RESTRICTED PRELIMINARY

PILOT'S HANDBOOK

Model BTD-1

DOUGLAS

PILOT'S HANDBOOK

The instructions contained in this handbook are furnished for the operator's information and without any warranty incident thereto. Furthermore, the Douglas Aircraft Company, Incorporated, reserves the right to revise or change the aforementioned information (approved by the Bureau of Aeronautics) whenever advanced methods of operation are introduced.

PILOT'S HANDBOOK

MODEL BTD-1

NAVY SPEC. NO. SD-354

CONTRACT NOα(s) 743

DOUGLAS AIRCRAFT CO., INC.

EL SEGUNDO PLANT EL SEGUNDO, CALIFORNIA

FEBRUARY 10, 1944 Copy No. 280183

To the Pilot

This handbook has been prepared to acquaint you with the design and characteristics of the Douglas Destroyer. In the handbook you will find the necessary instructions for operating the airplane -- both normal and emergency -- and for the operation of installed equipment. Flight charts, tables, and curves are also included for your reference.

The pilot's handbook does not presume to instruct you in general flying technique. It was written to familiarize you with this particular airplane and to assist you in understanding its peculiarities. By following the instructions and heeding the warnings contained herein, you should gain maximum efficiency and performance from your airplane.

DOUGLAS AIRCRAFT COMPANY, INC.

El Segundo Plant

El Segundo, California

C O N T E N T S

I L L U S T R A T I O N S

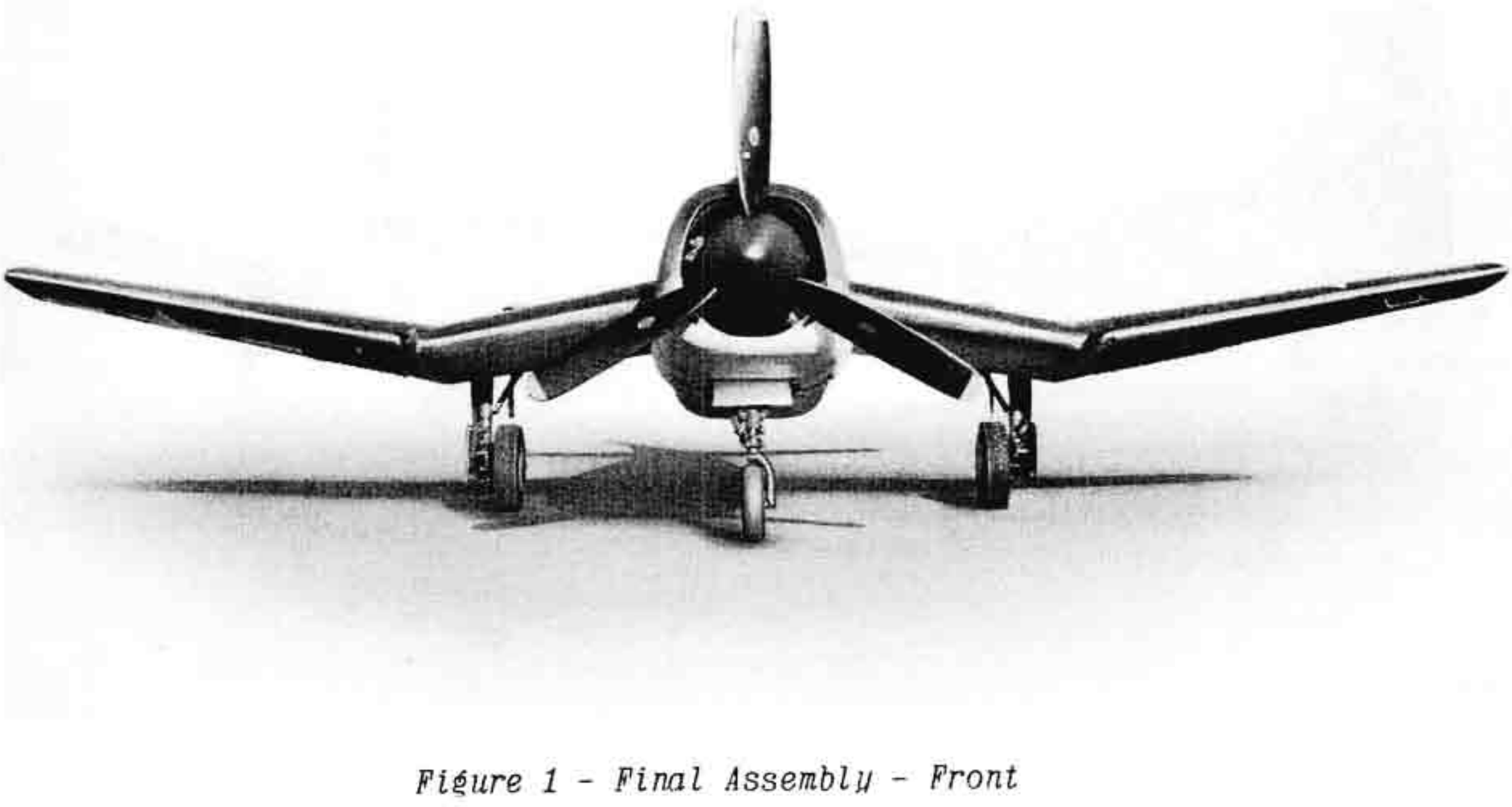


Figure 1 - Final Assembly - Front

Figure 2 - Final Assembly - Left Front

Figure 3 - Final Assembly - Right Rear

Figure 4 - Final Assembly - Rear

L E A D I N G P A R T I C U L A R S

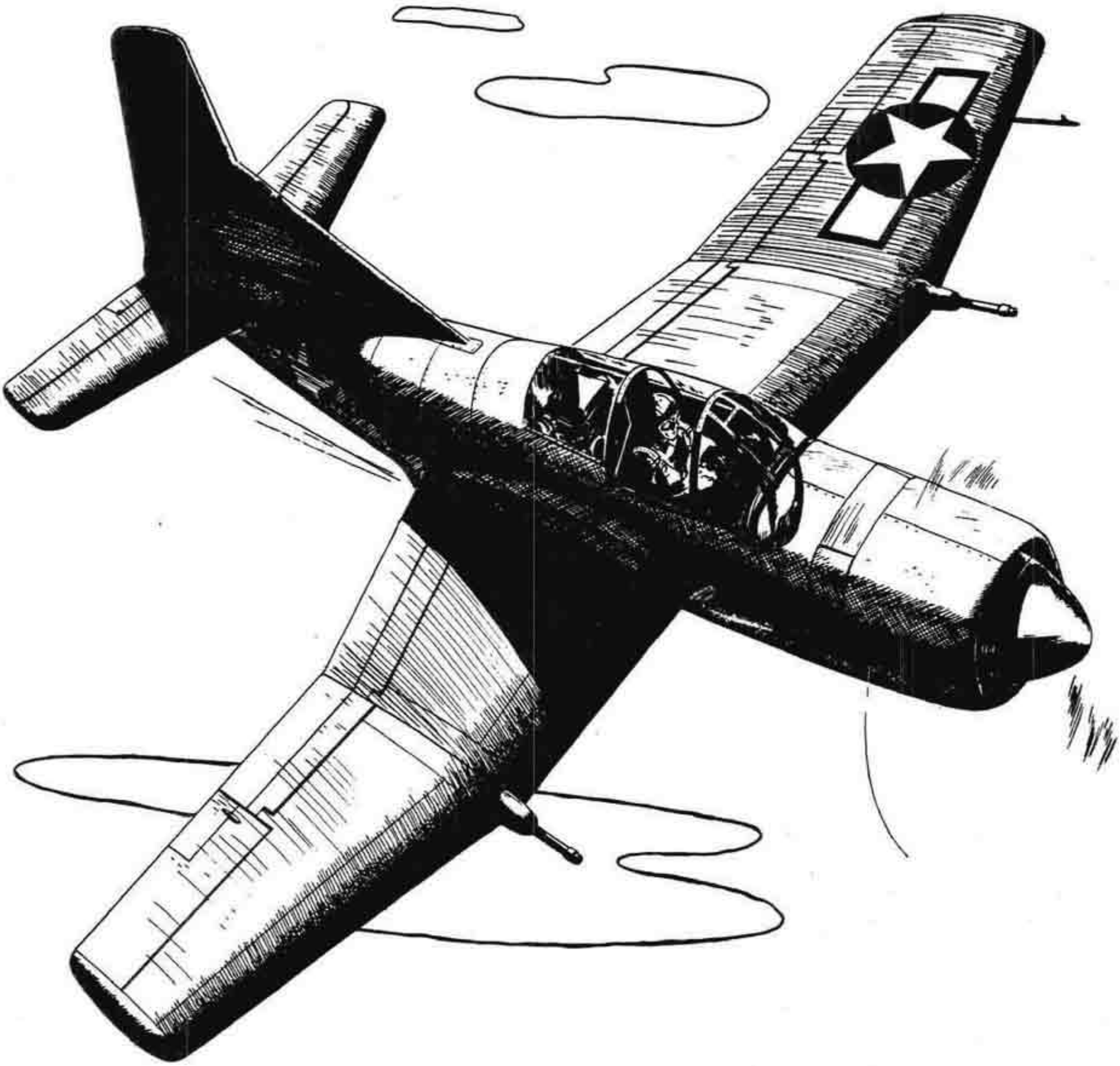
PRINCIPAL CHARACTERISTICS

Length	38 ft 6.7 in.
Height - Wings Folded	16 ft 2.0 in.
Height - Wings Spread	13 ft 6.5 in.
Span	45 ft 0 in.
Approximate Fuel Capacity (Without Droppable Tanks). .	490 gal (408 imp. gal)
Normal Rated Power	2100 bhp
	2400 rpm
	44.2 in. Hg
Maximum Engine Overspeed	3000 rpm

FLIGHT RESTRICTIONS

Prolonged Inverted Flight	Prohibited
Landing Gear Extension - Maximum	130 knots IAS
Wing Flap Extension - Maximum	130 knots IAS
Air Speed - Maximum	455 knots IAS

Section 1



DESCRIPTION

Airplane and Controls

SECTION I

DESCRIPTION

1. AIRPLANE.

The Model BTD-1 is a single-engined, midwing monoplane, capable of carrying out missions usually assigned to dive bombers and torpedo planes. This single-seater airplane is designed for catapulting as well as for normal ground and carrier take-offs.

The airplane is powered by a Wright Cyclone, 18-cylinder, double-row, radial, air-cooled engine (model R3350-14). The engine drives a three-bladed, Hamilton Standard hydromatic, constant-speed propeller and is equipped with a Bendix Stromberg injection carburetor.

The fire power consists of two forward-firing, 20-mm wing guns. Provisions are made for a maximum bomb load of two 1600-pound demolition bombs to be carried in the bomb bay or two Mark 13-1 or 13-2 torpedoes to be carried under the fuselage. Each wing panel is equipped with a bomb rack and is capable of carrying a 100-pound bomb as an alternative bomb load.

Foot and hand holds are provided on the right side of the airplane, and the enclosure slides aft to permit entrance to the cockpit.

2. CONTROLS.

All of the controls are conveniently located in the cockpit. The secondary flight controls are grouped in three banks of levers to the left of the instrument panel. The engine control quadrant is on the left side of the cockpit. The electric panel is to the right of the seat.

a. FLIGHT CONTROLS.

(1) CONTROL STICK AND RUDDER PEDALS.

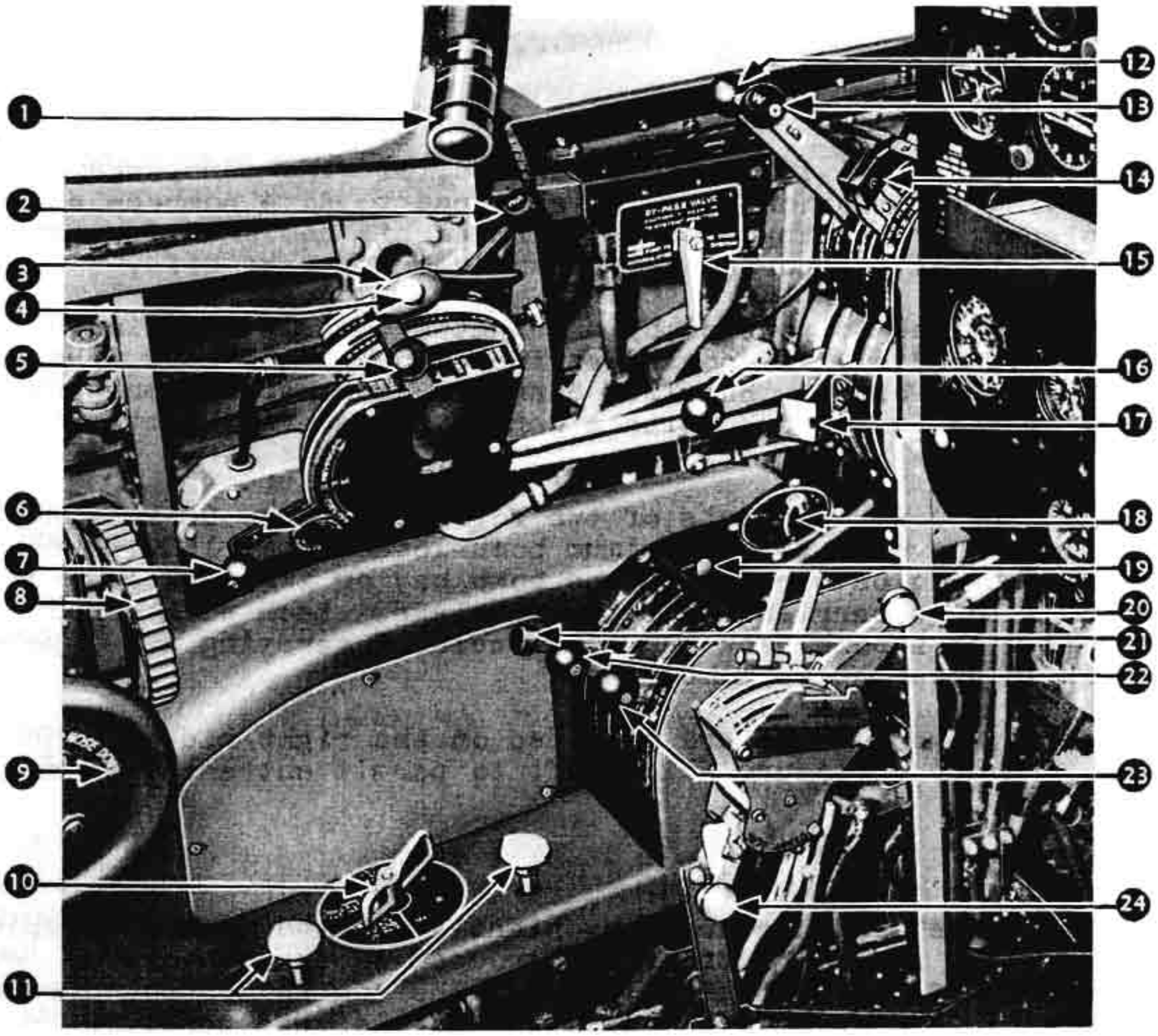
Location: Conventional. Gun trigger and bomb release switches are incorporated in control stick handle (figure 20).

Operation: Conventional.

(2) TRIM TAB CONTROL WHEELS AND POSITION INDICATORS.

Location: Trim tab control box to left of pilot (figure 5-8,9).

Operation: Conventional.



1. Cockpit Light
2. Supercharger Control
3. Throttle
4. Throttle Radio Switch
5. Mixture Control
6. Propeller Governor Adjustment Knob
7. Propeller Governor Control
8. Aileron Tab Control
9. Elevator Tab Control
10. Fuel Tank Selector
11. Gun Charger Controls
12. Arresting Hook Control
13. Landing Gear Control
14. Wing Flap Control
15. Hydraulic Bypass Valve Control
16. Bomb Door Control
17. Dive Brake Control
18. Ignition Switch
19. Wing-folding Lock
20. Torpedo and Bomb Manual Release
21. Wing-folding Control
22. Carburetor Air Control
23. Cowl Flap Control
24. Wing Bomb Manual Release

Figure 5 - Cockpit- Left Side

(3) WING-FOLDING CONTROL.

Location: Outboard lever in lower bank of controls (figure 5-21).

Operation: Place lever in "EXTEND" or "FOLD"; return lever to "OFF" when operation has been completed. Folding operation can be stopped at any point by placing lever in "OFF." Small safety lever (figure 5-19) above wing-folding control must be moved before control can be operated.

CAUTION

Keep dive brakes closed when wings are folded.

(4) WING FLAP CONTROL.

Location: Inboard lever--upper bank of controls (figure 5-14); position indicator--incorporated in landing gear and flap position indicator on instrument panel (figure 9).

Operation: Place lever in "UP," "LAND," or index setting for desired flap position. Flaps automatically stop at desired position. When flaps are in desired position, place lever in "OFF." Use flaps to increase gliding angle, not to decrease gliding speed. Do not lower wing flaps above 130 knots IAS.

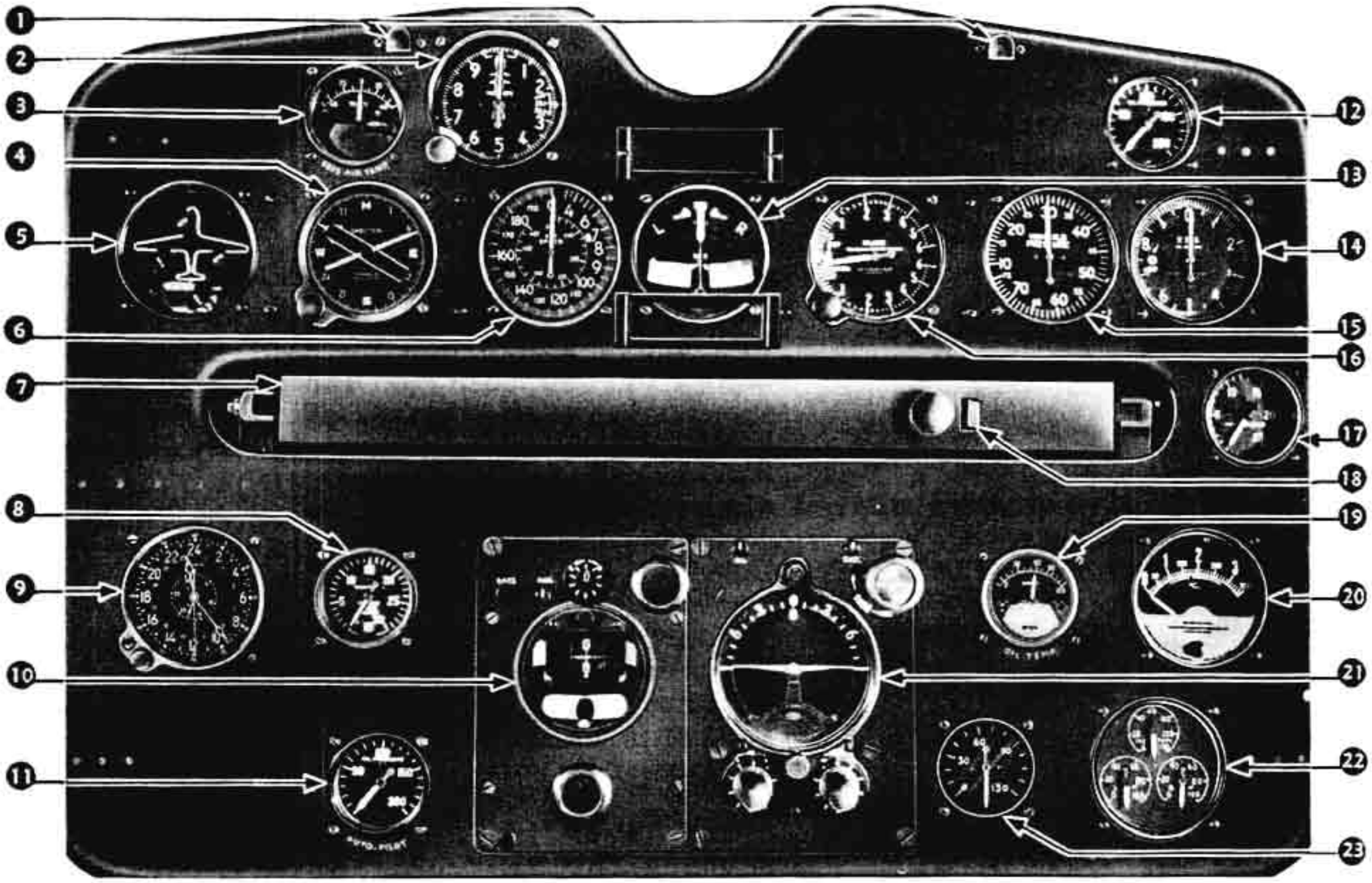
(5) DIVE BRAKE CONTROL.

Location: Inboard lever in center bank of controls (figure 5-17).

Operation: Place lever in "OPEN" or "CLOSE"; return lever to "OFF" after operation has been completed. To partially open brakes, place lever in "OPEN"; when brakes reach desired position, return lever to "OFF." Dive brakes will automatically close after bombs have been released.

CAUTION

When releasing bombs, keep hands away from dive brake and bomb door control handles (figure 5-16).



1. Chartboard Lights
2. Altimeter
3. Free-air Temperature Indicator
4. Remote-compass Indicator
5. Landing Gear and Flap Position Indicator
6. Air-speed Indicator
7. Chartboard
8. Hydraulic Pressure Gage
9. 8-day Clock
10. Directional Gyro
11. Automatic Pilot Oil Pressure Gage
12. Oil Pressure Gage
13. Turn-and-Bank Indicator
14. Tachometer
15. Manifold Pressure Gage
16. Rate-of-climb Indicator
17. Fuel Pressure Gage
18. Inner Chartboard Release
19. Oil Temperature Indicator
20. Cylinder Temperature Indicator
21. Bank-and-Climb Gyro
22. Fuel Level Indicator
23. Fuel Level Indicator (Aft Fus. Tank Reserve)

Figure 6 - Instrument Panel

(6) SURFACE CONTROL LOCK.

Location: Undetermined.

Operation: To lock controls; place channel bar horizontally across rudder pedals; insert locking pins (at each end of channel) into hole on each side of cockpit; insert pin through yoke of bar and eyelet of control stick.

b. POWER PLANT CONTROLS.

(1) THROTTLE.

Location: Center lever (metal handle) in engine control quadrant (figure 7-3).

Operation: Conventional.

(2) MIXTURE CONTROL.

Location: Inboard lever in engine control quadrant (figure 7-4).

Operation: Place lever in "IDLE CUT-OFF," "AUTO LEAN," "AUTO RICH," or "EMER. RICH."

(3) PROPELLER GOVERNOR CONTROL.

Location: Aft lever in engine control quadrant (figure 7-6).

Operation: Move lever upward to "DECREASE RPM" (higher pitch), or downward to "INCREASE RPM" (lower pitch).

NOTE

Small knob (figure 7-5) attached to inboard side of lever permits finer adjustment.

(4) SUPERCHARGER CONTROL.

Location: Outboard lever in engine control quadrant (figure 7-1).

Operation: Shift lever to "LOW BLOWER" or "HIGH BLOWER." When changing from "LOW BLOWER" to "HIGH BLOWER," close throttle partially; then shift controls quickly. Reset throttle.

CAUTION

Make certain that supercharger control is at extreme end of its travel at all times.

(5) CARBURETOR AIR CONTROL.

Location: Center lever in lower bank of controls (figure 5-22).

Operation: Place lever in "DIRECT" for cold air or "ALT" for warm air. Control shall be in "DIRECT" for take-offs, landings, and normal operation except in case of rain, snow, sleet, icing conditions, or inadvertent clogging of external air intake, when control shall be in "ALT."

CAUTION

Keep control in full "DIRECT" or full "ALT" at all times.

(6) COWL FLAP CONTROL.

Use: To control cylinder head temperatures (figure 5-23).

Location: Inboard lever in lower bank of controls.

Operation: Move lever to "OPEN" or "CLOSE"; when operation has been completed, return lever to "OFF." To partially open or close cowl flaps, move lever to "OPEN" or "CLOSE"; when flaps are at desired position, return lever to "OFF."

(7) STARTER AND MESH SWITCH.

Location: In first row of switches on electric panel (figure 10-2).

Operation: Place switch in "STARTER" for energizing; move switch to "MESH" for engaging.

(8) IGNITION SWITCH.

Location: Below center bank of controls--left of instrument panel (figure 5-18).

Operation: Place switch in one of four positions:
"L"--operates left magneto only.
"R"--operates right magneto only.

"BOTH"--operates both magnetos and is normal position.
"OFF"--grounds both magnetos.

(9) ENGINE PRIMER SWITCH.

Location: In first row of switches on electric panel (figure 10-3).

Operation: Move control to "ON."

(10) FUEL TANK SELECTOR CONTROL.

Location: On panel to left of pilot (figure 5-10).

Operation: Turn control to "FWD. FUS. TANK," "R.H. WING TANK," "L.H. WING TANK," "DROPPABLE TANKS," or "AFT FUS. TANK RESERVE." "OFF" cuts fuel flow to engine.

(11) AUXILIARY FUEL PUMP SWITCH.

Use: See section II, paragraph 3.g.(2)(b).

Location: In first row of switches on electric panel (figure 10-4).

Operation: Move switch to "FUEL PUMP."

(12) OIL DILUTION SWITCH.

Use: See section II, paragraph 3.b.(3).

Location: Upper right corner of electric panel (figure 10-20).

Operation: Lift guard and switch to "ON."

(13) OIL COOLER SWITCH.

Location: In first row of switches on electric panel (figure 10-21). Position indicator is on floor, adjacent to right rudder pedal.

Operation: Place switch in "OPEN" or "CLOSED." To partially open or close oil cooler, move switch to "OPEN" or "CLOSED"; release switch when indicator registers desired position. Switch operates to full position before reversing direction of operation.

