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T. O. NO. 01-110HA-1



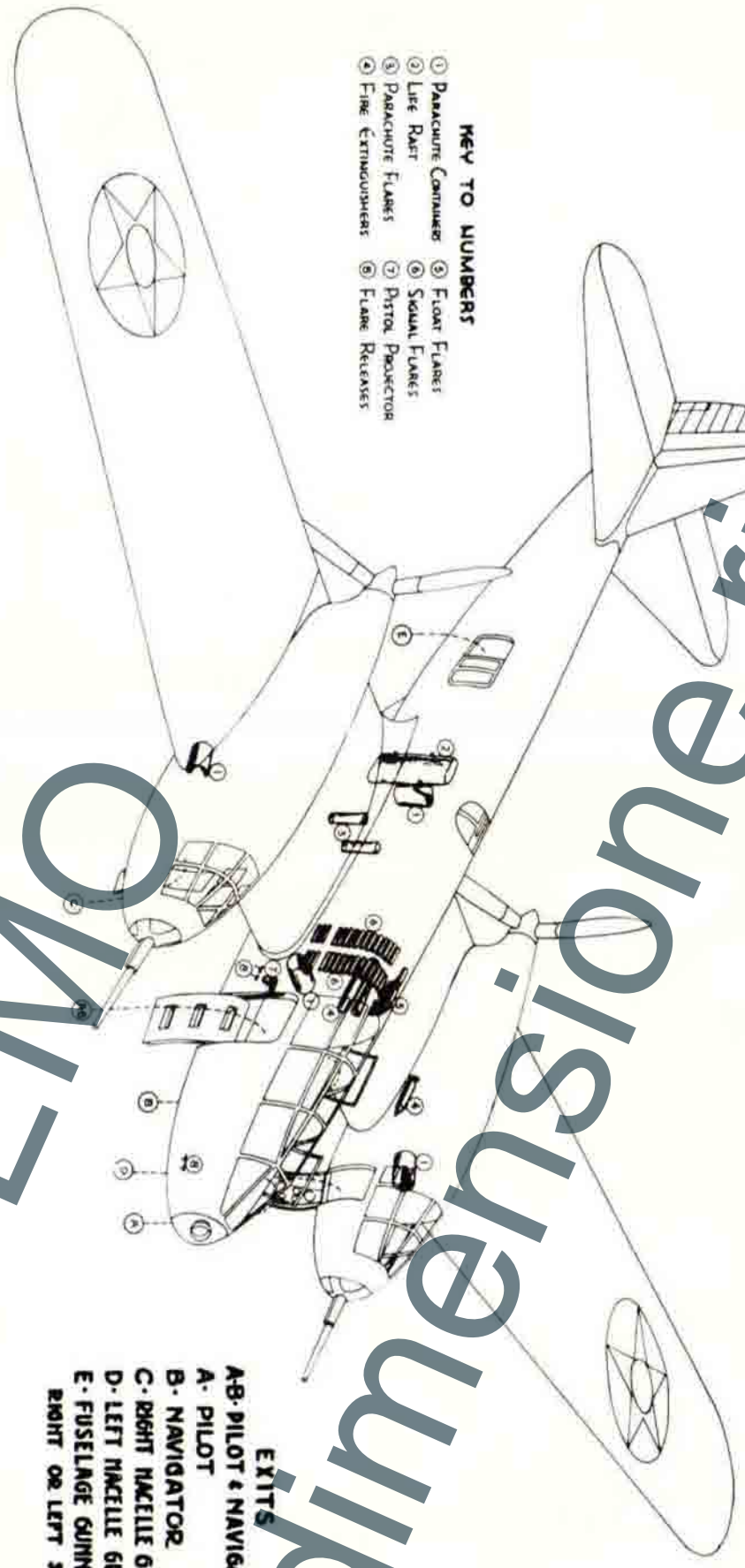
FIG. 1 - 3/4 LEFT REAR VIEW OF COMPLETE AIRPLANE

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- KEY TO NUMBERS**
- ① Parachute Container
 - ② Life Raft
 - ③ Parachute Flares
 - ④ Fire Extinguishers
 - ⑤ Float Flares
 - ⑥ Signal Flares
 - ⑦ Pistol Projector
 - ⑧ Flare Releases



- EXITS**
- A-B. PILOT & NAVIGATOR
 - A. PILOT
 - B. NAVIGATOR
 - C. RIGHT WING GUNNER
 - D. LEFT WING GUNNER
 - E. FUSELAGE GUNNER
RIGHT OR LEFT SIDE

FIG. 2 - EMERGENCY EQUIPMENT & EXITS

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2. Power Plant.

- a. Engines. - See Section V for description.
- b. Auxiliary Engine. - The auxiliary engine is a 13.5 H.P., two-cylinder, gasoline engine, designed for a constant speed of 4,000 r.p.m.
- c. Propellers. - The propellers are three-blade, constant speed, full feathering, automatic selective pitch, pusher type, controlled automatically or manually.
- d. Oil System. - Oil for the main engines is carried in two 28-1/2 gallon tanks, one located aft of each engine. Cooling is provided by two oil coolers equipped with viscosity valves. Additional temperature control is provided by means of manually operated shutters located in the air outlet ducts. Oil dilution for winter flying conditions is provided.
- e. Fuel System. - Fuel is carried in four tanks with a capacity of 200 gallons each. The two main tanks are on either side of fuselage in the center section of the wing and the auxiliary tanks in the outer panels, outboard of each nacelle. A stand pipe in the left hand main fuel tank insures 20 gallons of fuel for the auxiliary engine. This fuel is in addition to the normal supply and does not register on the fuel level indicator as it is not available for operation of the main engines. See Fuel System Diagram, Figure 3.

