

## V-Type Engines

In V-type engines, the cylinders are arranged in two in-line banks generally set  $60^\circ$  apart. Most of the engines have 12 cylinders, which are either liquid cooled or air cooled. The engines are designated by a V followed by a dash and the piston displacement in cubic inches. For example, V-1710. This type of engine was used mostly during the second World War and its use is mostly limited to older aircraft.

## Radial Engines

The radial engine consists of a row, or rows, of cylinders arranged radially about a central crankcase. [Figure 1-2] This type of engine has proven to be very rugged and dependable. The number of cylinders which make up a row may be three, five, seven, or nine. Some radial engines have two rows of seven or nine cylinders arranged radially about the crankcase, one in front of the other. These are called double-row radials. [Figure 1-3] One type of radial engine has four rows of cylinders with seven cylinders in each row for a total of 28 cylinders. Radial engines are still used in some older cargo planes, war birds, and crop spray planes. Although many of these engines still exist, their use is limited. The single-row, nine-cylinder radial engine is of relatively simple construction, having a one-piece nose and a two-section main crankcase. The larger twin-row engines are of slightly more complex construction than the single row engines. For example, the crankcase of the Wright R-3350 engine is composed of the crankcase front section, four crankcase main sections (front main, front center, rear center, and rear main), rear cam and tappet housing, supercharger front housing, supercharger rear housing, and supercharger rear housing cover. Pratt and Whitney engines of comparable size incorporate the same basic sections, although the construction and the nomenclature differ considerably.

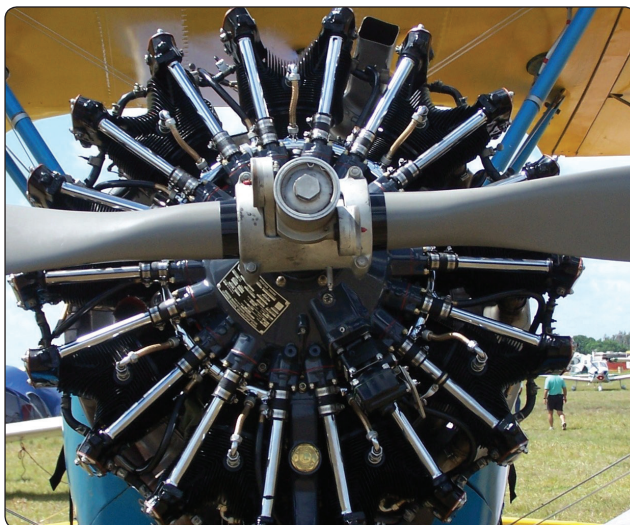


Figure 1-2. Radial engine.

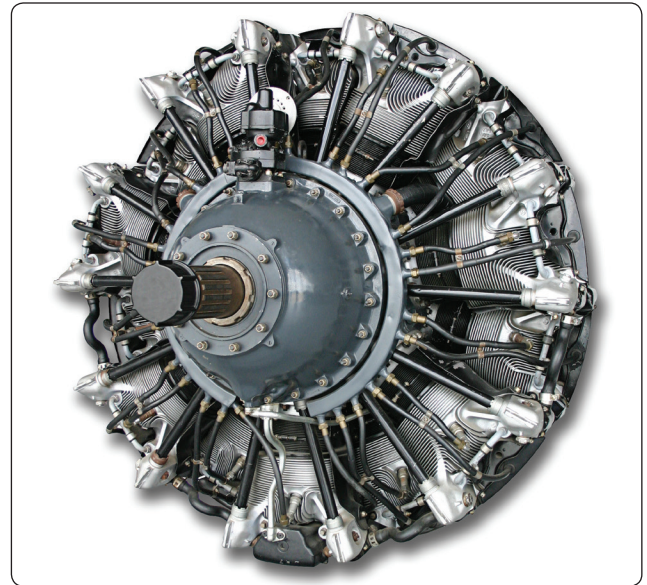


Figure 1-3. Double row radials.

## Reciprocating Engines

### Design and Construction

The basic major components of a reciprocating engine are the crankcase, cylinders, pistons, connecting rods, valves, valve-operating mechanism, and crankshaft. In the head of each cylinder are the valves and spark plugs. One of the valves is in a passage leading from the induction system; the other is in a passage leading to the exhaust system. Inside each cylinder is a movable piston connected to a crankshaft by a connecting rod. Figure 1-4 illustrates the basic parts of a reciprocating engine.

### Crankcase Sections

The foundation of an engine is the crankcase. It contains the bearings and bearing supports in which the crankshaft revolves. Besides supporting itself, the crankcase must provide a tight enclosure for the lubricating oil and must support various external and internal mechanisms of the engine. It also provides support for attachment of the cylinder assemblies, and the powerplant to the aircraft. It must be sufficiently rigid and strong to prevent misalignment of the crankshaft and its bearings. Cast or forged aluminum alloy is generally used for crankcase construction because it is light and strong. The crankcase is subjected to many variations of mechanical loads and other forces. Since the cylinders are fastened to the crankcase, the tremendous forces placed on the cylinder tend to pull the cylinder off the crankcase. The unbalanced centrifugal and inertia forces of the crankshaft acting through the main bearings subject the crankcase to bending moments which change continuously in direction and magnitude. The crankcase