

## SECTION 7

DESCRIPTION AND OPERATION  
OF THE AIRPLANE AND ITS SYSTEMS

## 7.1 THE AIRPLANE

The PA-28-181 ARCHER III is a single-engine, low-wing monoplane of all metal construction. It has four-place seating, two hundred pound baggage capacity, and a 180 horsepower engine.

## 7.3 AIRFRAME

The basic airframe, except for a tubular steel engine mount, steel landing gear struts, and other miscellaneous steel parts, is of aluminum alloy construction. The extremities - the wing tips, the cowling, the tail surfaces - are of fiberglass or ABS thermoplastic. Aerobatics are prohibited in this airplane since the structure is not designed for aerobatic loads.

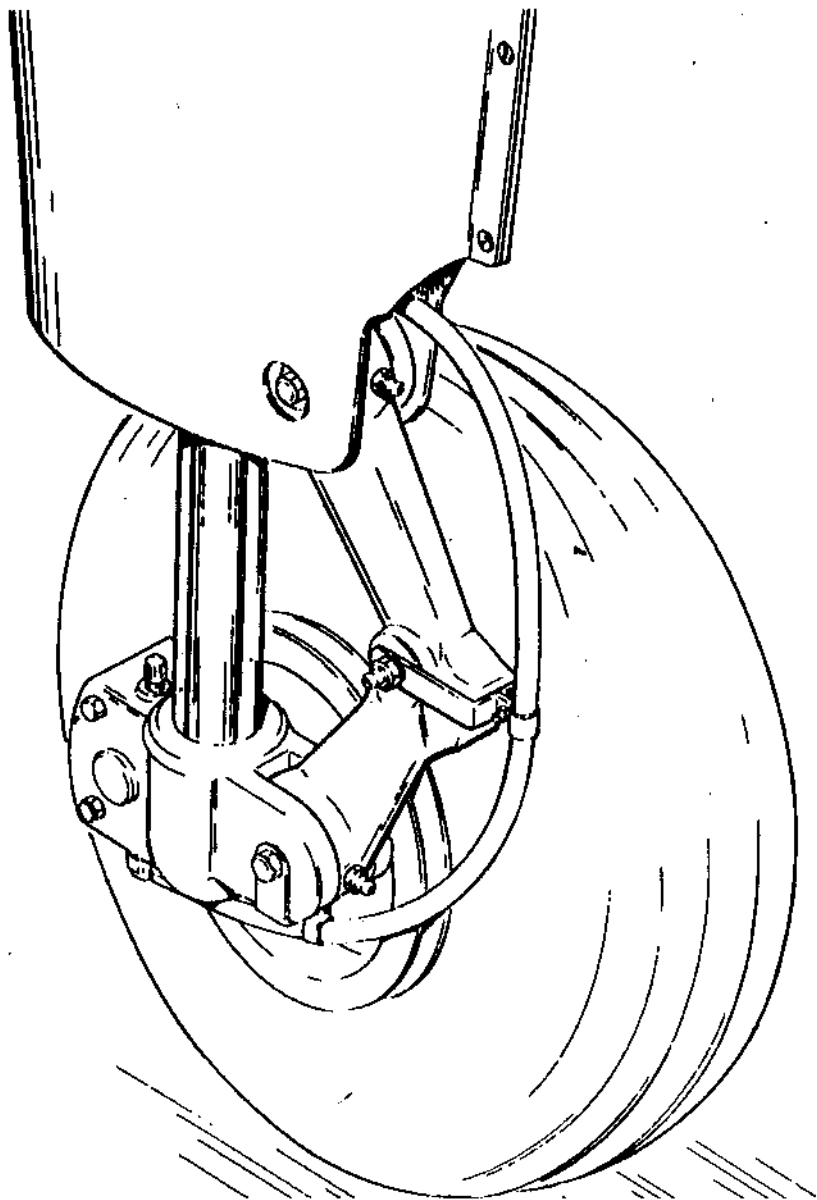
The semi-tapered wings have a laminar flow type NACA 652-415 airfoil. The wings are attached to each side of the fuselage by insertion of the butt ends of the respective main spars into a spar box carry-through which is an integral part of the fuselage structure, providing, in effect, a continuous main spar with splices at each side of the fuselage. There are also fore and aft attachments at the rear spar and at an auxiliary front spar.