3. Equipment.

- a. Flight Controls. - Dual wheel-column-stirrup flight controls are provided. A tab control unit is located convenient to each pilot.
- b. Electrical System. - A model 3716RX Eclipse, single voltage generator delivering 175 amperes at 4,000 r.p.m. is driven by the auxiliary engine. A 50 ampere, 24 volt, direct current generator driven by the right hand engine is arranged to operate in parallel with the main generator, thus providing an emergency source of power supply in event of failure of auxiliary engine or generator. Two type C-5 batteries are provided. Power for Autosyn instruments is obtained from a vibrator type converter or from the dynamotor which is an alternate source of power.
- c. Fuselage Equipment. - (1) Pilot's Seat: The pilot's seat has a lever on the right side to permit vertical adjustment. The seat back cushion is the pilot's life preserver.
- (2) Navigator's Seat: The navigator's seat is designed to permit fore and aft movement from the navigator's station to the co-pilot's station, controlled by a lever on the right side. Vertical adjustment is controlled by a lever on the left side. The seat back cushion is the navigator's life preserver.

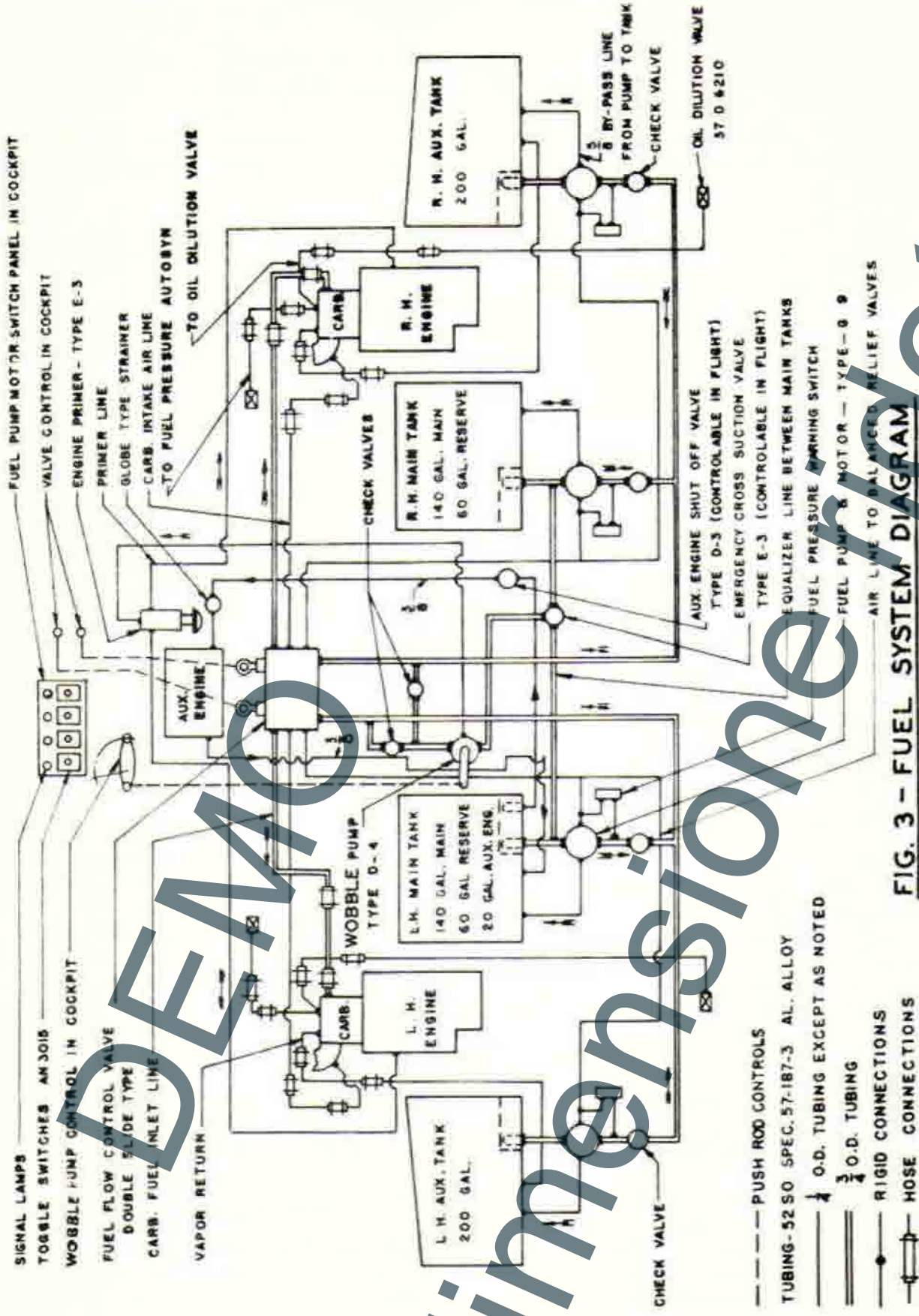


FIG. 3 - FUEL SYSTEM DIAGRAM

(3) Fuselage Gunner's Seat: The fuselage gunner's bench hinges on the right side and folds upward to stowed position. A release lever is located on the left side. A canvas seat back on the left side of the airplane is removable and is stowed on the right side. The seat cushion is the gunner's life preserver.

(4) Nacelle Gunner's Seat: The nacelle gunners are provided with folding canvas seats which are stowed in vertical position on front side of engine firewall. The seat cushion constitutes the nacelle gunner's life preserver.

(5) Emergency Equipment and Exits: (a) General: The emergency equipment and exits are illustrated in Figure 2.

(b) Parachutes: All crew members use the detachable type parachute except the pilot who uses the seat pack type.

