PIPER APACHE OWNER'S MANUAL

NOTE:

This is an original copy of the Pilot's Operating Handbook of the Apache from 1958. It has not been updated and is not intended for use in flight planning. This book is for reference only.

APACHE

PA-23

Owner's Handbook

PIPER

Piper Aircraft Corporation, Lock Haven, Pa.
U. S. A.

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FOREWORD

WITH the introduction of the Piper Apache into the utility airplane field, a new era in the development of personal and business aviation is presaged. In this era, the use and usefulness of this type of vehicle will be extended markedly through the medium of increased safety resulting from duplication of power plants.

For the Apache is the first low powered and relatively low priced twin-engined airplane to be produced in quantity anywhere in the world. It is designed to answer an accumulated demand by business and pleasure consumers for increased night, instrument and over-water utility.

Reliability, serviceability and performance have been built into the Apache to an even higher degree than in earlier Piper models. To take fullest advantage of these attributes, it is recommended that the operation and maintenance instructions provided in this manual be carefully studied and followed.

DESIGN FEATURES

I. SPECIFICATIONS:

Engines	Lycoming 0-320
HP and RPM	150 HP at 2700
Gross Weight (Lbs.)	3500
Empty Weight (Custom Model) (Lbs)	2200
Useful Load (Lbs.)	1300
Wing Span (Ft.)	37
Wing Area (Sq. Ft.)	204
Length (Ft.)	27.1
Height (Ft.)	9.5
Propeller Diameter (Max. In.)	76
Power Loading (Lbs. per HP)	11.7
Wing Loading (Lbs. per Sq. Ft.)	17.2
Baggage Capacity (Lbs.) Max.	200
Baggage Compartment Space (Cu. Ft.)	25
Fuel Capacity (Gals.)	72
Tire Pressure (Lbs.) Nose 27	Main 35
Wheel Base (Ft.)	7.3
Wheel Tread (Ft.)	11.3
Top Speed (MPH)	180
Optimum Cruising Speed at 75% Power, 6000′ (MPH)	170
Cruising Speed at 65% Power, 9000′ (MPH)	162
Sea Level Cruising Speed at 75% Power (MPH)	160
Stalling Speed (Power Off—MPH)*	59
Take-off Run (Ft.)	990
Landing Roll (Ft.)*	670
Best Rate of Climb Speed (MPH)	100
Rate of Climb (Ft. per Min.)	1350
Best Angle of Climb Speed (MPH)	76
Best Single Engine Rate of Climb Speed (MPH)	95
Single Engine Rate of Climb (Ft. per Min.)	240
Service Ceiling (Ft.)	18,500
Single Engine Absolute Ceiling (Ft.)	6750
Fuel Consumption (Gal./Hr. at 75% Power)	18.8
Fuel Consumption (Gal./Hr. at 65% Power)	16.3
Cruising Range—Maximum at 75% Power at Sea Level (Miles)	620
Cruising Range—Maximum at 65% Power at 9000′ (Miles)	710
Cruising Range—Optimum (Miles)	840

* Flaps Extended.

Performance figures are for Custom model airplanes flown at gross weight under standard conditions at sea level. Any deviation from Custom equipment may result in changes in performance.

II. POWER PLANTS AND PROPELLERS:

The Lycoming 150 HP O-320 engines used in the Apache are developments of the well proven four-cylinder series of engines which have been giving excellent service in earlier Piper products for many years. Basically the same engine as the 135 HP O-290-D2, but with larger cylinders, the O-320 represents the latest and most efficient design in this series of smooth, reliable power plants. Although 10% larger in displacement and power than the 135 HP model, it is only 5% heavier in basic weight.

The right engine on the Apache is equipped with a vacuum pump, and the left engine with a generator and a hydraulic pump for actuating the landing gear and flaps. Both engines are shielded and are equipped with Woodward propeller governor units.

Engine mounts are of steel tubing construction and incorporate vibration absorbing Lord mounts on the upper engine pads, with conventional rubber cones at the lower pads. Engine cowls are largely interchangeable and are cantilever structures attached at the firewall. Side panels are quickly removable by means of quick release fasteners.

Figure 2

The exhaust system is a cross-over type with exhaust gasses directed into jet augmenter tubes located on the outboard side of each engine. This system provides for exhaust elimination without power loss, and effective engine cooling through the pumping action of the exhaust gasses into the augmenter tubes, which draws cooling air through the engine compartment; no cowl flaps or cooling flanges are needed on the cowling. Higher aircraft speeds are obtainable with this system due to reduced cooling drag and due to extra thrust furnished by the exhaust augmentation.

Efficient aluminum oil coolers are mounted on the inboard sides of each engine. Oil drainage is accomplished with quick oil drain valves located on the right rear corner of the engine crankcases.

Carburetor air is directed through quickly removable filters, located in the nose cowls, to the carburetor air boxes. Heated air for the carburetors is taken from shrouds on the exhaust manifolds through flexible tubes to the air boxes.

The propellers on the Apache are Hartzell constant-speed controllable full-feathering units. These are controlled entirely by use of the propeller pitch levers in the center of the control quadrant. Feathering of the propellers is accomplished by moving the controls fully aft through the high pitch detent into the feathering position. Feathering takes place in approximately ten seconds. The propellers are unfeathered by moving the prop controls ahead and pressing the starter buttons.

III. FUSELAGE AND WING STRUCTURES:

The Apache fuselage is a composition of four basic units: the sheet metal tail cone, cabin section and nose section, and the steel tubular structure which extends from the tail cone to the nose wheel. The steel tube unit is intended to withstand the high loads imposed on the center section region of the airplane, and provides an extra safety factor in this critical area.

Finish on the tubular unit, as on all steel tube structures in the Apache, is zinc chromate primer with synthetic enamel.

The wing structure is lightweight but rugged, and consists of a massive stepped-down front spar, a rear spar, lateral stringers, longitudinal ribs, stressed skin sheets, and a readily detachable wing tip section. The rectangular plan form of the wing permits the use of many interchangeable parts and simplifies the construction, while providing for excellent stability and performance characteristics.

The wings are attached to the tubular center section structure with fittings at the sides and in the center of this sructure, and the main spars are bolted to each other with high strength butt fittings in the center of the fuselage, making in effect a continuous main spar. This arrangement combines high strength and light weight qualities, since heavy wing hinge fittings on the spars and fuselage are eliminated, as well as an elaborate carry-through structure through the center section of the fuselage.

IV. LANDING GEAR:

All three landing gear units on the Apache incorporate the same soft acting air-oil oleo struts, and contain many directly interchangeable parts.

Main wheels are 600 x 6 Goodrich units with Goodrich expander tube brakes and 700 x 6 tires. The nose wheel is Cleveland Aircraft Products model C-38501-H, 600 x 6 with a 600 x 6 tire and tube.

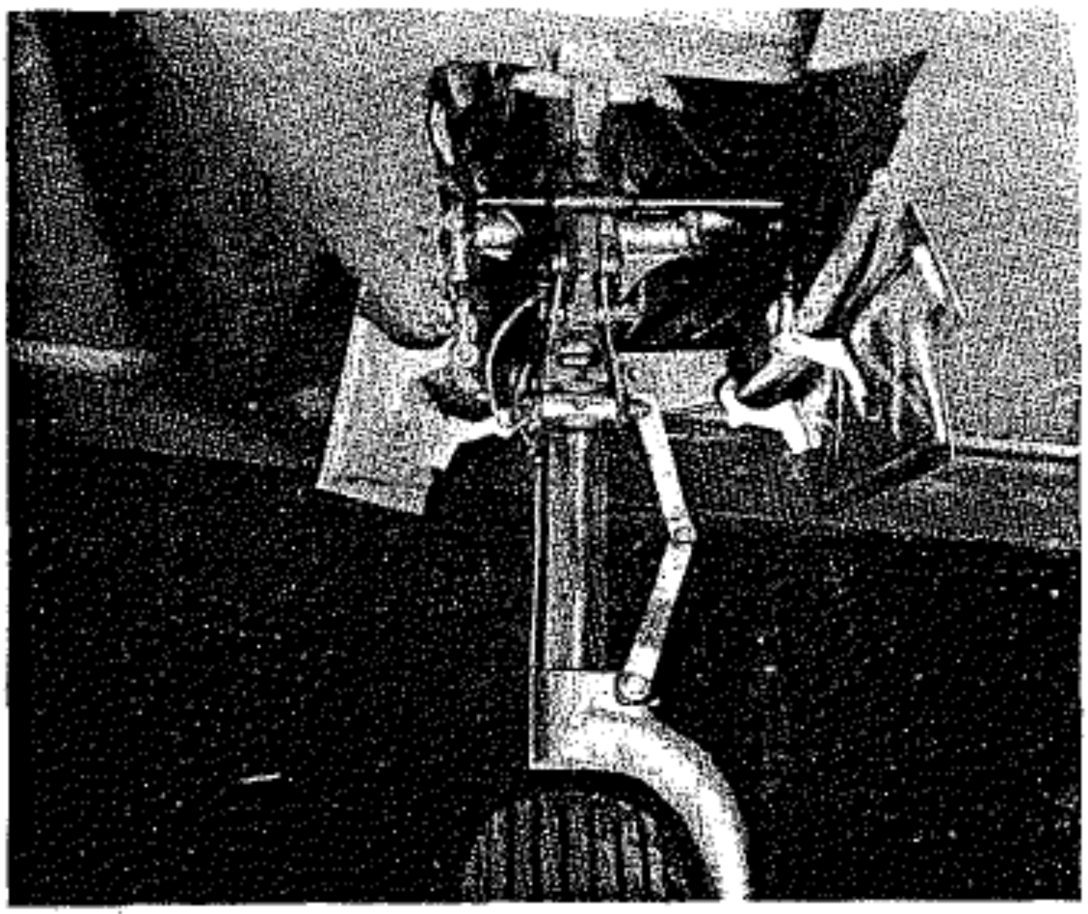


Figure 3a

Lowering and retracting of the landing gear is accomplished through hydraulic cylinders at each leg, actuated by hydraulic fluid pressure from the engine driven pump. Gear retraction is rapid, taking approximately 11 seconds. Gear lowering normally takes about 12 seconds. In the event of hydraulic pump failure, hydraulic pressure for gear or flap operation can be obtained with the manual hydraulic pump located with the gear and flap controls in the control quadrant.

For emergency extension of the landing gear if failure of the hydraulic system should occur due to line breakage or selector valve malfunctioning a separate CO_2 extension arrangement is provided. When the CO_2 control under the pilot's seat is pulled, the CO_2 flows to the gear actuating cylinders through separate lines and shuttle valves located near the cylinders, forcing the gear down. (See Operating Instructions for details).

The position of the landing gear is indicated by four light bulbs located on the pedestal. When the green lights are on, all three legs of the gear are down and locked; when the amber light is on, the gear is entirely up, and when no light is on, the gear is in an intermediate position.

Figure 3b

A red light in the landing gear control knob flashes when the gear is up and either one of the throttles is pulled back. When both throttles are closed beyond a given power setting, with wheels not down, the landing gear warning horn sounds.

To guard against inadvertant retraction of the landing gear on the ground, a mechanical latch, which must be operated before the landing gear control can be moved upward, is positioned just above the control lever. The control knob is in the shape of a wheel to differentiate it from the flap control knob which has an airfoil shape.

The nose wheel is steerable through a 30 degree arc through use of the rudder pedals. As the nose gear retracts, the steering linkage becomes disconnected from the gear so that rudder pedal action with the gear retracted is not impeded by nose gear operation.

Main gear brakes are actuated by toe brake pedals on the left rudder pedals. Hydraulic brake cylinders located in front of the left rudder pedals are readily accessible in the cockpit for servicing. A brake fluid reservoir which is attached to the brake cylinders with flexible lines and provides a reserve of fluid for the brake system, is mounted inside the left nose access panel.

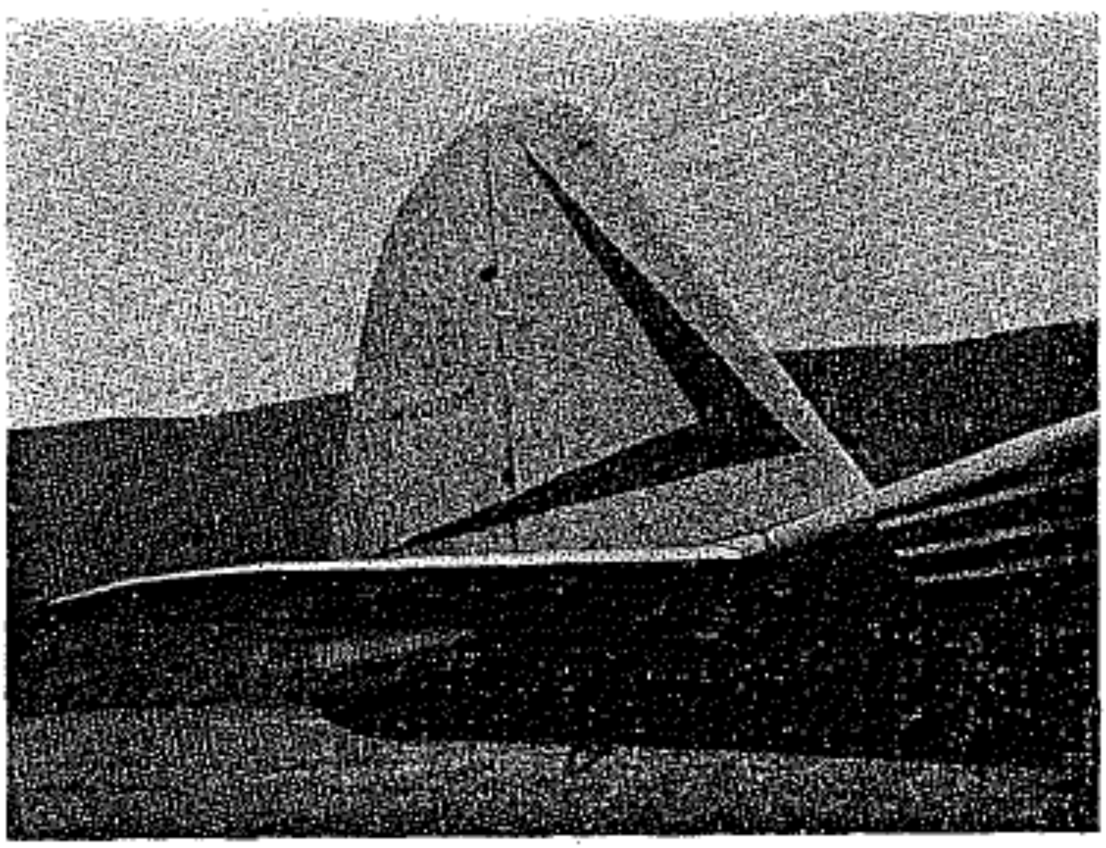


Figure 4

Parking brake valves, operated by a control on the lower left side of the instrument panel, are installed ahead of the forward cabin bulkhead and are also serviced through the left nose access panel.

V. CONTROL SYSTEM AND CONTROL SURFACES:

Dual wheel and rudder flight controls are provided in the Apache as standard equipment. All controls are light yet solid and effective in flight at all speeds down through the stalling speed. The nose wheel is steerable on the ground through the rudder pedals and the left pedals are equipped with toe brakes.

All control surfaces on the Apache are conventional sheet metal structures, fitted with cast hinges and needle bearings. The elevators are actuated by a tubular push-pull system, and the flaps by a hydraulic cylinder located in the right side of the cabin wall. Access to this cylinder is obtained by the removal of the upholstered interior panel immediately ahead of the baggage door.

The ailerons and rudder are connected by cables with the control wheel and rudder pedals. The rudder has a trim tab operated by a crank in the center of the forward cabin ceiling. Longitudinal trim is through bungee springs located back near the elevators and controlled by a larger crank adjacent to the rudder tab control.