## 7.5 ENGINE AND PROPELLER

The ARCHER III is powered by a four cylinder, direct drive, horizontally opposed engine rated at 180 horsepower at 2700 rpm. It is furnished with a starter, a 70 ampere, 28 volt alternator, a shielded ignition, vacuum pump drive, a fuel pump, and a dry, automotive type carburetor air filter.

The exhaust system is made entirely from stainless steel and is equipped with a single dual muffler. A heater shroud around the muffler is provided to supply heat for the cabin and windshield defrosting.

The fixed-pitch propeller is made from a one-piece alloy forging.



**MAIN WHEEL ASSEMBLY**

Figure 7-1

(Wheel fairing removed for clarity.)

## 7.7 LANDING GEAR

The three landing gears use Cleveland 6.00 x 6 wheels, the main gear wheels (Figure 7-1) being provided with brake drums and Cleveland single disc hydraulic brake assemblies. All three wheels use 6.00 x 6, four-ply rating, Type III tires with tubes.

A spring device is incorporated in the rudder pedal torque tube assembly to provide rudder trim. A bungee in the nose gear steering mechanism reduces steering effort and dampens bumps and shocks during taxiing. By using the rudder pedals and brakes the nose gear is steerable through a 30 degree arc each side of center. Later aircraft have the bungee removed from the nose gear steering mechanism and are steerable through a 20 degree arc each side of center. A shimmy dampener is also included in the nose gear.

The three struts are of the air-oil type, with a normal extension of 3.25 inches for the nose gear and 4.50 inches for the main gear.

The standard brake system consists of dual toe brakes attached to the rudder pedals and a hand lever and master cylinder located below and behind the left center of the instrument sub-panel. The toe brakes and the hand brake have their own brake cylinders, but they share a common reservoir. The brake fluid reservoir is installed on the top left front face of the fire wall. The parking brake is incorporated in the master cylinder and is actuated by pulling back on the brake lever, depressing the knob attached to the left side of the handle, and releasing the brake lever. To release the parking brake, pull back on the brake lever to disengage the catch mechanism and allow the handle to swing forward (refer to Figure 7-5).