1. Supercharger Control
2. Throttle Radio Switch
3. Throttle
4. Mixture Control
5. Propeller Governor Adjustment Knob
6. Propeller Governor Control

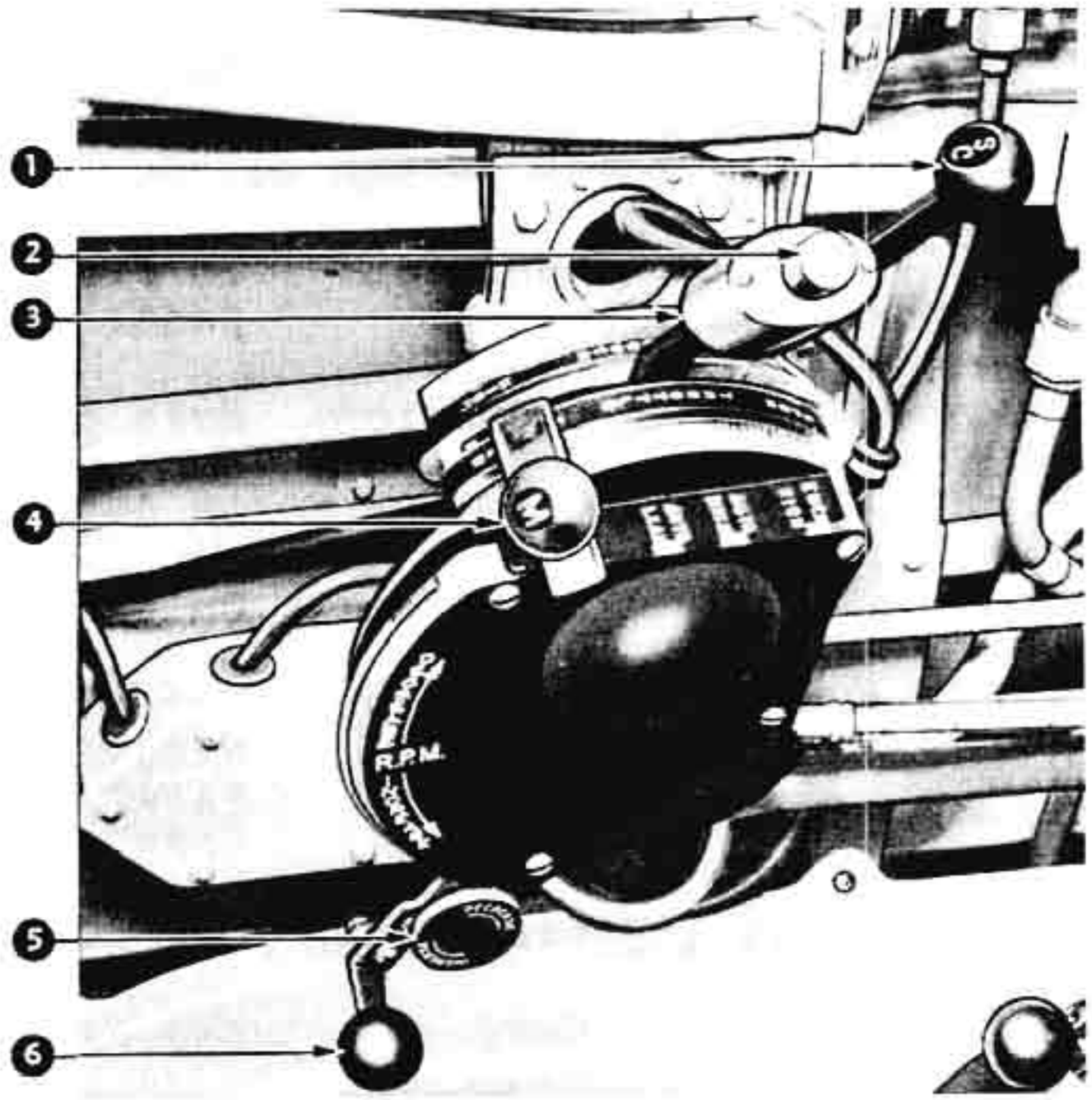


Figure 7 - Engine Control Quadrant

Figure 8 - Emergency Air Brake Control Panel

Figure 9 - Landing Gear and Flap Position Indicator

c. AUXILIARY CONTROLS.

(1) AUTOMATIC PILOT CONTROL.

Location: To right of instrument panel (figure 32), above emergency air brake pressure gage.

Operation: See section V, paragraph 5.a.

(2) LANDING GEAR CONTROL.

Location: Center lever in upper bank of controls (figure 5-13).

Operation: Move lever to "UP" or "DN." To raise gear, move lever to "UP"; when gear is fully retracted, return lever to "OFF." To extend gear, move lever to "DN"; when gear is extended, keep lever in "DN." Lever is automatically locked when airplane is on ground. Position of nose wheel can be checked through window in floor of cockpit. Position indicator for main landing gear and nose wheel is on instrument panel (figure 6-5).

CAUTION

Do not lower landing gear above 130 knots IAS.

Emergency Operation: Nose wheel gear can be extended with air pressure by pulling up handle on floor of cockpit, left side, after selector lever has been placed in "DN." After using emergency extension, inform ground crew to reset valve and bleed system. When hydraulic system fails, main landing gear will operate by force of gravity and action of landing gear bungee. Move selector lever to "DN."

(3) BOMB DOOR CONTROL.

Location: Outboard lever in center bank of controls (figure 5-16).

Operation: Move lever to "OPEN"; when doors are fully opened, return lever to "OFF." Green light below control will illuminate when doors are full open. Doors will

automatically close after bombs are released. When releasing bombs, keep hands away from bomb door and dive brake control handles. To manually close bomb doors, move lever to "CLOSE"; when doors are fully closed, return lever to "OFF."

CAUTION

Do not open bomb doors and extend landing gear simultaneously; interference will result.

Emergency Operation: In case of hydraulic failure, bomb doors can be mechanically opened by pulling hand lever to engage cable system. To open doors: Use hydraulic hand pump handle; place bomb door control in "OPEN"; pull doors open with handle (pull up). To close doors: Place bomb door control in "CLOSED"; pull latch lever up; push doors closed with handle (push down); reduce speed to diminish lever load.

(4) HYDRAULIC HAND PUMP.

Use: To build up pressure in hydraulic system or accumulator and to operate hydraulic units if engine pump fails or when airplane is parked.

Location: To right of pilot.

Operation: Place desired control lever in selected position and work hand pump until unit has functioned.

NOTE

Check position of hydraulic bypass valve before operating hand pump. (See paragraph (5), below.)

(5) HYDRAULIC BYPASS VALVE CONTROL.

Location: Forward of engine control quadrant (figure 5-15).

Operation: When hand pump is used to build up pressure in hydraulic system, move control to "HAND PUMP TO SYSTEM." When hand pump is used to build up pressure in

accumulator, move control to "HAND PUMP TO ACCUMULATOR."

NOTE

Bypass valve control should be kept in "HAND PUMP TO SYSTEM" at all times when hand pump is not in use.

(6) ARRESTING HOOK CONTROL.

Use: For carrier landings only.

Location: Outboard lever in upper bank of controls (figure 5-12).

Operation: Move lever from "OFF" to "UP" or "DN." Approach light automatically illuminates when arresting hook is lowered. Return lever to "OFF" when operation has been completed.

(7) ENGINE FIRE EXTINGUISHER CONTROL.

Location: On control panel to left of pilot.

Operation: Turn handle clockwise and pull.

NOTE

Prior to operating fire extinguisher, engine should be throttled down and cowl flaps and oil cooler doors should be closed.

(8) ELECTRIC PANEL CONTROLS. (figure 10)

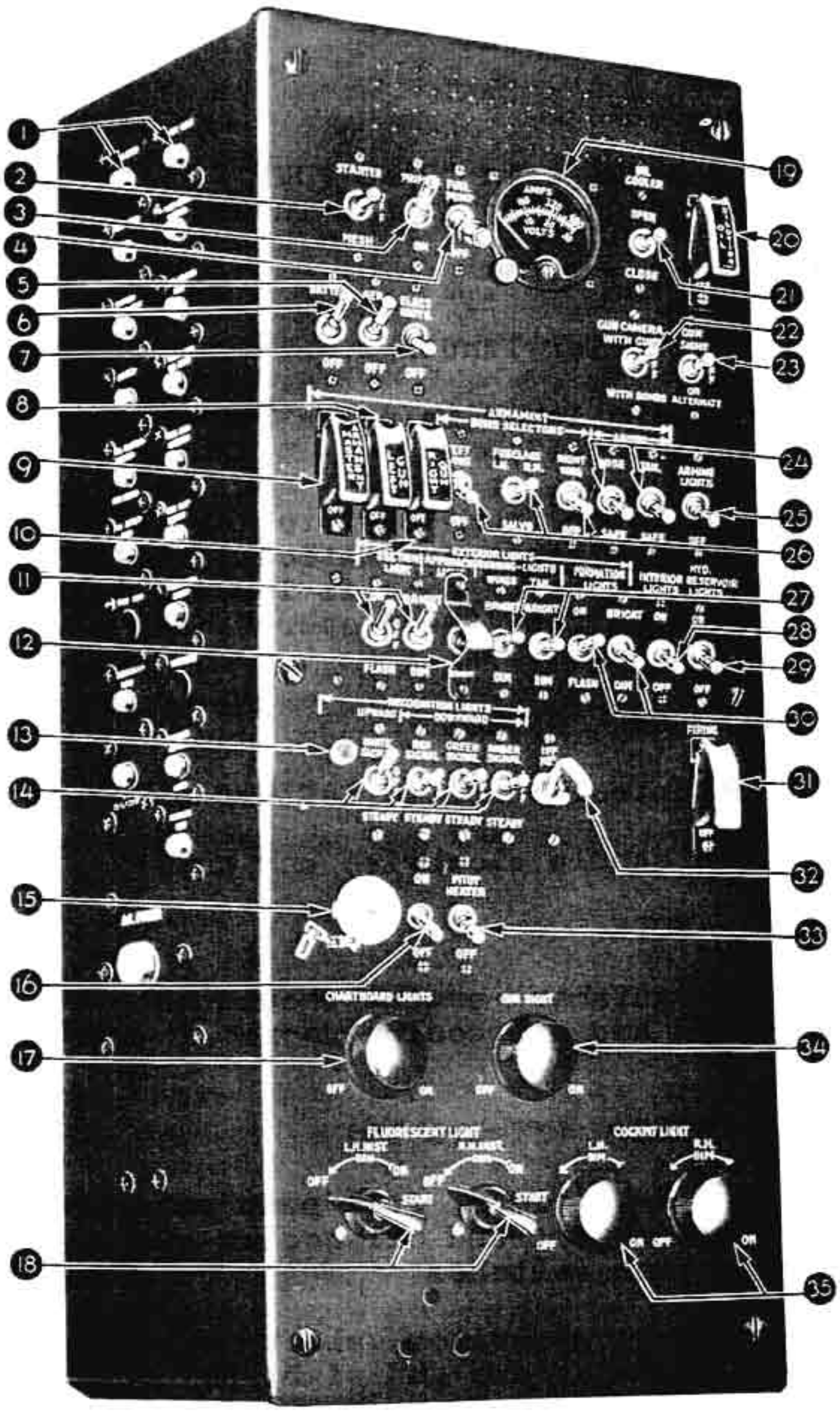
First row: Starter, primer, fuel pump switches; voltammeter; and oil cooler and oil dilution switches.

Second row: Battery, generator, electric instrument, gun camera, and gun sight switches.

Third row: Master armament, left gun, right gun, bomb selector, arming, and arming light switches.

Fourth row: Section light, approach light, running light, formation light, interior light, and hydraulic reservoir light switches.

Fifth row: Recognition light key, recognition light switches, IFF key, and radio firing switch.



1. Circuit Breakers
2. Starter
3. Primer
4. Fuel Pump
5. Generator
6. Battery
7. Electric Instruments
8. Left-gun Selector
9. Master Armament
10. Right-gun Selector
11. Section Light
12. Approach Light
13. Recognition Light Key
14. Recognition Lights
15. Receptacle
16. Receptacle Switch
17. Chartboard Light Rheostat
18. Fluorescent Light Rheostats
19. Volt-ammeter
20. Oil Dilution
21. Oil Cooler
22. Gun Camera
23. Gun Sight Filaments
24. Arming Switches
25. Arming Lights
26. Bomb Selectors
27. Running Lights
28. Interior Lights
29. Reservoir Lights
30. Formation Lights
31. Firing Switch
32. IFF Key
33. Pitot Heater
34. Gun Sight Rheostat
35. Cockpit Light Rheostats

Figure 10 - Electric Panel

Sixth row: Receptacle; receptacle and pitot heater switches.

Seventh row: Chartboard light and gun sight rheostat switches.

Eighth row: Fluorescent light and cockpit light rheostats.

(9) FLUORESCENT LIGHT RHEOSTATS.

Location: In last row on electric panel (figure 10-18).

Operation: Turn knob to "ON" for a few seconds; then release it. Lights are dimmed by turning rheostat left.

CAUTION

Adjust light rays away from eyes to prevent temporary impairment of vision.

(10) SEAT ADJUSTMENTS.

(a) HEIGHT LEVER.

Location: At side of seat.

Operation: Lift lever while raising or lowering seat by body weight. Release lever at position desired.

(b) SLIDE LEVER.

Location: On right side of seat.

Operation: Lift lever; adjustment range is four inches left of center position.

(11) RUDDER PEDAL ADJUSTMENT.

Location: Small levers on left side of each rudder pedal.

Operation: Depress levers and adjust pedals for comfort.

NOTE

Each rudder pedal is provided with an indicator which shows height adjustment of pedals in relation to one another. When indicators are adjusted to read alike,

rudder will be in neutral position whenever pedals are opposite to each other.

(12) CABIN HEATER CONTROL.

Location: Forward of electric panel (figure 28).

Operation: From "OFF," move selector to "ON," "INCREASE HEAT," or "MAX." For complete operation, see section V, paragraph 4.

(13) WINDSHIELD VENTILATION LEVER.

Location: In upper left corner of windshield.

Operation: Move lever to regulate amount of air circulated.

(14) COCKPIT ENCLOSURE CONTROLS.

(a) ADJUSTMENT CONTROL.

Location: Above electric panel--right side.

Operation: Depress button on top of crank handle and turn control in desired direction. To lock enclosure in any position, release button when locking pin is opposite desired latching hole.

(b) JETTISON CONTROL

Location: On forward edge of enclosure above pilot.

Operation: Pull down on control handle.

(15) FOOTBRAKES.

Location: On rudder pedals.

Operation: Depress upper portion of rudder pedals in conventional manner.

CAUTION

Do not pump brakes except in emergency.

(16) PARKING BRAKE CONTROL.

Location: Horizontal bar below instrument panel.

Operation: Set brakes by depressing both brake pedals and lowering parking brake control; release brakes by depressing both brake pedals (parking brake control will automatically release).

(17) EMERGENCY BRAKE CONTROL.

Location: Forward of electric panel (figure 8).

Operation: Turn handle "ON" to apply air pressure to brakes. When sufficient landing space is available, turn handle from "ON" to "NEUTRAL" to cut off additional pressure to brakes while maintaining applied pressure. When landing on shorter fields, it is often necessary to apply full air volume and stop airplane at a possible sacrifice of tires. Taxiing is not permissible when pilot has relied on air brakes, and airplane must be towed from field. Application of brakes is not necessary for carrier landings. After landing, use air brakes whenever necessary for safety.

CAUTION

Only operate emergency control if hydraulic brakes fail. After using emergency brakes, inform ground crew to bleed hydraulic brakes and refill air bottle.

d. MISCELLANEOUS EQUIPMENT.

(1) EMERGENCY WATER CANTEEN.

Location: In holder secured aft and right of seat, immediately below seat level.

(2) RELIEF CONTAINER.

Location: On floor on left side of cockpit.

(3) LIFE RAFT.

Location: Stowed in seat pack and attached to parachute harness.

Operation: Inflate after striking water; contains emergency equipment. Keep life vest on. Keep CO_2 cylinder on valve to prevent leakage. Tie down everything on board;

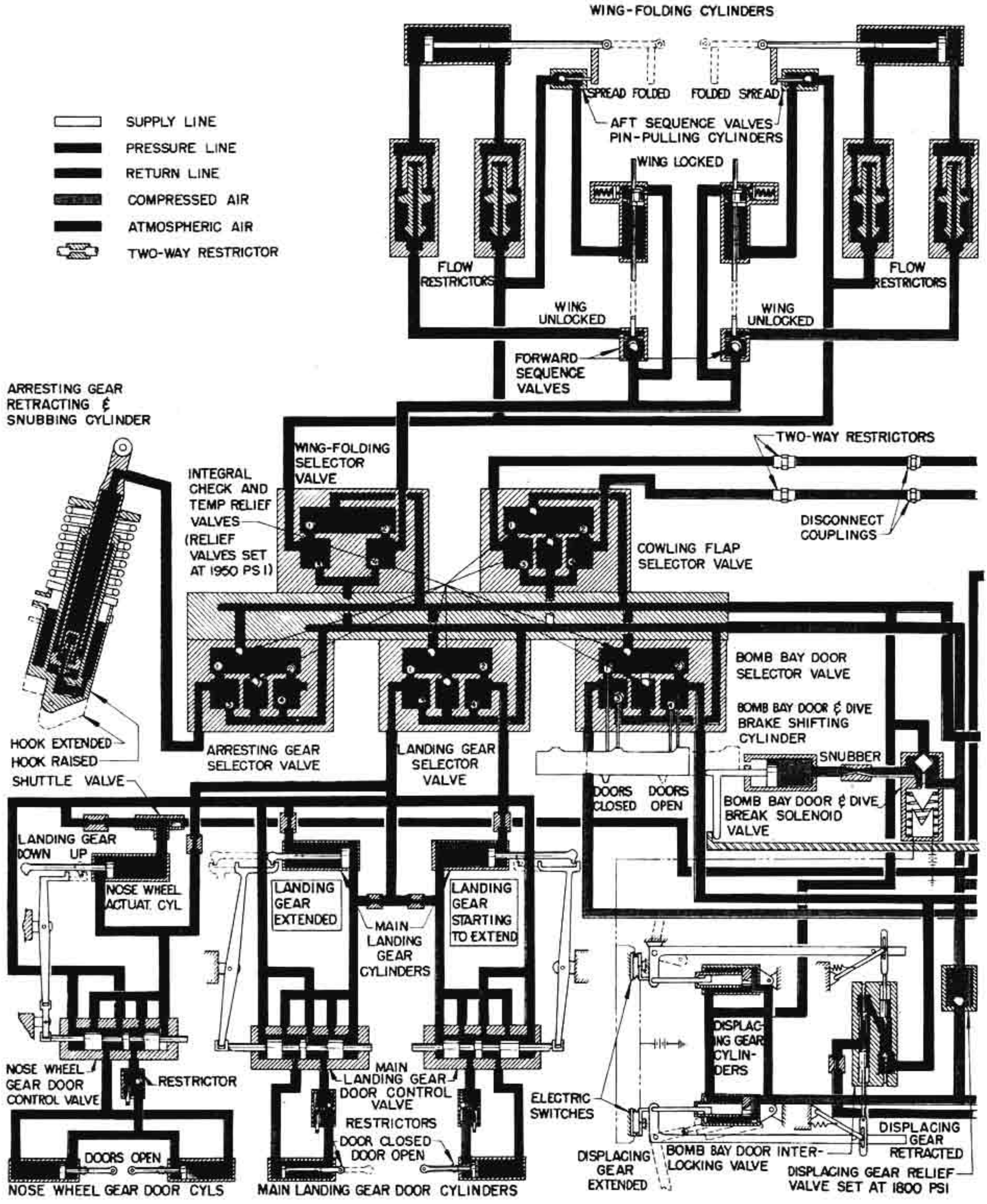


Figure 11 - Hydraulic System Schematic (Sheet 1 of 2 Sheets)

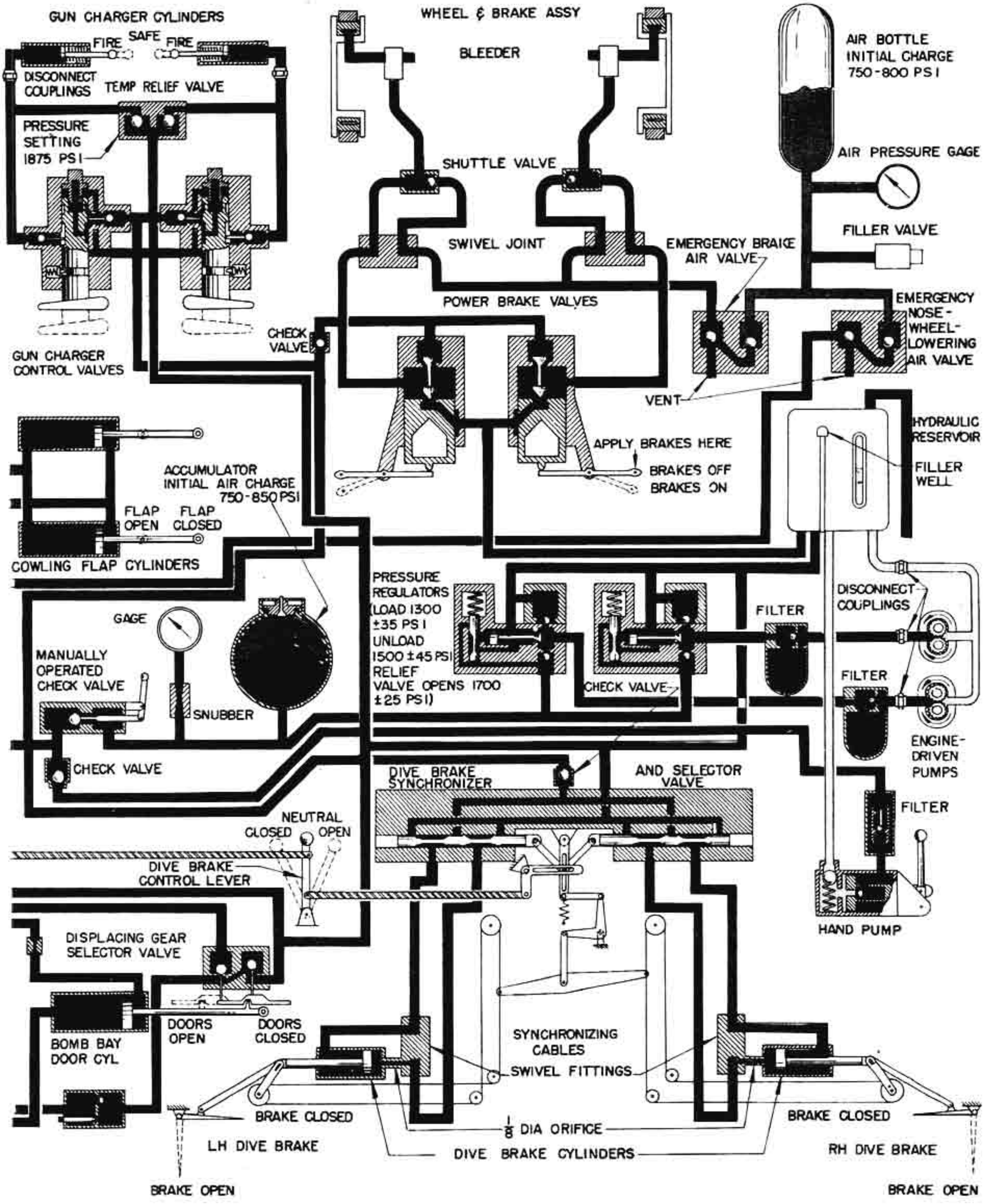


Figure 11 - Hydraulic System Schematic (Sheet 2 of 2 Sheets)

keep raft strap clipped to clothing and to raft to prevent loss of raft in case of capsizing. Blow into mouth tube to keep raft inflated; tighten valve after inflating.

(4) MAP CASE.

Location: To left of pilot.

(5) STOWAGE COMPARTMENT.

Location: In rear fuselage. Entrance is through lower access door.

(6) FIXED ENCLOSURE DECK.

Location: Behind cockpit. Pilot's head armor plate pulls forward to allow access.

