of requirements. A method established early on to classify gasoline is by its antiknock value, called octane.

Two types of hydrocarbons found in gasoline are isooctane and normal heptane. Isooctane has a high antiknock value, while normal heptane does not. Octane rating is simply the percentage of isooctane mixed into normal heptane. For instance, 80-octane gasoline is a solution of 80% isooctane in normal heptane. The higher the octane number, the greater the antiknock capability.

As new metal alloys were perfected, they permitted the development of engines capable of greater manifold pressures, increased cylinder compression ratios, and significantly higher power output. Before long, engines were burning 100-octane avgas, pure isooctane, and engineers were still pushing engines and causing them to succumb to fuel knock.

You may recall from the chapter on powerplants that an engine is most susceptible to engine knock, called detonation, at high power settings. This is particularly true if combined with improper leaning. Excessive temperature can cause the fuel/air mixture within the engine's cylinders to detonate explosively. The same problem exists by increasing cylinder pressure because it results in an increase in temperature. So there began to exist a need to push avgas beyond 100 octane, and the result was the development of fuel performance numbers.

Performance Numbers

It was discovered that by adding tetraethyl lead to avgas it was possible to increase its antiknock value in excess of 100. It is also true that the antiknock value of a given fuel will vary with the fuel/air ratio, so a performance number system was developed that uses two numbers. Take, for instance, 100/130 avgas.

The number 100 in 100/130 avgas represents the performance number at the engine's leanest fuel/air ratio. The 130 represents the performance number at the engine's richest ratio. These fuels opened up new horizons for engine manufacturers until it was discovered that tetraethyl lead has a number of drawbacks, including being a health hazard. Challenged again, manufacturers began developing low lead versions of some types of avgas through the use of other chemicals. The most common types of avgas used in general aviation today are 80/87, 100/130, and 100/130LL (low lead).

The bottom line regarding avgas is that when refueling an aircraft, never use a grade of fuel lower than what is recommended by the manufacturer. In general, you don't want to use a higher grade if you can avoid it, although the use of avgas one grade higher is acceptable if you have no choice.

GRAVITY FEED VERSUS PRESSURE SYSTEMS

The purpose of a light aircraft fuel system is to store fuel safely and deliver the correct amount of it at a uniform flow to the carburetor or other fuel control unit. There are two types of systems: gravity feed and pressure.

Gravity-feed systems, such as shown in Figure 6-2, rely on the force of gravity to deliver fuel from the tank to the carburetor, which limits them to high-wing aircraft. The Cessna 152 uses a gravity-feed system because it is very simple, relatively inexpensive,