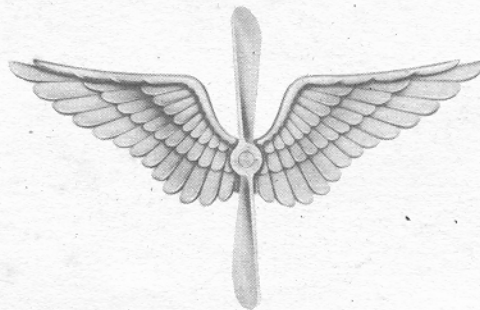


# PILOT'S HANDBOOK OF Flight Operating Instructions

## FOR THE

MODELS C-43, C-43A, C-43B, C-43C, C-43D, C-43E, C-43F, C-43G and C-43H  
TRANSPORT AIRPLANES, powered with Pratt and Whitney R-985 AN1, -13,  
-17, or -23 (Wasp Jr. SB-2 or SB-3), or Wright R-975-11, (-E3) R-760-E2, or Jacobs  
L-5, L-5M, L-5MB, L-6, L-6M or L-6MB Radial Air-Cooled Engines.



Manufactured by the Beech Aircraft Corporation, Wichita, Kansas  
Contract W535 AC 1042

*NOTICE: This document contains information affecting the  
National Defense of the United States within the meaning of  
the Espionage Act (U. S. C. 50:31:32). The transmission of  
this document or the revelation of its contents in any manner  
to an unauthorized person is prohibited.*

PUBLISHED BY AUTHORITY OF THE COMMANDING GENERAL,  
ARMY AIR FORCES, BY THE HEADQUARTERS, FIELD SERVICES,  
AIR SERVICE COMMAND, PATTERSON FIELD, FAIRFIELD, OHIO

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>	<u>Section</u>	<u>Page</u>
I Description	1-11	III Specific Engine Data	20-25
1. Airplane	1	1. R-985-AN1 (Model C-43 Air- planes Only)	20
2. Power Plant	1- 2	2. R-975-11 (Models C-43A, C-43E, and Alternate C-43H)	20-21
3. Propellers	2	3. R-985-13 (Alternate Model C-43B)	21-22
4. Operational Equipment	2- 6	4. R-985-17 (Alternate Model C-43B)	22
5. Engine Controls	7	5. R-985-23 (Alternate Model C-43B)	22-23
II Pilot Operating Instructions	12-19	6. L-6, L-6M, L-6MB (Model C-43D, and C-43G)	23
1. On Entering the Pilot's Compartment	12	7. L-5, L-5M, L-5MB (Models C-43D, and C-43G)	23-24
2. Starting the Engine	12-13	8. R-760-1 (Model C-43F Airplane Only)	24
3. Engine Warm-up	13	9. R-975-7 (Alternate Model C-43H)	24-25
4. Engine and Accessories Ground Test	13-14	IV Carburetor Heat and Detonation	26-27
5. Taxiing Instructions	14	1. Operation of Carburetor Heater	26
6. Take-off	14	2. Detonation	26-27
7. Engine Failure During Take-off	15	V Loading Schedule	29
8. Climb	15	VI Miscellaneous Notes	30
9. Engine Flight Charts	15	1. Fuses	30
10. General Flying Characteristics	15-16	2. Right Rudder Pedals	30
11. Engine Failure During Flight	16	3. Exhaust Gas in Cabin	30
12. Stalls	16	VII Winter Flying Suggestions	31
13. Speeds not To Be Exceeded	16		
14. Emergency Exit	17		
15. General Operation	17		
16. Engine Performance	17-18		
17. Flying Under Low Ceiling	18		
18. Approach, Landing and Cross- wind Landing	18		
19. Stopping Engine	18-19		
20. Before Leaving the Pilot's Compartment	19		
21. Maneuvers Prohibited	19		

ILLUSTRATIONS

<u>Figure</u>	<u>Page</u>
1 3/4 Rear View of Complete Airplane in Flight	1
2 Side View of Complete Airplane	3
3 Landing Gear	3
4 Hydraulic Brake System	5
5 Aileron Control	6
6 Wing Flap Control	6
7 Rudder and Rudder Tab Control	8
8 Elevator and Elevator Tab Control	8
9 Oil System	9
10 Fuel System	10
11 Fuselage Doors	11
12 Belly Landing	14
13 Flight Instrument Piping	28
14 Complete Airplane in Flight	30

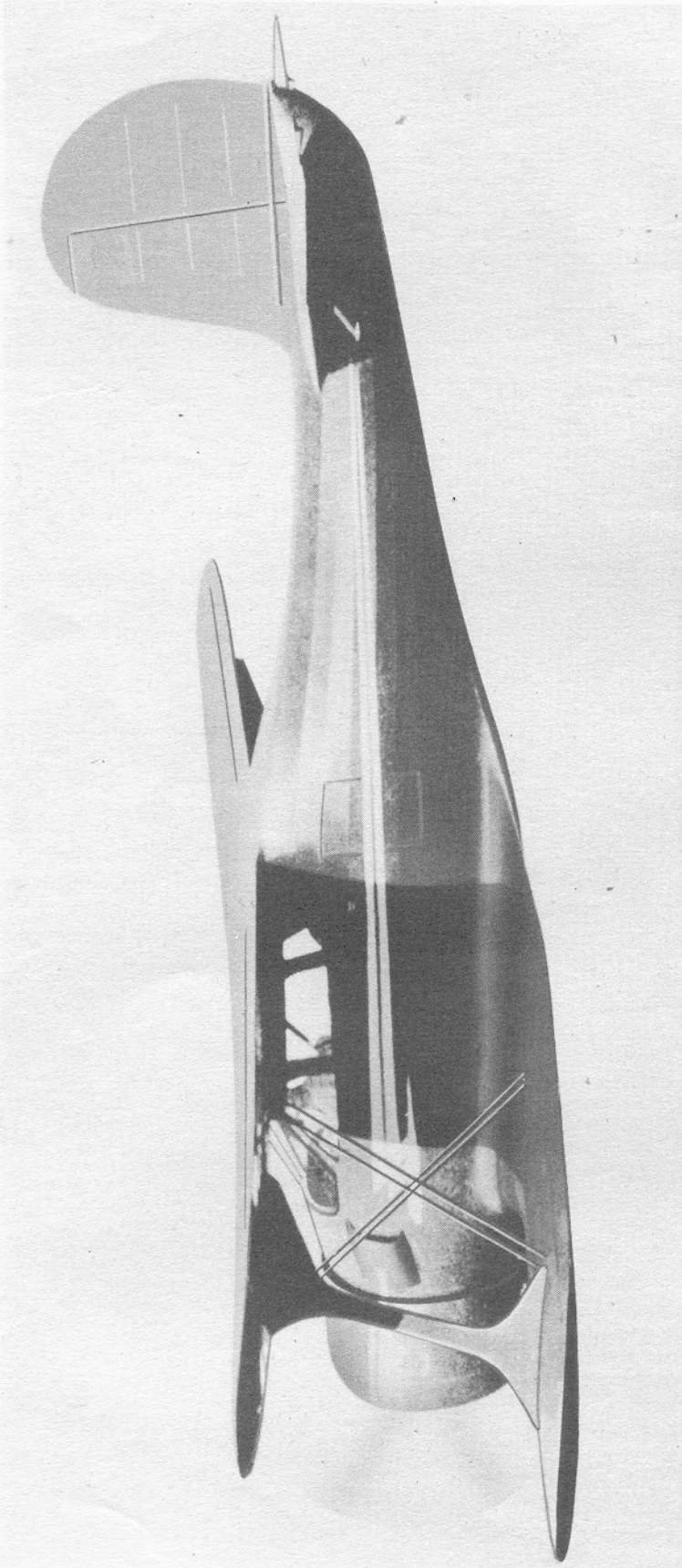


Figure 1



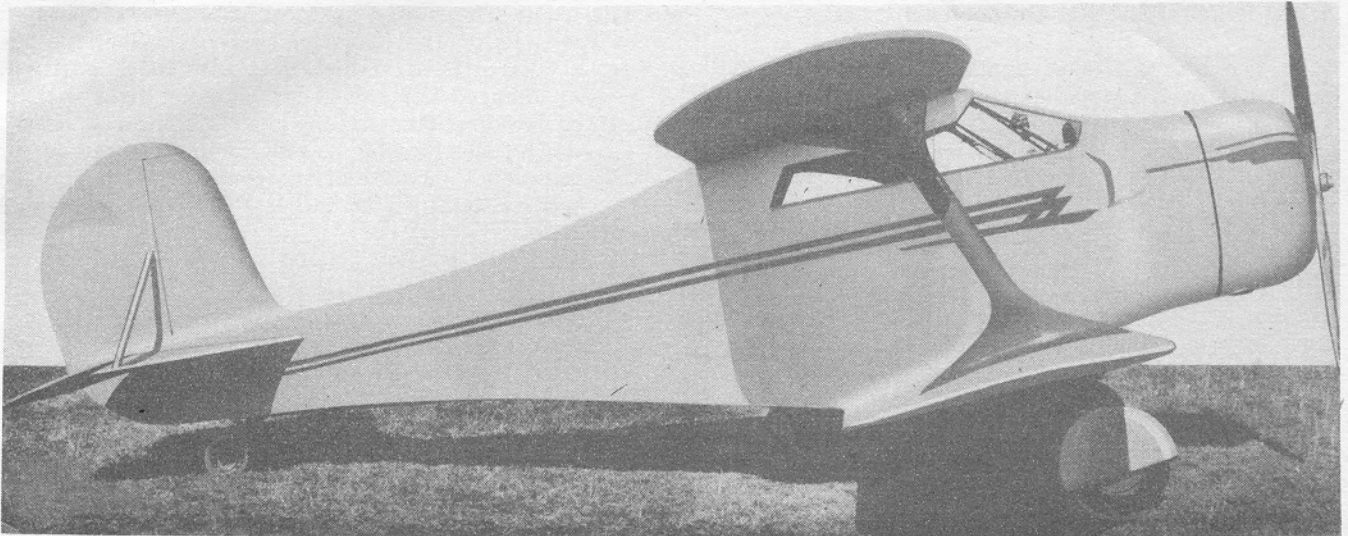


Figure 2 - Side View of Complete Airplane

## SECTION I

### DESCRIPTION

#### 1. Airplane.

a. General. - All Model C-43 series transport airplanes are structurally similar and have the same flying characteristics. They are single-engined, negative stagger biplanes with seating arrangements for pilot, copilot and three passengers and cargo space accommodating cargo weighing up to 125 pounds. Landing gear is of the electric retractable type. Fuselage construction is metal frame and fabric cover. Wing construction is wood frame and fabric cover. Wing flaps are provided on the trailing edge of the lower wings. Most of these airplanes are equipped with two-speed controllable propellers.

b. Access to Airplane. (See figure 11.) - Access to the main cabin is gained through a door on the left side of the fuselage above the lower wing and below the upper wing. Access to the cargo compartment is obtained through a smaller door aft of the entrance door. No access to the cargo compartment from the interior of the cabin is provided.

c. Landing Gear. (See figure 3.) - The landing gear consists of two main landing wheels and a tail wheel. Retraction and extension are accomplished electrically and provision is made for emergency manual operation by means of a hand crank. Operation of the landing gear position control raises or lowers all three wheels at the same time.

d. Hydraulic Brake System. (See figure 4.)

e. Oil System. (See figure 9.)

f. Fuel System. (See figure 10.) - Five fuel tanks are provided: The main fuselage fuel tank and one fuel tank in each upper and lower wing. Total fuel capacity is 121 U.S. gallons (100.8 Imperial gallons) of which 29 U.S. gallons (24.2 Imperial gallons) is carried in the main fuselage tank and 23 U.S. gallons (19.2 Imperial gallons) is carried in each of the four wing tanks.

#### 2. Power Plant.

a. The Model C-43 airplanes are powered with Pratt & Whitney R-985-AN-1 radial air-cooled engines.

b. The Model C-43A airplanes are powered with Wright R-975-11 (-E3) radial air-cooled engines.

c. The Model C-43B airplanes are powered with Pratt & Whitney R-985-13, R-985-17 or R-985-23 (Wasp Jr. SB-2 or SB-3) radial air-cooled engines.

d. The Model C-43C airplanes are powered with Jacobs L-6, L-6M or L-6MB radial air-cooled engines.

e. The Model C-43D airplanes are powered with Jacobs L-5, L-5M or L-5MB radial air-cooled engines.

f. The Model C-43E airplanes are powered with Wright R-975-11 (-E3) radial air-cooled engines.



g. The Model C-43F airplanes are powered with Wright R-760-E2 radial air-cooled engines.

h. The Model C-43G airplanes are powered with Jacobs L-5 or L-5M radial air-cooled engines.

i. The Model C-43H airplanes are powered with Wright R-975-11 (-E3) or R-975-E2 radial air-cooled engines.

### 3. Propellers.

Some C-43 series airplanes are fitted with wood propellers of fixed pitch, but the majority of these airplanes are fitted with two-speed controllable propellers. All propellers are of the two-blade type.

### 4. Operational Equipment.

a. Seat Adjustment. - The pilot's seats are on slides and may be released by a lever on the outer front corner of the seats. To get out of the airplane, slide the right seat all the way back. The pilot can shift over to this seat and then to the back seat. When getting in, grasp the brace tubes in the windshield and pull the seat forward. The seats can be locked anywhere in the range of 6 inches at the front. Be sure the seat is securely locked before take-off.

b. Swing Over Control Column. - The control column with a conventional wheel is swung over for the use of the copilot by pulling out on the button in the center of the column.

c. Control Surfaces. - The control surfaces of this airplane consist of two ailerons, two elevators, and rudder. Trimming tabs are provided on both elevators and on the rudder. Operation is conventional.

#### d. Elevator Trimming Tab.

(1) The horizontal stabilizer on these airplanes is fixed. Longitudinal balance is secured by the use of an elevator trimming tab.

(2) The tabs are operated by turning a knob located on the control column. The knob is turned clockwise to nose the airplane down. This action moves the trailing edge of the tab "UP" and the upward movement of the tab moves the trailing edge of the elevator "DOWN," which of course lowers the nose of the airplane. To cause the nose of the airplane to rise, the knob is turned counterclockwise, moving the trailing edge of the tab down and raising the trailing edge of the elevator.

e. Rudder Trimming Tab. - The rudder tab is operated from a crank in the roof marked "RUDDER TAB." The tab lever is turned clockwise to relieve pressure on the right rudder pedal.

