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.

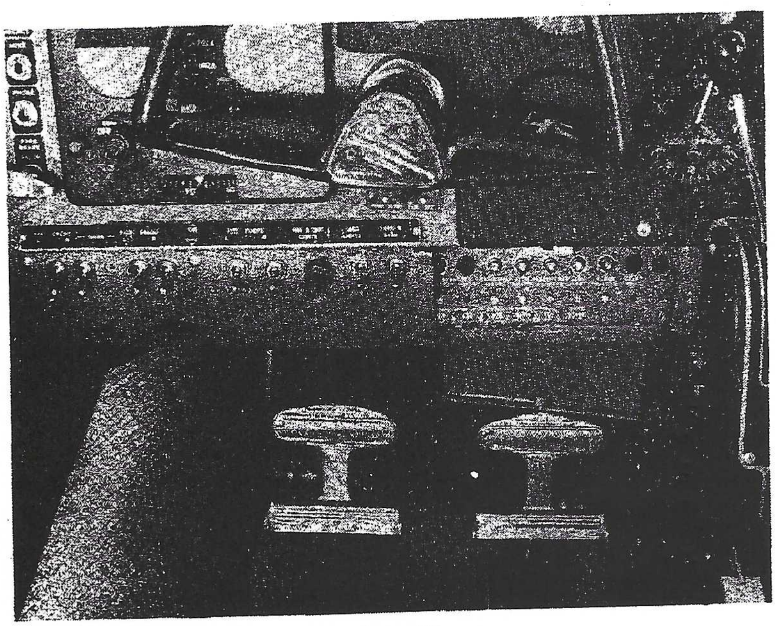


Figure 15

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.

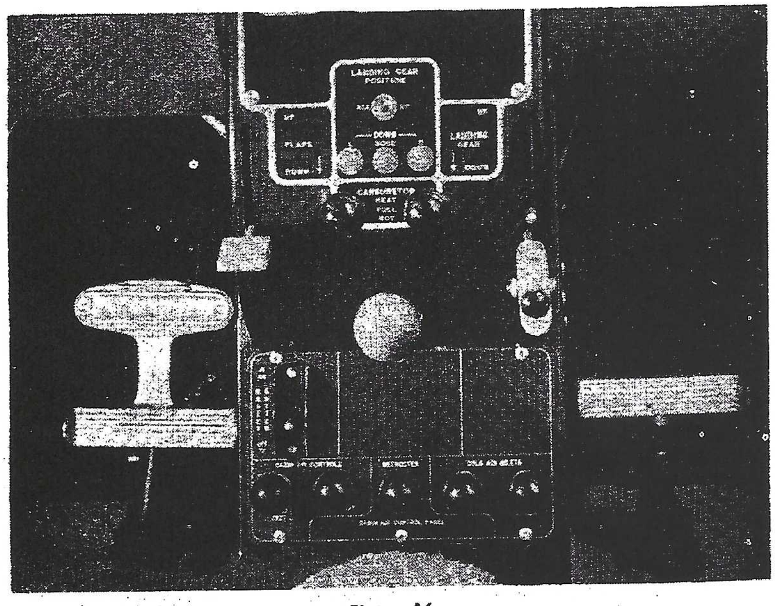


Figure 16

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.

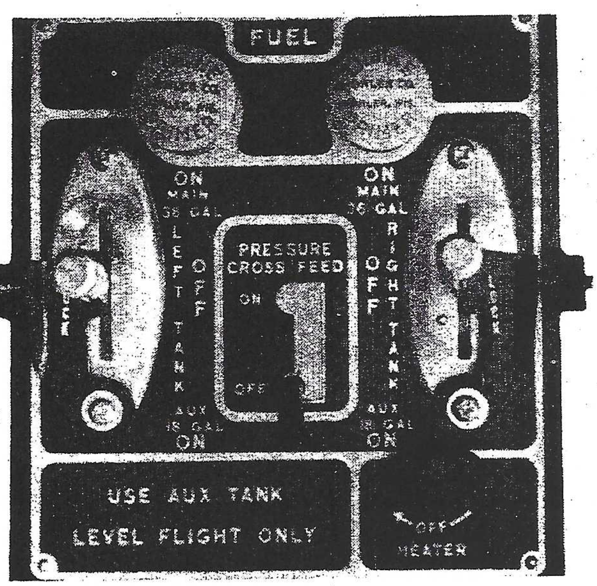


Figure 17

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.

