maximum allowable airspeed (indicated)*
Diving	See Placard Section II paragraph 17.	Flaps 50% extended	250 mph.
Landing gear extended	175 mph.	Landing light extended	140 mph.
Flaps 100% extended	150 mph.	300 gal. droppable tanks installed	250 mph.

2. AIRSPEED AND ALTIMETER CORRECTION TABLE.

Calibrated* I.A.S.	Airplane I.A.S. Gear and Flaps UP	Airplane I.A.S. Gear and Flaps DOWN	*ALTIMETER INSTALLATION ERRORS (Feet) Gear and Flaps UP				
			Sea Level	10000	20000	30000	40000
100	83	89	+110	+130	+200	+270	+430
120	106	116	+100	+125	+195	+265	+420
140	130	140	+ 90	+115	+175	+250	+380
160	153	....	+ 70	+100	+140	+190	+300
180	176	....	+ 50	+ 60	+ 90	+130	+190
200	200	....	0	0	0	0	0
220	226	....	— 80	—110	—160	—230	....
240	248	....	—130	—170	—250	—330	....
260	269	....	—160	—230	—370	—430	....
280	291	....	—210	—290	—400	—550	....
300	312	....	—260	—360	—500	....	....
320	334	....	—325	—450	—620	....	....
340	356	....	—400	—540	—750	....	....
360	377	....	—500	—650	....	....	....

*Includes "Installation Errors" only. Does not include "Instrument Errors" as obtained by the C-1 Field Test Set.

\+ Add to altimeter reading
\- Subtract from altimeter reading

SPECIFIC ENGINE FLIGHT CHART

AIRPLANE MODELS
P-38H

ENGINE MODELS
V-1710-89 (RH)
V-1710-91 (LH)

CONDITION	FUEL PRESSURE (LB/SQ IN.)	OIL PRESSURE (LB/SQ IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F
DESIRED	14-18	60-70	75-95	167-203	101-121	214-250
MAXIMUM	18	85	95	203	125	257
MINIMUM	12	55	40	104	85	185
IDLING	9	15				

MAX. PERMISSIBLE DIVING RPM: 3120

CONDITION	ALLOWABLE OIL CONSUMPTION
NORMAL RATED (MAX. CONT.)	13 U.S. QT/HR
MAX. CRUISE	9 U.S. QT/HR
MIN. SPECIFIC	7 U.S. QT/HR

SUPERCHARGER TYPE: EXHAUST DRIVEN TURBINE

OIL GRADE: (S) 1120 (W) 1120

FUEL GRADE: 100 OCTANE

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	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.		MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	54	1425		21000			AUTO RICH	162				15
WAR EMERGENCY	3000	60	1600		15000			AUTO RICH	180				DURING WAR EMERGENCY ONLY
MILITARY	3000	54	1425		21000			AUTO RICH	162				15
NORMAL RATED (MAX. CONT.)	2600	44	1100		* 26000 ** 28000			AUTO RICH	115				NO LIMIT
MAXIMUM CRUISE	2300	35	795		30000			AUTO LEAN	60				NO LIMIT
MINIMUM SPECIFIC CONSUMPTION	1600 1600 1800 1870 2200	23 24 26 26 27	325 350 380 450 535		SEA LEVEL 5000 10000 20000 30000			AUTO LEAN	25 26 29 34 42				NO LIMIT

REMARKS: NEVER EXCEED THE FOLLOWING MANIFOLD PRESSURES AT THE ALTITUDES SHOWN REGARDLESS OF ENGINE RPM.

* AIRPLANES WITH TYPE B-13 SUPERCHARGERS
** AIRPLANES WITH TYPE B-33 SUPERCHARGERS

ALTITUDE					
UP TO 15,000	20,000	25,000	30,000	35,000	40,000
60	55	45	35	30	20
60	55	48	40	35	30

SPEC. AN-H-8
DEC. 18, 1942

FORM ASC-512

AIRPLANE MODELS
P-38J
F-5B

SPECIFIC ENGINE FLIGHT CHART

ENGINE MODELS
V-1710-89 (RH)
V-1710-91 (RH)

CONDITION	FUEL PRESSURE (LB/SQ. IN.)	OIL PRESSURE (LB/SQ. IN.)	OIL TEMP. °C	OIL TEMP. °F	COOLANT TEMP. °C	COOLANT TEMP. °F		
DESIRED	14-18	60-70	75-95	167-203	101-121	214-250		
MAXIMUM	18	85	95	203	125	257		
MINIMUM	12	55	40	104	85	185		
IDLING	9	15						

MAX. PERMISSIBLE DIVING RPM: 3120

CONDITION	ALLOWABLE OIL CONSUMPTION
MAX. CONT.	13 U.S.QT/HR
MAX. CRUISE	9 U.S.QT/HR
MIN. SPECIFIC	7 U.S.QT/HR

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

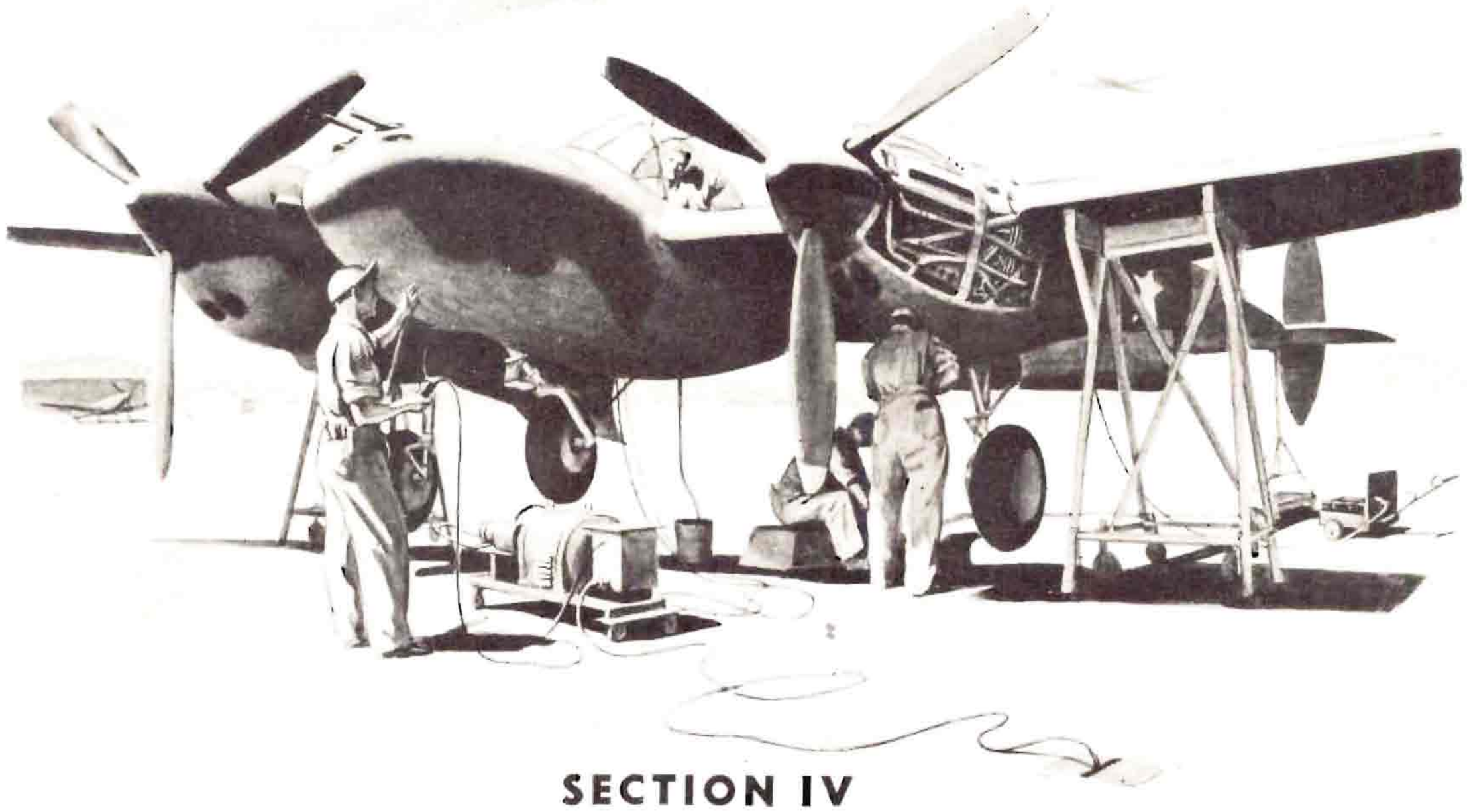
SUPERCHARGER TYPE: EXHAUST DRIVEN TURBINE

FUEL GRADE: AN-VV-F-781 AMEND 5 **OCTANE** 100

OPERATING CONDITION	RPM	MANIFOLD PRESSURE (BOOST)	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.)	MAXIMUM CYL. TEMP. °C	MAXIMUM CYL. TEMP. °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	3000	54	1425	26500	25000			AUTO-RICH	161				5
WAR EMERGENCY	3000	60	1600	26500	25000*			AUTO-RICH	187				5
MILITARY	3000	54	1425	26500	25000**			AUTO-RICH	161				15
MAXIMUM CONTINUOUS	2600	44	1100	32500	31000**			AUTO-RICH	127				NO LIMIT
MAXIMUM CRUISE	2300	35	795		36000**			AUTO-LEAN	72				NO LIMIT
MINIMUM SPECIFIC CONSUMPTION	2200 1800 1600 1600 1600	30 28.5 29 28 26	630 495 455 425 380		30000 20000 15000 10000 5000			AUTO-LEAN	51 39 36 34 30				NO LIMIT

REMARKS: NEVER EXCEED THE FOLLOWING MANIFOLD PRESSURES AT THE ALTITUDE SHOWN REGARDLESS OF ENGINE RPM:

ALTITUDE	UP TO 25000	30000	35000	40000
* WAR EMERGENCY POWER	60	50	41	33
**MILITARY POWER OR LESS	54	45	37	29



SECTION IV

Emergency Operating Instructions

1. HYDRAULIC FAILURE.

a. If the gear does not extend when the lever is put down, return the lever to UP and attempt to extend the flaps using the auxiliary system.

NOTE

The auxiliary system should be used for flap extension because in some cases there may not be sufficient fluid to extend both gear and flaps, and the gear may be extended with the emergency system fluid.

CAUTION

If one engine has failed in addition to the hydraulic system failure, remember that the airplane cannot maintain level flight on one engine with gear and flaps extended. Under these conditions it may be desirable to land with flaps UP.

b. EMERGENCY OPERATION OF FLAPS.

(1) If the engine pumps fail to extend the flaps, it may be possible to get them down by operating the hand pump.

(a) Check coolant override switches (figure 6-13) OFF.

(b) Flap control (figure 5-2) MANEUVER or DOWN.

(c) Source selector valve handle (figure 14-4) UP. (This is the normal position.)

(d) Operate the hand pump (figure 14-2) until the desired flap extension is obtained.

(2) If the above system fails to extend the flaps, leave the control at DOWN while extending the landing gear. Oil from the return side of the landing gear cylinders may fill the system enough to cause the flaps to operate.

c. EMERGENCY OPERATION OF THE LANDING GEAR.

(1) Operate the hand pump (figure 14-2) with all controls in the normal position for gear extension. Check Coolant override switch OFF.

NOTE

Nose gear door must open and nose gear must unlock before any pressure may flow to the main gear door cylinders.

(2) If, after considerable pumping, no reading is given on the position indicator (figure 7-19) operate the emergency system as follows:

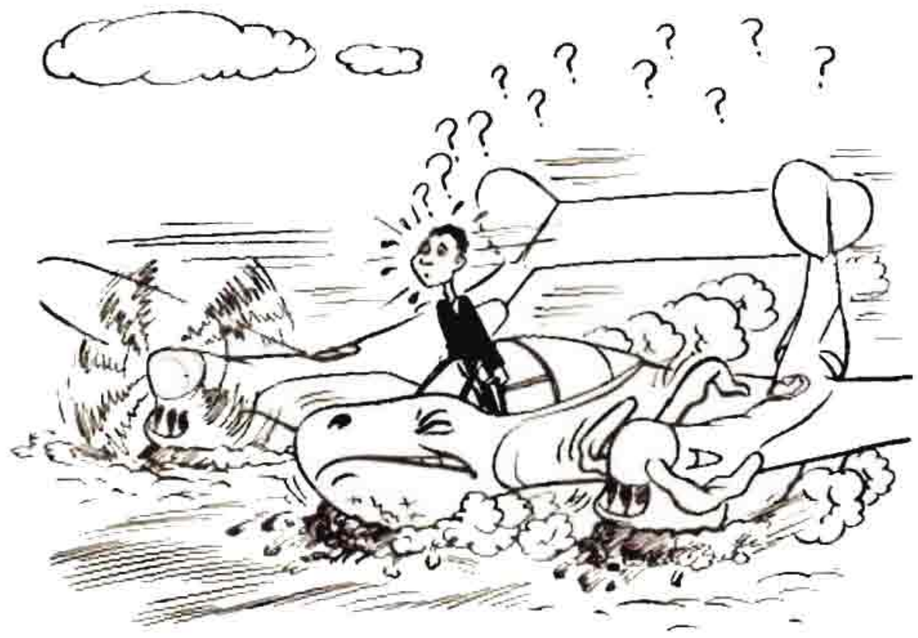
(a) Source selector valve handle; (figure 14-4) break safety wire and push DOWN.

(b) Bypass valve (figure 14-3); break safety wire and CLOSE tightly. (On later airplanes, separate control of the bypass valve will be eliminated by incorporating it into the source selector valve. If bypass valve is not present, disregard operation (b).)

(c) Check landing gear control DOWN and operate the hand pump.

NOTE

This system opens the gear doors by forcing them with the wheels. Remind the ground crew to check for broken locks and warped doors while the emergency system is being serviced.



YOU HAVE AN EMERGENCY EXTENSION SYSTEM..
WHY NOT LEARN TO USE IT ?

2. LANDING WITH WHEELS RETRACTED.

a. When a belly landing is necessary, it should be made without external tanks. Use ½ to full flaps.

NOTE

When belly landing is due to apparent hydraulic failure, unless forced down by lack of fuel or approaching darkness, don't give up until all methods of gear extension have been thoroughly and exhaustively tried.

b. Make a normal approach at 8 or 10 mph over the stalling speed and set the airplane on the ground slightly before the stall is reached.

3. LANDING ON WATER (DITCHING).

a. Unless the water is very smooth, it will probably be more desirable to bail out of the airplane than to try to land it on the water.

b. If a water landing is necessary, preparations for abandoning the airplane should be made while still in the air. Release bombs or drop tanks and the top hatch, and push down both side windows. Leave the shoulder harness on to prevent the shock of landing from throwing the head forward into the bullet proof glass.