#### f. Landing Gear Operation.

(1) Electric Retraction. - When the landing gear

is down and the master switch is on, the green light will burn. The motor switch and lock are operated by the same control (position control). When the position control is first moved to the "UP" position, neither the red nor the green warning light will be lighted (which shows that the gear is being retracted). As soon as the landing gear is completely retracted, only the red light will burn. Gear position may be checked as outlined in the instructions for manual operation.

#### (2) Manual Retraction.

(a) The landing gear should be retracted by hand only when the electric circuit to the landing gear retracting motor has been disconnected, or when the motor fails. (The circuit may be disconnected by removing the fuse from the fuse holder.) To retract the landing gear manually, move the position control to the "UP" position, engage the hand crank by pulling it toward the center of the airplane and turn the crank counterclockwise about 44 turns. The gear will be completely up when:

1. The hand crank ceases to turn.

2. The red warning light is lighted and the green light is not.

3. The clicking sound made by the locking pawl when the gear is in motion can no longer be heard.

(b) Do not engage the hand crank while the landing gear motor is in operation.

(c) The landing gear will retract easier in a fairly steep climb.

(3) Tail Wheel Retraction. - The tail wheel is retracted in the same manner, whether the landing gear is operated electrically or manually. A stretched shock cord retracts the tail wheel whenever the cable holding the tail wheel down is allowed to slacken sufficiently. This occurs when the landing gear is retracted since the tail wheel cable is connected to the landing gear retracting chain and moves toward the lower end of the slide tube during retractions.

(4) Warning Lights. - The landing gear warning lights work only when the master switch is turned on and the landing gear is in one of the two extreme positions, either up or down. A green light burning indicates the gear is down, and a red light burning indicates the gear is up. If at any time neither light will burn when in extreme positions, the lamps are either burned out or the fuse for the navigation lights has burned out. Always move the position control to the "DOWN" position before inserting a new fuse. (See Operation Instructions.)

(5) Lowering Electrically. - To lower the gear move the position control to the "DOWN" position. Neither the red nor the green warning lights will be

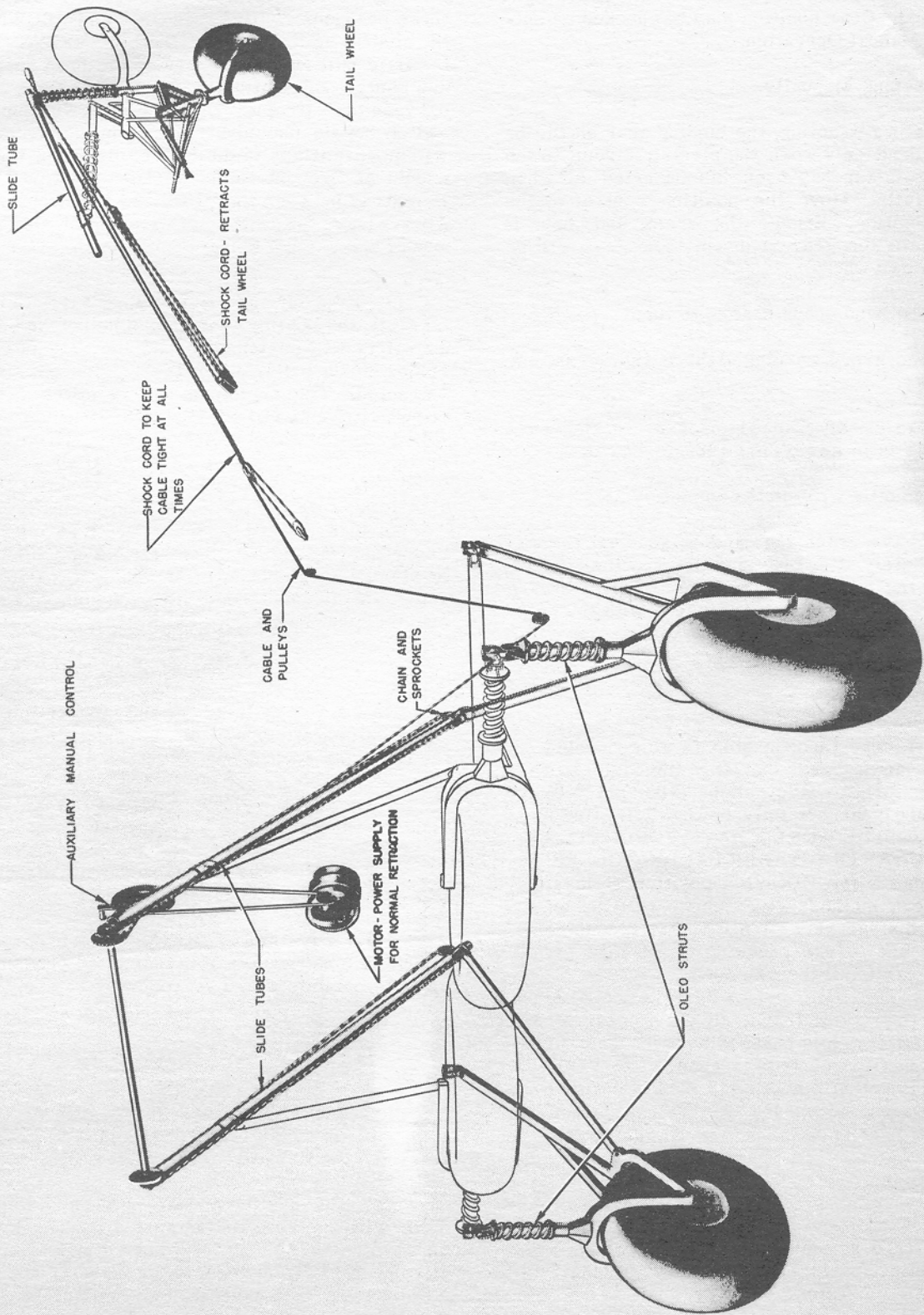


Figure 3 - Landing Gear

lighted (signifying that lowering is in process). When the gear is completely lowered only the green light will be lighted. Gear position may be checked as outlined under Manual Operation.

(6) Lowering Manually.

(a) As in retracting, the landing gear should be lowered by hand only when the electric circuit to the landing gear motor has been disconnected or when the motor fails. Move the position control to the "DOWN" position. Engage the crank and turn it clockwise until the gear is down. The gear will be completely down when:

1. The hand crank ceases to turn.
2. The green warning light is lighted and the red one is not.
3. The clicking sound made by locking pawl when the gear is in motion is no longer heard.
4. Throttle will close completely.

(b) Always crank the landing gear all the way down immediately after changing the position control. When using the hand crank be sure to pull it toward the center of the airplane to engage it with the gear. (There are only two positions 180 degrees apart in which the crank will engage the gear.)

(7) Throttle Stop.

**CAUTION:** The throttle stop is so connected with the landing gear that it is impossible to close the throttle below about 1200 rpm with the landing gear not fully down. **THE BEST PILOTS IN THE WORLD HAVE FORGOTTEN TO LOWER RETRACTABLE LANDING GEARS.** Always check the "DOWN" position at least by the four methods given above. Do not let anything distract your attention after releasing the gear and before checking to be sure the landing gear is all the way down.

When the slides travel up the slide tube 1/2 inch the throttle stop is engaged and will remain engaged until position control is changed to "DOWN" and the gear is rolled to within 1/2 inch of clear down. The throttle must be opened after retraction for the stop to work.

g. Wing Flaps.

(1) The wing flaps extend along the inboard section of the trailing edge of both lower wings. The maximum deflection is 43 degrees. The wing flaps are electrically operated.

(2) Operation of Wing Flaps. - Flaps may be used to retard the glide and reduce landing speed at any speed below 110 miles per hour. The standard flap

control switch location is on the instrument panel directly above the throttle control. The switch has three positions: "UP," "STOP," and "DOWN." With the control switch in the "UP" or "DOWN" position the flaps will run all the way up or down respectively and shut off automatically. To stop the flaps anywhere between the extreme "UP" or "DOWN" positions the switch handle should be placed in the position which will move the flaps in the desired direction, then handle should be brought to the "STOP" position. "STOP" is midway between the "UP" and "DOWN" positions. Always leave the switch in the center or stop positions when flaps are not being used.

(3) Take-off and Climb (Wing Flaps Up). - After take-off, the landing gear should be retracted as soon as safety will permit, because the rate of climb becomes much better after the landing gear has been retracted. The maximum rate of climb will be obtained at about 110 to 115 mph indicated air speed with a fixed pitch propeller or a controllable propeller in high pitch. The best rate of climb will be at 85 to 90 mph. The landing gear will be easier to retract at a lower air speed and a higher angle of climb. Always lock the tail wheel before take-off, so it will be locked on landing. The "Cruising Climb" should be started very shortly after take-off. A horsepower calculator is furnished with each ship as a guide for cruising power control.

(4) Take-off and Climb (Wing Flaps Down).

(a) A quicker take-off and steeper initial climb immediately after take-off can be accomplished by the following procedure:

1. With the elevator tab set in take-off range, open the throttle.
2. Raise the tail slowly with the elevators. (Not more than 1 foot off the ground.)
3. When the ground speed has increased enough (about 40 mph) to noticeably reduce the pressure on the control column which is required to keep the nose down, lower the flaps.
4. As soon as safety will permit, retract the landing gear.
5. Immediately after the landing gear is fully retracted the flaps should be raised.

(b) The maximum rate of climb with the flaps down will be realized at an indicated air speed of approximately 70 mph. Do not raise the nose in an attempt to increase the rate of climb. The ship will climb faster in a level attitude with flaps down than it will with the nose up.

(c) The use of flaps for take-off increases the angle of climb but not the rate of climb.



