The turbocharged engine, on the other hand, has all positive pressure strokes. When the intake valve opens, air from the turbocharger is pumped into the cylinder as fast as the piston can move downward. This prevents drastic force changes and is easier on the engine.

Despite the consistency of pressure within the cylinders, turbocharged engines have shorter TBOs than their normally aspirated counterparts. One factor used in determining TBO is how hard the engine is worked during an average hour. With a turbocharged engine, the pilot is able to operate at rated takeoff power for a significantly longer time. Whereas the normally aspirated engine begins to lose power immediately after takeoff, the turbocharged engine routinely operates at a higher percentage of its rated power during a greater part of its lifetime. That means the engine must dissipate more heat over a longer period of time. That greater amount of heat results from higher power settings, in addition to the heat generated by the turbocharger itself. Remember, when air is compressed, it increases in temperature. That hot, compressed air is mixed with fuel and shoved into the engine, and that heat reduces engine life.

CONTROLLING A TURBOCHARGER

From an operational standpoint, a turbocharger needs one additional piece of equipment. If engine exhaust gases spin the turbine, which in turn spins the compressor, the system needs a way of controlling the freewheeling turbine and the resultant air pressure. Control is accomplished with a *wastegate*, a damperlike device that regulates the amount of exhaust that hits the turbine rotor. This may be seen in the illustration of the Cessna Turbo Stationair turbocharger system in Figure 7-4.

Fig. 7-4. *Cessna TU206G Turbo Stationair turbocharger system.* (Courtesy of Cessna Aircraft Company)