FLIGHT MANUAL

YIB-17

BOMBARDMENT AIRPLANE

FOREWORD

This manual is offered to the flying personnel of the Air Corps to aid its members in becoming familiar with the Y1B-17 airplane.

An attempt has been made in the preparation of this manual to give only information which will facilitate familiarization with the airplane. Conventional items with which the personnel are well acquainted are not covered. Complete maintenance and technical information is contained in the Handbook of Instructions furnished with each airplane.

Subsequent Technical Orders or Engineering Memorandums will supersede any information given here, but until such time as tests of the first airplane are completed and further instructions issued, it is believed that the methods described herein will serve as a satisfactory basis for the operation of the airplane.

BOEING AIRCRAFT COMPANY.
Seattle, Washington, November 11, 1936.

These manuals have been numbered in series to facilitate keeping a record of the personnel to whom they have been issued.

Serial No. 49

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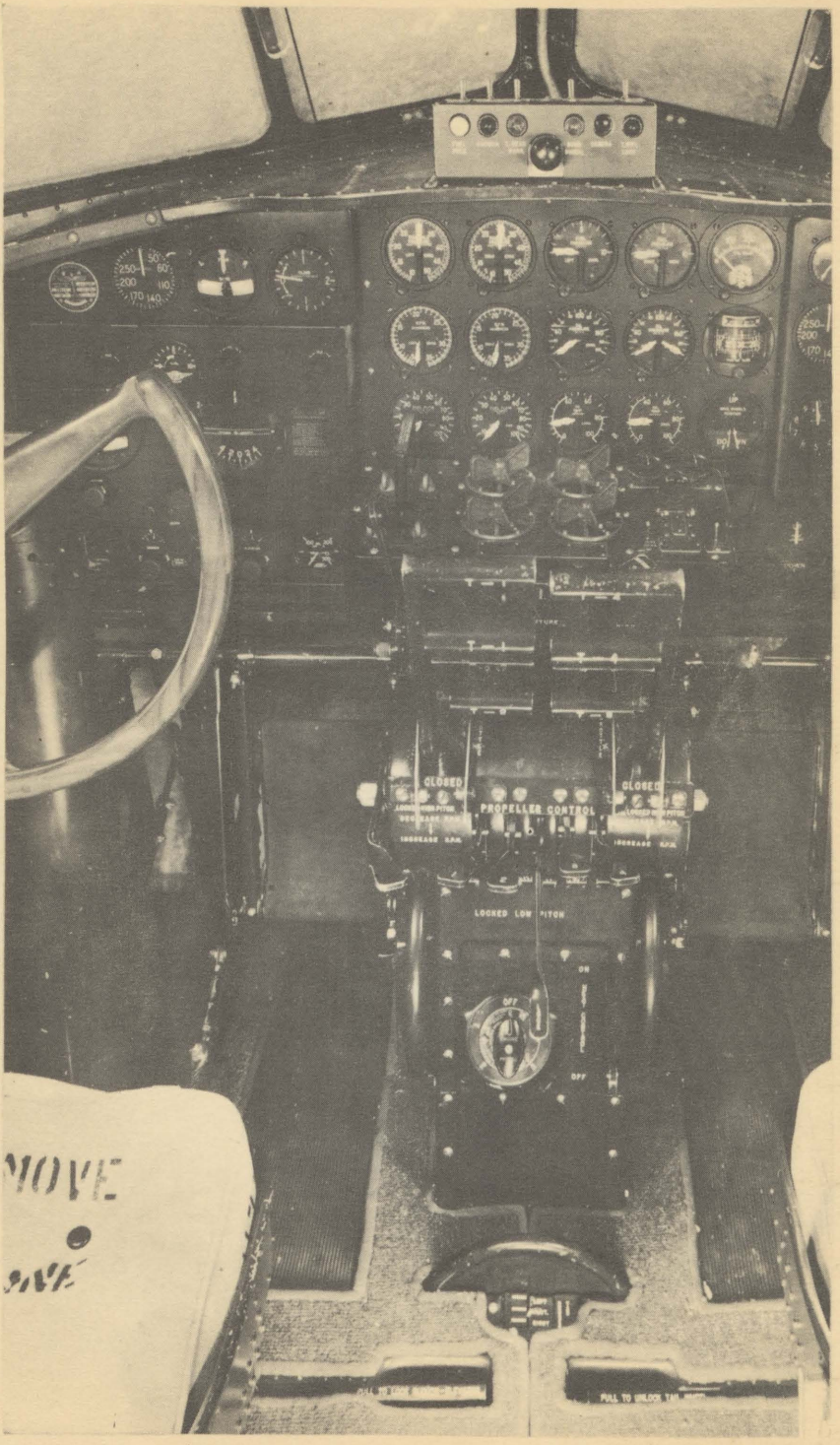
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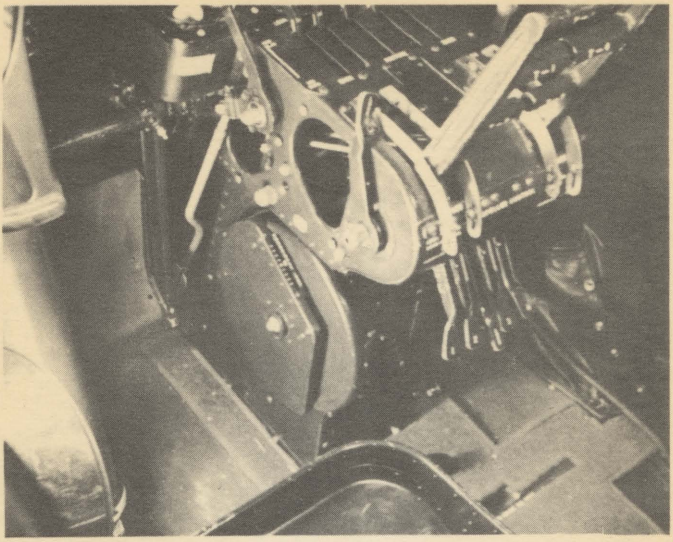
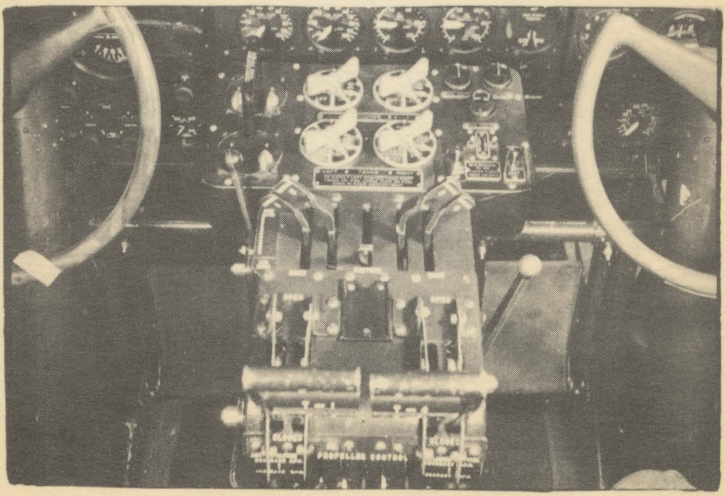



PROPELLING CONTROL

CONTROLS

ENGINE CONTROLS: All power plant controls are located on the central control stand. The throttles are so arranged that all four may be operated simultaneously with one hand, and may be securely held in any position by the adjacent locking lever. Stops are provided at each throttle to limit the takeoff manifold pressure. The mixture controls, located forward of the throttles, and the constant speed propeller controls, located below the throttles, lock in a similar manner, the latter having stops located to limit engine takeoff RPM. A carburetor air temperature control is located below the propeller controls. At the top left side of the stand is the supercharger control with which all impeller gear ratios may be changed simultaneously.

FLIGHT CONTROLS: The dual wheel-column-stirrup system which controls this airplane during flight is conventional in operation. The elevators, ailerons, and rudder operate in the normal manner, and may be locked in the parking position by means of the control handle located on the floor to the rear of the engine control stand. Adjustable tabs are used to trim the airplane in flight, with controls located as follows: elevator, each side of control stand; rudder, projecting through floor just aft control stand; aileron, on floor panel at pilot's left. Position indicators which show the tab positions and directions of motion required to secure desired trim conditions are mounted adjacent to each control. The landing flap is controlled by a switch on the center sub-panel. About ten seconds are required for complete 60° travel of the flap; an indicator on the center instrument panel shows its position at all times.

FUEL AND OIL SYSTEM

FUEL VALVES: The engine selector and fuel tank selector valve controls are located on the center sub-panel. Normally the left engines are fed from the left tanks and the right engines from the right tanks. All four engines may be fed from any one tank by, first, turning on the tank to be used, second, opening the cross-feed valve in the radio compartment, and third, turning off the opposite tank selector. Fuel may be pumped to any tank from an outside source by using the pump and valve controls located in the radio compartment. The outside fuel supply connection is made at the right side of the bomb bay rear wall.

FUEL PUMPS: Both wobble pumps are operated by the single handle located on the right side of the engine control stand. The two engine driven fuel pumps on each side of the airplane are connected in parallel, enabling either pump to supply both engines on that side.

