7

LOBE AND SLIDING VANE COMPRESSORS

Lobe-type* or rotary positive blowers, also called *rotary piston machines* or *gas pumps,* are intended for use with steam and noncorrosive gases. Basic models (Figs. 7.1 and 7.2) are usually designed with integral shaft ductile iron impellers (Fig. 7.3) that have an involute profile. The alloy steel timing gears are taper mounted on the shafts, and cylindrical roller bearings are generally used. Both ends of the unit are splash oil lubricated. The casing, headplates, gear cover, and end cover are typically made of gray cast iron. Piston ring seals form a labyrinth between the compression chamber and cored vent cavities. The vent cavities are valved for purge or drain.

On many modern lobe machines, high-performance mechanical seals are installed at each bearing to control gas and oil leakage and are suitable for vacuum or pressure service (Fig. 7.4). Some models of lobe blowers or gas pumps incorporate a proprietary design that reduces noise and power loss by using an exclusive wraparound flange and jet to control pressure equalization, eliminating rapid backflow of gas into the pump from the discharge area.

The operating principle of lobe machines is illustrated in Fig. 7.5. Incoming gas (right) is trapped by impellers. Simultaneously, pressurized gas (left) is being discharged (*a*). As the lower impeller passes the wraparound flange, a portion of the gas (white arrow) equalizes pressure between trapped gas and discharge area, thus aiding impeller movement and reducing power (*b*). The impellers now move gas into the discharge area (left). Backflow is controlled, resulting in reduction of noise relative to conventional gas pumps (*c*).

Main fields of application for rotary piston blowers, or lobe machines, are pneumatic conveying plants for bulk materials in vacuum and pressure operating systems. The smallest

* Based on information provided by Aerzen USA Company, Coatesville, Pa., and Dresser Industries, Inc., Roots Division, Connersville, Ind.

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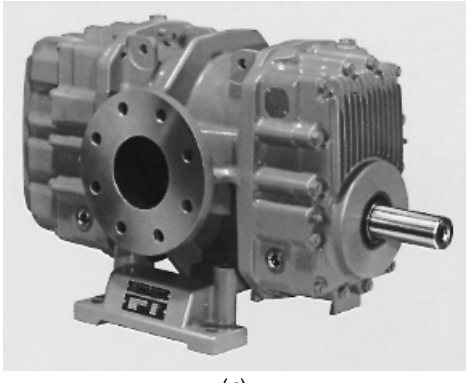
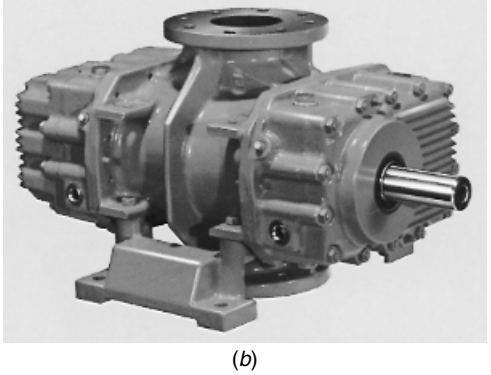
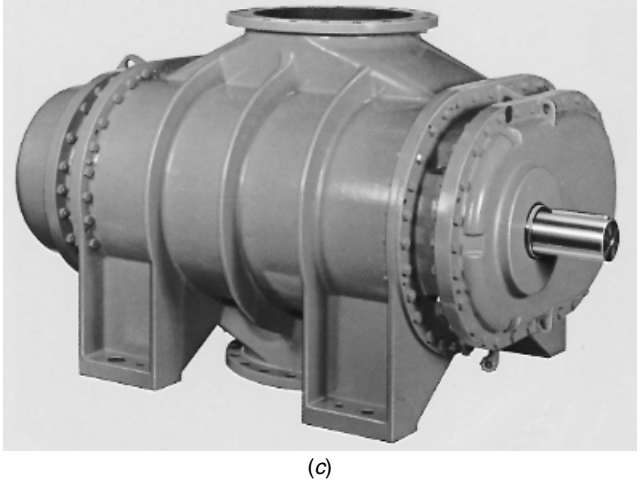


(*a*)