(c) Emergency Exits: Fall-away sections on the left side of the fuselage cabin enclosure at both pilot's and navigator's stations provide emergency exits. Releases for these sections are located at the top center of each. The fuselage gunner's emergency exit is by means of either side gun turret. The entrance doors on each nacelle constitute the nacelle gunner's exits.

(d) Flotation Gear: Four compartments within each wing outer panel provide flotation in event of emergency water landing. Vent and bilge lines run from these compartments to the top outboard side of each nacelle. A bilge pump carried in the fuselage over the bomb compartment should be used at each bilge connection after emergency landing on water.

(e) Life Raft: A type A-2 five-man life raft complete with CO₂ cylinder is carried on the right side of the fuselage aft of the top gun turret. Inflation is accomplished by manual operation of the valve on the raft itself.

(6) Baggage: Adequate space for baggage is provided in the fuselage below the floor, forward of the bottom turret gun compartment.

d. Heating and Ventilating Equipment. - Warm air is brought to each crew station through ducts from a heater muff around the exhaust manifold of each engine. Butterfly valves at each station control the warm air to suit requirements. Pilot's, navigator's, and nacelle gunner's station are ventilated by means of sliding Plexiglas panels in either side of the cabin enclosure.

e. Fire extinguishing Equipment. - A pressure type CO₂ fire extinguisher is provided for the engines. One type A-14 extinguisher and one type A-2 extinguisher are also provided.

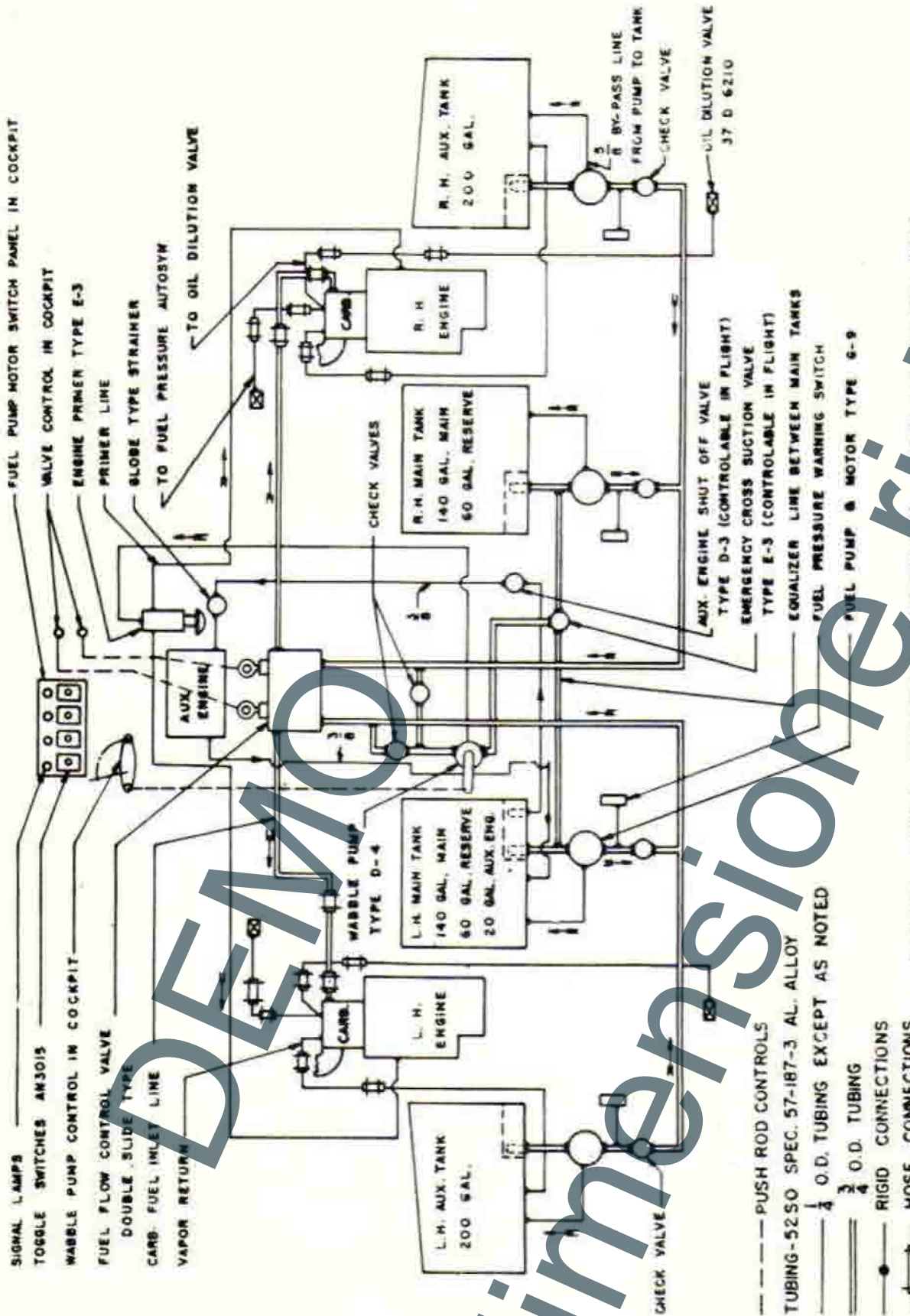


FIG. 3A - FUEL SYSTEM DIAGRAM - YFM-1B AIRPLANE

- PUSH ROD CONTROLS
- TUBING-5250 SPEC. 57-187-3 AL. ALLOY
- 1/4" O. D. TUBING EXCEPT AS NOTED
- 3/4" O. D. TUBING
- RIGID CONNECTIONS
- HOSE CONNECTIONS