FUEL AND OIL TANK CAPACITY: Fuel is carried as follows: Two main tanks, 425 gallons each; four extra tanks, 212.5 gallons each; total 1700 gallons. Fuel quantity gauges are located on the right instrument panel. Oil tanks are located in the leading edge of each wing, four tanks of 38 gallons each, total capacity 152 gallons. Each separate tank is provided with a pet cock located in the front of the tank to indicate when the tank is half full. The tanks should be filled to this level when only a normal fuel load is carried, the remaining capacity being for the overload fuel. The pet cocks are remotely controlled by handles located within the filler neck openings, and are arranged so that the doors cannot be closed while the cocks are open. The pet cocks drain from the lower surface of the leading edge.

AUXILIARY FUEL TANKS: Provisions have been made for the installation of two auxiliary fuel tanks in the bomb bay. Each has a capacity of 396 gallons, and increases the total overload fuel capacity to 2492 gallons. These tanks may be serviced through filler necks which are accessible from the bomb bay catwalk. A selector cock located below the catwalk aft of the tanks directs the flow from either or both tanks into the cross-feed line. When fuel is being drawn from this source, the cross-feed cock (in the radio compartment) must be "ON" and the wing tank fuel selectors must be "OFF." Each tank has a sight gauge to indicate fuel quantity. The tanks are supported in cradles attached to B-7 bomb shackles which are "loaded" on bomb rack stations. This makes it possible to drop both fuel tanks with the salvo bomb release.

AUXILIARY OIL TANKS: Provisions have been made for the installation of an auxiliary oil tank under the left side of the radio compartment floor. The capacity of this tank is 26 gallons and increases the total overload oil capacity to 178 gallons. A wobble pump located below the catwalk may be used to pump this oil through a four-way valve (left side of the bomb bay rear step) to any of the four main oil tanks. An oil quantity gauge for this tank is located on the bomb bay rear wall and gives continuous indications.

INSTRUMENTS

VACUUM SYSTEM: Two vacuum pumps located on engines 2 and 3 operate the gyro instruments and the gyro pilot. The failure of either pump will cause the suction to drop slightly, but will in no way hinder the normal operation of the system.

AUTOMATIC PILOT: A high pressure oil pump on engine No. 2 operates the gyro pilot servo, and its proper operation is indicated when the oil pressure gauge below the pilot unit shows 125 lbs. per sq. in. A by-pass valve (at the left of the pilot) is normally open but may be closed in the event of a serious leakage in the system. Speed control valves (below the gyro pilot) are used to obtain the desired sensitivity of control. To place the gyro pilot in operation the turn, climb, and bank knobs are rotated to align the follow-up pointers, and with the speed control valves in the half open position, the engaging lever (at left of the pilot) is turned to the "ON" position. The automatic turn control (below the gyro unit) is used when a continuous turn is desired. The proper amount of bank must be set on the bank knob to prevent skidding.

ENGINE INSTRUMENTS: The engine instruments are conventional except the fuel flow indicator and the Cambridge mixture indicator. Their use is explained under Engine Operation. Cylinder head temperatures are indicated by the thermocouple indicator on the center panel. The four position switch enables the operator to select the desired engine and determine the head temperature of one cylinder on that engine.

MISCELLANEOUS INSTRUMENTS: Landing gear, tail wheel, and flap position indicators are located on the center panel. The pilot director, boundary marker, and radio compass indicators are located at the left side of the gyro pilot. Three rheostats on the center sub-panel regulate the intensity of the instrument illumination. A compass, thermometer, and clock are located overhead on the small panel between pilots. An air brake supply tank pressure gauge is located at the extreme left of the pilot's panel. The bombers instruments are conventional and include a bomb door position indicator.

LANDING GEAR

ELECTRICAL OPERATION: The landing gear, comprised of the two main wheels and the tail wheel, is retractable both electrically and manually. A switch located on the center sub-panel operates all three reversible motors simultaneously. A guard on the "UP" side of the switch prevents inadvertent operation. Limit switches on the retracting screws automatically stop the operation at the end of the gear travel, and indicators on the center instrument panel show the position of each wheel at all times. A warning light and warning pedal vibrator (pilot only) function when any throttle is closed, if all three wheels are not completely down. Should flight conditions require a throttle to be closed continuously, a warning cutout switch at the left of the pilot may be thrown, but the closing of any other throttle will again give the warning.

HAND OPERATION: Manual operation of the main wheel retracting gear is accomplished by using the starter crank (carried in the radio compartment) to turn the torque connections on each side of the bomb bay forward wall. The tail wheel may be hand operated by use of the crank in the torque connection at the left of the lockers in the rear gun compartment. Slip clutches are provided in the retracting motors. Normally the main wheels retract and extend at approximately the same rate. Any wide divergence in their operating speeds may indicate a slipping clutch and should be corrected.

BRAKES: The brakes on this airplane are of the air operated disk type, and are somewhat of a departure from the conventional mechanical or hydraulic types. The major parts of the system are the air storage tank and compressor, the

metering valves at the toe pedals, the pressure gauge at the left of the pilot's instrument board, the parking brake lever, and the wheel and brake unit. The air compressor is automatic, and when in operation should maintain approximately 200 lbs. per sq. in. pressure. The master switch at the compressor should always be in the "ON" position when the airplane is on the line. About 15 minutes are required to completely fill the empty tank. The air pressure should always be checked before starting the engines or landing the airplane. The metering valves are operated by either the pilots or co-pilots brake pedals, admitting air to the brake on the forward stroke, and releasing on the backward stroke. Due to the compressibility of air, a slight lag will be noticeable between the pedal motion and the brake operation. For this reason smooth brake applications are very essential, and "fanning" does not have the same effect as noted in hydraulic brake operation. Rapid deceleration of an airplane of this size requires the absorption of a tremendous amount of energy by the brakes with the consequent development in the metal disks of extremely high temperatures. The effect of the comparatively small contact area (tire to ground) is noticeable through the ease with which the wheels slide. For these reasons it is recommended that all braking be done with caution, and over-use of the brakes be avoided. The brake manufacturer recommends that landings be made at intervals of not less than 12 minutes to allow for the normal cooling of the brake discs.

PARKING BRAKE: The parking brake lever located at the right of the co-pilot's instrument panel engages a lock on the pedal mechanism, and holds the brakes in a conventional manner. Locking the brakes immediately after ex-

tended taxiing when the discs are hot should be avoided since the combination of heat and pressure may cause sticking. The discs are easily replaceable and should be inspected frequently.

TAIL WHEEL LOCK: To facilitate braking after landing, the tail wheel should always be in its locked position. An electrical cutout will prevent retraction of the unit unless locked, and since it cannot be centered in flight, it becomes necessary to engage the locking pin before taking off. A warning light on the center panel indicates the position of the locking pin. The lock can best be released before taxiing if no side load is imposed upon the tail wheel, consequently it may be found advisable to bring the airplane to a complete stop before unlocking the pin or attempting a turn.

MISCELLANEOUS EQUIPMENT

EMERGENCY EXITS: The main entrance door, the auxiliary entrance door (below the control cabin), and the navigator's sliding hatch are equipped with emergency release handles for quick release in flight.

HEATING SYSTEM: There are two separate hot air heating systems used in this airplane. The right hand system furnishes the heat for the control cabin and the forward com partments. Controls for this unit are installed in the control cabin on the bottom of the radio support stand behind the co-pilot. The left hand system serves the radio operator and the rear gunner compartments. This unit is operated by the radio operator with the controls located on the side wall at his left.

OXYGEN: Type E-1 oxygen cylinders may be located as follows:

1. At the front gunners station.
2. Below the pilots floor to supply the pilot.
3. Under the co-pilot's seat.
4. At the radio operator's left.
5. Opposite the main entrance door to supply the bottom gunner.
6. At the rear gunner's station.

CAMERA AND VIEWFINDER: A door is provided in the floor of the radio compartment for access to the camera pit. A recessed latch is provided at the left side next to the operator's seat. This door folds back against the floor when open, making it necessary to keep the right side of the compartment clear if the camera is to be used. A Type A-2 viewfinder may be installed forward of the camera.

The bracket assembly used to support the intervalometer is stowed on the left side, the intervalometer is stowed on the right side of the camera pit. A plug-in socket for the intervalometer is supplied on a receptacle panel located on the right side of the camera pit. A green blinker light on the receptacle panel is wired in series with the indicator on the warning light panel in the control cabin. The double camera doors and the viewfinder door hinged in the bottom of the fuselage are operated by the lever located on the floor at the operator's seat.

COVERS: Interchangeable engine covers are provided and are stowed in the baggage locker. Turret covers are provided for the top and side guns.

CUSHIONS: Life preserver seat cushions, Type A-1, are provided at the pilot, co-pilot, navigator, radio operator, nose gunner, and rear gunner positions. Seat-back life preservers, Type A-3, are provided at the pilot, co-pilot, navigator, and radio operator positions.

FLIGHT REPORTS AND DATA CARDS: The airplane flight report holder, fuel diagram, and data cards are located on the control cabin door. Wiring diagrams are contained in a metal box located at the bottom of the frame supporting the co-pilot's seat.

LADDERS: Two portable ladders are provided and stowed on the left side of the fuselage opposite the main entrance door. The folding ladder is used for access to the nacelle steps. Three straps secure the ladder in place. Self-locking pins attached to the rung supports are inserted through the hinge joints to maintain the ladder in the extended position when in use. This folding ladder may also be

used as a step ladder. The main entrance ladder is secured above the window by means of flat spring support brackets. Hooks are provided at the upper ends of the rung supports to keep the ladder from slipping away from the entrance while being used.

LIFE RAFTS: Stowage space for two Type A-1 life rafts and operating equipment is located in the top fairing aft the cabin enclosure. This position is reached through the hatch above the navigator's tables.