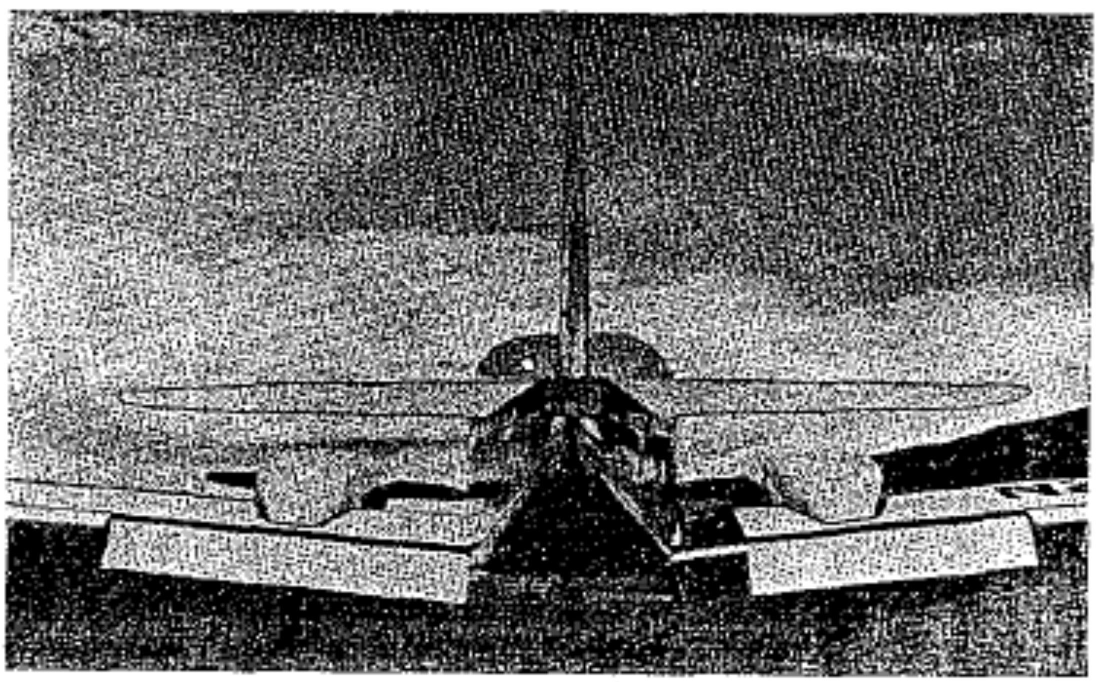
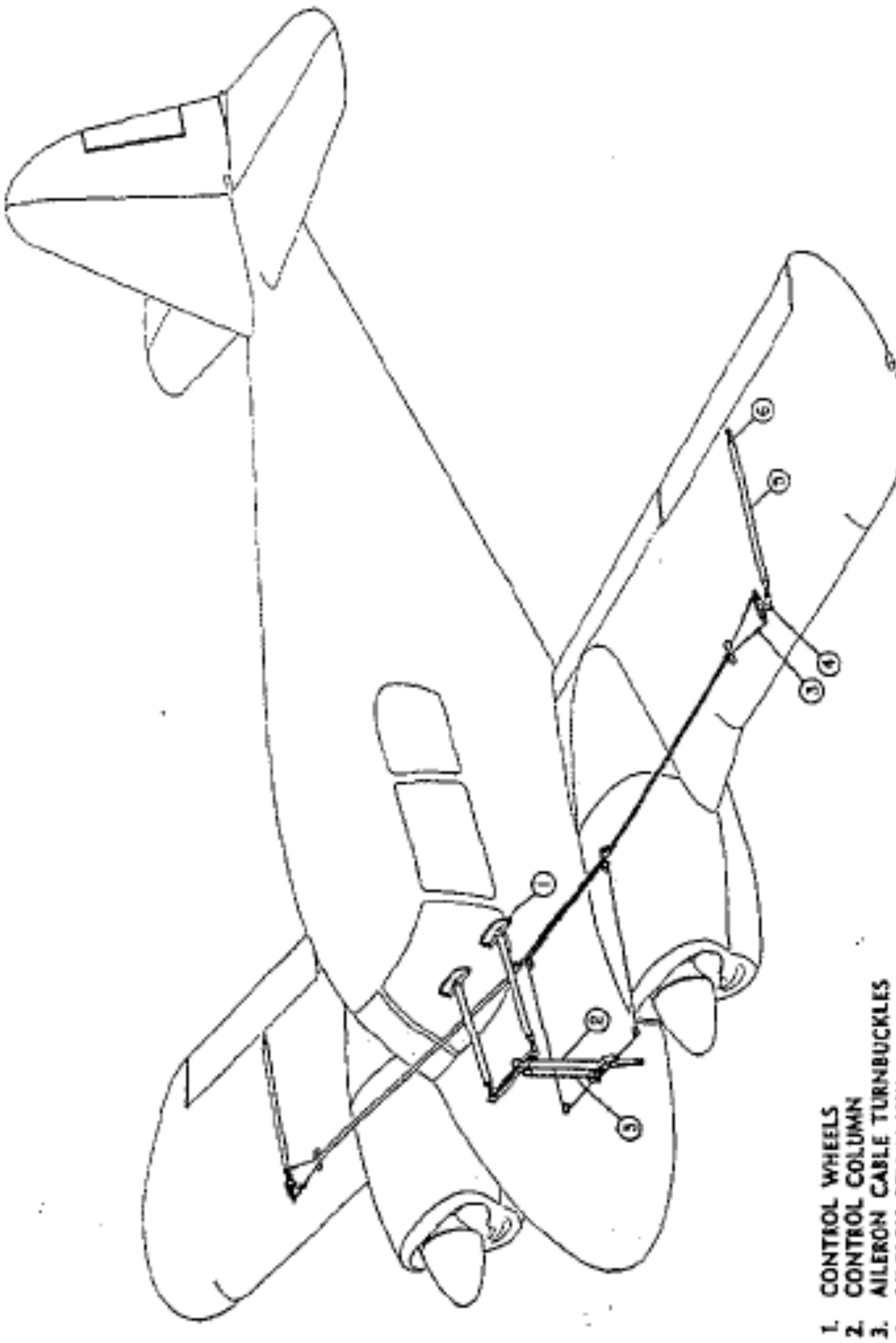
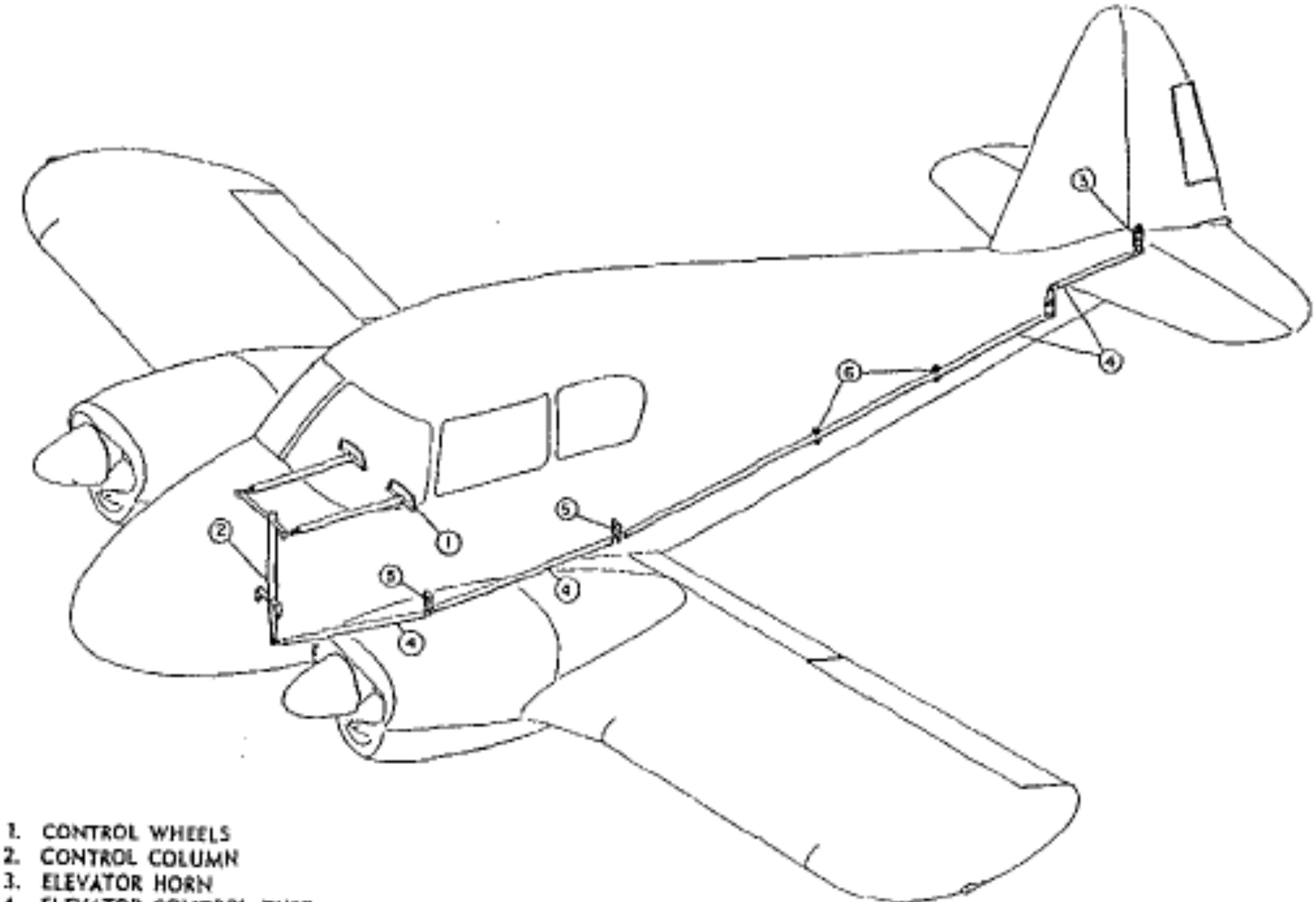


Figure 5



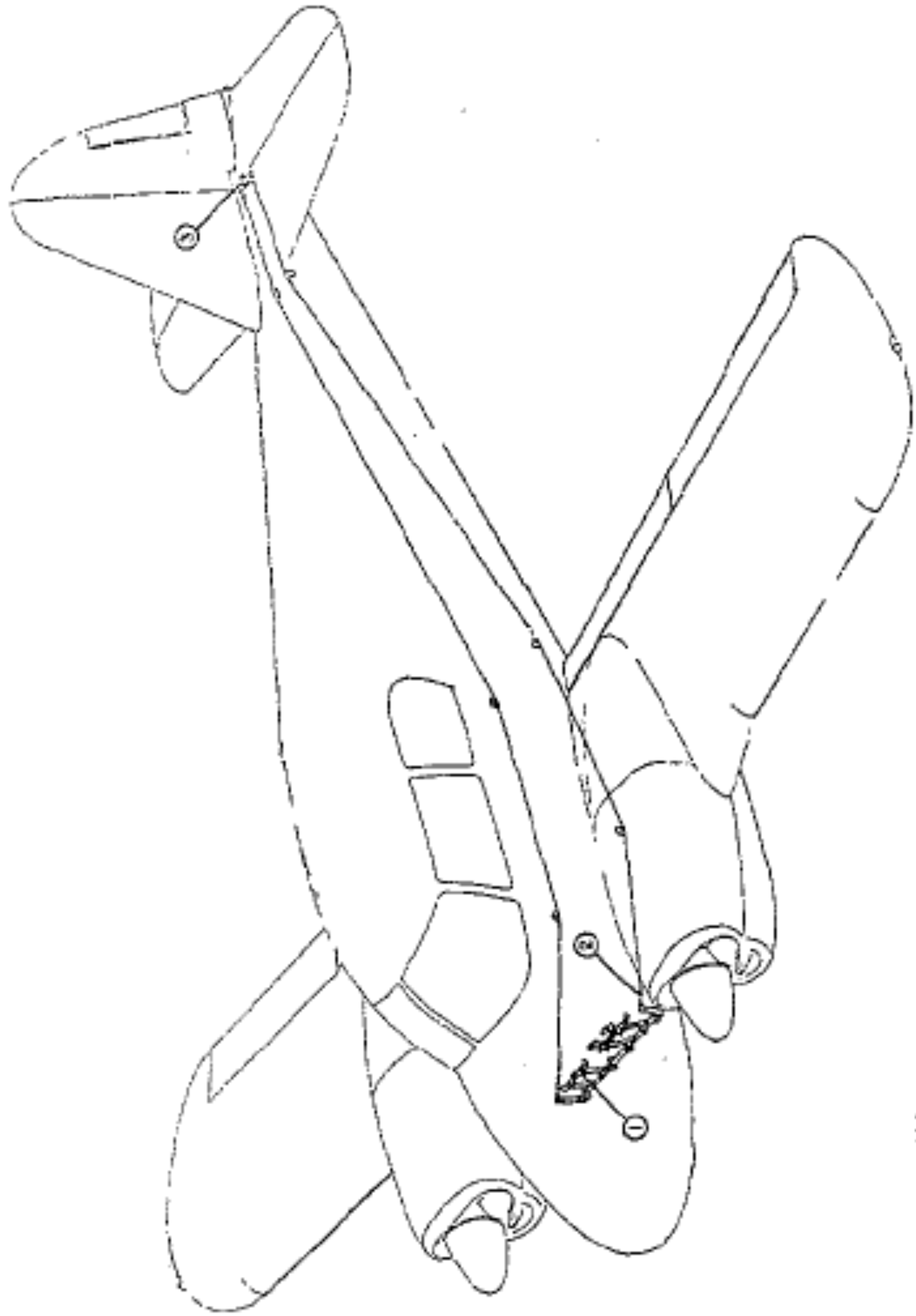
1. CONTROL WHEELS
2. CONTROL COLUMN
3. AILERON CABLE TURNBUCKLES
4. AILERON BELLCRANK
5. AILERON CONTROL TUBE
6. AILERON END BEARING

AILERON CONTROL SYSTEM
Figure 6



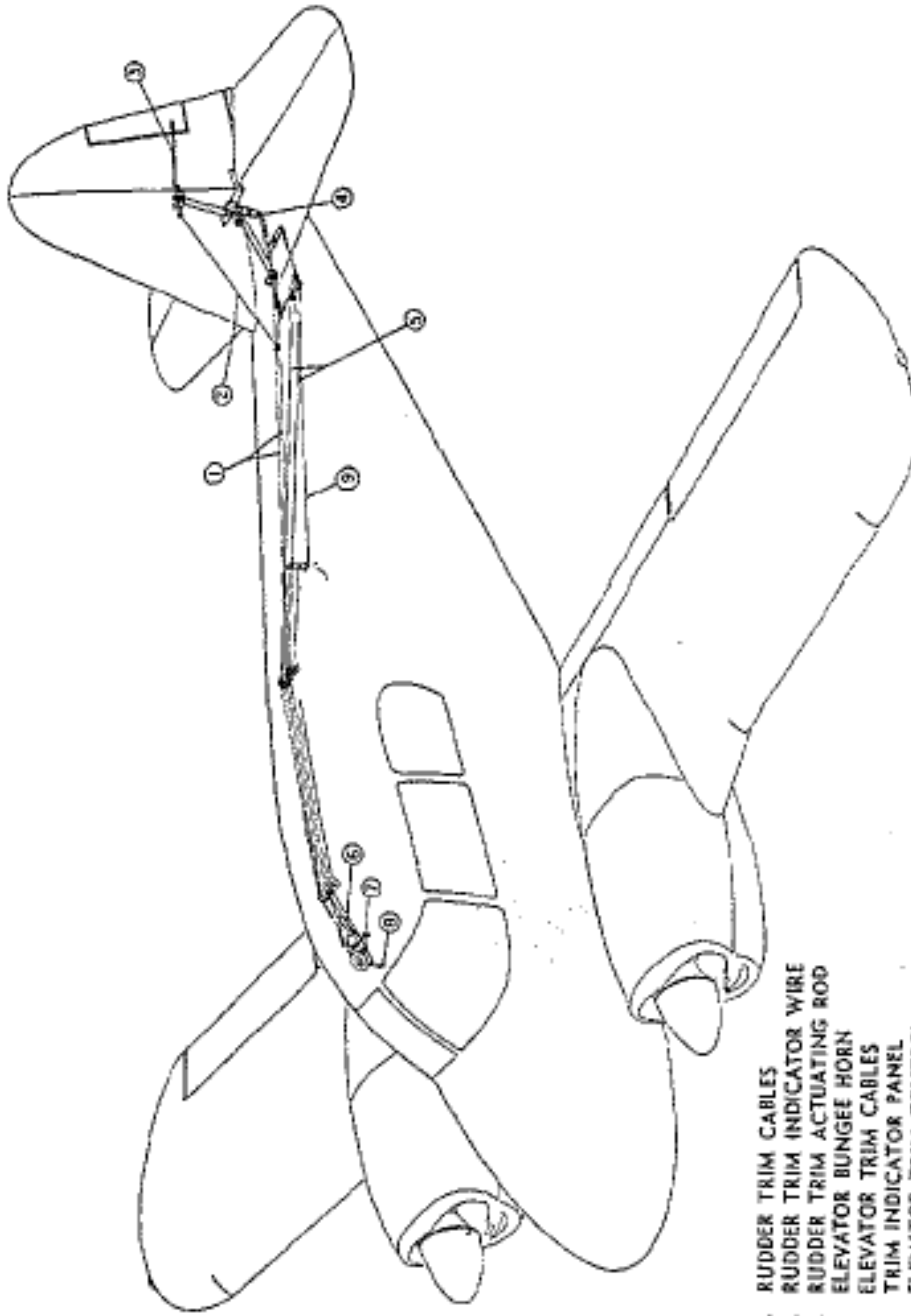
1. CONTROL WHEELS
2. CONTROL COLUMN
3. ELEVATOR HORN
4. ELEVATOR CONTROL TUBE
5. BRACKET ASSEMBLY
6. ROLLER

ELEVATOR CONTROL SYSTEM
Figure 7



1. RUDDER PEDALS
2. RUDDER CABLE TURNBUCKLES
3. RUDDER HORN

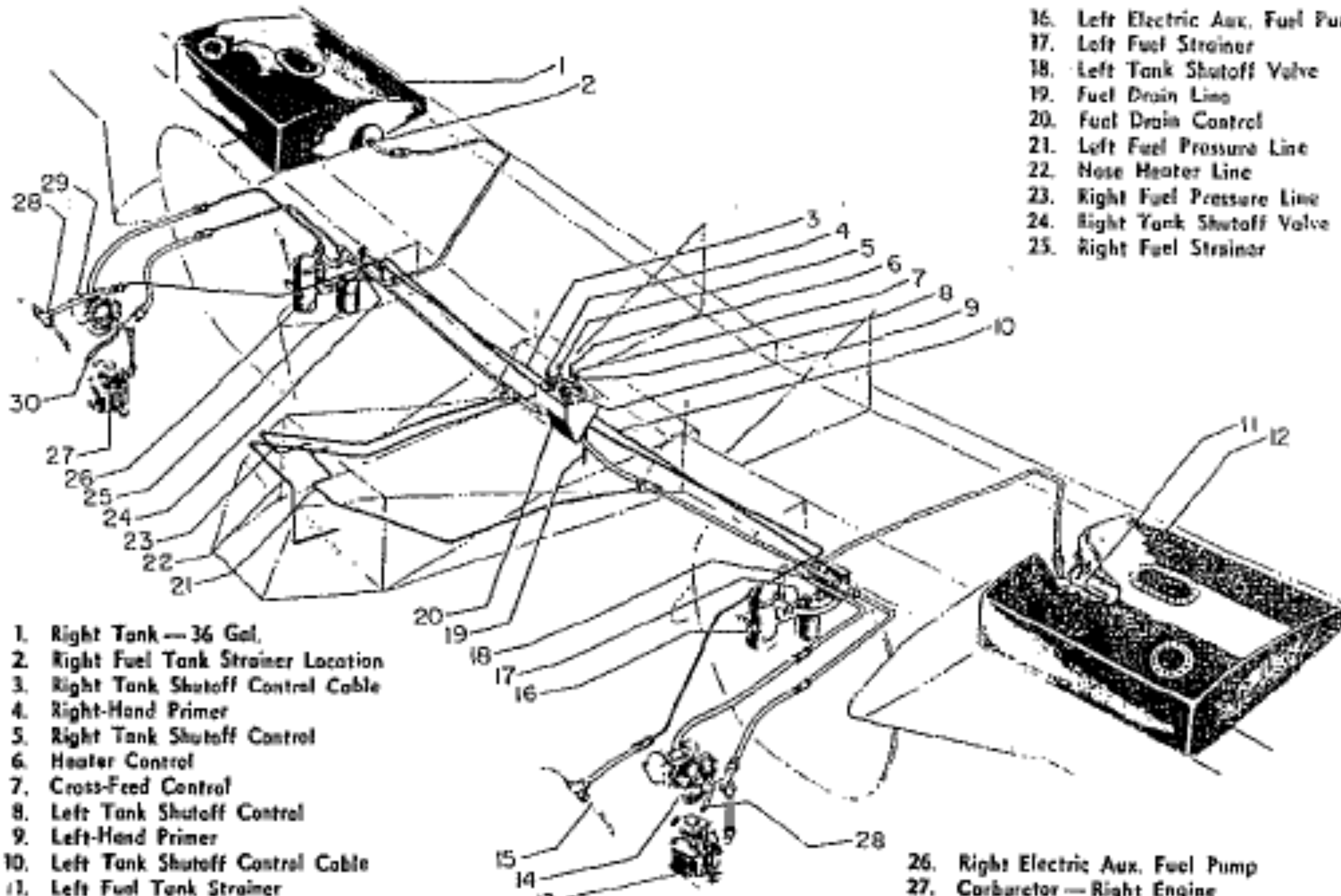
RUDDER CONTROL SYSTEM
Figure 8



1. RUDDER TRIM CABLES
2. RUDDER TRIM INDICATOR WIRE
3. RUDDER TRIM ACTUATING ROD
4. ELEVATOR BUNGEE HORN
5. ELEVATOR TRIM CABLES
6. TRIM INDICATOR PANEL
7. ELEVATOR TRIM CONTROL
8. RUDDER TRIM CONTROL
9. ELEVATOR TRIM INDICATOR WIRE

ELEVATOR-RUDDER TRIM SYSTEM
Figure 9

16. Left Electric Aux. Fuel Pump
17. Left Fuel Strainer
18. Left Tank Shutoff Valve
19. Fuel Drain Line
20. Fuel Drain Control
21. Left Fuel Pressure Line
22. Nose Heater Line
23. Right Fuel Pressure Line
24. Right Tank Shutoff Valve
25. Right Fuel Strainer



1. Right Tank — 36 Gal.
2. Right Fuel Tank Strainer Location
3. Right Tank Shutoff Control Cable
4. Right-Hand Primer
5. Right Tank Shutoff Control
6. Heater Control
7. Cross-Feed Control
8. Left Tank Shutoff Control
9. Left-Hand Primer
10. Left Tank Shutoff Control Cable
11. Left Fuel Tank Strainer
12. Left Fuel Tank — 36 Gal.
13. Carburetor — Left Engine
14. Left Engine Driven Fuel Pump
15. Primer Line — Left Engine

FUEL SYSTEM
Figure 10

26. Right Electric Aux. Fuel Pump
27. Carburetor — Right Engine
28. Overflow — Left Engine Driven Fuel Pump
29. Right Engine Driven Fuel Pump
30. Overflow — Right Engine Driven Fuel Pump

VI. FUEL SYSTEM:

Two thirty-six gallon nylon and neoprene fuel cells located outboard of the engines provide fuel storage in the Apache. The tanks should be kept full of fuel during storage of the airplane to prevent accumulation of moisture, and to prevent deterioration of the rubber cells. For long term storage without fuel, the cells should be coated with light engine oil to keep the rubber from drying out.