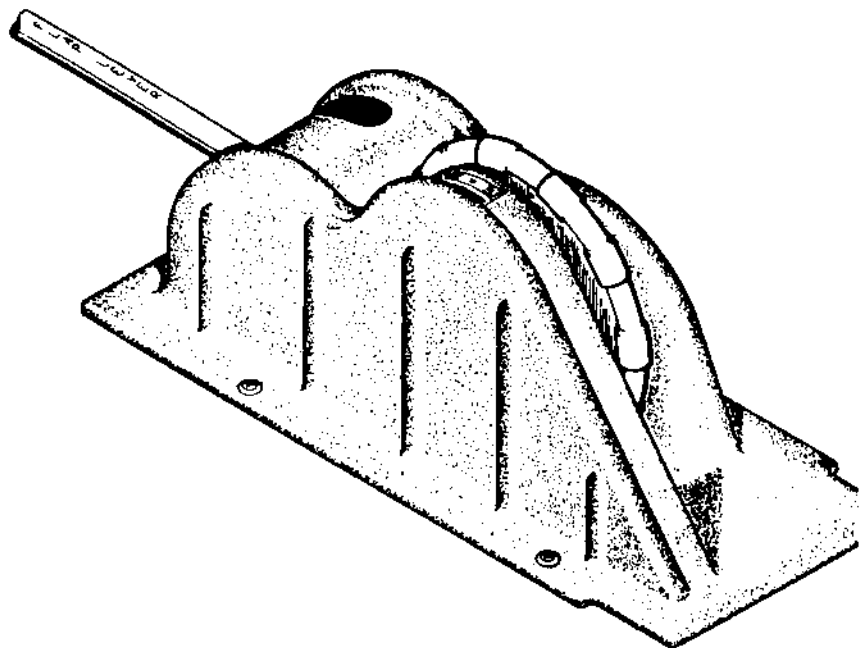
**FLIGHT CONTROL CONSOLE**

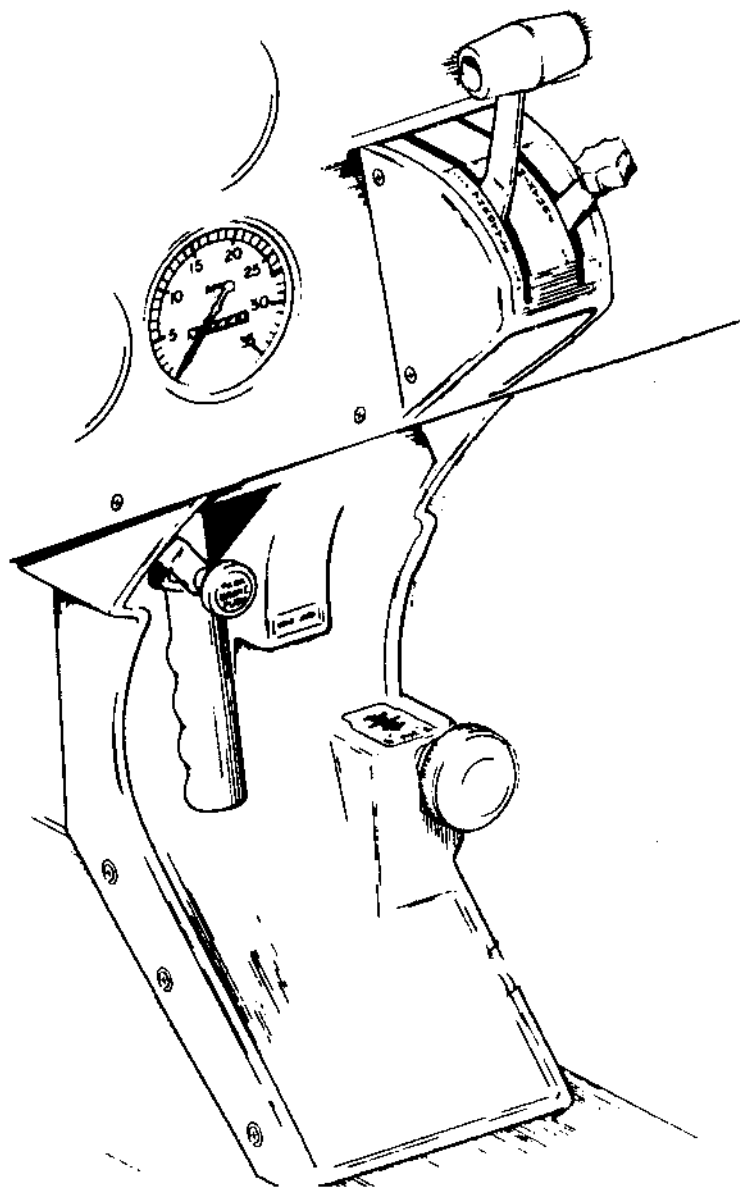
Figure 7-3

## 7.9 FLIGHT CONTROLS

Dual controls are provided as standard equipment, with a cable system used between the controls and the surfaces. The horizontal tail (stabilator) is of the all-movable slab type with a trim tab mounted on the trailing edge of the stabilator to reduce the control system forces. This tab is actuated by a control wheel on the floor between the front seats (Figure 7-3).

A rudder trim adjustment is mounted on the right side of the pedestal below the throttle quadrant and permits directional trim as needed in flight (refer to Figure 7-5).