PANTRY AND LOCKERS: Pantry and locker space is provided at the sides of the fuselage to the rear of the rear gunner's station. The center passageway separates these two compartments. Shelves for baggage and provisions are provided and are enclosed with heavy canvas laced to the supports. Talon fasteners close the front of each section. A 5-gallon capacity drinking water tank, equipped with a self-closing faucet, is strapped in the top of the left hand compartment. The filler neck is reached through a hinged access door operable from the outside.

SIGNAL EQUIPMENT: The pyrotechnic signal equipment consists of the following items: a pyrotechnic projector, M-2; ten white star parachute signals, M-10; ten red star parachute signals, M-11; and six parachute flares, M-9. Brackets, holders, and the projector for this equipment are located in the compartment at the upper right side of the airplane above the front wing beam. These signals may be fired through the navigator's hatch.

PARACHUTE FLARES: Six Type M-8 parachute flares may be carried as follows: two in racks permanently installed on the forward side of the front wing beam bulkhead below the navigator's floor, and four in the rack located on

the lower right side of the fuselage. The flare rack doors are operated by two release handles located on the floor at the co-pilot's right. The forward handle is used to release the right flare. The doors may be closed in flight from the area below the pilot's floor by means of two pedals on the flare rack door assembly. A hinged door is provided in the cabin floor above the racks to permit loading the flares.

PARACHUTES: Mounting racks for stowing 6 Type A-3 parachute packs are installed in the fuselage. These racks are located in the following places: two forward in the passageway to the bombers compartment; two on the side wall of the fuselage directly aft the main entrance door; and two directly opposite the main entrance door. In addition three Type A-3 packs may be stowed in the compartments provided under the navigator's table.

SAFETY BELTS: Type B-10 safety belts are provided for the pilot, the co-pilot, the navigator, and the radio operator. The navigator's seat is equipped with a swivelling hinged adjustment rack which can be displaced when entering or leaving the seat. Fixed racks are provided on all other seats. The belts are adjustable at the racks by pinching the levers together and moving them to the desired position. Provision is made in the floor at the front and rear gun positions for attaching Type A-3 gunner's belts. The top gunner's belt attachment is located just above the floor on the rear wing beam. The bottom gunner's belt attachment is located in the bottom of the fairing around the gun emplacement.

SEATS: The pilot's and co-pilot's seats are adjustable 7 inches vertically and 3 inches fore and aft. These seats

are operated by a lever located on the outboard side. The lever is raised to adjust the height, and lowered to adjust the fore and aft position. Pressure of the body against the seat is necessary when adjusting the aft or down positions. Springs supply the force for moving the seat upward or forward. A fixed seat is provided for the navigator. A swivelling seat is installed in the radio compartment which may be locked in either the front or rear positions by operating the handle at the left hand side. Folding seats without back rests are provided at the front gunner's station and the rear gunner's station. Hook attachments on two legs of the seats are inserted into keeper plates in the floor to provide stability while being used. Brackets are installed on the right side of the fuselage at the gunners' stations for stowage of both seats.

TABLES: The navigator's chart table is rigidly installed on the right side of the control cabin aft the co-pilot. The folding top may be extended across the passageway for use by the navigator. Leather straps are provided at the hinge for folding the top. Space is provided under the top for maps and charts. The navigator's instrument table is rigidly installed forward of the navigator's seat. A Type D-4 compass is installed under a hinged transparent cover provided in the table top. Provision is made for a driftmeter sight tube to be installed with the open end adjacent to the compass in the table top. The radio operator's table is installed in the front left side of the radio compartment with a drawer at the left for miscellaneous tools or supplies. Provision is made for the installation of radio equipment on the table.

MAP CASE: The navigator is provided with a map case, installed on the wall at his left.

NAVIGATOR'S KIT: A navigator's case may be carried on the support bracket under the navigator's seat.

CURTAINS: Removable fabric curtains are provided in the control cabin to separate the pilots and navigators sections. A Talon fastener is used to close the curtains at the center.

GUARD ROPES: Ropes with attaching hooks are provided along both sides of the catwalk through the bomb bay.

REPORT CONTAINER: Flight orders, reports, or miscellaneous papers may be stowed in a metal box located on the bulkhead above the radio operator's table.

CRANK: Two hand cranks, clamped to the rear wall of the radio compartment, may be used for starting the engines; retracting the landing gear and tail gear; and, when used with the extension mounted adjacent to the crank, for operating the bomb doors.

FIRST AID KIT: A first aid kit is located opposite the main entrance door.

TOOLS: A tool kit is provided on top of the pantry locker.

TAIL HOOK: A special hook is provided in the tool kit for hoisting the tail.

KEYS: Three keys are supplied with each airplane for the auxiliary and main entrance doors. In addition one master key is supplied, which operates all doors on all Y1B-17 airplanes.

ELECTRICAL SYSTEM

POWER SUPPLY: Electrical energy is supplied by three 50 ampere, 12 volt D.C. generators and three Type D-6 storage batteries located in nacelles 2, 3, and 4. Three voltage regulators, located on the right side of the forward wall of the bomb bay, are accessible in flight. Three main line generator switches, located near the three ammeters at the pilot's left, are conventional in operation. The output of any one generator may be checked by selective operation of the switch adjacent to the voltmeter. Autosyn instruments require alternating current, which is furnished by a dynamotor located in the tail of the airplane. The dynamotor control switch, located at the pilot's left, will operate only when the master ignition switch is on. A switch for testing only is located near the dynamotor. This switch energizes the dynamotor and permits operation of the Autosyn instruments when the master ignition switch is turned off.

FUSES: The electrical system is fused to protect the wiring. A tabulation of all fuse locations is given on the cover of the spare fuse and light box located on the right side of the radio compartment front wall.

LIGHTS: Type A-3 dash lights are located in the following places: on the control panel at the pilot's left, on a bracket at the co-pilot's right, on the warning light panel above the engine control stand, on a bracket above the flare racks, on the bomber's control panel, and on a bracket forward of the radio compass loop rotator. Two dome lights are located, one above the auxiliary entrance door, and one on the right side of the fuselage above the bomber's station. These lights are controlled by two

3-way switches, one on the pilot's seat support, and one on the bomber's control panel. A dome light, installed in the step leading into the cabin from the bomb bay, is controlled by two 3-way switches, one located at the right of each doorway entering the bomb bay. A dome light with switch is located at each side of the fuselage in the top of the bomb bay. The remaining dome lights are located, one above the rear lockers, and one at the main entrance door.

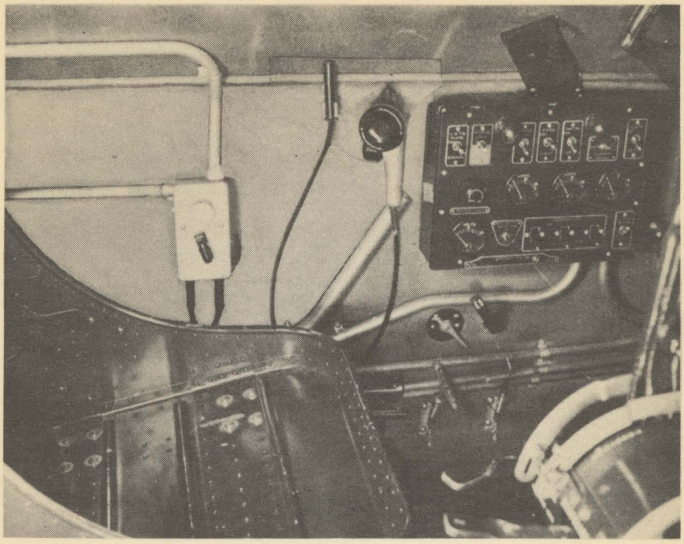
WORK LIGHTS: Individual switches are used for operating the work lights, which are located as follows: one over the navigator's table, one over the radio operator's table, one above the radio (liaison) transmitter, and one above the map table in the control cabin. A Type B-4 extension light is located at the right of the bomber's station.

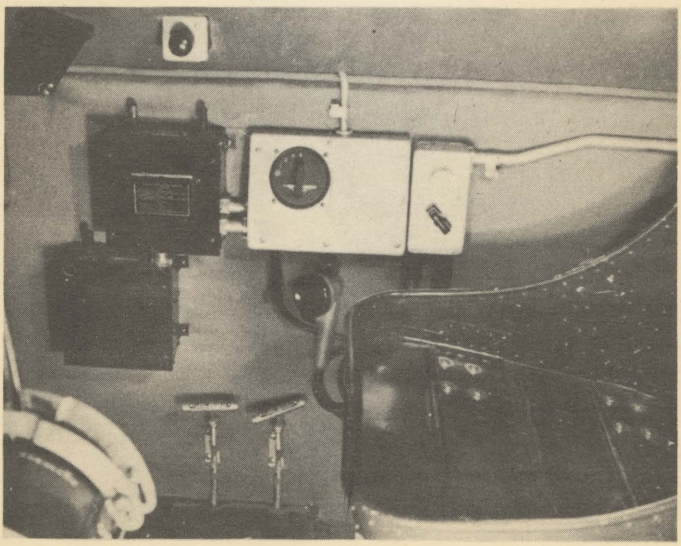
LANDING LIGHTS: Two Type A-7 landing lights are located in the leading edges of the wings beyond the outboard propeller circles. They are controlled through landing light relays by two switches located on the auxiliary control panel.