The fuel system in the Apache is simple, but completely effective. Fuel can be pumped from either tank to both engines, through use of the four fuel pumps provided for this purpose.

For normal operation, fuel is pumped by the engine driven pumps from the tanks directly to the adjacent carburetors. The fuel valves can be left on at all times and the crossfeed left in the off position. Electric auxiliary fuel pumps are installed in by-pass fuel lines between the tanks and the engine driven pumps. The electric pumps can be used to provide pressure in the event of failure of the regular pumps. They are normally turned on to check their operation before starting the engines, and left on during take-off and landing, to preclude the possibility of fuel pressure loss due to pump failure at critical times.

If one of the engine driven pumps fails, the electric pump to that engine can be turned on to supply the fuel. However, if desired, the fuel can be pumped by the operating engine driven pump to the failed pump engine simply by turning on the crossfeed. The good pump will then be supplying both engines from its tank. If this tank runs low on fuel, fuel can be drawn from the opposite tank by turning on the electric pump on the failed pump side, leaving the crossfeed on, and turning the fuel valve on the empty tank off. Then the electric pump on the failed pump side will be supplying both engines from its tank.

Fuel can thus be used from one tank or the other, by shutting off one main valve and turning on the crossfeed, to balance fuel loads or for other purposes. For all normal operation, it is recommended that fuel be pumped directly from the tanks to their respective engines, with the crossfeed off.

The fuel valve controls and crossfeed control are located with the engine primer pumps in fuel control panel between the front seats. Two electric fuel gauges in the engine gauge cluster on the instrument panel indicate the fuel quantity in each tank. The electric fuel pump switches are on the lower left side of the instrument panel.

A crossfeed line drain valve control is mounted on the front face of the fuel control panel box. This valve should be opened occasionally, with the crossfeed on, to allow any water that might accumulate at that point to be drained out. The heater fuel control is also placed on the fuel control panel, so that fuel to the heater can be turned off if necessary.

The main fuel strainers are located in the inboard sides of the main wheel wells. They are fitted with quick drains and should be drained regularly through their small access ports. Fuel screens are provided at the tank outlets, in the strainers and at the carburetors.

Idle cut-offs are incorporated in the mixture controls and should always be used to stop the engines.

VII. ELECTRICAL SYSTEM:

The master switch for the electrical system is located on the lower left side of the control pedestal, along with the heating and ventilating control panel. Other electrical switches and circuit breakers are grouped on the lower left side of the instrument panel. The starter buttons are installed on the underside of the extreme left of the panel where they are concealed from those not familiar with the airplane. Adjacent to the starter buttons are the ignition switches.

Automatic circuit breakers are provided for the lights, generators, radios, landing gear indicator system, Turn and Bank, fuel pumps and cabin heater. These units automatically break the electrical circuit if an overload is applied to the system, preventing damage to any electrical component. To reset the circuit breakers, simply push in the buttons. Continual popping out of a circuit button indicates trouble in the electrical system and should be investigated immediately.

A 12-volt 33-ampere hour battery, enclosed in a sealed stainless steel battery box, is mounted in the nose section on the right side. (See Section Four, III, Battery Service).

The position and panel lights are operated by a rheostat switch located with the other electrical switches. The position lights are turned on with the first movement of the knob; panel light intensity is increased by further rotation of the control. A dome light switch is incorporated in the light unit in the center of the cabin ceiling.

A voltage regulator, attached to the rear side of the firewall in the left engine nacelle, regulates the flow of current from the 35 ampere generator to the battery.

VIII. FINISH:

All alumnium sheet components of the Apaches are carefully finished inside and outside to assure maximum service life. Both sides of all pieces are alodine treated, then sprayed with zinc chromate primer. External surfaces are coated with durable synthetic enamels in attractive high gloss colors. The application of primer to interior surfaces will prevent corrosion of structural and non-structural parts on the inside where there is no access for normal maintenance.

Steel tubular structures are also finished with zinc chromate primer and enamel.

IX. CABIN FEATURES:

The instrument panel of the Apache has been designed to accommodate all of the customary advanced blind flight instruments on the left side in front of the pilot, and all required engine instruments on the right side. Provision for extra instruments has been made in both sections. The flight instrument group is shock mounted in an easily removed sub-panel. All instruments are accessible for maintenance by removing a portion of the fuselage cowl over the instruments.

The Artificial Horizon and Directional Gyro in the flight group are vacuum operated through use of a vacuum pump installed on the right engine. The Turn and Bank is an electrically operated instrument and serves as a standby for the Gyros in case of vacuum system failure. A switch for the Turn and Bank is included in the switch grouping on the lower left of the panel. The vacuum gauge in the engine instrument group normally indicates 3½ to 4½ inches of suction, required to operate the gyros.

Two Recording Tachometers are provided to eliminate the need for constant reference to aircraft and engine log books. A 9 gauge engine instrument cluster, at the bottom of the engine group, includes two oil pressures, two oil temperatures, two fuel pressures, two fuel gauges and one ammeter. The gauges in this cluster can be replaced individually by removing the column of three gauges in which the defective unit is incorporated, then detaching the proper gauge from this column.

Radio units are installed in the extreme left and right sections of the main panel, with the primary radios in front of the pilot and the auxiliary units on the right. Radio power supplies are mounted in the forward part of the nose section near the battery.

The landing gear and flap selector valve unit is housed within the control pedestal under the engine controls, with the landing gear control lever projecting rearward on the right side and the flap control lever on the left. To effect extension or retraction of the gear or flaps, the controls are moved from the center "off" position in the desired direction. When the selected component is fully extended or retracted, hydraulic pressure within the selector valve unit forces the control back to the "off" position, so that the component actuating cylinders and lines are not under constant hydraulic pressure. This prevents complete loss of hydraulic fluid in the event of a leak in the lines between the selector valve and the component or at the actuating cylinders. The movement of the control handles back to "off" indicates that the components have reached full extension or retraction.

The emergency hydraulic pump, which is integral with the selector valve, is used to obtain hydraulic pressure in case of failure of the hydraulic pump or failure of the left engine. To operate the pump the handle should be extended to its full length by pulling

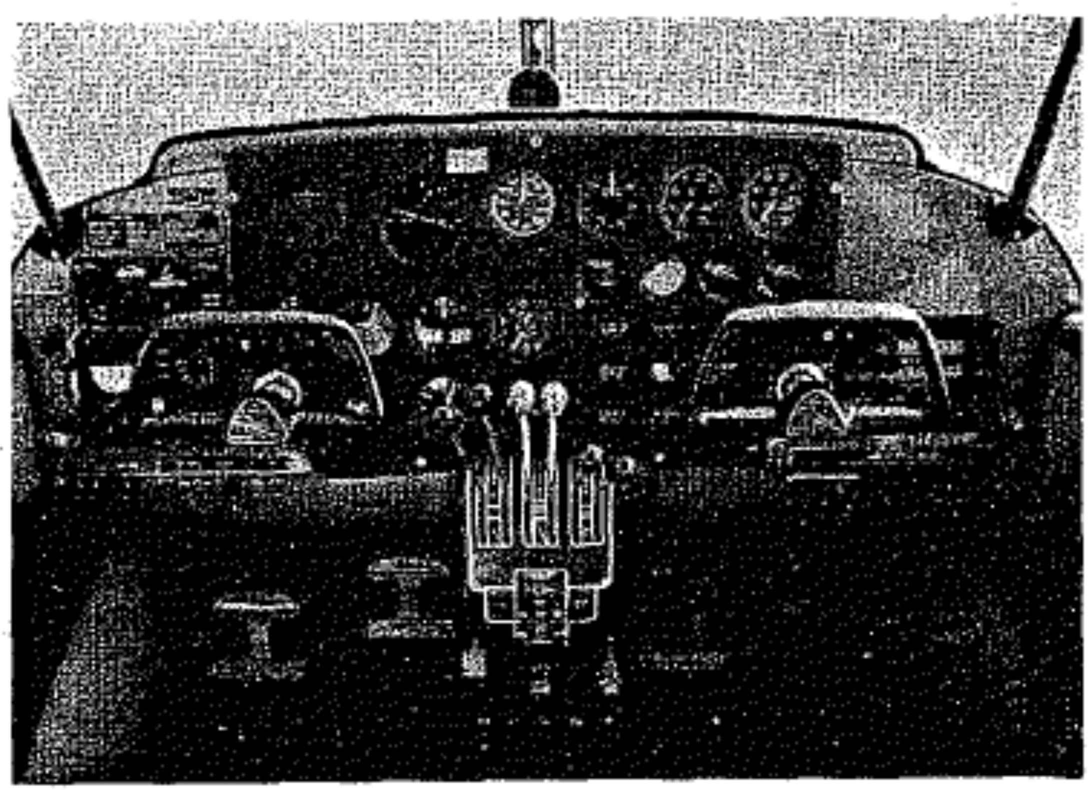


Figure 11

aft. 30-40 pump strokes are required to raise or lower the landing gear, and about 20-30 seconds.

The front seats in the Apache are constructed of steel tubing, with no-sag springs and foam rubber cushions. Upholstery is top grain leather and nylon frieze fabric. The seats are adjustable fore and aft through a 7-inch range by operation of a release control under the front of each seat. The right seat is also adjustable aft beyond the normal range to provide ease of entrance to the pilot's seat. Both seats are easily removed by taking out the lower bolts in the stop plates at the rear of the seat structure, swinging the stop plates laterally and sliding the seats forward off their tracks.

The rear seat area is readily convertible to a cargo compartment by removing all or half of the rear seat. To take out the entire rear seat, first the bottom and back cushions are removed, then the seat support tubes are rotated 90 degrees, withdrawn from their brackets and removed with the canvases.

Half of the rear seat can be removed with the other half still in place, if it is desirable to carry cargo or a stretcher as well as a

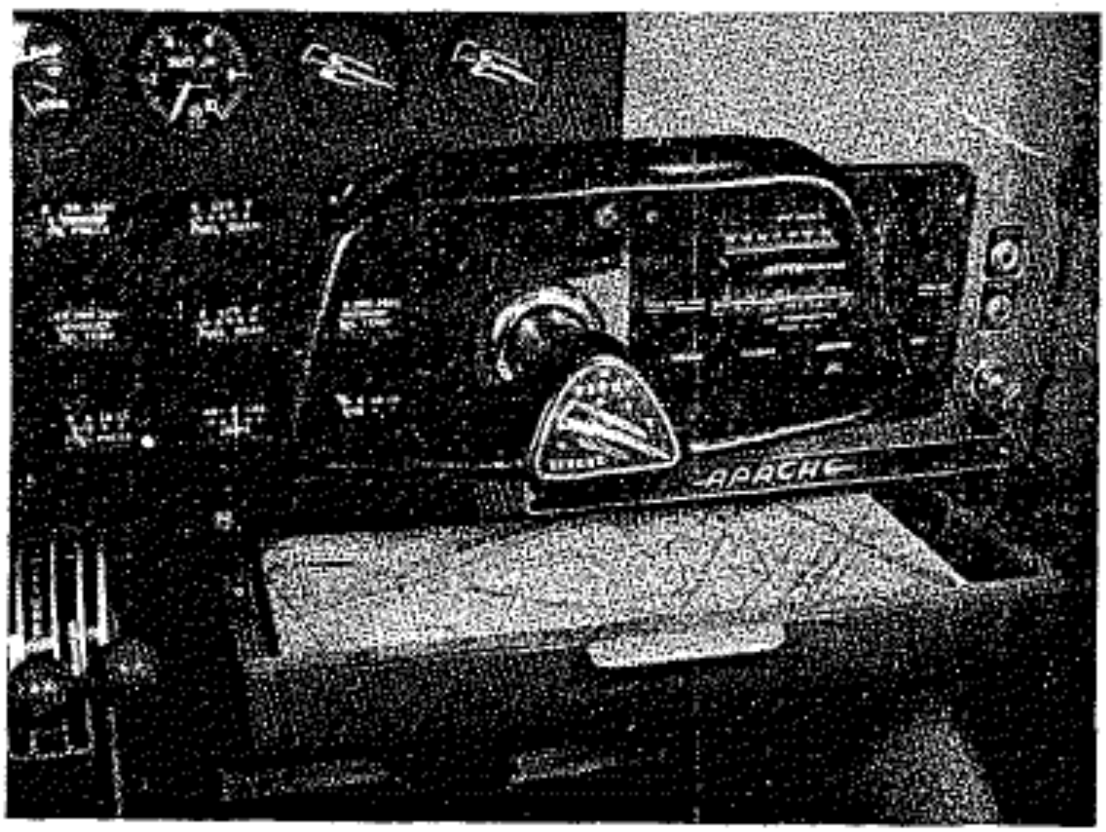


Figure 12

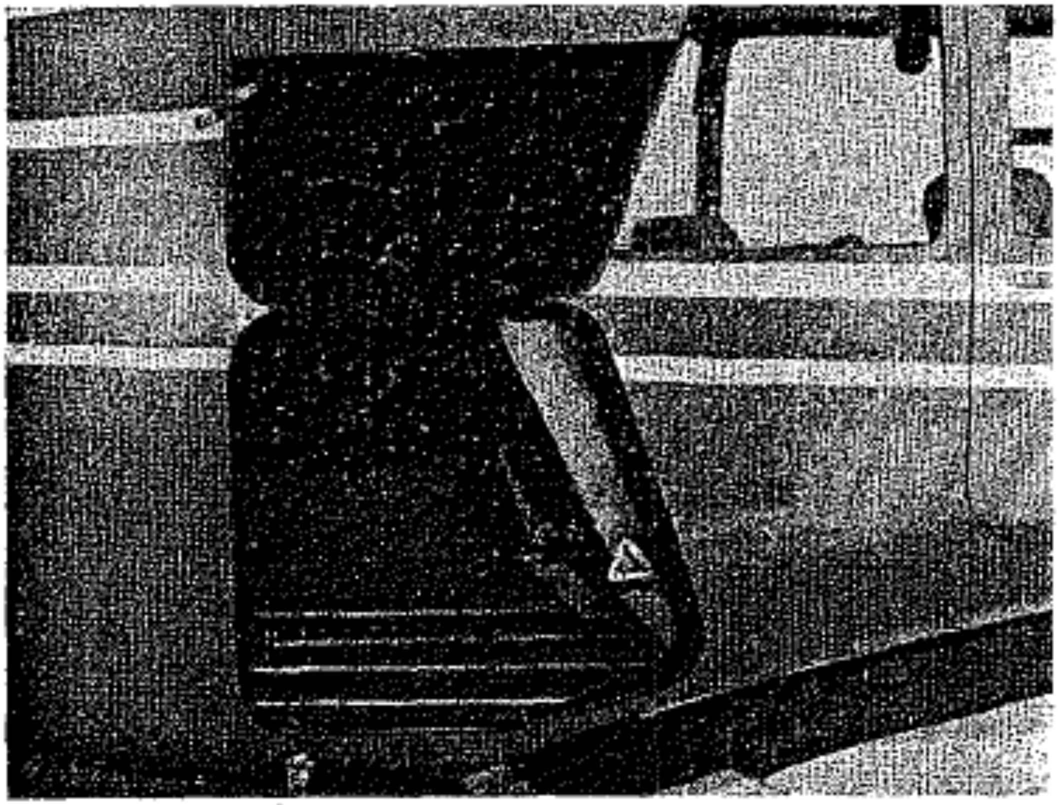


Figure 13

rear seat passenger or attendant. This is accomplished in the same manner as in removing the entire seat, but by taking out only one set of cushions and one canvas.

Arm rests for all seats, coat hangars, ash trays, a cigarette lighter, and a spacious map drawer are all standard on the Apache. The cabin door and baggage doors are equipped with locks operated by the same key. With each Apache are also furnished a tow bar and a detachable mounting step. The tow bar is installed in the baggage compartment when not in use, and the step can be removed for long-trips by removing a bolt under an access plate in the baggage compartment.

In the standard model of the Apache, provisions for radio installations include dual microphone and headset jacks, a microphone and headset mounting bracket, a loud speaker, wiring to these units, and panel space for at least four radio sets.

The Custom model includes the above along with the installation of a group of radio units which are specifically chosen to provide in the Apache all of the most recent radio developments normally desired in this type of aircraft. The Lear ADF-12 gives low frequency range and entertainment bands with a long range Automatic Direction Finder. The Narco Omnigator with 8 channel VHF transmitter provides Omni navigation and primary VHF communications, and the Narco Simplexer with its 12 transmitting frequencies and special tuning frequency locater gives additional and standby VHF communications.

The Omnigator also incorporates a Marker Beacon receiving unit, and VAR and ILS runway localizer receiving features.

The flow of air for cooling or heating the Apache cabin is regulated at the Cabin Air Control Panel, at the bottom of the pedestal, where five separate knobs provide positive control of the volume and temperature of the incoming air. (See Figure 16).

The amount of air entering the cabin is adjusted by use of the two controls on the left side of the panel. The left hand control regulates air flowing to the front seat and the second knob from the left controls air flowing to the rear seat.

The center knob controls the defroster and the two right hand knobs control cold air inlets. The one on the extreme right side, marked Cold Air Inlet—Heater System, adjusts an inlet valve at the air intake near the landing light, letting air into the heater system ahead of the heater. The second knob from the right controls the air flowing from an intake box under the nose to the firewall.

An 18,000 BTU Southwind heater installed in the nose of the Apache furnishes a source of hot air for the cabin and for defrosting the windshield. Heater operation is controlled by an Off—Fan—Low Heat—High Heat switch located under the left control wheel.