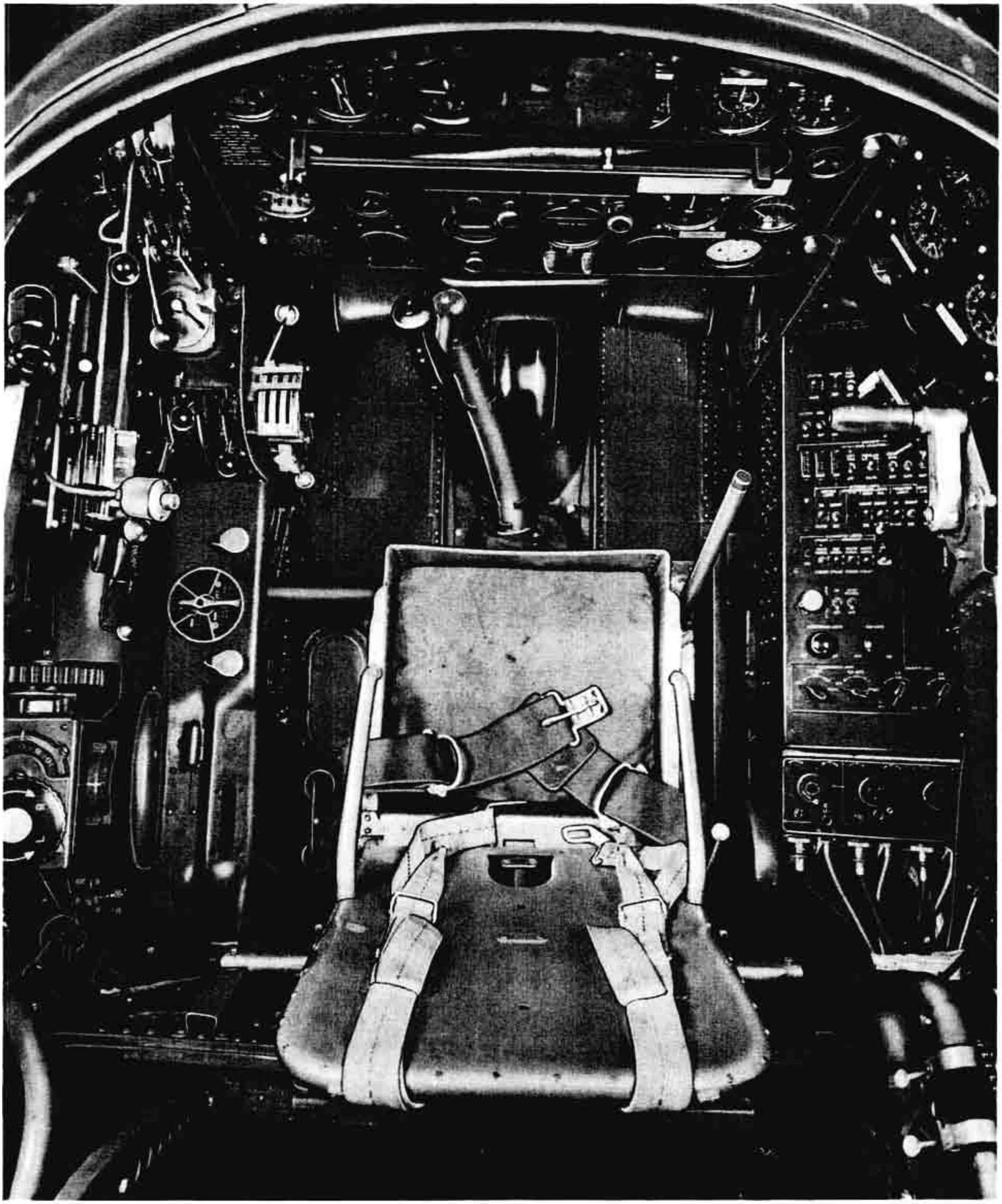


Figure 12 - Cockpit - Bottom

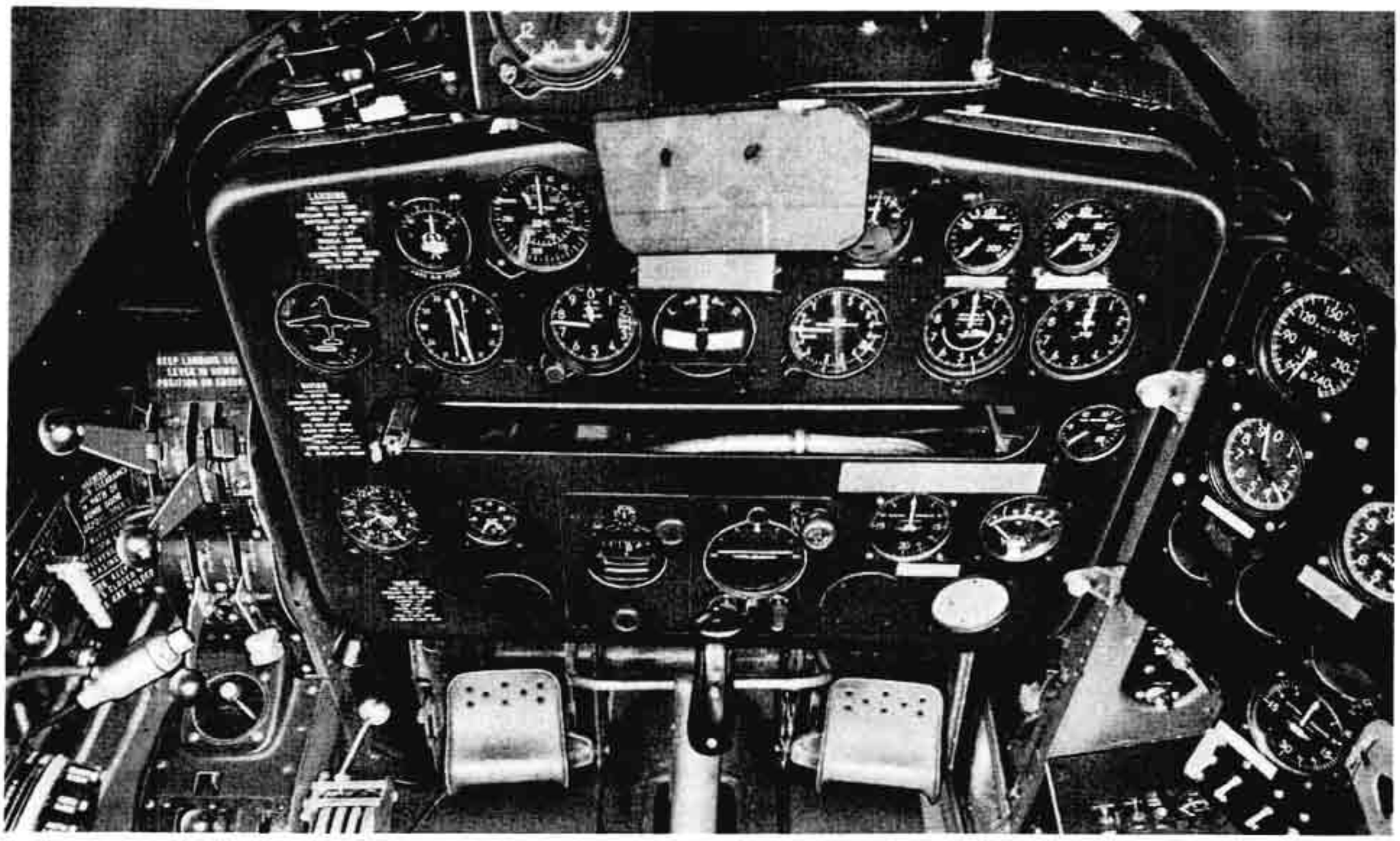


Figure 13 - Cockpit - Front

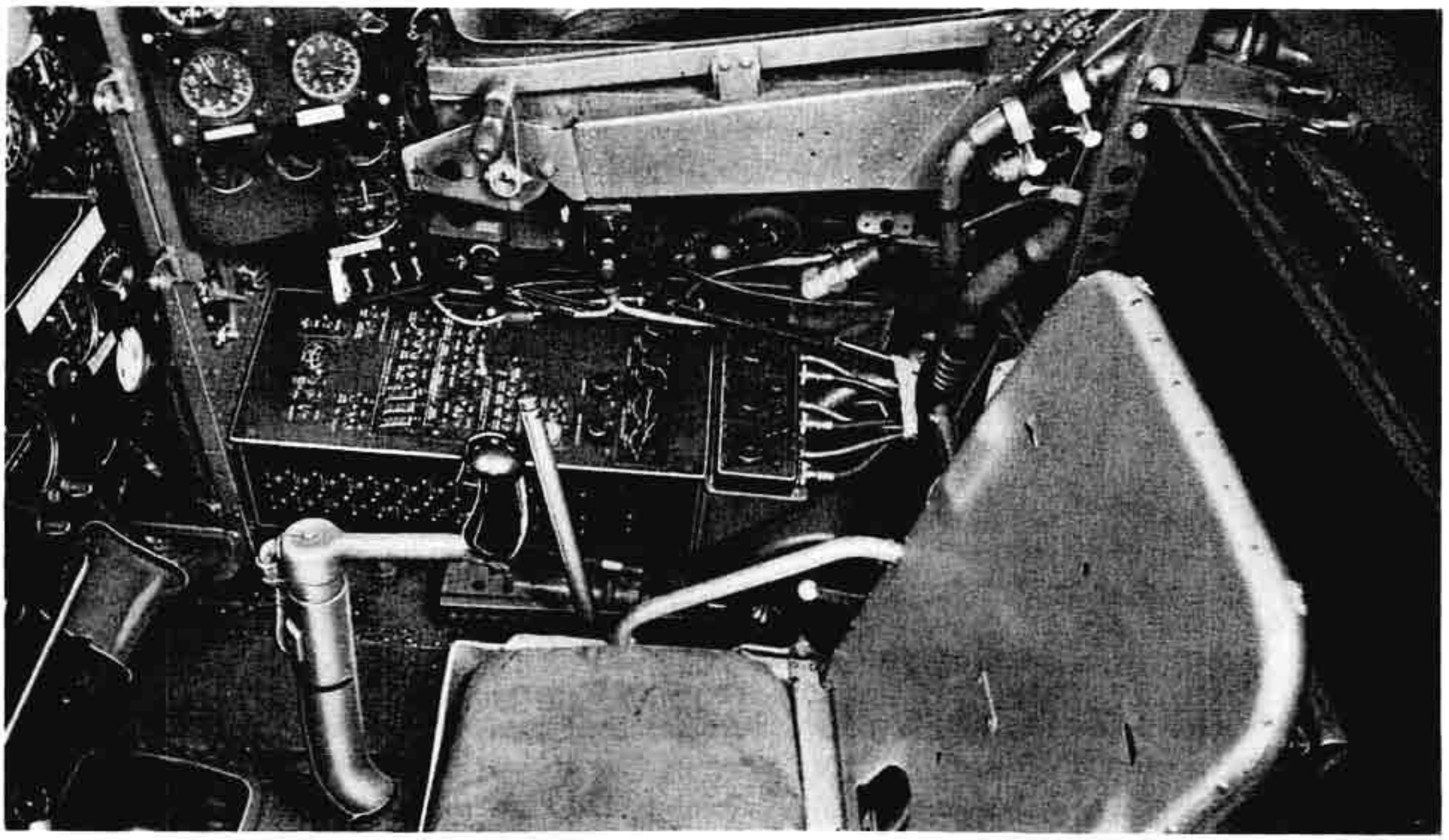


Figure 14 - Cockpit - Right Side

Section 2

PILOT'S OPERATING INSTRUCTIONS

Flight Operation

Special Flight Instructions

Power Plant

R E S T R I C T I O N S

A number of airplanes are placarded with the following take-off and flight restrictions:

2500 rpm
45 in. Hg
205 bmep

SECTION II

PILOT'S OPERATING INSTRUCTIONS

1. FLIGHT OPERATION.

a. BEFORE ENTERING COCKPIT.

(1) Flight Clearance Papers: Obtain.

(2) Gross Weight and Loading Condition: Check.

(3) Bomb Load: Note type and amount to be carried.

b. PRIOR TO ALL FLIGHTS.

(1) Flight Controls: Unlock and adjust.

(2) Rudder Pedals: Adjust for proper leg length.

(3) Seat: Adjust to desired level.

(4) Hydraulic Reservoir Light: "ON" (if necessary).

(5) Hydraulic Fluid: "NORMAL."

(6) Fuel Quantity: Check.

(7) Oil Quantity: Check.

(8) Landing Gear Lever: "DN."

(9) Dive Brake Lever: "CLOSE."

(10) Wing-folding Lever: "EXTEND."

(11) Bomb and Gun Switches: "OFF."

(12) Communication Equipment: Check for operation.

(13) Master Armament Switch: Desired position.

(14) Ammunition: Check for proper quantity.

(15) Gun Sight: Check for proper illumination.

(16) Electric Circuits: Check.

(17) Flight Controls: Check for free movement and smooth

functioning over entire operating range.

(18) Oxygen Mask: Check for proper fit.

(19) Oxygen Cylinder: Check for pressure (approximately 1800 psi).

(20) Altimeter: Set for proper reading.

c. PRIOR TO NIGHT FLIGHTS.

Test operate following lights:

(1) Cockpit and Chartboard Lights.

(2) Compass Light.

(3) Recognition Lights.

(4) Running Lights.

(5) Approach Light.

(6) Gun Sight Illumination.

d. STARTING ENGINE.

(1) Airplane: Head into wind.

(2) Ignition: "OFF."

(3) Battery: "OFF."

(4) Generator: "OFF."

(5) Cowl Flaps: "OPEN."

(6) Propeller Governor: High rpm (low pitch).

(7) Supercharger: "LOW BLOWER."

(8) Mixture: "IDLE CUT-OFF."

(9) Propeller: Pull through nine blades.

NOTE

If abnormal effort is required, cylinders are probably

loaded; remove spark plugs from lower cylinders and drain liquid. Dry spark plugs before replacing them. Presence of any quantity of liquid in combustion chamber of engine is likely to cause serious damage.

(10) Ignition: "BOTH."

(11) Battery: "BATTERY."

(12) Generator: "GEN."

(13) Throttle: 1000 rpm.

(14) Oil Cooler Scoops: "CLOSED."

(15) Carburetor Air: "DIRECT."

(16) Fuel Selector: "FWD. FUS. TANK."

(17) Auxiliary Fuel Pump: "FUEL PUMP." Pressure should be 17 psi. Continue to operate until engine is firing evenly.

(18) Starter: Energize by switching to "STARTER." When starter has reached proper speed, engage it by switching to "MESH." Keep starter engaged until engine fires.

(19) Primer: "ON" (as required).

CAUTION

Do not overprime. Overpriming may prevent engine firing from taking place or may result in only a few explosions, torching, and white fog from exhaust stack. If engine becomes overprimed, turn off ignition switch, place mixture in "IDLE CUT-OFF," open throttle and turn engine over several revolutions by hand until it has cleared out. Make certain ignition switch is off during this period. When engine is cleared, return throttle to 1000 rpm position.

(20) Mixture Control: Move to "AUTO RICH" as soon as engine fires.

(21) Throttle: Increase slowly to warm-up speed (1000 to 1200 rpm).

(22) Oil Pressure: If oil pressure is not 45 psi within 30 seconds after starting, shut down engine.

(23) Engine Fails to Start: After 10 to 20 revolutions (30 seconds maximum), let starter cool and repeat above starting procedure. If unit stops functioning because of overload, four to five minutes will be required to cool thermostatic breaker.

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e. ENGINE WARM-UP.

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(1) Cockpit Enclosure: Close to prevent exhaust gases from entering cockpit.

(2) Control Settings: Retain as given above.

(3) Propeller Governor: High rpm (low pitch).

(4) Oil Cooler Scoops: Adjust for proper oil temperature.

(5) Carburetor Air: "DIRECT."

(6) Engine: Operate at 1000 rpm until an oil inlet temperature rise of at least 10°C (18°F) is attained. (Minimum for normal take-off is 30°C (86°F).)

(7) Oil Pressure: Remedy fluctuations (caused by air trapped in oil line) by extending warm-up period until oil pressure stabilizes.

(8) Cowl Flaps: "OPEN."

CAUTION

Do not close cowl flaps during warm-up. Closed flaps may result in cylinder fin cracking or burning of ignition insulation.

(9) Instruments: Check for correct operation.

(10) Hydraulic Pressure: 1300 to 1500 psi.

(11) Automatic Pilot Ground Check: See section V, paragraph 5.c.

---

f. EMERGENCY TAKE-OFF.

---

(1) Oil Temperature: At 20 C (68 F) minimum.

(2) Oil Pressure: Steady at 60 to 85 psi (front and rear bank)

with rpm change.

(3) Engine: Running smoothly and will "take" to throttle.

---

g. OPERATION GROUND TEST--ENGINE AND ACCESSORIES.

---

(1) Propeller and Propeller Governor Check:

(a) Engine: Approximately 1700 rpm.

(b) Propeller Governor Control: Turn to low rpm (high pitch).

(c) Tachometer Reading: Observe; rpm should decrease approximately to 1200 rpm as blade angle increases.

(d) Propeller Governor Control: Turn to high rpm (low pitch).

(e) Tachometer Reading: Observe; rpm should increase to 1700 rpm if propeller and propeller governor are operating properly.

(2) Supercharger Check:

(a) Propeller Governor: High rpm (low pitch).

(b) Throttle: Close down.

(c) Supercharger Control: "HIGH BLOWER" (move control quickly).

(d) Throttle: Move to 30 in. Hg.

(e) Supercharger Control: Shift immediately to "LOW BLOWER" without moving throttle.

(f) Manifold Pressure: Sudden decrease indicates supercharger is operating properly.

(3) Ignition System and Oil Pressure Check:

(a) Engine: 25 in. Hg for routine check; 30 in. Hg for high power roughness.

NOTE

All manifold pressures are for sea level operation unless otherwise specified.

(b) Propeller Governor: High rpm (low pitch).

(c) Oil Pressure: Check over entire power range. If oil pressure drops or increases beyond limits (85 psi) when throttle is opened, warm-up period has been insufficient and should be continued at 1200 rpm. If front and rear bank oil pressures are not at 75 psi, idle engine and have oil pressure relief valves adjusted by maintenance crew.

(d) Ignition: From "BOTH," turn to "L" and back to "BOTH"; then turn from "BOTH" to "R" for flash readings. Do not exceed five seconds on either magneto.

CAUTION

Make check in as short a time as practicable, since continued running on one switch point may cause serious detonation.

(e) Engine RPM: If rpm drops more than 100, check for roughness and for misfiring of one or more cylinders caused by faulty spark plugs or trouble in ignition system.

(f) Engine: Idle at approximately 700 rpm.

(g) Ignition: Turn to "OFF" for two or three seconds and note whether engine stops firing; if it does not, ground wires are not properly connected.

(4) Fuel Pressure Check:

(a) Normal Pressure: 16 to 18½ psi; 17 psi desired.

(b) Auxiliary Fuel Pump Pressure: Turn auxiliary fuel pump switch to "FUEL PUMP" and check gage; an increase of one-half psi should be indicated.

---

h. TAXIING.

---

(1) Cowl Flaps: "OPEN."

(2) Engine: Maintain lowest power necessary for desired taxiing speed to avoid excessive braking. Avoid gunning.

(3) Propeller Governor: High rpm (low pitch).

(4) Brakes: Avoid excessive use.

CAUTION

Do not drag brakes.

(5) Mixture: "AUTO RICH."

NOTE

Directional changes in taxiing are effected by differential braking.

i. TAKE-OFF

(1) Before leaving ground:

(a) Auxiliary Fuel Pump: "ON."

(b) Fuel Selector: "FWD. FUS. TANK" or "AFT FUS. TANK RESERVE."

(c) Supercharger: "LOW BLOWER."

(d) Cowl Flaps: "OPEN."

(e) Oil Cooler Scoops: "OPEN."

(f) Carburetor Air: "DIRECT" unless icing occurs.

(g) Heater: "OFF."

(h) Propeller Governor: High rpm (2800).

(i) Trim Tabs: Set.

(j) Wing Flaps: Adjust for take-off.

(k) Mixture: "AUTO RICH."

(l) Brakes: Release.

(m) Throttle: Open steadily to 49.5 in. Hg (five minutes only).

NOTE

After releasing brakes, control direction by means of rudder. Any braking used will appreciably lengthen rolling distance. After reaching stalling indicated air speed for take-off conditions (gross weight, flap

angle) raise nose wheel until it just clears ground. Allow airplane to fly itself from ground in this attitude.

(2) After leaving ground:

(a) Brakes: Use lightly to stop wheels from spinning.

(b) Landing Gear: Retract.

NOTE

If field is muddy or snow-covered, landing gear may freeze and lock in "UP." Leave gear extended until all moisture has evaporated or has frozen; then retract gear.

(c) Wing Flaps: Retract slowly.

(d) Power: Reduce power as follows and in accordance with arrows:

	THROTTLE (in. Hg)	PROPELLER (RPM)	CONDITION (Low Blower)
	49.5	2800	Take-off (5 min only)
Step 1 ↓		Step 2 ↓	
	47.5	2600	Military
Step 3 ↓		Step 4 ↓	
	45.5	2400	Normal Rated
Step 5 ↓		Step 6 ↓	
	35.0	2130	Maximum Cruise

(e) Take-off Power: Five minutes only; the following values are recommended:

1. Maximum Cylinder Head Temperature: 248°C (478°F).

WARNING

Immediately before take-off, temperature must be low enough to permit normal take-off and climb without exceeding maximum temperature limit of 248°C (478°F) at any time. It should be below 205°C (400°F).

2. Oil Pressure: Front Bank — Rear Bank

75 ..... Desired ..... 75 psi
85 ..... Maximum ..... 85 psi
60 ..... Minimum ..... 60 psi

3. Oil Temperature: Normal take-off (minimum) 30°C (86°F). Emergency take-off (minimum) 20°C (68°F).

4. Fuel Pressure: Desired ..... 17 psi
Maximum ..... 18.5 psi
Minimum ..... 16 psi

(f) Additional Information: Refer to "Specific Engine Flight Chart" and "Operating Limits Chart."

(g) Engine Failure During Take-off: See paragraph 2.a., below.

---

j. CLIMB.

---

(1) Take-off Power: Operate at take-off power until all obstacles are cleared, climb established, and wing flaps and landing gear raised. Reduce power as recommended above. Use of rated power or less during climbs will depend upon operating conditions. Take-off power can be used for maximum of five minutes in an emergency.

NOTE

Refer to "Operating Limits Chart" for recommended horsepower, rpm, and manifold pressure. (See also paragraph k., below, (4) to (7), inclusive.)

(2) Throttle: Close to obtain recommended horsepower.

(3) Propeller Governor: Set for recommended rpm (high rpm, low pitch).

(4) Mixture: "AUTO RICH."

(5) Supercharger: "LOW BLOWER."

(6) Cowl Flaps: "OPEN" for maximum cooling. Adjust to maintain cylinder head temperature within limitations. (See paragraph 3.f.(4).)

k. GENERAL FLYING CHARACTERISTICS.

(1) Changing Power Conditions:

(a) To Increase Power:

1. Engine Flight Chart: Check for desired horsepower, rpm, and manifold pressure.

2. Mixture: "AUTO RICH" (if increasing power from below 70 percent rated power to above 70 percent).

3. Propeller Governor: Set for desired rpm.

4. Throttle: Open to desired manifold pressure.

(b) To Decrease Power:

1. Engine Flight Chart: Check for desired horsepower, rpm, and manifold pressure.

2. Throttle: Close to desired manifold pressure.

3. Propeller Governor: Set for desired rpm.

4. Throttle: Readjust if necessary.

5. Mixture: "AUTO LEAN" (after power is below 70 percent of normal rated power and cylinder head temperatures are within cruising range).

(2) Supercharger Operation: Shift to "HIGH BLOWER" at recommended altitudes. (See "Operating Limits Chart.") Control must be at extremity of its travel at all times. Desludging of clutch after flight is not necessary.

(a) To shift from "LOW BLOWER" to "HIGH BLOWER":

1. Mixture: "AUTO RICH."

2. Throttle: Close as necessary to avoid exceeding desired manifold pressure in "HIGH BLOWER."

3. Engine Speed: Not less than 1700 rpm.

4. Supercharger Control: Shift rapidly to "HIGH BLOWER."

5. Propeller Governor: Reset for desired rpm.

6. Throttle: Readjust for desired manifold pressure.

7. Mixture: Adjust if necessary.

(b) To shift from "HIGH BLOWER" to "LOW BLOWER":

1. Supercharger Control: Shift rapidly to "LOW BLOWER" without moving throttle.

2. Power: Adjust as desired.

(3) Trim Tab Adjustments:

(a) Elevator Trim Tabs: Adjust for nose-up or nose-down tendency.

(b) Aileron Trim Tabs: Adjust for low left wing or low right wing.

(c) Rudder Trim Tabs: Adjust for right or left yaw.

CAUTION

Do not adjust trim tabs too rapidly. Overcontrolling may result.

(4) Military Power Climb and Level Flight:

(a) Mixture: "AUTO RICH."

(b) Throttle: Regulate as specified in "Operating Limits Chart."

(c) Propeller Governor: 2600 rpm (five minutes only).

(d) Maximum Cylinder Head Temperature: 248°C (478°F).

(e) Supercharger: Shift at 8000-foot altitude.

CAUTION

After each five-minute period of military power climb and level flight, reduce rpm to 2400 and climb at normal rated power. Military power operation may be resumed after 10 minutes at normal rated power. Use of military power reduces life of engine and decreases intervals between overhauls.

(5) Normal Rated (100%) Power Climb and Level Flight:

(a) Mixture: "AUTO RICH."

(b) Throttle: Regulate as specified in "Operating Limits Chart."

(c) Propeller Governor: 2400 rpm.

(d) Maximum Cylinder Head Temperature: 232°C (450°F) one hour operation; 218°C (424°F) continuous operation.

(e) Supercharger: Shift at 8000-foot altitude.

(6) Maximum Cruising (65%) Power Climb and Level Flight:

(a) Throttle: Regulate as specified in "Operating Limits Chart."

(b) Propeller Governor: 2130 rpm to 2200 rpm.

(c) Mixture: "AUTO LEAN" for level flight; "AUTO RICH" for climb.

(d) Maximum Cylinder Head Temperature: 205°C (401°F).

(e) Supercharger: Shift at 19,000-foot altitude.

(7) Desired Cruising (60%) Power Climb and Level Flight (for minimum fuel consumption):

(a) Throttle: Regulate as specified in "Operating Limits Chart."

(b) Propeller Governor: 1600 rpm to 2000 rpm.

(c) Mixture: "AUTO LEAN" for level flight; "AUTO RICH" for climb.

(d) Maximum Cylinder Head Temperature: 205°C (401°F).

(e) Supercharger: Always use "LOW BLOWER."

1. STALLS.

(1) Stalling Speeds and Conditions: Data not available until flight tests have been completed.

(2) Aileron Control: Normal.

m. SPINS.

Spin Characteristics: Data not yet available.

n. ACROBATICS.

(1) Normal Acrobatics: Permitted.

(2) Snap Rolls: Prohibited with full bomb load.

(3) Prolonged Inverted Flying: Not permitted under any circumstances.

o. DIVING.

(1) Diving Characteristics: Normal.

(2) Angles and Air Speeds: Data not yet available.

(3) Fuel Selector: "AFT FUS. TANK RESERVE."

(4) Mixture: "AUTO RICH."

(5) Supercharger: "LOW BLOWER."

(6) Cowl Flaps: "CLOSE."

(7) Carburetor Air: "DIRECT."

(8) Maximum Permissible Diving RPM: 3000.

(9) Oil Cooler Scoops: "CLOSED."

(10) Trim Tabs: Check.

CAUTION

Trim tabs must always be set for final position in dive before entering dive. Use of elevator tab for primary control in pull-outs from high-speed dives is prohibited except in an emergency.

(11) Auxiliary Fuel Pump: On.

(12) Bomb Doors: "OPEN."

(13) Dive Brakes: "OPEN."

WARNING

Dive brakes are used to limit dive velocities but are not used to reduce velocities already attained.

(14) Maximum Allowable Overspeed: 3000 rpm.

(15) Bombs: When bombs are released, bomb bay doors and dive brakes will close automatically. When bombs are not released, close bomb bay doors and dive brakes by moving selector levers to "CLOSE."

CAUTION

When releasing bombs, keep hands away from bomb door and dive brake handles.

---

p. NIGHT FLYING.

---

(1) Approach Light. Automatically illuminates when arresting hook is extended.

(2) Exterior Lights: Switches for section light, running lights, and formation lights are on fourth row of electric panel; switches for recognition lights are on fifth row of electric panel.

(3) Interior Lights: Airplane is equipped with fluorescent lights, hydraulic reservoir light, chart-board lights, and cockpit lights.

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q. APPROACH AND LANDING.

---

(1) Heater: "OFF."

(2) Fuel Selector: "AFT FUS. TANK RESERVE."

(3) Mixture: "AUTO RICH."

(4) Auxiliary Fuel Pump: On.

(5) Supercharger: "LOW BLOWER."

(6) Throttle: Closed to 30 in. Hg.

(7) Propeller Governor: 2100 rpm.

(8) Carburetor Air: "DIRECT" unless icing is present.

(9) Oil Cooler Scoops: "OPEN."

(10) Landing Gear: Lower below 130 knots IAS.

(11) Wing Flaps: Lower below 130 knots IAS.

(12) Cowl Flaps: Partly open, depending on cylinder head temperatures. "OPEN" after landing.

(13) Arresting Hook: Lower (for carrier landings only).

(14) Throttle: Use as necessary.

CAUTION

Maintain flying speed well above stalling point for proper control of airplane.

(15) Trim Tabs: Check.

(16) Emergency: For an emergency which will prevent normal landing, see paragraph 2.b., below.

(17) Approach Speeds: Data to be furnished upon completion of flight tests.

(18) Brakes: Avoid excessive use.

(19) Cross-wind Landings: Specific data to be furnished upon completion of flight tests. For general instructions, see paragraph 2.c., below.

---

r. STOPPING ENGINE.

---

(1) Oil Dilution: Employ if cold weather is anticipated. (See paragraph 3.h.(3), below.)

(2) Cowl Flaps: "OPEN."

(3) Propeller Governor: High rpm while taxiing to avoid overheating.

(4) Wing Flaps: "UP."

(5) Engine: After airplane has stopped rolling, idle engine at 600 to 800 rpm until cylinder head temperatures drop below 200°C (392°F). Run engine at 1200 rpm for 30 seconds prior to stopping.

CAUTION

Watch temperatures carefully so as not to exceed specified limits. It may be necessary to shorten idling period or to idle at a higher speed than normal in order to prevent overheating.

(6) Mixture: "IDLE CUT-OFF."

(7) Throttle: Move slowly to full "OPEN" at same time as preceding step in order to remove accelerating charge from induction system.

(8) Ignition: Turn "OFF" after engine stops turning.

(9) Battery: "OFF."

(10) Fuel Selector: "OFF."

(11) Mixture: Leave in "IDLE CUT-OFF" until engine is started again.

---

s. BEFORE LEAVING COCKPIT.