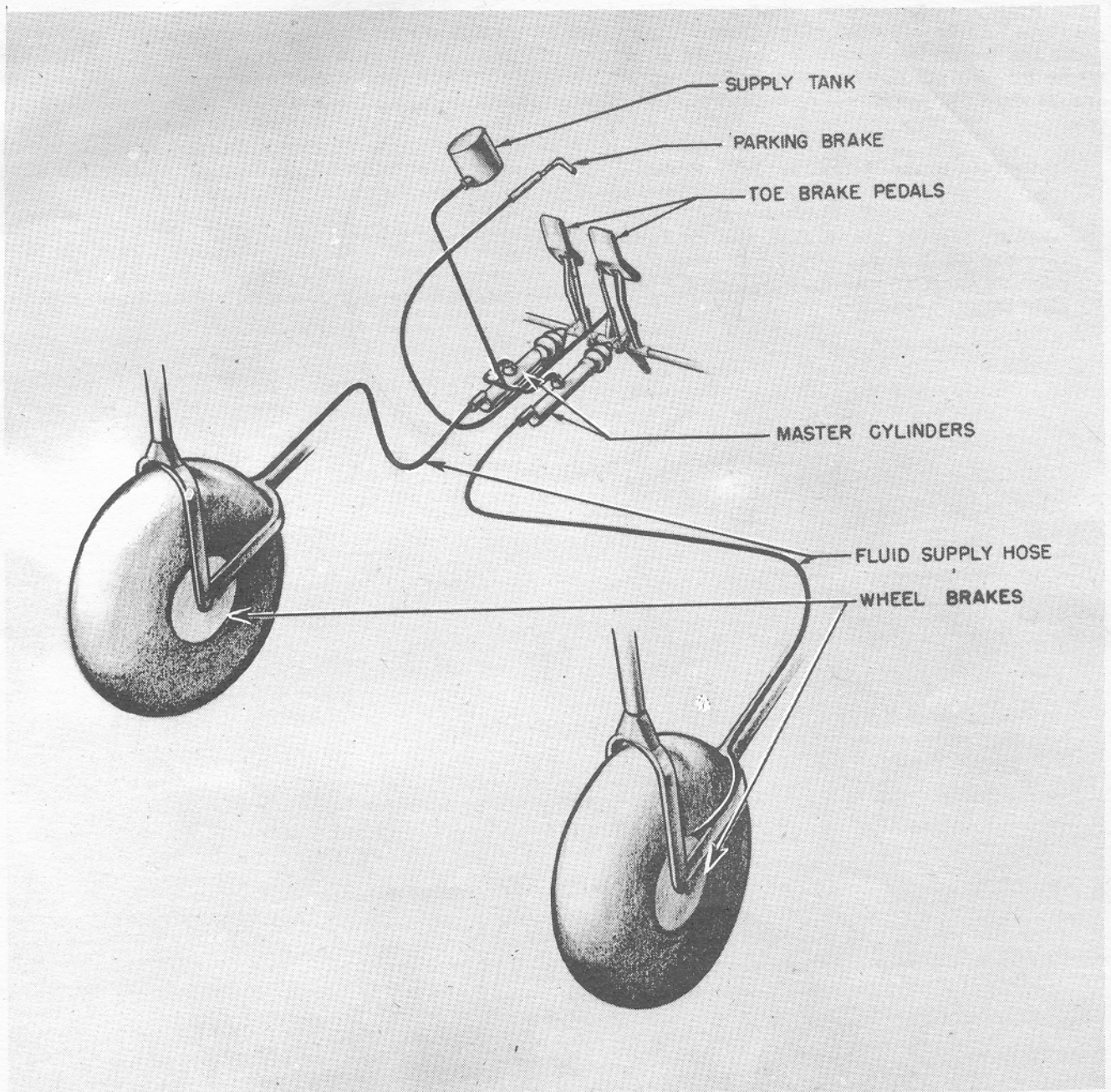


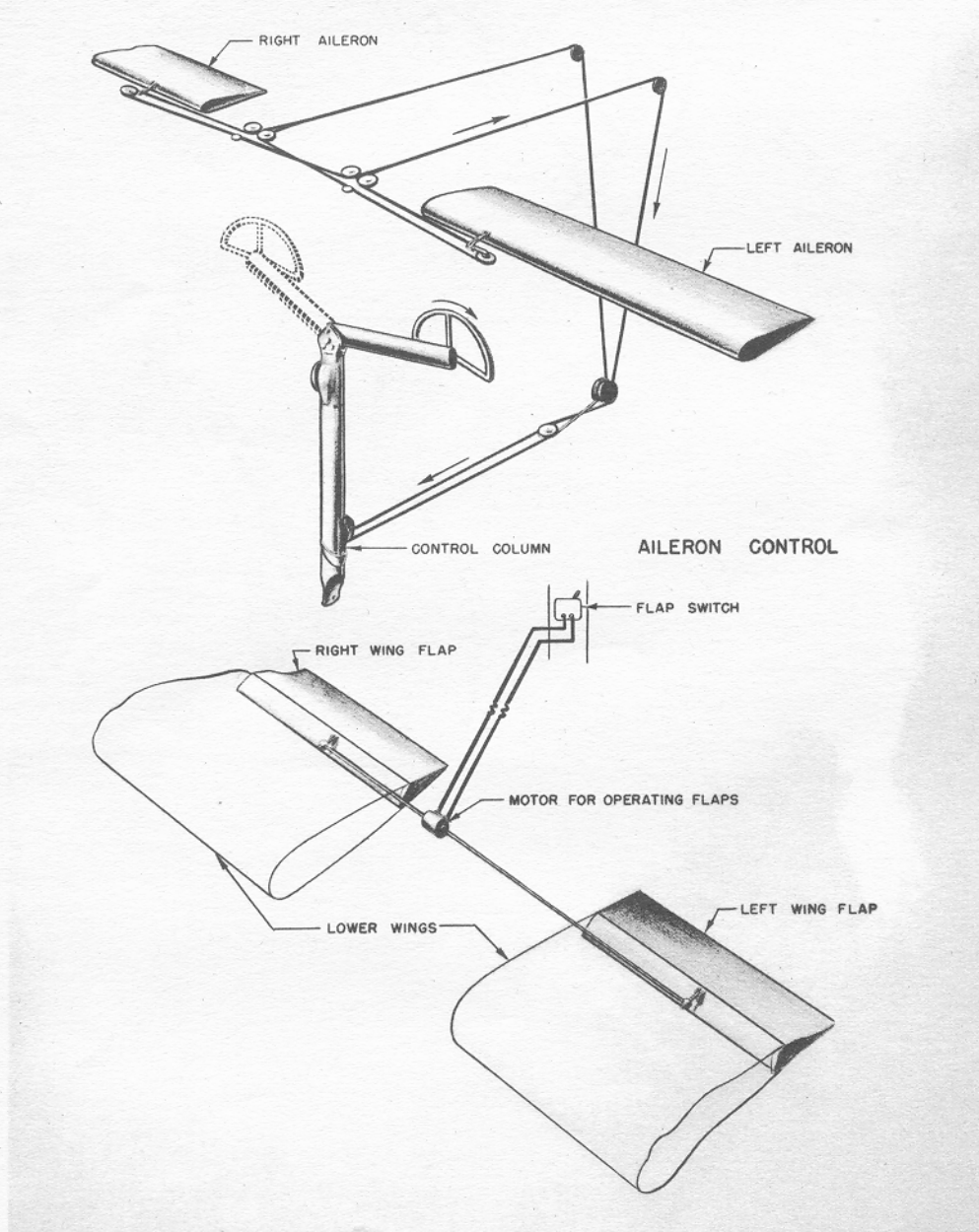
Figure 4 - Hydraulic Brake System

**h. Brakes.** - The parking brake control is of the push type located to the left of the control column just under the instrument panel. It should be in the extreme forward position for taxiing. Taxiing brakes are standard equipment only on the left pilot's rudder pedals.

**CAUTION:** Brake Action is Very Powerful. Use brakes with care until thoroughly familiar with them. Be careful to not use any brake on take-off, because the brakes can be ruined very rapidly this way since it is easy for a pilot not familiar with the ship to use a little right brake on take-off.

**i. Tail Wheel Lock.** - The tail wheel locking control is underneath the instrument panel directly in front of the pilot's chair. To unlock the tail wheel so it will swivel, push the control to the left as far as it will go. It will stay in this position until changed. Do not attempt to unlock the tail wheel unless the airplane is moving in a straight line. To lock the tail, push the control to the right as far as it will go.

**j. Landing Lights.** - Do not use the landing lights more than is absolutely necessary. They use 20 amperes each, and will drain the battery very rapidly. Use only one light at a time whenever possible.



Figures 5 and 6 - Wing Flap Control

5. Engine Controls.a. Throttle Control. - Conventional.b. Mixture Control.

(1) Full Rich (Full forward). - This is the setting of the mixture control lever in the position giving maximum fuel flow.

(2) Best Power (Sometimes termed "Maximum Power"). - This is the setting of the mixture control lever which, with a given fixed throttle setting, results in the maximum engine rpm at the leanest fuel flow; i.e., further leaning of the mixture would cause a decrease in engine rpm.

(a) Rich Best Power. - This is the setting of the mixture control lever which, with a given fixed throttle setting, results in the maximum engine rpm at the richest fuel flow.

(3) Smooth Operation. - To obtain the setting for "Smooth Operation" the setting for "Best Power" is obtained and the mixture enriched until engine speed drops from 20 to 30 rpm.

(4) Maximum Economy. - This is obtained by adjusting the "Best Power" and then leaning to obtain a decrease of 40 to 50 rpm.

(5) Detailed Settings. - Refer to section III in this Handbook for specific and detailed mixture control settings.

c. Increasing or Decreasing Engine Power.

(1) To prevent excessive cylinder pressure when changing power conditions the following procedure will always be followed whether in flight or during ground operation.

(a) Increasing Power. - Enrich mixture to obtain the fuel air ratio specified for the desired power condition.

1. Move propeller controls to obtain the desired rpm.

2. Move throttle to obtain the desired manifold pressure.

3. Readjust mixture control if necessary.

(b) Reducing Power. - Move throttle to obtain the desired manifold pressure.

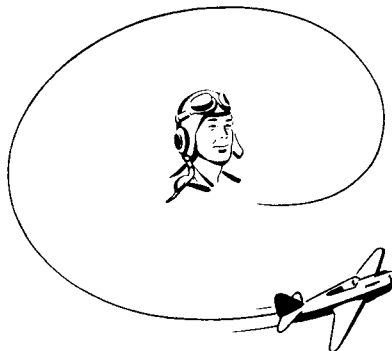
1. Move propeller controls to obtain the desired rpm.

2. Readjust throttles as necessary.

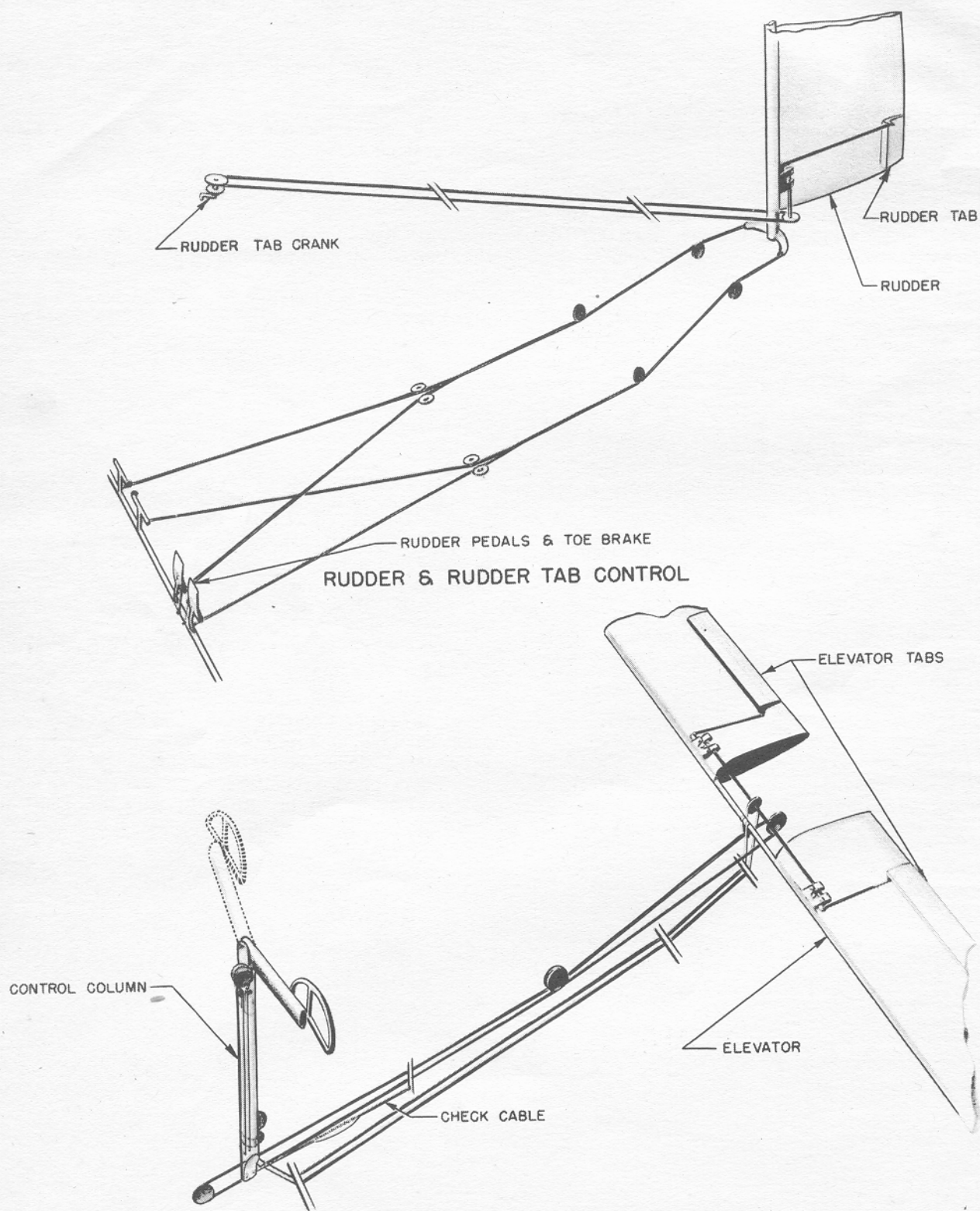
3. Adjust mixture control for the specified fuel air ratio.

d. Carburetor Ice. - Heat to the carburetor may be used to prevent the formation of ice, or to remove ice already formed. EXCEPT UNDER UNUSUAL ICE-FORMING CONDITIONS, carburetor heat should not be used during take-off. Under extreme ice-forming conditions the carburetor heat control may be from 1/2 to 2/3 "ON" with manifold pressure reduced two or three inches Hg from that normally allowed for take-off. Carburetor heat should be turned off as soon as practicable.

e. Propeller Controls. - Most Model C-43 series airplanes are equipped with two-pitch controllable propellers. Some of these airplanes are equipped with fixed pitch propellers. The controllable propellers may be set in "HIGH PITCH" (low rpm) or "LOW PITCH" (high rpm).