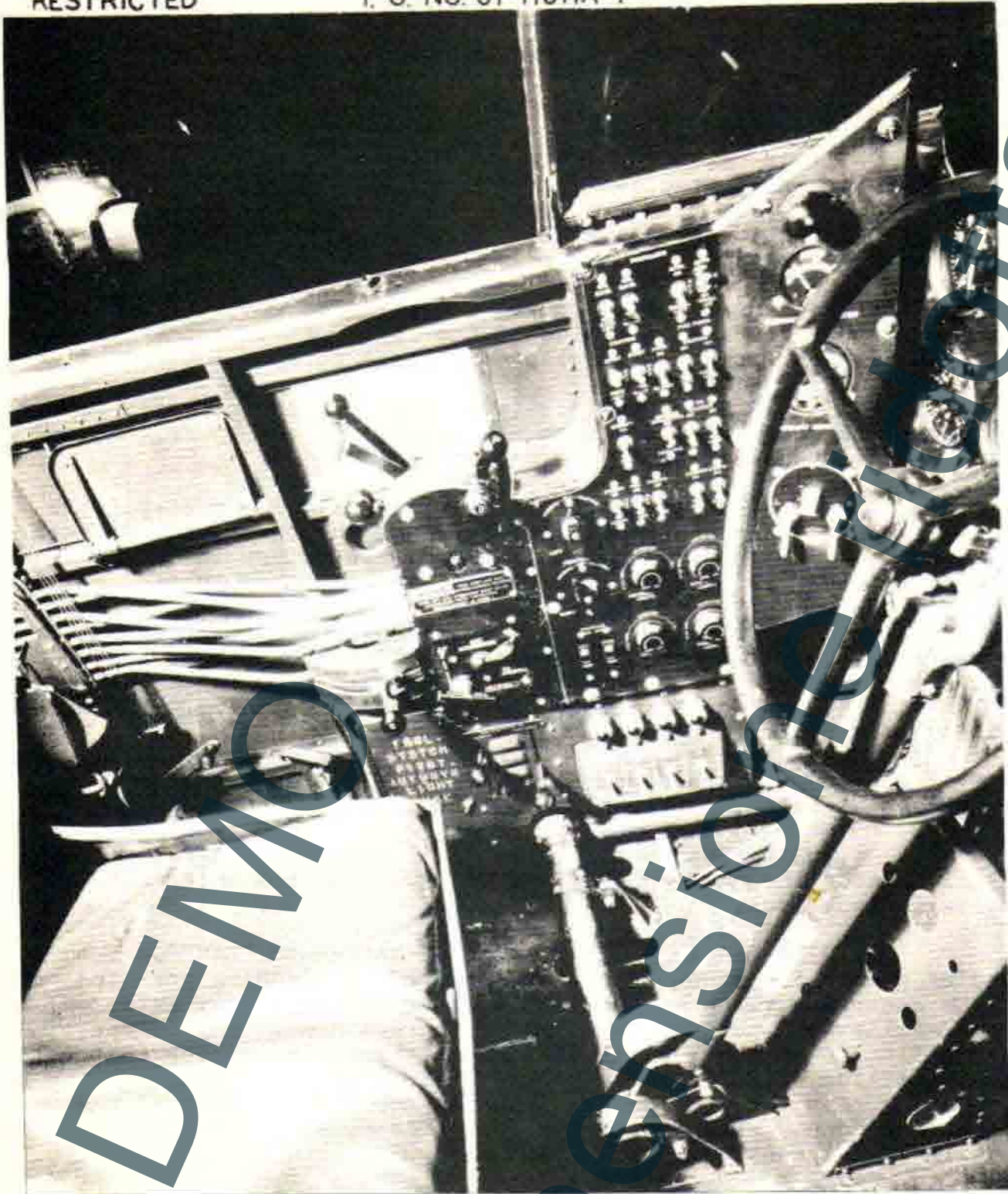


FIG. 4 - PILOT'S COCKPIT ARRANGEMENT & CONTROLS-LEFT SIDE