---

(1) Electric Switches: "OFF."

(2) Landing Gear Lever: "DN."

(3) Parking Brakes: Set.

(4) Surface Controls: Locked.

---

t. TYING DOWN.

---

(1) Airplane: Head into wind.

(2) Mooring Ropes: Allow sufficient slack; absorption of moisture will cause tightening of ropes.

(3) Surface Controls: Locked. (See section I, paragraph 2.a.(6).)

(4) Wheels: Brace with wheel chocks.

(5) Parking Brakes: Make certain that they are set.

NOTE

Following these operations, cockpit enclosure cover, engine cover, and propeller cover should be put in place and adjusted by ground crew.

2. SPECIAL FLIGHT INSTRUCTIONS.

a. ENGINE FAILURE DURING TAKE-OFF.

(1) Procedure: Maintain flying speed and land straight ahead into wind. Do not attempt to stretch glide, bank, or turn back to field. These maneuvers will result in stalls.

(2) Wing Flaps: Lower, if time permits.

(3) Ignition: "OFF."

(4) Landing Gear: Ascertain position. If ground is fairly level and hard, extend gear. If ground is uneven or soft, retract gear. If landing on water, retract gear.

(5) Fuel Selector: "OFF."

b. OVERSHOOTING OR INABILITY TO LAND.

(1) Throttle: Open slowly as necessary.

CAUTION

If throttle is opened quickly, serious overspeeding will occur which may result in damage to the engine.

(2) Propeller Governor: Adjust rpm to correspond to manifold pressure selected.

(3) Cowl Flaps: If closed, open.

c. CROSS-WIND LANDINGS.

(1) Approach: Slightly lower and longer than usual to allow sufficient time for establishing an airplane heading to give a ground track corresponding to landing runway.

(2) Wings: Should be level with no skidding necessary.

(3) Course: Just before contacting ground, change course to that of runway by using rudder; then allow wheels to contact ground.

(4) Nose Wheel: Should not be raised once contact has been made

(5) Brakes: Apply in normal manner to decrease roll.

NOTE

The foregoing procedure simplifies pilot technique and offers greatest visibility.

d. OPERATION OF TRICYCLE LANDING GEAR.

(1) Special Characteristics:

(a) Ground Looping: Airplane will not ground loop.

(b) Flight Attitude: Provides normal flight attitude on ground.

(c) Take-off: Airplane tends to hug ground, regardless of speed, and pilot must pull airplane off when sufficient air speed has been attained for take-off.

(d) Turns: When airplane moves slowly, it has little stability. Have airplane rolling before attempting a turn.

(e) Visibility: Provides better visibility for taxiing.

(f) Nose Wheel: Nose wheel is not steerable. Keep as much weight off nose wheel as possible when taxiing, landing, or taking-off on soft ground.

(g) Brakes: Apply as necessary to decrease acceleration and differential ground directional control.

(h) Wheels: Sliding is undesirable.

(2) Special Landing Instructions:

(a) Approach: Normal.

(b) Speed: 20 percent above stalling speed for landing condition. Do not stall airplane while landing; fly airplane to landing surface.

(c) Main Wheels: Touch ground first.

(d) Tail Position: Do not land with tail so low that tail

bumper strikes ground.

(e) Brakes: Apply evenly to stop roll.

CAUTION

If brakes are applied with nose wheel off ground, excessive bouncing of nose wheel may occur.

(f) Locked Wheels: On slippery runways, uneven brake application or uneven friction of field surface may cause one wheel to lock and airplane to turn in direction opposite to locked wheel. Airplane will immediately straighten itself out if brakes are released and then applied evenly.

(g) Poor Visibility: When landing at night or during periods of poor visibility, land at a slightly higher speed and with nose wheel slightly lower than normal. It is much safer to land in this attitude and risk striking ground at higher speed than to run risk of landing at such a speed and attitude that airplane might stall, pitch forward, and allow nose wheel to strike ground first.

3. POWER PLANT.

The airplane is powered by a Wright Cyclone engine (model R3350-14, series C18BB). The 18-cylinder, radial, air-cooled engine is equipped with a Bendix Stromberg injection-type carburetor (model PR58-A1) and a Hamilton Standard three-bladed, hydromatic, constant-speed propeller with a gear reduction of .5625 and a blade diameter of 12 feet 7 inches.

a. ENGINE RATING (estimated, subject to revision):

Condition	BHP	RPM	Max Manifold Press. (in. Hg)	Blower	Altitude (in feet)
Take-off (5 min only)	2300	2800	49.5	LOW	Sea Level
Military rated	2250	2600	47.5	LOW	S.L.-2,000
	1900	2600	46.5	HIGH	8,000-13,500
Normal rated 100%	2100	2400	45.5	LOW	S.L.-2,500
	1800	2400	45.0	HIGH	8,000-14,000
Max cruise	1470	2130	35.0	LOW	S.L.-8,700
	1260	2200	30.0	HIGH	19,000-up

Condition	BHP	RPM	Max Manifold Press. (in. Hg)	Blower	Altitude (in feet)
Desired cruise	1210	2000	32.0	LOW	S.L.-11,200
(Min specific	1070	1800	31.5	LOW	S.L.-10,000
consumption)	960	1600	31.0	LOW	S.L.- 8,700

b. FUEL: 100/130 (Spec. AN-F-28) or 98/130 C-S (Spec. AN-F-27).

c. OIL: Grade 1120 (Spec. AN-VV-O-446a).

d. PROPELLER ACCUMULATOR.

(1) NORMAL OPERATION: Accumulator stores up oil pressure during normal operation. When normal oil pressure fails, accumulated oil pressure is utilized, by means of check valves, to maintain constant oil pressure to governor at all times. This action permits propeller governor operation during momentary loss of engine oil pressure.

(2) DIVE: If engine oil inlet becomes uncovered at tank during dive and oil pressure drops, accumulator maintains pressure.

e. MAXIMUM ENGINE OVERSPEED: 3000 rpm.

f. MIXTURE CONTROL (figure 7-4): Has four definite positions:

(1) "EMER. RICH": Place control in "EMER. RICH" for emergency operation only.

(2) "IDLE CUT-OFF": Whenever fuel pressure is greater than five psi, fuel will flow through carburetor when mixture control is in any position except "IDLE CUT-OFF," whether engine is running or not. Whenever engine is not running, mixture control should be left in "IDLE CUT-OFF" to prevent fuel from collecting in supercharger and running out drain tube. If engine should cut out during ground running, immediately move mixture control to "IDLE CUT-OFF" to prevent loading induction system with fuel.

(3) "AUTO RICH": If operating under cruising conditions with mixture control in "AUTO LEAN," move control to "AUTO RICH" before changing engine power. Use "AUTO RICH" at all

altitudes above critical altitude of airplane; for all power operations above 80 percent of normal rated power; on ground, where cooling conditions are more critical than in flight; and whenever engine temperatures are too high. Main functions of "AUTO RICH" are to provide adequate mixture for high-power operation, particularly at low altitudes, and to provide maximum cylinder head cooling.

(4) "AUTO LEAN": Mixture should be leaned for smooth engine performance above critical altitude of airplane. Use "AUTO LEAN" below 70 percent of normal rated power when low fuel consumption is of major importance and to prevent excessively rich mixtures with an increase in altitude. Employ when cruising at lower powers and at higher altitudes. Use of "AUTO LEAN" results in higher cylinder head temperatures and lower fuel consumption. Desired fuel economy will not result when cylinder head temperatures are too high. Use of "AUTO LEAN" is contingent upon satisfactory engine cooling as defined by maximum cylinder head temperatures listed below:

CONDITION	CYLINDER HEAD TEMPERATURES	MIXTURE CONTROL
Take-off (max 5 min).	248°C (478°F)	"AUTO RICH"
Military rated power (max 5 min).	248°C (478°F)	"AUTO RICH"
Normal rated power (max 1 hr) . .	232°C (450°F)	"AUTO RICH"
Continuous (max allowable). . . .	218°C (425°F)	"AUTO RICH"
Cruising (max recommended). . . .	205°C (400°F)	"AUTO LEAN"

g. FUEL SYSTEM.

(1) TANKS. (All capacities are approximate only.)

(a) FUSELAGE FORWARD: 135 U.S. gal (112 imp. gal).

(b) RIGHT-HAND WING: 110 U.S. gal (91 imp. gal).

(c) LEFT-HAND WING: 110 U.S. gal (91 imp. gal).

(d) FUSELAGE AFT RESERVE: 135 U.S. gal (112 imp. gal).

Section II
Operating Instructions

TANK SELECTOR DIAL

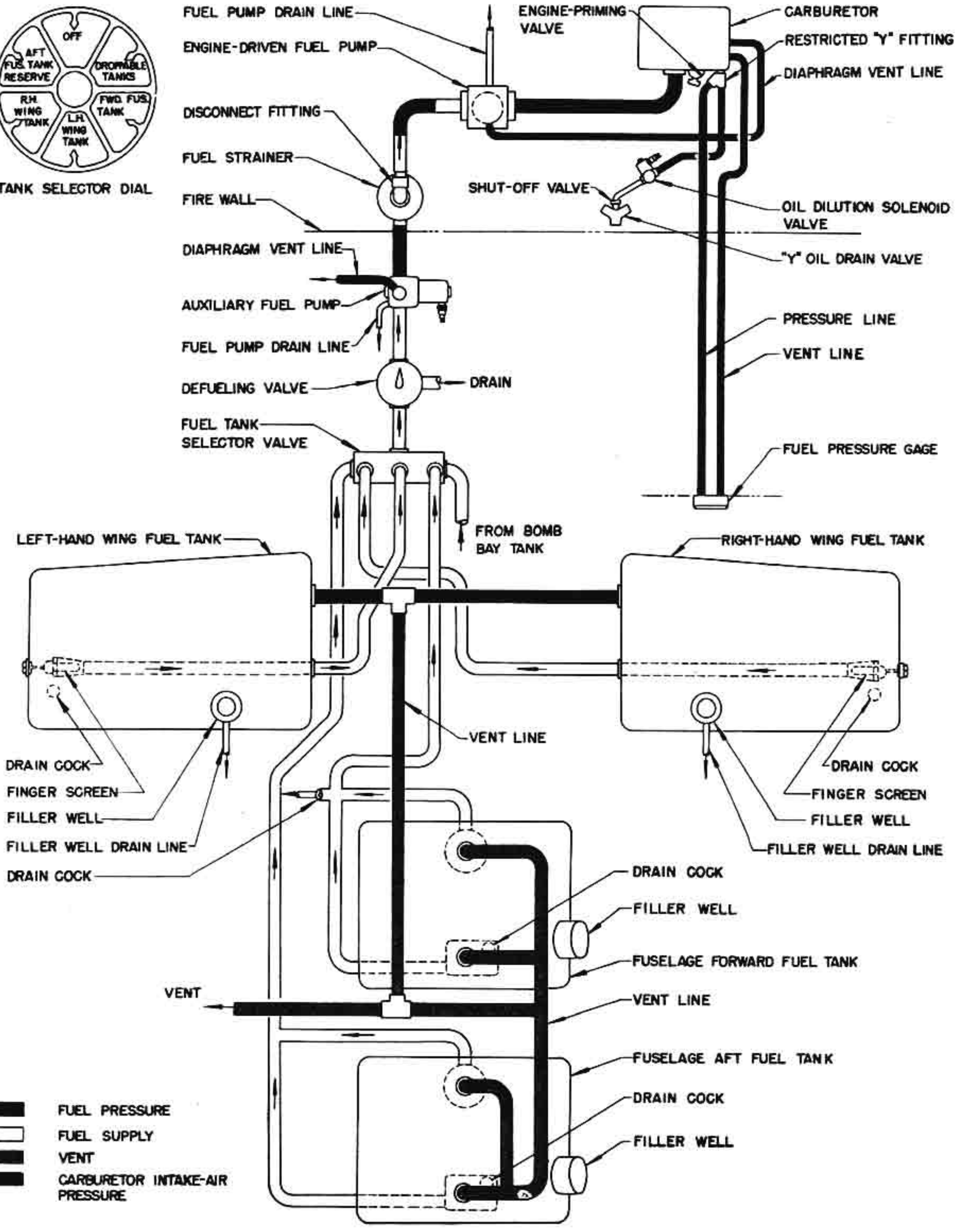


Figure 15 - Fuel System Schematic Diagram

(e) LH DROPPABLE: 100 U.S. gal (83 imp. gal). Carried in bomb bay. Bombs or torpedoes cannot be carried.

(f) RH DROPPABLE: 100 U.S. gal (83 imp. gal). Carried in bomb bay. Fuselage bomb may be carried on left bomb rack; torpedoes cannot be carried.

(2) INSTRUMENTS AND CONTROLS.

(a) FUEL TANK SELECTOR.

Use: Forward fuselage tank for take-off and level flight. Aft fuselage reserve tank for take-off, for all diving and landing operations and as a reserve tank to be used last. Wing and droppable tanks for level flight only; use these tanks before fuselage tanks during level flight.

Location: On control panel to left of pilot (figure 5-10).

Operation: Dial positions (reading clockwise): "OFF," "DROPPABLE TANKS," "FWD. FUS. TANK," "L.H. WING TANK," "R.H. WING TANK," and "AFT FUS. TANK RESERVE." To change from one fuel supply to another: Maintain airplane in level flight; switch fuel tank selector to desired tank.

NOTE

If any decrease in pressure or momentary surging occurs, operate auxiliary pump.

(b) AUXILIARY FUEL PUMP SWITCH.

Use: For all take-offs, landings, and for flight above 10,000 feet and below 1000 feet, as well as to furnish fuel pressure for starting engine; to aid engine-driven pump in maintaining operating pressure at any altitude; to substitute for engine pump in event of failure.

Location: Top row of electric panel (figure 10-4).

(c) FUEL LEVEL INDICATORS.

Location: Right side of instrument panel (figure 6-22-23). Large indicator consists of individual pointers for wing tanks and forward fuselage tank. Small indicator contains pointer for reserve tank. There is no indicator for droppable tank.

(d) FUEL PRESSURE GAGE.

Location: Right of chartboard (figure 6-17). Pressure should always remain the same:

Desired . . . . 17 psi
Maximum . . . . 18.5 psi
Minimum . . . . 16 psi
Idling . . . . 14 psi

(e) DROPPABLE TANK CONTROLS (JETTISON).

Location: Same as bomb controls. (See section V, paragraph 1.d.)

Operation: Open bomb bay doors (figure 5-16); turn fuselage bomb selector (figure 10-26) to "SALVO," or to "R.H." when right droppable tank is being carried along with a bomb in left bomb bay; press bomb release (figure 20). If electric system fails, place manual bomb release lever (figure 5-20) in "SALVO" (or in "R").

h. OIL SYSTEM.

(1) TEMPERATURES: Controlled by operation of oil cooler doors. Oil temperature values are as follows:

Desired . . . 70°C (158°F)-85°C (185°F)
Maximum . . . 102°C (216°F)
Minimum . . . 60°C (140°F)
Min for normal take-off . . . 30°C (86°F)
Min for emergency take-off. . 20°C (68°F)

(2) PRESSURE: Cannot be controlled by pilot. If fluctuations in oil pressure exist during warm-up (caused by air trapped in oil line), stabilize pressure by extending warm-up period.

If oil pressure drops or rises beyond limits with rpm change, warm-up period has been insufficient and should be continued at 1200 rpm. If oil pressure is not at desired value of 70 psi, idle engine and have oil pressure relief valves adjusted by maintenance crew. Oil pressure values are as follows:

Front Bank		Rear Bank
75 psi	Desired	75 psi
85 psi	Maximum	85 psi
60 psi	Minimum	60 psi
45 psi	Idling	45 psi

NOTE

45 psi must be reached within 30 seconds after engine starts.

(3) OIL DILUTION.

Use: Must be employed before stopping engine if temperatures below -5°C (23°F) are anticipated. Switch is on upper right corner of electric panel (figure 10-20).

NOTE

An oil that is too heavy and viscous for starting is indicated by oil pressure that is too high or that fluctuates and falls back when the engine rpm is increased.

Operation: OIL COOLER SCOOP: "OPEN."

COWL FLAPS: "OPEN."

ENGINE: 800 rpm.

OIL-IN TEMPERATURE: 5°C (41°F) to 50°C (122°F).

CAUTION

Fuel vaporizes at 70°C (158°F), creating gas fumes which constitute a fire hazard and make dilution impossible. If oil-in temperatures rise above 50°C (122°F), turn off engine; cool engine to 35°C (95°F); and then proceed.

OIL DILUTION SWITCH: "ON" for two to four minutes.

MIXTURE: "IDLE CUT-OFF."

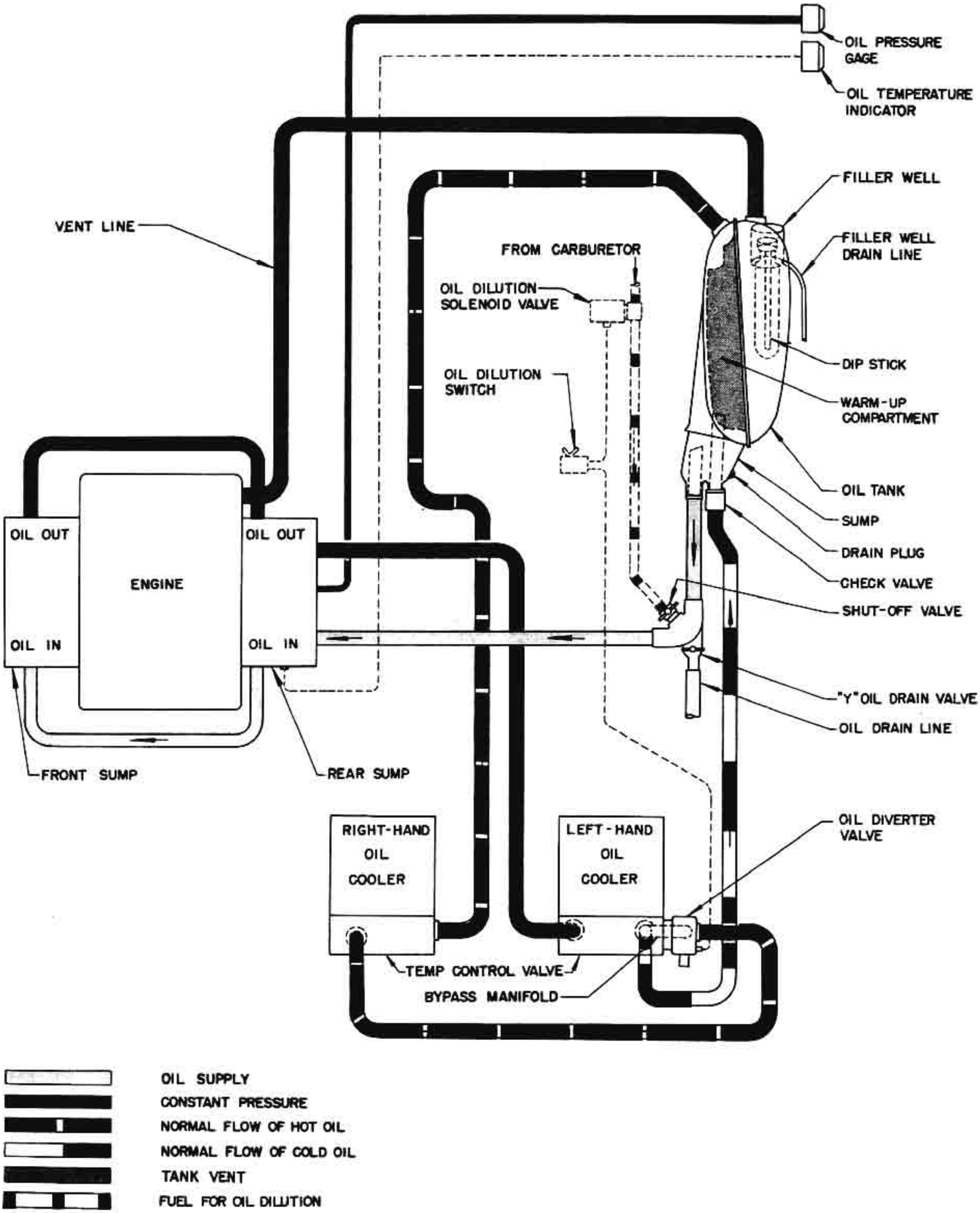


Figure 16 - Oil System Schematic Diagram

OIL DILUTION SWITCH: "OFF" after propeller stops turning.

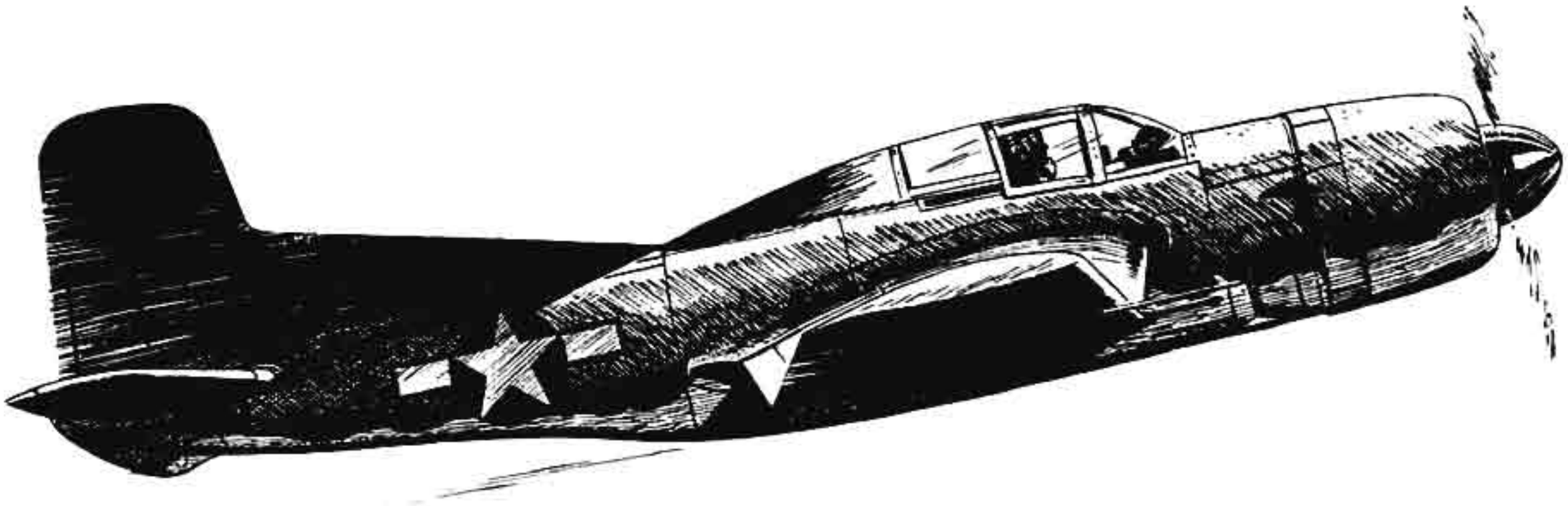
TEMPERATURE: Extremely low; repeat foregoing procedure after 15-minute interval.

NOTE

If properly diluted, oil should not be diluted again until engine has been operated for 20 minutes or until oil temperature has reached 70°C (158°F) or above for five minutes or longer.

Precautions: Stop dilution immediately if oil pressure drops to less than half of normal pressure at 800 rpm. Guard against overdilution. Guard against fire. Resort to dilution with discretion, as dilution increases oil consumption and tends to engender excessive oil contamination. Keep oil system free from sludge and water. Check oil strainers frequently.

(4) PROPELLER OIL DILUTION: Should be employed whenever engine oil is diluted and at same time. While engine oil is being diluted, shift propeller governor (figure 7-6) from "INCREASE RPM" to "DECREASE RPM" several times to allow diluted oil to fill propeller dome.



Section 3

FLIGHT OPERATION DATA

Air-Speed Limitations

Specific Engine Flight Chart

SECTION III

FLIGHT OPERATION DATA

1. AIR-SPEED LIMITATIONS.

   a. FLAPS: Do not extend above 130 knots IAS.

   b. LANDING GEAR: Do not extend above 130 knots IAS.

   c. MAXIMUM AIR SPEED: 455 knots IAS.

2. SPECIFIC ENGINE FLIGHT CHART.

The "Specific Engine Flight Chart" (figure 17) is based on preliminary estimated data and is subject to revision upon completion of flight tests.

R E S T R I C T I O N S

A number of airplanes are placarded with the following take-off and flight restrictions:

2500 rpm
45 in. Hg
205 bmep

FORM ASC-512A

AIRPLANE MODELS

BTD-1

SPECIFIC ENGINE FLIGHT CHART

ESTIMATED DATA

ENGINE MODELS

R-3350-14, PRODUCTION MODEL

CONDITION	FUEL PRESSURE (LB/SQ. IN)	OIL PRESSURE PSI FRONT PUMP	OIL PRESSURE PSI REAR PUMP	OIL TEMP. °C		
DESIRED	17	75	75	70-85		
MAXIMUM	18.5	85	85	102		
MINIMUM	16	60	60	60**		
IDLING	14	45	45***			

MAX PERMISSIBLE DIVING RPM: 3000

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

OIL GRADE: 1120, SPEC NO. AN-VV-O-446a

SUPERCHARGER TYPE: Two-Speed, Single Stage.

FUEL GRADE: 100/130, SPEC NO. AN-F-28 or 98/130 C-S, SPEC NO. AN-F-27 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.	FUEL FLOW (GAL/HR/ENG) IMP.	MAXIMUM CYL TEMP °C	MAXIMUM CYL TEMP °F	MAXIMUM DURATION (MINUTES)
TAKE-OFF	2800	49.5	2300		Sea Level	LOW	Always use Low Blower	Automatic Rich			248	478	Five
WAR EMERGENCY	-	-	-		-	-	-	-			-	-	-
MILITARY	2600 2600	47.5-46.0(FT) † 46.5-44.0(FT)	2250 1900		S.L. - 2000 8000 - 13500	LOW HIGH	-	Automatic Rich			248	478	Five
NORMAL RATED (MAX CONT)	2400 2400	45.5-44.0(FT) 45.0-42.5(FT)	2100 1800		S.L. - 2500 8000 - 14000	LOW HIGH	-	Automatic Rich			(218 (232	425 450	Continuous Sixty
MAXIMUM CRUISE	2130 2200	35.0-32.0(FT) 30.0 - FT	1470 1260		S.L. - 8700 19000 - UP	LOW HIGH		*Automatic Lean			205	400	Continuous
MINIMUM SPECIFIC CONSUMPTION	2000 1800 1600	32.0-28.5(FT) 31.5-28.0(FT) 31.0-28.0(FT)	1210 1070 960		S.L.- 11200 S.L.- 10000 S.L.- 8700	LOW	Always use Low Blower	*Automatic Lean			205	400	Continuous

REMARKS:

* OPERATION IN AUTO LEAN IS CONTINGENT UPON MAINTAINING TEMPERATURES BELOW LIMITS.