To heat the cabin (1) turn the heater switch to High heat or Low heat, as desired, (2) adjust the left hand Cabin Air Control to get the required heat to the front seat, (3) adjust the Rear Seat Control to obtain the required flow to the back of the cabin. The amount of heated air passing to the rear seat area can also be regulated by opening or closing the shutters at the outlets in the floor.

Additional adjustment of the quantity and temperature of the air coming from the heater can be obtained by operating the right hand knob on the Control Panel which regulates the flow of cold air into the heater system. Normally the heater passes air recirculated from the cabin.

To cool the cabin (1) open the Cabin Air Controls on the left side of the panel, (2) open the Cold Air inlets on the right side, as required, (3) adjust the overhead individual Fresh Air vents.

To defrost or defog the windshield (1) turn on the heater in cold weather, or open the right hand Cold Air Inlet in warm weather, (2) adjust the defroster control as required.

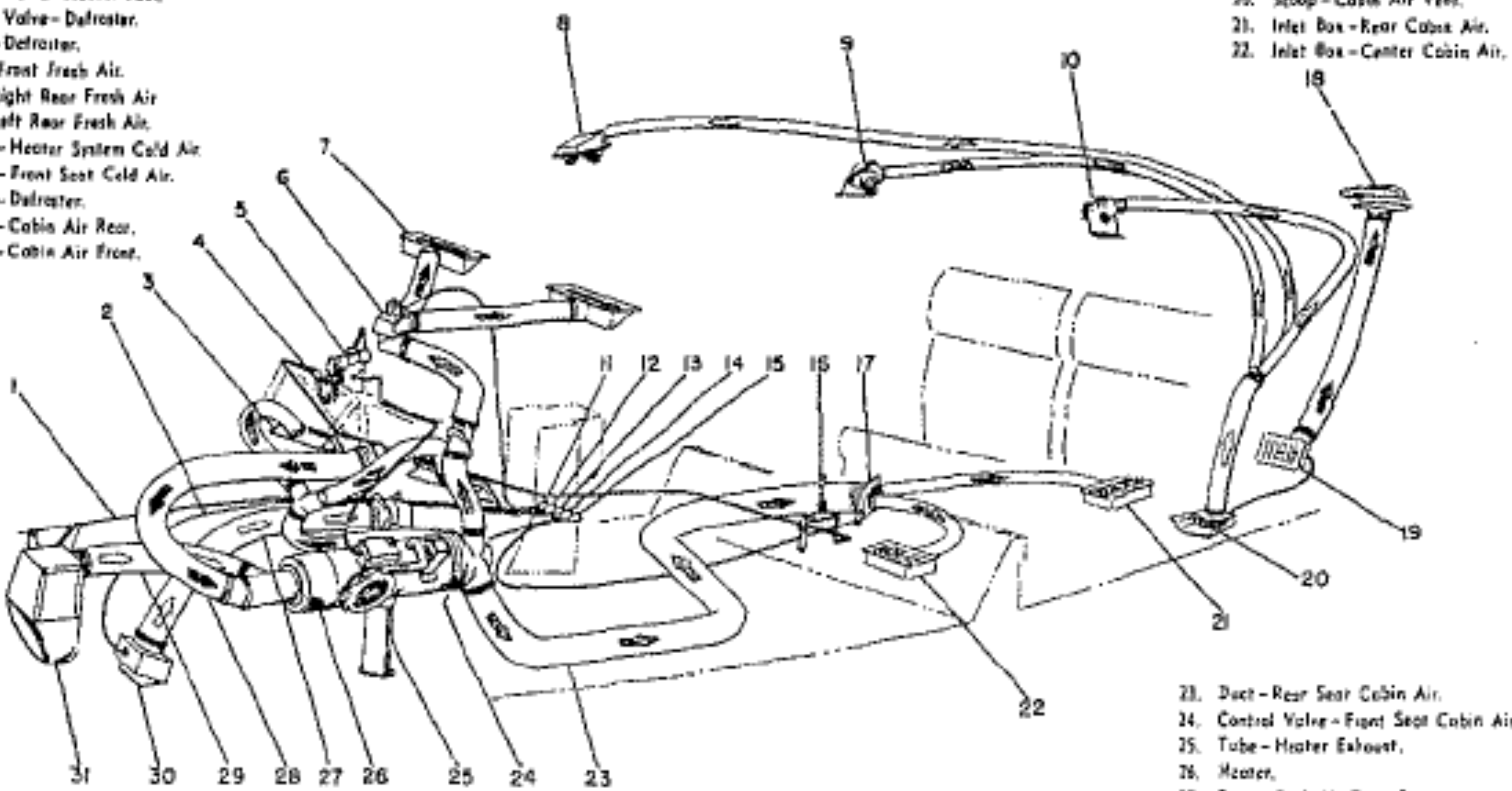
The cabin heater uses gasoline from the left main fuel tank when the fuel crossfeed is off, and from both tanks when the crossfeed is on. Only about one quart of gasoline per hour is used by the heater at maximum output.

To turn the heater on, first ascertain that the heater fuel valve (on the fuel control panel) is on, then move the heater switch to High or Low heat. If the heater does not start promptly, return the heater switch to Fan position for 15 seconds to prime the heater; then upon moving the switch to High heat, the heater should start and continue to operate after 1-1½ minutes of warm-up.

After the heater switch is turned to the Off position, combustion in the heater stops, but the combustion fan and the circulating air fan continue to operate for about two minutes, while the heater cools slowly and purges itself of hot air and fumes. To obtain best service life from the heater components, it is recommended that the heater switch be turned off about two minutes before stopping the engines and shutting off the master switch. This should normally be done during taxiing after landing.

The heater can be used to warm up the cabin before flight by turning on the master switch, the left electrical fuel pump, and the heater switch. The operation of these units takes about 8 amps, and they should not be used in such a way as to run down the battery, making starting difficult.

1. Cable – Cold Air Inlet Box – Heater System.
2. Cable – Cold Air Inlet Box – Front Seat.
3. Heater System Air Inlet – Front Seat.
4. Filter – Heater Fuel.
5. Control Valve – Heater Fuel.
6. Control Valve – Defroster.
7. Outlet – Defroster.
8. Vents – Front Fresh Air.
9. Vent – Right Rear Fresh Air.
10. Vent – Left Rear Fresh Air.
11. Control – Heater System Cold Air.
12. Control – Front Seat Cold Air.
13. Control – Defroster.
14. Control – Cabin Air Rear.
15. Control – Cabin Air Front.
16. Control – Heater Fuel Shut-off.
17. Control Valve – Rear Seat.
18. Exhaust Outlet – Cabin Air.
19. Exhaust Box – Cabin Air.
20. Scoop – Cabin Air Vent.
21. Inlet Box – Rear Cabin Air.
22. Inlet Box – Center Cabin Air.



23. Duct – Rear Seat Cabin Air.
24. Control Valve – Front Seat Cabin Air.
25. Tube – Heater Exhaust.
26. Heater.
27. Duct – Cold Air Front Seat.
28. Duct – Recirculating Air.
29. Duct – Cabin Air Heater System.
30. Box – Cold Air Inlet, Front Seat.
31. Box – Cold Air Inlet, Heater System.

Cold Air.
Heater System Air.
Cabin Air.

Ventilating and Heating
Figure 14

SECTION TWO

OPERATING INSTRUCTIONS

I. PREFLIGHT CHECKS:

The airplane should be given a careful visual inspection prior to flight to ascertain that tires and shock struts are properly inflated, control surfaces are free, fuel tank caps tight, cowling and other openable parts are secure, and no obvious damage exists. Propellers should be examined for nicks, tow bar stowed under the rear seat, and gascolators drained. Upon entering the plane, the pilot should make sure that all controls operate normally, that the landing gear and other controls are in proper positions, and that the main door is firmly secured.

II. STARTING:

Before starting the engine, the pilot should set the parking brake and turn on the master switch and the electric fuel pumps. When the engine is cold, prime three to five strokes, making sure fuel valves are on, cross-feed off, fuel pressures normal and fuel quantity checked. Push mixture controls to full rich, carburetor heat off, and open throttles about one-quarter inch. If the engines are extremely cold, they should be pulled through by hand four to six times.

Next turn all ignition switches on and engage starter on left engine first. After engine starts, idle at 800 to 1000 RPM and start right engine. If battery is low, before starting right engine, run left engine over 1200 RPM to cut in the generator. This will produce extra power for starting the right engine. If the engine does not start in the first few revolutions, open the throttle on that engine while the engine is turning over with the ignition on. When the engine starts, reduce the throttle.

If the above procedure does not start the engine, reprime and repeat the process. Continue to load cylinders by priming or unload by turning the engine over with the throttle open. If the engine still doesn't start, check for malfunctioning of ignition or fuel system.

Priming can be accomplished by pumping the throttle controls, and excessive pumping may over-prime the engines, making starting difficult.

When the engines are warm, do not prime, but turn ignition switches both on before engaging starter. The engines should start after rotating through about four compression strokes.

III. WARM-UP AND GROUND CHECK:

As soon as the engines start, the oil pressures should be checked. If no pressure is indicated within thirty seconds, stop the engine and determine the trouble.

Warm-up the engines at 800 to 1000 RPM for not more than two minutes in warm weather, four minutes in cold weather. If electrical power is needed from the generator, the engines can be warmed at 1200 RPM at which point the generator cuts in. The magnetos should be checked at 1800 RPM, the drop not to exceed 100 RPM. The engines are warm enough for take-off when the throttles can be opened without engine faltering.

Carburetor heat should be checked during the warm-up to make sure the heat control operation is satisfactory and to clear out the carburetor if any ice has formed. It should also be checked in flight occasionally when outside air temperatures are between 20 degrees and 70 degrees to see if icing is occurring in the carburetor. In most cases when an engine loses manifold pressure without apparent cause, the use of carburetor heat will correct the condition.

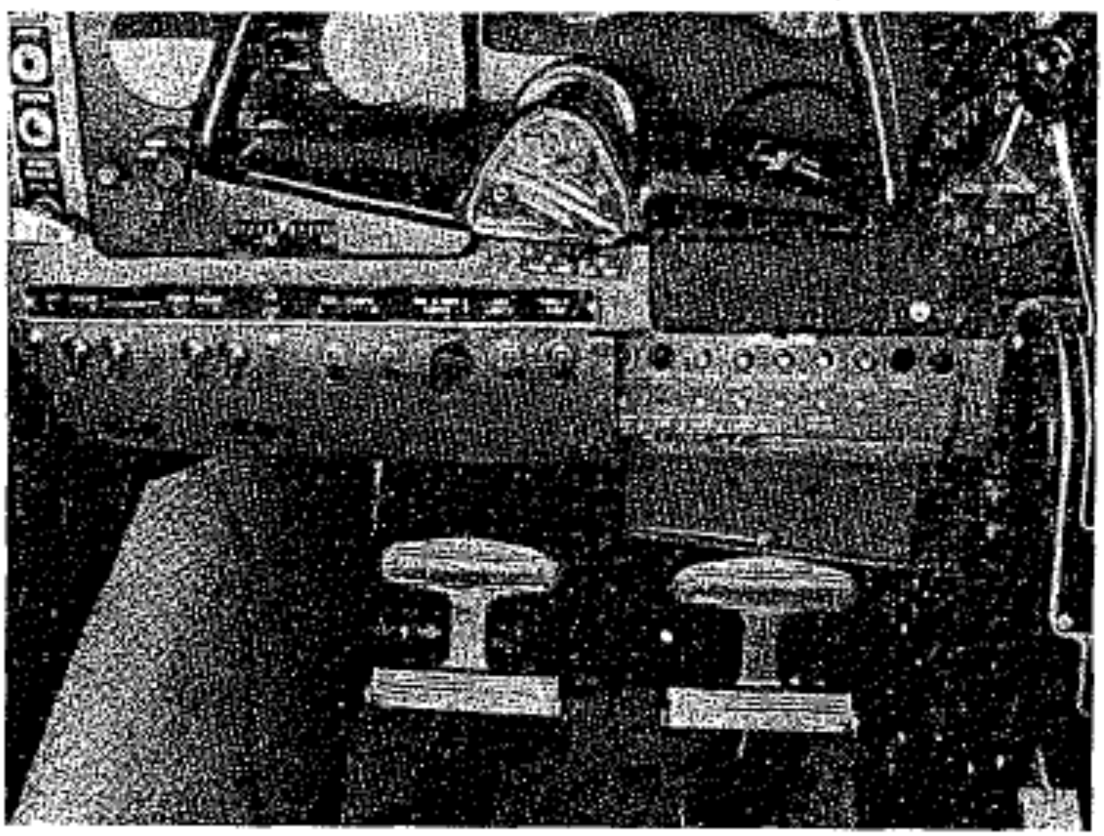


Figure 15

The propeller controls should be moved through their normal ranges during the warm-up to check for proper operation, then left in the full low pitch positions. Feathering checks on the ground are not recommended, because of the excessive vibration caused in the power plant installations.

The electric fuel pumps should be turned off after starting or during warm-up to make sure that the engine driven pumps are operating. Prior to take-off the electric pumps should be turned on again to prevent loss of power during take-off due to fuel pump failure.

IV. TAKE-OFF, CLIMB AND STALLS:

Just before take-off the following should be checked:

1. Controls free.
2. Flaps up.
3. Tabs set.
4. Propellers set.
5. Mixtures rich.

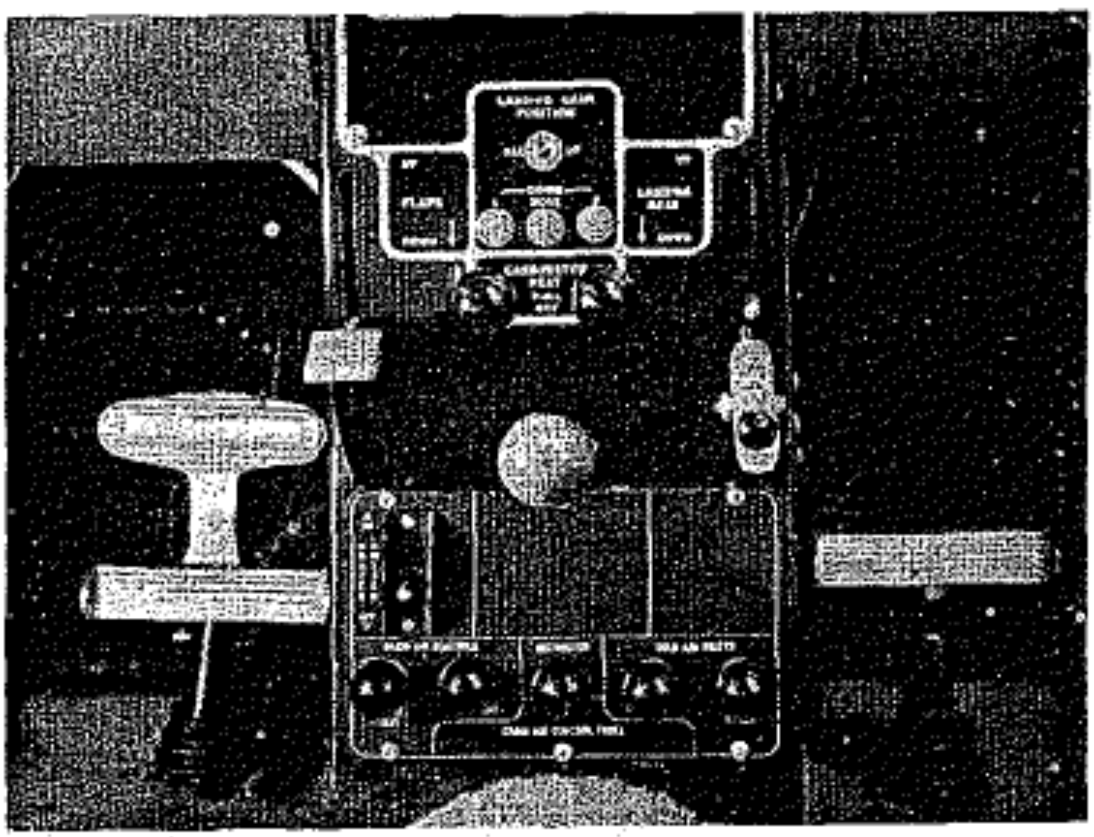


Figure 16

6. Carburetor heat off.
7. Fuel on, crossfeed off.
8. Electric fuel pumps on.
9. Engine gauges normal.

After the take-off has proceeded to the point where a landing can no longer be made wheels-down in the event of power failure, the wheels should be retracted. As the wheels come up, the throttle should be brought back to climbing power, 25″ M. P., and the R. P. M. reduced to 2400. Minimum single engine speed (85 M. P. H.) should be attained as soon as possible. The best rate of climb is obtained at 100 M. P. H., but to give a high forward speed as well as a good rate of climb, a cruising climb speed of 120 M. P. H. is recommended.

The gross weight power off stalling speed of the Apache is 59 M. P. H., with full flaps. The stalling speed increases about 5 M. P. H., with flaps up. All controls are effective at speeds down through the stalling speed, and stalls are gentle and easily controlled.

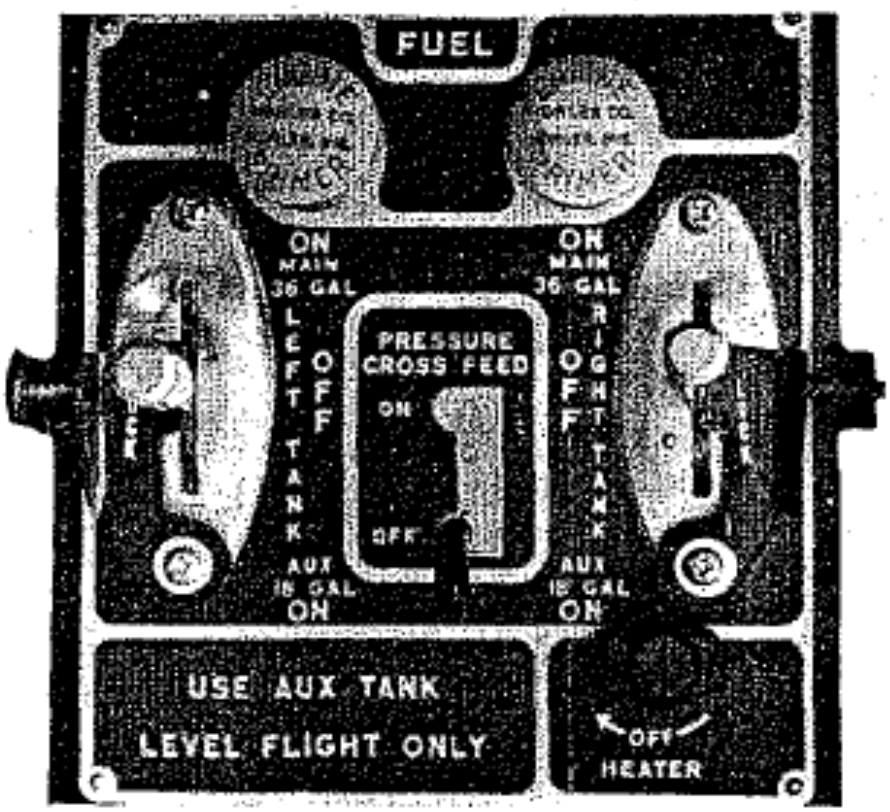


Figure 17

V. CRUISING:

The cruising speed of the Apache is determined by many factors including power setting, altitude, temperature, load, and equipment installed on the airplane.