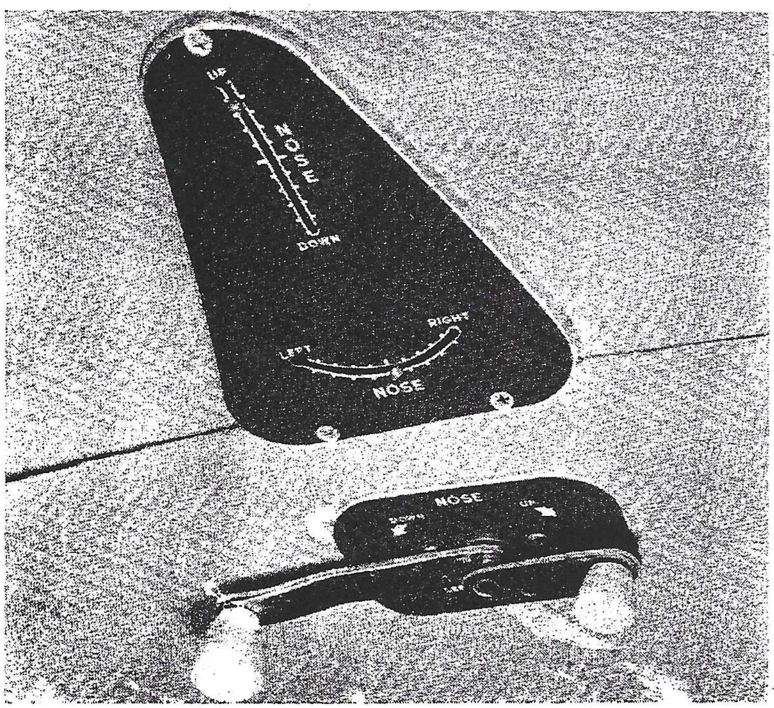


Figure 18

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 $\frac{1}{8}$th 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:

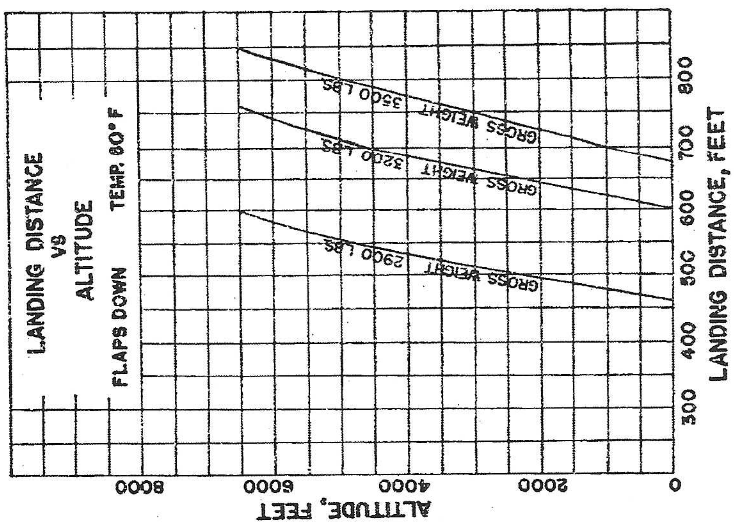
The Apache should be moved on the ground with the aid of the nose wheel steering bar provided with each plane and installed in the baggage compartment.

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.
300 400 500 600 700 800
LANDING DISTANCE, FEET
0 2000 4000 6000 8000
ALTITUDE, FEET