(1) Since a much flatter approach can be made with power on, the landing should be made before the fuel has competely run out.

(2) Wind and surface conditions should be noted so that the approach may be made along the swell and as near into the wind as possible.

c. Make contact with landing gear UP (water landings with gear down are invariably fatal), flaps ⅔ DOWN, and at an airspeed slightly above the stalling point.

d. After coming to rest, release the safety belts and swim clear of the airplane before it sinks.

4. ELECTRICAL FAILURE.

a. Electrical failure may be indicated by a zero reading on the voltmeter (figure 6-8) and the ammeter (figure 7-13) and by rapidly diminishing battery power (the first indication of a low battery will be given by failure of the propeller governors to hold the proper rpm). When the above conditions are noticed;

(1) Set the propeller selector switches to FIXED PITCH.

(2) Set the oil cooler flap switches to MANUAL.

(3) Restrict the use of all lights and radio.

(4) If possible, turn the battery switch OFF until electrical power is needed.

(5) If it is necessary to land with the propeller selector switches on MANUAL, the following setting should be made to insure that sufficient power will be available and that the engines will not overspeed in the event of a mislanding. Make this adjustment, if possible, while there is still sufficent battery power to operate the propellers.

(a) Altitude—Not over 5000 feet above the airport.

(b) Adjust the throttles and propeller selector switches to obtain 2600 rpm and 25" Hg. manifold pressure at an approximate airspeed of 180 mph in level flight.

5. ENGINE FAILURE.

a. The airplane flies well on one engine. Using normal rated power, it will climb to about 26,500 feet, and can be flown at more than 255 mph (true speed) in level flight at 20,000 feet.

b. When one engine fails, or is shut down:

(1) Reduce the power from the live engine if necessary to maintain directional control.

(2) Close the throttle (figure 4-2) of the dead engine.

(3) Propeller pitch (figure 4-4) control DEC RPM.

(4) Mixture (figure 4-6) IDLE CUTOFF.

(5) Feather the dead engine's propeller. (figure 4-13).

(6) Ignition (figure 6-18) OFF.

(7) Open throttle enough to silence the landing gear warning horn.

NOTE

IN AN EXTREME EMERGENCY, FEATHER THE PROPELLER FIRST.

(8) Use as little power as necessary from the good engine and refer to the single engine cruising chart in Appendix II if range is important. For maximum single engine range with droppable tanks installed, fly the airplane as low as safety permits and at the lowest power which will maintain an airspeed of approximately 160 mph. Use fuel from the tank on the live engine side first and drop each tank as soon as it is empty. After both tanks have been dropped, refer to the single engine cruising chart in Appendix II to obtain the range available with the fuel remaining in the wing tanks.

BE CAREFUL WHERE YOU DROP YOUR TANKS !!

(9) If the left engine has failed, and consequently the generator stopped, take action indicated under ELECTRICAL FAILURE, Section IV paragraph 4. (This is not applicable to F-5B airplanes which have a generator on each engine).

c. To unfeather a propeller in flight:

(1) Prepare the engine for normal starting except set the propeller pitch control to DEC RPM and do not prime.

(2) Turn the feathering switch (figure 4-13) to NORMAL.

CAUTION

When practicing single engine flight, always shut down the right engine so that the generator will remain in operation. Make all re-starting preparations immediately so that the engine may be started quickly if the left engine should fail during the practice.

(3) Hold the propeller selector switch (figure 4-5) to INC RPM until the engine is turning 600 to 800 rpm then place it to AUTO CONSTANT SPEED. Place mixture control to AUTO RICH and engine should start.

(4) Warm up the engines before operating at full power.

6. ICING CONDITIONS.

a. Pitot heat (figure 6-14) ON.

b. The formation of carburetor ice is unlikely in this airplane due to the injection type carburetors and the heating effect of the turbo superchargers. It is possible, however, that ice could form while flying at low powers in a humid atmosphere.

c. If icing conditions are present during a landing approach, move the throttles occasionally to prevent ice from freezing them in a closed position. Put gear down, flaps ½ down, and make the approach under partial power.

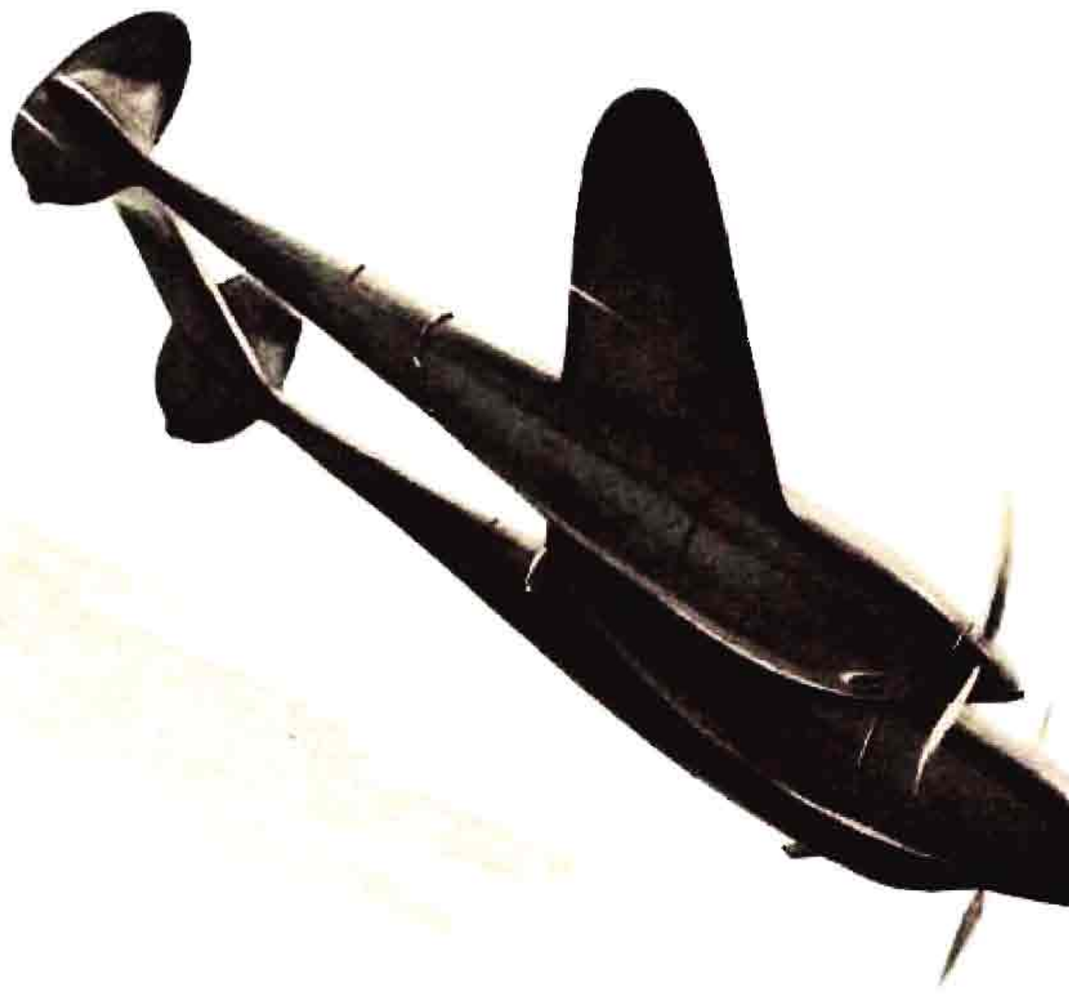
d. If carburetor ice forms in cruising flight, it may be removed by increasing the power boldly and putting the airplane into a steep climb. Intercooler shutters (on P-38J and F-5B airplanes only) should be closed as far as possible without exceeding the maximum 45°C carburetor air temperature.

e. Ice formation on the windshield may be removed by turning the cockpit heat ON and directing the flexible heater tube to the desired point on the glass.

7. EMERGENCY EXIT.

a. (Recommended) Slow down as much as possible, (below 200 mph) and trim the airplane in an approximately level attitude heading towards an unpopulated area if possible. Pull the handle (figure 20-4) to release the top hatch, crank or push either side window down, crawl out and slide off the wing head first.

b. (Alternate) If control is still available, turn the airplane upside down and unhook the safety belt.



SECTION V

Operational Equipment

1. RADIO.

a. These airplanes may be equipped with an SCR-522 command set as shown in figure 5 or an SCR-274N command set illustrated in figure 22. An SCR-695-A radio and a Detrola model 438 beacon receiver are installed when the airplane leaves the factory. Provisions for the BC-608 contactor are installed at the factory and the unit may be installed in the field.

b. OPERATION OF THE SCR-522 RADIO.

(1) Plug the headphones and microphones into the jack (figure 14-5).

(2) Check the generator switch (figure 6-16) and the battery switch (figure 6-15) ON.

(3) Set the selector switch (figure 5-9) to REM. The T and R positions of this switch are not to be used.

(4) Push the A, B, C, or D button (figure 5-7), depending on which pre-tuned frequency is to be used, and wait about one minute for warm-up. Lights beside each button indicate which button has been pushed. The lever (figure 5-6), beside the OFF button, may be used to dim the indicator lights.

(5) Press the microphone button in the center of the control wheel and speak slowly and clearly.

(6) Release the microphone button to receive.

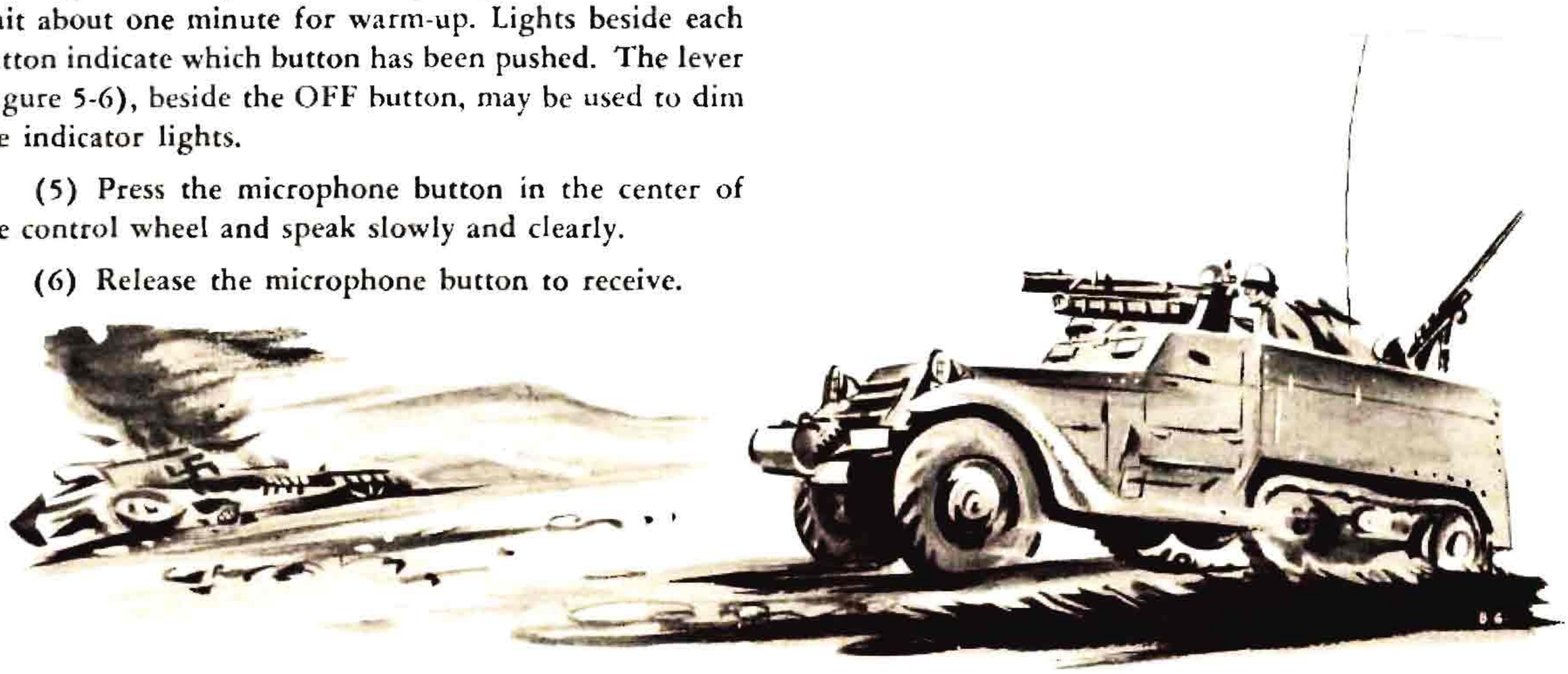
NOTE

The T and R positions are provided for use on installations employing a separate radio operator. Transmission is impossible with the switch in the R position; reception is impossible with the switch in the T position. The lock lever (figure 5-8) spring loads the selector switch to the R position and prevents operation in the REM position.

(7) To stop the equipment, push the OFF button (figure 5-5).

NOTE

This radio is not equipped with a volume control. Some installations may have a remote volume control installed in service which will be located on the junction box on the right hand side of the cockpit over the hydraulic hand pump.



c. OPERATION OF THE SCR-274N RADIO.

There are three separate receivers, and there may be any two of four available transmitters installed.