The normal recommended cruising speed for the custom model is 162 M. P. H. at 9000 feet at 65% power. This power setting is obtained under standard conditions at 2400 R. P. M. and 20.5″ Manifold Pressure. Fuel consumption at this speed approximates 8.1 gallons per hour per engine or 16.3 gallons per hour total. This consumption gives a total cruising range of 4.4 hours or 710 miles.

The optimum cruising speed of the Apache is 170 M. P. H. at 6000 feet at 75% power. 2400 R. P. M. and 23.4 M. P. will give this power setting at that altitude. (See Power and Performance charts for performance at other power settings and altitudes).

Two R. P. M. settings are recommended for cruising, 2100 R. P. M. for moderate power settings, low noise levels, lower fuel consumption and reduced engine wear, or 2400 R. P. M. for higher performance cruising. Any other R. P. M. within the propeller pitch range can be used, up to 2700. However, to avoid undesirable stresses on the propeller and the possibility of detonation in the engine, no Manifold Pressure settings over 25″ should be used with an R. P. M. setting less than 2300.

Use of the mixture control in cruising flight reduces fuel consumption about 10%, according to altitude. The above consumption data is for cruising with mixture leaned. The continuous use of carburetor heat during cruising flight increases fuel consumption. Unless icing conditions in the carburetor are severe, do not cruise with the carburetor heat on. Apply full heat only for a few seconds at intervals determined by icing severity.

VI. APPROACH AND LANDING:

During the approach, the gear can be lowered at speeds under 125 M. P. H., preferably on the downwind leg. Flaps should be lowered in final approach at an airspeed under 100 M. P. H., and the airplane trimmed to a gliding speed of 90 M. P. H. Normally about 12″ M. P. should be maintained to give a reasonable approach angle. R. P. M. should be left at high cruising R. P. M. or approximately 2400. This propeller setting gives ample power for an emergency go-around and will prevent overspeeding of the engines if the throttle is advanced sharply.

The amount of flap used during landings and the speed of the airplane at contact should be varied according to the wind, the landing surface, and other factors. It is always best to contact the ground at the minimum practicable speed consistent with landing conditions.

Normally, the best technique for short and slow landings is to use full flap and a small amount of power, holding the nose up as long as possible before and after ground contact. In high wind conditions, particularly in strong crosswinds, it may be desirable to approach the ground at higher than normal speeds, with half or no flaps.

Landing Check List:

1. Mixtures rich.
2. Props at high cruising R. P. M.

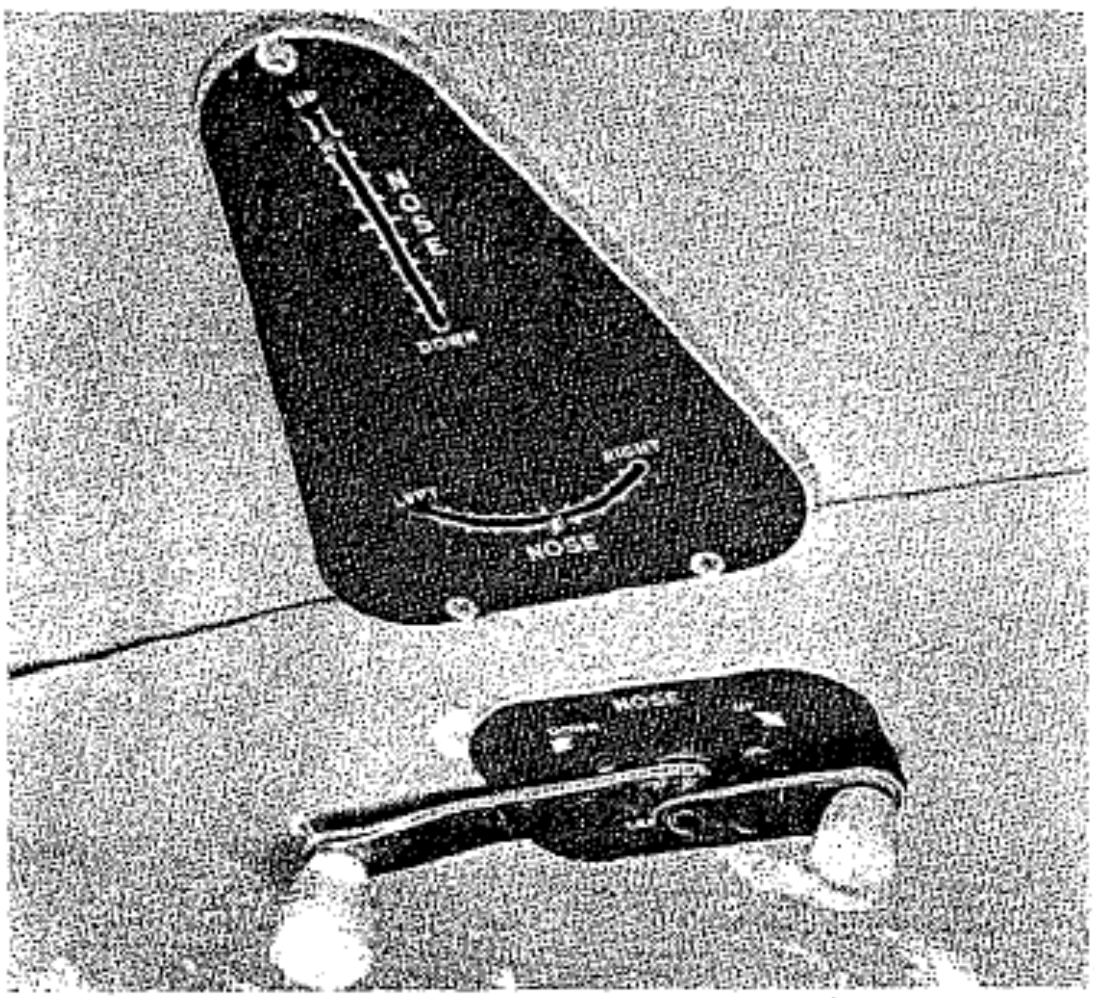


Figure 18

3. Carburetor heat cold (unless icing conditions exist).
4. Electric fuel pumps on.
5. Landing gear down (Under 125 M. P. H.), check green indicator lights on, landing gear warning horn off, and flashing red light in landing gear control handle off.
6. Flaps full down or as desired (under 100 M. P. H.).

VII. STOPPING THE ENGINES:

During the landing roll, the flaps should be raised, the heater turned off, and the electric fuel pumps off. After parking, the radios should be turned off, and the engines stopped by pulling the mixture controls aft to idle cut-off. The throttle should be left full aft to avoid engine vibration while stopping. Then the ignition and master switches should be turned off, and the parking brakes set.

VIII. EMERGENCY PROCEDURES:

1. ENGINE FAILURE:

An engine failure on the Apache during cruising flight presents very minor operational problems. As the engine loses power, a slight yaw in the direction of the dead engine will occur, which can be corrected easily with the rudder or the rudder trim tab. While the plane is slowing down to the single engine cruising speed of about 110 M. P. H. at low altitudes and at moderate power settings, the propeller on the dead engine should be feathered by pulling the throttle to idling position, and the prop pitch control back fully; then the mixture should be set at idle cut-off, and the ignition off. Best single engine performance will be obtained with the dead engine wing held up about 3 degrees higher than level to help counteract the tendency to turn in that direction.

If the left engine has failed, the generator and hydraulic pump will not be functioning. Enough power will remain in a well-charged battery to operate the electrical equipment in the airplane for a considerable period, but conservation of the battery power by turning off all unneeded equipment should be practiced. If it is necessary to lower the landing gear or flaps with the left engine dead, the hydraulic hand pump located in the pedestal is used.

If the right engine fails, the vacuum pump will no longer function, and the Directional Gyro and Artificial Horizon will not operate. The electric Turn and Bank will then be used for instrument flight.

2. FEATHERING:

The Hartzell feathering propellers can only be feathered while the failed engine is rotating, and not if the engine stops completely, because the centrifugal force due to rotation is necessary to hold out a stop-pin which keeps the propeller from feathering each time the engine is stopped on the ground. Therefore, if an engine freezes up, it will not be possible to feather its propeller. In that case, single engine flight can be maintained with the dead engine propeller unfeathered, although a noticeable decrease in single engine performance will take place.

If an engine failure occurs during the take-off run, the power on the good engine should be cut and the airplane stopped straight ahead. If it occurs after leaving the ground, but with sufficient landing area still ahead, a landing should be effected immediately. If no landing can be made directly after the failure, the following steps should be followed:

(1). Apply full power to good engine.

(2). Feather dead engine.

(3). Retract landing gear and flaps, if extended (using hand pump if left engine is out). If enough altitude has been reached before the failure occurred, or if performance is satisfactory for reaching the airport with the gear extended, leave the landing gear in the down position.

(4). Maintain a best climb airspeed of 95 M. P. H., 85 M. P. H. minimum.

(5). Trim directionally with rudder trim.

(6). As the airport is reapproached for the landing, reduce power on the good engine and gradually retrim with the rudder tab. When it is obvious that the airport can be reached easily, lower the landing gear and check the indicators to make sure it is down and locked. Maintain a little extra altitude and speed during the approach, keeping in mind that the landing should be made right the first time, and that either undershooting or overshooting may require the use of full power on the good engine, making control more difficult. Lower the flaps at the last moment before landing.

3. UNFEATHERING:

It is not recommended that propeller feathering and unfeathering be practiced on the ground because of the excessive vibration that occurs in the engine installation. In flight, feathering should be practiced only to familiarize the pilot with the proper procedures. To unfeather a propeller in flight, the following technique is recommended:

(1). Turn ignition switches on dead engine off.
(2). Mixture at idle cut-off.
(3). Throttle ⅛th open.
(4). Prop control at cruising setting or same as other propeller control.
(5). Depress starter button until propeller windmills of its own accord.
(6). Move mixture control to rich, turn ignition switch on.
(7). Move throttle full back to idle, to allow prop to unfeather smoothly and minimize vibration.
(8). Adjust engine controls for a slow warm-up if the engine is very cold, then adjust to cruising power when engine is warm. If the engine cannot be rotated sufficiently with the starter to obtain windmilling, unfeathering can be accomplished by putting the ignition switches on and mixture to rich before starting to unfeather. In this case, the operating engine rather than the starter will rotate the propeller so as to move it into lower pitch positions.

4. EMERGENCY LANDINGS:

The Apache is designed to take gear-up emergency landings without extensive damage to the structure of the airplane. All three wheels protrude about one-third of their diameter when retracted, and structure is provided to take minor loads in this condition. On a wheels-up landing, since the main wheels are forward of their down position, the airplane will tend to settle down at the rear when the landing speed is decreasing, and full forward control wheel pressure should be used to hold the tail up as long as possible. The flaps should not be extended because they will contact the ground first, causing damage to the flap and the wing.

A wheels-up landing should only be made during an emergency when the surface is too soft or too rough to permit a gear-down landing, or when an emergency water landing is necessary.

5. EMERGENCY LANDING GEAR EXTENSION:

If the engine driven hydraulic pump fails, or the left engine driving the pump, extension of the landing gear or flaps is accomplished by supplying hydraulic pressure with the manual hydraulic pump. With the gear or flap control in the desired position, 30-40 strokes of the pump handle will raise or lower the landing gear, and 12 strokes will raise or extend the flaps.

In the event of hydraulic system failure caused by a line breaking or the selector valve malfunctioning, the landing gear can be lowered by using the Emergency Gear Extender. The control for the Extender is located beneath a small cover plate under the pilot's seat. When this control is pulled, CO_2 flows from a cylinder under the floorboards through separate lines to shuttle valves adjacent to the gear extension cylinders. The gas pressure opens the shuttle valves, allowing CO_2 to enter the gear cylinders, extending the gears.

The landing gear control on the selector valve must be in the *down* position when the gear extender control is pulled, in order to allow the gear to be extended properly.

The Emergency Gear Extender should only be used when all other means of lowering the landing gear have failed, and only when the gear can be left down for landing. When the Extender has been used, the landing gear must not be retracted or actuated hydraulically in any way until the extension system has been returned to its normal condition.

IX. GROUND HANDLING AND MOORING:

The Apache should be moved on the ground with the aid of the nose wheel steering bar provided with each plane and installed in the baggage compartment.

Tie down ropes for mooring the airplane can be fastened to the wing tie down rings and at the tail skid.

The aileron and elevator controls should be secured by means of the safety belt or control locks to prevent control surface damage. The rudder is held in position by its connections with the steerable nose wheel, and does not need to be secured except under unusually high wind conditions.

X. WEIGHT AND BALANCE:

For weight and balance data, see the Weight and Balance Form supplied with each airplane, which gives the exact weight of the airplane and permissible center of gravity conditions.

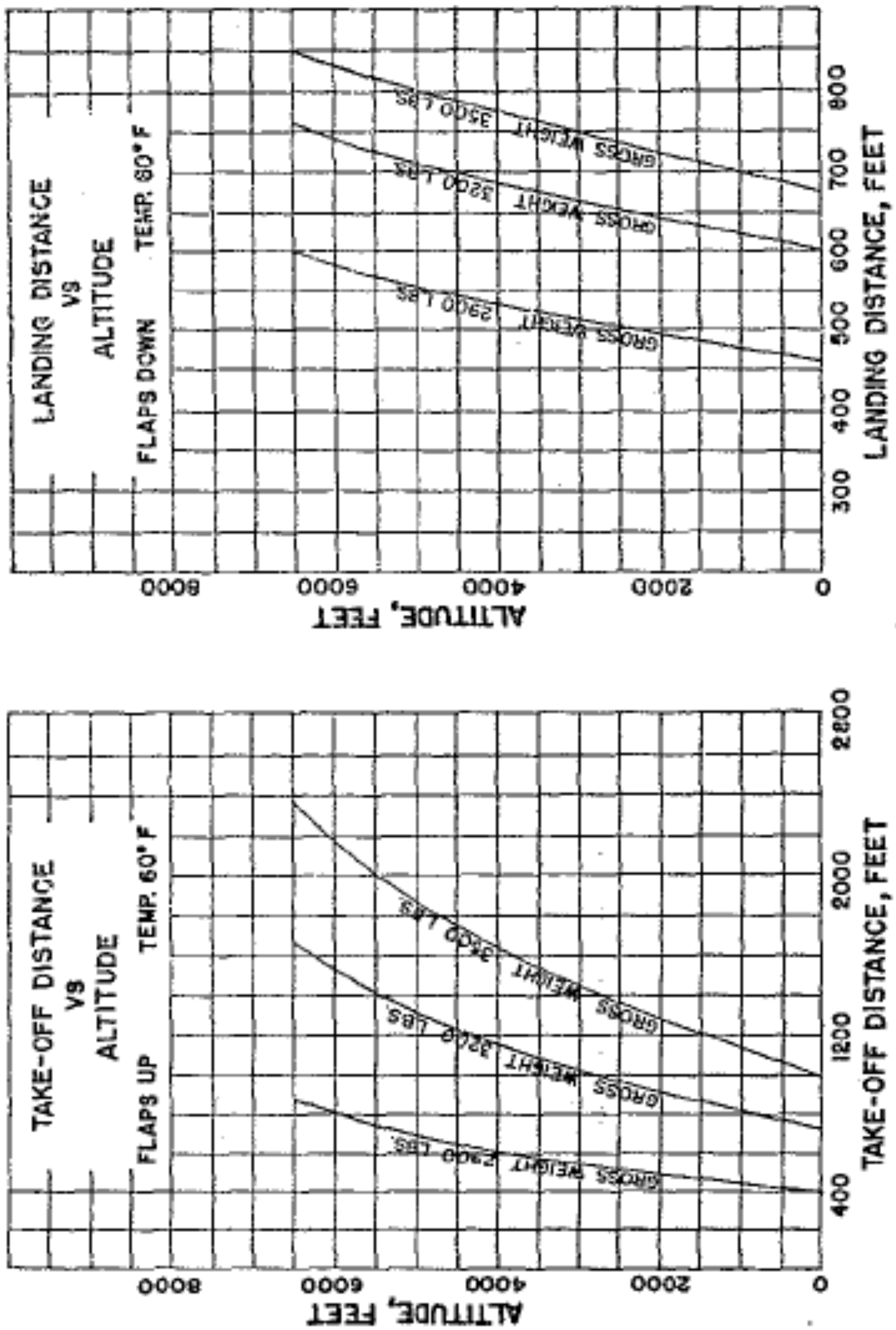

LANDING DISTANCE
VS
ALTITUDE
FLAPS DOWN
TEMP. 60° F
GROSS WEIGHT 3500 LBS
GROSS WEIGHT 3200 LBS
GROSS WEIGHT 2900 LBS
ALTITUDE, FEET
0
2000
4000
6000
8000
300
400
500
600
700
800
LANDING DISTANCE, FEET
TAKE-OFF DISTANCE
VS
ALTITUDE
FLAPS UP
TEMP. 60° F
GROSS WEIGHT 3500 LBS
GROSS WEIGHT 3200 LBS
GROSS WEIGHT 2900 LBS
ALTITUDE, FEET
0
2000
4000
6000
8000
400
1200
2000
2800
TAKE-OFF DISTANCE, FEET

Figure 19

38

SECTION THREE

PERFORMANCE

I. TAKE-OFF, CLIMB AND LANDINGS:

The take-off run of the Apache at a gross weight of 3500 lbs. is 990 feet on a hard runway, with no wind and under standard sea level atmospheric conditions. The length of the take-off run varies according to the weight and air conditions as shown on the Take-off Distance Chart, Figure 7.

Since acceleration is so rapid on the Apache, and the take-off distance very short, it may be desirable not to use full R. P. M. on take-offs on any except the shortest runways. On average runways, 2400 R. P. M. gives a very satisfactory take-off without the additional noise and engine wear that results at 2700 R. P. M., the maximum continuous rated R. P. M. of the engine. During the take-off, if full power is needed for some reason, such as failure of one engine, the power can very quickly be applied by pushing the propeller controls forward.

The airspeed for maximum rate of climb at gross load under standard conditions is 100 M. P. H. This indicated speed will decrease with altitude about 1 M. P. H. per 1000 feet. The service ceiling with both engines operating is 18,500 feet. (See Figure 20 for rate of climb and ceiling).

The landing roll chart (Figure 8) shows how the roll distance varies with conditions. At gross weight with full flaps, no wind, on a hard runway, and at standard conditions, the minimum landing roll is 670 feet.

II. CRUISING:

Figure 21 shows the cruising speed of the Apache at gross weight, at various standard altitudes and percentages of power. 65% of power is recommended for normal cruise, and a maximum of 75% of power at 2400 R. P. M. for fast cruise.

For economy cruising at gross load, 55% of power will give the best results. At lower weights smaller percentages of power may be more economical, and the best power settings can readily be computed with the Lycoming Engine Power and Fuel Consumption computer, supplied with each airplane.