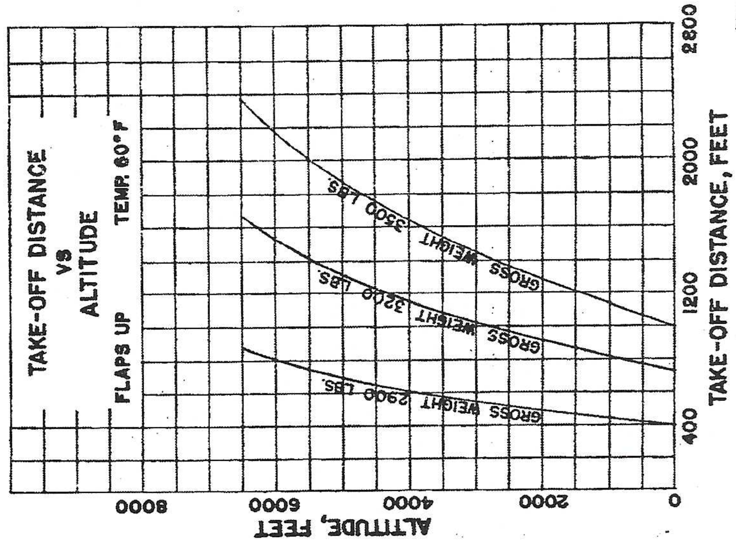

TAKE-OFF DISTANCE
VS
ALTITUDE
FLAPS UP
TEMP. 60° F
GROSS WEIGHT 3500 LBS.
GROSS WEIGHT 3200 LBS.
GROSS WEIGHT 2900 LBS.
400 1200 2000 2800
TAKE-OFF DISTANCE, FEET
0 2000 4000 6000 8000
ALTITUDE, FEET

Figure 19

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

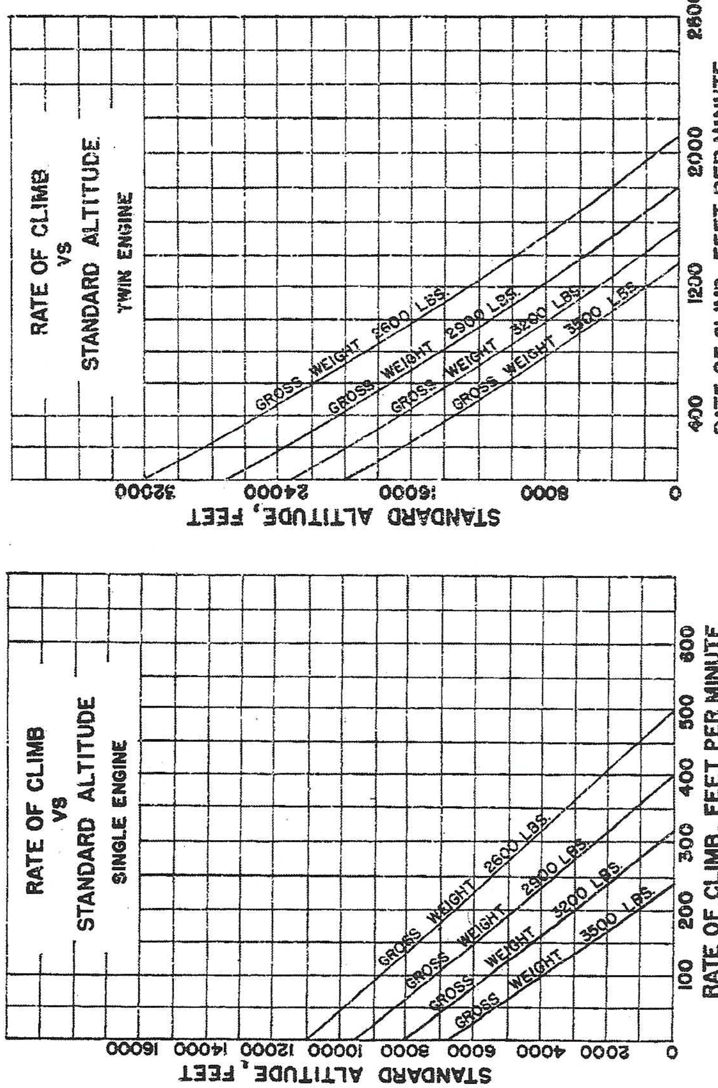

RATE OF CLIMB
VS
STANDARD ALTITUDE
TWIN ENGINE
GROSS WEIGHT 2600 LBS.
GROSS WEIGHT 2900 LBS.
GROSS WEIGHT 3200 LBS.
GROSS WEIGHT 3500 LBS.
STANDARD ALTITUDE, FEET
0
8000
16000
24000
32000
RATE OF CLIMB, FEET PER MINUTE
400
1200
2000
2800
RATE OF CLIMB
VS
STANDARD ALTITUDE
SINGLE ENGINE
GROSS WEIGHT 2600 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

