

Chapter Fourteen

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Fig. 14-1. *The pressure of a static liquid at any one point is the same in every direction and exerts an equal force in all directions.*

An example of a closed hydraulic system is the car rack at an automobile repair shop. The fluid is contained within the unit and used over and over. The hydraulic system in an aircraft is a closed system because it confines the fluid. In a closed system, fluid pressure may be increased, which increases the amount of work derived from a given amount of fluid.

There are many possible uses for hydraulics in an airplane. Some of them can alternately be accomplished with pneumatics and electric motors but overall hydraulics tends to be the system of choice for doing big jobs. The more obvious uses of hydraulics are brakes, flaps, and retractable landing gear such as shown in Figure 14-2, but there are others. Hydraulics has also been used with gear struts, engine valve lifters, shock absorbers, nosewheel shimmy dampers, antiskid systems, and control surface actuators.

SYSTEM COMPONENTS

While hydraulic systems may be used in many different ways, all systems share common components. Hydraulic systems are composed of six basic elements: hydraulic fluid, reservoir, pump, pressure control valve, fluid control valves, and actuators. All systems share these common components, while more sophisticated systems may include additional components such as an accumulator.

Fluid

Fluids are flexible. They readily change shape to fit their surroundings, can be divided into parts to work in different places, have the capability to move rapidly in one place and slowly in another, and can transmit a force in any direction.

There are two categories of fluid: compressible and incompressible. Compressible fluids, called gases, are such fluids as air and nitrogen. The branch of mechanics that deals with the properties of gases is called *pneumatics*. Incompressible fluids (liquids) include water, oil, and hydraulic fluids, to name a few. The science that deals with the transmission of energy, and the effect of the flow of liquids, is called *hydraulics*.

Hydraulic fluid is the lifeblood of the system. There are many other incompressible fluids that could transmit force, but hydraulic fluid is very special because its characteristics