NAVIGATION LIGHTS: The navigation light circuit is controlled by a switch located at the pilot's left. This circuit includes both the red and green wing tip lights and the clear tail light.

PASSING LIGHT: The Type B-1 passing light, located adjacent to the landing light in the left wing only, is controlled by a switch located at the pilot's left.

POSITION LIGHTS: Two position lights are installed on each horizontal stabilizer forward of the hinge line. Three position lights are mounted on top of the fuselage, one





approximately 42 inches aft the top turret, one 24 inches forward of the vertical stabilizer, and one midway between these two lights. Remote control of the position lights is obtained through a rheostat at the pilot's left.

WARNING LIGHTS: The lights located on a special panel above the main instrument board are used for warning signals as follows:

(a) **Fuel Pressure:** This circuit is closed when the fuel pressure drops below 1½ lbs. per square in. at any engine, thus energizing the white light at the left.

(b) **Vacuum:** The vacuum circuit is closed when the vacuum drops below 3 inches of mercury on the vacuum indicator, thus energizing the green light at the left.

(c) **Landing gear:** The red landing gear light warns if any wheel is not fully lowered at the time any throttle is closed.

(d) **Bomber's signal:** This amber light is used as a call signal from the bomber's section to the control cabin.

(e) **Camera light:** The camera light is a green blinker connected in series to a similar light at the camera, and is operated by the intervalometer.

(f) **Tail wheel lock:** The tail wheel lock warning light indicates when the tail wheel locking pin is withdrawn. This red light will stay on until the locking pin actually returns to the locked position, or until the ignition switches are turned off.

(g) **Test switches:** The warning lamp filaments may be individually tested when the master ignition switch is on, through the operation of individual test switches located on the top of the warning light box.

STARTERS: Electrical control of the starter motors from the cabin is obtained by operating the switches located on the right auxiliary control panel in front of the co-pilot. Push the lever "UP" to operate the motor, and "DOWN" to mesh the clutch and energize the booster coil. A manual starter clutch handle is located just aft the crank extension on each nacelle.

IGNITION SWITCH: Two 2-engine ignition switches, located on the auxiliary control panel, provide a means of controlling each magneto individually. The push-pull bar (master switch) grounds all engine magneto circuits; opens the fuel pressure warning, vacuum warning, tail wheel lock warning, the deicer distributor valve and pump, the starter meshing and booster, the autosyn dynamotor and the pitot heater circuits; in a single operation.

RADIO AND INTERPHONE

The following equipment is installed in this airplane:

Command Set, Type SCR—( )—183
Liaison Set, Type SCR—( )—187-A
Radio Compass, Type SCR—242
Interphone, Type RC—( )—15
Marker Beacon Receptor, Type A-1

COMMAND SET: The major parts of the command set, consisting of the transmitter and receiver, are installed on a shelf below the navigator's chart table. The transmitter control box, the receiver control box, the tuning unit, and the remote control unit are located within reach of pilot, co-pilot and navigator. The dynamotor is installed under the navigator's table. Four spare coils for the transmitter are supplied and located on the supports under the co-pilot's seat. A spare coil for the receiver is mounted on the side wall at the co-pilot's right.

RADIO COMPASS: The radio compass unit is installed under the navigator's chart table immediately aft the command receiver. The rotating loop assembly is mounted on the centerline of the airplane, immediately forward of the mast antenna. Two compass indicators are provided; one mounted on the pilot's instrument panel, and one to the left of the loop. The control box is located at the pilot's left for use by the pilot only. The navigator's control is at the compass unit.

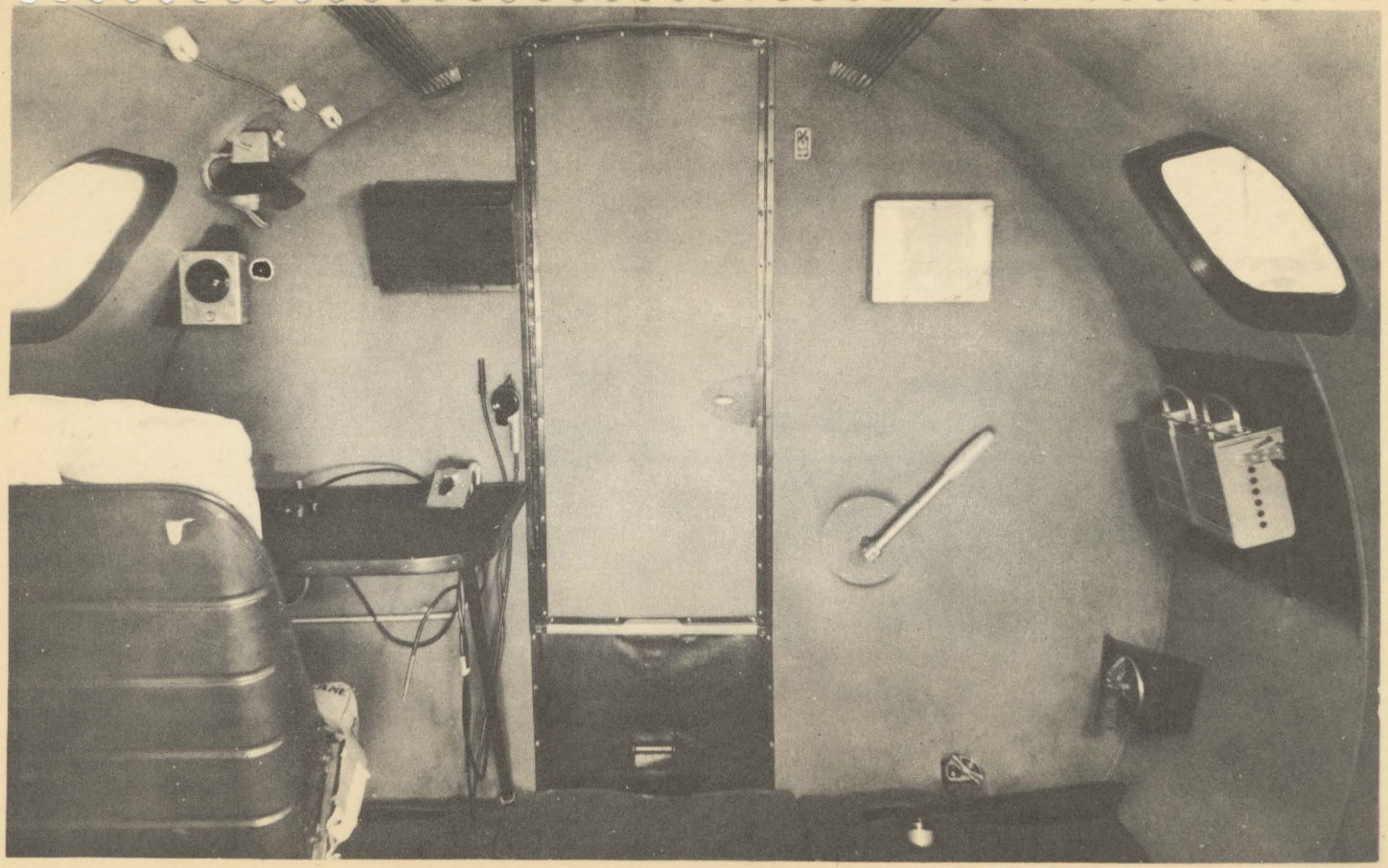
LIAISON SET: The receiver for the liaison set is mounted on the radio operator's table. A type J-5 transmitter key is also installed on this table. The transmitter for the liaison set is supported on the bulkhead in the rear left

corner of the radio compartment with an antenna change-over switch above it. Space is provided for 5 spare tuning units on the right side of the radio compartment rear wall.

ANTENNAE: A fixed antenna, used for the command set, is supported from the upper end of the mast antenna, and from supports on number 1 and number 4 nacelles. The The lead-in, extending from near the top of the mast to the radio units, leads through the right side of the fuselage to the antenna relay which is mounted on the lower side of the navigator's map shelf. The fixed liaison antenna leads from a point on the vertical stabilizer to the top of the mast antenna, with a vertical lead-in extending through the top of the fuselage to the antenna change-over switch. The trailing wire antenna, entering the fuselage through a fairlead near the liaison transmitter, is wound on a reel connected to the change-over switch. The cantilever mast antenna is partially braced by the command set antenna which should not be separately removed.

MARKER BEACON: The antenna and mast assemblies are mounted below the airplane with the receptor unit mounted between the masts. The rectifier is installed under the control cabin floor. The indicator is mounted at the extreme left of the pilot's instrument panel. The complete set is controlled by a switch located at the pilot's left.

INTERPHONE SYSTEM: A multi-place interphone system with nine jack boxes, nine microphones, nine headsets, and one amplifier box is incorporated in the radio system. The amplifier box is located on the left wall of the radio compartment. The jack boxes are located at the fol-



lowing stations: front gunner, bomber, pilot, co-pilot, navigator's left, navigator's right, radio operator, bottom gunner, and rear gunner. Except for the control cabin stations, bright amber telephone call signals, operable by a switch at the pilot's left, are located at points visible from each of the above stations.

ALARM BELLS: The alarm system is operated by a toggle switch at the left of the pilot. One alarm bell is located in the radio compartment, and one each at the front and rear gun stations.

FIRE EXTINGUISHING SYSTEM

The pressure fire extinguishing system is divided into two separate units, one protecting the engines, the other protecting the fuel tank compartments.