The most economical cruising will be obtained at the lowest R. P. M. at which the desired percent of power can be obtained. Low R. P. M.'s are also desirable to reduce propeller noise and

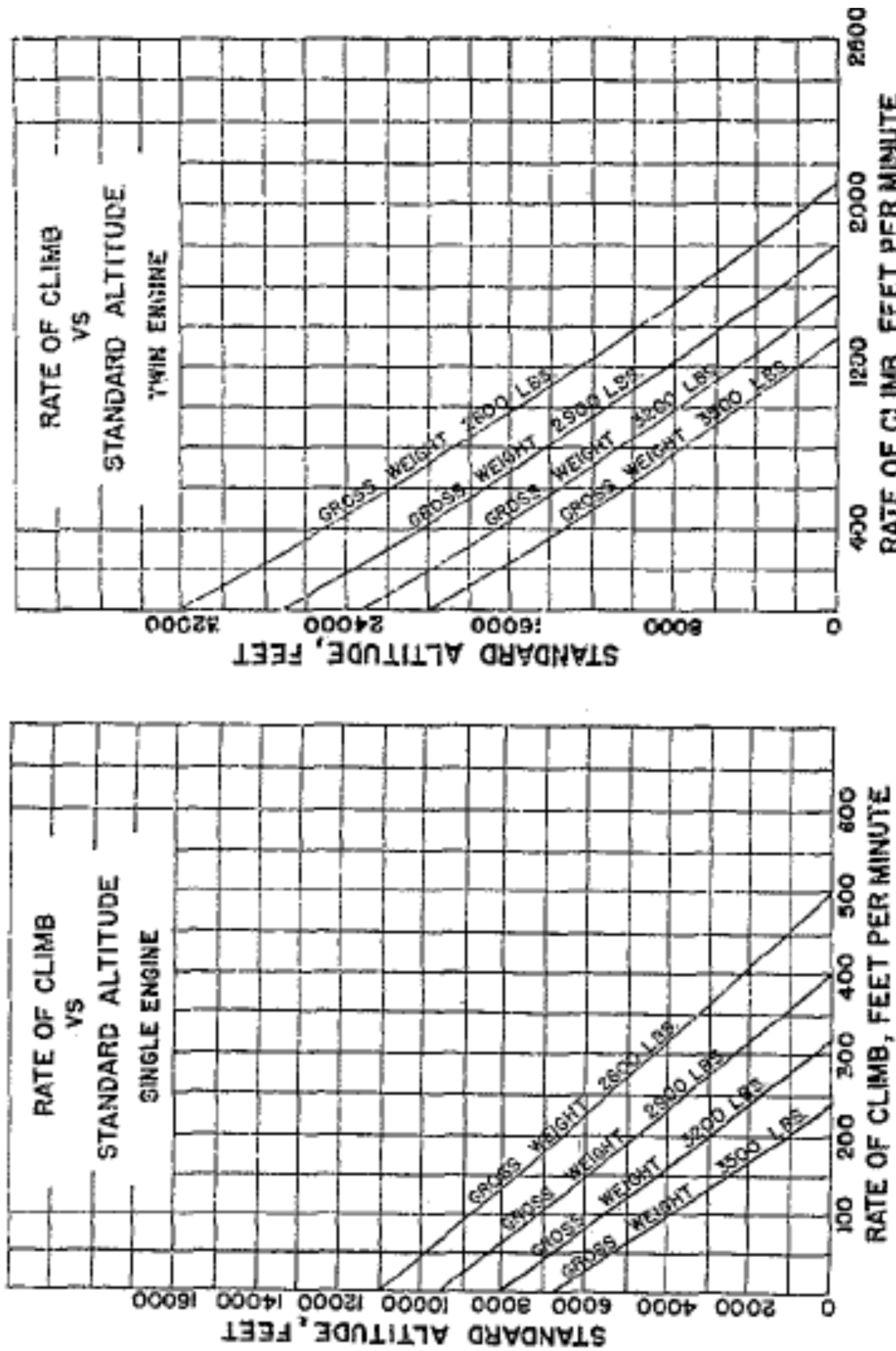
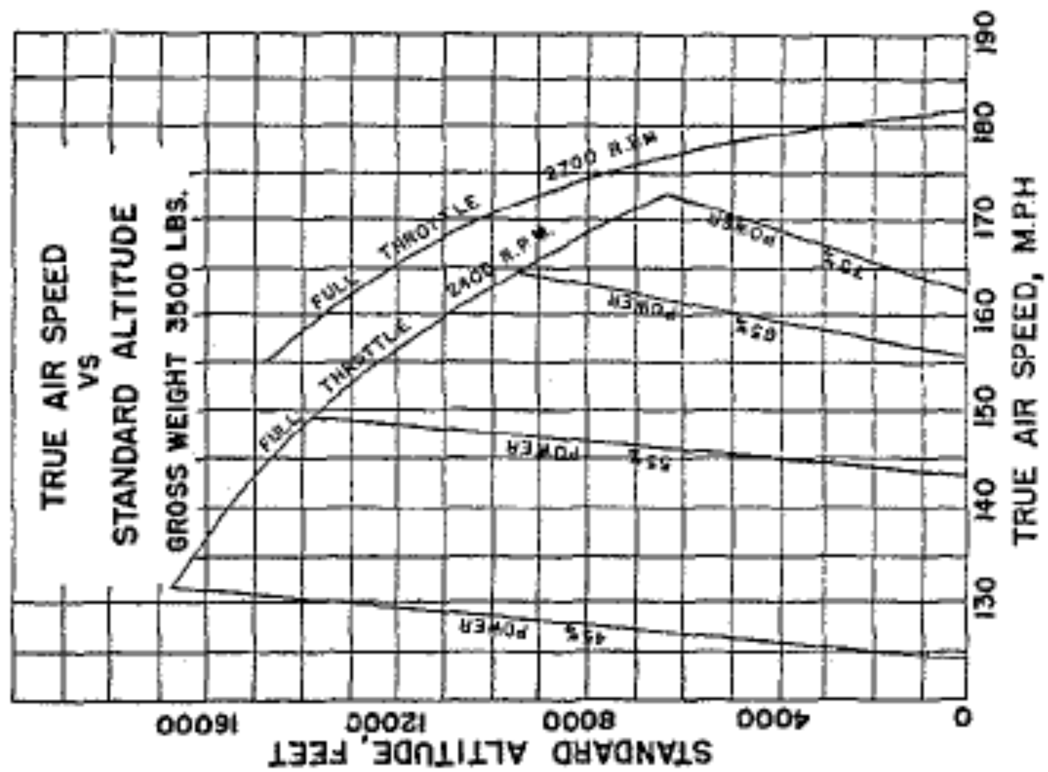

RATE OF CLIMB
VS
STANDARD ALTITUDE
TWIN ENGINE
GROSS WEIGHT 2600 LBS
GROSS WEIGHT 2900 LBS
GROSS WEIGHT 3200 LBS
GROSS WEIGHT 3500 LBS
STANDARD ALTITUDE, FEET
0
8000
16000
24000
32000
RATE OF CLIMB, FEET PER MINUTE
400
1200
2000
2800
RATE OF CLIMB
VS
STANDARD ALTITUDE
SINGLE ENGINE
GROSS WEIGHT 2600 LBS
GROSS WEIGHT 2900 LBS
GROSS WEIGHT 3200 LBS
GROSS WEIGHT 3500 LBS
STANDARD ALTITUDE, FEET
0
2000
4000
6000
8000
10000
12000
14000
16000
RATE OF CLIMB, FEET PER MINUTE
100
200
300
400
500
600

Figure 20


TRUE AIR SPEED
VS
STANDARD ALTITUDE
GROSS WEIGHT 3500 LBS.
FULL THROTTLE 2700 R.P.M.
FULL THROTTLE 2400 R.P.M.
75% POWER
65% POWER
55% POWER
45% POWER
130
140
150
160
170
180
190
TRUE AIR SPEED, M.P.H
0
4000
8000
12000
16000
STANDARD ALTITUDE, FEET

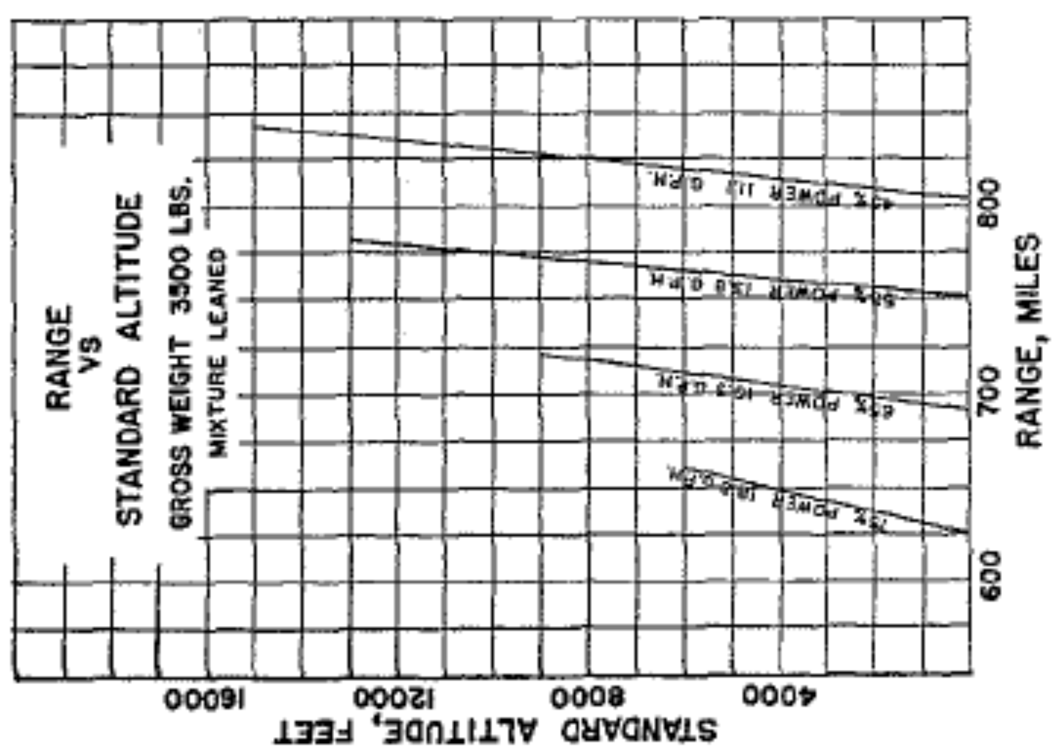

RANGE
VS
STANDARD ALTITUDE
GROSS WEIGHT 3500 LBS.
MIXTURE LEANED
45% POWER
55% POWER
65% POWER
75% POWER
600
700
800
RANGE, MILES
4000
8000
12000
16000
STANDARD ALTITUDE, FEET

Figure 21

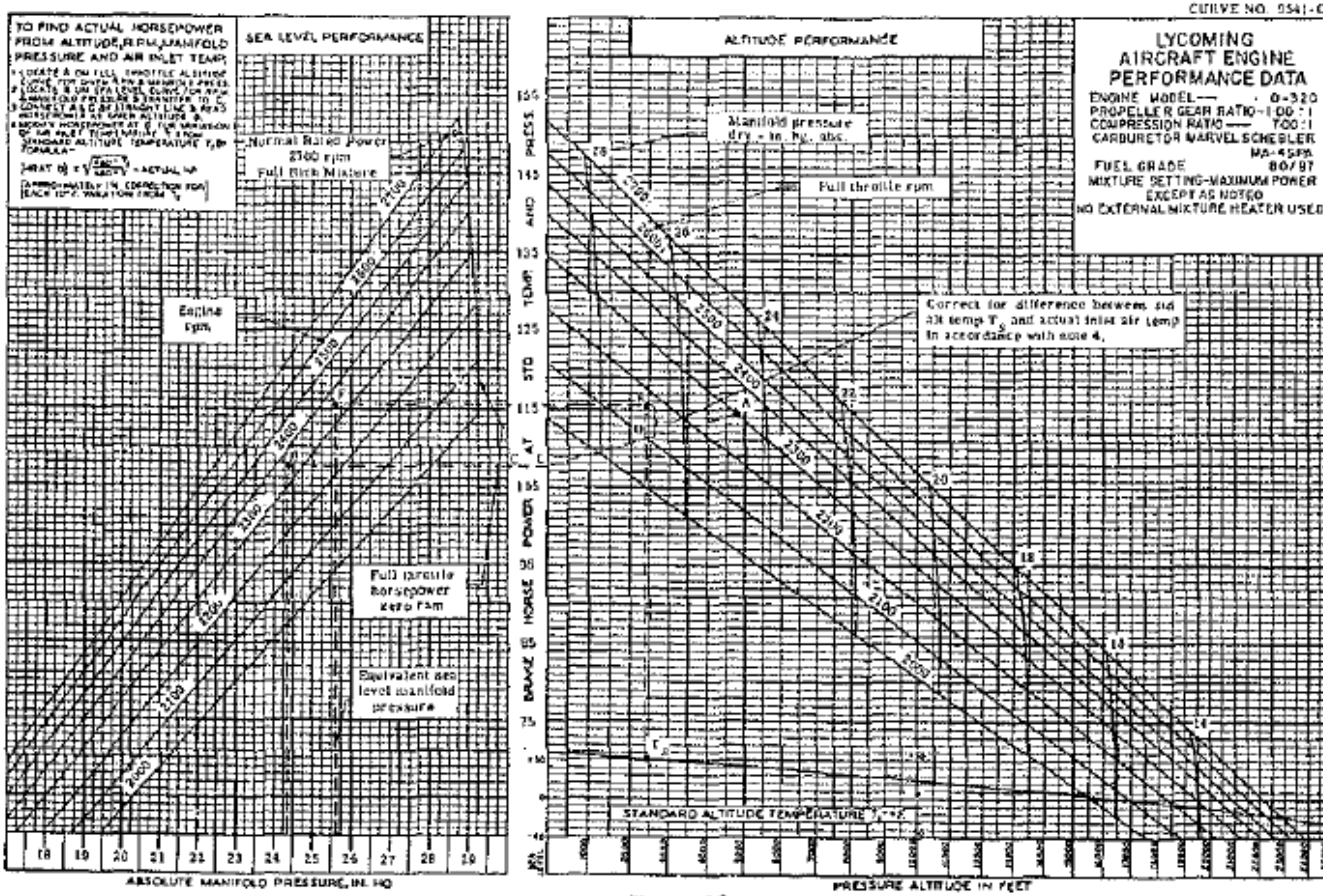

TO FIND ACTUAL HORSEPOWER FROM ALTITUDE, R.P.M., MANIFOLD PRESSURE AND AIR INLET TEMP.
SEA LEVEL PERFORMANCE
Normal Rated Power
2700 rpm
Full Rich Mixture
Engine rpm
Full throttle horsepower zero ram
Equivalent sea level manifold pressure
ABSOLUTE MANIFOLD PRESSURE, IN. HG
18
19
20
21
22
23
24
25
26
27
28
29
BRAKE HORSE POWER AT STD TEMP AND PRESS
ALTITUDE PERFORMANCE
CURVE NO. 9541-C
LYCOMING
AIRCRAFT ENGINE
PERFORMANCE DATA
ENGINE MODEL — O-320
PROPELLER GEAR RATIO — 1.00 : 1
COMPRESSION RATIO — 7.00 : 1
CARBURETOR MARVEL SCHEBLER MA-4SPA
FUEL GRADE 80/87
MIXTURE SETTING—MAXIMUM POWER EXCEPT AS NOTED
NO EXTERNAL MIXTURE HEATER USED
Manifold pressure dry - in. hg. abs.
Full throttle rpm
Correct for difference between std alt temp T_s and actual inlet air temp in accordance with note 4.
STANDARD ALTITUDE TEMPERATURE T_s - °F.
PRESSURE ALTITUDE IN FEET

Figure 22

engine wear. 2100 R. P. M. is recommended as an all-around low power cruise setting. However, when the R. P. M. is below 2300, no Manifold Pressures exceeding 25 inches should be used, because higher throttle settings may impose undesirable stresses on the propeller.

III. SINGLE ENGINE PERFORMANCE:

The important factors in obtaining single-engine performance are gross weight, density altitude, power output on the good engine, and piloting technique. At maximum gross weight the single engine ceiling of the Apache is 6750 feet on the critical or right engine. The ceiling increases markedly as the flying weight is decreased.

In reaching the ceilings shown on the single engine chart, the operating engine is run at maximum obtainable power, leaned out, with full throttle and 2700 R. P. M. Usually it will be unnecessary to use full power to obtain and hold the desired altitude, and at medium altitudes, a 75% power setting will produce an indicated cruising airspeed of about 110 M. P. H. At 110 M. P. H. and 75% power, gasoline consumption and cruising range (about 12 miles per gallon at 9.3 gallons per hour) may be better than that at normal twin-engine cruising settings, depending on altitude and other variables.

SECTION FOUR

GENERAL MAINTENANCE

I. LEVELING AND RIGGING:

Leveling the Apache for purposes of reweighing or rigging is accomplished as follows:

1. Partially withdraw the two machine screws located on the side of the fuselage under the right stabilizer. These screws are leveling points, and the airplane is longitudinally level when a level placed on the heads of the screws indicates level.

2. To put the airplane in a longitudinally level position, either on the scales for weighing purposes, or on the floor for rigging checks, deflate the nose wheel tire, or if necessary the nose wheel oleo strut, until the proper position is reached.

3. To level the airplane laterally, place a bubble-protractor on a straight-edge held along the front spar on the under surface of the wing. Raise or lower the wing by pushing up or down on the tip until five degrees of dihedral is indicated on the pro-

Figure 23

tractor. The smooth, easy action of the landing gear oleo units makes it possible to position the wing laterally with very little effort. After checking the first wing at five degrees dihedral, the opposite wing should also be checked to make sure it has equal dihedral.

RIGGING INSTRUCTIONS:

Although the fixed flight surfaces on the Apache obviously cannot be adjusted in position for rigging purposes, it may be necessary on occasion to check the positions of these surfaces. The movable control surfaces, with the exception of the flaps, all have adjustable stops, as well as adjustments on their cables or push-pull connections, so that their range of movement can be altered. The positions and travels of the various surfaces are as follows:

1. Wings: 5° dihedral, washout 1° in 70″ of distance along the front spar. (Total washout approximately 2°).
2. Stabilizer: No dihedral—both stabilizer main spars should have identical relationship to horizontal. Incidence is 1° up in relation to horizontal.
3. Fin: Should be vertical and in line with centerline of fuselage.
4. Ailerons: Travel—30° up, 15° down.
5. Flaps: Travel—50° down.
6. Elevators: Travel—20° up, 15° down.
7. Rudder: Travel—30° left and right.

For the purposes of adjusting the lateral trim on the Apache, aileron tabs are incorporated on both ailerons. These tabs can be bent to position the aileron in flight, changing the lateral trim as desired.

II. TIRE INFLATION:

For maximum service from the tires, keep the Apache main wheels inflated to 35 lbs. and the nose wheel to 27 lbs. Reverse the tires on the wheels, if necessary, to produce even wear. All Apache wheels and tires are balanced before original installation, and the relationship of tire, tube and wheel should be maintained upon reinstallation. Out-of-balance wheels can cause extreme vibration in the landing gear during take-off and landing. In the installation of new components, it may be necessary to rebalance the wheels with the tires mounted.