The flaps are manually operated and spring-loaded to return to the up position. A past-center lock incorporated in the actuating linkage holds the flap when it is in the up position so that it may be used as a step on the right side. The flap will not support a step load except when in the full up position, so it must be completely retracted when used as a step. The flaps have three extended positions, 10, 25 and 40 degrees.



CONTROL QUADRANT AND CONSOLE

Figure 7-5

## 7.11 ENGINE CONTROLS

Engine controls consist of a throttle control and a mixture control lever. These controls are located on the control quadrant on the lower center of the instrument panel (Figure 7-5) where they are accessible to both the pilot and the copilot. The controls utilize teflon-lined control cables to reduce friction and binding.

The throttle lever is used to adjust engine RPM. The mixture control lever is used to adjust the air to fuel ratio. The engine is shut down by the placing of the mixture control lever in the full lean position. For information on the leaning procedure, see Section 4 of this Handbook.

The friction adjustment lever on the right side of the control quadrant may be adjusted to increase or decrease the friction holding the throttle and mixture controls or to lock the controls in a selected position.

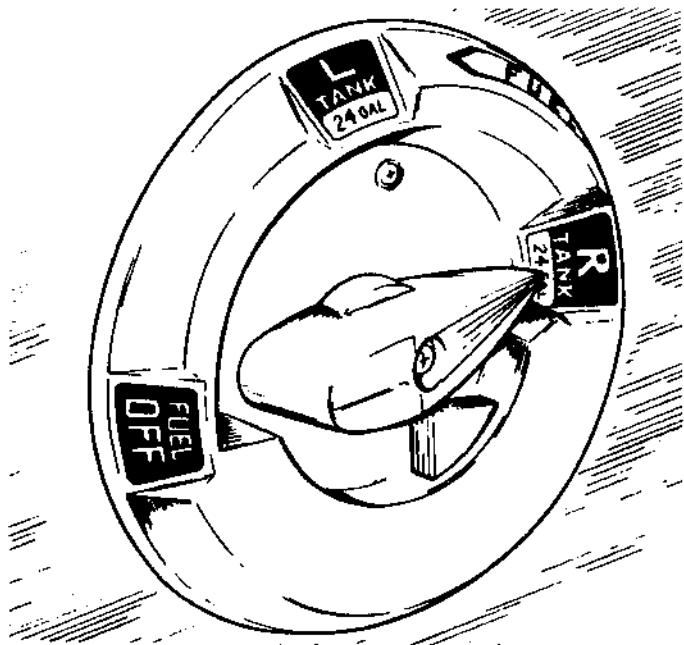
The carburetor heat control lever is located to the right of the control quadrant on the instrument panel. The control is placarded with two positions: "ON" (down), "OFF" (up).

## 7.13 FUEL SYSTEM

Fuel is stored in two twenty-five gallon (24 gallons usable) tanks which are secured to the leading edge structure of each wing by screws and nut plates. Each tank is equipped with a filler neck indicator tab to aid in determining fuel remaining when the tanks are not full. Usable capacity to the bottom of the indicator tab is 17 gallons.

The fuel selector control (Figure 7-7) is located on the left side-panel, forward of the pilot's seat. The button on the selector cover must be depressed and held while the handle is moved to the OFF position. The button releases automatically when the handle is moved back into the ON position.

An auxiliary electric fuel pump is provided in case of failure of the engine driven pump. The electric pump should be on for all takeoffs and landings, and when switching tanks. The pump switch is located in the switch panel above the throttle quadrant.