The engine system is provided with a direct control and a separate CO_2 supply, with controls located on the right side of the co-pilot's instrument panel. The distributor valve must be properly set before pulling either CO_2 release handle.

Controls for the fuel tank compartment system (wings) are located at the left of the pilot, and utilize the same CO_2 supply used to operate the fuel tank purging system.

Two Type A-2 hand operated fire extinguishers are installed. One unit is located on the right wall of the fuselage forward of the main entrance door, the other is located behind the navigator's station.

DEICING EQUIPMENT

LEADING EDGE DEICERS are operated by the exhaust air from the vacuum pumps on engines No. 2 and 3. In the event one pump fails, a check valve in the outlet line will automatically close, thus preventing the loss of pressure through the inoperative unit. The remaining pump will operate the system with reduced effectiveness. The exhaust from the pumps is controlled by the pilot through the wing deicer valve handle located on his left. A pressure indicator gauge is mounted above this control handle. (Normal operating pressure is approximately 6 lbs. per sq. in.) A rotary valve, located in the right hand wing gap, directs the air to various leading edge units. This valve is controlled by an electric switch to the left of the pilot. To place the system in operation, first throw the switch to start the rotary valve, then turn on the wing deicer valve. When shutting down the system, the rotary valve should be left running for a minute or so after shutting off the wing deicer valve to allow complete deflation of the deicer boots.

PROPELLER DEICERS consist of a 20 gallon supply tank, located under the radio compartment floor; two electric pumps (inboard and outboard propeller supply); a four-point switch, located at the left of the pilot; lines leading from the pumps to the slinger rings on each propeller, thence onto the blades; and rubber covered spinners to protect the hubs from ice formations. The fluid used in the supply tank shall be 85 parts by volume of denatured ethyl alcohol and 15 parts by volume of C. P. glycerine. Filling the tank is accomplished from the radio compartment through a filler neck which extends above the floor.

The use of a large funnel or a non-drip can is recommended to prevent soiling the carpet. A measuring rod is provided in spring clips on the right side wall of the radio compartment. The rubber covered spinners should be saturated before each flight with the special oil provided for this purpose. The pump rheostats have been set to deliver approximately 2 quarts of fluid per engine per hour. If it is found that this output is insufficient to produce satisfactory results, the fluid flow can be increased as required. Adjustment of the pump speed is made at the rheostat located in the extension of the motor housing. The motors are accessible from the camera pit through holes in the floor supports. On the ground the output may be checked by measuring the drip from each supply tube at the engine. Rotate the propeller to bring one of the three slinger ring outlets to the bottom and collect the fluid delivered by running the pumps for 15 minutes, from which the hourly output can then be determined.

WARNING: A LARGE AMOUNT OF STATIC ELECTRICITY MAY BE RETAINED IN THE DEICER BOOTS AFTER A FLIGHT. IT IS THEREFORE IMPERATIVE THAT THE STATIC ELECTRICITY BE DISCHARGED UPON GROUNDING THE AIRPLANE BY PASSING A GROUND WIRE LOOP OVER THE SURFACE OF ALL BOOTS, ESPECIALLY PRIOR TO REFUELING OPERATIONS.

FLOTATION SYSTEM

When forced to land this airplane on water, the following sequence of operations is recommended:

1. Warn crew by alarm bells.
2. Open bomb doors, drop bombs, close doors.
3. Pull master ignition switch.
4. Turn tank selector valves to "OFF."
5. Pull both fuel dump valves. (Pilot's left.)
6. Pull flotation release. (Pilot's left.)
7. Close dump valves.
8. Land with wheels and flaps "UP."

The fuel purging system in this airplane has been tested in flight and will completely empty the fuel tanks in less than one minute. Large streams of gasoline vapor can be seen leaving the trailing edge of the wing, and a gasoline odor is noticeable in the control cabin. Since CO_2 pressure operates the dump valve release pistons, the dump valves cannot be closed until the CO_2 supply is completely exhausted. In other words, once the system is placed in operation, all the fuel will be lost. The dump valve controls must be depressed, turned counter-clockwise a quarter turn, and pulled. Since flotation is dependent upon the empty fuel tanks, the valves must be closed before actually landing on water. This is accomplished by pushing the control handle to close and turning a quarter turn to lock. To stabilize the airplane in the water, flotation bags are provided in the front and rear gun compartments. The bags are released by CO_2 pressure with the operating handle located to the left of the pilot. Access to the life raft compartment in the top of the fuselage is provided through the navigator's hatch. The hand air pumps, stowed with the rafts, are used to keep the flotation bags filled by pumping air through outside connections at points over both bags.

BOMBING EQUIPMENT

The airplane is equipped with 4 internal and 2 external bomb racks. The number, size, and type of bombs carried are shown by the charts located on the bomb bay doors.

WARNING: SINCE THE STRENGTH OF THE AIRPLANE STRUCTURE IS PARTIALLY DEPENDENT UPON THE INTERNAL BOMB RACKS, THIS AIRPLANE MUST NOT BE FLOWN WITHOUT THESE RACKS.

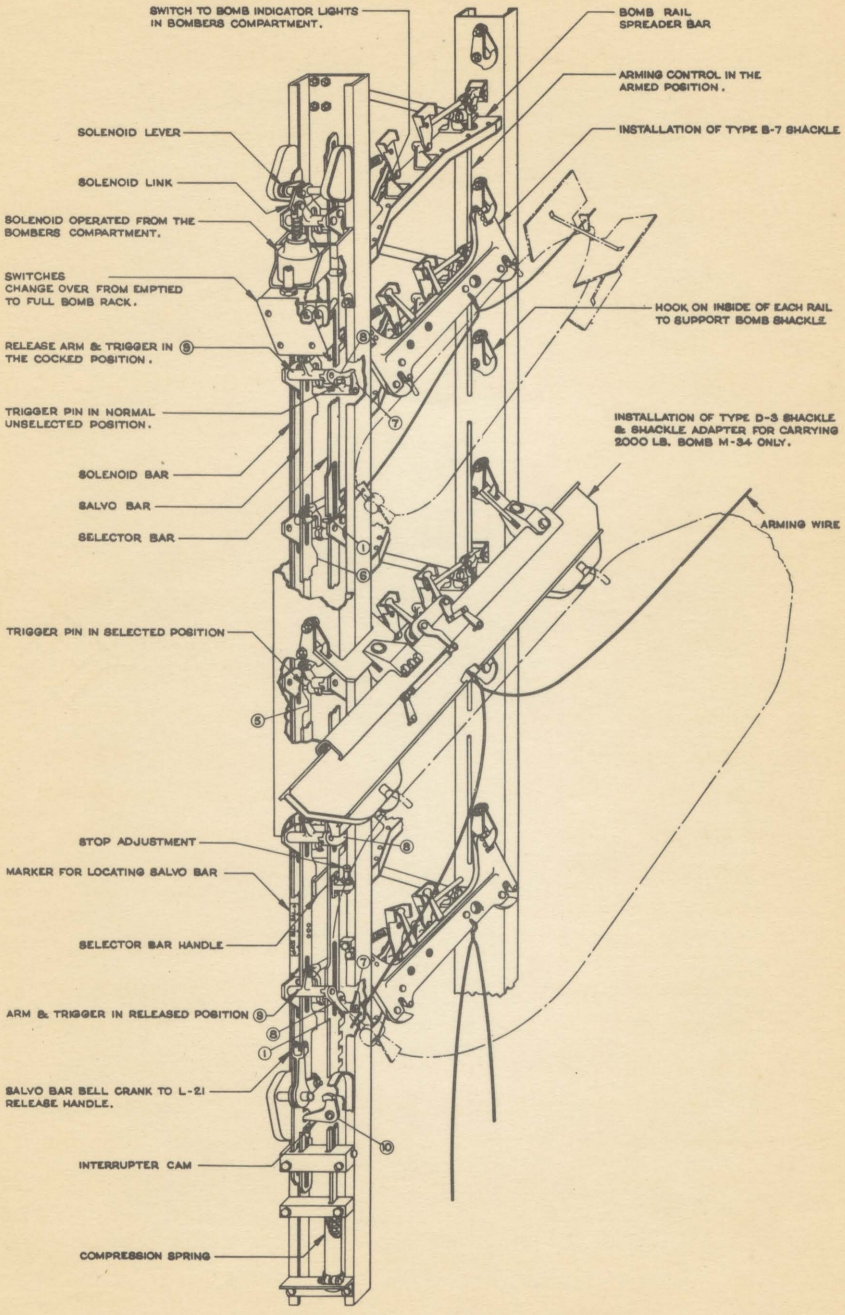
The bomb bay is located immediately aft the control cabin. Entrance to this section is from the cabin, or from the radio compartment through large bulkhead doors. The truss, constructed through the bomb bay on the centerline of the airplane, supports a catwalk and the inner bomb rack rails. Steps are provided at each end of the catwalk.

The two bomb doors in the bottom of the compartment, hinged to the lower chord of the body compression members, swing outward. They are normally controlled from the bomber's compartment. However, emergency controls for the doors are provided in the control cabin and in the bomb bay.

The Type M-1-A bomb sight, A. C. Dwg. H-35K-1341, the bomb control handles and indicator equipment are located in the bomber's compartment which is in the bottom of the fuselage, directly behind the front gun.

A forked rod for emergency bomb release is provided on the left side of the bomb bay rear wall. Steps at the outer edges of the bomb bay facilitate the fusing of bombs.