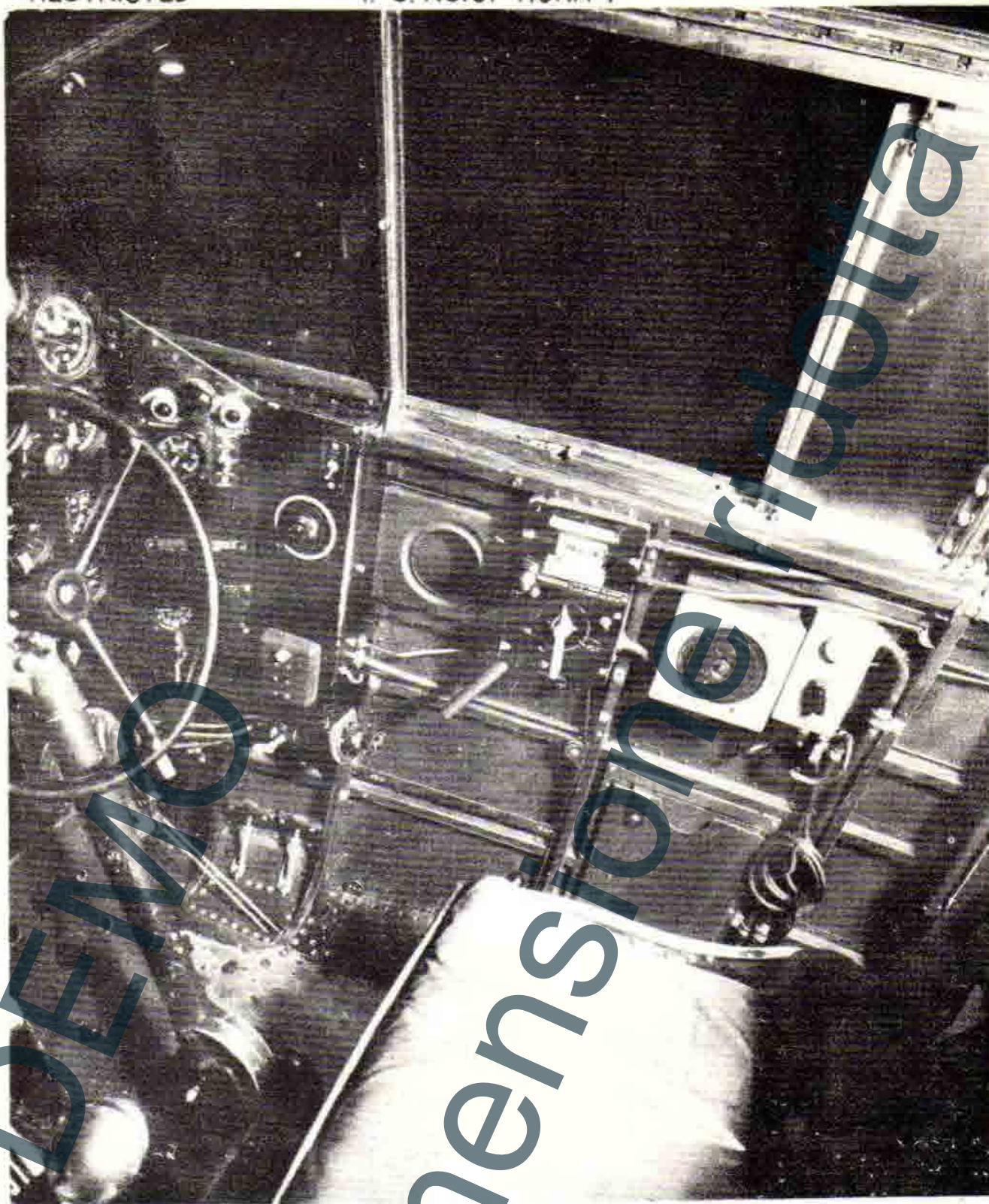
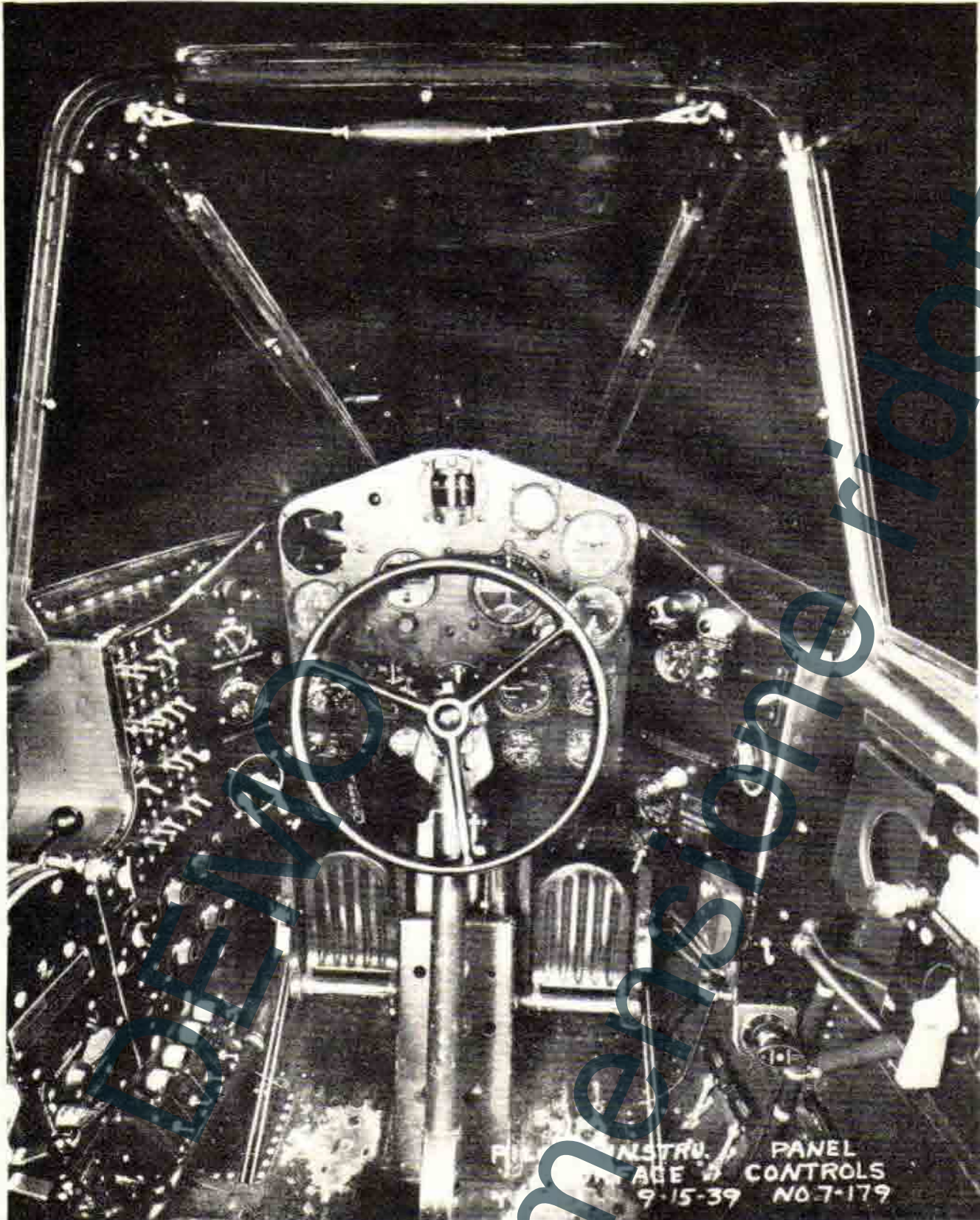
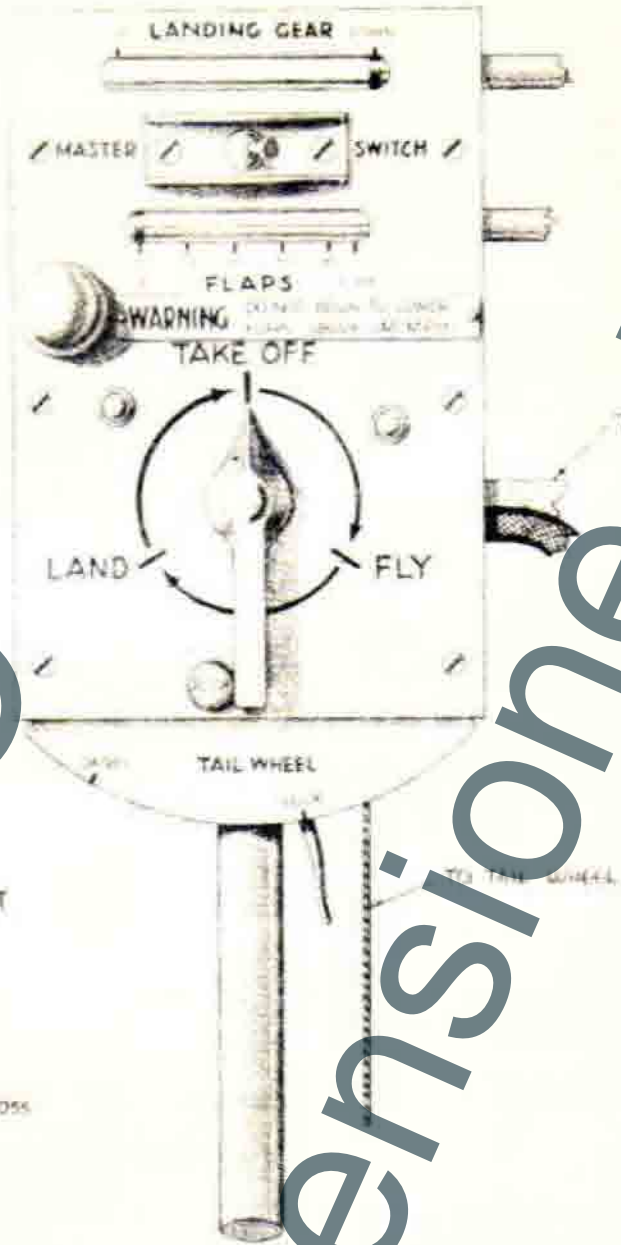