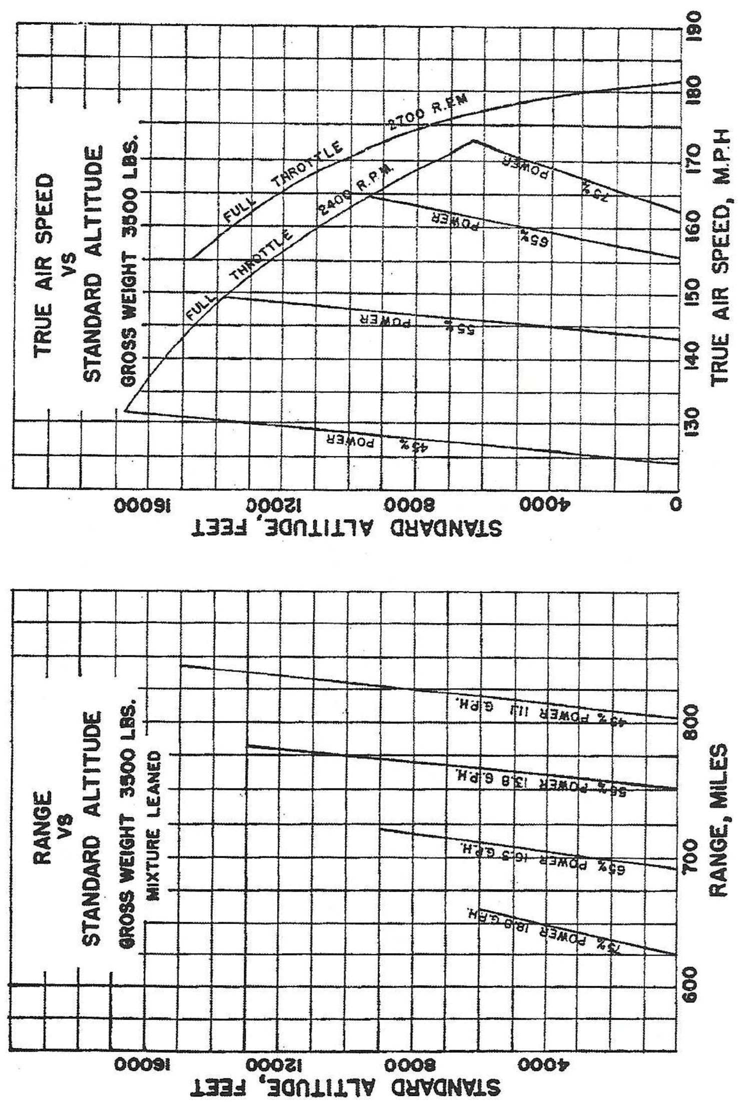

TRUE AIR SPEED
VS
STANDARD ALTITUDE
GROSS WEIGHT 3500 LBS.
FULL THROTTLE 2700 R.P.M.
FULL THROTTLE 2400 R.P.M.
75% POWER
65% POWER
55% POWER
45% POWER
STANDARD ALTITUDE, FEET
TRUE AIR SPEED, M.P.H
RANGE
VS
STANDARD ALTITUDE
GROSS WEIGHT 3500 LBS.
MIXTURE LEANED
45% POWER 11.1 G.P.H.
55% POWER 13.8 G.P.H.
65% POWER 16.5 G.P.H.
75% POWER 18.8 G.P.H.
RANGE, MILES