Provision is made for the installation of one Type D-3 bomb shackle under each wing. A complete arming



BOMB RACK OPERATING MECHANISM

and release control is provided for each shackle, and is connected to the internal bomb controls. The external bombs are loaded with a special portable hoist. No provision is made for carrying this hoist in the airplane.

INTERNAL BOMB RACKS: The major parts of each bomb rack are shown in the accompanying figure which is diagrammatic and representative only of the various conditions of operation. The installation of the Type D-3 bomb shackle and adapter, and the installation of the 2000 lb. M-34 bomb is shown together with the installation of a bomb of a smaller denomination. Bombs carried above the 2000 lb. bomb must not be released until the D-3 shackle and adapter are removed.

Note: The bombs may be fused in flight. Two hinged doors are provided in the rear bulkhead of the compartment under the cockpit floor for fusing access to the M-34 bombs.

Loading: To load the internal bomb racks: set the L-21 release handle to "SELECTIVE," lift the selector bar high enough to cock the lowest bomb station used, cock **only** the stations to be loaded by pushing the bomb release lever toward the front rail, and then return the L-21 release handle to the locked position before loading as a precaution against tripping the release mechanism during loading operations. Install the B-7 bomb shackles on the bombs and load the stations as desired.

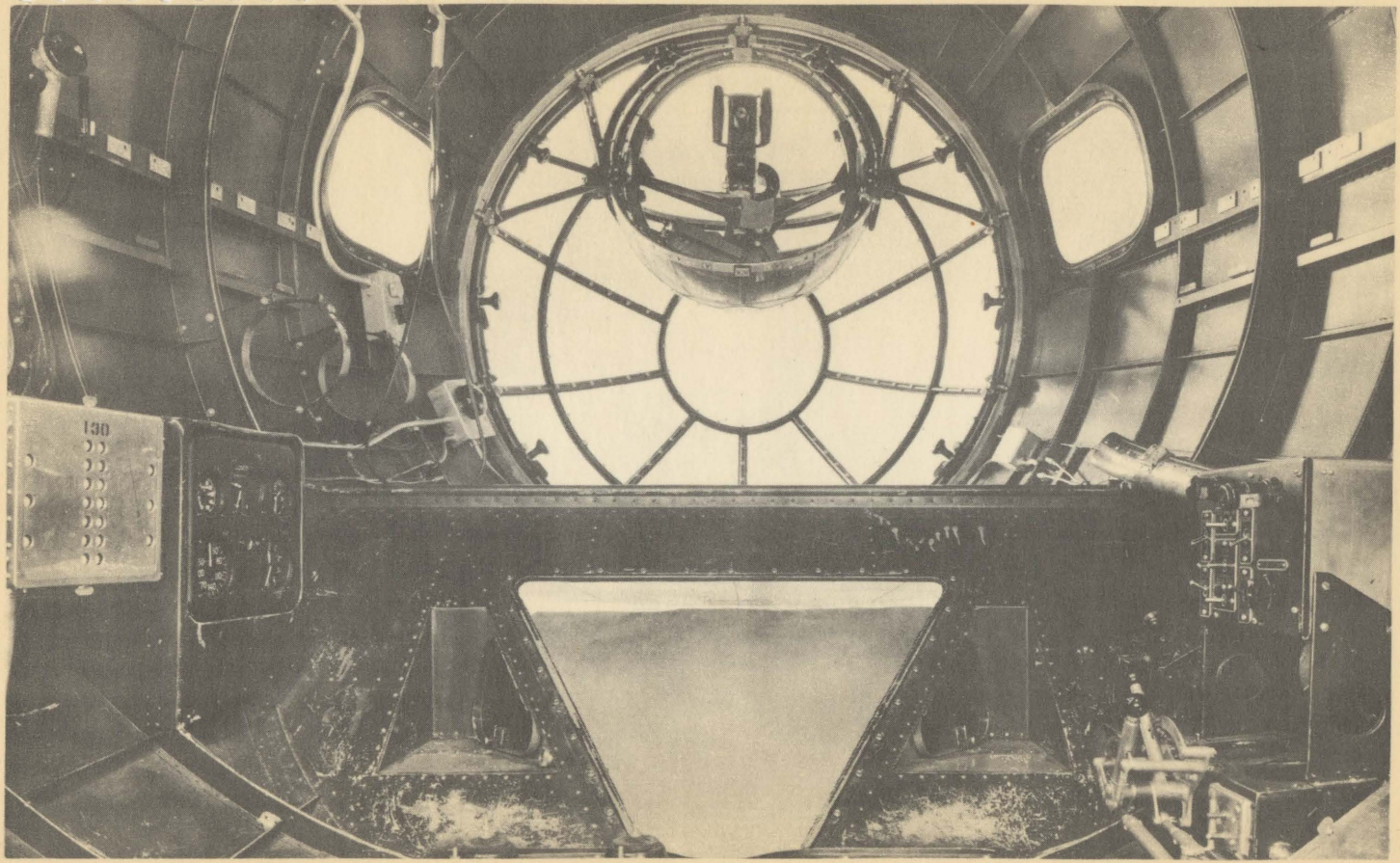
EXTERNAL BOMB RACKS: Provision is made for the installation of an external bomb rack under each wing. Each rack consists of a beam, from which the bomb shackle is suspended, and sway braces.

BOMB INDICATORS: Bomb loads are indicated on the electric indicator located at the bomber's left. The indicator is provided with twenty T-2, 12-16 volt lamps indicating each bomb station in the four racks. A switch on the bomber's switch panel is used to cut out the indicator circuit.

CONTROL PANEL: The bomber's control switch box is mounted on top of the bracket which supports the manual controls at the right of the bomber's station. A rack selector switch which is pushed up to complete the circuit through the internal racks and pushed down to complete the circuit through the external racks, is provided on the panel. Operating in conjunction with this switch, is a switch for selecting the left or right external bomb. Both selector switches should be in properly selected positions prior to dropping any bombs. The actual release of the selected bomb is accomplished by operating the switch marked "Bomb Release."

In addition to the above, a pilot's call switch, a dome light switch, a dash light and an instrument light rheostat are mounted on the panel. A flexible conduit and plug are provided for the bomb sight and the pilot director. When the bomb sight is not in position, the plug should be inserted in the receptacle provided for that purpose.

BOMB DOORS: The bomb bay is closed by two doors, operated by a system of motor driven retracting screws, but quickly releasable for emergency salvo of the bombs. A mechanism, operated by the left hand door, locks the bomb controls until this door is in the full open position, thus preventing the inadvertent release of any bombs with closed doors. The manual bomb controls are operated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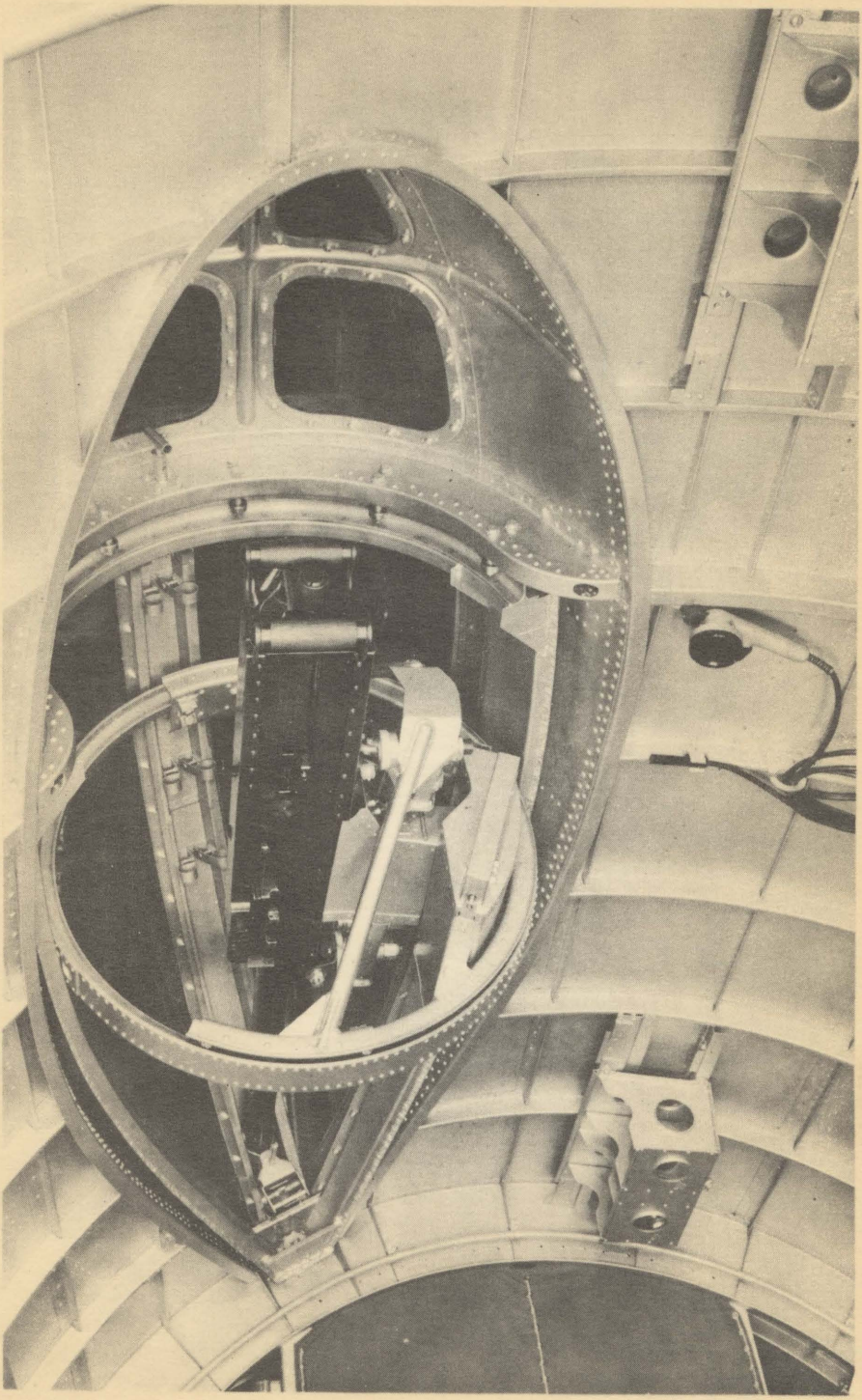
from the bomber's station by handles located at the bomber's right. The release lever, connected to the salvo bars on the racks, is used to lock the racks; to set them for selective electric release; or to release all bombs salvo. The arming lever is conventional in operation. The door operating lever is located to prevent moving the release handle from the "locked" position while the door lever is in the "closed" position, thereby preventing release of any bombs until the doors are opened, also preventing closing the doors until the racks are locked.