FIG. 5 - PILOTS COCKPIT ARRANGEMENT & CONTROLS - RIGHT SIDE



FILED INSTRU. / PANEL
PAGE 7 / CONTROLS
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FIG. 6 - PILOT'S COCKPIT ARRANGEMENT & CONTROLS - CENTER



LUBRICATE AT OVERHAULS
Check also for wear & bearing loss

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FIG. 7 - LANDING GEAR & FLAP CONTROL BOX

(4) Fly: After take-off, the landing gear is retracted by moving selector switch to "FLY" position.

NOTE: Master Switch should be in "ON" position at all times during operation of the airplane except in condition explained in (2), above.

(5) Manual Operation: To manually extend the landing gear and flaps insert hand crank into slow speed socket, in the center of the carry-thru deck. Crank until high handle loads have been eliminated, then shift to high speed socket and proceed until landing gear and flaps are extended. The high speed socket will lower the gear three times as fast as the slow speed socket.

(6) Tail Wheel Lock: Place in "Lock" position for landing and take-off.

(7) Brakes: Brake controls are incorporated in the rudder pedals. The parking brake, located in front of the pilot at the lower edge of the instrument panel may be engaged when pedals are depressed and disengaged by again depressing pedals.

c. Power Plant Controls. - (1) General: For complete operation and flight instructions, see T. O. No. 02-5A-1. T. O. No. 02-1-29 also contains essential instructions.

(2) Starting: Starting will be accomplished in accordance with T. O. No. 02-5A-1, except for the following special instructions:

(a) Place master ignition switch in center of main engine ignition switch in "ON" position, and start auxiliary engine as per paragraph (7) below.

(b) Place engine selector valve handle in "ON" position for engine to be started.

(c) Place mixture control handle of engine to be started in "IDLE CUT-OFF" position.

(d) Turn on autosyn dynamotor.

(e) Check fuel quantity indicator.

(f) Place fuel pump switch of tank desired to "ON" position. Left main tank should be used for starting left engine and right main tank for right engine. If the engine is to be started from tank on opposite side of airplane both fuel selector valves must be placed in "CROSS FEED" position and mixture control lever of engine not running placed in "IDLE CUT-OFF" position to prevent electric driven fuel pumps from flooding engines.

(g) Prime engine to be started two to four times if engine is cold, otherwise no priming is necessary.

(h) As starter is meshed, throw mixture control lever into "RICH" position. No wobble pump operation is necessary with electric driven fuel pumps.

(i) If engine does not start, return to "IDLE CUT-OFF" position immediately to prevent flooding.

(j) If engine floods, repeat starting operation as above, but leave mixture lever in "IDLE CUT-OFF" position until engine catches. Then place in "RICH" position.

(3) Stopping: The engines will be stopped in accordance with T. O. No. 02-1-29.