Figure 21

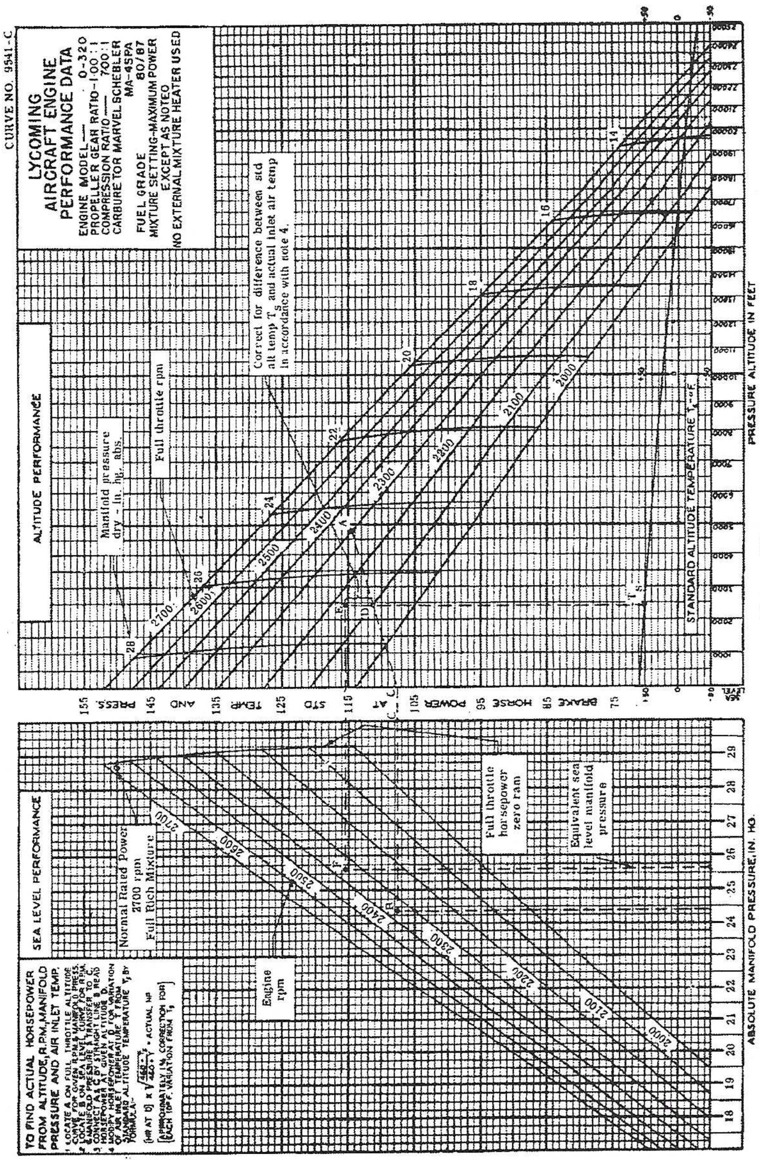

CURVE NO. 9541-C
LYCOMING AIRCRAFT ENGINE PERFORMANCE DATA
ALTITUDE PERFORMANCE
SEA LEVEL PERFORMANCE
STANDARD ALTITUDE TEMPERATURE
PRESSURE ALTITUDE IN FEET
ABSOLUTE MANIFOLD PRESSURE, IN. HG.

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-

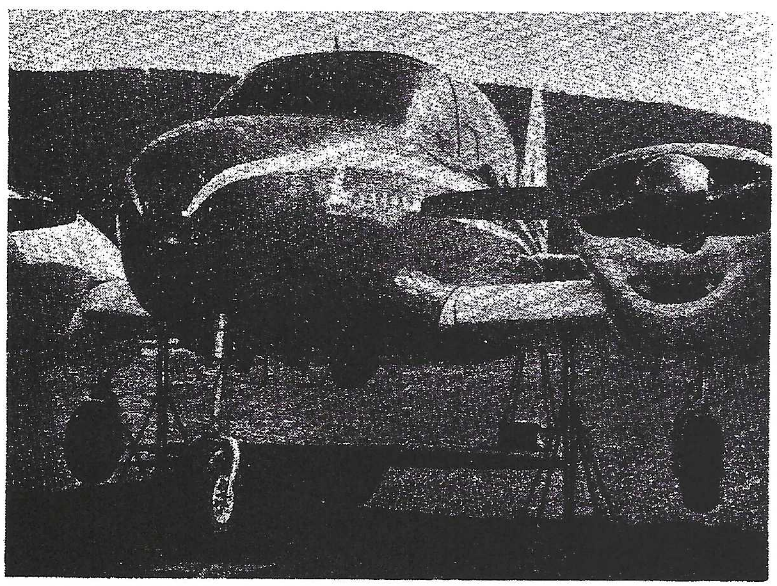


Figure 23

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.