EMERGENCY RELEASE: Two Type A-3 emergency handles are provided, one in the floor at the pilot's left, and one above the step at the forward end of the bomb bay. The initial movement of either handle opens the bomb doors; further movement drops all bombs salvo.

MACHINE GUNS

ARRANGEMENT: Provisions have been made for mounting five flexible, Type M-2, .50 cal. machine guns as follows: one in the nose of the airplane, one in the top center of the fuselage aft of the bomb bay, one in the bottom center of the airplane at the trailing edge of the wings, and one in each side of the body midway between the wings and the horizontal stabilizers. These guns are so arranged as to command the complete sphere around the airplane with lines of fire overlapping at 100 yards. One flexible Type 1918, M-1, .30 cal. machine gun may be installed as an alternate at any of the above stations.

FORWARD GUN: The forward gun is mounted in a rotating turret comprising the entire nose section of the airplane. The installation consists of a steel frame and universally mounted sphere in which the gun is supported. The entire structure is fitted with clear plastacelle windows and may be rotated by depressing the spring loaded lock release in the floor ahead of the gunner. Locking notches are provided at 15° intervals around the ring. Six lead balance weights are used to offset the weight of the sphere and the .50 cal. gun installation. The two center weights 15-4119-1 should be removed when the .30 cal. gun is installed. To install the .30 cal. gun, the type A-3 bolt and bracket assembly must be carried on the rear mount, while the type A-3 mounting post must be moved to its forward position. A lock installed in the sphere frame engages a slot in the outer ring track and in the nose support frame to cage the sphere in normal vertical and horizontal positions. The sphere may be released by rotating the lock handle a quarter turn.



REAR GUNS: The after guns are installed in rotating streamline turrets. A gun stop mast mounted on the top of the fuselage prevents firing into the vertical stabilizer. All rear guns are equipped with a retractable gun latch and bumper to cage the gun barrel. To retract these latches apply a slight pressure against the lever which permits the coil spring to snap the latch into the turret. The rear gun turrets may be caged by means of a plunger type lock, which is released by pulling out and turning the handle.

MAGAZINES: Provisions are made for carrying six .50 cal., Type O-1 ammunition boxes on the side walls of the fuselage. Holders for carrying four .30 cal., Type L-4 ammunition boxes may also be attached.

EJECTION CHUTE: The case ejection chute is rigidly attached to the gun mount by means of an adjustable bracket. A removable lip is provided to suit the contour of the ejection port of the gun used. The link chute consisting of two halves is assembled by means of hinge pins with the base riveted to the right side of the case chute. The removable part may be changed to suit either .30 cal. or .50 cal. guns.

CONTAINER: The link and shell container is a metal box formed to the contour of the sphere and supported in tracks constructed on the gun mount to permit its removal for emptying. A handle and latch are provided to facilitate these operations. Space is provided in the container for the cases and links from one magazine of either .30 or .50 cal. cartridges. It is recommended that the container be emptied after firing approximately half of each magazine to insure against obstruction of the passage between the box and ejection chute.

.50 CAL. GUN INSTALLATION: The outer mounting posts are used for the .50 cal. gun installation. The front gun may be put in place without removing the vane sight by sliding one side of the slot cover around the sphere. This is accomplished by pulling the pin in the hinge type fastener adjacent to the after side of the gun support ring. Bolt the gun in place. Attach the .50 cal. lip to the case chute and adjust the chute position to suit. Install the link chute on the base and then install the Type C-1A mount assembly for the ammunition box. Set the adjustable angles on the magazine support out to hold the Type O-1 ammunition boxes.

.30 CAL. GUN INSTALLATION: The inner mounting posts are used for the .30 cal. gun installation. Substitute the .30 cal. lip on the case chute and assemble the link chute on the base, adjusting as necessary. Install the Type L-4 ammunition box holder 6-4908 on the gun and attach the ammunition box adapter to the holder with steel bolts and castle nuts. Set the adjustable angles on the magazine supports back to clear ammunition box holder 9-2020 and bolt the holder in place with steel bolts and self-locking nuts.

GAP COVERS: FRONT GUN: A two-piece plastacelle slot cover which rotates with the gun in grooves is attached to the inner track ring by means of a hinge type fastener.

GAP COVERS: REAR GUNS: Gap covers are provided for closing the gun slots in the streamline turrets when the guns are not in use. They may be quickly removed from the inside by squeezing the finger grips together. The covers are interchangeable except those for the bottom gun which are shorter. Access to the bottom gun turret is provided by opening the hinged floor panels.

LOADING

The airplane has been designed to give a guaranteed performance while carrying a definite normal load. To accomplish certain missions under restricted operating conditions an overload of either fuel or bombs may be carried.

The normal load consists of fuel—850 gals., oil—76 gals., bombs—2500 lbs., crew of six, five .50 cal. guns, 1000 rounds of .50 cal. ammunition, oxygen equipment, six flares, all signal equipment, and complete radio equipment. The normal load does not include photographic equipment, flotation gear, refueling system, internal bomb hoist, life rafts, ladders, engine and turret covers, or personal baggage. Since this equipment is usually in the airplane, its equivalent weight in fuel, bombs, or other equipment should be removed if a normal loading is to be maintained.

When the airplane is loaded in this normal condition it will be stable in flight and balanced correctly for take-off or landing. When the fuel load and bomb load have been expended, the airplane becomes slightly nose heavy. To facilitate landing in this light condition the crew members should not be in any position forward of their regular stations.

When any other than the normal load is carried, it should be distributed in a manner which will give very nearly the same balance as the normal loading condition.

Overloads, if carried, will materially affect the take-off run and landing speed and will create higher stresses in the airplane structure. For this reason such overloads should be avoided until pertinent Technical Orders are issued.

ENGINE OPERATION

The airplane is powered with four R-1820-39 Wright Cyclone engines, geared 16:11, and rated at..... H.P. for altitude ratings: ..... H.P. at ..... ft. or ..... H.P. at ..... ft.

ENGINE LIMITATIONS:

Condition	*Altitude*	*M.P. H.P.*	*in. Hg.*	*Blower Ratio RPM*
Takeoff	S.L.	.....	.....	Low
Max. climb & high speed..	S.L.	.....	.....	Low
Max. climb & high speed.....		.....	.....	Low
Max. climb & high speed.....		.....	.....	High
Max. climb & high speed.....		.....	F.T.	High

It should be noted that these are maximum power conditions and that particular care must be given to mixture adjustment and engine cooling while maximum power is being used.

MAXIMUM CLIMB:

1. Take off in low blower at rated power with full rich mixture.
2. Immediately throttle back to ..... manifold pressure and set propellers at ..... RPM.
3. After full throttle becomes necessary to maintain ..... M.P., continue climb until M.P. drops to ..... and then change to high blower (see supercharger instructions) continue climb at ..... M.P. and ..... RPM.
4. For all other flight attitudes than takeoff when using **low blower,** observe the manifold pressure and lean out the mixture until the indicator needle approaches the marking on the dial for the existing absolute man-

NOTE

Until such time as the R-1820-39 engine passes type test, the following engine limitations shall be maintained:

1. Use LOW BLOWER *only*.
2. Takeoff—2200 RPM, 36.5 in. Hg. M.P.
3. Climb—2100 RPM, 33.5 in. Hg. M.P.
4. Cruising—1900 RPM, 29.0 in. Hg. MP.
   Do not exceed this condition in any level flight.

(On completion of type test, fill out specified ratings on page 34 and remove this page.)

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ifold pressure gauge reading. It will be found necessary to adjust the mixture ratio continually as the climb progresses. The reverse procedure is required while descending. Lower fuel consumption may be obtained when most economical cruising is desired.

5. For all flight attitudes when using **high blower, do not lean** below .09 (extreme L.H. mark on the dial) fuel-air ratio, with range box switch on "3189" position.

CRUISING: The recommended power limits for this condition are, 1900 RPM, and 29″ man. press., neither of which should be exceeded. Cruising at 570 H.P. per engine will give approximately ten hours endurance, while 330 H.P. per engine will give maximum range and endurance (1700 gallons of fuel).

DIVING: The maximum allowable engine speed is 2520 RPM. (Observe airplane air speed limitation.)

OPERATING LIMITATIONS:

Maximum cylinder head temperature—

Normal ..... 205° C.