(4) Fuel System. - The fuel system control panel consisting of an "OFF" and "ON" switch, a test switch and a fuel pressure signal lamp for each of the four electrically driven fuel pumps is located on the left side of the pilot's cockpit. A fuel reserve lamp which indicates when the reserve fuel is being used is located below the fuel level indicator on the left side of the main instrument panel. The mixture control incorporates the "IDLE CUT-OFF" for emergency stoppage of engines. The primer is located on the pilot's right. Tanks are selected by switches on pilot's left. Engine selector valves are operated by handles at pilot's left. Fuel equalization is obtained by operation of the cross suction valve on the fuel equalization line on the floor at the gunner's station.

(5) Supercharger Regulator in the YFM-1 Airplane: A Type A-7A supercharger regulator is installed for each supercharger. The regulator line is attached to the exhaust manifold to eliminate surging. Because of this, the supercharger control handles in the cockpit must be pulled back as the airplane gains altitude to prevent excessive boost.

(6) Propeller: (a) General: Operating instructions for the propeller are contained in T. O. No. 03-20BA-1. When controlled automatically, a predetermined engine speed is held constant by means of a governor set by the propeller control on the throttle quadrant. When controlled by manual selection, the blade angle may be varied by operation of the increase or decrease r.p.m. switch independently of the governor. Emergency fast feathering is assured by a separate switch on the pilot's electric panel which applies, through means of a voltage booster, an increased voltage of approximately three to one to the propeller motors causing the propellers to feather in 6 to 8 seconds. The markings on the propeller control are approximate and the desired r.p.m. should be obtained by relying on the tachometer.

(b) For automatic constant speed control throw switches to automatic and set propeller controls as follows:

1. For Take Off: Set propeller controls on throttle quadrant to 2950 r.p.m.

2. During Flight: Set propeller controls on throttle quadrant to desired r.p.m.

3. For Landing: Set propeller controls on throttle quadrant for 2,000 to 2,400 r.p.m. The speed should be sufficiently below take-off r.p.m. to prevent overspeeding of the engine in case a sudden burst of power is applied.

(c) For Manual Control: Throw switches to "MANUAL" and operate switches marked "INCREASE AND DECREASE R.P.M."

(d) For Feathering: Move red control switches to forward position marked "FEATHER".

(7) Auxiliary Engine: (a) To operate auxiliary engine place fuel valve located at rear of wing carry-thru on right side of airplane in "ON" position.

(b) Move auxiliary engine ignition switch on co-pilot's panel to "BOTH". This switch is safetied thru the main ignition switch.

(c) Move "Start - Generate" switch to "START" position until engine starts - then release.

(d) Move ignition switch to "IDLE" for warm up period -- then back to "BOTH".

(e) To stop engine move ignition switch to "OFF" position.

d. Other Controls. - (1) Master and Ignition Switches: These switches are clearly marked on the pilot's electrical control panel. The master switch is located above the left and right engine ignition switches and other than controlling the ignition, this master switch also controls all those circuits that are safetied through it, namely, the starter circuits, the pitot heater circuit, the fuel pressure warning circuits, the auxiliary engine ignition and fuel pump electrical circuit. This switch should always be thrown to "OFF" position before leaving the airplane.

(2) Pitot Heater: A switch on the pilot's electrical panel controls the heating element in the pitot tube.

(3) Warning Bell: Warning Bells at each crew station are operated by a switch on the pilot's control panel.

(4) Ice Eliminating Equipment: A motor operating the de-icer distributing valve is controlled by a switch on the pilot's right auxiliary panel. This panel also contains a double pole switch controlling motors on the vacuum pumps. The propeller anti-ice system control is on the pilot's right panel.

(5) Fire Extinguishing Equipment: (a) Engine Extinguisher: One type A-12 CO₂ extinguisher is mounted in the forward part of the fuselage under the floor. Control pull and selector valve are located on left side of pilot's electrical panel.

(b) Hand Extinguishers: One type A-14 extinguisher is located in the fuselage above the wing crawlway to the left rear of the navigator. One type A-2 extinguisher is located in the left landing gear wheel well, accessible from the ground. Refer to T. O. No. 00-25-5 for procedure to be followed in case of fire during flight.

(6) Oxygen Equipment: The pilot's regulator is situated in the right lower corner of the instrument panel. The co-pilot's regulator is readily accessible on the left. The fuselage gunner's regulator is on the right side; the nacelle gunner's regulators are conveniently located.

(7) Armament: (a) Operation sequence for the top turret gun is as follows:

1. Remove turret slot cover
2. Release gun barrel from spring clip by rotating gun barrel upward.
3. Unlatch gun mount by pressing lever at butt end of gun mount, and fold gun down inside of turret.
4. Extend turret by operating hand crank on left side of airplane.
5. Extend gun through turret slot and latch gun mount by engaging the taper pin. Top hole for operating position, bottom hole for stowed position.

(b) Operation Sequence for the two .50 caliber side turret guns is as follows:

1. Release catch.
2. Extend the turret by operating the turret retraction and extension crank.
3. Remove the gun barrel from stowage clip.

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holding clip provided.

4. Swing turret door inboard and aft to

lock by turning handle and raise opposite gun mount to the top position.

5. Release vertical adjustment of opposite

forward and up.

6. Release rotation lock and swing gun

gun.

7. Release vertical adjustment and raise

(c) To operate the 30 caliber belly turret gun, pull turret release lock and rotate turret to top locked position. Break gun from stowage clip and swing into firing position.

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SECTION IVSPECIAL INSTRUCTIONS

1. Flight Limitations.

a. Maneuvers Prohibited.