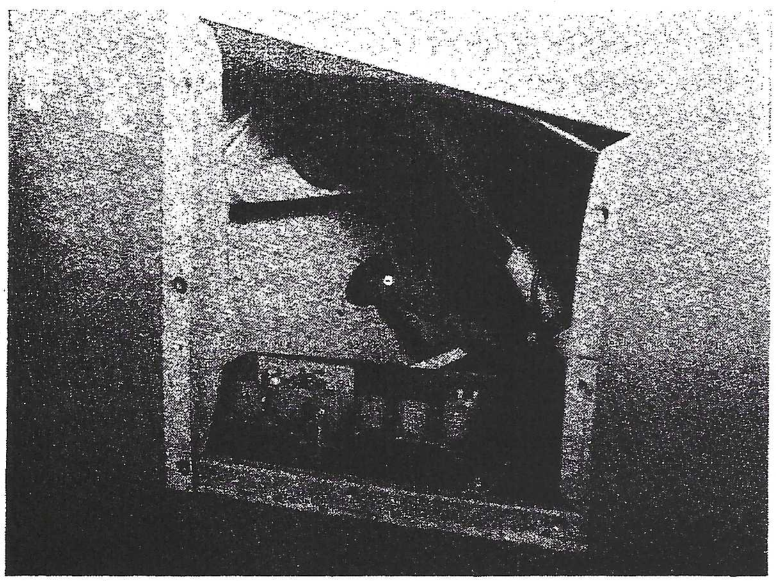
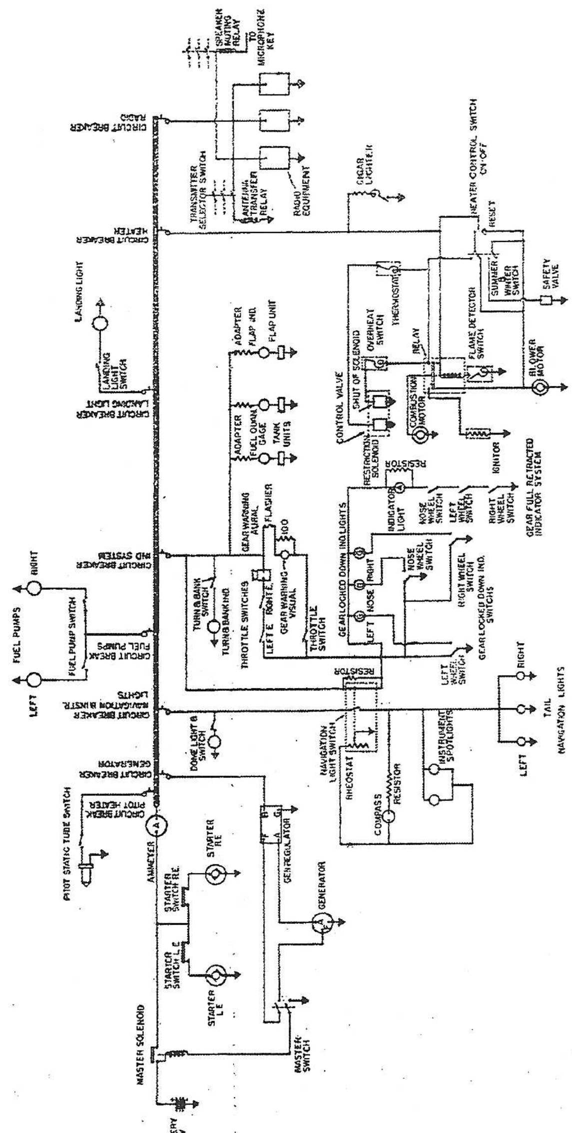


Figure 24



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

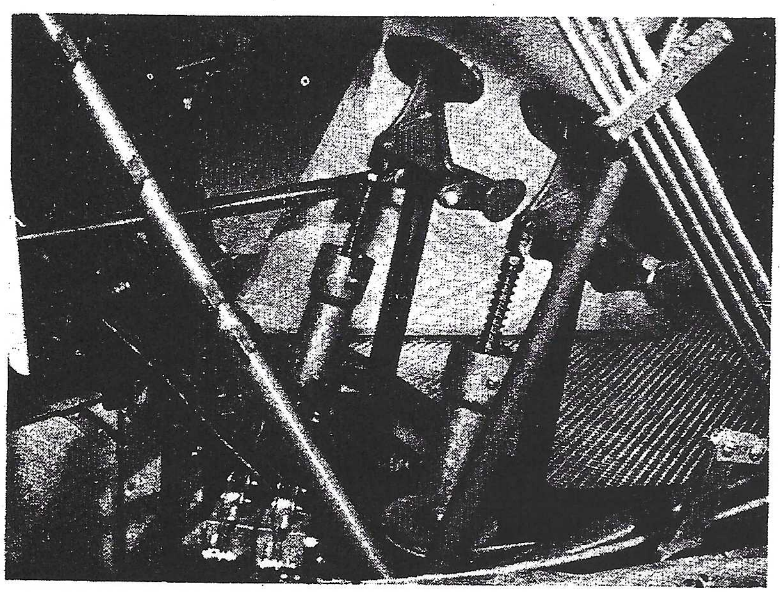


Figure 26

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.