Receiver Frequencies	Transmitter Frequencies
190 to 550 kilocycles	3 to 4 megacycles
3 to 6 megacycles	4.0 to 5.3 megacycles
6 to 9.1 megacycles	5.3 to 7.0 megacycles
	7.0 to 9.1 megacycles

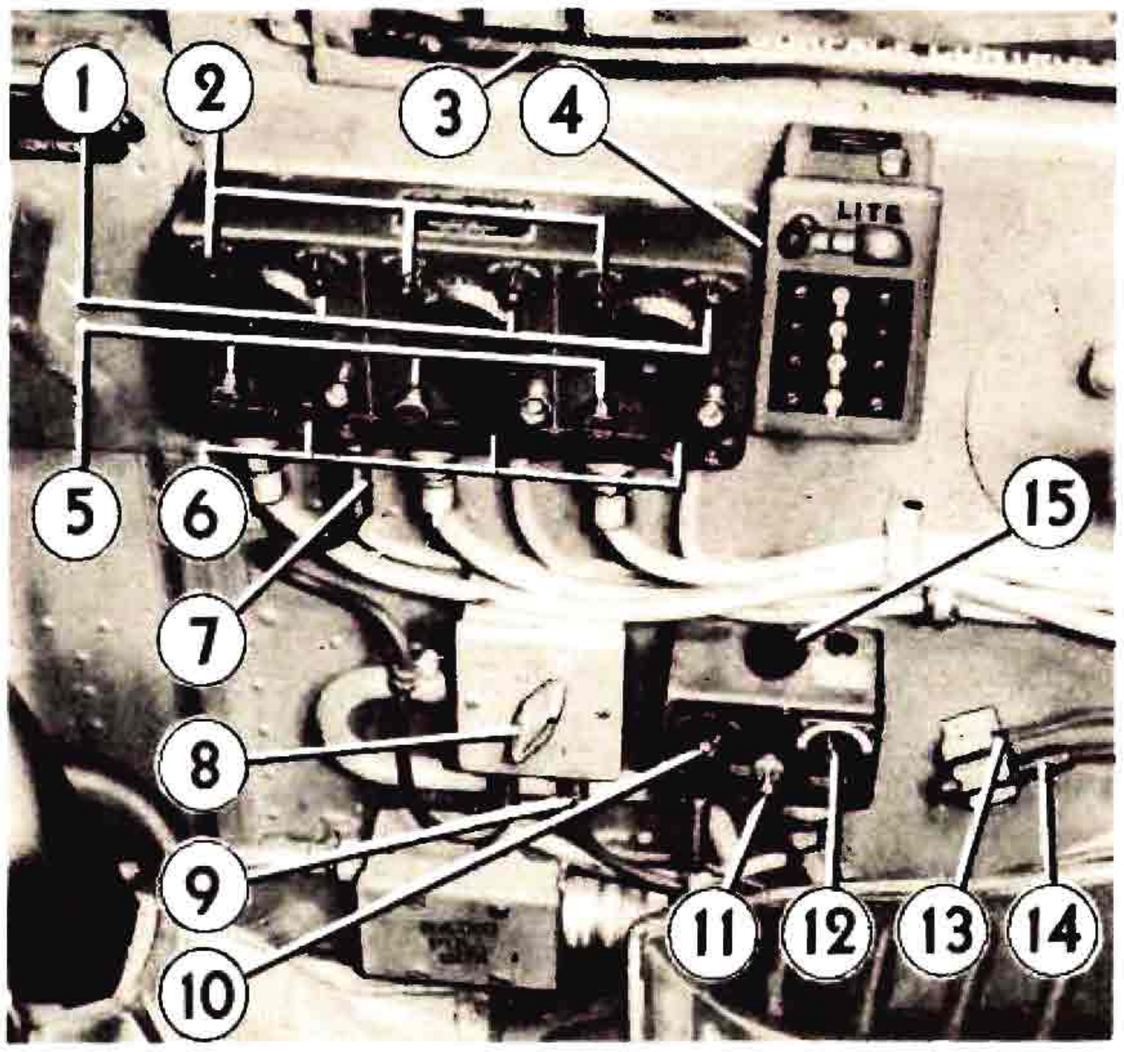


Figure 22 — SCR-274N Radio Controls

1. Main power switch (receivers).
2. Headset selector switches.
3. Surface controls lock.
4. Recognition light switch box.
5. Volume controls.
6. Tuning cranks.
7. Tel. plug (in B jack).
8. Radio range filter switch.
9. Headset jack.
10. Emission selector switch.
11. Main power switch (transmitter).
12. Transmitter selector switch.
13. Microphone jack (stowed).
14. Headset extension cord jack (stowed).
15. Transmitter key.

The receivers may be tuned in flight, the transmitters are pre-tuned to the proper frequency on the ground.

(1) Receiving.

(a) Plug the headphones into the jack JK-26 (figure 22-14) which is, in turn, plugged into the bottom of the filter box (figure 22-9).

(b) Determine the frequency to be used and turn the main power switch (figure 22-1) for that receiver to MCW or to CW, depending on the type of reception desired.

(c) For normal reception, set the range selector switch (figure 22-8) to BOTH. To receive radio range without voice interference, set the selector switch to RANGE. To eliminate radio range interference from a station broadcasting range and voice signals on the same frequency, set the selector switch to VOICE.

(d) Note which jack (A or B) the TEL plug (figure 22-7) is in and turn the headset selector switch (figure 22-2) of the receiver being used to the corresponding position (A or B).

(e) Adjust the volume (figure 22-5) to obtain a light frying noise and tune in the desired station using the crank (figure 22-6).

NOTE

Two or three receivers may be turned on simultaneously by following the instructions contained in paragraphs *(d)* and *(e)* above for each receiver.

(2) Transmitting.

(a) Select the desired frequency with the transmitter selector switch (figure 22-12).

(b) Plug the microphone into the jack JK-48 (figure 22-13) which is plugged into the bottom of the transmitter control box.

(c) Turn the main power switch (figure 22-11) ON and allow 15 seconds for the transmitter to warm up.

(d) Turn the emission selector (figure 22-10) to CW, MCW, or TONE as desired.

(e) If MCW was selected, press the microphone button in the center of the control wheel and talk slowly and clearly.

(f) If CW or TONE is selected, operate the key (figure 22-15).

d. DETROLA MODEL 438 BEACON RECEIVER.

This receiver is in addition to the SCR 522 or the SCR 274N radio when the airplane leaves the factory. If it is still installed:

(1) Plug headphones into the jack (figure 14-5) which is plugged into the face of the radio panel.

(2) Turn the volume control (figure 5-15) up until the background noise is heard.

(3) Tune to the desired frequency with the tuning knob (figure 5-14).

(4) Frequencies covered are 200 to 400 kilocycles.

e. SCR-695-A RADIO.

(1) Before take-off insert the destructor plug in the radio located just forward of, and accessible through the baggage compartment door on the right boom. The destructor plug socket is on the right side, set apart from the group of three sockets on the left side of the radio.

DANGER

Do not insert the destructor plug if the red warning lights, located over the radio set in the boom, are lighted. Make sure that the warning light system has been checked and is in proper working order.

(2) After take-off set the "ON-OFF" switch (figure 23-3) to "ON."

(3) Set the six-position switch (figure 23-1) to the position specified by the Communications Officer-in-Charge. (In the absence of specific information, set to "1".)

(4) Set the "G" band switches (figure 23-7) as directed by the Communications Officer.

(5) Details concerning the use of the EMERGENCY switch (figure 23-2) and destructor buttons (figure 23-6) should be obtained from the Communications Officer.

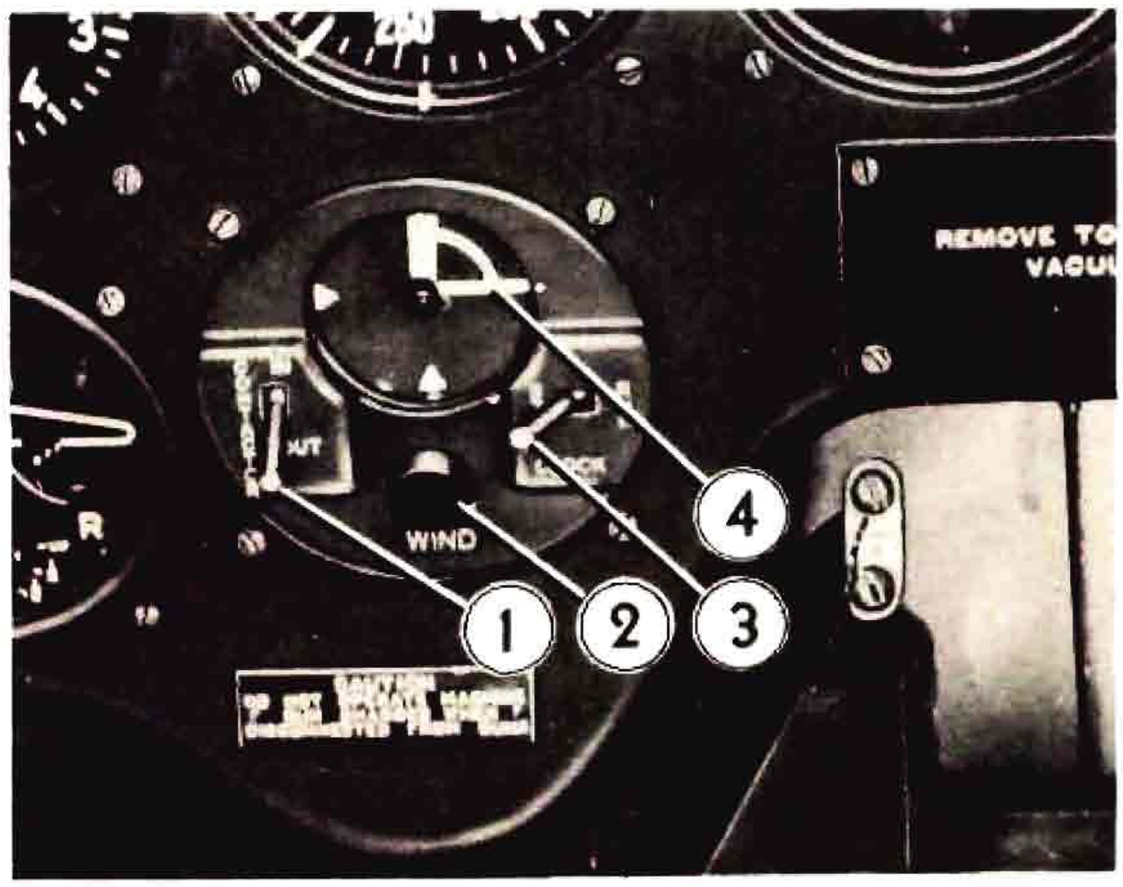


Figure 24 — BC 608 Contactor Controls

1. Contactor in-out switch.
2. Clock winding knob.
3. Clock stop-run switch.
4. Clock indicator.

(6) To stop the equipment, turn all switches OFF.

(7) Disconnect the destructor plug as soon as the airplane lands in friendly territory.

f. BC-608 CONTACTOR.

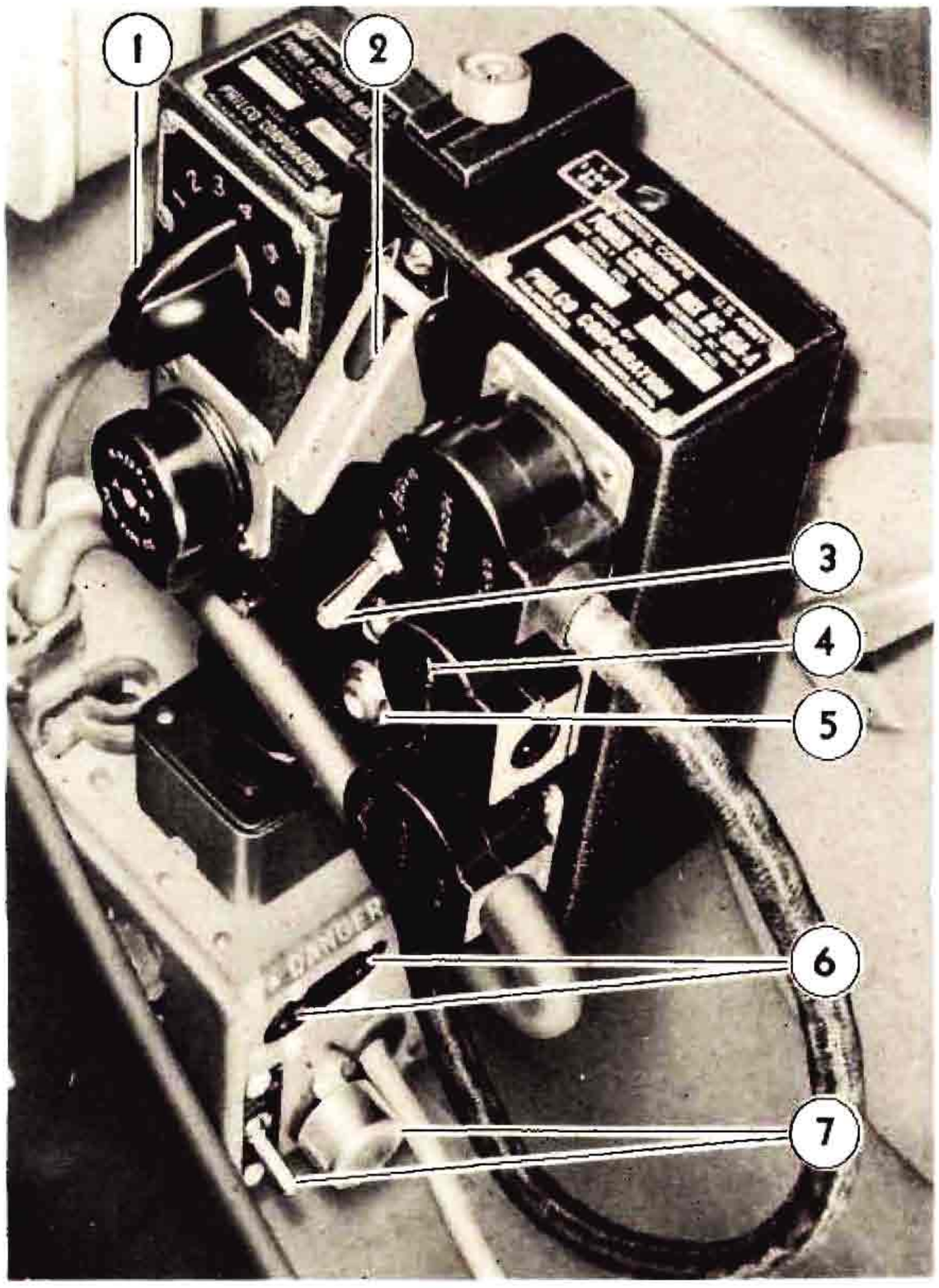
Provisions have been made for the installation of this unit when in British squadrons or when operating in conjunction with British airplanes.

(1) Before take-off, turn the contactor heater switch ON, wind the clock and synchronize it with the control clock by setting the clock switch (figure 24-3) to RUN at the given signal.

(2) Turn the command transmitter ON.

(3) Turn the contactor switch (figure 24-1) to IN.

(a) Automatic transmission takes place during the 15 seconds the clock hand is between the 12:00 and the 3:00 o'clock position. Normal transmission and reception is not possible during this time.



1. Six-position switch.
2. Emergency switch.
3. ON-OFF switch.
4. Protection plug
   (to prevent short circuit with safety belt).
5. Headset jack.
6. Destructor buttons.
7. "G" band switches.

Figure 23 — SCR-695-A Radio Controls

g. MN-26Y RADIO COMPASS.

This radio compass may be temporarily installed in airplanes serial 42-67702 and up when they leave the factory. The compass is intended for use during the ferry flights, and may be removed in combat zones.

(1) GENERAL.

(a) The master control switch marked OFF, COMP., REC. ANT., and REC. LOOP controls all radio compass equipment functions other than tuning and adjustment of signal level.

(b) The COMP setting is used for obtaining communications reception, visual on-course indication of homing and bearings.

(c) The REC. ANT setting is used for communication and aural radio range reception.

(d) The REC. LOOP setting is used for obtaining communications reception during conditions of severe rain and snow static, aural radio range reception, aural null bearings, and aural null homing from communication stations.