Figures 7 and 8 - Elevator and Elevator Tab Control

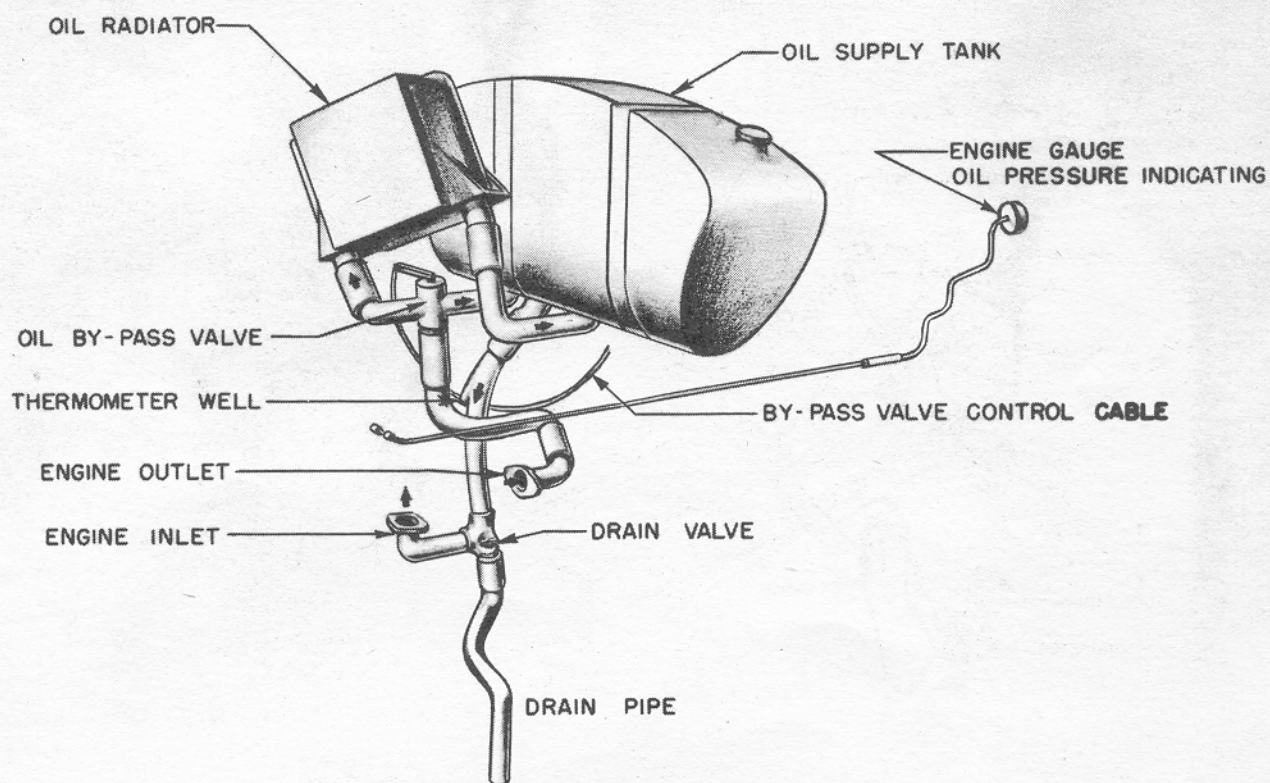


Figure 9 - Oil System



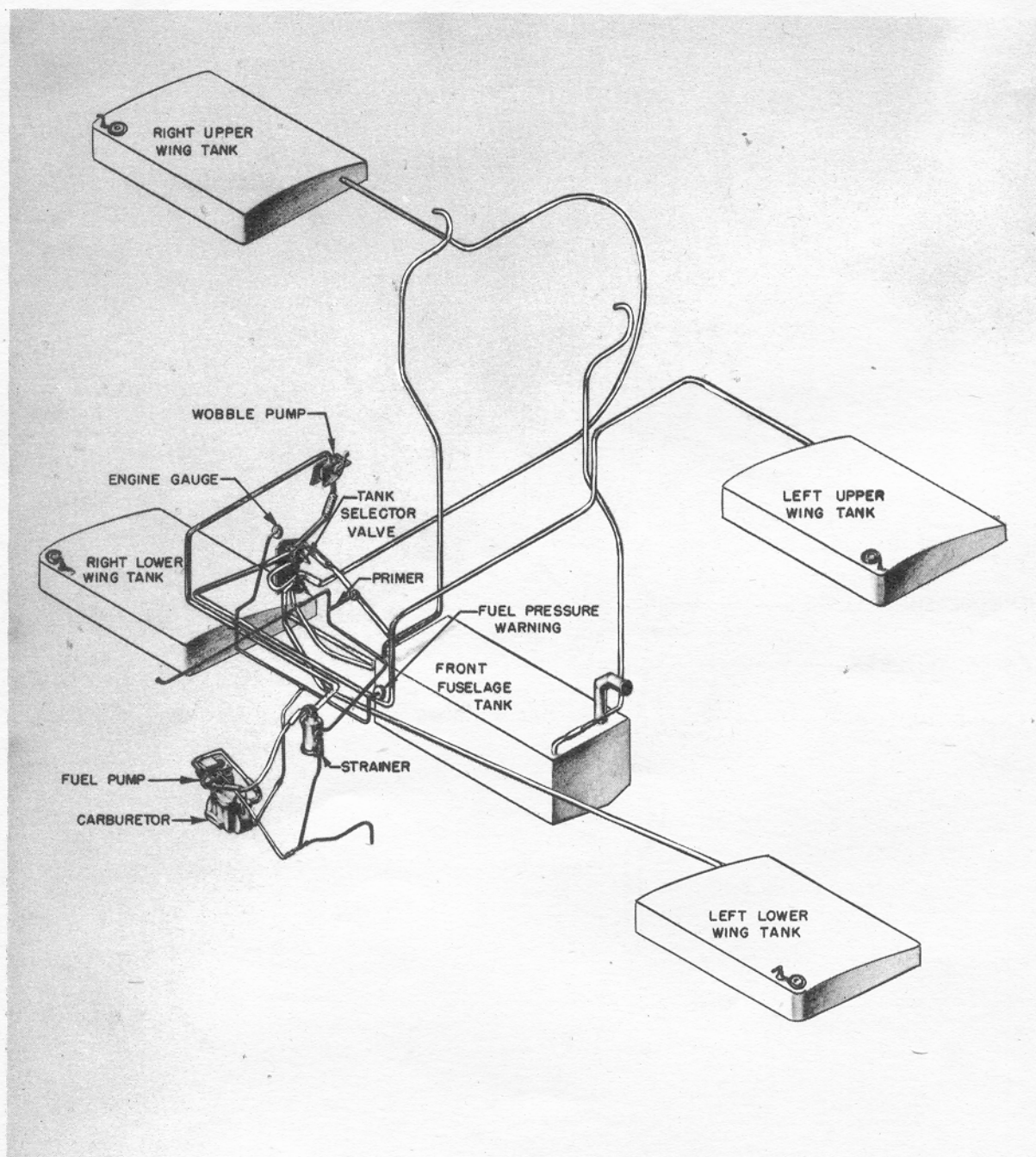


Figure 10 - Fuel System



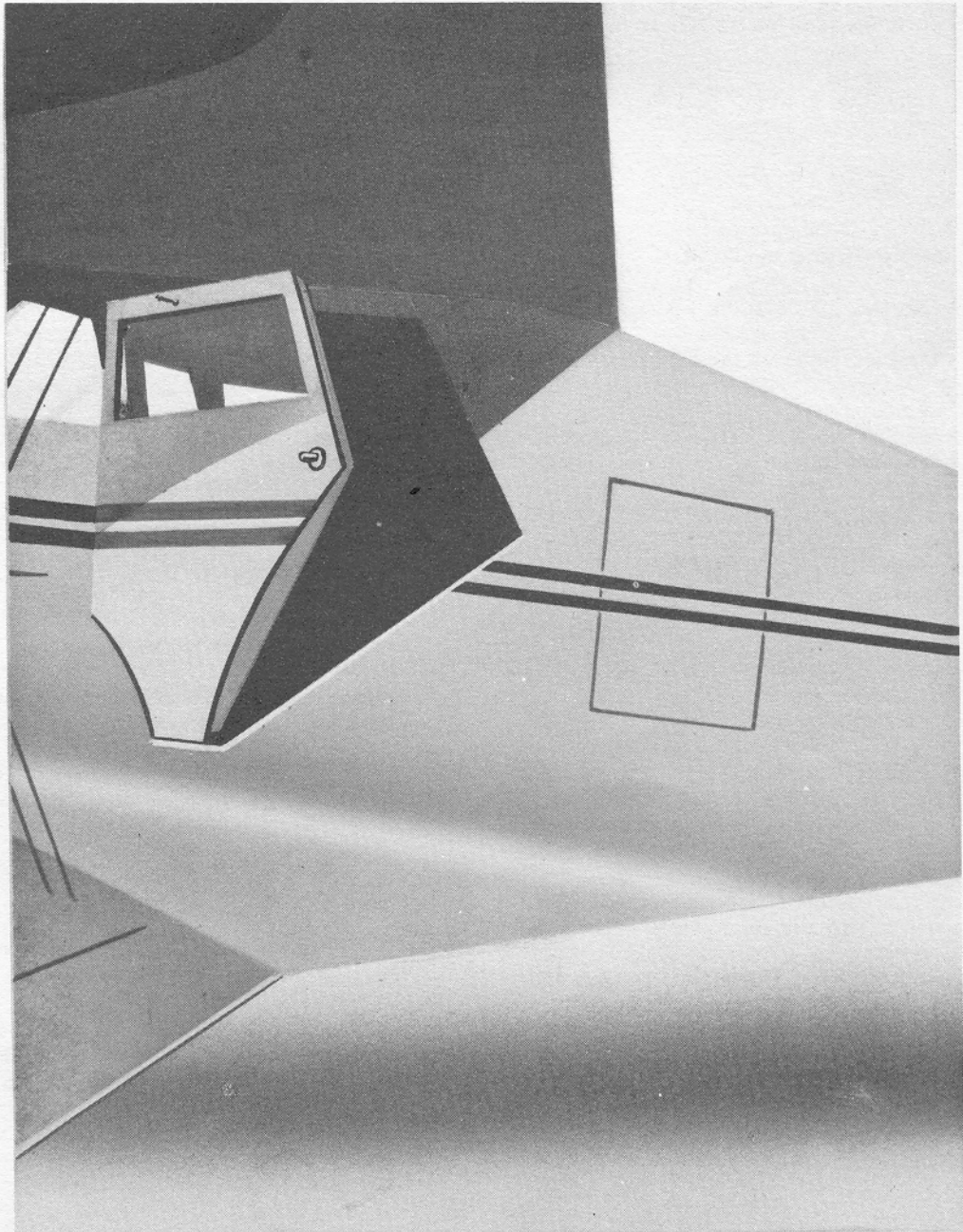


Figure 11 - Fuselage Doors

SECTION II  
PILOT OPERATING INSTRUCTIONS

1. On Entering the Pilot's Compartment.

a. Check for All Flights.

(1) Be sure the ignition switch is in the "OFF" position.

(2) Be sure the landing gear handle is in the "DOWN" position.

(3) Place the flap control handle in the "UP" position.

(4) Place the parking brake "ON."

(5) See that the controls are FREE.

(6) Set the fuel valve on the "FUSELAGE" tank position.

(7) Set the propeller control in "LOW PITCH" (high rpm) position - move the control forward.

(8) Move the throttle to the wide "OPEN" position.

(9) Move the mixture control back to the "IDLE CUT-OFF" position.

(10) Place the carburetor heat control in the "COLD" position. Possible backfires in starting will not then damage the induction system.

2. Starting the Engine.

a. Cold Engine. - With ignition switch "OFF" pull the propeller through four or five revolutions.

**NOTE:** If the engine has been idle for more than 2 hours or if excessive priming has been used during starting attempts, be sure combustion chambers are clear of fluids. Difficulty in turning over is an indication of liquid lock. **STARTING THE ENGINE WITH EXCESSIVE OIL OR FUEL IN THE CYLINDERS MAY RESULT IN BENT OR BROKEN RODS.**

b. Move the throttle almost to the "CLOSED" position or about 1/8 inch open, equivalent to 600-800 rpm.

c. Bring the fuel pressure to 3 or 4 pounds per square inch, with the hand wobble pump.

d. Move the mixture control forward to the "FULL RICH" position.

e. Place the propeller control out in the "HIGH PITCH" (low rpm) position.

(1) In airplanes powered with L-5 and L-6 series engines having battery ignition systems, the distributors are provided with automatic spark advance.

(2) The spark setting is the same in both distributors at operating speeds, but at idling speed one distributor is fully retarded for starting and smooth idling, while the other is only half retarded so that a quick spark is always available if a sudden burst of throttle is required in a glide.

(3) When the engine is warm it should be started with the switch only on the fully retarded distributor, as this allows much less chance of a severe kick-back on the starter gears. When cold it will start more easily on both distributors.

(4) If the engine is ever being started by turning the propeller by hand, it is most important for safety that the switch be only on the fully retarded distributor.

(5) On engines delivered after January 1, 1938, the fully retarded distributor is the right distributor. On engines delivered prior to that date it was the left one, unless subsequently changed. It can always be easily identified, however, as the engine will idle noticeably more slowly and smoothly on the fully retarded distributor than on the partially retarded one.

(6) With magneto-battery ignition, it is advisable to start the engine with the switch on the battery distributor only, unless it is very cold.

f. Hold the starter button "ON" until the engine begins to fire.

g. Turn the ignition switch to the "BOTH" on position.

h. As soon as the engine fires regularly, open the throttle slowly to the desired warm-up speed. Keep the throttle nearly closed in starting to bring the idling system of the carburetor into operation when the engine is turned over by the starter. If the throttle is opened rapidly when the engine starts to fire, lean mixtures will be encountered and the engine will stop or serious backfires will occur.

i. Cold-Weather Starting. - During sub-zero weather, if starting difficulties are encountered, set the carburetor mixture control in the "FULL RICH" position and raise the fuel pressure to 6 to 8 pounds by

operating the hand wobble pump at the same time the starter is engaged with the engine. In the event this practice is used, it is essential that the wobble pump action be discontinued if the engine does not start during the fourth revolution. However, if the engine does not start, turn off the ignition switch and pull the engine through by hand with the carburetor throttles in the wide open position to clear the engine of excess fuel.

(1) Place the carburetor mixture control in the "IDLE CUT-OFF" position.

(2) While maintaining fuel pressure with the hand wobble pump, prime engine with three or four strokes with the hand primer.

(3) In operating the hand type priming pump, prime as little as possible. Three or four strokes are generally adequate but up to ten strokes may be necessary for radial engines when cold. Avoid excessive priming as it has a tendency to wash the oil off the cylinder walls causing scoring of the barrels or seizing of the pistons. In temperate climates and when the engine is warm, priming will usually be unnecessary. After the engine is primed, lock the priming plunger in the "CLOSED" position. Do not prime through the exhaust ports or spark plug holes with raw fuel. If the engine is overprimed as indicated by an excessive quantity of fuel emitted from the drain, open the throttle wide and pull the engine through by hand with ignition switch "OFF" to clear the engine of excess fuel. THROTTLE PRIMING is NOT authorized for any engine except where special operating instructions issued in Technical Orders pertaining to a particular engine direct this method of priming.

(4) After the engine is primed, lock the primer plunger in the "OFF" position and mesh the starter to the engine. When the engine starts firing raise fuel pressure to 6 to 8 pounds by use of the hand wobble pump, and set the carburetor mixture control in the "FULL RICH" position.

1. Set the throttle to maintain 600 to 800 rpm until the oil pressure begins to come up.

**WARNING:** Stop the engine if oil pressure does not register within 30 seconds after starting.

### 3. Engine Warm-up.

a. Aircraft engines will always be warmed up on the ground until proper lubrication and engine operation for the take-off and flight are assured.

b. As soon as the engine has started, the oil gage should be watched for pressure. If the oil pressure gage does not indicate pressure within one-half minute, the engine should be shut down and an investigation made.

c. After the oil gage indicates pressure, shift the propeller to take-off setting and run the engine at 600 or 800 rpm until the pressure is normal (a value between 30 and 65 pounds per square inch) for this speed.

d. During the warm-up period, the engine rpm will not be permitted to exceed one-half of the maximum permissible ground rpm until after the engine maintains, without fluctuations, at least two-thirds of the minimum full power oil pressure specified for the particular engine, and the oil temperature gage shows a definite increase in oil temperature, indicating that oil is circulating properly. When these conditions are obtained, and being sure that the mixture and the propeller controls are set for take-off, the engine rpm may be increased to check for proper functioning of the engine and engine instruments at higher rpm except that the maximum permissible ground rpm will not be maintained for periods in excess of 20 to 30 seconds on the ground. In some cases, the oil pressure gage may record a wide range of rapid fluctuations of oil pressure during the start of the warm-up, but these fluctuations should gradually subside as the oil warms until the indicator hand of the oil pressure gage remains practically steady.

e. Due to insufficient cooling on the ground when operating at high rpm, tightly baffled air-cooled radial engine cylinders quickly reach a cylinder temperature that is beyond the lubricating range of the oil, resulting in the sticking of pistons or rings. Therefore, it is desirable to nose the airplane into the wind during warm-up.

f. Engines will be stopped rather than idled for prolonged periods after warm-up has been accomplished.

g. Change the propeller pitch during warm-up until the propeller operates freely.

### 4. Engine and Accessories Ground Test.

a. Ignition System. - Note the loss of revolution or manifold pressure when switched to one magneto at a time. Whenever an engine is operated on only one magneto, as in the check, the manifold pressure must not exceed maximum cruising manifold pressure to avoid detonation when firing on only one set of spark plugs. The propeller governors must be set to take-off speed and the throttle adjusted to give cruising engine speed or less during the ignition check. It is important to switch back to "BOTH" and leave switch in this position until the engine has picked up the loss in rpm resulting from operating on one magneto before testing for loss in rpm on the other magneto. The normal loss in rpm when operating on one magneto should not exceed 100 rpm. The difference in timing of the two magnetos results in a difference in loss in rpm, or manifold pressure when operating on either magneto alone.



**CAUTION:** This check should be made in as short a time as possible, and should not exceed 15 seconds.

**b. Controllable Propellers.** - Check the operation of the controllable propeller. During ground operation the manifold pressure must not exceed the specified maximum cruising manifold pressure, to prevent over-heating of the engine while operating in the low rpm (high pitch) position.

