

## Chapter Fourteen

activation of other hydraulic components. Check valves permit flow in one direction only, preventing fluid from backing up in the system. Thermal relief valves are activated by excessively high fluid temperature, which causes fluid to expand. The valve will eliminate the excess fluid.

### Actuators

The purpose of an actuator is to transform the energy of fluid flow to a mechanical force. There are several types of basic actuators: single acting, double acting, and rotary. The single-acting cylinder depicted in Figure 14-3 moves under hydraulic pressure in only one direction. To return to its original position, it requires some outside force such as a spring. Some flap systems are single acting, using the air load to retract the flaps.

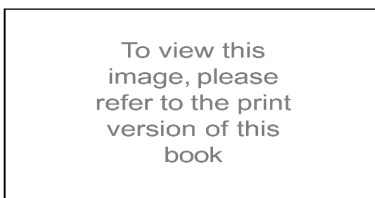
The double-acting cylinder (nondifferential type) uses the same force in both directions, because each side of the cylinder has an identical surface area, as illustrated in Figure 14-4. Generally, the left rod in the illustration will not be connected to anything, but it is there to take up space and assure equal surface (equal pressure) on both sides. Cessna uses the simple rack and rotary-actuator-driven pinion to retract the main landing gear on its single-engine aircraft. For tasks requiring continuous motion, a piston-and-vane type hydraulic motor is used. Such a motor, common on larger aircraft, provides high power output with instantaneous reversal capability.

The alternative to a hydraulic actuator is an electromechanical actuator. For all the talk within the aerospace power and motion control industry about electromechanical systems, it is somewhat surprising that they are still fairly rare in the industry and essentially nonexistent on light, general-aviation aircraft. At least for the time being, these devices appear to be relegated to a secondary or backup system status on a few select military and air transport aircraft.

There are two primary methods of incorporating electromechanical actuators. One method is a system controlled by a single, main motor with flexshafts that go to the in-



**Fig. 14-3.** *Single-acting cylinder.*



**Fig. 14-4.** *Double-acting cylinder.*