** 30°C MINIMUM FOR NORMAL TAKE-OFF. 20°C MINIMUM FOR EMERGENCY TAKE-OFF.

*** 45 PSI MUST BE REACHED WITHIN 30 SECONDS AFTER ENGINE STARTS.

† FT DENOTES FULL THROTTLE. CRITICAL ALTITUDES GIVEN ARE FOR STANDARD CONDITIONS AND NO RAM. ACTUAL CRITICAL ALTITUDES WILL VARY WITH RAM AND ATMOSPHERIC CONDITIONS.

Figure 17 - Specific Engine Flight Chart

Section 4

EMERGENCY OPERATING INSTRUCTIONS

Cautions and Warnings

Fire

Forced Landings

Engine Failure

Hydraulic Failure

SECTION IV

EMERGENCY OPERATING INSTRUCTIONS

1. CAUTIONS AND WARNINGS.

a. WING FLAPS: Do not lower above 130 knots IAS.

b. LANDING GEAR: Do not lower above 130 knots IAS.

c. MAXIMUM AIR SPEED: 455 knots IAS.

d. HEATER: Do not operate while airplane is on ground or during take-off and landing.

e. HYDRAULIC BYPASS VALVE: Do not fail to check position of valve before operating hydraulic hand pump.

f. ARRESTING HOOK: Do not neglect to extend hook before landing on carrier.

g. OXYGEN: Do not fail to use when flying above 15,000 feet.

h. ENGINE: Do not overprime. Do not run above 3000 rpm.

i. COWL FLAPS: Do not close during warm-up.

j. TAKE-OFF: Do not use for longer than five minutes.

k. OIL PRESSURE: Do not allow to rise above maximum of 85 psi.

l. OIL TEMPERATURE: Do not allow to rise above 102°C (216°F).

m. FUEL PRESSURE: Do not allow to rise above 18.5 psi.

n. SNAP ROLLS: Do not snap-roll with full bomb load.

o. INVERTED FLYING: Do not fly in inverted position for any appreciable time. Watch oil and fuel pressures.

p. FUEL TANK: Do not fail to use "FWD. FUS. TANK" or "AFT FUS. TANK RESERVE" for take-off; use "AFT FUS. TANK RESERVE" only for diving or landing operations.

q. AUXILIARY FUEL PUMP: Use for all take-offs and for landing; for altitudes below 1000 feet and above 10,000 feet; and whenever necessary.

r. PILOT'S HANDBOOK: Do not fail to study carefully before leaving ground.

2. FIRE.

a. WHILE STARTING: Backfiring sometimes causes fire in induction system because of presence of excessive fuel after priming. Extinguish fire as follows:

(1) ENGINE: Allow to run. This procedure will often cause fire to be drawn through engine and become extinguished.

(2) FIRE EXTINGUISHER: Use if above procedure does not extinguish fire. Keep engine running.

(3) FUEL SUPPLY: Shut off.

(4) IF ENGINE STOPS: Ground crew must use portable fire extinguisher. Shut off fuel supply; if necessary, use built-in fire extinguisher.

b. DURING TAKE-OFF: Land as quickly as possible.

c. DURING FLIGHT: If flying low, and conditions permit, attain as much altitude as possible. If fire still burns, it is left to pilot's discretion whether airplane will be abandoned or a landing attempted.

d. ELECTRICAL FIRE: Main switches "OFF."

e. IGNITION OF FLARES IN RACK: Release flares.

f. ENGINE FIRE:

(1) FIRE EXTINGUISHER: Turn handle and pull it (left control panel).

(2) FUEL TANK SELECTOR: "OFF" if altitude permits.

(3) THROTTLE: Full "OPEN."

NOTE

If fire is extinguished, land as soon as possible to determine and correct cause before continuing flight.

(4) IF CRASH IS INEVITABLE: Cut main switches.

g. WING FIRE:

(1) ALL NAVIGATING LIGHT SWITCHES: "OFF."

(2) MANEUVER: Attempt to extinguish fire by side-slipping away from fire.

h. BAILING OUT: To facilitate escape from airplane, jettison cockpit enclosure by pulling control handle on forward edge of enclosure.

3. FORCED LANDINGS.

a. ON HARD OR MARSH LAND WHILE LANDING GEAR IS RETRACTED:

(1) BOMBS: Release in "SAFE" over uninhabited area from altitude of not less than 500 feet.

(2) DROPPABLE TANKS: Release tanks over suitable area and leave door open long enough to dissipate gasoline fumes from bomb bay.

(3) WING FLAPS: Full down.

(4) COCKPIT ENCLOSURE: Open.

(5) TURNS: Do not attempt near ground; otherwise, stalls may result.

(6) LANDING: Up wind.

(7) BEFORE LANDING: Level airplane.

(8) SWITCHES: Turn off ignition and master switches before landing.

(9) CRASH: Brace yourself with crash, not against it.

b. ON WATER (DITCHING).

(1) LANDING GEAR: Maintain in retracted position.

(2) WING FLAPS: Full down.

(3) EQUIPMENT: Throw loose equipment overboard.

(4) COCKPIT ENCLOSURE: Jettison.

(5) APPROACH: Power on at lowest possible IAS.

(6) WING: Keep level.

(7) LANDING DIRECTION: In wind below 25 knots, land along swell; in wind above 25 knots, land as near into wind as possible and angle onto upslope of swell.

(8) LANDING POSITION: As close to full stall as possible.

(9) IMPACT: Brace yourself against impact, since airplane will stop quickly.

(10) LIFE RAFT: Be ready to use.

(11) BAILING OUT: Under certain conditions, particularly if ships are nearby, it will be safer to bail out than to attempt a landing.

4. ENGINE FAILURE.

a. DURING TAKE-OFF:

(1) PROCEDURE: Maintain flying speed and land straight ahead into wind. Do not attempt to stretch glide, bank, or turn back to field. These maneuvers will result in stalls.

(2) WING FLAPS: Lower, it time permits.

(3) IGNITION: "OFF."

(4) LANDING GEAR: Ascertain position. If ground is fairly level and hard, extend gear. If ground is uneven or soft, retract gear. If landing on water, retract gear.

(5) FUEL SELECTOR: "OFF."

b. ENGINE FUEL PUMP FAILURE: If engine fuel pump fails, use auxiliary fuel pump. If pressure is not restored by this action, fuel tank is empty or fuel line is broken.

c. GENERATOR FAILURE: Conserve battery current by turning all electric switches "OFF" until needed.

5. HYDRAULIC FAILURE.

a. ENGINE HYDRAULIC PUMP FAILURE: If engine hydraulic pump fails to actuate units, use hydraulic hand pump.

b. HYDRAULIC LINES BREAK: Place hydraulic selector levers, except landing gear, in "OFF" to prevent fluid from being pumped overboard.

c. EMERGENCY LANDING GEAR EXTENSION: When hydraulic system fails, main landing gear will operate by force of gravity and by action of landing gear bungee. Move selector lever to "DN."

Section 5

OPERATIONAL EQUIPMENT

Armament

Communication Equipment

Oxygen Equipment

Air-Conditioning Equipment

Automatic Pilot Equipment

SECTION V

OPERATIONAL EQUIPMENT

1. ARMAMENT.

a. EQUIPMENT.

(1) GUNS: Two forward-firing, wing guns. Provision is made for 200 rounds of ammunition for each gun.

(2) BOMB BAY: Equipped with two racks designed to carry following:

1 or 2 - 500-lb class bombs, or
1 or 2 - 1000-lb class bombs, or
1 or 2 - 1600-lb class bombs, or
2 - aircraft depth bombs (325 lb ea), or
2 - incendiary cluster bombs.

(3) UNDER FUSELAGE: 1 or 2 - Mark 13-1 or 13-2 torpedoes.

(4) WING: Equipped with two racks designed to carry following:

2 - 100-lb class bombs, or
2 - aircraft depth bombs (325 lb ea), or
2 - incendiary cluster bombs.

b. GUN CONTROLS.

(1) CONTROL SWITCHES.

Location: Master armament (figure 10-9) and right and left gun selector switches on electric panel (figure 10-8,10).

Operation: Lift guards and move switches. Switches must be "ON" before trigger switch in control handle will fire guns.

(2) CHARGER CONTROLS.

Location: On control panel to left of pilot--forward control for right gun and aft control for left gun (figure 5-11).

Operation: To safety guns, turn controls to "PUSH TO SAFE" and push down. To charge guns, turn controls to "PUSH TO CHARGE" and push down. When gun mechanism jams, charger must be reset and again depressed.

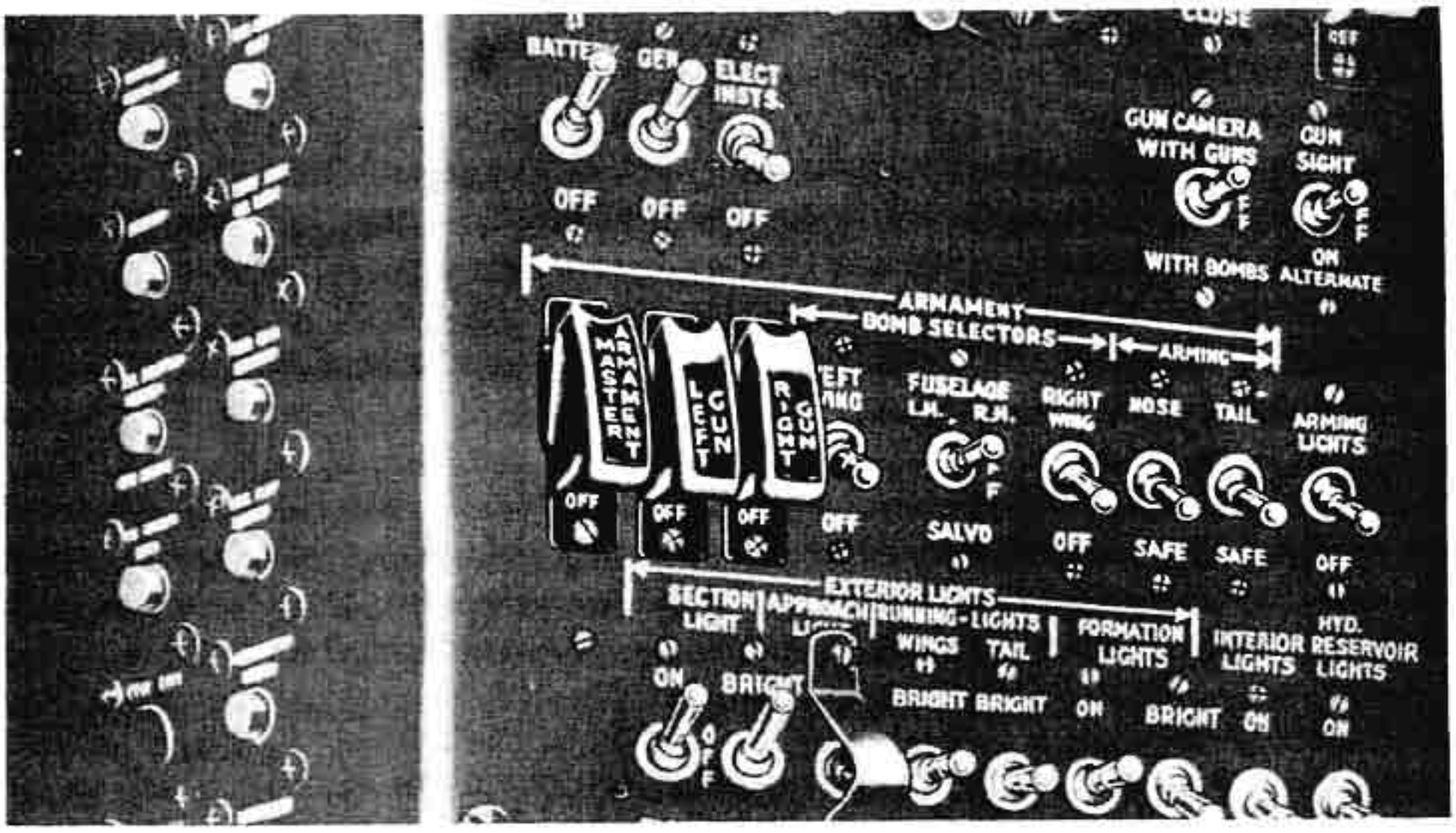


Figure 18 - Armament Controls

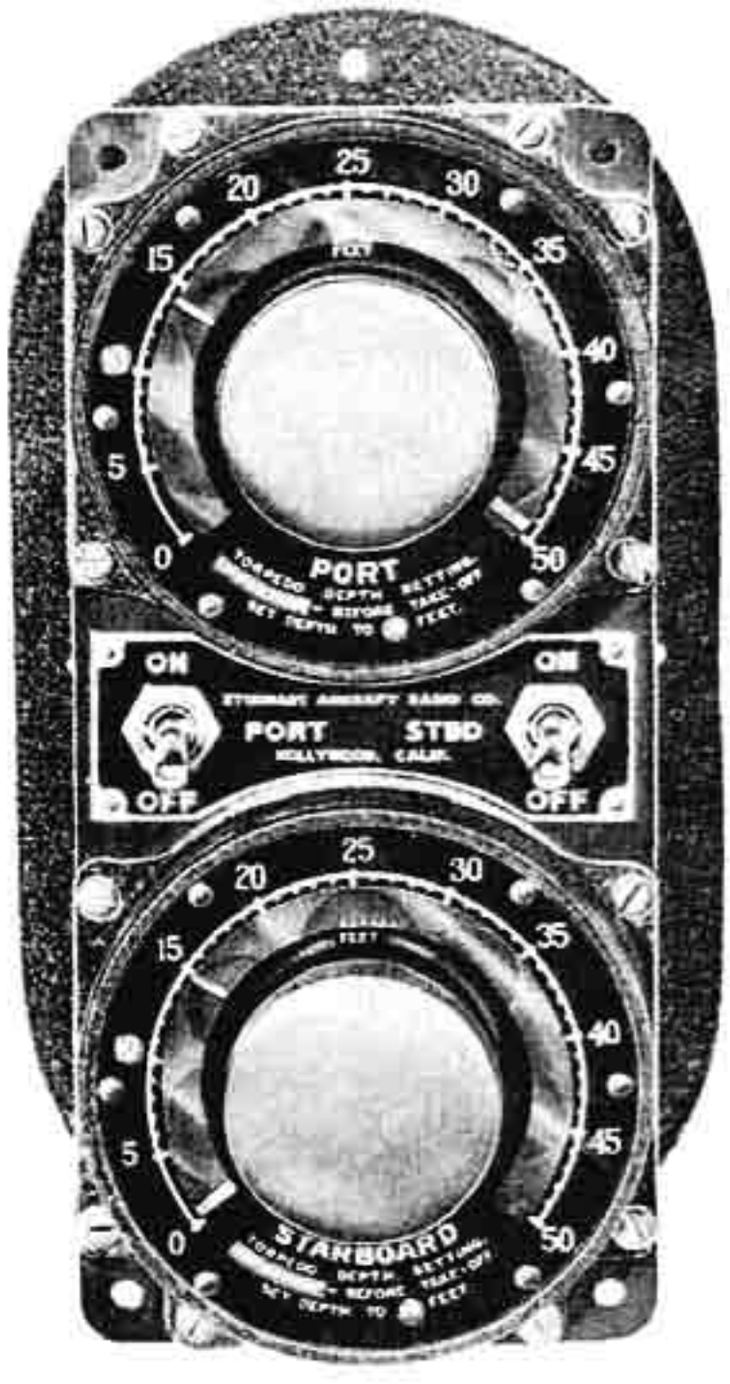


Figure 19 - Torpedo Depth Setting Control

Figure 20 - Bomb Release and Gun Firing Controls

NOTE

Controls should be in "PUSH TO SAFE" during take-off and landing but should be turned to "PUSH TO CHARGE" before entering combat to insure against pilot's forgetting to turn controls during combat.

(3) GUN SIGHT.

Location: In upper center of instrument panel (torpedo director, figure 21).

Operation: Turn master armament switch (figure 10-9) "ON" and gun sight switch (figure 10-23) to "GUN SIGHT"; set track angle (figure 21-3) to zero; release sight angle detent (figure 21-4) to full upward position.

(4) AUXILIARY GUN SIGHT.

Location: Left of bullet-resistant windshield panel.

Operation: Use when windshield has been damaged. Small ring aft of windshield and post-and-bead forward of windshield are both adjustable vertically.

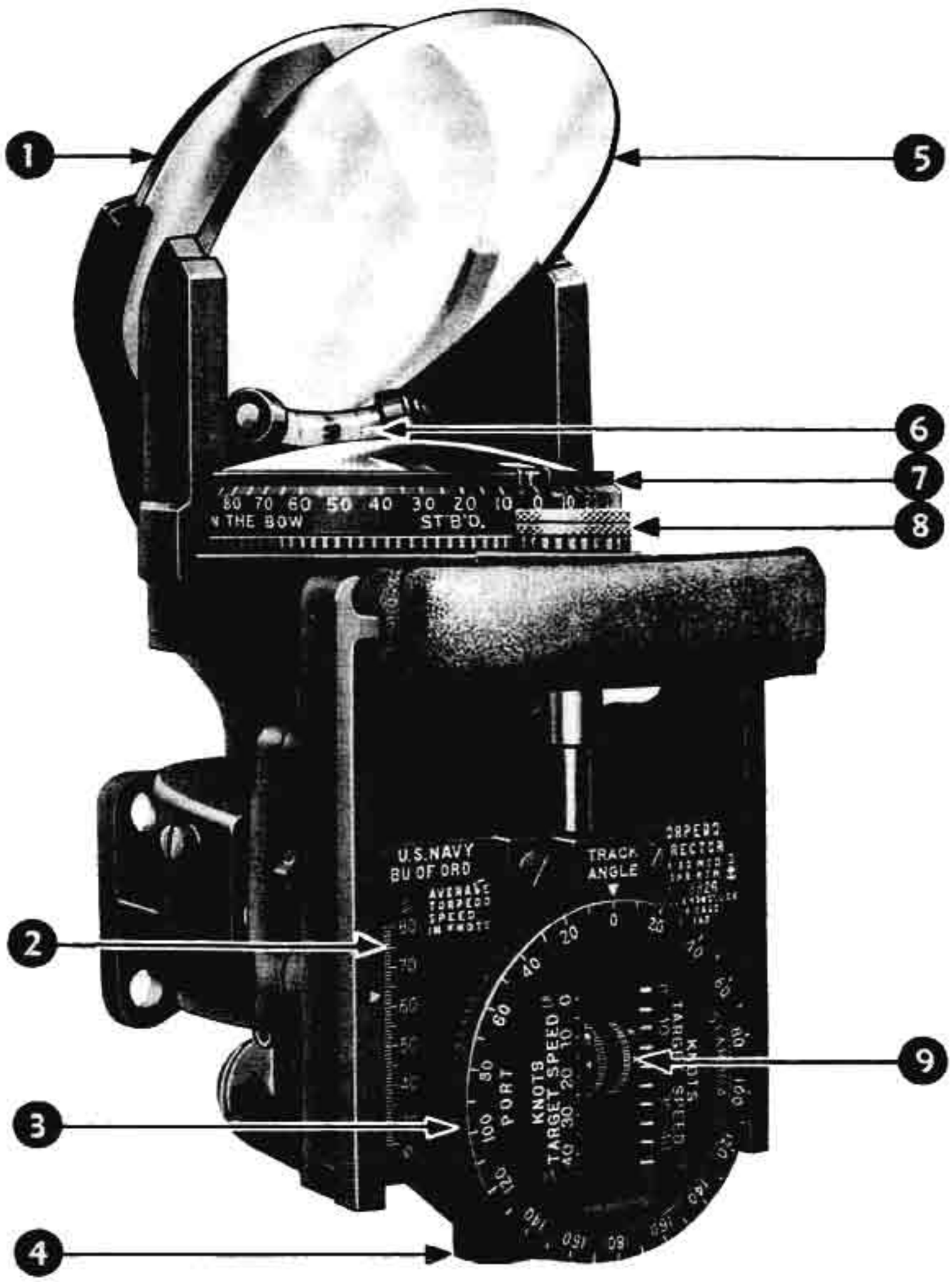
(5) GUN CAMERA.

Location: Switch in second row of electric panel (figure 10-22).

Operation: Place switch in "WITH GUNS" or "WITH BOMBS." Camera will photograph automatically when guns are fired or bombs dropped. Camera will also operate independently of guns or bombs. On first four airplanes (serial Nos. 04959 to 04962, inclusive), turn master armament switch (figure 10-9) "ON," place camera switch in "WITH GUNS" (or "WITH BOMBS"), and press trigger switch (or bomb release, figure 20). On next nine airplanes (serial Nos. 04963 to 04971, inclusive), follow same procedure but leave master armament switch turned "OFF."

CAUTION

Do not have gun, bomb, or torpedo selector switches on when using camera only.



1. Sun Filter
2. Torpedo Speed-setting Indicator
3. Track Angle Dial
4. Sight Angle Detent Knob
5. Reflector
6. Level
7. Angle on the Bow Dial
8. Torpedo Speed-setting Knob
9. Target Speed-setting Slide

Figure 21 - Torpedo Director and Gun Sight

c. TORPEDO OPERATION.

(1) TORPEDO DIRECTOR AND GUN SIGHT (MARK 30).

Location: In upper center of instrument panel (figure 21). Controls are as follows: angle on bow dial; average torpedo speed-setting knob; target speed-setting slide; sight angle detent knob; track angle dial; sun filter; illuminated sight rheostat (seventh row on electric panel); filament switch (extreme right of second row of switches on electric panel, figure 10-23).

Operation:

SOLUTION OF SIGHT ANGLE: Solution of sight angle for torpedo launching is based on average torpedo speed, target speed, and angle on the bow (angle set by track angle dial). Sight has 60-degree movement to either side of center.

SUN FILTER: Is adjustable without regard to value of sight angle. In ordinary operation, sun filter will rotate as sight angle rotates and will swing down on either side of gun sight.

SIGHT ILLUMINATION: Turn master armament switch (third row on electric panel) "ON"; turn gun sight switch (on extreme right of second row of switches on electric panel, figure 10-23) to "GUN SIGHT." If sight illumination fails, one of the filaments has probably burned out. Turn gun sight switch to "ON ALTERNATE" and other filament will operate. Rheostat (in seventh row on electric panel, figure 10-24) is used to control intensity of illumination. Turn clockwise to increase illumination.

(2) TORPEDO RELEASE CONTROLS.

Location: Torpedo rack control and mechanical

release are on quadrant to right of lower bank of controls (figure 5-20). (Quadrant must be converted from a bomb manual selection and release quadrant when torpedoes are carried.) Electric selector switch is fuselage bomb selector switch in third row of electric panel (figure 10-26). Electric release is same as bomb release on control stick handle (figure 20).

Operation: To move control lever, flip back arms which bar its path. To retain lever in desired position (lever is spring-loaded to return to "RACKS LOCKED"), flip arm down behind lever. Control lever has three positions: "RACKS LOCKED": Torpedoes cannot be released; "RACKS UNLOCKED": Torpedoes can be selected by fuselage bomb selector switch on electric panel (figure 10-26) and released by bomb release button on control stick handle; "SALVO": Torpedoes are released mechanically, either one at a time or in salvo, by moving control down one of three channels on top side of quadrant: "L," "SALVO," or "R."

NOTE

Torpedoes do not require arming. Lever on bottom of rack (figure 5-24) is used for releasing wing bombs.

(3) TORPEDO DEPTH-SETTING CONTROLS.

Location: On left side of cockpit floor (figure 19). Controls consist of two transmitters, one for port torpedo and one for starboard torpedo, and two battery switches between transmitters.

Operation:

TRANSMITTERS: Before take-off, set transmitters for 10 feet. This precautionary measure provides a safe torpedo in case cables are shot away or control mechanism fails.

MASTER BATTERY SWITCHES: "ON." Switches may be left "ON" during flight, since current is

not consumed when mechanism is not being operated.

TRANSMITTER KNOBS: Turn to desired depth setting--clockwise to increase depth; counterclockwise to decrease depth

NOTE

If follow-up indicator does not move to position at which control pointer has been set, mechanism has failed. Turn off switch of defective unit.

(4) TORPEDO TRAINING CAMERA.

Location: In right wing.

Operation: Master armament switch must be "ON." Nose-arming switch (figure 10-24) on electric panel heats camera. Right wing bomb selector switch (figure 10-26) prepares camera. Pressing torpedo (bomb) release (figure 20) takes pictures as long as release is depressed.

d. BOMBING OPERATION.

(1) ELECTRIC BOMB RELEASE.

Location: Selection and arming switches on electric panel (figure 10-26,24); bomb release button on top of control stick handle.

Operation:

BOMB DOORS: "OPEN."

NOTE

For emergency operation of bomb doors, see section I, paragraph 5.c.(3).

MASTER ARMAMENT SWITCH: "ON."

SELECTOR SWITCHES: Select bomb or bomb combination.

ARMING SWITCHES: Arm bombs as desired. Turning

nose-arming switch to "NOSE," arms nose fuses of all bombs. Turning tail-arming switch to "TAIL," arms tail fuses of all bombs.

NOTE

Nose arming provides instantaneous action. Tail arming provides delayed action. A combination will result in instantaneous action. Selection of bombs must always precede arming.

ARMING LIGHT SWITCH: On; (figure 10-25); check for correct nose and tail arming.

BOMBS: Release with control stick release button.

CAUTION

Keep clear of bomb door and dive brake levers when releasing bombs.

(2) MANUAL BOMB RELEASE.

(a) FUSELAGE BOMBS.

Location: Manual selection and release control is on bomb control quadrant (also torpedo control quadrant) to right of lower bank of controls--upper lever (figure 5-20).

Operation: To release fuselage bombs, move selector in one of three guides to "L," "SALVO," or "R" position.

NOTE

When manually releasing fuselage bombs, master armament switch must be "ON" and bombs must be armed by means of fuselage arming switch on electric panel (figure 10-24).

(b) WING BOMBS.

Location: Wing bomb manual release control is bottom lever on manual bomb release quadrant (figure 5-24).

Operation: Bombs must be armed by arming switches on electric panel. Push bomb release

control forward to release bombs. When wing bombs are manually released, they cannot be selected but will be released in salvo.

(3) BOMB SIGHT.

Location: Upper center of instrument panel (torpedo director, figure 21).

Operation: Use torpedo director as bomb sight by sighting through cross hairs as in gun firing.

(4) BOMB CAMERA (GUN CAMERA).

Location: In right wing.

Operation: Turn switch on electric panel (figure 10-22) to "WITH BOMBS" and press bomb release. Camera will operate as long as bomb release is depressed.

CAUTION

Do not have bomb selector switches (figure 10-26) on when using bomb camera only.

e. SIGNAL FLARE CONTROLS.

(1) AN-M8 SIGNAL PISTOL.

Location: On wall of cockpit to left of pilot.

Operation: Break pistol, insert flare, close breech, and pull trigger. Pistol must be in mount before inserting cartridge.

CAUTION

Never leave live cartridge in pistol when pistol is removed from mount; pistol is cocked at all times when breech is closed.

(2) SIGNAL PISTOL FLARES (12).

Location: Two canvas containers: one on aft wall to left of pilot; one below control shelf to left of pilot.