**c. Fuel Supply.** - The engines will be started and warmed up on the ground with the fuel cock on "FUSELAGE TANK." During the warm-up, the functioning of all the tanks will be tested by switching the fuel valve to each tank, each tank being tested long enough to insure that the fuel from the tank has an opportunity to flow to the engine. Proper performance of the engines during this test will insure, insofar as possible, that the entire fuel system is free from water, dirt, etc., and is functioning properly in all fuel valve positions.

**d. Manifold Pressure Gage Drain.** - When warming up the engine, the shut-off cock for the manifold pressure gage drain will be opened for a few seconds to clear the line of liquids and vapors. This will be done at idling speeds. At such speeds there will be an inflow of air through the vent line which forces vapor and condensation out of the line and into the engine. If the shut-off cock is opened at engine speeds procuring a manifold pressure greater than ambient pressures, successful draining is not accomplished.

#### 5. Taxying Instructions.

**a.** All taxying from the line for take-off or returning to the line after landing will be accomplished with the propeller controls in the high rpm (low pitch) position.

**b.** Following warm-up, the throttle should be opened to the position corresponding to take-off for not over 30 seconds. Prolonged running at or near take-off throttle position should be avoided on the ground.

**CAUTION:** Avoid taxying through mud holes or tall grass, because the propeller can be damaged easily by striking small stones, mud clots or pieces of foreign material. **DO NOT TAXI WITH FLAPS EXTENDED.**

#### 6. Take-off.

##### **a. Preflight Check.**

- (1) Set the elevator trimming tabs for "TAKE-OFF."
  - (2) Set the rudder trimming tab for "TAKE-OFF."
  - (3) See that controls are FREE.
  - (4) Lock the tail wheel by moving the handle to the right.
  - (5) Set the mixture control forward to "FULL RICH" position.
  - (6) Set the propeller control forward in "LOW PITCH" (high rpm) position.
  - (7) Set the fuel valve on the "FUSELAGE" tank position.
  - (8) Set the flaps in the "UP" position.
  - (9) Release the parking brake.
  - (10) Do not start take-off with cylinder head temperatures above 205° C (401° F).
  - (11) Engines will be operated at full throttle during take-off.
  - (12) See section III in this Handbook for all flight operating data.
- b.** Raise the landing gear as soon as practicable after breaking ground.

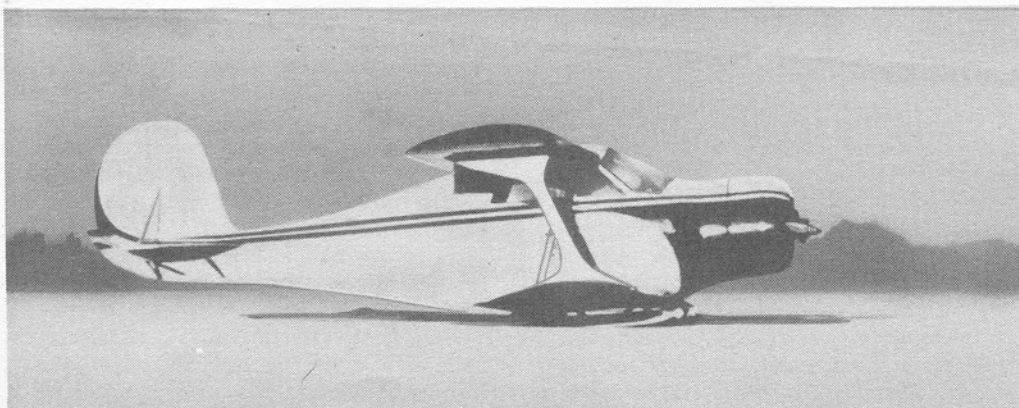


Figure 12 - Belly Landing

## 7. Engine Failure During Take-off.

a. Move the mixture control back to the "IDLE CUT-OFF" position.

b. Turn the ignition to the "OFF" position.

c. Do not move the wheel or control column. The airplane will level itself out gradually. The airplane can then be landed straight ahead or turned and brought back into the field for a cross-wind or into-the-wind landing.

d. The landing gear should remain up until the airplane is approaching the boundary of the field for the emergency landing. Then, and as late as possible, the wheels should be dropped and the usual and normal power-off landing made.

e. In case of an emergency landing on level ground, the ground run is from 100 to 150 feet. In case of doubt in an emergency landing, keep the wheels retracted. The flaps can be used for the approach but should be retracted at the last moment to save them from being damaged. No falling out will be experienced as the flaps are lifted. The lower wings are close to the ground and therefore are affected by the "GROUND CUSHION" during a belly landing. The airplane can be belly-landed in the usual high-angle-of-attack position until the tail strikes the ground, after which it will settle forward without undue shock, using the ground cushion of air to prevent slamming.

## 8. Climb.

a. In the C-43, the angle of climb is so steep that the airplane even when fully loaded, will attain an altitude of from 500 to 600 feet at the edge of an average size field. The pilot should learn to climb the airplane at the steep angle of climb of which it is capable. At this angle the average pilot feels that the airplane is "HANGING ON THE PROPELLER," and that should the engine stop it would immediately start spinning, which is not the case.

b. Normally, two position propellers will be operated during flight in low rpm (high pitch) position. However, for maximum climb, the propeller may be shifted to high rpm (low pitch) position.

c. The airplane may be climbed at an indicated speed of 70 mph with flaps down which renders the maximum angle of climb, although the rate of climb is not superior to that obtained at 100 to 120 mph. The wheels should be retracted as soon as the airplane is definitely flying. This greatly increases the climbing angle.

d. Refer to section 1, paragraph 4.g.(1),(2), and (3) in this Handbook for complete description of the use of wing flaps in climbing.

## 9. Engine Flight Charts.

Use of the ENGINE FLIGHT CHARTS during flight. These charts are located in section III in this Handbook.

## 10. General Flying Characteristics.

a. Stability. - With normal and military loads, the airplane is stable.

(1) For landing, the elevator tab should be trimmed, after the wheels and flaps are extended, to give a hands-off steady glide of 75 to 80 mph. This will allow sufficient reserve speed to check the descent on a power-off landing. Lower gliding speeds are safe for control purposes, but power must be used to check the high sinking velocity, at the flare-out of the glide.

(2) In bumpy air the C-43 should be allowed to recover by itself, with only slight aid from the controls. The work required from the pilot is less under these circumstances and the ride is actually smoother.

(3) It can be flown continuously without use of the rudder pedals except for take-off and landing. Steep turns can be performed with precision without the use of any rudder control whatever.

(4) It can be trimmed with the tabs and flown by rudder only. In this case it is necessary to take fuel alternately from each side, in the wing tanks, at half-hour intervals.

b. Gliding. - The airplane has an unusually flat gliding angle following a stall. This is approximately 15 to 1 with the wheels in a retracted position, at an indicated air speed of 100 mph.

### c. Climb Without Power.

(1) Another factor of safety for pilots who must fly at a low altitude, is the fact that C-43 airplanes will climb from 400 to 500 feet without power. In order to check this performance, the altimeter should be noted and the airplane flown at normal cruising speed. The throttle can then be closed and the mixture control pulled all the way out, and simultaneously, the wheel should be pulled back steadily until the airplane reaches an angle of attack of about 45 degrees. It should be held in this position until it reaches the top of its climb and the control forces lighten, then the wheel can be eased and the ship allowed to stall by itself with a consequent dropping of the nose. As the stall occurs, the altitude should be noted on the altimeter. The amount that is gained will be from 400 to 500 feet. Thus, in case a power failure occurs at low altitude the pilot can pull the airplane up from 400 to 500 feet to allow time to discover the best available landing area.

(2) If a turn is not required, a landing can be made approximately 1 mile ahead of the position. If a turn is required, landing can be made approximately 1/2 mile to each side or 1/4 mile behind, as the ship should be kept in a practically stalled position in order not to use too much radius of turn. Practice in stalled turns will show that there is no danger in them. However, if the airplane is loaded with a full tail-heavy loading, with baggage and people in the rear, it should be given a little more consideration than when it is loaded only in the front seats.

d. Order of Fuel Tank Use.

(1) Fuselage tank.

(2) Right and left upper and lower wing tanks alternately to preserve balance.

**WARNING:** Never let one fuel tank run dry before switching to another tank.

(3) All tanks are connected to the engine-driven pump. The hand wobble pump, when used, should be pumped slowly so the pressure does not rise over about 6 to 8 pounds per square inch or the carburetor may become flooded. All take-offs and landings must be made using the main tank. The auxiliary wing

tanks are to be used only in the air, and are **NOT TO BE USED FOR EITHER TAKE-OFF OR LANDING or FOR FLYING AT LOW ALTITUDE WITH LOW FUEL SUPPLY.**

11. Engine Failure During Flight.

a. The nose will not drop much below the horizon if restrained by pulling back on the wheel. If the engine failure occurs at low altitude a climb without power of 400 to 500 feet will afford an opportunity to seek a suitable place to land. (Refer to paragraph 10.c. this section.)

b. Turn the ignition switch "OFF."

c. Turn the fuel selector valve "OFF."

d. If a suitable landing field is available, glide to a normal power-off landing. If not, keep the landing gear in the retracted position and make a belly landing. (Refer to paragraphs 7.f. and 10.c. this section.)

12. Stalls.

There is no tendency to fall off into a spin from a stall. No control force is required to keep the airplane in a stable position.

13. Speeds Not To Be Exceeded.

Model No.	True Indicated in Glide or Dive	True Indicated in Level Flight or Climb	True Indicated with Flaps Extended
C-43	240	190	115
C-43A	240 (222)*	190 (189)*	115 (117)*
C-43B	240	190	115
C-43C	222	189	117
C-43D	222	183	115
C-43E	222	189	117
C-43F	225 (223)*	206 (186)*	100 (115)*
C-43G	225	183	100
C-43H	222	189	117

\* In some airplanes of this model with alternate (L-6 series) engines.



#### 14. Emergency Exit.

a. The cabin door on this airplane may be easily and quickly removed while in flight in case of an emergency.

b. To remove the door proceed as follows:

(1) Remove the cover over the release handle (the handle is located in back of pilot's chair below the window).

(2) Turn the handle clockwise.

(3) Unlatch and shove outward on the door.

**NOTE:** The door will not fall off unless it is unlatched before shoving. It is made this way on purpose to prevent unintentional loss of the door should the release handle accidentally become turned.

#### 15. General Operation.

a. Cruising. - The maximum recommendations for cruising conditions are as follows:

(1) Standard practice is to use 70 percent of rated power for climbing to cruising altitude, and 60 percent of rated power for cruising in level flight and in descending from cruising altitude. A large part of the time spent in climbing to cruising altitude will be regained by starting the cruising descent at a point far enough away from the destination to permit descent at 200 to 250 feet per minute. The rate of descent and the distance away from the destination at which the descent should be started will depend on a number of factors. It is permissible to increase the rate of descent up to approximately 400 feet per minute or even more in case the air is not too rough and in case the air speed does not build up beyond the limiting values. The only time it would be desirable to make the descent at a higher figure than 200 feet per minute would be in the case of a very good tail wind at high altitude and a smaller tail wind or head wind at lower altitude. In this case, of course, it would be desirable to stay at the high altitude as long as possible.

(2) The cruising climb should be commenced as quickly as possible after leaving the ground and clearing the obstructions surrounding the field. This will depend, of course, on the terrain surrounding the field and a great many other considerations. It is, of course, desirable to use the take-off power of the engine as little as possible and to use cruising power as much of the time as possible. The cruising climb should be limited to 280 horsepower and the airplane should be flown at an indicated air speed of about 145 miles per hour; a lower air speed will result in a more rapid rate of climb but an air speed of 145 miles per hour will give the best balance between rate of climb and forward speed.

(3) It should be remembered that the cruising speed of the airplane with constant horsepower will

increase 1 percent for each 1000 feet of altitude. It is possible to maintain cruising power to approximately 14,000 feet of altitude and, therefore, it will always be desirable to make the cross-country flight at as high an altitude as can efficiently be used taking into account the length of the trip and the prevailing wind condition. Ignoring the effect of wind the best altitude for various trip lengths will be approximately as follows:

50 miles -	5000 feet
100 miles -	7500 feet
150 miles -	10,000 feet
200 miles -	12,000 feet
250 miles and over -	14,000 feet

(4) The above figures are on the assumption of a rate of descent of approximately 400 feet per minute. If the rate of descent is to be limited to 200 feet per minute the trip length corresponding to the altitudes given will be about 50 miles longer. To illustrate the importance of cruising descent and show the large amount of time spent in cruising climb and descent even on a long cross-country trip, the following example may be considered. If we take off from sea level on a trip of 600 miles with a cross-wind so that the wind does not affect the cruising altitude, we will climb approximately 20 minutes at an indicated air speed of 145 miles per hour and an average rate of climb of about 700 feet per minute in order to reach 14,000 feet which is to be the cruising altitude. In this 20 minutes, we will have covered approximately 60 miles on the trip. Working back from the destination, we have 14,000 feet of altitude to lose, assuming that the other field is also at sea level. At 200 feet per minute, this will take 70 minutes. The average speed in the cruising descent at 240 horsepower will be about 200 miles per hour or 3-1/3 miles per minute; thus, it is necessary to start the cruising descent 233 miles away from the destination. This leaves only about half of the 600 miles of the trip to be flown in level flight at cruising power. The remainder being flown either in climbing or in gliding.

b. Landing (Airplane with Controllable Propeller). - Ships equipped with controllable propellers can be landed at slightly lower speeds by landing with the propeller in "HIGH PITCH" setting. This is possible due to the fact that the air stream behind a slow turning propeller in "HIGH PITCH" is smoother (or less turbulent) than the air behind a propeller in "LOW PITCH." The smoother air flow provides better rudder and elevator control making it possible to control and land the ship at a lower speed.

#### 16. Engine Performance.

a. The rpm, cylinder temperature, oil pressure, and temperature give the most satisfactory indication of the engine's performance. If any one of these appears irregular, the engine should be throttled and, if the cause is not apparent, a landing should be made to investigate and correct the trouble.