**FUEL SELECTOR**

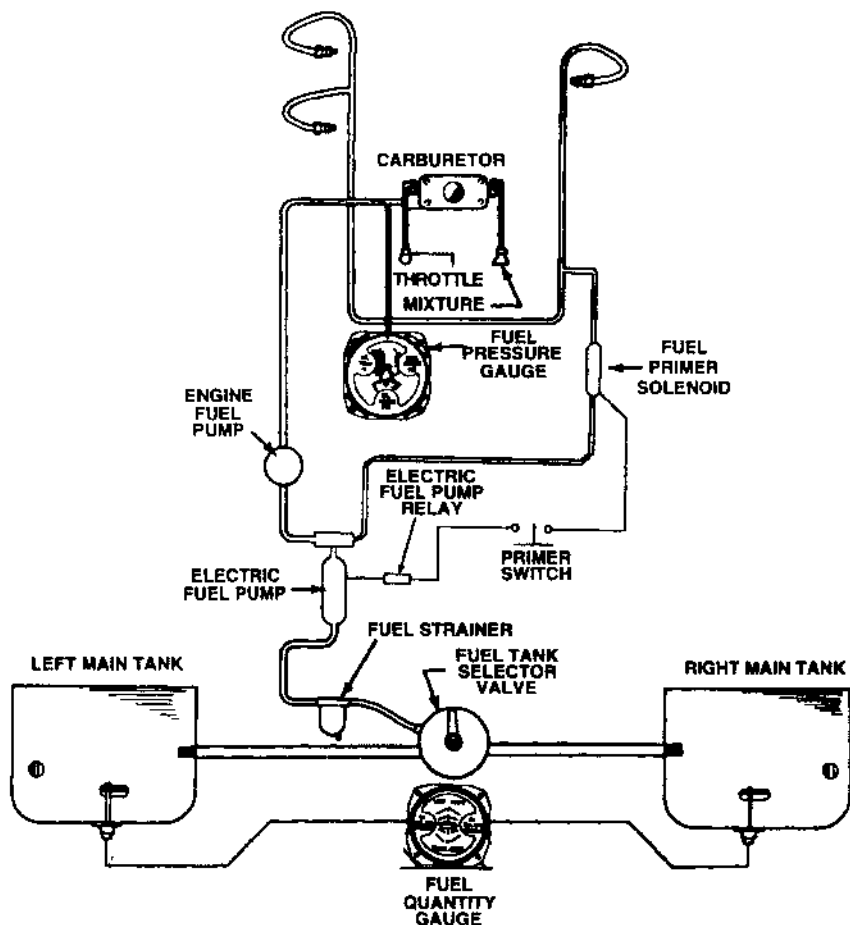
Figure 7-7

The fuel drains should be opened daily prior to first flight to check for water or sediment and proper fuel. Each tank has an individual drain at the bottom, inboard rear corner.

A fuel strainer, located on the lower left front of the fire wall, has a drain which is accessible from outside the nose section. The strainer should also be drained before the first flight of the day. Refer to paragraph 8.21 for the complete fuel draining procedure.

A dual fuel quantity gauge is located in lower center of the instrument panel.

An electric engine priming system is provided to facilitate starting. The primer switch is located in the far left side of the overhead switch panel (refer to Figure 7-15A).



FUEL SYSTEM SCHEMATIC

Figure 7-9

## 7.15 ELECTRICAL SYSTEM

The 28-volt electrical system includes a 24-volt battery for starting and to back up alternator output. Electrical power is supplied by a 70 ampere alternator. The battery is mounted in a box on the battery shelf located in the aft fuselage. A voltage regulator with integral overvoltage relay is located on the forward left side of the fuselage behind the instrument panel.

All powerplant and exterior lighting switches are grouped in a overhead switch panel, with all avionics switches grouped in a switch panel just above the throttle quadrant (figure 7-15). The circuit breaker panel is located on the lower right side of the instrument panel (figure 7-15). Each breaker is clearly marked to show which circuit it protects. Also, circuit provisions are made to handle the addition of communications and navigational equipment.

Standard electrical accessories include the starter, the electric fuel pump, electric engine primer, the stall warning horn, the ammeter, and the annunciator panel.