2. COMMUNICATION EQUIPMENT.

The airplane is equipped with a communication radio (ATA/ARA),

an ARB ferry radio, a tactical radio, and a recognition radio.

a. COMMUNICATION RADIO (ATA/ARA).

Location:

TRANSMITTER CONTROL BOX: Right side of cockpit (figure 24). Controls operation of two transmitters with preset frequencies. Transmitter selector control contains four positions of which only first two are operative. Emission switch controls type of emission: "TONE," "CW," or "VOICE." Transmitter power toggle switch is "ON-OFF" control. An external key jack and a microphone jack are on bottom of control box and a built-in key is on top. Microphone jack is used for insertion of hand microphone or mask microphone plugs; key jack is used for throttle switch (figure 7-2).

NOTE

Microphone jack is constructed so that sleeve may either be grounded to box by turning protruding knurled nut counterclockwise by hand as far as nut will go, or ungrounded by turning nut clockwise. In counterclockwise position, sleeve is grounded and "push-to-talk" button on microphone will close microphone and relay circuits to ground when actuated. When nut is in maximum clockwise position, "push-to-talk" button can be locked closed and built-in key or throttle switch (figure 7-2) will perform same functions that "push-to-talk" button did when knurled nut was in counterclockwise position.

RECEIVER CONTROL BOX: Right side of cockpit (figure 25). Controls operation of three receivers by means of three separate units. Each unit tunes and controls one receiver independently of the others. "CW-OFF-MCW" control is combination power supply and heterodyne oscillator switch. Tuning control tunes each receiver. "INCREASE OUTPUT" control is a manually adjustable gain control. It can be used to fade output of one receiver with respect to others. "TEL" line selector control switches output

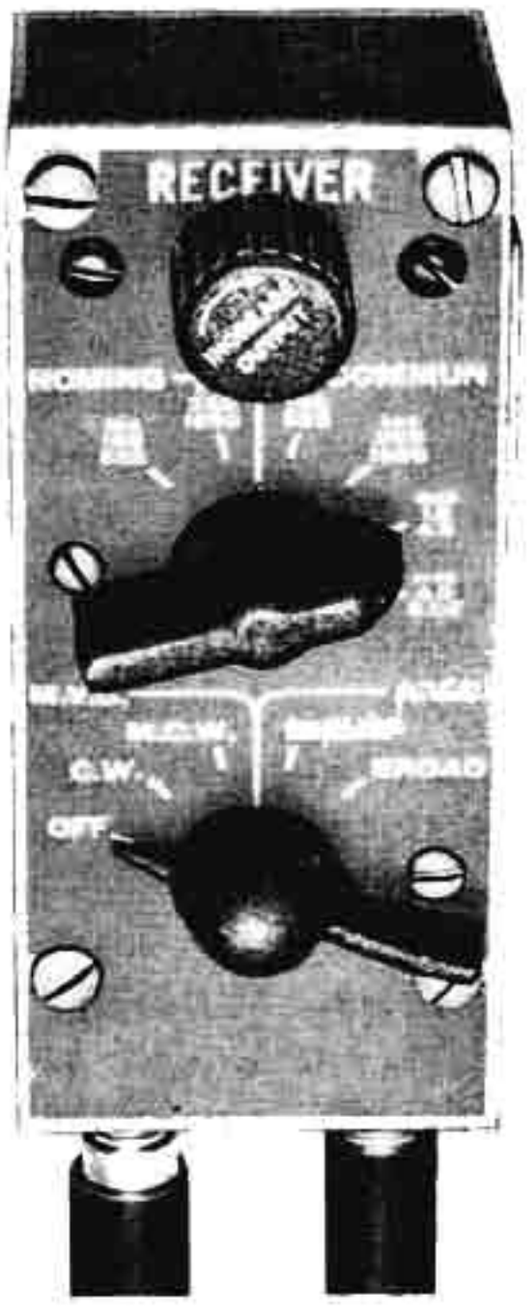


Figure 22 - ARB Radio Control Box

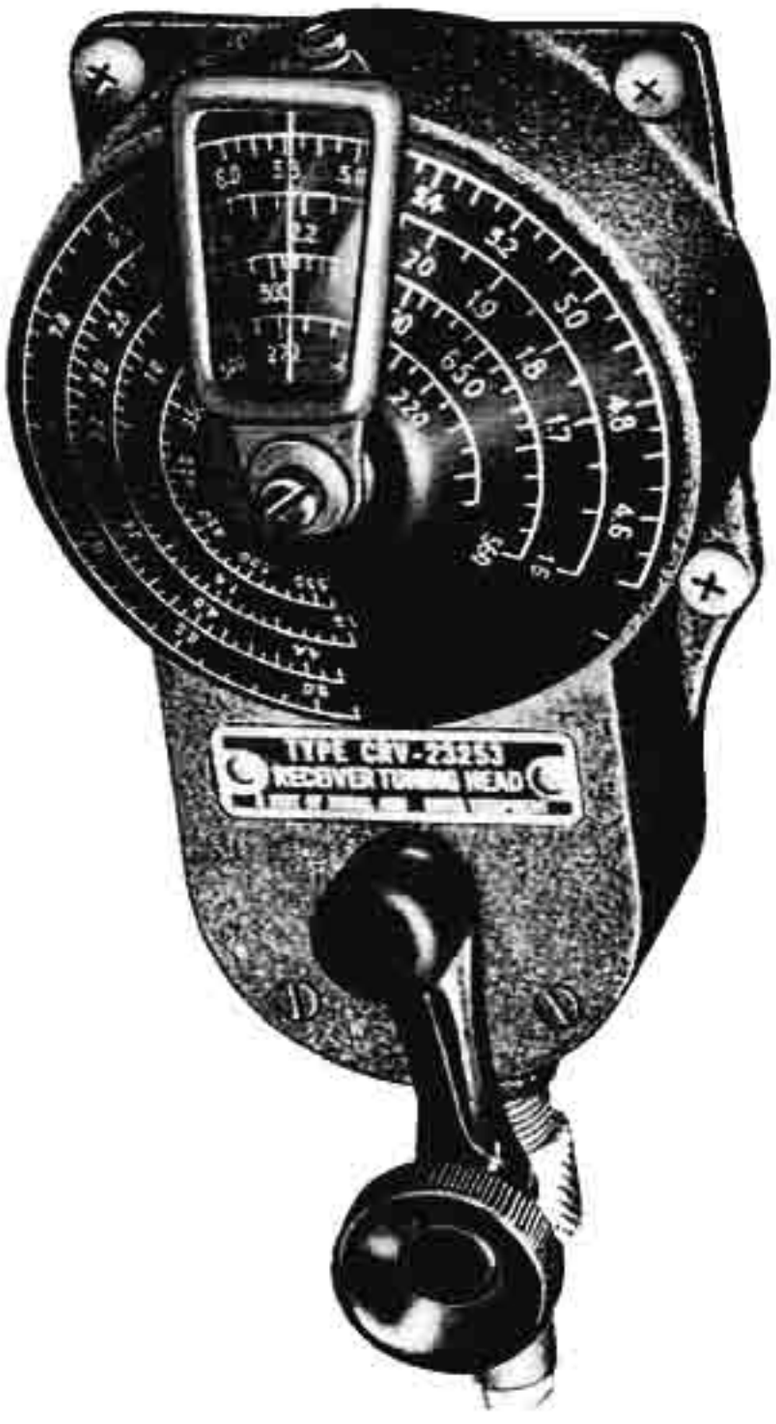


Figure 23 - ARB Radio Tuning Head

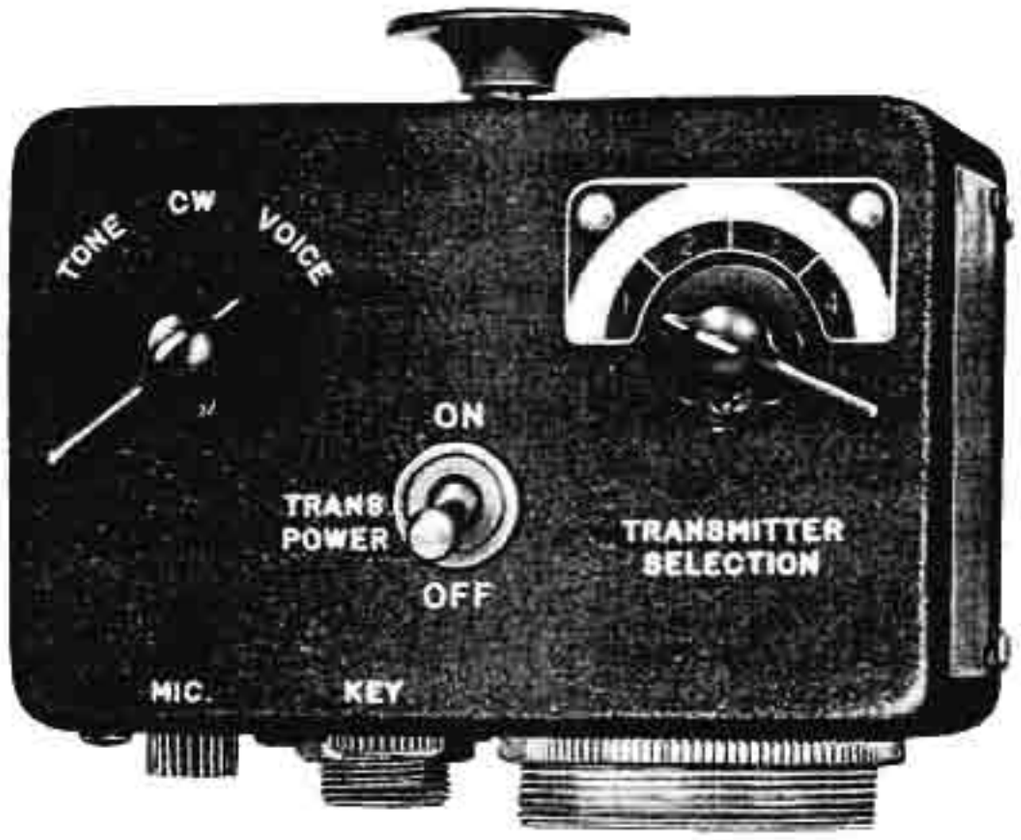


Figure 24 - Transmitter Control Box

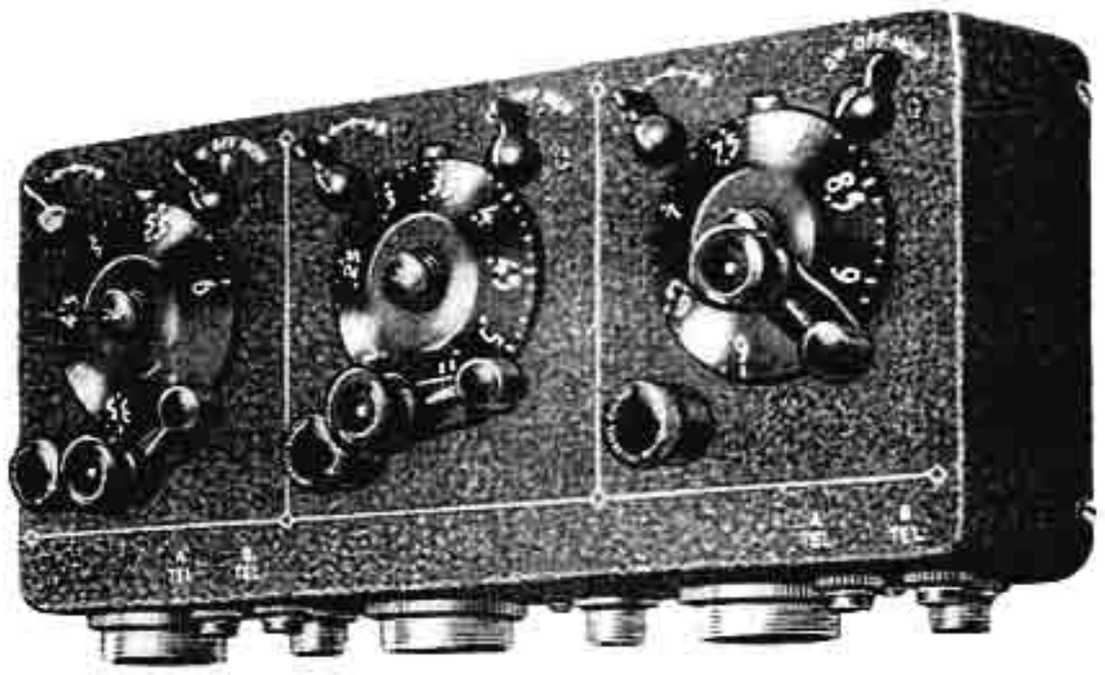


Figure 25 - Receiver Control Box

Figure 26 - Recognition Radio Control Box

of a receiver to "A" line or "B" line. If control is left in center, it acts as a "stand-by" switch by turning off all output from receiver without necessity of turning off power, detuning, or retarding gain control.

Operation: To Transmit:

BATTERY SWITCH: "BATTERY."

TRANSMITTER SELECTOR CONTROL: Select desired transmitter. Only one transmitter may be selected at a time.

EMISSION SWITCH: Set for "TONE," "CW," or "VOICE."

TRANSMITTER: Turn to "ON" and wait 15 seconds before further action in order to permit all transmitter tubes to warm up. Switch should be left "ON" throughout flight to avoid repetition of warm-up period.

"PUSH-TO-TALK" BUTTON: If emission switch is on "VOICE," press button and talk clearly into microphone. In "VOICE," transmitting dynamotor will not start until "push-to-talk" button has been pressed. Sidetone should be heard distinctly during transmitting.

"TONE" and "CW": Turn emission switch to desired position. Transmitting dynamotor will start and continue to run as long as emission switch is in one of these positions, but transmitter will not be on the air until built-in key or external key is pressed. A sidetone of approximately 1000 cycles per second should be heard.

EMISSION SWITCH: To reduce battery drain and increase dynamotor life, place emission switch in "VOICE" unless continued use in "CW" or "TONE" is expected. In "CW" and "TONE," dynamotor is constantly running; in "VOICE," dynamotor starts

and stops with each keying. Keying in "VOICE" therefore involves a heavy starting current which reduces life of dynamotor and should be avoided.

CAUTION

Do not switch transmitters while transmitting.

To Receive:

BATTERY SWITCH: "BATTERY."

"CW-OFF-MCW": Turn to "CW" or "MCW." In "CW," primary power and continuous wave (CW) heterodyne oscillator are both for reception of continuous wave (CW) signals. In "MCW," primary power is on but receiver is capable of receiving only amplitude modulated (MCW) signals. For operation on "VOICE," this switch should be left in "MCW" throughout flight.

TUNING CONTROL: Tune receiver as desired.

CAUTION

Do not attempt to tune beyond stops because of possibility of damage to equipment.

"INCREASE OUTPUT" CONTROL: Adjust as desired. Control must not be left in a retarded position or weak signals may be lost. If control is left in maximum gain position, strong signals may appear to be uncomfortably loud at first but will seem less loud after first half hour or more. Cotton in the ears may be desirable for long flights.

IMPORTANT

For reception of airway radio range signals, "INCREASE OUTPUT" control must always be kept retarded to a point well below level of maximum audio output; otherwise distortion will result.

"TEL" SELECTOR SWITCH: Select "A" line or "B" line; if neither line is desired, center switch to eliminate output from that receiver.

CAUTION

Operation of this equipment involves the use of high voltages which are dangerous to life. Observe safety regulations at all times.

b. TACTICAL RADIO.

Location: Control box--right side of cockpit. Indicator--between instrument panel and windshield.

Operation: All control switches are on control box.

c. RECOGNITION RADIO.

Location: Control box--right side of cockpit (figure 26). IFF key--on fifth row of electric panel (figure 10-32). Firing switch--to right of fifth row on electric panel (figure 10-31).

Operation: All operating switches are on control box. Destruction of set: Detonator will be set off automatically if a crash landing occurs. If destruction of set becomes necessary, lift guard on firing switch and pull switch up. Explosion is not dangerous, but contact with set should be avoided at that moment.

d. FERRY RADIO (ARB).

Location: ARB ferry radio is installed in airplane for ferry purposes only and is removed when airplane is made ready for combat duty. Following controls are installed on right side of cockpit (figure 22):

RECEIVER CONTROL BOX: Receives voice, M.C.W., or C.W. signals with frequency range of 195-9050 kilocycles. "INCREASE OUTPUT" control is a sensitivity control. When flying on radio range, this switch is used as a gain control. "HOMING-COMMUN" control selects one of six bands. "M.V.C.-A.V.C." control permits continuous wave (C.W.) reception or modulated

continuous wave (M.C.W.) reception in "M.V.C." (manual volume control) position. In "A.V.C." (automatic volume control) position, "SHARP" provides for reception of "M.C.W." signals utilizing the A.V.C. circuits and normal selectivity; "BROAD" is used when M.C.W. signals are being located on the two higher frequency bands. Control also acts as on-off switch.

TUNING HEAD: A separate control which mechanically selects and tunes any one of four bands (figure 23).

Operation:

HEAD PHONES: Plug into receiver box.

"M.V.C.-A.V.C." CONTROL: Turn from "OFF" to desired position.

"HOMING-COMMUN" CONTROL: Turn to desired band.

TUNING HEAD: Tune.

"INCREASE OUTPUT" CONTROL: Regulate sensitivity.

M.C.W. SIGNALS: To receive signals, operate "M.V.C.-A.V.C." control to "M.C.W." position. Set "HOMING-COMMUN" control to position corresponding to frequency range and type of antenna desired. Tune signal for maximum output. If automatic volume control is desired, reset "M.V.C.-A.V.C." control to desired position under "A.V.C." and readjust volume control for desired output level.

C.W.SIGNALS: To receive signals, operate "M.V.C.-A.V.C." control to "C.W." position. Set "HOMING-COMMUN" control to desired frequency band.

RADIO RANGE: When on radio range, "M.V.C.-A.V.C." control will automatically

be in "M.V.C." position. Use "INCREASE OUTPUT" control as a gain control. It is necessary to be on radio range in order to get course indications.

COMMUNICATION CHANNELS: When "M.V.C.-A.V.C." control is on "SHARP" or "BROAD," "INCREASE OUTPUT" control can be used on any of the communication channels.

3. OXYGEN EQUIPMENT.

Pilot is provided with a diluter-demand type oxygen system. The importance of proper use of oxygen should not be underestimated. A pilot's efficiency becomes increasingly impaired above 10,000 feet if oxygen is not used wisely. The immediate results from lack of oxygen are mental haziness, slight dizziness, lack of coordination, sleepiness, impairment of sight, nausea, and fatigue. Unconsciousness and death are swift at higher altitudes. Oxygen is particularly important in night flights where 100 percent vision is most necessary. Night vision begins to lessen at 5000 feet without use of oxygen mask.

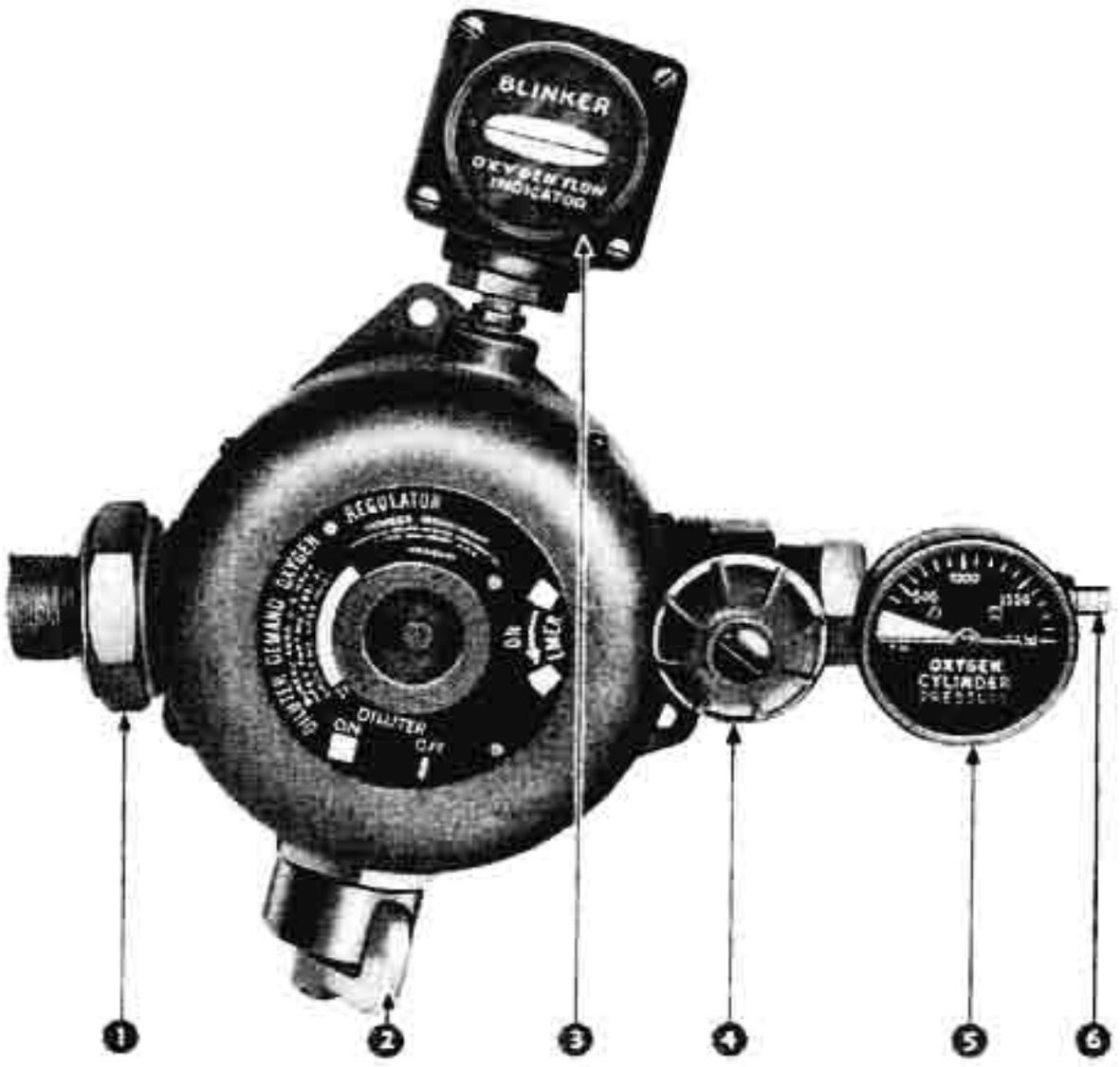
NOTE

All personnel using oxygen equipment should familiarize themselves thoroughly with the symptoms of anoxia as described in Technical Note 30-41 so that they will at all times be on the alert to detect oxygen deficiencies before serious physical effects have resulted.

a. OXYGEN CYLINDER.

Location: Behind armor plate on right side of wing shear panel. Main shut-off valve is at forward end of cylinder. Capacity of cylinder is 295 cubic inches at 1800 psi pressure. Length of time fully charged cylinder will supply oxygen at various altitudes is as follows:

ALTITUDE (in feet)	DURATION
10,000	5 hrs 45 min
15,000	4 hrs 48 min
20,000	4 hrs 8 min
25,000	3 hrs 30 min
30,000	2 hrs 48 min



1. To Oxygen Mask
2. Air Dilution Valve
3. Blinker
4. Emergency Bypass Valve
5. Cylinder Pressure Gage
6. To Oxygen Cylinder

Figure 27 - Oxygen Regulator

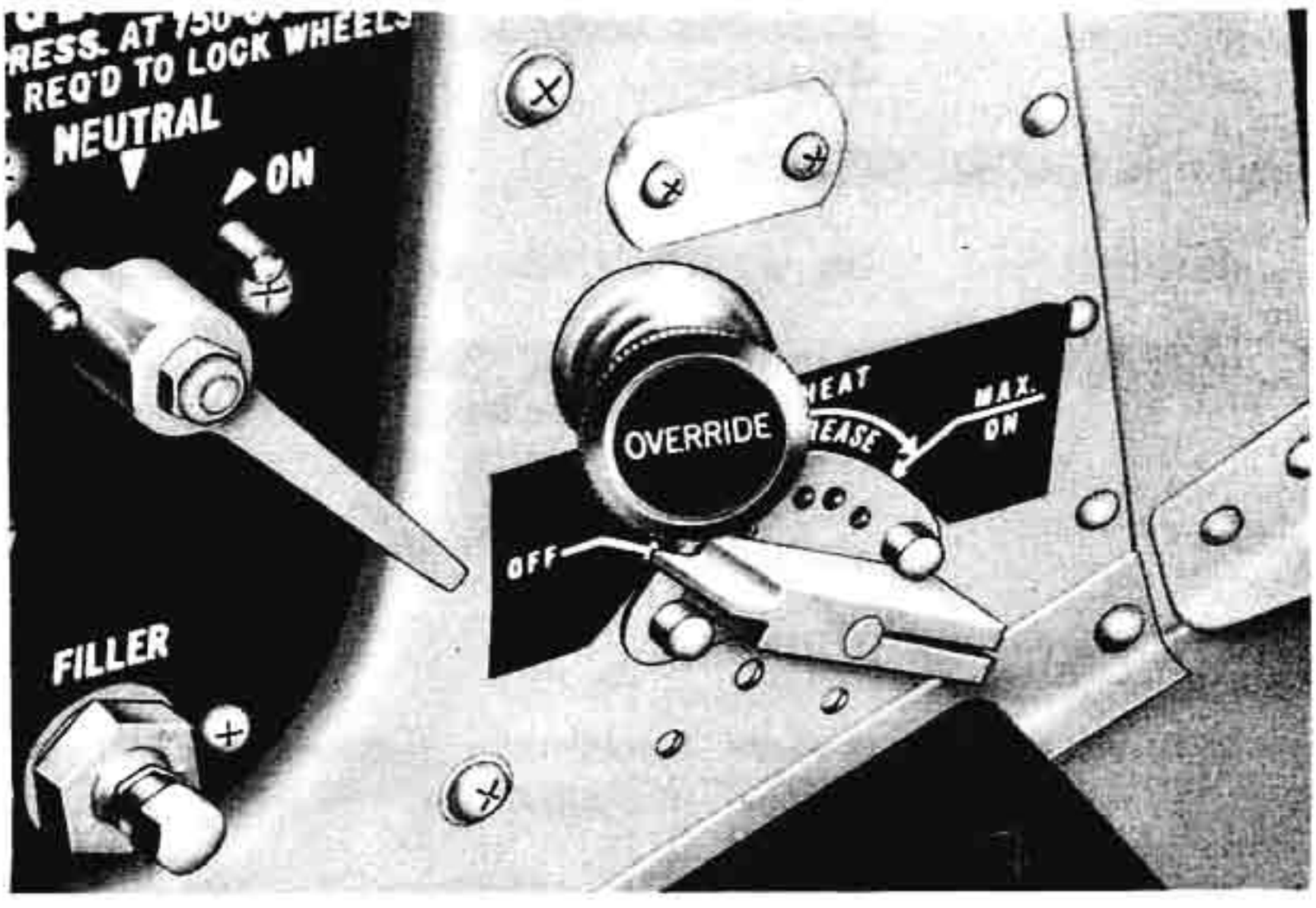


Figure 28 - Heater Controls

Approximate rate of oxygen flow is as follows:

ALTITUDE (in feet)	AMOUNT (per minute)
10,000	1.6 liters
20,000	2.2 liters
30,000	3.2 liters

b. OXYGEN REGULATOR.