(e) The OFF setting opens all current consuming circuits thus rendering the equipment inoperative.

(f) The azimuth control warning light operates at all times when the equipment is in use except when the azimuth control is set at zero.

(g) The azimuth crank is used to rotate the loop antenna. Antenna position is indicated on the azimuth indicator.

(h) The left-right indicator indicates whether the station is to the right or left of the centerline of the airplane only when the azimuth indicator is turned to zero. An azimuth indicator warning light indicates whenever the azimuth indicator is not on zero.

(2) OPERATION OF THE MN-26Y RADIO COMPASS.

(a) Turn the main switch ON and set the band selector switch to the frequency range desired.

(b) Tune to the desired station and adjust the volume (audio) control. Set the C.W. switch to ON for code reception, OFF for voice reception.

(c) Set the master switch according to the operation to be conducted.

2. OPERATION OF THE OXYGEN EQUIPMENT.

a. 400 to 450 lb/sq in. is full pressure in the three bottles. This supply is sufficient to last approximately

12¾ hours at 15000 feet
9 hours at 20000 feet
7 hours at 25000 feet
or 6¼ hours at 30000 feet

if properly used.

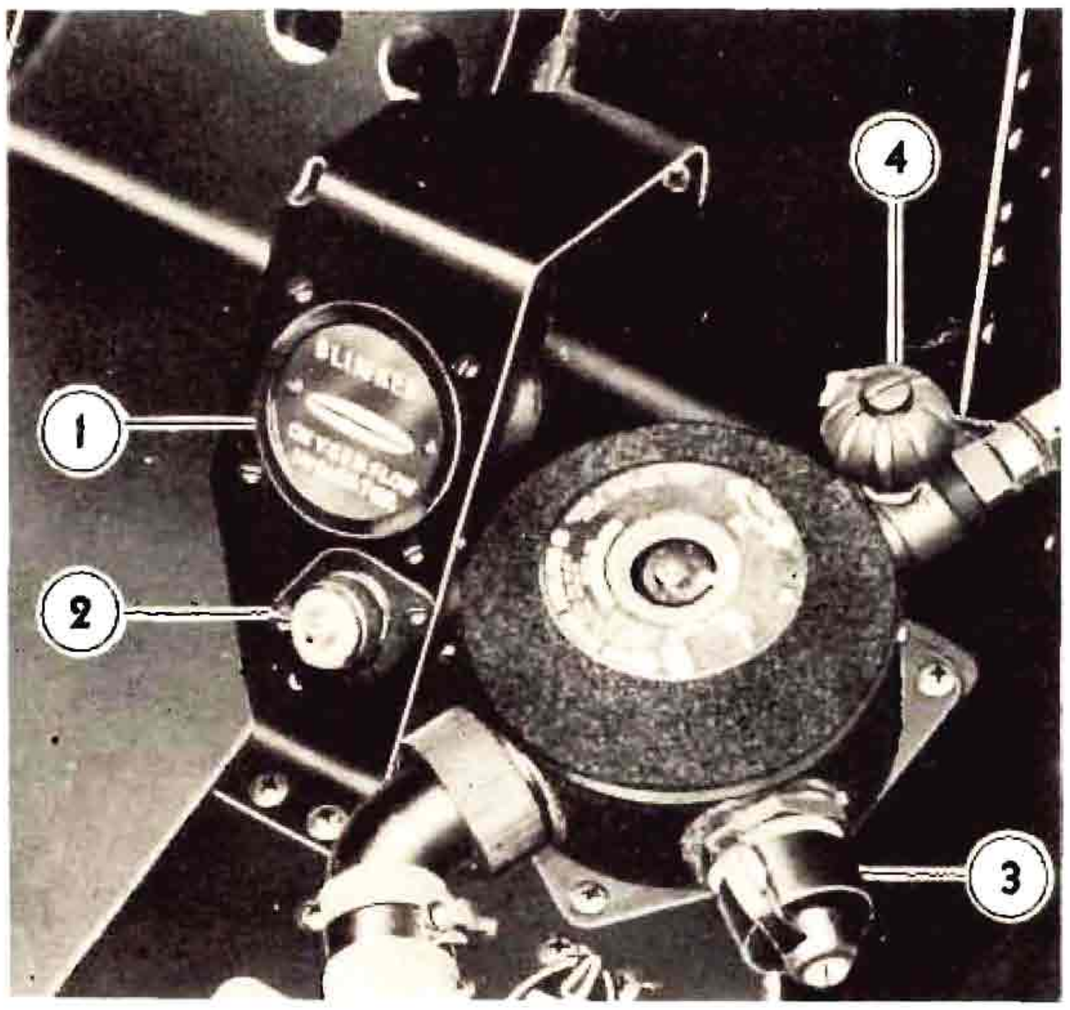
b. Fit the demand type mask snugly to the face and test the fit by pinching the tube and sucking lightly. The mask should collapse. Clip the mask tube to the clothing allowing for all necessary head movement without pulling the mask away from the face.

WARNING

It must be remembered that the suction of breathing is used to open the oxygen valve, and that any leakage in the mask will cause this valve to become inoperative and will stop the flow of oxygen.

c. Check the auto-mix lever (figure 25-3) ON and the emergency knob (figure 25-4) OFF. Under these conditions a correct oxygen air mixture will be supplied *at any altitude* as required by normal breathing.

d. Failure of the automatic supply will be indicated by failure of the flow indicator (figure 25-1). If re-adjustment of the mask does not restore the flow turn the emergency knob (figure 25-4) ON and the auto mix lever OFF. This will supply a constant stream of oxygen to the mask regardless of the breathing requirements.



1. Oxygen flowmeter.
2. Oxygen pressure warning light.
3. Auto-mix lever.
4. Emergency knob.

Figure 25 — Oxygen Controls

e. With the auto-mix and the emergency controls both turned OFF, pure oxygen will be supplied as required by normal breathing. This setting, however, is wasteful of oxygen and should be used only in an emergency or when denitrogenizing for high altitude flight has been accomplished.

f. The supply warning light (figure 25-2) indicates when the pressure drops below approximately 100 lb/sq in. Pressure is indicated on the oxygen pressure gage figure 4-34).

3. OPERATION OF THE ARMAMENT.

a. The airplanes are equipped with four .50 caliber machine guns and one 20 mm cannon. Space is provided for carrying 500 rounds of ammunition for each .50 caliber gun and 150 rounds for the 20 mm cannon. A small motion picture camera operates with the guns to record results.

(1) Before take-off check that machine guns and cannon have been charged. (P-38H only is equipped with a machine gun charger which may be operated in flight as follows:)

(a) Pull the charging selector (figure 4-16) out and turn it to the gun to be charged.

(b) Pull the charging handle (figure 4-10) all the way back and then push it forward.

(c) Strike the charging selector with the heel of the hand.

NOTE

Never attempt to move the charging selector unless the charging handle is in the full forward position.

(d) Charge the other three machine guns in the same manner.

(2) Turn the armament switch (on control column) to COMBAT.

(3) Push the machine gun button or the cannon button (figure 4-12) to fire the guns. (Machine gun button is on reverse side of wheel from cannon button shown.)

(a) If it is desired to use the camera without the guns, set the armament switch to CAMERA and operate either the gun or cannon button.

NOTE

Turn gun heat (figure 4-23) ON whenever the outside air temperature is below freezing.

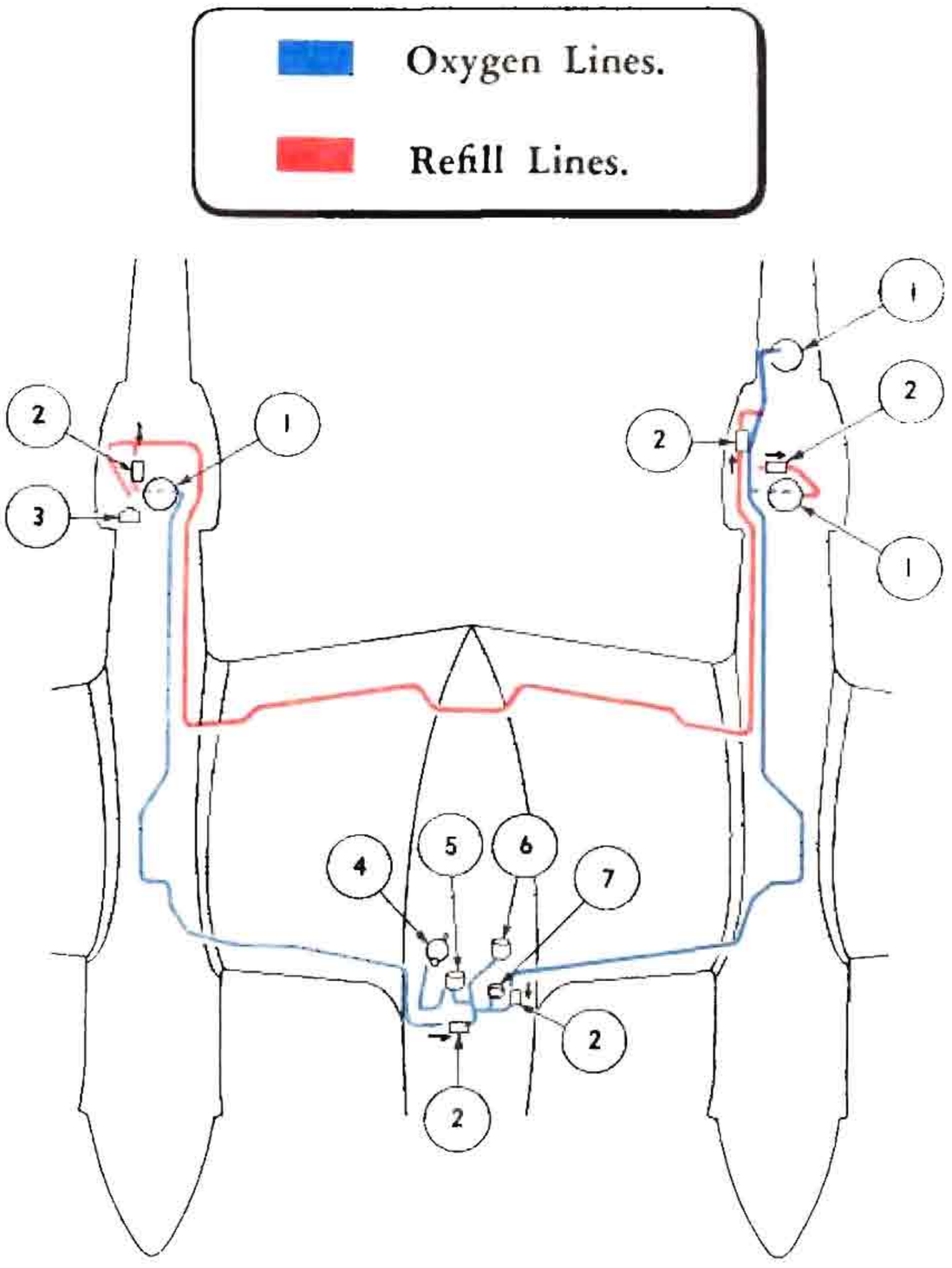


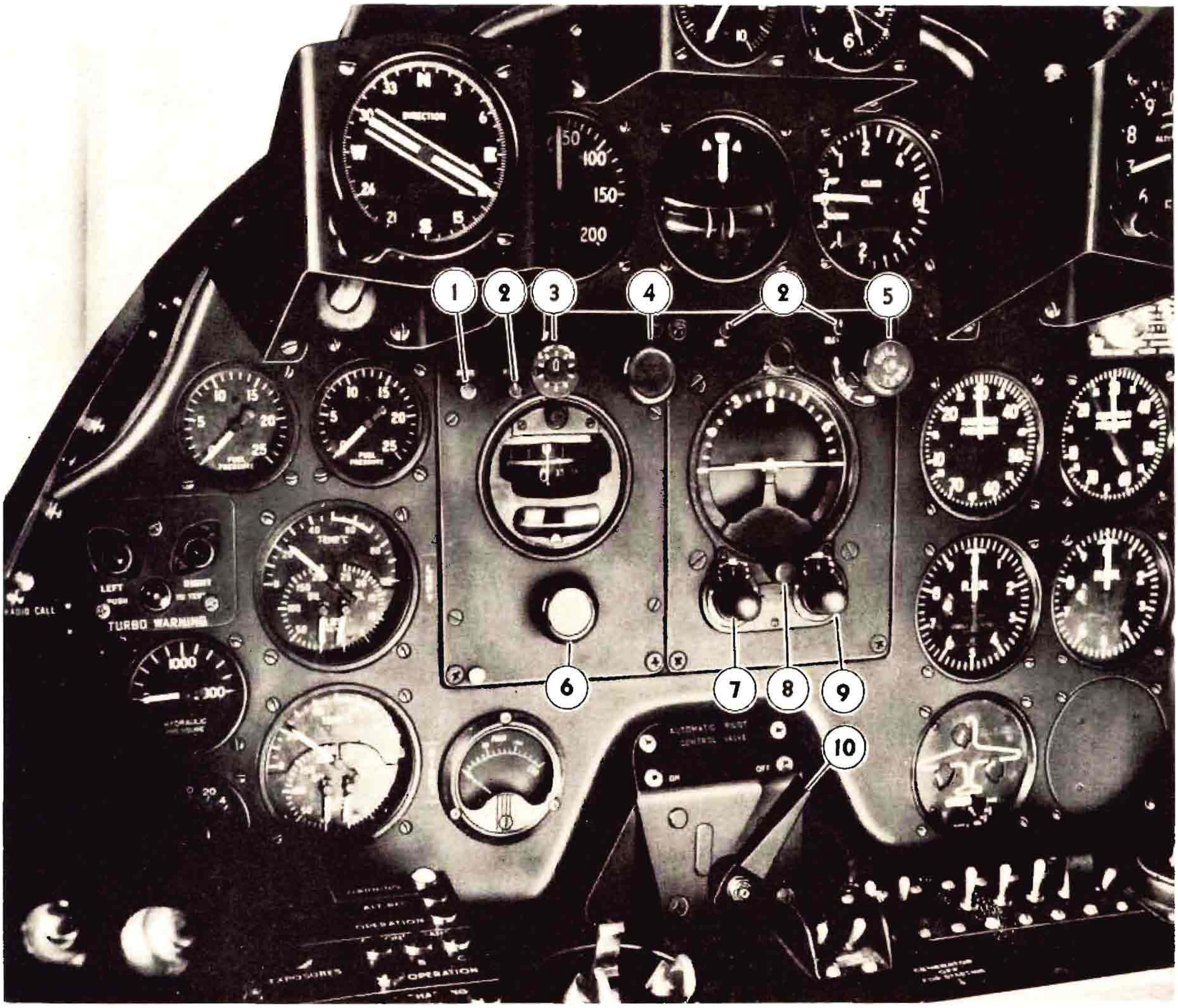
Figure 26 — Oxygen System Diagram

1. Oxygen bottles.
2. Check valves.
3. Refill connection.
4. Demand type oxygen regulator.
5. Oxygen flowmeter.
6. Oxygen pressure gage.
7. Pressure warning light.