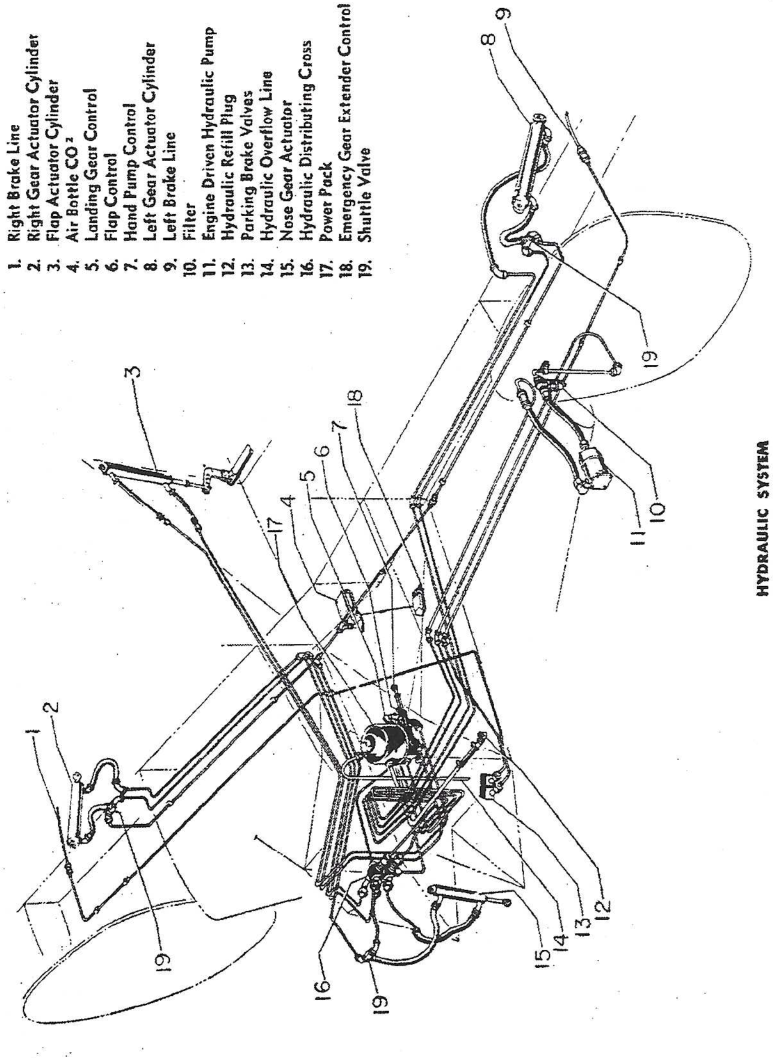
V. LANDING GEAR SERVICE:

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

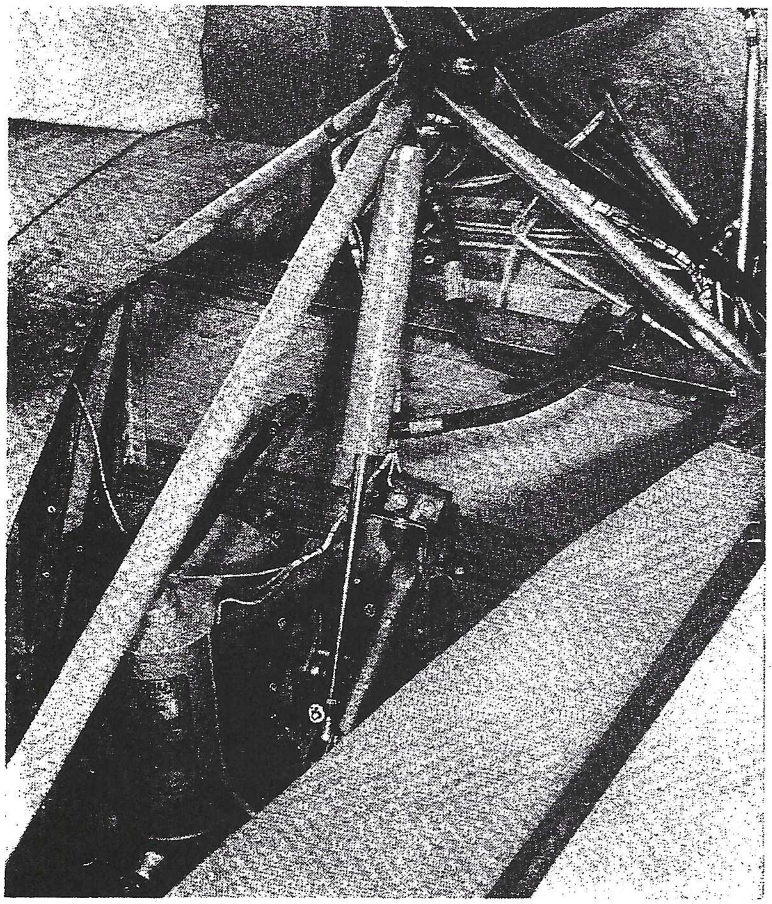


Figure 28

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 ¼″ 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).