III. BATTERY SERVICE:

Access to the 12-volt, 33-ampere hour battery is obtained by removing a quickly detachable access plate on the right side of the nose section. The battery is installed in a sealed stainless steel box, opened by removing wing nuts. The box has a plastic drain tube which is normally closed off with a clamp and which should be opened occasionally to drain off any accumulation of liquid.

The battery should be checked frequently for proper fluid level, but must not be filled above the baffle plates. All connections must be clean and tight.

If the battery is not up to proper charge, recharge starting with a charging rate of 4 amps and finishing with 2 amps. Quick charges are not recommended.

IV. BRAKE SERVICE:

The brake system is filled with Univis No. 40 (petroleum base) hydraulic brake fluid. This should be checked at every 100 hours inspection and replenished when necessary.

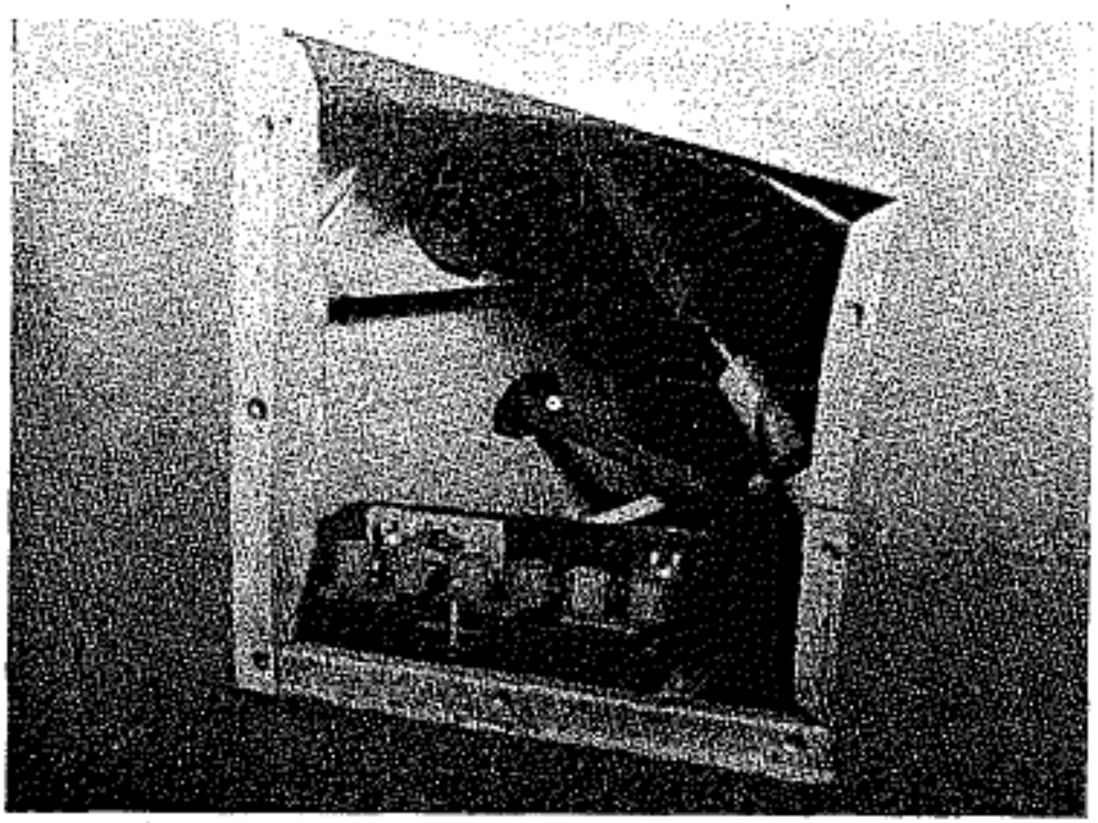
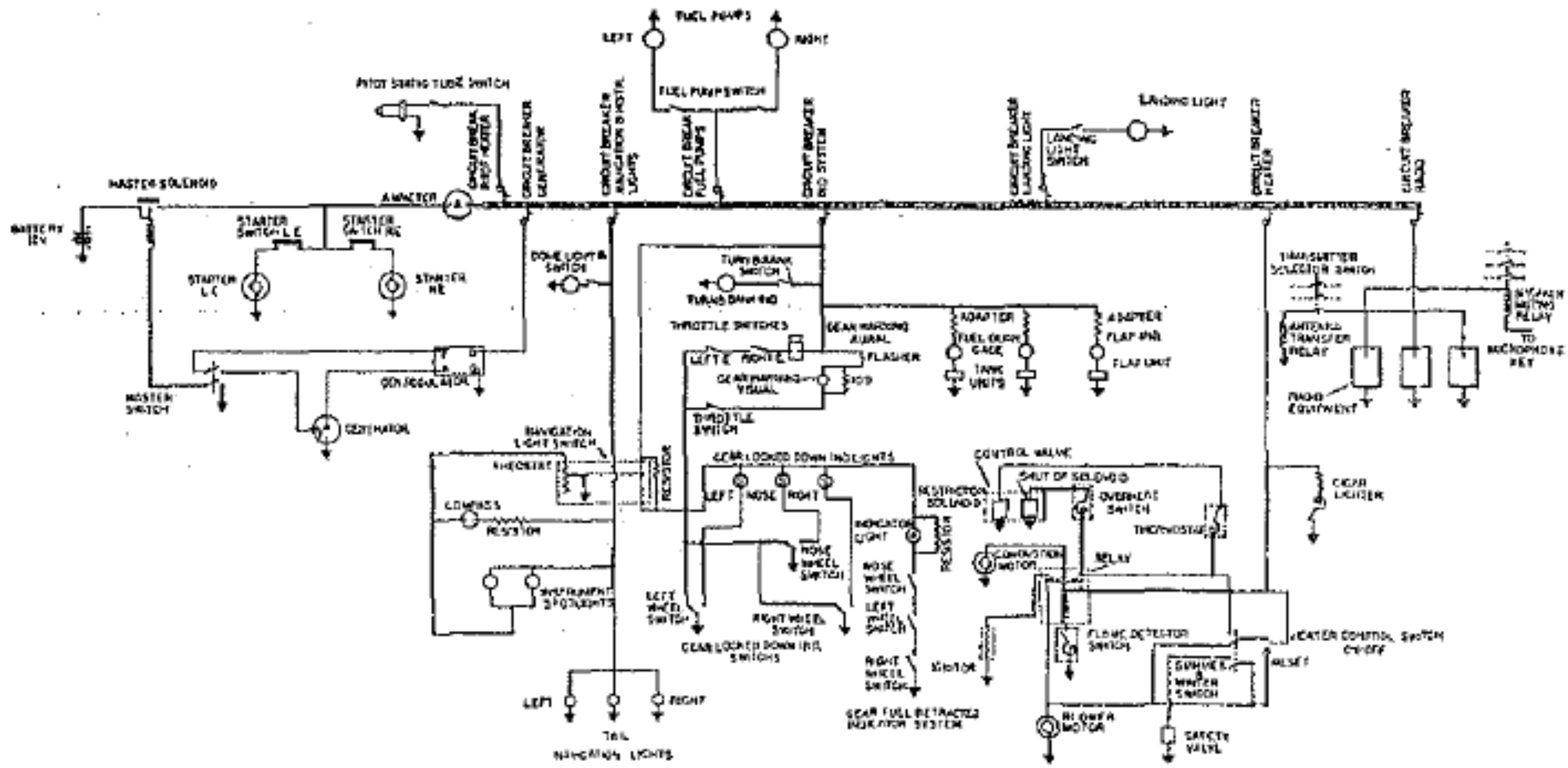


Figure 24



Electrical System

Figure 25

Do not use vegetable base brake fluids when refilling the system. When it is necessary to add fluid, remove the left nose access panel, exposing the brake reservoir. Then add fluid to the reservoir, bringing the fluid to the indicated level.

If it is necessary to bleed the brake system to get air out of the lines, fluid should be added under pressure at the bottom of the system at the bleeder attachment. This attachment is on the brake adjustment valve, installed in the brake line near the wheel. The fluid entering from the bottom flows through the lines to the cylinders, and through the cylinders to the reservoir.

No adjustment of the brake clearances is necessary on the Apache brakes. If after extended service the brakes become less effective, the brake shoe segments can be easily replaced as follows: Remove the wheels to expose the brake shoe blocks, then slip the blocks from their retainer clips with a screwdriver. Replace with new brake segments and reinstall wheels.

If braking action requires too much movement of the toe pedal, although the brake blocks are not excessively worn and the brake

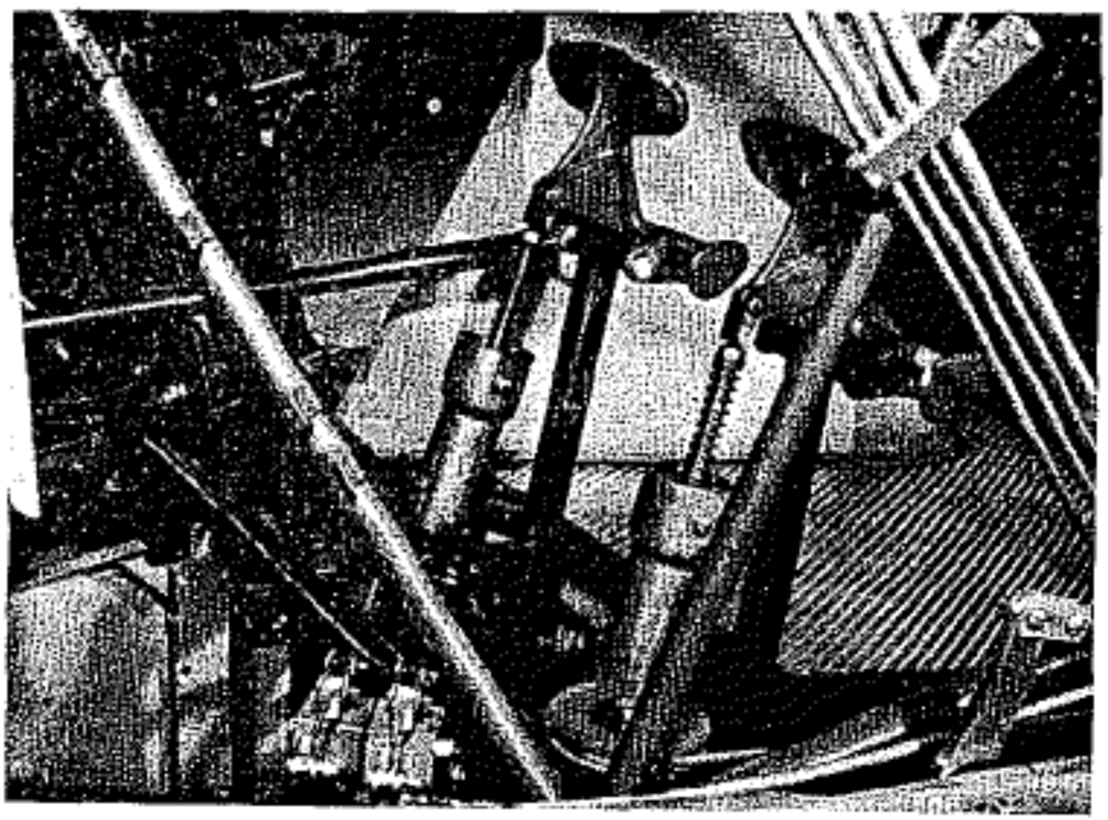


Figure 26

system is full of fluid, this condition can be corrected by an adjustment of the Goodrich brake adjustment valves. To make this adjustment, first jack the gear up so that the wheel can be turned. Then loosen the lock nut on the valves and turn the adjustment caps clockwise as far as possible. When pressure is applied at the brake pedal, this will cause fluid to be locked in the brake expander tubes under pressure. Then back off the adjustment caps until the wheel just turns freely. This position of the valve maintains an initial pressure and amount of fluid in the brake expander tube so that less fluid must be forced down from the cylinder and less toe movement is therefore required.

Main wheels are quickly removed by taking off the hub cap, extracting the cotter pin from the hub nut on the axle, and unscrewing the nut. The wheel can then be pulled freely from the axle. The nose wheel is removed by taking off the hub nut and withdrawing the axle bolt, the axle retainer cups, and the axle from the nose wheel fork.

Tires are dismounted from the wheels by deflating the tube, then removing the wheel through bolts, allowing the wheel halves to be separated. In reassembling the wheels, care should be taken to torque the nuts properly according to instructions on the wheels.

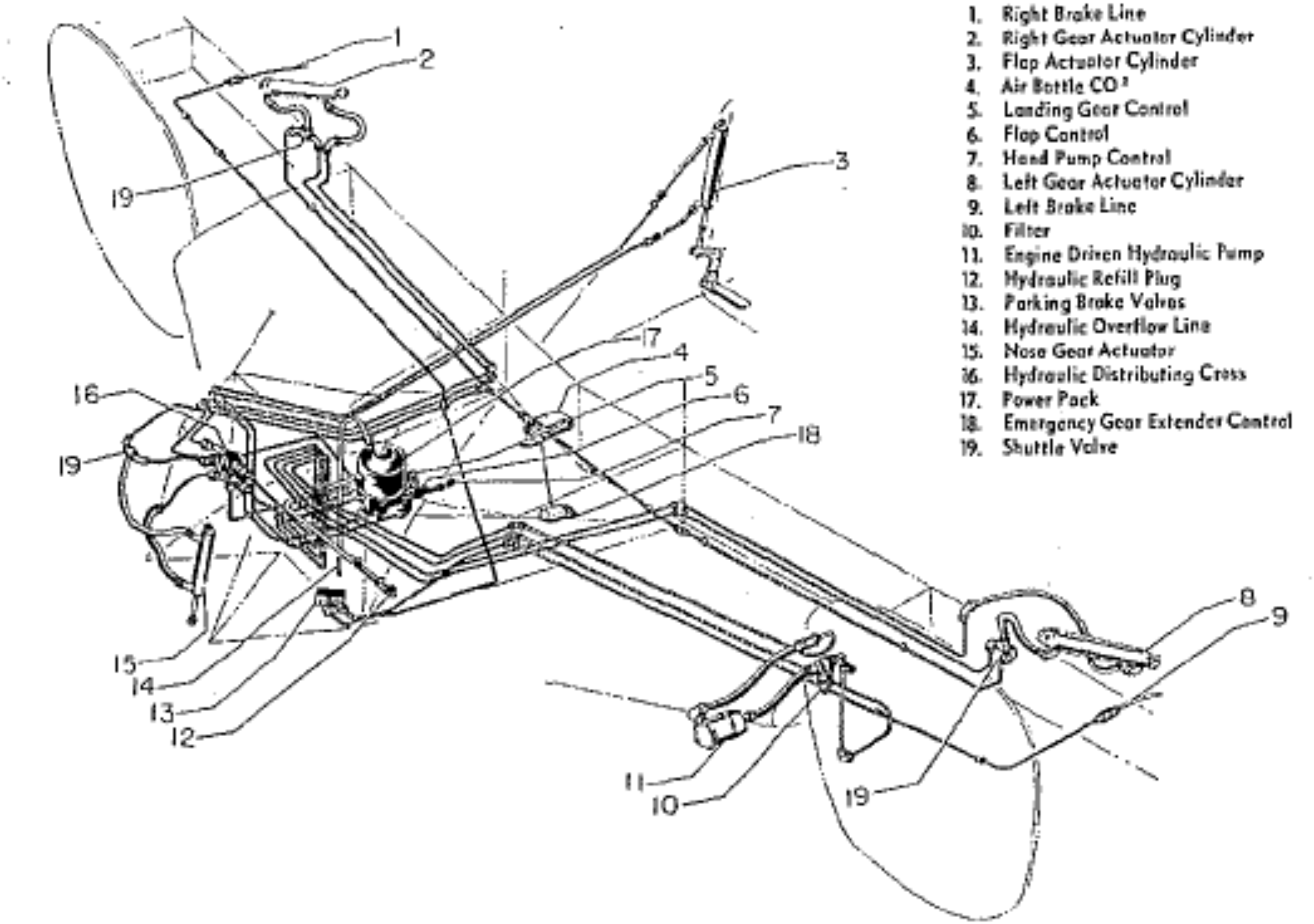
V. LANDING GEAR SERVICE:

In jacking the Apache up for landing gear and other service, the PA-23 Jack Kit (available through the Piper Aircraft Corporation Service Department) should be used. This kit includes two hydraulic jacks and a tail support; the jacks are placed under the jack pads on the front wing spar, and the tail support attached to the tail skid.

Approximately 250 lbs. of ballast should be placed on the base of the tail support to hold the tail down. Then the jacks should be raised until all three wheels are clear of the floor.

The right and left landing gear units on the Apache are completely interchangeable by reversing the nutcracker units on the gears. The oleo unit on the nose wheel gear contains parts that are also entirely interchangeable with the oleo parts on the main gears, although the oleo housing forging and the fork and axle are different on the nose wheel unit. The nutcracker parts and all inside components are identical on both nose and main gears.

The operation of the landing gear oleos is standard for the air-oil type; hydraulic fluid passing through an orifice serves as the



1. Right Brake Line
2. Right Gear Actuator Cylinder
3. Flap Actuator Cylinder
4. Air Bottle CO_2
5. Landing Gear Control
6. Flap Control
7. Hand Pump Control
8. Left Gear Actuator Cylinder
9. Left Brake Line
10. Filter
11. Engine Driven Hydraulic Pump
12. Hydraulic Refill Plug
13. Parking Brake Valves
14. Hydraulic Overflow Line
15. Nose Gear Actuator
16. Hydraulic Distributing Cross
17. Power Pack
18. Emergency Gear Extender Control
19. Shuttle Valve

HYDRAULIC SYSTEM

Figure 27

major shock absorber while air compressed statically to about 85 lbs. acts as a taxiing spring. The piston tube has a total travel of 8″, and about 3″ of tube should be exposed under normal static loads.