(4) The optical gun sight is turned ON by the rheostat (figure 6-10) which adjusts the intensity of the reflection on the glass behind the windshield. Adjust the seat vertically until the sight reflection is easily visible.

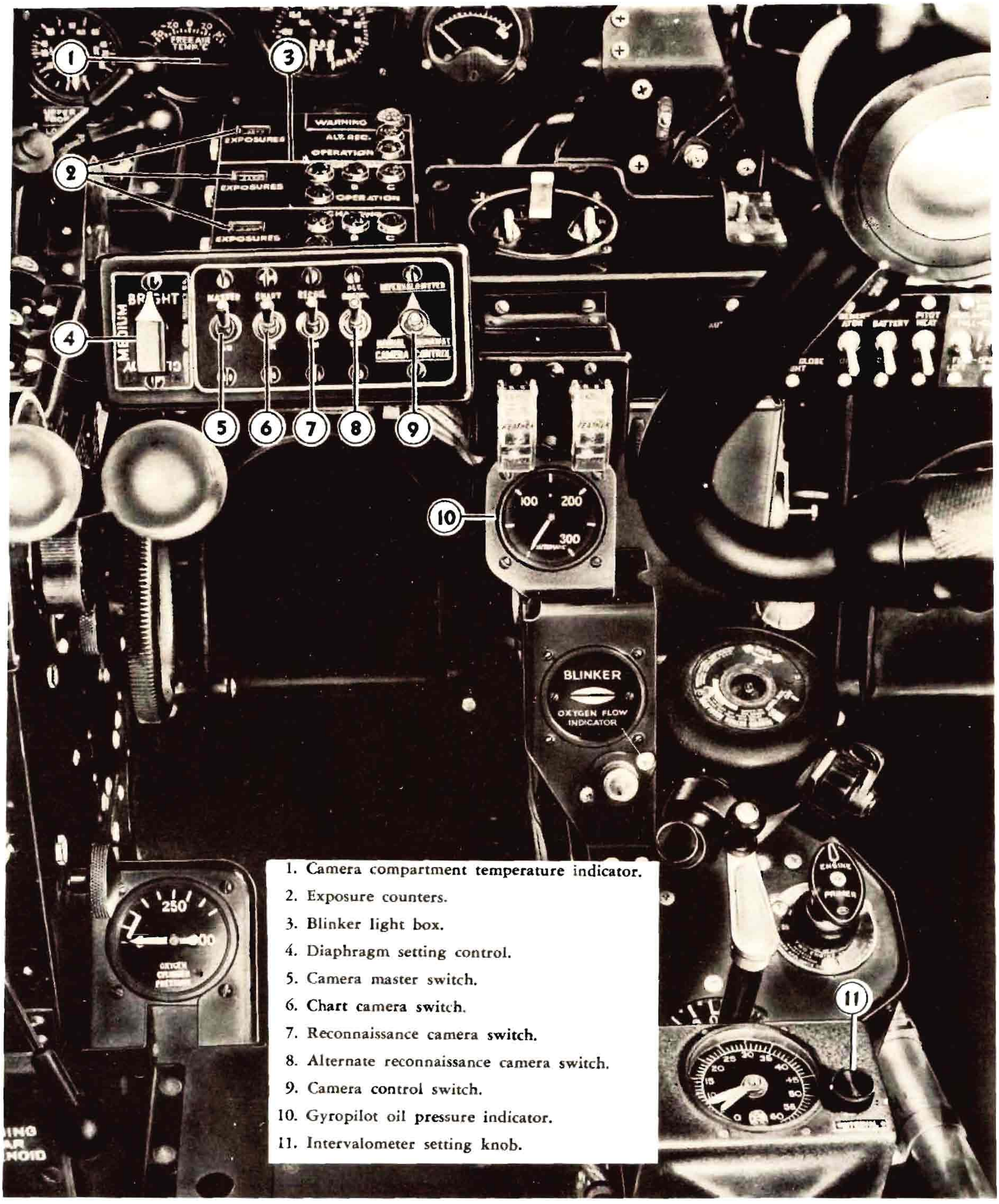
(5) When flying in bright sunlight place the dark glass (figure 4-31) in position over the gunsight (figure 29-2).

(6) To drop bombs, set the arming switch (figure 4-24) to ARM (or safe), set the bomb selector switch (figure 4-20) to ON for the bomb to be dropped and, while flying at not more than 400 mph and not more than 30° from the horizontal, with flaps UP, press the release button (figure 4-27).



1. Rate control (ground adjustment only).
2. Speed valves.
3. Course setting knob indicator.
4. Course setting knob.
5. Artificial horizon caging knob.
6. Directional gyro caging knob.
7. Aileron trim knob.
8. Miniature airplane control.
9. Elevator trim knob.
10. Gyropilot shutoff valve.

Figure 27 — Gyropilot Controls



1. Camera compartment temperature indicator.
2. Exposure counters.
3. Blinker light box.
4. Diaphragm setting control.
5. Camera master switch.
6. Chart camera switch.
7. Reconnaissance camera switch.
8. Alternate reconnaissance camera switch.
9. Camera control switch.
10. Gyropilot oil pressure indicator.
11. Intervalometer setting knob.

Figure 28 — A-1 Camera Controls

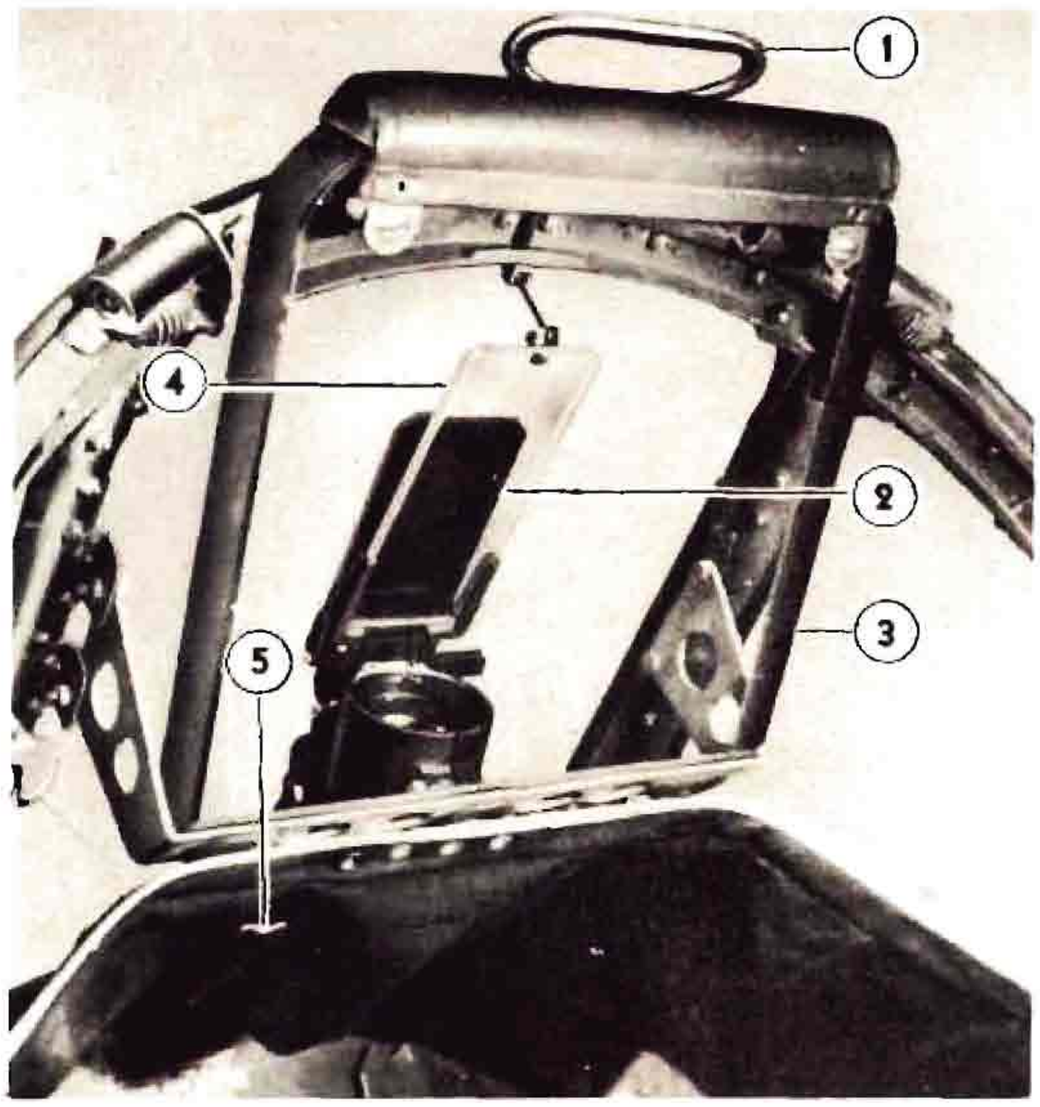


Figure 29 — Gun Sight

1. Emergency hatch release.
2. Gun sight dark glass.
3. Bullet proof glass.
4. Reflecting glass.
5. Glare shield.

(Later airplanes will be rearranged with the bullet-proof glass forming the front windshield surface and a new type gunsight, operating on the same principle, mounted on the glass.)

4. OPERATION OF THE A-4 AUTOMATIC PILOT (F-5B only).

a. During warm up.

(1) Check vacuum (figure 7-10) 4 or 5" Hg.

(2) Check auto pilot oil pressure (figure 28-10) 125 lb/sq in.

(3) Uncage the bank and climb unit (figure 27-5).

(4) Match the directional gyro cards and uncage the directional gyro (figure 27-6).

(5) Turn the automatic pilot control valve (figure 27-10) ON.

(6) Turn the course setting knob (figure 27-4), the elevator trim knob (figure 27-9) and the aileron trim knob (figure 27-7) to check operation of the units.

(7) CHECK AUTOMATIC PILOT CONTROL VALVE *OFF* BEFORE TAKE-OFF.

b. TO ENGAGE AUTOMATIC PILOT IN FLIGHT.

(1) Trim the airplane for "hands off" flight.

(2) Set the directional gyro (lower) card to agree with the compass and rotate the course setting knob until the upper and lower cards coincide.

(3) Uncage the directional gyro.

(4) Turn the elevator and aileron trim knobs to zero.

(5) Turn the automatic pilot control valve ON.

(6) Adjust the course setting knob and the trim knobs to hold the airplane in straight and level flight.

(7) Adjust the speed valves (figure 27-2) to obtain the proper rate of control.

(8) Disengage automatic pilot every 15 minutes in flight to reset the directional gyro with the compass and retrim the airplane for "hands off" flight.

(9) Make small directional changes (flat turns) by turning the course setting knob *slowly* to the new heading.

(10) Make faster turns by setting the airplane in a bank with aileron trim knob, caging the directional gyro, and rotating the course setting knob until the ball bank indicator is centered.

CAUTION

The operating limits are 55° in a climb or dive and 90° in a bank. Both gyros should be caged during any maneuvers which might exceed these limits.

5. OPERATION OF THE CAMERA EQUIPMENT (F-5B only).

a. All the cameras are installed in the fuselage nose which is divided into three camera compartments. The forward compartment accomodates one 6" K-17 chart camera. The center compartment will accomodate two 6" K-17 chart cameras or one 12" or 24" K-17 reconnaissance camera. The aft compartment accommodates two 24" K-17, or one 24" K-18, reconnaissance cameras.

b. CAMERA OPERATION (for pilot)

(1) Before take-off the pilot should determine which cameras are installed and that the airplane is properly balanced. THIS IS IMPORTANT (see Section II, paragraph 2*a*).

(2) TO OPERATE CAMERAS:

(a) Set camera diaphragm control (figure 28-4) as required. (Bright, medium, or cloudy.)

(b) Turn camera switches (figure 28-6, 7 or 8) ON for each group of cameras to be used.

NOTE

Camera heat (figure 4-23) should be adjusted to maintain approximately 5°C (40°F.) on the camera compartment temperature indicator (figure 28-1). Some airplanes may be equipped in service with prestone-electric fan heaters which will be operated through a switch and rheostat in the cockpit.

(c) FOR INTERVALOMETER OPERATION:

1. Determine time interval from the INTERVALOMETER SETTING table (figure 30).

2. Set the intervalometer hand to the selected time interval. Push and turn knob (figure 28-11) to set hand.

3. Set the camera control switch (figure 28-9) to INTERVALOMETER.

4. Turn camera master switch (figure 28-5) ON. An exposure will be made immediately.

5. Amber lights flash when exposure is made. Green lights indicate when film is winding. The white light gives a three-second warning before exposure.

6. To take an extra picture at any instant, throw the control switch to RUNAWAY and immediately return it to INTERVALOMETER.

(d) FOR MANUAL CONTROL:

1. Set camera control switch to MANUAL.

2. Turn camera master switch ON.

3. Pull the camera control trigger, (on the control wheel) to make an exposure.

(e) FOR RUNAWAY OPERATION:

1. Set camera control switch to RUNAWAY.

2. Turn camera master switch ON.

NOTE

Because the time to wind varies slightly for each camera, exposures will not be made simultaneously during runaway operation. Pictures will, therefore, not be suitable for stereoscopic viewing.

3. Runaway operation may also be obtained by setting the controls for manual operation and holding the trigger down.

(f) The pilot should fill out photographic data sheet "B" on completion of each photographic flight.

c. GROUND OPERATION (for photographer).

(1) Owing to the limited space, the dark slides must be removed before installation of the magazines. With this in mind, do not roll the entire daylight loading leader onto the take-up spool until after the magazine is installed. The leader may then be wound up in checking the operation of the camera controls.

(2) Set the reversing switch, located on the control box in the camera compartment, and arrange cams in the control box so that cameras will fire in the desired order. Usually the adjustment will be made so that 24" cameras fire at the beginning of each time interval, 12" cameras fire at the beginning of intervals 1, 3, 5, etc. and 6" cameras fire at every fourth interval, 1, 5, 9, etc.

(3) The camera windows may have to be protected from spray from the nose wheel when taking off from muddy, wet or oily runways. The following expedient has been found satisfactory.

(a) Cut a piece of cardboard to the size of the visible glass area. Attach this over the glass with two pieces of masking tape, one across the front side and one across the back. Before applying the front tape, run a stout cord along the edge of the window frame just ahead of the cardboard and attach the tape over the cord. Tie a loop in the cord so as to cause it to encircle the tape. Tie the other end of the cord to the nose wheel strut and take up all possible slack. This is repeated for the other windows as required. Retraction of the nose wheel will pull off the front tapes and permit the cardboard covers to blow away.