**b. Oil Temperature Range.**

Grade Oil	Air Temperature at Ground +	Safe Maximum "Oil-in" Temp. ++	Safe Minimum "Oil-in" Temp. +++
1120	4° C (40° F) and above +++	95° C (203° F)	20° C (68° F)
1100	-7 to +27° C (20° to 80° F)	85° C (185° F)	10° C (50° F)
1080	10° C (50° F) and below	75° C (167° F)	0° C (32° F)

+ The low ground temperatures listed for each grade in this column are sufficiently high that even under severe operating conditions starting and warming-up difficulties should not ordinarily result. Under ordinary conditions of airplane storage, in heated hangars, etc., the various grades specified may be used without starting difficulties at still lower temperatures. Grade 1080 ( or 77 ) will be used at low temperatures, but below - 15° C ( 5° F ) starting difficulties may be encountered unless the engine is started immediately upon removal from a heated hangar or after being serviced with warm oil.

++ Temperature in excess of those listed in this column should not be the cause of forced landings unless they are accompanied by oil pressures below the prescribed minimum.

+++ At temperatures above 38° C ( 100° F ) grade 1120 ( or 120 ) oil will be used, but at such high temperatures it may be impossible to stay under the 95° C ( 203° F ) maximum "OIL-ON" temperatures under some flight conditions.

17. Flying Under Low Ceiling. - Slow the airplane down by watching the air-speed indicator - not the tachometer. The speed range of the C-43 is so great that the engine may be throttled to a very low rpm and still maintain adequate air speed.

18. Approach, Landing, and Cross-Wind Landing.

a. Approach.

(1) Set the fuel valve on the "FUSELAGE" tank position.

(2) Set the mixture control forward to the "FULL RICH" position.

(3) Slow down the airplane to 110 mph indicated air speed and set the propeller control in the "LOW PITCH" (high rpm) position.

(4) Extend the landing gear, watching for the green light to be illuminated, indicating the landing gear is fully down.

(5) Close the throttle, checking the throttle stop.

(6) Trim the elevator tab for a 75 to 80 mph glide.

(7) Lower the flaps to the "DOWN" position.

(8) Move the tail wheel lock handle to the right to lock the tail wheel.

b. Emergency Operation of Landing Gear. - If the throttle cannot be closed, the landing gear is not down. Put the landing gear handle in the "DOWN" position, pull out the hand crank to engage and turn it clockwise until the gear is down (approximately 44 turns).

c. Prevent Over-Cooling. - Care should be taken to prevent over-cooling in long glides.

d. Cross-Wind Landing. - Avoid cross-wind landings whenever practicable.

e. Landing. - At the conclusion of the landing run:

(1) Close the throttle.

(2) Raise the flaps.

(3) Unlock the tail wheel.

(4) Apply toe brakes and set the parking brake.

f. Emergency Take-off if Landing is Not Completed.

(1) Open the throttle.

(2) Do not retract the flaps until above 500 feet altitude.

19. Stopping Engine.

a. Preliminary Procedure.

(1) Set mixture control to the "FULL RICH" position.

(2) Set throttle to the normal idling position.

(3) The engine will be stopped with the propeller control set so that the propeller blades will be in the high rpm (low pitch) position.

(4) After landing, the engine should be idled at 400 rpm until cylinder head temperatures drop below 150° C (302° F). The rpm should then be increased to between 1000 and 1100 rpm for 15 seconds to assure scavenging of the crankcase oil.

(5) Allow the engine to run at normal idling speed until the engine has cooled appreciably below cruising temperatures during the gliding for landing and taxiing. The resulting temperatures during this idling period will vary according to climate and the amount of power that was required for taxiing.

**CAUTION:** It may be necessary to shorten the idling period to a minimum, especially on tightly baffled, geared, air-cooled, radial engines, in order to prevent this overheating. Temperatures must be carefully controlled and must not be permitted to exceed the specified limits.

(6) Close the fuel valve.

b. The following procedure will be followed upon completion of the preliminary procedure.

(1) The engine will be stopped by using the "IDLE CUT-OFF," leaving the fuel valve on. The engine will be stopped by first idling at 800 to 1000 rpm and then setting the mixture control lever to the "FULL LEAN" mixture position. This actuates the idling cut-off valve, which causes the engine to cut out abruptly. The ignition switch will be turned to the

"OFF" position after the engine ceases firing. Since the carburetor is not drained, the mixture control lever will be left in the "FULL LEAN" or "IDLE CUT-OFF" position as a precaution against accidental starting.

(2) The following note will be maintained in the cockpit of the airplane if the mixture control quadrant does not indicate that the engine is equipped with a carburetor containing the "IDLE CUT-OFF" valve:

"This airplane is equipped with an "IDLE CUT-OFF."

c. In airplanes powered with L-5 and L-6 series engines, the following will apply:

(1) Shutting off the gasoline supply is not recommended, but is permissible when necessary after the engine has had sufficient idling. The disadvantage of doing it is that it provides a lean mixture to the cylinders, which tends to heat them, as the supply of gas in the lines gets low.

(2) Shutting off the engine without sufficient idling is likely to cause warpage of valves and cylinders because of the rapid temperature drop that occurs.

(3) Be sure the switch is turned to the "OFF" position before leaving the ship.

#### 20. Before Leaving the Pilot's Compartment.

a. Turn the fuel selector valve "OFF."

b. See that all switches are turned "OFF."

c. Turn the ignition switch "OFF."

d. Make out Form 1.

21. Maneuvers Prohibited. - Loop, roll, spin, and inverted flying.



SECTION IIISPECIFIC ENGINE DATA1. R-985-AN-1. (Model C-43 Airplanes Only.)

Sea level engines rated at 450 HP at 2300 rpm normal rated and take-off power, maximum diving speed - 2760 rpm. Fuel of lower than 91 octane rating should not be used in the operation of these engines.

Take-off (5 minute duration only)

Maximum engine rpm	2300
Maximum manifold pressure	38.5 in. Hg
Mixture control	"Full Rich"

High Speed

Maximum engine rpm	2300
Maximum manifold pressure	37.5 in. Hg
Mixture control	"Full Rich"
Minimum fuel air ratio	.092

Cruising - Maximum

Maximum engine rpm	2000
Maximum manifold pressure	33 in. Hg
Mixture control	"Full Rich" to "Smooth Operation"
Minimum fuel air ratio	.084
Fuel consumption - gal/hr	31
Maximum allow. oil consumption - qt/hr	4.6

Cruising - Desired

Engine rpm	2000
Maximum manifold pressure	31 in. Hg
Mixture control	"Best Power"
Minimum fuel air ratio	.075
Fuel consumption - gal/hr	27

OR

Engine rpm	1940
Maximum manifold pressure	29.5 in. Hg
Mixture control	"Best Power"
Minimum fuel ratio	.073
Fuel consumption - gal/hr	23

<u>Cylinder Temperatures -</u>	<u>Heads</u>	<u>Barrels</u>
<u>Maximum</u>		
Take-off	260°C (500°F)	166°C (330.8°F)
High speed and climb - continuous	260°C (500°F)	166°C (330.8°F)
Cruising - continuous	235°C (455°F)	166°C (330.8°F)

Oil Pressure - lb/sq in.

Desired	75 to 90
Maximum	100
Minimum cruising	60
Minimum idling	15

Oil Inlet Temperature

Desired	50° to 70°C (122° to 158° F)
---------	---------------------------------

Fuel Pressure - lb/sq in.

Desired	3 to 4
---------	--------

Cylinder Temperatures -

<u>Maximum</u>	<u>Heads</u>	<u>Barrels</u>
Take-off	260°C (500°F)	166°C (330.8°F)
Military, climb, high speed	260°C (500°F)	166°C (330.8°F)
Normal, climb, high speed	260°C (500°F)	158°C (316.4°F)
Cruising - continuous	232°C (449.6°F)	150°C (302°F)

Oil Pressure - lb/sq in.  
at 60°C (140°F)

Desired	65 to 90
Maximum	90
Minimum cruising	55
Minimum idling	15

Oil Inlet Temperature

Desired	50° to 70°C (122° to 158°F)
---------	--------------------------------

Fuel Pressure - lb/sq in.

Desired	3 to 4
---------	--------

2. R-975-11. (Models C-43A, C-43E and Alternate Engine Installation, Model C-43H Airplanes.)

Rated at 400 bhp at 2200 rpm at sea level; 400 bhp at 2200 rpm at 1400 ft altitude; 400 bhp at 2200 rpm for take-off. Maximum diving speed - 2250 rpm. Fuel of lower than 91 octane rating will not be used in the operation of these engines except in emergency. (Refer to T. O. No. 06-5-1.)

Take-off

Maximum engine rpm	2250
Mixture control - below 3500 ft	"Full Rich"
Mixture control - above 3500 ft	"Smooth Operation"
Propeller control	"Low Pitch"

Climb and High Speed

Maximum engine rpm	2200
Mixture control - below 3500 ft	"Full Rich"
Mixture control - above 3500 ft	"Smooth Operation"
Fuel consumption - gal/hr (approximately)	42.0
Propeller control	"Low Pitch" for climb "High Pitch" for high speed

Cruising - Maximum

Maximum engine rpm	1920
Mixture control	"Best Power"
Fuel consumption - gal/hr (approximately)	23.0
Propeller control	"High Pitch"

Cruising - Desired

Maximum engine rpm	1850
Mixture control	"Best Power"
Fuel consumption - gal/hr (approximately)	20.0
Propeller control	"High Pitch"
Oil consumption - qt/hr - (maximum)	7.0

Cruising - Long Range

Maximum engine rpm	1720
Mixture control	Maximum Economy
Propeller control	"High Pitch"
Fuel consumption - gal/hr (approximately)	16.0

<u>Cylinder Temperatures - Maximum</u>	<u>Heads</u>	<u>Barrels</u>
Take-off and climb	260°C	163°C
High speed	235°C	149°C
Cruising - continuous	205°C	136°C

Oil Pressure (lb/sq in. at 60°C)

Desired	75
Maximum	80
Minimum	60
Minimum idling	15

Oil Inlet Temperature

Desired	60°C
Maximum	88°C

Fuel Pressure (lb/sq in.)

Desired	3 to 4
---------	--------

3. R-985-13. (Alternate Engine Installation, Some Model C-43B Airplanes, Only.)

Rated at 400 HP at 2200 rpm at 5000 ft; 385 HP at 2200 rpm at sea level, and 450 HP at 2300 for take-off. Maximum diving speed - 2640 rpm. Fuel of lower than 91 octane rating should not be used in the operation of these engines.

Take-off (5 minute duration only)

Maximum engine rpm	2300
Maximum manifold pressure	37.0 in. Hg
Mixture control	"Full Rich"

Climb and High Speed

Maximum engine rpm	2200
Maximum manifold pressure	33.5 in. Hg
Mixture control, below 4000 ft	"Full Rich"
Mixture control, above 4000 ft	"Smooth Operation"
Minimum fuel air ratio	.090
Fuel consumption - gal/hr (approximately)	40

Cruising - Maximum

Maximum engine rpm	1925
Maximum manifold pressure	28.5 in. Hg
Mixture control	"Smooth Operation"
Minimum fuel air ratio	.079
Fuel consumption - gal/hr (approximately)	26.5
Maximum allow. oil consumption - qt/hr	5.6

Cruising - Desired

Engine rpm	1925
Maximum manifold pressure	26.5 in. Hg
Minimum fuel air ratio	.073
Mixture control	"Best Power"
Fuel consumption - gal/hr (approximately)	22.0

Cruising - Long Range

Maximum engine rpm	1850
Maximum manifold pressure	24.5 in. Hg
Mixture control	"Best Power"
Minimum fuel air ratio	.071
Fuel consumption - gal/hr (approximately)	19.0

<u>Cylinder Temperature - Maximum</u>	<u>Heads</u>	<u>Barrels</u>
---------------------------------------	--------------	----------------

Take-off or climb	260°C (500°F)	166°C (330.8°F)
High speed - continuous	260°C (500°F)	150°C (302°F)
Cruising - continuous	235°C (455°F)	150°C (302°F)

Oil Pressure - lb/sq in.  
at 60°C (140°F)

Desired	70 to 100
Maximum	100
Minimum cruising	60
Minimum idling	15

Oil Inlet Temperatures

Desired	50° to 70°C (122° to 158°F)
---------	-----------------------------

Fuel Pressure - lb/sq in.

Desired	3 to 4
---------	--------

4. R-985-17. (Alternate Engine Installation, Some Model C-43B Airplanes, Only.)

Rated at 400 HP at 2200 rpm at 5000 ft; 376 HP at sea level; and 450 HP at 2300 rpm at take-off. Maximum diving speed - 2640 rpm. Fuel of lower than 91 octane rating should not be used in the operation of these engines.

Take-off (5 minute duration only)

Maximum engine rpm	2300
Maximum manifold pressure	36.5 in. Hg
Mixture control	"Full Rich"

Climb and High Speed

Maximum engine rpm	2200
Maximum manifold pressure	32.8 in. Hg
Mixture control, below 4000 ft	"Full Rich"
Mixture control, above 4000 ft	"Smooth Operation"
Minimum fuel air ratio	.090
Fuel consumption - gal/hr (approximately)	40

Cruising - Maximum

Maximum engine rpm	1925
Maximum manifold pressure	28.5 in. Hg
Mixture control	"Smooth Operation"
Minimum fuel air ratio	.079
Fuel consumption - gal/hr (approximately)	26.5
Maximum allow. oil consumption - qt/hr	5.6

Cruising - Desired

Engine rpm	1925
Maximum manifold pressure	26.5 in. Hg
Mixture control	"Best Power"
Minimum fuel air ratio	.073
Fuel consumption - gal/hr (approximately)	21.5

Cruising - Long Range

Maximum engine rpm	1850
Maximum manifold pressure	25.0 in. Hg
Mixture control	"Best Power"
Minimum fuel air ratio	.073
Fuel consumption - gal/hr (approximately)	19.0

Cylinder Temperatures - Heads      Barrels  
Maximum

Take-off or climb	260°C (500°F)	166°C (330.8°F)
High speed - continuous	260°C (500°F)	150°C (302°F)
Cruising - continuous	235°C (455°F)	150°C (302°F)

Oil Pressure - lb/sq in. at 60°C

Desired	65 to 90
Maximum	90
Minimum cruising	55
Minimum idling	15

Oil Inlet Temperatures

Desired	50° to 70°C (122° to 158°F)
---------	--------------------------------

Fuel Pressure - lb/sq in.

Desired	3 to 4
---------	--------

5. R-985-23. (Alternate Engine Installation, Some C-43B Airplanes, Only.)

Rated at 400 HP at 2200 rpm at 5000 ft; 450 HP at 2300 rpm at take-off; 375 HP at 2200 rpm at sea level; and 450 HP at 2300 rpm at 3500 ft military rating. Maximum diving speed - 2640 rpm. Fuel of lower than 91 octane rating should not be used in the operation of these engines.