Loop
Roll
Immelmann
Inverted Flight
Spin

b. Other Restrictions. - (1) Do not exceed a speed equal to the indicated high speed times 1.225.

(2) Do not exceed an indicated air speed of 140 M.P.H. with flaps down.

(3) Do not subject the airplane to load factors in excess of those listed below.

(a)	Preliminary - positive	3.4
	negative	.5
(b)	Final - positive	5.6
	negative	1.6

2. Engine Cooling System. - The engines should not be allowed to idle for a long period of time on the ground as the cooling system is designed for efficient cooling in flight only. Maximum allowable temperature of prestone before take-off is 125°C. (257°F.)

3. Landing Gear. - The pilot should be thoroughly familiar with the operation of the landing gear. When the airplane is on the ground the selector switch should be either on "LAND" or "TAKE-OFF" before operating the landing gear and flap control master switch.

4. Warning. - Due to close proximity of propeller to tail surfaces, a sudden reduction of power of one engine either through an engine failure or excessive movement of one throttle will result in a much more violent and immediate control reaction than on multi engine tractor type airplanes. Failure of one engine may result in a spin unless the other engine is retarded or trim tab control adjusted immediately. In case of failure of one engine the other engine should be retarded immediately and the throttle of good engine advanced gradually as trim tab control is adjusted to counteract turning moment. With proper adjustment of trim tab, airplanes can be safely flown on one engine. Single engine practice flights will not be engaged in below ten thousand feet. This airplane should be flown only by experienced multi engine pilots.

SECTION VPOWER PLANT

1. Engine.

a. General. - Each YFM-1 and YFM-1B airplane is powered with two Allison, prestone cooled, Vee type engines driving three-bladed pusher propellers through extension shafts. The engines are normally operated on 100 octane fuel and have a compression ratio of 6.65:1 and a propeller reduction gear ratio of 2:1.

b. YFM-1 Airplane. - (1) General: The type V-1710-23 engines used in the YFM-1 airplane have type B-1 exhaust driven turbo superchargers in addition to the engine driven blowers which have a gear ratio of 6.26:1.

(2) Ratings.	BHP	RPM
Normal (Sea Level)	1000	2600
Take-Off " "	1150	2950
Military " "	1150	2950

c. YFM-1B Airplane. - (1) General: The V-1710-41 engines used in the YFM-1B airplane are similar to the type V-1710-23 except that the blower gear ratio is increased to 8.77:1 to obtain power at altitude without the necessity of incorporating a turbo-driven supercharger in addition to the engine blower.

(2) Ratings.	BHP	RPM
Normal (Sea Level)	960	2600
Take-Off " "	1090	3000
Military " "	1090	3000

SECTION VI

FLYING CHARACTERISTICS

YFM-1B Airplane

1. Level Flight Speeds at Design Altitude of ft. with Design Gross Weight of 18,373 lb.

Maximum Speed	-	m. p. h. at	-	r. p. m. with	-	b. hp. (-	rated)
High Speed at 12,600'	268*	m. p. h. at	2600	r. p. m. with	1920	b. hp. (100	rated)
Operating Speed at 12,000±240		m. p. h. at	2280	r. p. m. with	1440	b. hp. (70	rated)
Cruising Speed at 12,000±200		m. p. h. at	1900	r. p. m. with	960	b. hp. (50	rated)

2. Optimum Range and Endurance with 800 gal fuel and 0 lb. bombs.

At High Speed	1080	miles at	1.35	mi./gal. or	4.02	hrs. at	199	gal./hr. (s. f. c. .52)
At Operating Speed	1700	miles at	2.13	mi./gal. or	7.10	hrs. at	113	gal./hr. (s. f. c. .47)
At Cruising Speed	2180	miles at	2.73	mi./gal. or	10.9	hrs. at	73.5	gal./hr. (s. f. c. .46)

3. Practical Range and Endurance with 800 gal. fuel and 0 lb. bombs.

At Operating Speed	1330	miles at	1.67	mi./gal. or	5.55	hrs. at	144	gal./hr. (s. f. c. .60)
At Cruising Speed	1670	miles at	2.08	mi./gal. or	8.33	hrs. at	96	gal./hr. (s. f. c. .60)

4. Climb Data with Gross Weight of 18,373 lb.

Standard Altitude	ft.	S.L.	5000	10,000	15,000	20,000	25,000	29,900
Climbing Speed	m. p. h.		120	130.5	141	150.5	157	163.5
Engine Speed	r. p. m.		2600	2600	2600	2600	2600	2600
Total Power	b. hp.		1690	1780	1880	1720	1450	1200
Maximum Rate	f. p. m.		1520	1520	1520	1215	825	460
Minimum Time	min.		0	3.3	6.2	10.6	15.5	23.5
								44.1

5. Ceiling: Normal Engine Operation: Service Ceiling 29,900 ft. Absolute Ceiling 31,300 ft.

6. Take-off and Landing Distances—To Clear 50 ft. Obstacle at Sea Level (no wind).

Take-off	1800	ft. at	90	m. p. h.	15	deg. flap.	Gr. Wt. 18,373 lb.	Ground run	1250	ft.
Land	1377	ft. at	77	m. p. h.	Full	deg. flap.	Gr. Wt. 18,373 lb.	Ground run	852	ft.

7. References and Remarks: This airplane may be expected to give approximately the above performance with given load under standard atmospheric conditions. Figures given may vary slightly from figures listed elsewhere in this Technical Order and other technical publications for this model of airplane.

*Temporary engine restrictions prohibit the attainment of this speed.
References: M.R.'s PHQ-M-19-1102-A, dated 6/22/40, and EXP-M-51/P642-32, dated 7/22/40

The airplane may be expected to give approximately the above performances with the weights as quoted herein.