(4) A piece of tape should be put over any inoperative blinker lights for the pilot's information.

(5) The photographer should fill out photographic data sheet "A" before the airplane takes off.

AIRPLANE'S AIRSPEED INDICATOR READING—MPH																
Airplane's Altimeter Reading (1,000 Ft.) — Altimeter Set at 29.92" Hg.																
6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
180	170	165	160	155	150	145	140	130	125							
210	200	195	185	180	170	165	160	150	145	140	135	125				
235	230	220	215	205	195	185	180	170	165	160	150	145	140	135	125	
260	255	245	240	230	225	215	205	195	190	180	170	165	160	150	145	140
285	275	270	260	250	245	235	230	220	210	200	190	180	175	170	160	155
310	300	290	280	275	265	260	250	240	230	220	215	205	195	185	180	170
330	320	310	300	295	285	280	270	260	250	240	230	225	215	205	195	190
355	345	335	325	315	310	300	290	280	270	260	250	240	230	225	215	205
380	370	360	350	340	330	320	310	300	290	280	270	260	250	240	230	220

INTERVALOMETER SETTING—SEC.																
Altitude Above Ground — 1,000 Ft.																
6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
2"	3"	4†	5†	5†	6†	6†	9	9	9	9	12	12	12	15	15	15
2"	3"	4†	4†	5†	6†	6†	6†	9	9	9	9	12	12	12	12	12
2"	3"	3"	4†	4†	5†	6†	6†	6†	9	9	9	9	9	12	12	12
2"	2"	3"	3"	4†	5†	5†	6†	6†	6†	9	9	9	9	9	9	12
2"	2"	3"	3"	4†	4†	5†	5†	6†	6†	6†	6†	9	9	9	9	9
1"	2"	2"	3"	3"	4†	4†	5†	5†	6†	6†	6†	6†	9	9	9	9
1"	2"	2"	3"	3"	4†	4†	5†	5†	5†	6†	6†	6†	6†	9	9	9
1"	2"	2"	3"	3"	3"	4†	4†	5†	5†	5†	6†	6†	6†	6†	9	9
1"	1"	2"	2"	3"	3"	4†	4†	4†	5†	5†	5†	6†	6†	6†	6†	9

To determine intervalometer setting: (1) Find airplanes altimeter reading in left hand side of table; (2) Follow down to first indicated airspeed higher than airplane's airspeed; (3) Follow across horizontal to intervalometer setting below distance above the ground.

Time intervals marked (") are too short for runaway operation with K-17 camera.

Time intervals marked (†) are too short for runaway operation with K-18 camera.

Figure 30 — Intervalometer Setting (60% Over Lap)

PHOTOGRAPHIC DATA SHEET "A"

_____ 19____

1._____Dark slide removed.
2._____Cameras properly secured in airplane.
3._____Shutter tested.
4._____Shutter speed. (Set properly).
5._____Filter used.
6._____Lens tight.
7._____Magazine properly seated.
8._____Camera operations checked on Intervalometer and on Manual Trip Switches.
9._____Blinker lights and warning lights checked.
10._____Daylight loading trailer wound off supply spool.
11._____Camera windows clean.
12. Cameras used—

	A. Camera Serial No.	B. Magazine Serial No.
a. 6" vertical	_____	_____
b. 24" vertical	_____	_____
c. 12" vertical	_____	_____
d. 6" oblique, right	_____	_____
e. 6" oblique, left	_____	_____
f. 24" oblique, right	_____	_____
g. 24" oblique, left	_____	_____

I certify that the above cameras have been installed in aircraft No. _____ under my supervision, this date, and are ready for use.

_____
Photographer

PHOTOGRAPHIC DATA SHEET "B"

1. Diaphragm setting_____
2. Weather conditions_____
3. Altitude (true)_____
4. Exposures made_____
5. Approximate time_____
6. Area covered_____

_____
Pilot

Magazine taken up five (5) exposures_____

_____
Photographer

APPENDIX I

GLOSSARY OF NOMENCLATURE (U. S. A.-BRITISH)

AMERICAN	*BRITISH*	*AMERICAN*	*BRITISH*
Accumulator (hydraulic)	Pressure reservoir	Lean mixture	Weak mixture
Air filter	Air cleaner	Left	Port
Airfoil	Aerofoil	Level off	Flatten out
Antenna	Aerial	Life raft	Dinghy
Battery (electrical)	Electrical accumulator	Manifold pressure	Boost pressure
Ceiling	Cloud height	Mooring line	Mooring guy
Check valve	Non-return valve	Mooring rings	Picketing rings
Command set (radio)	Pilot controller set	Oil pan	Crankcase sump
Course (direction with respect to true north)	Track angle	Panel (center wing)	Centre section plane
		Panel (outboard)	Outer plane
Critical speed	Stalling speed	Radio mast	Rod aerial
Cylinder (hydraulic)	Jack (hydraulic)	Radio range beacon	Radio track beacon
Drift	Drift-angle	Right	Starboard
Empennage	Tail unit	Screen (oil)	Filter
Flare (signal)	Signal star, signal projecticle	Stabilizer (horizontal)	Tail plane
		Stabilizer (vertical)	Fin
Gage (fuel)	Fuel-contents gauge	Tachometer	Engine speed indicator, revolution counter
Gasoline (gas, fuel)	Petrol or fuel		
Generator	Dynamo	Take-off distance	Take-off run
Ground (electrical)	Earth	Tube (radio)	Valve
Gyro horizon	Artificial horizon	Valve (fuel or oil)	Cock
Heading	Course	Weight (empty)	Tare
Indicated air speed (ias)	Air-speed-indicator reading	Weight (gross)	All-up weight
		Windshield	Windscreen
Landing gear	Alighting gear, under-carriage	Wing	Main plane

APPENDIX II

Flight Operating Charts, Tables, Curves, and Diagrams

1. FLIGHT PLANNING.

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.

a. 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."

(1) 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 the flight arrive at its destination at the predetermined time.

Fuel should be used in the following sequence:

1. Reserve tanks for first 15 minutes.
2. External tanks.
3. Main tanks.
4. Reserve tanks.

(2) Select the FLIGHT OPERATION INSTRUCTION CHART corresponding to the weight and external load items 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.

(3) 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 2, *a,* (2) 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.

(4) 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 (2) 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 (3) and calculate a new corrected ground speed with the aid of a navigator's triangle of velocities.

(5) 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 column listing the range desired.

CAUTION

Ranges listed in column I under "Max. Cont. Power" are correct only at the altitude given in footnote 1.

(6) 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.

(7) In using the FLIGHT OPERATION INSTRUCTION CHARTS set the propeller pitch control 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.

b. 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 *a,* in its entirety, and then added together to make up the total flight and its requirements.

"WHAT WAS THAT ?"

AIRPLANE MODELS

P-38H

ENGINE MODELS

V-1710-89 (RH)

V-1710-91 (LH)

TAKE-OFF, CLIMB & LANDING CHART

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND (MPH)	HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
		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.
16,100	0	880	1650	1120	2010	1420	2530	920	1700	1160	2060	1490	2620	1010	1820	1300	2250	1700	2870
	17	650	1300	850	1620	1080	2040	680	1350	880	1660	1140	2110	750	1440	990	1820	1300	2330
	34	430	960	570	1230	740	1550	440	1000	600	1240	780	1600	490	1060	680	1390	900	1790
	51	190	620	290	840	400	1060	200	650	320	830	430	1080	240	700	360	950	500	1260
18,100	0	1150	2160	1420	2590	1830	3300	1200	2230	1490	2690	1930	3440	1350	2440	1700	2970	2250	3840
	17	870	1740	1080	2080	1400	2720	900	1800	1140	2160	1500	2830	1020	1960	1300	2400	1760	3180
	34	590	1310	740	1570	980	2140	610	1360	780	1630	1060	2240	700	1500	900	1830	1260	2520
	51	310	880	400	1070	560	1570	320	930	420	1110	620	1620	370	1020	500	1270	760	1850
19,500	0	1400	2590	1690	3110	2170	3980	1470	2690	1780	3230	2300	4170	1680	2970	2070	3570	2700	4720
	17	1060	2080	1290	2520	1700	3320	1120	2160	1390	2640	1800	3460	1290	2400	1620	2920	2140	3920
	34	720	1570	900	1910	1220	2660	770	1630	970	2060	1300	2760	900	1830	1170	2290	1560	3130
	51	380	1070	520	1320	750	1980	420	1110	560	1460	800	2060	510	1270	720	1640	990	2340

NOTE: INCREASE DISTANCE 10 % FOR EACH 10 C ABOVE 0 C (11 % FOR EACH 20 F ABOVE 32 FI

ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 54 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 3000 RPM & 54" IN. HG

FERRY MISSIONS USE 2300 RPM & 34 IN. HG

GROSS WEIGHT (IN LBS.)	TYPE OF CLIMB	S.L. TO 5000 FT. ALT.			AT 10,000 FT. ALT.				AT 15,000 FT. ALT.				AT 25,000 FT. ALT.				AT 35,000 FT. ALT.				BLOWER CHANGE
		BEST I.A.S.	FT./MIN.	TIME FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	
16,100	COMBAT	175	3400	2	175	3200	3	51	170	3100	5	56	155	2100	9	66	130	500	17	73	
	FERRY	145	1700	3	140	1700	6	45	140	1600	9	53	135	1300	17	73					
18,100	COMBAT	165	2700	2	165	2600	4	54	160	2400	6	59	145	1500	11	72	125	100			
	FERRY	160	1300	4	155	1200	8	51	155	1100	13	63	145	800	25	94					
19,500	COMBAT	165	2400	2	165	2200	4	55	160	2100	7	60	145	1300	12	76	125				
	FERRY	165	1100	5	160	1000	10	56	160	900	16	70	155	600	33	114					

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (5 % FOR EACH 20°F ABOVE 32 F)

FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	BEST I. A. S. Approach	HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
		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.	GROUND ROLL
13,500	100	2510	1320	2730	1440	3000	1590	2660	1470	2900	1610	3170	1760	4520	3330	4910	3620	5460	4050
15,500	105	2800	1480	3050	1620	3360	1790	2970	1650	3250	1820	3580	1990	5100	3780	5560	4130	6180	4610

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS: *FOR COMBAT CLIMB USE 3000 RPM AND 54 IN. HG, TO 20,000 FEET. REDUCE MANIFOLD PRESSURE AS FOLLOWS ABOVE 20,000 FEET STILL USING 3000 RPM.

	ALTITUDE			
	25,000	30,000	35,000	40,000
WITH TYPE B-13 SUPERCHARGERS	45	35	30	20
WITH TYPE B-33 SUPERCHARGERS	48	40	35	30

LEGEND

I. A. S.: Indicated Air Speed

NOTE: All distances are average, and subject to considerable variations because of differences in pilot technique, load, C.G., etc.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

AIRPLANE MODELS
P-38J
F-5B

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS
V-1710-89 (R.H.)
V-1710-91 (R.H.)

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND (MPH)	HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
		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.
16,200	0	880	1650	1120	2010	1420	2530	920	1700	1160	2050	1490	2620	1010	1820	1330	2250	1700	2870
	17	650	1300	850	1620	1080	2040	680	1350	880	1660	1140	2110	750	1440	990	1820	1300	2330
	34	430	960	570	1230	740	1550	440	1000	600	1240	780	1600	490	1060	680	1390	900	1790
	51	190	620	290	840	400	1060	200	650	320	830	430	1090	240	700	360	950	500	1260
18,200	0	1150	2160	1420	2590	1830	3300	1200	2230	1490	2690	1930	3440	1350	2440	1700	2970	2250	3840
	17	870	1740	1080	2080	1400	2720	900	1800	1140	2160	1500	2830	1020	1960	1300	2400	1760	3180
	34	590	1310	740	1570	980	2140	610	1360	780	1630	1060	2240	700	1500	900	1830	1260	2520
	51	310	880	400	1070	560	1570	320	930	420	1110	620	1620	370	1020	500	1270	760	1850
19,200	0	1400	2590	1690	3110	2170	3980	1470	2690	1780	3230	2300	4170	1680	2970	2070	3570	2700	4720
	17	1060	2080	1290	2520	1700	3320	1120	2160	1380	2640	1800	3460	1290	2400	1620	2920	2140	3920
	34	720	1570	900	1910	1220	2660	770	1630	970	2060	1300	2760	900	1830	1170	2290	1560	3130
	51	380	1070	520	1320	750	1980	420	1110	560	1460	800	2060	510	1270	720	1640	990	2340

NOTE: INCREASE DISTANCE 10 % FOR EACH 10 C ABOVE 0 C (11 % FOR EACH 20 F ABOVE 32 F)

ENGINE LIMITS FOR TAKE-OFF 3000 RPM & 54 IN. HG

CLIMB DATA

COMBAT MISSIONS USE 3000 RPM & 54* IN. HG

FERRY MISSIONS USE 2300 RPM & 34 IN. HG

GROSS WEIGHT (IN LBS.)	TYPE OF CLIMB	S.L. TO 5000 FT. ALT.			AT 10000 FT. ALT.				AT 15000 FT. ALT.				AT 25000 FT. ALT.				AT 35000 FT. ALT.				BLOWER CHANGE
		BEST I.A.S.	FT./MIN.	TIME FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	
16,200	COMBAT	170	3400	2	165	3300	3	57	160	3200	5	65	155	2500	8	83	130	1100	14	107	
	FERRY	145	1700	3	140	1700	6	45	140	1600	9	53	135	1300	17	73					
18,200	COMBAT	165	2800	2	160	2600	4	61	155	2500	6	71	150	1900	11	94	125	500	20	133	
	FERRY	160	1300	4	155	1200	8	51	155	1100	13	63	145	800	25	94					
19,600	COMBAT	165	2500	3	160	2400	5	63	155	2200	7	75	150	1600	12	101	125	300	25	154	
	FERRY	165	1100	5	160	1000	10	56	160	900	16	70	155	600	33	114					

NOTE: INCREASED ELAPSED CLIMBING TIME 5 % FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE (5 % FOR EACH 20°F ABOVE 32°F)

FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	BEST I. A. S. Approach	HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
		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.	GROUND ROLL
13,500	100	2510	1320	2730	1440	3000	1590	2660	1470	2900	1610	3170	1760	4520	3330	4910	3620	5460	4050
15,500	105	2800	1480	3050	1620	3360	1790	2970	1650	3250	1820	3560	1990	5100	3780	5560	4130	6180	4610

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS * FOR COMBAT CLIMB USE 3000 RPM AND 54 IN. HG. TO 25,000 FT., THEN GRADUALLY REDUCE MAN. PRESS. TO 45.5 IN. HG. AT 30,000 FT. AND TO 37 IN. HG. AT 35,000 FT.