Take-off (5 minute duration only)

Maximum engine rpm	2300
Maximum manifold pressure	36.5 in. Hg
Mixture control	"Full Rich"

Military Rating (available for 5 minutes)

Maximum engine rpm	2300
Maximum manifold pressure	35.5 in. Hg
Mixture control	"Full Rich" or
Minimum fuel air ratio	.097

Normal Climb and High Speed

Maximum engine rpm	2200
Maximum manifold pressure	33 in. Hg
Mixture control	"Full Rich" to
	"Smooth Operation" or
Minimum fuel air ratio	.090



Cruising - Maximum

Maximum engine rpm	1925
Maximum manifold pressure	28.5 in. Hg
Mixture control	"Smooth Operation" or
Minimum fuel air ratio	.082
Fuel consumption - gal/hr (approximately)	29
Oil consumption - qt/hr	4.6

Cruising - Desired

Engine rpm	1925
Maximum manifold pressure	26.5 in. Hg
Mixture control	"Best Power" or
Minimum fuel air ratio	.075
Fuel consumption - gal/hr (approximately)	22

OR

Engine rpm	1850
Maximum manifold pressure	25.5 in. Hg
Mixture control	"Best Power" or
Minimum fuel air ratio	.072
Fuel consumption - gal/hr (approximately)	19

6. L-6, L-6M, L-6MB. (Model C-43C Airplanes Only.)

Engines rated at 300 HP at 2100 rpm at 3700 ft altitude. Take-off power rated at 330 HP at 2200 rpm at 26 in. Hg manifold pressure. Fuel of lower than 80 octane rating containing not more than 3 cc of lead per gal or higher than 90 octane rating should not be used in the operation of these engines.

Take-off (1 minute duration only)

Maximum engine rpm	2200
Maximum manifold pressure	26 in. Hg
Mixture control	"Full Rich"

High Speed and Climb

Maximum engine rpm	2100
Maximum manifold pressure	24.5 in. Hg
Mixture control	"Full Rich"

Cruising - Maximum  
(up to 6000 ft)

Maximum engine rpm	1900
Maximum manifold pressure	21 in. Hg
Mixture control	"Full Rich"
Fuel consumption - lb/bhp hr	.45
Maximum allow. oil consumption - lb/bhp hr	.025

Cruising - Maximum  
(above 6000 ft)

Engine rpm	2000
Maximum manifold pressure	20.5 in. Hg
Mixture control	"Full Rich" to "Smooth Operation"
Fuel consumption - lb/bhp hr	.45
Maximum allow. oil consumption - lb/bhp hr	.025
Minimum fuel air ratio	.08

Cruising - Desired

Engine rpm	1900 - 2000
Maximum manifold pressure	21 in. Hg
Mixture control	"Smooth Operation"
Fuel consumption - lb/bhp hr	.43
Oil consumption - pt/hr	3 to 5
Minimum fuel air ratio	.076

Cylinder Temperatures -  
Maximum

	<u>Heads</u>	<u>Barrels</u>
Take-off	288°C (550°F)	149°C (300°F)
High speed and climb - continuous	288°C (550°F)	149°C (300°F)
Cruising - continuous	149°C - 204°C (300°F - 408°F)	149°C (300°F)

Oil Pressure - lb/sq in.

Desired	60 to 90
Maximum	90
Minimum cruising	60
Minimum idling	60

Oil Inlet Temperatures

Desired	60°C (140°F)
Minimum	38°C (100°F)
Maximum	82°C (180°F)

Fuel Pressure - lb/sq in.

Desired	3 to 4
---------	--------

7. L-5, L-5M, L-5MB. (Models C-43D and C-43G  
Airplanes Only.)

The L-5 series engines are rated at 285 HP at 2000 rpm at sea level. Fuel of lower than 73 octane rating should not be used in these engines.

Take-off (5 minute duration only)

Maximum engine rpm	2000
Maximum manifold pressure	23 in. Hg
Mixture control	"Full Rich"

Maximum engine rpm	2000
Maximum manifold pressure	23 in. Hg
Mixture control	"Full Rich"

Maximum engine rpm	2000
Maximum manifold pressure	23 in. Hg
Mixture control	“Full Rich” to “Smooth Operation”
Fuel consumption - gal/hr	23 to 25
Maximum allow. oil consumption - qt/hr	3

Engine rpm	1900
Mixture control	“Full Rich” to “Smooth Operation”
Fuel consumption - gal/hr	15 to 17

Take-off	232°C (450°F)	149°C (300°F)
High speed and climb - continuous	260°C (500°F)	149°C (300°F)
Cruising - continuous	140°C - 218.3°C (300°F - 425°F)	149°C (300°F)

Desired	60 to 90
Maximum	90
Minimum	60

<b>Desired</b>	49° to 71°C (120° to 160°F)
<b>Maximum</b>	82°C (180°F)
<b>Minimum</b>	32.2°C (90°F)

Desired	3 to 4
---------	--------

This engine is a sea level engine rated at 225 HP at 1900 rpm. Fuel of lower than 65 octane rating will not be used in the operation of these engines.

Maximum engine rpm	1900
Minimum fuel air ratio	"Full Rich"

Maximum engine rpm 1900  
Minimum fuel air ratio "Full Rich"  
to "Smooth Operation"

Maximum engine rpm	1660
Mixture control	“Full Rich” to “Smooth Operation”
Fuel consumption gal/hr (approximately)	10.5
Maximum allow. oil consumption qt/hr	2.8

Engine rpm	1600
Mixture control	"Best Power"
Fuel consumption gal/hr (approximately)	8.7

Engine rpm	1540
Mixture control	"Best Power"
Fuel consumption gal/hr (approximately)	8.2

Take-off	260°C (500°F)	163°C (325.4°F)
Continuous operation	232°C (449.6°F)	163°C (325.4°F)

Desired	60
Maximum	80
Minimum	50

Desired 60°C (140°F)

Desired	1-1/2 to 2
---------	------------

Rated at 400 HP at 2200 rpm at sea level. Maximum diving speed - 2640 rpm. Fuel of lower than 91 octane rating will not be used in the operation of these engines except in an emergency. (Refer to T. O. No. 06-5-1.)

Take-off

Maximum engine rpm	2200
Mixture control, below 3500 ft	"Full Rich"
Mixture control, above 3500 ft	"Smooth Operation"
Propeller control	"Low Pitch"

Climb and High Speed

Maximum engine rpm	2200
Mixture control, below 3500 ft	"Full Rich"
Mixture control, above 3500 ft	"Smooth Operation"
Fuel consumption - gal/hr (approximately)	48.0
Propeller control	"Low Pitch"

Cruising - Maximum

Maximum engine rpm	1925
Mixture control	"Best Power"
Fuel consumption - gal/hr (approximately)	30.0
Maximum allow. oil consumption - qts/hr	7.2
Propeller control	"High Pitch"

Cruising - Desired

Maximum engine rpm	1850
Mixture control	"Best Power"
Fuel consumption - gal/hr (approximately)	26.0
Propeller control	"High Pitch"

Cruising - Long Range

Maximum engine rpm	1750
Mixture control	Maximum Economy
Fuel consumption - gal/hr (approximately)	22.00
Propeller control	"High Pitch"

Cylinder Temperatures - Maximum

	<u>Heads</u>	<u>Barrels</u>
Take-off, climb, and high speed	260°C	163°C
Cruising - continuous	235°C	163°C

Oil Pressure (lbs/sq in. at 60°C)

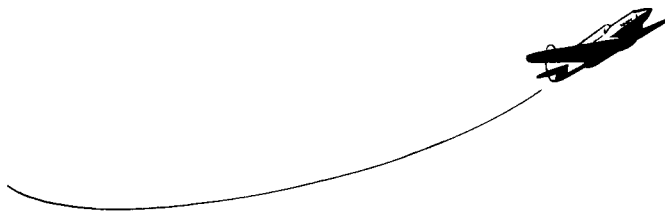
Desired	75
Maximum	80
Minimum cruising	70
Minimum idling	15

Oil Inlet Temperatures

Desired	60° to 70°C
---------	-------------

Fuel Pressure (lb/sq in.)

Desired	3 to 4
---------	--------



## SECTION IV

### CARBURETOR HEAT AND DETONATION

#### 1. Operation of Carburetor Heater.

a. Except under unusual ice-forming conditions, carburetor air heat should not be used during take-off. In this connection, it should be realized that as the engine is opened up to full throttle the exhaust temperature is increased, thus increasing the amount of heat available and that, therefore, the control setting giving a specific temperature on the ground will give a much higher temperature at take-off or in the air. Under extreme icing conditions, the heat control may be from 1/2 to 2/3 "ON," while the actual ground run and take-off is made. If practicable, take-off power should be limited to 2 or 3 in. Hg less manifold pressure than normally allowed. As soon as ground obstructions are cleared, a check should be made to assure that all temperatures are not excessive. IT IS HIGHLY ESSENTIAL THAT THIS PROCEDURE FOR TAKE-OFF BE FOLLOWED SINCE DETONATION AND ENGINE FAILURE ARE SURE TO BE THE RESULT OF OPERATING AT FULL THROTTLE WITH EXCESSIVELY HIGH INTAKE AIR TEMPERATURES.

b. As soon as practicable after take-off, set the heater control to give the intake air temperatures listed in section II, paragraph c. below. When the engine is throttled down after take-off or after climb, the heater control and the mixture control must be readjusted.

c. On airplanes equipped with float type carburetors which are susceptible to ice formation and equipped with carburetor air temperature thermometers located in the air intake system, adjust the carburetor heater to maintain temperatures between 30° to 35° C (85° to 95° F). On airplanes equipped with float type carburetors and mixture thermometers but not equipped with carburetor hot spots, the carburetor heater will be adjusted to maintain temperatures between 2° to 5° C (35° to 40° F). On airplanes equipped with diaphragm type carburetors such as the Chandler-Groves and Bendix injection types of carburetors, adjust the carburetor heater to maintain a carburetor air temperature of 5° to 10° C. On airplanes equipped with mixture thermometers and carburetor hot spots (some Pratt & Whitney engines only), the carburetor heat will be adjusted to maintain temperatures between 12° to 15° C (53° to 59° F). Operation instructions carried in the back of the Form 1 books will be corrected as necessary.

d. When cruising under severe icing conditions, it will be necessary to use at least 75 percent power and keep the mixture control on the rich side of best power. This is essential to maintain sufficient carburetor heat to eliminate the ice. At the same time it is desirable to seek a more favorable altitude.

e. If ice formation does occur as evidenced by severe loss of power at best power mixture setting or by sticking of the throttle, the mixture will be leaned, the throttle opened wide and full heat applied to the intake air. In some cases, leaning out the carburetor mixture until backfiring occurs will loosen the ice in the carburetor and cause it to be blown clear of the inlet passages. This is a dangerous procedure, however, and should not be used except in an emergency. It is necessary to be prepared to immediately reduce heat and throttle and richen the mixture when power is regained or if detonation is suspected. If the formation of ice has not been severe and results only in a slight loss of manifold pressure or of rpm, it will only be necessary to use temperature 8° to 10° C above those listed in paragraph c. above until the ice has melted (indicated by a return to normal of manifold pressure and rpm with the particular throttle setting). When the return to normal has occurred, the carburetor air heat will be reduced to the values specified.

#### 2. Detonation.

Detonation is a too rapid burning of a portion of the combustible mixture in the cylinder.

##### a. Indications of Detonation.

(1) Engine Roughness. - Engine roughness does not necessarily indicate that detonation is present but when unusual roughness is present it may be due to detonation. A rough running engine should be carefully checked and the proper remedial action taken to provide smooth operation, since the defect may lead to detonation, preignition, or other serious difficulty.

(2) Cylinder Temperature Increase. - Detonation liberates an unusual amount of heat to the combustion chamber walls. This will not necessarily result in the cylinder temperatures exceeding the maximum specified for safe operation. In fact, the cylinder temperature increase may be apparent only when very careful observations are made, or, in some instances, it may not be noted at all. This is particularly true when operation is at a relatively low output, such as when cruising.

(3) Erratic Fuel Air Ratio. - An erratic reading of the fuel air ratio meter may indicate detonation and should be investigated. If, as the mixture is leaned out, the indicating needle does not show a leaner mixture or backs up the scale towards the rich side, detonation has very probably been encountered and the mixture should be enriched.

##### b. Causes of Detonation.

(1) Use of Fuels of Low Octane Number. - Fuels are rated in terms of their resistance to detonation



and, the greater their resistance to detonation, the higher the "OCTANE NUMBER" of the fuel. A higher "OCTANE NUMBER" fuel than that specified in the operating instructions for a given engine may be safely used, but a lower "OCTANE NUMBER" fuel than that specified should never be used except in an emergency, in which case the engine instructions covering the use of a lower grade fuel should be strictly adhered to.

(2) Low Fuel Air Ratio. - The greatest tendency for a fuel to detonate occurs near the fuel air ratio for best power and between best power and maximum economy. Therefore, leaning the mixture increases the detonation tendencies of the fuel whereas rich fuel mixtures have the effect of increasing the antiknock value of the fuel and of cooling the cylinders. In order to permit take-off power to be obtained without detonation the carburetor must be set to give a rich mixture, while at lower power outputs the carburetor may be set to give successively leaner mixtures as the severity of engine operating conditions is decreased.

(3) Engine Operating Conditions. - Any change in engine operating condition which increases the peak pressure or peak temperature in the combustion chamber increases the tendency of the fuel to detonate. Therefore, the detonation tendency will be increased:

- (a) By increasing the manifold pressure.
- (b) By advancing the ignition timing or by operating on only one of two spark plugs.
- (c) By increasing the intake air temperature with the carburetor air preheater, or by increasing the fuel air mixture temperature, to obtain a given manifold pressure.
- (d) By an increase of cylinder temperature.
- (e) By the building up of engine deposits which tend to decrease the rate at which heat is conducted away from the combustion chambers. These deposits may cause either detonation or preignition, or both.

(f) By operating the engine for an excessive period on the ground. This will result in high cylinder temperatures which will cause detonation during take-off.

(g) By leaning the fuel air mixture.

c. Results of Detonation.

(1) Loss of Power. - Unless all the fuel is burned, the economy of operation of the engine will be decreased, and the power output, at a given throttle and mixture control setting, will be reduced.

(2) Overheating. - A further effect which may be expected from detonation is overheating of the cylinders which will occur during detonating combustion.