Short periods ..... 260° C.

Maximum oil inlet temperature..... 85° C.

Minimum oil inlet temperature (takeoff)..... 40° C.

Fuel Pressure—

Normal .....3 to 4 lbs. per sq. in.

Warning light set at.....1½ lbs. per sq. in.

Oil Pressure—

Normal .....50 to 65 lbs. per sq. in.

Minimum .....50 lbs. per sq. in.

SUPERCHARGER: This engine is equipped with a two-speed supercharger controllable in flight. Low blower (7.14:1)

is used for all power conditions at altitudes below 8000 ft., and for cruising powers up to approximately 20,000 ft. High blower is used only for maximum power above 8000 ft., and for cruising at relatively high altitudes. To change from one blower ratio to the other, place the mixture controls in full rich, throttle back to about 1/4 throttle, quickly shift the supercharger lever completely forward into high blower ratio, and gradually open throttles to desired manifold pressure. The mixture may again be leaned, but for any given power high blower requires a richer mixture than the low blower. To compensate for this richer mixture on the mixture indicator, a range switch on the control box must be shifted from "NORMAL" for low blower to "3189" for high blower. When this change is made, the mixture indicator functions in a normal manner with respect to the Manifold Pressure calibration only. To allow for clutch cooling, the change in blower ratio should not be made at intervals of less than five minutes, and when a change is made, the lever must be thrown **completely** over against the stops on the engine.

FUEL FLOW METERS: These instruments indicate the quantity of fuel flowing into each engine, and may be used in conjunction with power output and fuel consumption data to maintain desired fuel-air ratios. When a change is made in the mixture of an engine, the variation will be noted on both the fuel flow indicator and the mixture indicator, thus allowing one to be checked against the other at any time.

MIXTURE INDICATOR: This is a dual instrument, giving continuous indication of the fuel-air ratio being supplied to one pair of engines. The indicator is balanced and controlled by two three-position switches mounted on a

box located at the right of the co-pilot. One switch is marked "STD," "ON," "OFF," the other is marked "SELECTOR," which gives a choice of indications from engines No. 1 and 4 or engines No. 2 and 3 as shown by the nameplate adjacent to this switch. The indicator scale is graduated in both fuel-air ratio by weight, and allowable manifold pressure. Other markings are "RICH" and "LEAN," also designated as "POWER" and "DANGER," and marks "A" and "B" to set the pointers when balancing.

Operation:

1. When "STD" switch is in "OFF" position the pointers should stand at the line marked "A" on the scale. Adjustment of the small screws above and below the scale will occasionally be necessary to maintain this position.
2. With the switch on "STD" the upper pointer should then be adjusted to stand at the line marked "B" by the rheostat screw on the forward side of the control box.
3. With "STD" switch in the "ON" position mixtures are indicated as selected.

PROPELLER OPERATION: The constant speed propellers used are actuated by governors which control the oil pressure required to hold the blades in low pitch. The governors are controlled by the pilot, and will accurately maintain engine speed. Stops are provided at the propeller controls to limit the engine speeds to the rated takeoff RPM, but may be overridden if additional power is desired. After takeoff the engines can be synchronized by reducing the speed of the two inboard engines to the desired RPM and synchronizing by ear. The two outboard engines may then be brought down until their indicated speed coincides with the adjusted pair. It will be found

that once adjusted the propellers will maintain their speed and synchronism indefinitely. It must be remembered that with this system of propeller control, the only indication of a change in throttle setting is the variation in manifold pressure.

CARBURETOR AIR CONTROL: Carburetor air heaters are used to prevent carburetor icing. A single control operates all four carburetor air heat control valves, and may be adjusted to furnish carburetor air at any desired temperature. While flying in air having a temperature and humidity which creates conditions favorable to carburetor icing, a steady drop in the manifold pressure should be taken as an indication of carburetor icing. The air heater control lever should then be moved up from the normally used cold position only far enough to provide sufficient heat to indicate by an increase in manifold pressure that ice is being removed.

STARTING: The following order of operations is recommended:

1. **Air Pressure**—check brake supply.
2. **Ignition Switch**—turn master on.
3. **Instrument Switch**—autosyn dynamotor on.
4. **Fuel Valves**—tank and engine selectors on.
5. **Prime Cold Engine**—five full strokes using hand wobble pump while priming.
6. **Propeller Controls**—against high pitch stops.
7. **Carburetor Air**—cold position.
8. **Mixture Controls**—full rich.
9. **Supercharger Control**—against low blower stop.
10. **Throttles**—to give approximately 800 RPM.
11. **Starters**—operate in conventional manner.

STOPPING: The following order of operations is recommended:

1. **Idle Engines**—until head temperatures reach approximately 180° C.
2. **Fuel Valves**—turn off.
3. **Throttles**—open to give approximately 800 RPM.
4. ***Mixture Controls**—move to full lean when engine is running smoothly to shut off fuel.
5. **Ignition Switch** — turn off after engines stop and **do not open throttles.**

*The final 10° travel of the mixture control lever to full lean shuts off the fuel supply **when the engine is operating above idling speed.**

Note: To give a positive check on the operation of the fuel and vacuum pumps, it is recommended that the engines be stopped and started in the order 2, 3, 1, and 4.

FLYING CHARACTERISTICS

Due to the number of operations which must be performed in flying this airplane it is essential to check each operation before taking off or landing. The following lists should be individually checked by both the pilot and co-pilot.

BEFORE TAXIING FROM LINE:

1. **Ballast**—check airplane loading.
2. **Brakes**—check air pressure.
3. **Supercharger**—low blower.
4. **Warning Lights**—test.
5. **Altimeters**—set to field altitude.
6. **Flight Control Locks**—release.
7. **Fuel Pressure, Oil Pressure, Ignition**—at run up.
8. **Propeller Operation**—check full range of controls.
9. **Instruments**—check operation.
10. **Tail Wheel**—unlock.
11. **Wheel Blocks**—remove.

BEFORE TAKE-OFF:

1. **Flight Control Locks**—release.
2. **Fuel Cocks**—check position.
3. **Mixture Controls**—full rich.
4. **Propeller Controls**—against low pitch stops.
5. **Carburetor Air**—on cold (down).
6. **Landing Flaps**—normally up.
7. **Trim Tabs**—set in neutral.
8. **Engines**—run up individually.
9. **Tail Wheel**—lock when in position for take-off.

BEFORE LANDING:

1. **Landing Gear**—down.
2. **Tail Wheel**—locked.
3. **Brakes**—check air pressure.
4. **Fuel Cocks**—set on "reserve" if fuel is low.
5. **De-Icers**—turn off.
6. **Mixture Controls**—full rich.
7. **Propeller Controls**—against low pitch stops.
8. **Landing Flaps**—lower as required.
9. **Trim Tabs**—set to maintain glide.
10. **Landings**—not to be made at intervals of less than 12 minutes.

The flight controls are very light and are easily operated in the air. Except for the additional controls required by its four engines, the plane flies and handles like a much smaller two-engine airplane.

When necessary to obtain the best angle of climb after takeoff, the flaps may be lowered approximately 10°. Any further extension will increase the drag with a consequent loss in climb. The flaps can easily be operated by the co-pilot at the command of the pilot who calls out the desired setting. This will leave the latter free to operate the engine and flight controls. Complete 60° motion of the flap requires but 10 seconds, so a little practice will be required to stop the movement at the desired position. Otherwise the flap action is entirely normal.

In flight it will be found that a slight unbalance in the power output of the outboard engines tends to yaw the airplane, whereas the same unbalance between the inboard engines is hardly noticeable. For this reason it is quite essential to keep the power output of engines Nos. 1 and 4 equal during takeoff and climb.

The stalling characteristics of the airplane are entirely normal with flaps either up or down. There is no tendency to drop off on either wing, but due to the high wing loading in the overload condition, considerable altitude will be lost during recovery from a complete stall.

The normal balance of the airplane with its disposable load either on board or fully expended affords excellent characteristics for landing. However, to secure the greatest ease of control during landings made with light load, it is suggested that the crew members normally stationed in the rear compartments remain at their stations during such landings.

It should be borne in mind while operating this airplane that maneuvers must be limited to those permitted for bombardment type airplanes. A considerable amount of research has produced control surfaces which will enable the operating personnel to accomplish long range missions under adverse weather conditions with a minimum of effort and fatigue. It is sincerely hoped that the great power of the flight controls will not be abused, as it is easily possible to perform maneuvers producing loads far in excess of those for which the structure has been designed.

CONTROLS

FUEL & OIL SYSTEM

INSTRUMENTS

LANDING GEAR & BRAKES

MISCELLANEOUS EQUIPMENT

ELECTRICAL SYSTEM

RADIO & INTERPHONE

FIRE EXTINGUISHING

DEICING EQUIPMENT

FLOTATION EQUIPMENT

BOMBING EQUIPMENT

MACHINE GUNS

LOADING

ENGINE OPERATION

FLYING CHARACTERISTICS

CONTROLS

FUEL & OIL SYSTEM

INSTRUMENTS

LANDING GEAR & BRAKES

MISCELLANEOUS EQUIPMENT

ELECTRICAL SYSTEM

RADIO & INTERPHONE

FIRE EXTINGUISHING

DEICING EQUIPMENT

FLOTATION EQUIPMENT

BOMBING EQUIPMENT

MACHINE GUNS

LOADING

ENGINE OPERATION

FLYING CHARACTERISTICS

NOTES