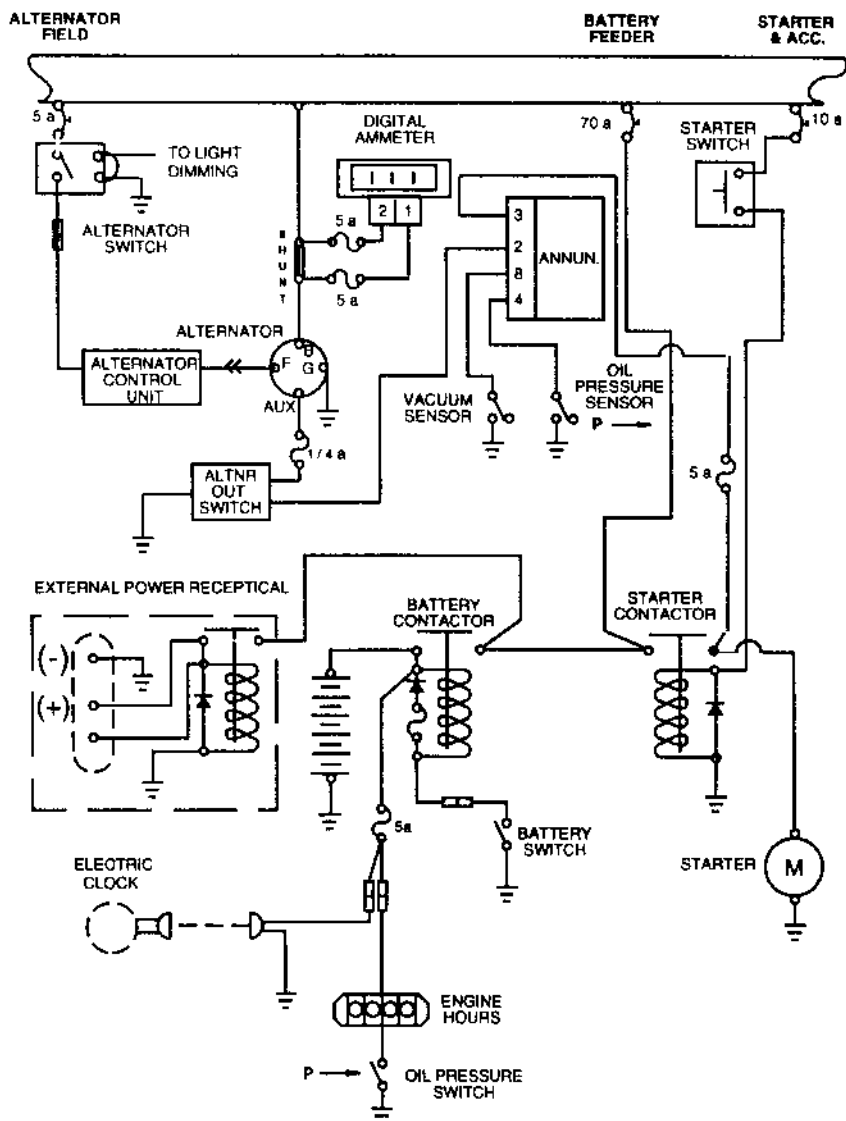
The annunciator panel includes, alternator inop, oil pressure, vacuum inop., low bus voltage, start engage, pitot heat and provisions for optional air conditioner door open. The annunciator panel lights are provided only as a warning to the pilot that a system may not be operating properly, and that the applicable system gauge should be checked and monitored to determine when or if any corrective action is required.

Standard electrical accessories include the navigation lights, anti collision strobe lights, landing/taxi lights, instrument panel lighting and cabin dome light.

Two lights, mounted in the overhead panel, provide instrument and cockpit lighting for night flying. The lights are controlled by rheostat switches located in the overhead panel. A map light window in each lens is actuated by an adjacent switch. A wing tip landing/taxi light system consists of 2 lights (one in each wing tip) and is operated by a rocker type switch mounted on the overhead switch panel. (Wing tip lights also used as recognition lights.)