Location: To right of pilot (figure 27).

Operation: In conjunction with pilot's normal respiration to supply correct amount of oxygen at all altitudes.

NOTE

At sea level, no oxygen is delivered because atmosphere contains sufficient oxygen (21 percent); at approximately 30,000 feet, 100 percent oxygen is required and is delivered on demand.

(1) OXYGEN PRESSURE GAGE

Location: Top of regulator (figure 27-5). Registers correct amount of oxygen pressure. Calibration is in hundreds up to 2000 psi. Lower scale, from 100 to 300 psi, is of a luminous orange color and indicates oxygen supply is practically depleted.

(2) OXYGEN DILUTER CONTROL.

Location: On right side of regulator (figure 27-2).

Operation: Turn control "ON"; regulator will automatically select correct oxygen-air mixture. When control is "OFF," pure oxygen is supplied on demand. Control should be "ON" for all normal operations.

(3) OXYGEN EMERGENCY CONTROL.

Location: Below pressure gage--red knob marked "EMER" (figure 27-4).

Operation: Turn knob counterclockwise; pure oxygen is delivered in a steady flow. To close, turn knob clockwise. Use in flight above 35,000 feet only or if

diluter-demand regulator becomes inoperative. When using emergency control, open it slowly and obtain minimum flow required.

(4) OXYGEN FLOW INDICATOR (BLINKER).

Location: Left side of oxygen regulator (figure 27-3).

Operation: Blinker operates whenever oxygen is flowing through regulator, except when emergency valve is in use.

NOTE

If diluter control is turned on near sea level, blinker cannot register flow of oxygen, since no additional oxygen is required at that altitude.

c. OXYGEN MASK: Provided with straps for attachment to helmet or head harness. Straps can be worn parallel or crossed. Facepiece incorporates two expiratory valves. Make certain mask fits perfectly.

d. OXYGEN CONTROLS.

Operation: If oxygen is to be used in flight, adjust controls as follows:

Before take-off:

OXYGEN CYLINDER PRESSURE: Check by opening cylinder valve. Pressure gage should read 1800± 50 psi if cylinder is fully charged.

CYLINDER VALVE: Close. If pressure drops more than 100 psi in five minutes, there is excessive leakage and system should be repaired prior to use.

MASK: Check for fit by squeezing breathing tube and inhaling lightly. Mask will collapse if there is no leakage. Do not use a mask that leaks. Emergency control must be off when check is made.

EMERGENCY FLOW: Check to make certain lines are clear and that valve is closed.

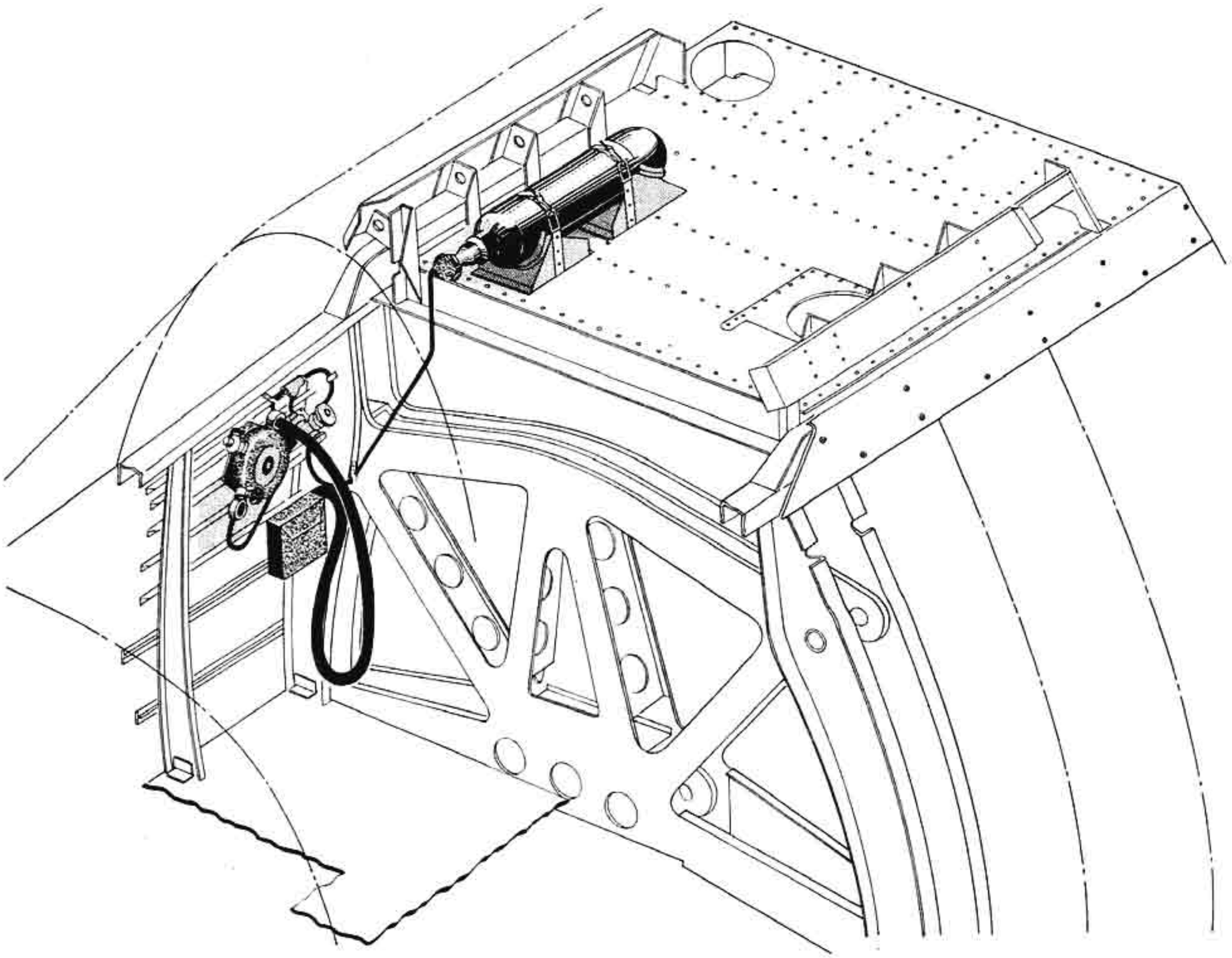


Figure 29 - Oxygen System

DILUTER CONTROL: "ON."

EMERGENCY CONTROL: Off.

CYLINDER VALVE: On. Breathe several times to determine that regulator is functioning properly.

CAUTION

Make certain that all lines and fittings are free from oil, grease, or other lubricants; otherwise, fire or explosion may result.

To use oxygen:

DILUTER CONTROL: "ON."

EMERGENCY CONTROL: Off.

MASK: Snug fit.

BREATHING: Normal.

NOTE

At low temperatures, manipulate mask to free it of any ice that may form. If signs of oxygen deficiency appear, open emergency valve.

EXTENDED FLIGHTS: When climbing directly to altitudes of 30,000 feet or above, at an average rate of climb in excess of 500 feet per minute, diluter valve shall be turned "OFF" before take-off and 100 percent oxygen shall be used throughout flight until return is made to an altitude of 10,000 feet or less. Use oxygen above 15,000 feet, when flying for two hours or longer between 12,000 feet and 15,000 feet, and when flying for four hours or longer above 10,000 feet. If demand mechanism should fail, turn emergency control "ON" to supply a direct flow of oxygen.

CAUTION

If system should fail, quickly descend to at least 15,000 feet. Unconsciousness occurs in a very short time at higher altitudes.

CYLINDER VALVE: Turn off at conclusion of flight.

4. AIR-CONDITIONING EQUIPMENT.

a. HEATER: A Stewart-Warner heater with an output of 80,000 Btu's per hour delivers heat into cockpit at 88°C (200°F).

b. CABIN HEAT CONTROL.

Location: To right of emergency brake, above electric panel (figure 28).

Operation: Turn to desired position on control: "OFF," "ON," "INCREASE," "MAX. ON," or any intermediate stop.

CAUTION

Do not operate heater while airplane is on ground or during take-off, climb, or landing.

c. OVERRIDE CONTROL.

Location: Directly above cabin heat control (figure 28).

Operation: Illumination of red light above control indicates that heater is too hot. When heater becomes too hot or when cockpit is too warm, turn handle one-quarter turn and pull it out. This action opens shutters in temperature turbine regulator and allows cold air to pass through heater at a greater rate and thereby cool heater and cockpit. When sufficient time has elapsed to cool heater, close shutters by pushing handle in.

NOTE

Override control can be pulled out when heater is turned "OFF" to supply cool air to cockpit.

d. COCKPIT VENTILATOR AND WINDSHIELD DEFROSTER.

Location: Between windshield and bulletproof glass.

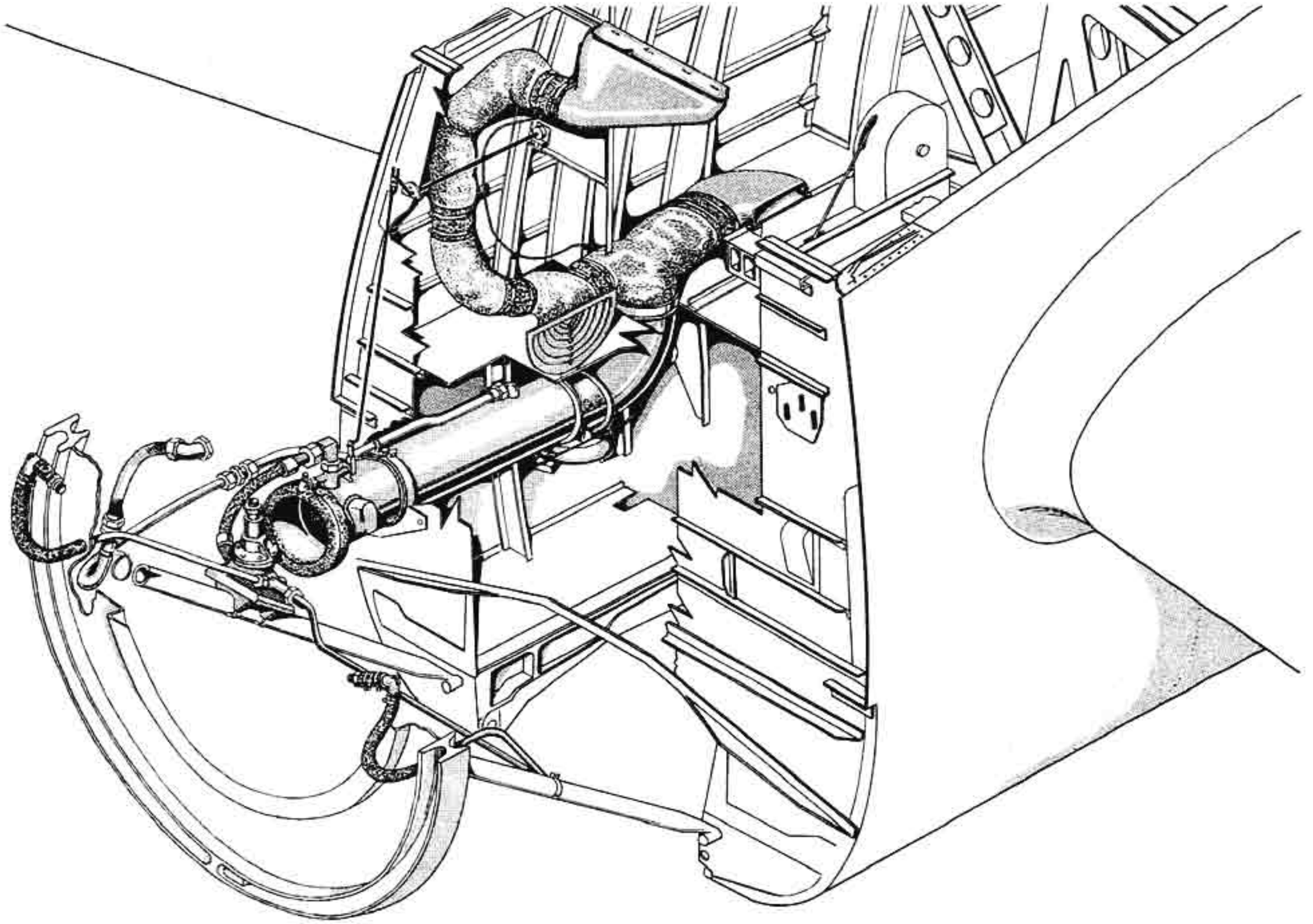


Figure 30 - Heating System

Operation: Controlled by lever on left side of windshield. Ventilator--Move lever horizontally to right. Two intermediate stops permit door to be held partially open. Defroster--Place lever in closed position at extreme left.

5. AUTOMATIC PILOT EQUIPMENT.

a. CONTROL AND INSTRUMENTS.

Location: Control--to right of instrument panel, above emergency air brake pressure gage (figure 32); instruments--center of instrument panel (figure 31).

Operation: Conventional.

b. OPERATING LIMITS OF AUTOMATIC PILOT.

(1) CLIMBING OR GLIDING: When operating airplane automatically, do not exceed 18 degrees in either direction. When operating airplane manually, with gyros acting as flight instruments only, do not exceed 55 degrees in either direction.

CAUTION

If flight reference limits (55 degrees) are to be exceeded, cage gyros while airplane is still in level flight.

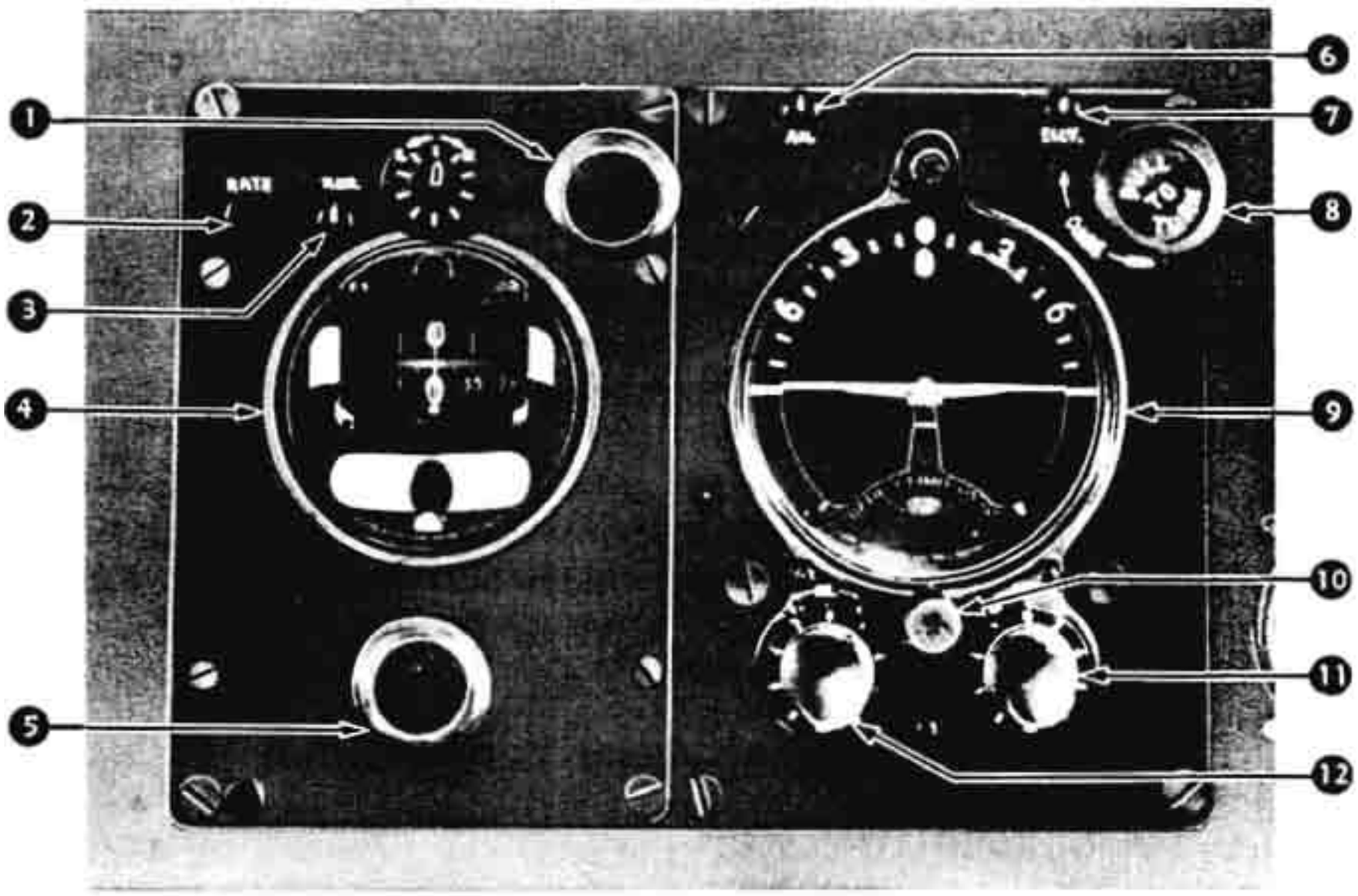
(2) BANKING: When operating airplane automatically, do not exceed 25 degrees in either direction. When operating airplane manually, with gyros acting as flight instruments only, do not exceed following limits:

Directional Gyro . . . . . 55 degrees
Bank-and-Climb Gyro. . . . 90 degrees

CAUTION

If flight reference limits are to be exceeded, cage gyros while airplane is still in level flight.

(3) TURNING: Amount of turn which can be made is unlimited.



1. Course-setting Knob
2. Rate Adjustment
3. Rudder Signal Adjustment
4. Directional Gyro
5. Caging Knob
6. Aileron Signal Adjustment
7. Elevator Signal Adjustment
8. Caging Knob
9. Bank-and-Climb Gyro
10. Miniature Airplane Adjustment
11. Elevator Trim Knob
12. Aileron Trim Knob

Figure 31 - Automatic Pilot Gyro Control Unit

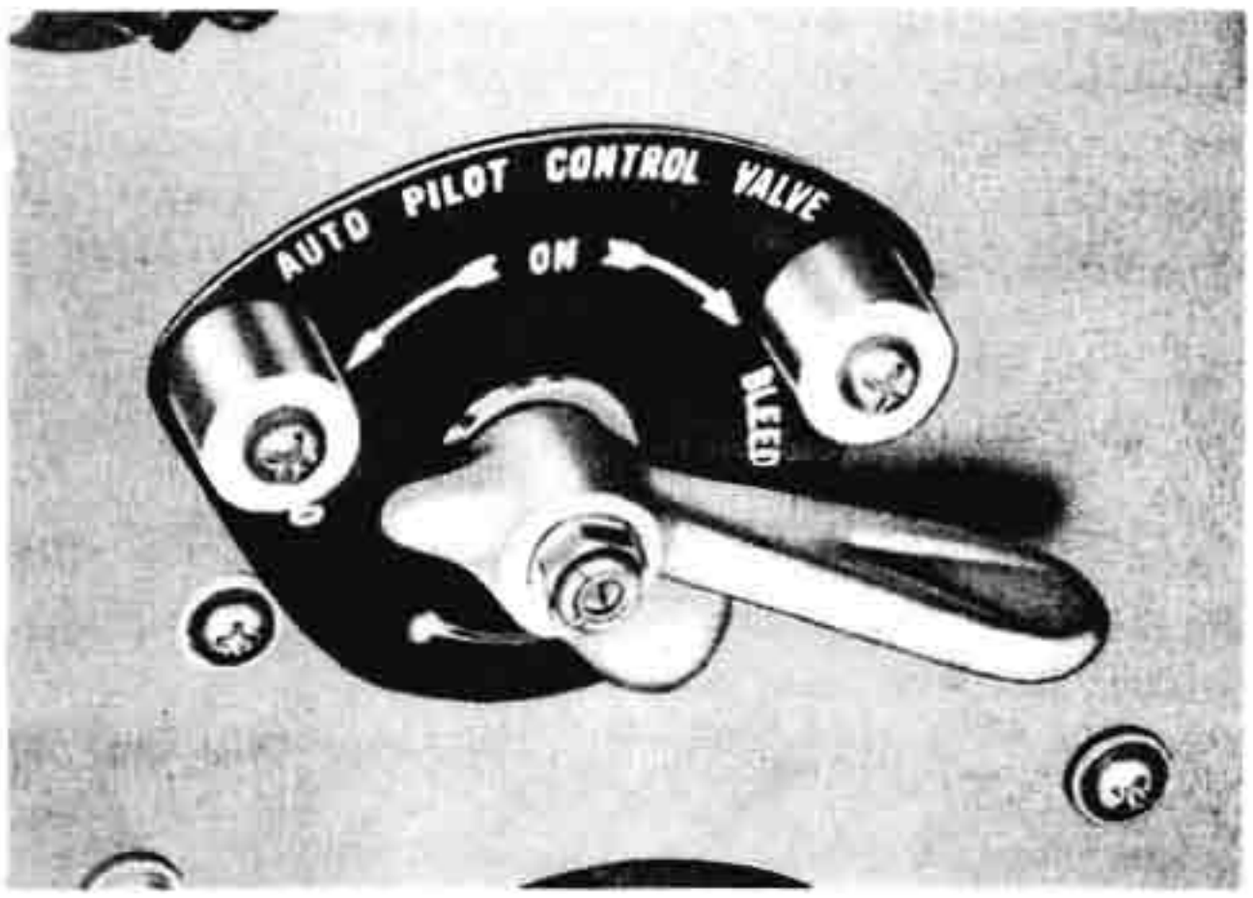


Figure 32 - Automatic Pilot Control

c. GROUND CHECK OF AUTOMATIC PILOT.

(1) OIL IN RESERVOIR: Quantity should be "NORMAL."

(2) VACUUM AND OIL PUMPS:

ENGINE: Set at 600 to 700 rpm.

GAGE: Note reading; use portable vacuum gage.

(3) OIL PRESSURE:

PRESSURE: 4 to 5 in. Hg and 115 to 125 psi.

AUTOMATIC PILOT: "ON."

ENGINE: Running at 1000 rpm.

(4) AIRPLANE CONTROLS:

AIRPLANE CONTROLS: Note neutral position.

ENGINE: Run at 1000 rpm.

AIRPLANE CONTROLS: Center.

GYROS: Uncage.

GYRO TRIM KNOBS: Set at "0."

AUTOMATIC PILOT: "ON."

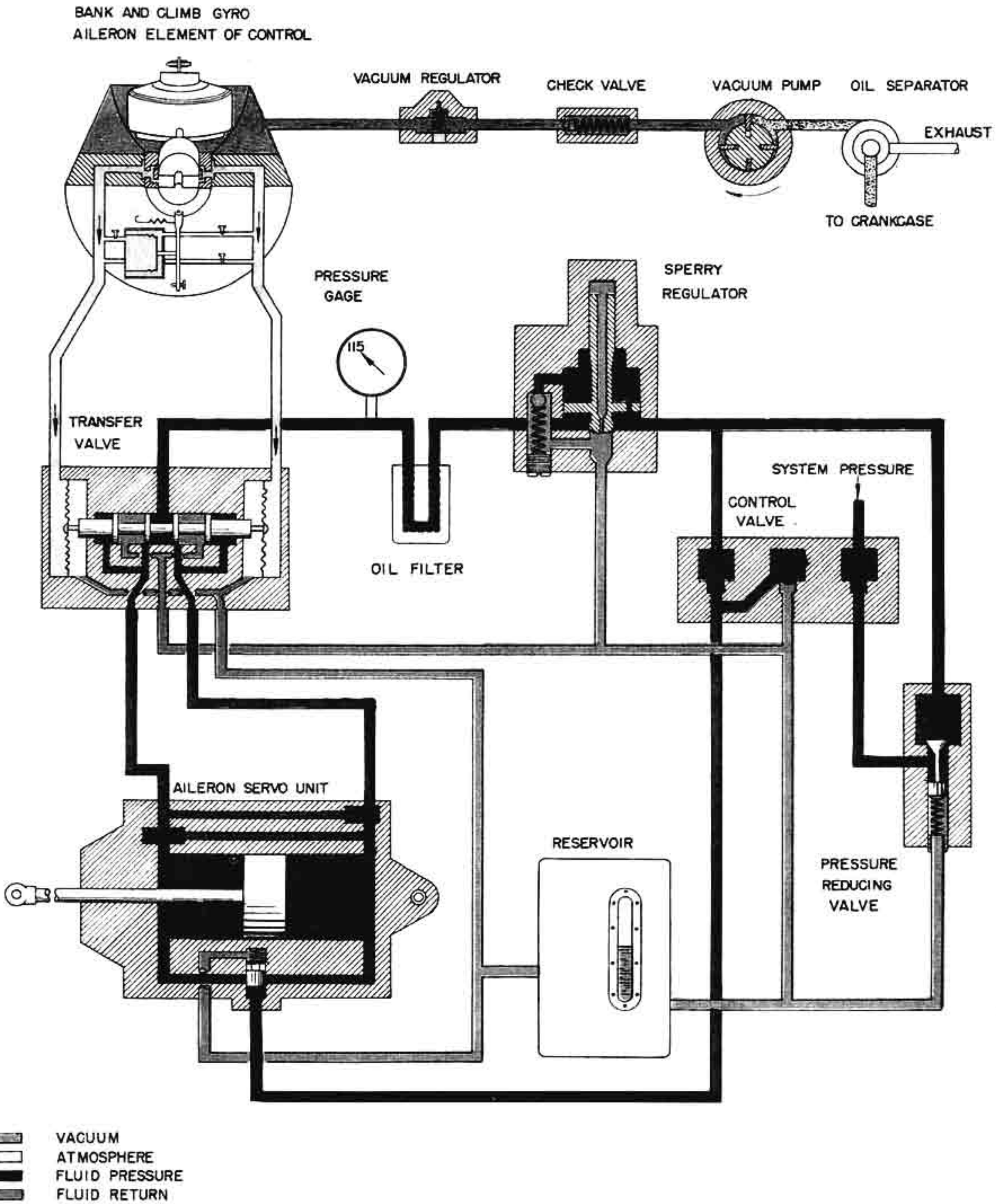


Figure 33 - Automatic Pilot Engaged, Airplane in Level Flight

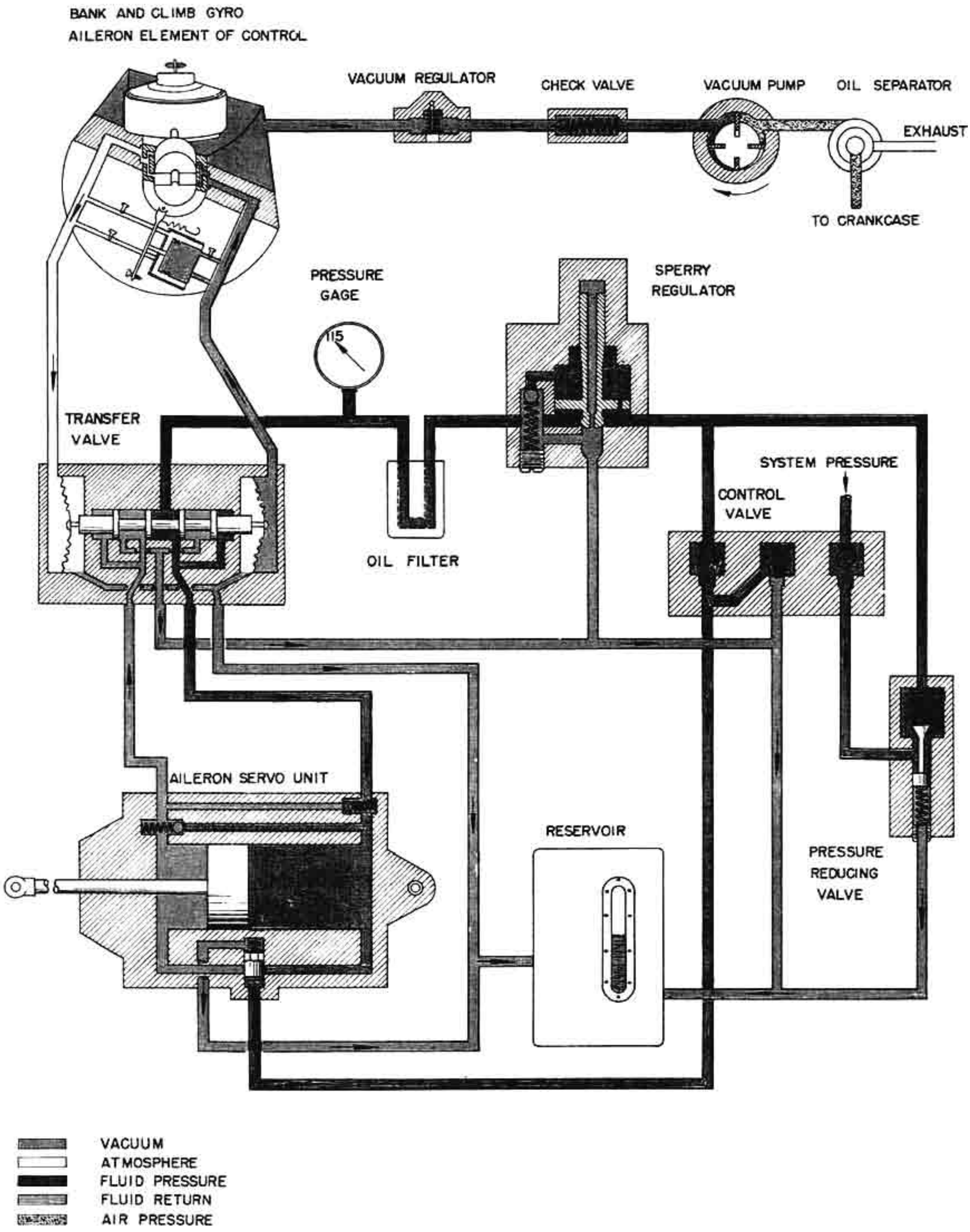


Figure 34 - Automatic Pilot Engaged, Bank-and-Climb Gyro Shown Correcting a Bank

AN/ARC-5 RADIO EQUIPMENT

The instructions given below are for the operation of the AN/ARC-5 communication radio equipment and supersede the information contained in paragraph 2.a., pages 76 to 80, inclusive. The ATA/ARA communication radio is a temporary alternative installation only.