(3) Preignition. - Detonation may also cause local hot spots inside the combustion chamber to reach sufficiently high temperatures to cause preignition of the fuel.

(4) Physical Damage. - The rapid burning of the fuel air mixture results in serious overstressing of engine parts due to the sharp rise in pressure and the extreme peak pressures often encountered, which may exceed normal combustion pressures by 50 percent or more. Some concrete examples of the results of detonation are overheated pistons, resulting in stuck and broken piston rings; scored pistons and cylinders; actual burning of the piston; warped valves; cracked or broken cylinder heads; and overstressed or broken cylinder hold-down studs.

d. Stopping Detonation. - When detonation is present or suspected, the following may be accomplished to obtain detonation-free operation immediately:

- (1) Reduce the manifold pressure.
- (2) Enrich the mixture.
- (3) Reduce the carburetor air preheating to the minimum temperature at which icing of the carburetor may be prevented.



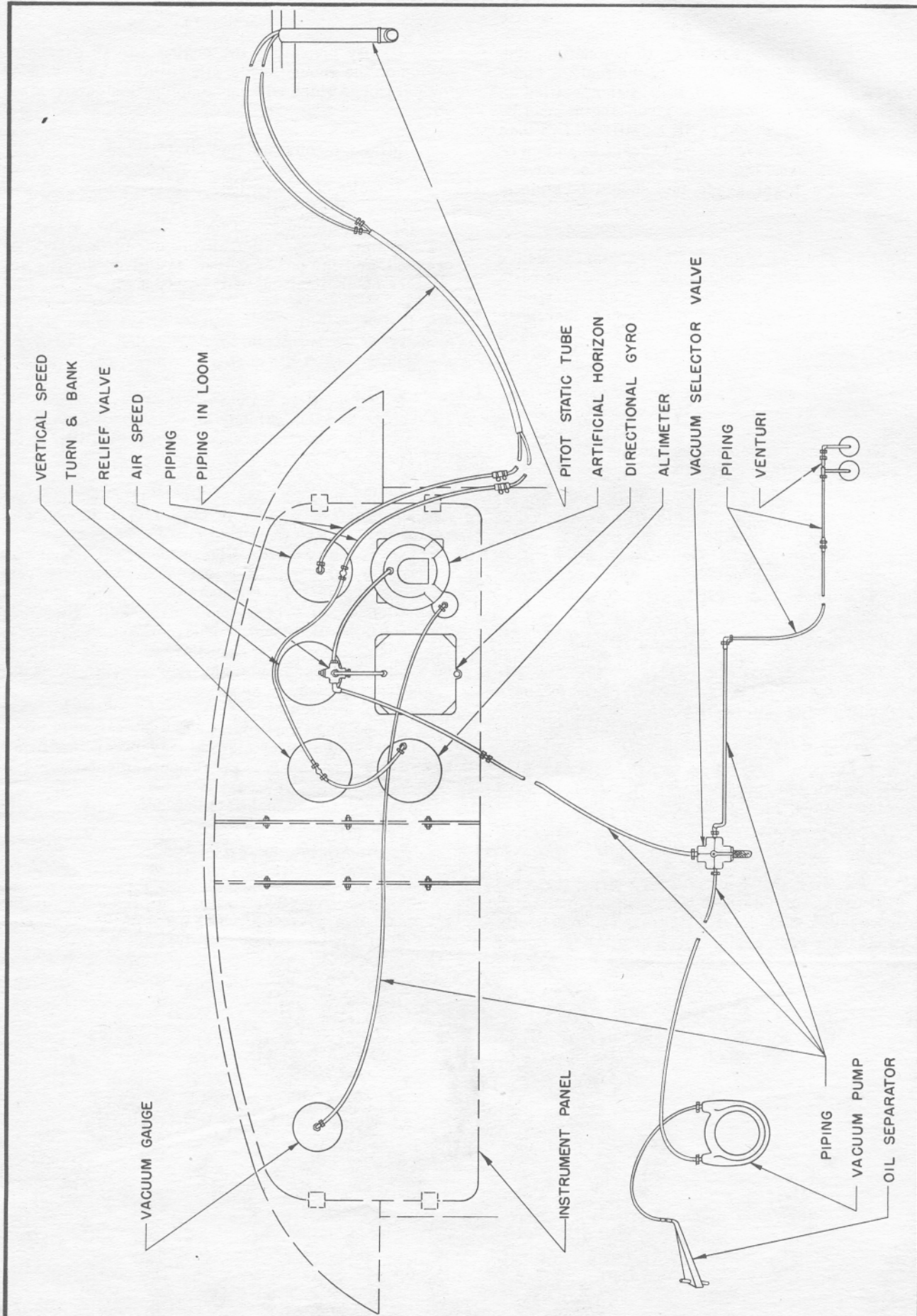


Figure 13 - Flight Instrument Piping

SECTION VLOADING SCHEDULESPECIAL FUEL RESTRICTIONS

Use fuselage tank for take-off and landing. Fill fuselage tank before filling wing tanks. Use wing tanks before using fuselage tank. Fill lower wing tanks before upper wing tanks. Use upper wing tanks before lower wing tanks.

MAXIMUM LOADINGS

OCCUPANTS	GASOLINE - GALLONS			BAGGAGE POUNDS	
	Total	Front Fuselage	Lower Wings	Upper Wing	Baggage
5	52	29	23	0	4
with para-	50	29	21	0	16
chutes	40	29	11	0	76
0 through 34		var.	var.	0	110
*4	84	29	46	9	2
with para-	80	29	46	5	26
chutes	70	29	41	0	86
0 through 66		var.	var.	0	110
3	112	29	46	37	4
with para-	110	29	46	35	16
chutes	100	29	46	25	76
0 through 94		var.	var.	var.	110
2	121	29	46	46	110
with para-	0 through 121	var.	var.	var.	110
chutes					
1	121	29	46	46	110
with para-	0 through 121	var.	var.	var.	110
chutes					

\* Includes pilot, copilot and 2 passengers.



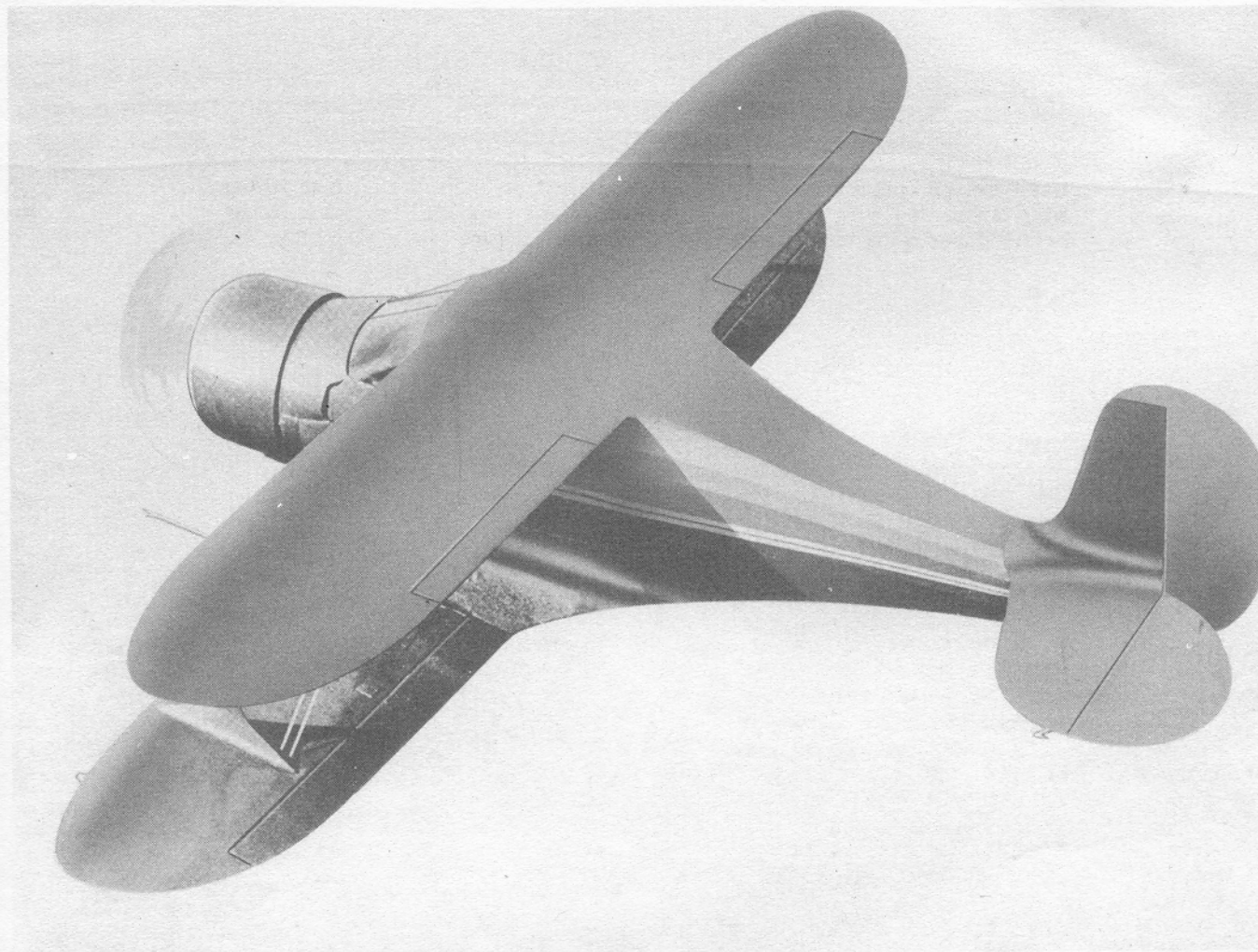


Figure 14 - Complete Airplane in Flight

## SECTION VI

### MISCELLANEOUS NOTES

1. Fuses.

Fuses and spares are carried in holders in the instrument panel.

2. Right Rudder Pedals.

The right side set of rudder pedals may be removed by removing the bolts in the stubs and pulling straight up on them.

3. Exhaust Gas in Cabin.

The cause of this trouble has always been traceable to landing gear doors which are out of adjustment. At the first sign of exhaust gas in the cabin, the ship should be hoisted and the fit of these doors carefully checked. The doors should be readjusted to fit tightly, if necessary.





SECTION VIIWINTER FLYING SUGGESTIONS

1. Do not pump the throttle in order to keep the engine running in cold weather as this will only cause flooding of the carburetor and may cause a fire if the engine should backfire while it is still cold. The primer valve should be left open several minutes after starting the airplane and the primer should be used to keep the engine running rather than the throttle.

2. The engine oil should be changed to the viscosity recommended by the engine manufacturer for the temperature at which it will be operated.

3. Be sure the carburetor heat controls are working satisfactorily but never start the engine with the carburetor heat control at the "HOT" position. The reason for this is that there is not enough heat available when the engine is being started to do any good and the carburetor heat doors may be damaged if the engine should backfire with the heat control in the "HOT" position.

4. The most important item to check before flying in cold weather is to be sure that all slide tubes on the landing gear are kept clean and dry and free from any oil or grease. The slide tubes are well enough protected so no trouble will be experienced flying off of wet or muddy fields but if any oil or grease is present on the slide it will congeal and make the landing gear difficult to operate. The slides should be cleaned with gasoline and dry powdered graphite should be rubbed on them.

5. In case the battery is run down, great care should be used in retracting the landing gear electrically. If you have any doubt about the condition of your battery, either wait until reaching a high altitude before attempting to retract the landing gear electrically, or retract it by hand. In order to retract the landing gear by hand it will be necessary to remove the landing gear fuse because as soon as the position control is moved to the "UP" position, the electric motor automatically starts to retract the landing gear.

6. On this landing gear a 40-ampere fuse should be used. Since the capacity of a fuse steadily decreases as the fuse becomes older, it is natural to expect a failure of the fuse once in a while even if the landing gear is operating perfectly, unless a new fuse is installed periodically, say every 100 hours.

7. In case a fuse fails while retracting the landing gear, it is best to move the position control to "DOWN" before inserting the new fuse. The reason for this is that the new fuse will probably blow out also, due to the fact that the motor is trying to start under a heavy load if the position control is left in the "UP" position. In case it is necessary to operate the landing gear manually, remember that it is always necessary to move the position control to the proper position.

8. Although both landing gear warning lights secure their current from separate circuits, there is still a

remote possibility of a light bulb burning out. For this reason it is advisable to always check the gear position by hand before landing.

9. The exhaust stacks should be inspected underneath the cabin heater to be sure there are no cracks or places where the stacks have become thin and are likely to burn through. If the noise level in the cabin suddenly becomes high when flying with the heater on, or if any exhaust odor can be detected, the heater should be shut off immediately and the stack examined upon landing, as those are indications that there is a leak in the exhaust stack.

10. Do not try to take-off with snow or heavy frost on the wings. Even a light coat of snow will increase the stalling speed by 50 percent - not due to its weight, but due to the ruining of the lift on the top of the wing.

11. No difficulty will be experienced in keeping the oil sufficiently warm when flying in cold weather if the following suggestions are heeded.

12. Plugs are furnished with each airplane to close the cold air blast tubes leading from in front of the engine baffles into the engine compartment. When flying in cold weather it is desirable to close either one or both of the blast tubes in order to assist in keeping the oil warm.

13. The following procedure should be observed in order to prevent fluctuation of the oil temperature due to congealing of the oil in the radiator. The oil should be warmed up with the airplane on the ground by opening the bypass and closing the oil radiator shutters; this is done by pulling both controls out. The oil should be warmed up to about 100° C (212° F) before take-off and the bypass control should be pushed in before take-off, but the oil radiator shutter control must be left out. When the bypass control is pushed in, the rise in oil temperature will be stopped temporarily and the temperature may even drop slightly before starting to rise. This, however, is natural, due to the fact that cold oil from the radiator is coming into the system; also that all of the oil in the tank is beginning to circulate. As soon as the oil temperature reaches about 140° C (284° F) the oil radiator shutter control should be pushed in slightly and the shutter control adjusted to maintain the oil temperature at about 140° C (284° F).

14. If an attempt is made to warm up the engine with the radiator shutters open, and if the airplane is taken off with the shutters open, the oil will congeal in the radiator causing the temperature to go to 180° C (356° F) before the oil will flow through the radiator. When the flow starts through the radiator the temperature will drop rapidly and will probably result in congealing in the radiator again, which will cause a steady fluctuation of oil temperature between about 120° and 180° C (248° and 356° F). This trouble will not be experienced, however, if the above procedure is followed in warming up the engine and commencing flight.