All of the oleos are inflated through readily accessible valves on the top of the unit, at the front. The nose wheel unit is steerable through the rudder pedals, and incorporates a shimmy dampening

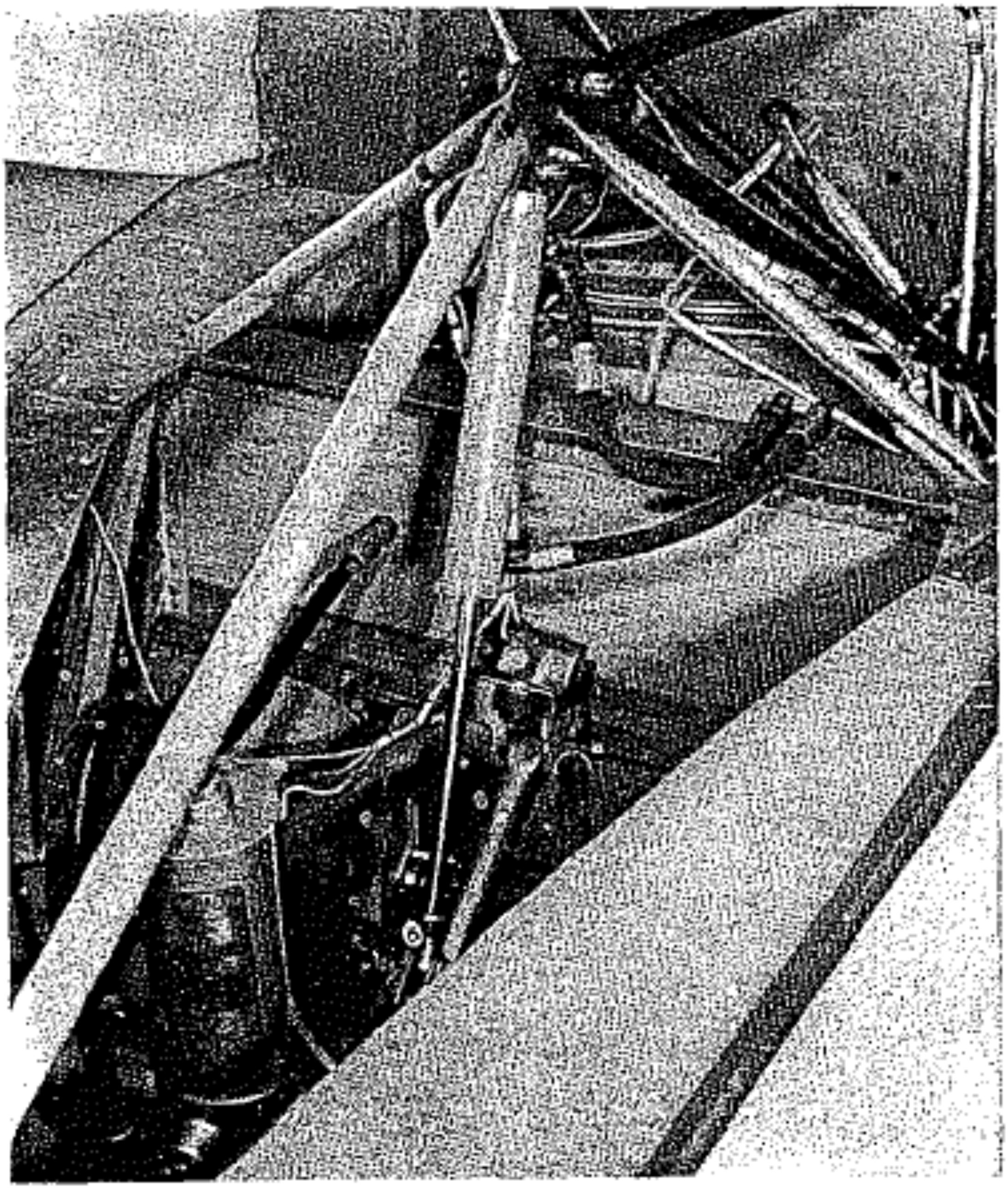


Figure 28

device at the bottom of the outer housing. All major attachment and actuation bearings are equipped with grease fittings for lubrication of the bearing surfaces, and should be lubricated periodically with medium lubricating grease.

To add air to the oleo struts, a strut pump is attached at the air valve and the oleo pumped up until 3″ of piston tube is exposed with normal static weight on the gears. To add oil, first release all the air through the valves, allowing the oleo to compress fully. Next remove the air valve core and fill the unit through this opening, extending the strut by rocking the airplane while adding fluid. Compress the oleo again to within 1/4″ of full compression, allowing excess oil to overflow and working out any trapped air. Then reinsert the valve core and pump up the strut.

If a landing gear oleo has been completely emptied of oil during servicing, the following procedure should be used to refill it, to make sure that no air remains trapped in the unit. First, a clear plastic tube should be attached to the valve stem, from which the core has been removed. The other end of the tube should be placed in a container of hydraulic fluid. When the oleo is extended, fluid will be sucked into the oleo cylinder. The oleo should be compressed and extended until it is full of fluid and no more air bubbles appear in the plastic tube. About one pint of fluid is required to fill the oleo.

To check shimmy of the nose wheel, if it should develop, tighten the bolt on the dampening device at the base of the nose wheel forging. The bolt should be tightened just enough to keep the nose wheel from moving freely, but not enough to require excessive pressure to move the wheel by hand. It may be necessary to remove shims from the shimmy dampening collar to permit tightening of the device.

The steering arms from the rudder pedals to the nose wheel steering torque shaft arm are adjusted at the rudder pedals or at the torque shaft rollers by turning in or out the threaded rod end bearings. Adjustment is normally accomplished at the forward end of the rods, and should be done in such a way that the nose wheel is in line with the fore and aft axis of the plane when the rudder pedals and rudder are centered. Alignment of the nose wheel can be checked by pushing the airplane back and forth with the rudder centered to determine that the plane follows a perfectly straight line. The turning arc of the nose wheel is 15 degrees in either direction and is factory adjusted at stops on the bottom of the forging.

In adjusting the steering arm stops, care should be taken to see that the nose wheel reaches its full travel just after the rudder hits its stops. This guarantees that the rudder will be allowed to move through its full travel.

Adjustable rod end bearings are present on each of the hydraulic cylinders that actuate the landing gear legs. These rod ends should be set so that the cylinders move the landing gear retracting links just far enough to engage the spring loaded down locks and make contact at the stops. Too much extension of the adjusting screws will overload the links, and too little extension will prevent the links from going to the required past-center position.

At each of the landing gear legs, micro-switches are installed so as to close after full movement of the gear in either direction. The down switches are connected individually with green indicator lights on the pedestal, and the up switches are in series so that all three contacts must be made before the amber "gear up" light on the pedestal lights up. The micro-switches must be adjusted carefully so that contact is made just as the gear reaches the required position of extension or retraction.

Other micro-switches on the landing gear warning system are installed inside the contral pedestal at the throttles. The warning horn is also located here, and the landing gear knob flasher unit is attached to the left side of the pedestal forward of the instrument panel.

The main landing gear legs are dismounted from the airplane by, (1) removing the top engine nacelles, (2) detaching the lower end of the lever retracting link from the gear leg, (3) detaching the brake line at the lower end of the flexible line, and (4) withdrawing the half-inch landing gear attachment bolts.

The nose gear unit is dismounted by (1) removing the nose access panels and the canvas boot covering the top of the nose gear, (2) detaching the lower retracting link, and (3) extracting the landing gear bolts.

Disassembling of the landing gear oleos is done as follows:

(1) Release air from air valve at top of unit and remove core.

(2) Detach lower end of oleo torque link assembly (nutcracker) from fork.

(3) Remove snap ring, located inside and at bottom of forging, with small-nosed pliers.

(4) Slide piston tube and bearing assemblies out of forging. Oleo fluid will flow from the forging and much of it can be caught in a container and reused.

(5) Remove the upper bearing retainer pins and slide both upper and lower bearings from the strut. The "0" rings and wiper strips are then exposed for inspection.

To reassemble the oleo unit, reverse the above procedure, being very careful to see that the snap ring and the upper bearing retainer pins are properly reinstalled.

In the event that the oleo strut slowly loses pressure and extension, the most probable source of trouble is the air valve attachment to the leg, or the core of the air valve. These parts should be checked first to determine whether or not air leaks are occurring. If hydraulic fluid is evident on the exposed chrome-plated oleo strut, the "0" rings on the piston tube bearing units may need to be replaced.

VI. HYDRAULIC SYSTEM SERVICE:

The hydraulic system is filled through a filler tube located inside the left nose access panel. Only petroleum base hydraulic fluid, such as Univis 40 or Mil-0-5606, should be used.

To add fluid to the system, remove the cap from the filler neck and fill the system completely while holding the filler tube extension level. Then turn the elbow on the filler tube down until the excess oil has drained out. (See separate instructions for filling and cleaning the complete hydraulic system).

VII. FUEL REQUIREMENTS:

Aviation Grade 80-87 octane gasoline should be used in the Apache. The tank and line sumps should be drained regularly to remove water or sediment.

The oil capacity of the Lycoming 0-320 is 8 quarts. It is recommended that engine oil be changed every 50 flying hours or sooner under favorable conditions. The minimum safe quantity of oil required is 2 quarts. The following grades are required for the specified temperatures:

Temperatures above 40° F -------------- S.A.E. 50
Temperatures below 40° F -------------- S.A.E. 30

LUBRICATION CHART
PIPER APACHE PA-23

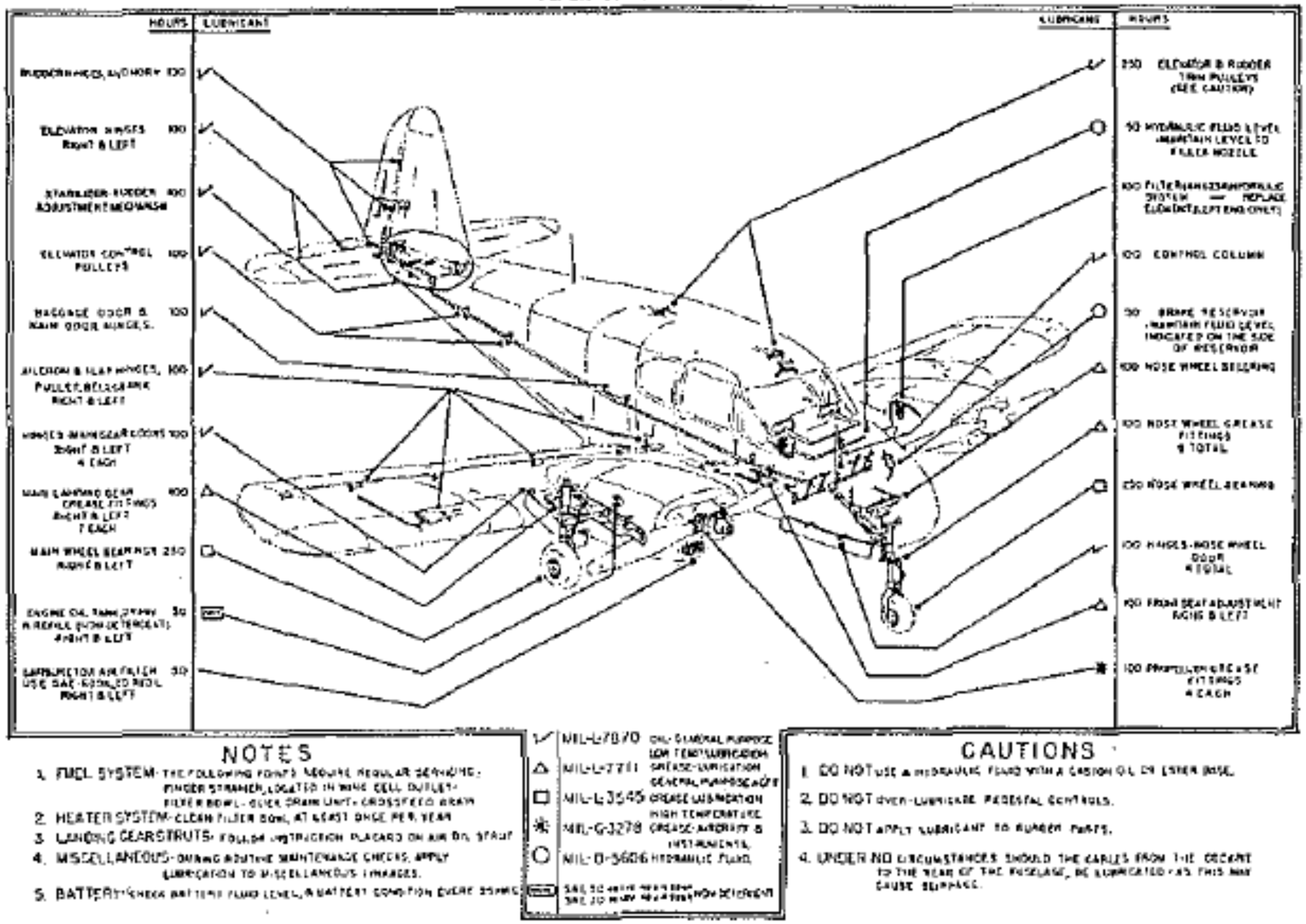


Figure 29

VIII. CARE OF AIR FILTER:

The Carburetor Air Filters, mounted in the nose cowls, should be removed and cleaned regularly to prevent clogging of the filters or the passage of dirt into the engine. Under very clean operating conditions, the filters need only to be cleaned during 100 hour checks, but under dusty conditions, the filters should be cleaned daily.

To clean the filters, first wash them with kerosene or gasoline, then soak them in SAE 10 or SAE 20 oil, allowing them to drain thoroughly before reinstallation.

IX. CARE OF WINDSHIELD AND WINDOWS:

The windshield and windows are made of plexiglas and a certain amount of care is required to keep them clean and clear. The following procedure is suggested:

1. Flush with clean water and dislodge excess dirt, mud, etc., with your hand.
2. Wash with mild soap and warm water. Use a soft cloth or sponge. (Do not rub).
3. Remove oil, grease or sealing compounds with a cloth soaked in kerosene.

   NOTE: Do not use gasoline, alcohol, benzene, carbon tetrachloride, lacquer thinner, or window cleaning sprays.
4. After cleaning, apply a thin coat of hard polishing wax. Rub lightly with a soft dry cloth.
5. A severe scratch or mar can be removed by using jewelers rouge to rub out scratch, smooth on both sides and apply wax.

X. SERIAL NUMBER PLATE:

The serial number plate on the Apache is located on the top of the tail stinger, underneath the rudder. The serial number of the plane should always be used in referring to the airplane in service or warranty matters.

SECTION FIVE

OPTIONAL EQUIPMENT

The following items described as optional equipment are available as factory installations or may be obtained for field installation by ordering the appropriate kit through the factory service department:

I. AUXILIARY FUEL TANKS:

Additional fuel capacity is made possible through the installation of two auxiliary fuel cells in the section of the wing just inboard of the detachable tip. This arrangement is similar to the main cell installation and provides an added 36 gallons of fuel. This allows a total of 108 gallons of fuel, or an endurance of six hours at recommended cruise power, instead of the normal four hours.

When the auxiliary tanks are installed, the fuel control system is modified to provide control of fuel from the added tanks as well as from the standard tanks. With the selector handles in the forward position fuel from the main tanks is fed to the engines; with the handles in the full aft position the auxiliary tanks are feeding. In the center position both sets of tanks are shut off. The on-off valves for the auxiliary tanks are located close to the main tank valves in the engine nacelles aft of the firewall. Another feature of this installation is the addition of micro-switches in conjunction with the selector handles which automatically switch the fuel quantity indicators to the tanks selected. The micro-switches are attached to the main spar under the cabin floorboards.

When the fuel selectors are placed in the auxiliary position, the main tank valves are closed and the auxiliary tank valves are opened. The auxiliary fuel flows into the gascolators of the normal fuel system and may be utilized the same as the fuel from the main tanks. Fuel transfer is not possible with this system and an effort should be made to use an equal amount of fuel from each tank. Since the auxiliary tanks are located quite far outboard in the wings, unequal consumption may result in a wing-heavy flight condition, although the airplane handles well with one auxiliary tank full and the opposite empty. Auxiliary fuel should be used only in cruising flight, and the main tanks should be selected for take-off and landing.

Changes in allowable aircraft loading with this installation may be determined from the weight and balance data which is with the aircraft papers.

II. FIVE SEAT INSTALLATION:

Apache operators who wish to carry a larger proportion of their useful load in passengers may do so through installation of the optional five seat arrangement, restricting their fuel and baggage as necessary.

With this installation the standard rear seat and the hat shelf are removed. Four seat tracks are attached with bolts through the floorboards to the under floor structure, and three individual sliding seats are mounted on the tracks. All production airplanes are fitted with the track mounting brackets and it is necessary only to locate and drill the holes and the tracks are easily installed.

The rear seat in this arrangement is fixed in the full aft position, but the two middle seats, which are interchangeable, are adjustable through long ranges on the tracks by operating a locking handle on the front of the seats. These two seats must be locked in position for take off and landing.

Easy access to the rear seat may be had by moving the left middle seat forward and sliding the right seat to the rear. With all three seats occupied, the left middle seat should be so positioned that its passenger and the rear seat passenger have an equal amount of leg room. The right seat can be adjusted as desired for maximum comfort. Any baggage carried while using this installation will be stowed to the right of the rear seat and in back of the right seat, allowing stowage or removal through the baggage door without disturbing the seats or their passengers.

All three seats are quickly detachable by removing the slide stops at both ends of the tracks, positioning the seat so that the hold down clamps are over the removal slots, and lifting the seats out.

The five seat arrangement will increase the empty weight of the airplane approximately 30 pounds. Care must be taken in loading the airplane so as not to exceed the allowable gross weight or the rearward center of gravity limit. When loading, consult the weight and balance data which is with the aircraft papers.

III. RECLINING REAR SEAT:

The same track arrangement used in the five seat installation also will accommodate two airline type reclining seats. These luxurious seats are installed and removed by the same quick and easy method used with the smaller seats, and in flight may be adjusted to obtain unrestricted leg room and a maximum of reclining comfort for their occupants. This seat arrangement will add slightly over 30 pounds to the empty weight of the aircraft.

IV. DUAL GENERATOR:

For those operators who desire a reserve source of electrical power for night and instrument flying or increased current capacity for operating electrical accessories, there is available a separate generator installation for the right engine. This installation is a duplicate of the standard installation on the left engine with the addition of a reverse current relay between the two generators, which prevents the output of one generator from feeding into the opposite.

With the dual generator installation, manual control of each generator is provided by means of two generator switches which are mounted on the right side of the same panel as the battery master switch. During engine preflight, individual generator output may be checked by switching off the undesired generator.

V. DUAL VACUUM SYSTEM:

The optional dual vacuum system is designed to provide automatic and continued operation of the vacuum driven instruments in event of pump failure, engine failure, or other malfunction of the vacuum system.

In addition to the standard pump installation on the right engine, a drive adapter is installed in place of the hydraulic pump on the left engine. This adapter provides mounting pads for both the hydraulic pump and the second vacuum pump.

From the pump on each engine, vacuum lines run to a single main vacuum regulator valve mounted in the nose section of the fuselage just above the battery. A suction relief valve in each pump line protects the system from abnormal pressures, and check valves prevent a reverse flow of air in the pump line if either pump fails.

A vacuum gauge selector valve mounted adjacent to the gauge permits the pilot to check the suction at four points in the system. The valve has four positions; left source, gyro-compass, gyro-horizon, and right source. The pressure at any of the points selected is indicated in inches of mercury on the suction gauge. During normal operation the selector should be positioned to either gyro-compass or gyro-horizon.

In adjusting the system the two pressure relief valves should be set to provide between 9 and 9.5 inches of mercury on the suction gauge. For this adjustment the gauge selector will be set on left and right source respectively. Next the selector is positioned to either the gyro-compass or the gyro-horizon and the main pressure regulator is set to give an indication of 4.25 to 5 inches of mercury on the suction gauge.

The two pump relief valves are mounted on the reverse inboard side of each engine firewall with the adjustment set screw protruding through the firewall so that adjustments may be made by removing the side cowl.