LEGEND

I. A. S.: Indicated Air Speed

NOTE: All distances are average, and subject to considerable variations because of differences in pilot technique, load, C.G., etc.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

SPEC. AN-H-8 DEC. 18, 1942 — FORM ASC-511

MODEL (S) P-38H

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 1 SHEETS

GR. WT. 15,700 TO 13,500 POUNDS

EXTERNAL LOAD ITEMS TANK SUPPORTS ONLY

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	
TAKE-OFF	3000	54	-	A.R.	15	162	
MILITARY POWER	3000	54	-	A.R.	15	162	
ENGINE (S)	V-1710-89 (R.H.); -91 (L.H.)						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND) **ALTERNATE CRUISING CONDITIONS** (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL U.S. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
AT S.L.	AT 12,000	AT S.L.	AT 12,000	300		40 U.S. Gallons not available in flight.					300		
	360		310	260	530	460	650	560	830	720	260	910	790
	330		290	240	490	430	600	520	770	670	240	840	730
	310		270	220	450	390	550	470	700	610	220	770	670
	280		240	200	410	350	500	430	640	550	200	700	610
	250		220	180	370	320	450	390	570	500	180	630	550
	220		190	160	330	280	400	350	510	440	160	560	490
	200		170	140	290	250	350	300	450	390	140	480	430
	170		140	120	250	210	300	260	380	330	120	420	370
	140		120	100	200	180	250	220	320	280	100	350	300
	110		100	80	160	140	200	170	260	220	180	280	240
	80		70	60	120	110	150	130	190	170	60	210	180

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.
2600		A.R.	35	172	380	30000							2300	230	A.R.	32	130		2250	215	A.L.	29	95		30000	2200	195	A.L.	25	80	
2600		A.R.	40	220	390	25000	2350	260	A.R.	36	163		2300	245	A.L.	31	115		2200	220	A.L.	28	89		25000	2050	195	A.L.	25	78	
2600		A.R.	41	228	375	20000	2300	270	A.R.	35	156		2300	255	A.L.	32	115		2150	225	A.L.	28	89		20000	1850	190	A.L.	25	67	
2600		A.R.	41	228	360	15000	2300	280	A.R.	34	147		2300	265	A.L.	32	115		2100	225	A.L.	27	77		15000	1700	190	A.L.	25	62	
2600		A.R.	41	228	355	12000	2300	280	A.R.	33	141		2250	265	A.L.	32	111		2050	230	A.L.	27	74		12000	1600	190	A.L.	25	59	
2600		A.R.	41	228	345	9000	2300	280	A.R.	33	136		2250	270	A.L.	30	106		2050	230	A.L.	26	71		9000	1600	190	A.L.	24	56	
2600		A.R.	41	228	335	6000	2300	280	A.R.	32	131		2200	270	A.L.	30	103		2000	230	A.L.	26	68		6000	1600	190	A.L.	23	54	
2600		A.R.	41	228	325	3000	2300	285	A.R.	32	126		2200	270	A.L.	30	99		2000	230	A.L.	25	65		3000	1600	190	A.L.	22	51	
2600		A.R.	41	228	320	S.L.	2300	290	A.L.	31	125		2150	270	A.L.	30	95		1950	290	A.L.	25	62		S.L.	1600	190	A.L.	22	49	

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 40 U. S. GALS., ____ IMP. GALS. FOR WARM UP.

TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE

RETURN FUEL FLOWS TO TANK ____

USE FUEL FROM TANKS IN THE FOLLOWING ORDER ____

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour

F.T.: Full Throttle
S.L.: Sea Level

A.R.: Auto Rich
A.L.: Auto Lean

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-H-8 DEC. 18, 1942 — FORM ASC-511

MODEL (S) P-38H

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 1 SHEETS

GR. WT. 17,700 TO 13,500 POUNDS

EXTERNAL LOAD ITEMS
150 OR 75 GALLON TANKS OR 1,100 LB. BOMB

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.
TAKE-OFF	3000	54	-	A.R.	15	162
MILITARY POWER	3000	54	-	A.R.	15	162
ENGINE (S)	V-1710-89 (R.H.); -91 (L.H.)					

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL U.S. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
AT S.L.	AT 12,000	AT S.L.	AT 12,000	613		43 U. S. Gallons not available in flight.					613		
	740		640	570	1070	930	1290	1120	1650	1430	570	1870	1620
	670		580	520	970	850	1180	1020	1500	1300	520	1700	1470
	610		530	470	880	760	1070	930	1360	1180	470	1520	1320
	540		470	420	790	680	950	830	1210	1050	420	1350	1170
	480		420	370	690	600	840	730	1070	930	370	1180	1030
	410		360	320	600	520	730	630	920	800	320	1020	890
	350		300	270	510	440	610	530	780	680	270	850	740
	280		250	220	410	360	500	430	640	550	220	690	600
	220		190	170	320	280	390	330	490	430	170	530	460
	160		130	120	220	200	270	240	350	300	120	370	320
	90		80	70	130	110	160	140	200	180	70	220	190

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.	(1) DENSITY ALT. IN FEET
2600		A.R.	35	172	345	30000
2600		A.R.	40	220	360	25000
2600		A.R.	41	228	350	20000
2600		A.R.	41	228	335	15000
2600		A.R.	41	228	330	12000
2600		A.R.	41	228	320	9000
2600		A.R.	41	228	315	6000
2600		A.R.	41	228	305	3000
2600		A.R.	41	228	300	S.L.

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.
2350	235	A.R.	35	162	
2300	245	A.R.	35	154	
2300	255	A.R.	34	147	
2300	255	A.R.	33	142	
2300	260	A.R.	33	138	
2300	265	A.R.	32	133	
2300	265	A.R.	32	128	
2300	270	A.L.	31	115	

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.
2300	200	A.R.	32	126	
2300	225	A.L.	31	115	
2300	230	A.L.	31	115	
2300	240	A.L.	31	115	
2250	240	A.L.	31	110	
2250	245	A.L.	31	108	
2200	250	A.L.	30	104	
2200	250	A.L.	30	100	
2200	250	A.L.	29	96	

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.
2050	195	A.L.	27	75	
2000	195	A.L.	27	72	
2000	195	A.L.	26	68	
2000	195	A.L.	26	66	
1950	195	A.L.	25	64	
1950	200	A.L.	25	62	

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIXTURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.	(1) DENSITY ALT. IN FEET
2200	180	A.L.	28	88		30000
2050	180	A.L.	28	80		25000
1850	180	A.L.	27	73		20000
1700	180	A.L.	27	68		15000
1600	180	A.L.	27	64		12000
1600	180	A.L.	26	61		9000
1600	180	A.L.	25	59		6000
1600	180	A.L.	24	56		3000
1600	180	A.L.	23	54		S.L.

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 43 U. S. GALS. _____ IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK _____
USE FUEL FROM TANKS IN THE FOLLOWING ORDER _____

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour

F.T.: Full Throttle
S.L.: Sea Level

A.R.: Auto Rich
A.L.: Auto Lean

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-H-8 DEC. 18, 1942
FORM ASC-511

MODEL (S) P-38H

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 1 SHEETS

GR. WT. 19,500 TO 13,700 POUNDS

EXTERNAL LOAD ITEMS 300 GALLON TANKS

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.
TAKE-OFF	3000	54	--	A.R.	15	162
MILITARY POWER	3000	54	--	A.R.	15	162
ENGINE (S)	V-1710-89 (R.H.): -91 (L.H.)					

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. **NOTES:** (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND) **ALTERNATE CRUISING CONDITIONS** (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL U.S. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STAYUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
AT S.L.	AT 12,000	AT S.L.	AT 12,000										
				938		48 U. S. Gallons not available in flight.					938		
	1110		970	890	1600	1390	1920	1670	2100	1820	890	2640	2290
	1010		880	810	1410	1260	1750	1520	1910	1660	810	2380	2070
	910		790	730	1310	1140	1570	1370	1720	1490	730	2130	1850
	810		710	650	1170	1010	1400	1220	1530	1330	650	1880	1630
	710		620	570	1030	890	1230	1070	1340	1170	570	1640	1420
	610		530	490	880	770	1060	920	1150	1000	490	1390	1210
	510		450	410	740	640	880	770	970	840	410	1160	1000
	410		360	330	590	520	710	620	780	680	330	920	800
	310		270	250	450	390	540	470	590	510	250	690	600
	210		180	170	310	270	370	320	400	350	170	470	410
	110		100	90	160	140	190	170	210	180	90	250	210

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.	OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.
2600		A.R.	35	172	320	30000							2300	180	A.L.	31	115		30000	2200	175	A.L.	31	95	
2600		A.R.	40	220	340	25000	2350	225	A.R.	35	160		2300	195	A.L.	31	115		25000	2050	175	A.L.	30	87	
2600		A.R.	41	228	335	20000	2300	235	A.R.	35	154		2300	215	A.L.	31	115		20000	1850	175	A.L.	30	80	
2600		A.R.	41	228	325	15000	2300	245	A.R.	34	147		2300	230	A.L.	31	115		15000	1700	170	A.L.	29	74	
2600		A.R.	41	228	315	12000	2300	245	A.R.	33	142		2250	235	A.L.	31	112		12000	1600	170	A.L.	29	70	
2600		A.R.	41	228	310	9000	2300	250	A.R.	33	138		2250	235	A.L.	31	108		9000	1600	170	A.L.	28	67	
2600		A.R.	41	228	305	6000	2300	255	A.R.	32	133		2200	240	A.L.	31	105		6000	1600	170	A.L.	27	64	
2600		A.R.	41	228	300	3000	2300	255	A.R.	32	128		2200	240	A.L.	30	102		3000	1600	170	A.L.	26	61	
2600		A.R.	41	228	290	S.L.	2300	260	A.L.	31	115		2200	245	A.L.	30	98		S.L.	1600	170	A.L.	25	59	

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	TAS M.P.H.
2250	190	A.L.	31	107	
2200	205	A.L.	31	105	
2200	210	A.L.	30	99	
2150	215	A.L.	30	96	
2150	215	A.L.	29	91	
2150	220	A.L.	29	89	
2100	220	A.L.	28	86	
2100	225	A.L.	28	84	

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.
(2) ALLOW 48 U. S. GALS., _____ IMP. GALS. FOR WARM UP,
TAKE-OFF AND CLIMB TO 5,000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK _____
USE FUEL FROM TANKS IN THE FOLLOWING ORDER _____

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour
F.T.: Full Throttle
S.L.: Sea Level
A.R.: Auto Rich
A.L.: Auto Lean

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

SPEC. AN-H-8 DEC. 18, 1942 — T.O. No. ASC-511

MODEL (S) P-38H

SINGLE ENGINE OPERATION

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 1 SHEETS

GR. WT. 15,700 TO 13,500 POUNDS

EXTERNAL LOAD ITEMS
DEAD PROPELLER FEATHERED

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.
TAKE-OFF	3000	54	-	A.R.	15	162
MILITARY POWER	3000	54	-	A.R.	15	162
ENGINE (S)	V-1710-89 (R.H.); -91 (L.H.)					

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) — (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES				FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL U.S. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE		NAUTICAL			STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
AT S.L.	AT 6,000	AT S.L.	AT 6,000										
	550		480	300	600	520	670	580	830	720	300	880	760
	510		440	275	550	480	610	530	760	660	275	810	700
	460		400	250	500	430	560	490	690	600	250	740	640
	420		360	225	450	390	500	430	620	540	225	660	570
	370		320	200	400	350	450	390	550	480	200	590	510
	320		280	175	350	300	390	340	480	420	175	510	440
	280		240	150	300	260	330	290	420	370	150	440	380
	230		200	125	250	220	280	240	350	300	125	370	320
	180		160	100	200	170	220	190	280	240	100	290	250
	140		120	75	150	130	170	150	210	180	75	220	190
	90		80	50	100	90	110	100	140	120	50	150	130
	50		40	25	50	40	60	50	70	60	25	70	60

OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA						OPERATING DATA						OPERATING DATA						(1) DENSITY ALT. IN FEET	OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S. M.P.H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S. M.P.H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S. M.P.H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S. M.P.H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	T.A.S. M.P.H.
						30000																			30000					
						25000																			25000					
2600		A.R.	41	114	255	20000	2600	185	A.R.	41	114		2400	160	A.R.	37	90								20000					
2600		A.R.	41	114	250	15000	2550	195	A.R.	40	108		2400	170	A.R.	37	88								15000					
2600		A.R.	41	114	245	12000	2500	195	A.R.	40	105		2400	175	A.R.	37	87								12000					
2600		A.R.	41	114	240	9000	2500	200	A.R.	39	102		2350	180	A.R.	37	85								9000					
2600		A.R.	41	114	235	6000	2500	210	A.R.	39	100		2350	190	A.R.	36	85		2300	155	A.L.	31	57		6000					
2600		A.R.	41	114	230	3000	2450	210	A.R.	39	97		2350	195	A.R.	36	83		2300	165	A.L.	31	58		3000					
2600		A.R.	41	114	225	S.L.	2450	20	A.R.	38	95		2350	200	A.R.	36	81		2300	175	A.L.	31	58		S.L.	2200	155	A.L.	30	41	

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW _____ U. S. GALS. _____ IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO _____ FEET ALTITUDE
RETURN FUEL FLOWS TO TANK _____.
USE FUEL FROM TANKS IN THE FOLLOWING ORDER _____

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour

A.R.: Auto Rich
A.L.: Auto Lean

F.T.: Full Throttle
S.L.: Sea Level

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

SINGLE ENGINE OPERATION

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

MODEL (S)
P-38J
F-5B

FLIGHT OPERATION INSTRUCTION CHART
SHEET 1 OF 1 SHEETS

GR. WT. 16200 LB TO 13500 POUNDS

EXTERNAL LOAD ITEMS
EXTERNAL TANK SUPPORTS ONLY

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.
TAKE-OFF	3000	54	—	A-R	5	322
MILITARY POWER	3000	54	—	A-R	15	322
ENGINE (S)	V-1710-89 (RH) AND V-1710-91 (LH)					

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES		FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL U.S. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		300	50 U.S. GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT.						300		
340	300	250	470	410	610	530	740	640	250	870	760
310	270	230	440	380	560	490	680	590	230	800	700
290	250	210	400	350	510	440	620	540	210	730	640
260	230	190	360	310	460	400	560	490	190	660	580
230	200	170	320	280	410	360	500	440	170	590	520
210	180	150	280	250	360	320	440	390	150	520	450
180	150	130	250	210	320	270	380	330	130	450	390
150	130	110	210	180	270	230	330	280	110	380	330
120	110	90	170	150	220	190	270	230	90	310	270
100	80	70	130	120	170	150	210	180	70	240	210
70	60	50	90	80	120	110	150	130	50	170	150

OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.	(1) DENSITY ALT. IN FEET	OPERATING DATA R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G.P.H.
2600	263	A.R.	44	253	30000	2400	245	A.R.	37	179	2200	230	A.L.	34	133	2200	210	A.L.	30	101	30000					
2600	272	A.R.	44	253	25000	2350	246	A.R.	35	166	2100	233	A.L.	34	123	2000	211	A.L.	30	93	25000					
2600	281	A.R.	44	253	20000	2300	249	A.R.	34	154	2000	234	A.L.	33	114	1800	212	A.L.	30	86	20000	1800	180	A.L.	26	64
2600	290	A.R.	44	253	15000	2300	254	A.L.	34	143	1900	237	A.L.	33	106	1600	211	A.L.	31	80	15000	1600	173	A.L.	25	57
2600	297	A.R.	44	253	12000	2300	259	A.L.	34	142	1800	237	A.L.	33	102	1600	211	A.L.	30	76	12000	1600	174	A.L.	25	54
2600	301	A.R.	44	253	9000	2250	261	A.L.	34	136	1750	237	A.L.	33	97	1600	211	A.L.	29	72	9000	1600	172	A.L.	24	51
2600	306	A.R.	44	253	6000	2200	262	A.L.	34	131	1700	238	A.L.	32	93	1600	210	A.L.	28	69	6000	1600	171	A.L.	23	49
2600	311	A.R.	44	253	3000	2100	264	A.L.	34	126	1600	237	A.L.	32	89	1600	209	A.L.	28	66	3000	1600	171	A.L.	23	47
2600	314	A.R.	44	253	S.L.	2050	266	A.L.	34	122	1600	238	A.L.	32	86	1600	208	A.L.	27	63	S.L.	1600	170	A.L.	22	45

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 50 U. S. GALS. _____ IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO 5000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK RESERVES (FRONT)
USE FUEL FROM TANKS IN THE FOLLOWING ORDER RESERVES (15 MINUTES), MAINS, RESERVES

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour

F.T.: Full Throttle
A.R.: Auto Rich
A.L.: Auto Lean

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

MODEL (S)
P-38J
F-5B

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 1 SHEETS

GR. WT. 18200 LB TO 13500 POUNDS

EXTERNAL LOAD ITEMS
TWO 150 GALLON TANKS

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	
TAKE-OFF	3000	54		A-R	5	322	
MILITARY POWER	3000	54		A-R	15	322	
ENGINE (S)	V-1710-89 (RH) AND V-1710-91 (LH)						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES		FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL U.S. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		630	60 U.S. GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT.						630		
720	620	570	910	790	1100	960	1300	1120	570	1490	1290
660	570	520	830	720	1010	870	1180	1030	520	1360	1180
590	510	470	750	650	910	790	1070	930	470	1230	1070
530	460	420	670	580	810	710	950	830	420	1100	950
470	400	370	590	510	720	620	840	730	370	970	840
400	350	320	510	440	620	540	730	630	320	840	730
340	300	270	430	370	520	450	610	530	270	700	610
280	240	220	350	310	430	370	500	430	220	570	500
210	190	170	270	240	330	290	390	340	170	440	390
150	130	120	190	170	230	200	270	240	120	310	270
90	80	70	110	100	140	120	160	140	70	180	160

OPERATING DATA					(1) DENSITY ALT. IN FEET	OPERATING DATA					OPERATING DATA					OPERATING DATA					(1) DENSITY ALT. IN FEET	OPERATING DATA				
R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.
2600	241	A. R.	44	253	30000	2450	226	A. R.	38	198	2300	206	A. L.	34	143	2200	196	A. L.	33	125	30000	2200	178	A. L.	30	101
2600	248	A. R.	44	253	25000	2400	228	A. R.	37	183	2300	216	A. L.	34	143	2000	201	A. L.	33	117	25000	2000	178	A. L.	30	93
2600	255	A. R.	44	253	20000	2350	230	A. R.	36	171	2250	220	A. L.	34	136	1900	203	A. L.	33	109	20000	1800	180	A. L.	30	86
2600	262	A. R.	44	253	15000	2300	233	A. R.	35	160	2150	224	A. L.	34	127	1800	208	A. L.	33	101	15000	1600	182	A. L.	31	80
2600	267	A. R.	44	253	12000	2300	235	A. R.	34	154	2100	226	A. L.	34	123	1750	207	A. L.	33	97	12000	1600	180	A. L.	30	75
2600	272	A. R.	44	253	9000	2300	239	A. R.	34	143	2000	227	A. L.	33	117	1650	208	A. L.	32	93	9000	1600	181	A. L.	29	73
2600	276	A. R.	44	253	6000	2300	243	A. L.	34	143	1950	226	A. L.	33	113	1600	207	A. L.	32	89	6000	1600	180	A. L.	28	69
2600	281	A. R.	44	253	3000	2250	246	A. L.	34	140	1900	228	A. L.	33	108	1600	207	A. L.	31	85	3000	1600	181	A. L.	28	67
2600	286	A. R.	44	253	S. L.	2200	247	A. L.	34	135	1850	229	A. L.	33	104	1600	208	A. L.	31	82	S. L.	1600	177	A. L.	27	62

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 60 U. S. GALS. _____ IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO 5000 FEET ALTITUDE
RETURN FUEL FLOWS TO TANK RESERVES (FRONT)
USE FUEL FROM TANKS IN THE FOLLOWING ORDER RESERVES (15 MINUTES), DROP TANKS, MAINS, RESERVES

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour

F.T.: Full Throttle
A. R.: Auto Rich
A. L.: Auto Lean

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

MODEL (S)
P-38J
F-5B

FLIGHT OPERATION INSTRUCTION CHART
SHEET....1.....OF.....1.....SHEETS

GR. WT.....19600 LB.....TO.....13700.....POUNDS

EXTERNAL LOAD ITEMS
TWO 300 GALLON TANKS

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.
TAKE-OFF	3000	54	-	A-R	5	322
MILITARY POWER	3000	54	-	A-R	15	322
ENGINE (S)	V-1710-89 (RH) AND V-1710-91 (LH)					

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

(NO WIND) **ALTERNATE CRUISING CONDITIONS** (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER) RANGE IN AIR MILES		FUEL U.S. GALS. (2)	II RANGE IN AIR MILES		III RANGE IN AIR MILES		IV RANGE IN AIR MILES		FUEL U.S. GALS. (2)	V (MAX. RANGE) RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
		950	60 U.S. GAL. TAKE-OFF & CLIMB TO 5000 FT. ALLOWANCE NOT AVAILABLE IN FLIGHT.						950		
1090	950	890	1330	1160	1590	1390	1830	1590	890	2080	1810
990	860	810	1210	1050	1440	1250	1670	1450	810	1900	1650
890	780	730	1090	950	1300	1130	1500	1310	730	1710	1480
800	690	650	970	850	1160	1010	1340	1160	650	1520	1320
700	610	570	850	740	1020	880	1170	1020	570	1330	1160
600	520	490	730	640	870	760	1010	880	490	1150	1000
500	440	410	610	530	730	630	850	730	410	960	830
400	350	330	490	430	590	510	680	590	570	770	670
310	270	250	370	330	450	390	520	450	250	590	510
210	180	170	250	220	300	260	350	300	170	400	350
110	100	90	130	120	160	140	190	160	90	210	180

OPERATING DATA					(1) DENSITY ALT. IN FEET	OPERATING DATA					OPERATING DATA					OPERATING DATA					(1) DENSITY ALT. IN FEET	OPERATING DATA				
R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.
2600	234	A.R.	44	253	30000	2450	220	A.R.	39	207	2350	200	A.R.	35	162	2250	191	A.L.	34	136	30000	2200	170	A.L.	31	108
2600	240	A.R.	44	253	25000	2400	223	A.R.	38	191	2300	206	A.L.	34	143	2150	197	A.L.	34	127	25000	2000	175	A.L.	32	102
2600	248	A.R.	44	253	20000	2350	225	A.R.	36	178	2300	215	A.L.	34	143	2050	200	A.L.	34	119	20000	1800	180	A.L.	32	96
2600	255	A.R.	44	253	15000	2350	229	A.R.	35	166	2250	220	A.L.	34	136	1950	203	A.L.	33	111	15000	1600	182	A.L.	32	89
2600	260	A.R.	44	253	12000	2300	231	A.R.	35	160	2150	221	A.L.	34	131	1900	205	A.L.	33	106	12000	1600	183	A.L.	32	85
2600	265	A.R.	44	253	9000	2300	232	A.R.	34	154	2100	223	A.L.	34	126	1800	206	A.L.	33	102	9000	1600	185	A.L.	31	82
2600	270	A.R.	44	253	6000	2300	235	A.L.	34	143	2050	225	A.L.	34	121	1750	207	A.L.	33	98	6000	1600	183	A.L.	30	78
2600	275	A.R.	44	253	3000	2300	239	A.L.	34	143	2000	226	A.L.	33	118	1700	209	A.L.	33	94	3000	1600	183	A.L.	29	74
2600	279	A.R.	44	253	S.L.	2300	243	A.L.	34	141	1950	228	A.L.	33	112	1650	211	A.L.	32	91	S.L.	1600	183	A.L.	29	71

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.

(2) ALLOW 60 U. S. GALS. _____ IMP. GALS. FOR WARM UP,
TAKE-OFF AND CLIMB TO 5000 FEET ALTITUDE

RETURN FUEL FLOWS TO TANK RESERVES (FRONT)

USE FUEL FROM TANKS IN THE FOLLOWING ORDER RESERVES (15 MINUTES), DROP TANKS, MAINS, RESERVES.

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour

F.T.: Full Throttle
A. R.: Auto Rich
A. L.: Auto Lean

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK

11-20-42

MODEL (S) P-38J AND F-5B

SINGLE ENGINE OPERATION

FLIGHT OPERATION INSTRUCTION CHART

SHEET 1 OF 1 SHEETS

GR. WT. 16200 LB TO 13500 POUNDS

EXTERNAL LOAD ITEMS

SINGLE ENGINE OPERATION
DEAD PROPELLOR FEATHERED
EXTERNAL TANK SUPPORTS ONLY

CONDITION	R.P.M.	M.P. (IN. HG.)	BLOWER POSITION	MIXTURE POSITION	DURATION IN MIN.	U.S. G.P.H.	
TAKE-OFF			IMPOSSIBLE				
MILITARY POWER	3000	54		A-R	15	322	
ENGINE (S)	V-1710-89 (RH) AND V-1710-91 (LH)						

INSTRUCTIONS FOR USING CHART: Select figure in fuel column equal to or less than total amount of fuel in airplane. Move horizontally to the right or left and select a figure equal to or greater than the air miles to be flown. Vertically below and opposite desired cruising altitude read optimum cruising conditions. *NOTES:* (A) Avoid continuous cruising in Column I except in emergency. (B) Columns (II, III, IV & V) toward the right progressively give increase in range at sacrifice in speed. (C) Manifold Pressure (M.P.), Gallons Per Hour (G.P.H.), are approximate maximum values for reference. (D) For quick reference, take-off and military power data are listed in the upper left corner of chart.

ALTERNATE CRUISING CONDITIONS

(NO WIND) (NO RESERVE FUEL ALLOWANCE)

I (MAX. CONT. POWER)		FUEL U. S. GALS. (2)	II		III		IV		FUEL U. S. GALS. (2)	V (MAX. RANGE)	
RANGE IN AIR MILES			RANGE IN AIR MILES		RANGE IN AIR MILES		RANGE IN AIR MILES			RANGE IN AIR MILES	
STATUTE	NAUTICAL		STATUTE	NAUTICAL	STATUTE	NAUTICAL	STATUTE	NAUTICAL		STATUTE	NAUTICAL
530	460	300	600	520	660	580	750	650	300	820	710
490	430	275	550	480	610	530	690	600	275	750	650
450	390	250	500	430	550	480	620	540	250	680	590
400	350	225	450	390	500	430	560	490	225	610	530
360	310	200	400	350	440	380	500	430	200	540	470
310	270	175	350	300	390	340	440	380	175	480	410
270	230	150	300	260	330	290	370	320	150	410	350
220	190	125	250	220	280	240	310	270	125	340	300
180	150	100	200	170	220	190	250	220	100	270	240
130	120	75	150	130	170	140	190	160	75	200	180
90	80	50	100	90	110	100	120	110	50	140	120
40	40	25	50	40	60	50	60	50	25	70	60

OPERATING DATA						OPERATING DATA						OPERATING DATA						OPERATING DATA						OPERATING DATA					
R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.		R.P.M.	I.A.S. M.P.H.	MIX-TURE	M.P. IN. Hg	U.S. G. P. H.	
					30000																		30000						
2600	179	A.R.	44	127	25000	2550	172	A.R.	42	118													25000						
2600	191	A.R.	44	127	20000	2500	179	A.R.	41	112		2400	156	A.R.	37	90							20000						
2600	201	A.R.	44	127	15000	2500	185	A.R.	40	107		2350	167	A.R.	36	88		2300	151	A.L.	34	72	15000						
2600	205	A.R.	44	127	12000	2450	189	A.R.	39	103		2350	173	A.R.	36	86		2300	160	A.L.	34	72	12000						
2600	211	A.R.	44	127	9000	2450	192	A.R.	38	99		2350	177	A.R.	35	84		2300	168	A.L.	34	72	9000						
2600	217	A.R.	44	127	6000	2400	195	A.R.	38	96		2350	181	A.R.	35	82		2250	173	A.L.	34	70	6000						
2600	222	A.R.	44	127	3000	2400	197	A.R.	37	93		2300	185	A.R.	35	79		2250	177	A.L.	34	68	3000	1950	154	A.L.	33	56	
2600	226	A.R.	44	127	S.L.	2400	201	A.R.	37	90		2300	188	A.R.	34	77		2200	182	A.L.	34	67	S.L.	1950	162	A.L.	33	55	

LEGEND

(1) INDICATED ALTITUDE CORRECTED FOR FREE AIR TEMPERATURE.
(2) ALLOW _____ U. S. GALS. _____ IMP. GALS. FOR WARM UP.
TAKE-OFF AND CLIMB TO _____ FEET ALTITUDE
RETURN FUEL FLOWS TO TANK RESERVE (FRONT)
USE FUEL FROM TANKS IN THE FOLLOWING ORDER DROP TANKS (LIVE ENGINE THEN DEAD ENGINE), MAINS, RESERVES.

REFER TO "SPECIFIC ENGINE FLIGHT CHART" FOR ADDITIONAL ENGINE OPERATION DATA.

I.A.S.: Indicated Air Speed
M.P.: Manifold Pressure (In. Hg)
U.S.G.P.H.: U. S. Gallons Per Hour

F.T.: Full Throttle
A. R.: Auto Rich
A. L.: Auto Lean

RED FIGURES ARE PRELIMINARY: SUBJECT TO REVISION AFTER FLIGHT CHECK