COMMUNICATION RADIO (AN/ARC-5).

Location:

TRANSMITTER CONTROL BOX: Above electric panel. Contains seven buttons: Four buttons ("A," "B," "C," "D") on top row select channels for VHF transmitter and receiver simultaneously; "OFF" switch (first button on second row) throws off all power to transmitting equipment and turns off all transmitter heaters; next two buttons ("2" and "3") select two MHF transmitters which have preset frequencies (only one transmitter or channel can be selected at a time); emission switch sends on "TONE," "CW" (continuous wave), or "VOICE"; microphone switch or throttle switch turns transmitters on.

RECEIVER CONTROL BOX: Aft of electric panel. Controls three receivers: "REC.A" controls VHF receiver--receives on one of four channels selected by VHF buttons on transmitter control box. "REC. B" controls ARB (MHF) receiver--receives on preset frequency. "REC. C" controls ARC-HF receiver--receives on a preset frequency. All receivers are pretuned before flight. Limited range sensitivity control--above each receiver switch. Moving control in direction of arrow increases sensitivity but also increases noise. Set for maximum tolerable noise to gain

maximum sensitivity. Volume control on lower left side controls audio for all sets. Microphone selector switch on upper left side selects "ICS" or "RADIO." ("ICS" is not used in this airplane.) Homing receiver controls --on right side of control box.

JACK BOX: Right side of seat. Two jacks on top of box are for hand microphone and extension to head set. Extension cable on side of jack box is for connection of oxygen mask microphone. Lower plug on side of box is connected to throttle switch. This switch operates transmitter selected and switches antenna relay from receiver to transmitter. When hand microphone is used, same result is obtained by depressing microphone switch.

MICROPHONE HOLDER: Aft of tactical radio control box.

Operation: To Transmit:

BATTERY SWITCH: "BATTERY."

CIRCUIT BREAKERS: Make certain that all buttons are pushed in.

TRANSMITTER: Select desired transmitter on transmitter control box. (Only one can be selected at a time.) Allow 15-second warm-up period after pressing button. If using VHF transmitter, select desired channel--button "A," "B," "C," or "D." If using one of MHF transmitters (button "2" or "3") with VHF receiver, press desired VHF button before selecting transmitter. To change receivers, again depress a VHF button before returning to transmitter. Last VHF button (receiver) used will continue to operate when MHF button is pressed.

CAUTION

Allow approximately four seconds before switching from a VHF transmitter to an MHF transmitter.

EMISSION
SWITCH: Set for "TONE," "CW," or "VOICE."

"PUSH-TO-TALK"
BUTTON: Depress (throttle or hand microphone) if on "VOICE."

NOTE

When on "VOICE," transmitter dynamotor will not start until "push-to-talk" button is pressed. Sidetone is heard during transmitting.

EMISSION
SWITCH: To reduce battery drain and increase dynamotor life, place transmitter emission switch in "VOICE" unless continued use in "CW" or "TONE" is expected. In "CW" and "TONE," dynamotor is constantly running; in "VOICE," dynamotor starts and stops with each keying. Keying in "VOICE" therefore involves a heavy starting current which reduces life of dynamotor and should be avoided.

CAUTION

Do <u>not</u> switch transmitters while transmitting.

<u>To Receive</u>:

BATTERY
SWITCH: "BATTERY."

CIRCUIT
BREAKERS: Make certain that all buttons are pushed in.

"PUSH-TO-TALK"
BUTTON: Release to listen.

RECEIVER: Select desired receiver with <u>one</u> of three switches: If using VHF receiver, select one of four channels on transmitter control box. If using VHF receiver with an MHF transmitter, select channel with one of VHF buttons before selecting transmitter.

SENSITIVITY
CONTROL: Adjust for maximum tolerable noise.

VOLUME CONTROL: Adjust for desired level of reception.

MICROPHONE SELECTOR SWITCH: Make certain that switch is on "RADIO."

NOTE

All three receivers, plus homing receiver, can be operated simultaneously.

HOMING RECEIVER (AN/ARR-2).

Location: Following controls are on right side of receiver control box:

CRANK: Selects one of six bands. Window shows number of selected band.

SENSITIVITY CONTROL: Acts as on-off switch and adjusts sensitivity.

PITCH CONTROL: Adjusts pitch and corrects for tuning error.

"CW-VOICE" SWITCH: Selects one of two positions for reception. ("CW" is usual position.)

HEAD SET: Plugged into bottom of control box.

Operation:

HEAD SET: Plug in.

SENSITIVITY CONTROL: Turn receiver on.

HOMING BAND: Select with crank.

"CW-VOICE" SWITCH: Turn to "CW" (or "VOICE").

PITCH CONTROL:	Adjust for pleasing tone and correct for error in reception.
SENSITIVITY CONTROL:	Adjust.
SIGNAL:	Listen until signal comes around.

Appendix I

GLOSSARY OF NOMENCLATURE

APPENDIX I

GLOSSARY OF NOMENCLATURE

U.S.A. - BRITISH

U.S.A.	BRITISH
Accumulator	Pressure Reservoir
Acrobatics	Aerobatics
Airport	Aerodrome
Antenna	Aerial
Battery (Storage)	Accumulator
Bulletproof Glass	Armor Glass
Ceiling	Cloud Height
Course	Track Angle
Directional Gyro	Turn Indicator
Empennage	Tail Unit
Engine	Aero-engine
Exit	Egress
Fuel Capacity	Petrol Volume
Gasoline	Petrol
Generator	Dynamo
Ground (Electrical)	Earth
Gross Weight	All-up Weight
Horizontal Stabilizer	Tail Plane
Hydraulic Cylinder	Hydraulic Jack
Lean	Weak
Left	Port
Level-off	Flatten Out
Life Raft	Dinghy
Manifold Pressure	Boost
Mixture Control	Altitude Control
Navigation	Avigation
Power Plant	Aero Engine
Right	Starboard
Signal	Signal Star
Tachometer	Engine Speed Indicator
Ton (2000 pounds)	Short Ton
Ton, Long (2240 pounds)	Ton
Useful Load	Disposable Load
Valve	Cock
Vertical Stabilizer	Fin
Weight Empty	Tare
Windshield	Windscreen
Wing	Main Plane

Appendix 2

FLIGHT OPERATING CHARTS, TABLES, CURVES, DIAGRAMS

Operating Limits Chart

Fuel Flow Chart - "Auto Rich"

Fuel Flow Chart - "Auto Lean"

Propeller Load Curve - Chart 1

Propeller Load Curve - Chart 2

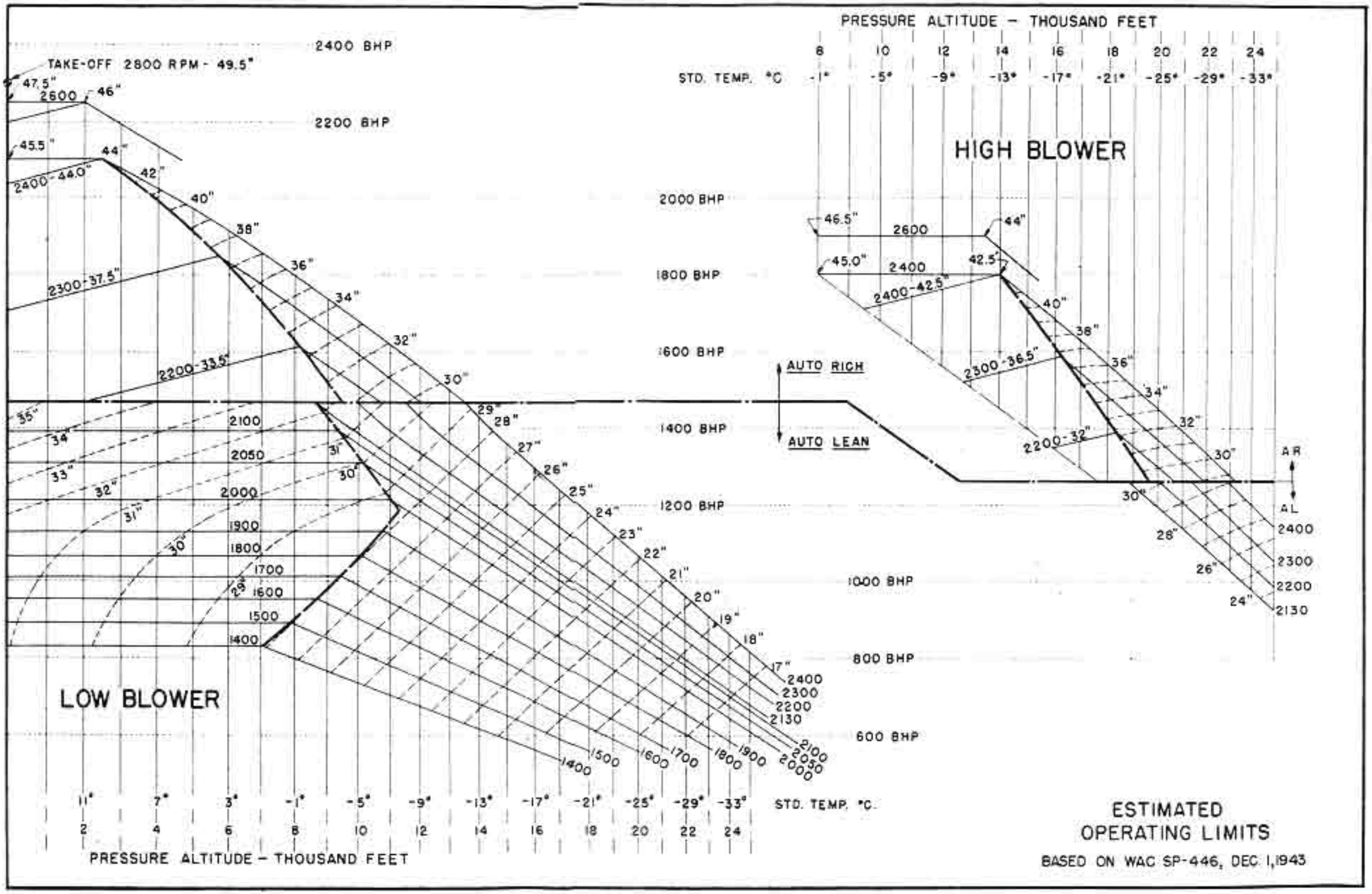


Figure 35 - Operating Limits Chart

FUEL FLOW CURVES AT CONSTANT POWER WITH CARBURETOR SETTING SUBMITTED FOR APPROVAL
SPEC. AN9515A

MIXTURE CONTROL IN "AUTO RICH" POSITION

CURVE NO. 5A
DATE 3-31-42
CARB MODEL STROMBERG PR58-A1
SERIAL NO. 40116
TRUE BAROMETER 29.88 IN. HG
WET BULB TEMP 39°F
DRY BULB TEMP 45°F
VAPOR PRESSURE 0.17 IN. HG
CARB AIR TEMP (AVG) 85°F
AIR BLAST TEMP (AVG) 47°F
FUEL 100 OCTANE W.A.C. SPEC. 5806
LOG SHEETS NO. 317 - 324
MAGNETO TIMING 20° - 20°

LEGEND

⊞	200 BHP	+	900 BHP
⊕	300 BHP	×	1000 BHP
Y	400 BHP	▽	1100 BHP
⊠	500 BHP	△	1200 BHP
f	600 BHP	⊡	1300 BHP
•	700 BHP	⊙	1400 BHP
◇	800 BHP		

WOT INDICATES WIDE OPEN THROTTLE

MPP INDICATES MINUMUM PROPELLER PITCH

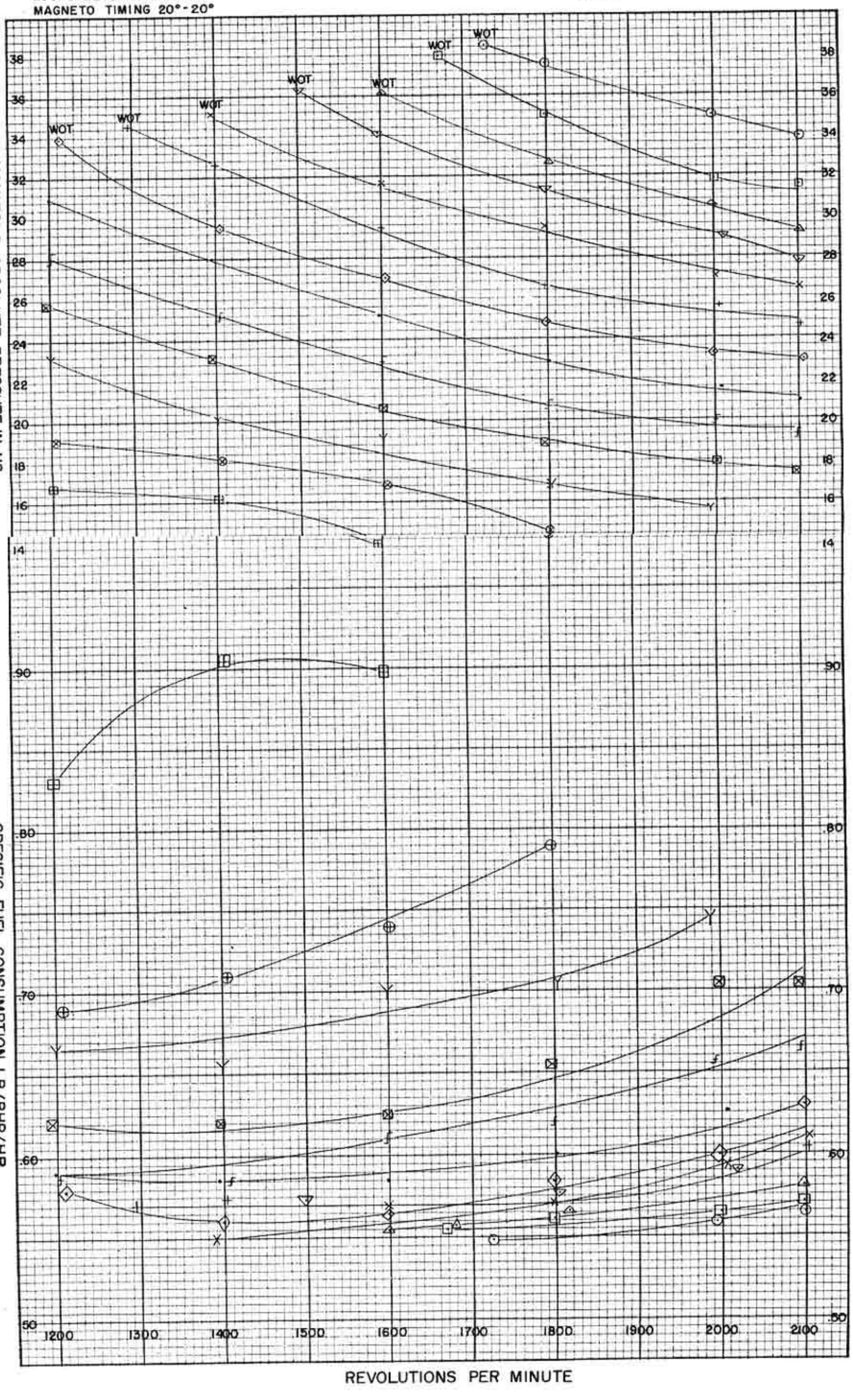


Figure 36 - Fuel Flow Chart - "AUTO RICH"

WRIGHT DOUBLE ROW CYCLONE R3350-14 (R3350-8 NO. 16821 CR 6.85:1 SR 6.08:1)
FUEL FLOW CURVES AT CONSTANT POWER WITH CARBURETOR SETTING SUBMITTED FOR APPROVAL
SPEC. AN9515A

MIXTURE CONTROL IN "AUTO LEAN" POSITION

CURVE NO. 58
DATE 3-30-42
CARB MODEL STROMBERG PR58-A1
SERIAL NO. 40116
TRUE BAROMETER 29.75 IN. HG
WET BULB TEMP 37 °F
DRY BULB TEMP 41 °F
VAPOR PRESSURE 0.22 IN. HG
CARB AIR TEMP (AVG) 85 °F
AIR BLAST TEMP (AVG) 49 °F
FUEL 100 OCTANE W.A.C. SPEC. 5806
LOG SHEETS NO. 329-332
MAGNETO TIMING 20°-20°

LEGEND

⊞	200 BHP	+	900 BHP
⊗	300 BHP	×	1000 BHP
Y	400 BHP	▽	1100 BHP
⊠	500 BHP	△	1200 BHP
f	600 BHP	⊡	1300 BHP
·	700 BHP	⊙	1400 BHP
◇	800 BHP		

WOT INDICATES WIDE OPEN THROTTLE
MPP INDICATES MINIMUM PROPELLER PITCH

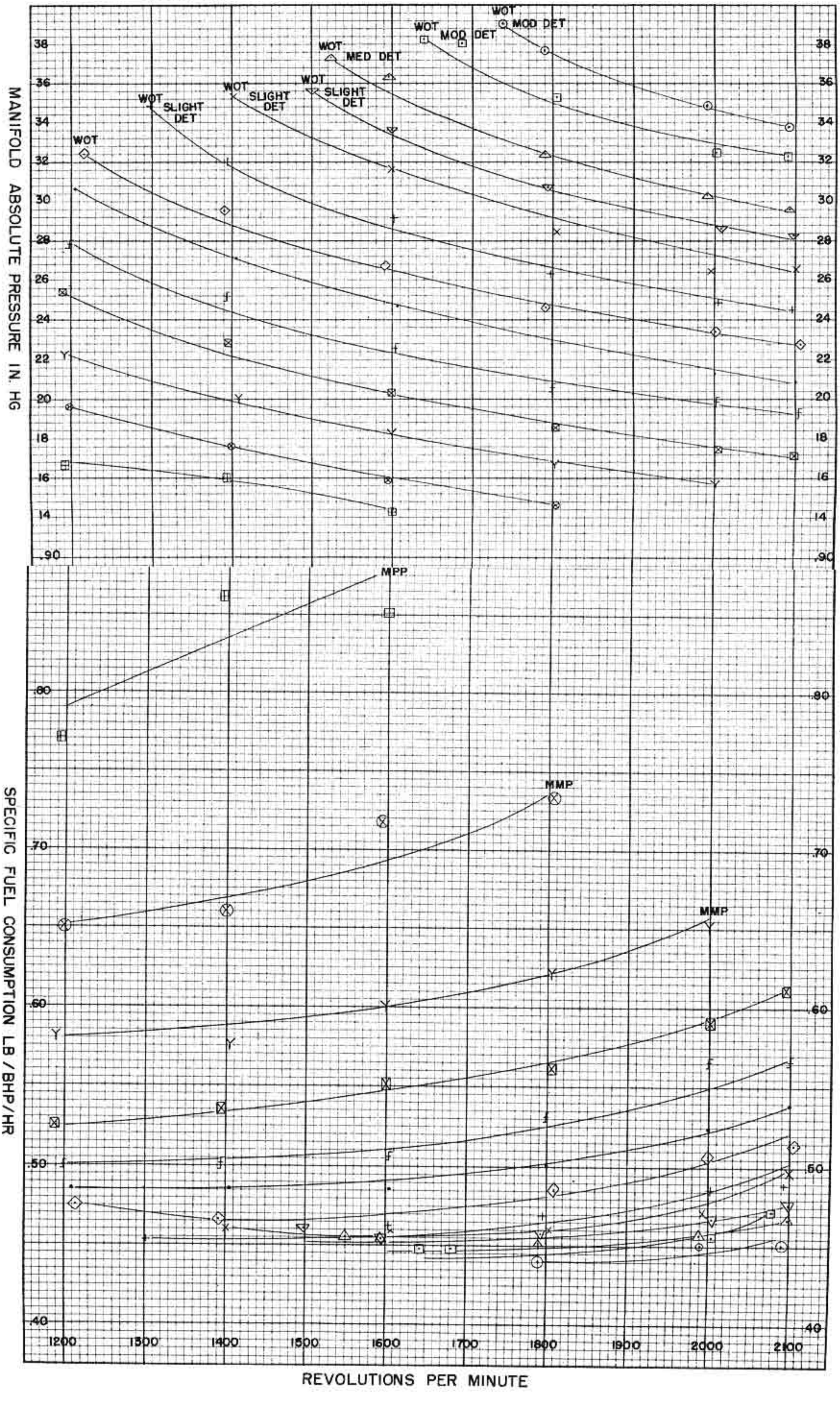


Figure 37 - Fuel Flow Chart - "AUTO LEAN"

WRIGHT DOUBLE ROW CYCLONE R3350-14 (R3350-8 NO.16821 CR 6.85:1 SR 6.08:1)
FLIGHT PROPELLER LOAD CURVES WITH CARBURETOR SETTING SUBMITTED FOR APPROVAL
SPEC. AN9515A

CURVE NO 38
DATE 3-26-42
CARB MODEL STROMBERG PR58-A1
SERIAL NO 40116
TRUE BAROMETER 30.09 IN. HG
WET BULB TEMP 41°F
DRY BULB TEMP 54°F
VAPOR PRESSURE 0.11 IN. HG
CARB. AIR TEMP (AVG) 83°F
AIR BLAST TEMP (AVG) 52°F
FUEL 100+ OCTANE W.A.C. SPEC. 5808
LOG SHEETS NO. 291-295
NO. 335-337
MAGNETO TIMING 20°-20°

BRAKE HORSEPOWER
AIR FLOW LB/HR
FUEL FLOW LB/HR
FUEL - AIR RATIO
SPEC. FUEL CONSUMPTION LB/BHP/HR
REVOLUTIONS PER MINUTE

Figure 38 - Propeller Load Curve - Chart I

WRIGHT DOUBLE ROW CYCLONE R3350-14 (R3350-8 NO. 16821 CR 6.85:1 SR 6.08:1)
FLIGHT PROPELLER LOAD CURVES WITH CARBURETOR SETTING SUBMITTED FOR APPROVAL
SPEC. AN9515A

CURVE NO. 38 (CONTINUED)

LEGEND:
"AUTO RICH" FLIGHT PROPELLER LOAD CURVE
"AUTO LEAN" FLIGHT PROPELLER LOAD CURVE

MANIFOLD ABSOLUTE PRESSURE IN. HG

METERING SUCTION DIFFERENTIAL IN. H O

CARBURETOR PRESSURE DROP IN. HG

FUEL PRESSURE LB/SQ IN.

REVOLUTIONS PER MINUTE

Figure 39 - Propeller Load Curve - Chart II

INDEX TO DOUGLAS EL SEGUNDO PHOTOGRAPH NUMBERS

Figure		Photo No.
	The Douglas Destroyer	40647
1.	Final Assembly - Front	40558
2.	Final Assembly - Left Front	40565
3.	Final Assembly - Right Rear	40562
4.	Final Assembly - Rear	40559
5.	Cockpit - Left Side	40556
6.	Instrument Panel	40555
7.	Engine Control Quadrant	40554
8.	Emergency Air Brake Control Panel	40178
9.	Landing Gear and Flap Position Indicator	40131
10.	Electric Panel	40651
12.	Cockpit - Bottom	40653
13.	Cockpit - Front	40661
14.	Cockpit - Right Side	40652
18.	Armament Controls	40649
19.	Torpedo Depth Setting Control	40372
20.	Bomb Release and Gun Firing Controls	40267
21.	Torpedo Director and Gun Sight	40553
22.	ARB Radio Control Box	40488
23.	ARB Radio Tuning Head	40487
24.	Transmitter Control Box	40591
25.	Receiver Control Box	40601
26.	Recognition Radio Control Box	40654
27.	Oxygen Regulator	40552
28.	Heater Controls	40510
31.	Automatic Pilot Gyro Control Unit	40551
32.	Automatic Pilot Control	40358

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