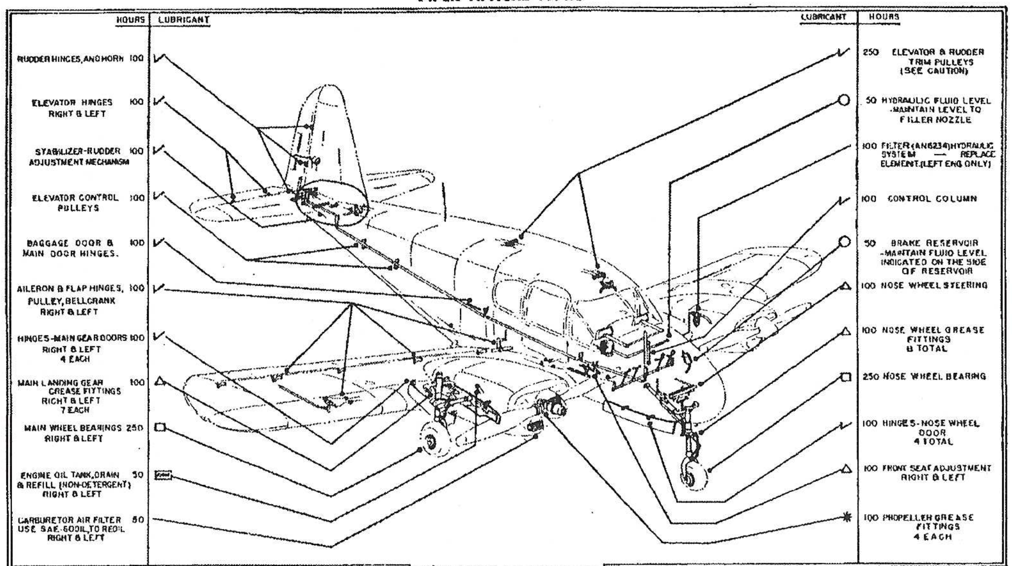
VII. FUEL REQUIREMENTS:

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



NOTES

1. FUEL SYSTEM - THE FOLLOWING POINTS REQUIRE REGULAR SERVICING, FINGER STRAINER, LOCATED IN WING CELL OUTLET-FILTER BOWL - QUICK DRAIN UNIT - CROSSFEED DRAIN.
2. HEATER SYSTEM - CLEAN FILTER BOWL AT LEAST ONCE PER YEAR.
3. LANDING GEAR STRUTS - FOLLOW INSTRUCTION PLACARD ON AIR OIL STRUT.
4. MISCELLANEOUS - DURING ROUTINE MAINTENANCE CHECKS, APPLY LUBRICATION TO MISCELLANEOUS LINKAGES.
5. BATTERY - CHECK BATTERY FLUID LEVEL, & BATTERY CONDITION EVERY 25 HRS.

✓	MIL-L-7870	OIL-GENERAL PURPOSE LOW TEMP. LUBRICATION
△	MIL-L-7711	GREASE-LUBRICATION GENERAL PURPOSE ACFT
□	MIL-L-3545	GREASE-LUBRICATION HIGH TEMPERATURE
✱	MIL-G-3278	GREASE-AIRCRAFT & INSTRUMENTS.
○	MIL-O-5606	HYDRAULIC FLUID.
[box]	SAE 50 ABOVE 40 AIR TEMP. SAE 30 BELOW 40 AIR TEMP.	NON-DETERGENT

CAUTIONS

1. DO NOT USE A HYDRAULIC FLUID WITH A CASTOR OIL OR ESTER BASE.
2. DO NOT OVER-LUBRICATE PEDESTAL CONTROLS.
3. DO NOT APPLY LUBRICANT TO RUBBER PARTS.
4. UNDER NO CIRCUMSTANCES SHOULD THE CABLES FROM THE COCKPIT TO THE REAR OF THE FUSELAGE, BE LUBRICATED - AS THIS MAY CAUSE SLIPPAGE.

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.