The digital ammeter in the alternator system displays in amperes the load placed on the alternator. It does not indicate battery discharge. With all electrical equipment off (except the master switch) the ammeter will be indicating the amount of charging current demanded by the battery. As each item of electrical equipment is turned on, the current will increase to a total appearing on the ammeter. This total includes the battery. The average continuous load for night flight, with radios on, is about 32 amperes. This 32 ampere value, plus approximately 2 amperes for a fully charged battery, will appear continuously under these flight conditions.

**WARNING** Anti-collision lights should not be operating when flying through cloud, fog or haze, since the reflected light can produce spatial disorientation. Strobe lights should not be used in close proximity to the ground such as during taxiing, takeoff or landing.

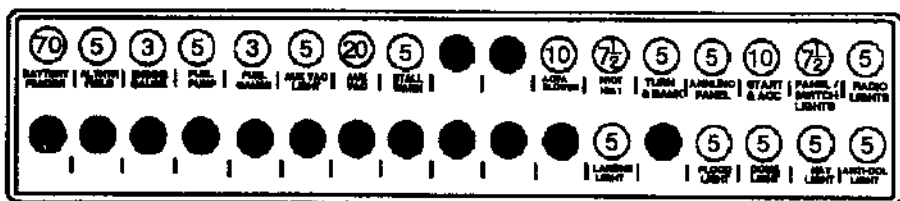


ALTERNATOR AND STARTER SCHEMATIC

Figure 7-11

**CAUTION:** Do not use cigar lighter receptacles as power sources for any devices other than the cigar lighters supplied with the airplane. Any other device plugged into these receptacles may be damaged.

For abnormal and/or emergency operation and procedure, see Section 3.



### CIRCUIT BREAKER PANEL

Figure 7-13

#### 7.17 VACUUM SYSTEM

The vacuum system is designed to operate the air driven gyro instruments. This includes the directional and attitude gyros when installed. The system consists of an engine driven vacuum pump, a vacuum regulator, a filter and the necessary plumbing.

The vacuum pump is a dry type pump which eliminates the need for an air/oil separator and its plumbing. A shear drive protects the pump from damage. If the drive shears, the gyros will become inoperative.

The vacuum gauge, mounted on the left instrument panel (refer to figure 7-15), provides valuable information to the pilot about the operation of the vacuum system. A decrease in pressure in a system that has remained constant over an extended period may indicate a dirty filter, dirty screens, possibly a sticking vacuum regulator or leak in system (a low vacuum indicator light is provided in the annunciator panel). Zero pressure would indicate a sheared pump drive, defective pump, possibly a defective gauge or collapsed line. In the event of any gauge variation from the norm, the pilot should have a mechanic check the system to prevent possible damage to the system components or eventual failure of the system.

A vacuum regulator is provided in the system to protect the gyros. The valve is set so the normal vacuum reads 4.8 to 5.2 inches of mercury, a setting which provides sufficient vacuum to operate all the gyros at their rated RPM. Higher settings will damage the gyros and with a low setting the gyros will be unreliable. The regulator is located behind the instrument panel and is accessible from below the instrument panel.

### 7.19 INSTRUMENT PANEL

The instrument panel (Figure 7-15) is designed to accommodate the customary advanced flight instruments and the normally required powerplant instruments. The artificial horizon and directional gyro are vacuum operated and are located in the center of the left hand instrument panel. The vacuum gauge is located on the upper left hand instrument panel with the electric standby vacuum pump switch located directly below. The turn indicator the left side is electrically operated.

The radios are located in the center section of the panel, and the circuit breakers located in the lower right corner of the panel. All avionics switches plus pitot heat are grouped below the left radio stack.

Incorporated in the over head switch panel (7-15A) are all the engine related switches, grouped to the left of center, with exterior lighting switches grouped to the right of center.

Standard 3 1/8 inch diameter engine gauges are installed to the left of the throttle quadrant for monitoring engine operation. These gauges consist of a combination oil pressure, oil temperature and fuel pressure gauge, exhaust gas temperature (EGT), and a tachometer (RPM) gauge.

The normal operating range for ground and flight operation is indicated on the radial nearest the yellow or green arc, the limit is met.