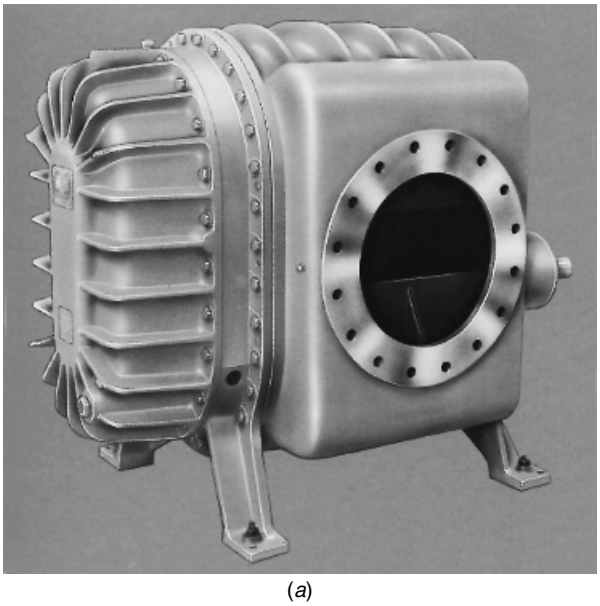


(*b*)

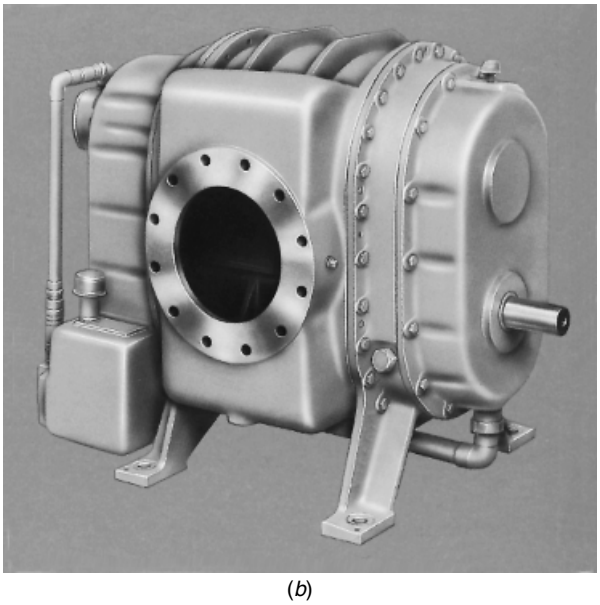


(*c*)

FIGURE 7.1 Typical small-to-moderate-sized lobe blowers. *(Aerzen USA Company, Coatesville, Pa.)*



(*a*)



(*b*)

FIGURE 7.2 Basic lobe blowers. *(Dresser Industries, Inc., Roots Division, Connersville, Ind.)*

blowers are mounted on bulk-carrying vehicles; the largest machines (Fig. 7.6) are used in pneumatic elevators for unloading of vessels. The hourly output of these plants is up to 1000 tons. Another frequent application is in aeration ponds of sewage treatment plants. Other lobe machines are found in power plants or facilities requiring high-pressure gas circulation with pressure-tight machines up to a maximum of 25 bar internal pressure. Typical pressure rise capabilities are 12 psi (0.8 atm).

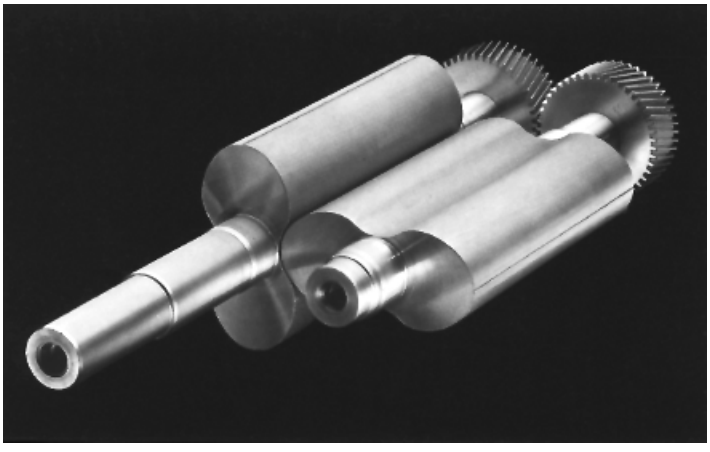


FIGURE 7.3 Integral shaft ductile iron rotors and impellers for lobe blowers. *(Aerzen USA Company, Coatesville, Pa.)*

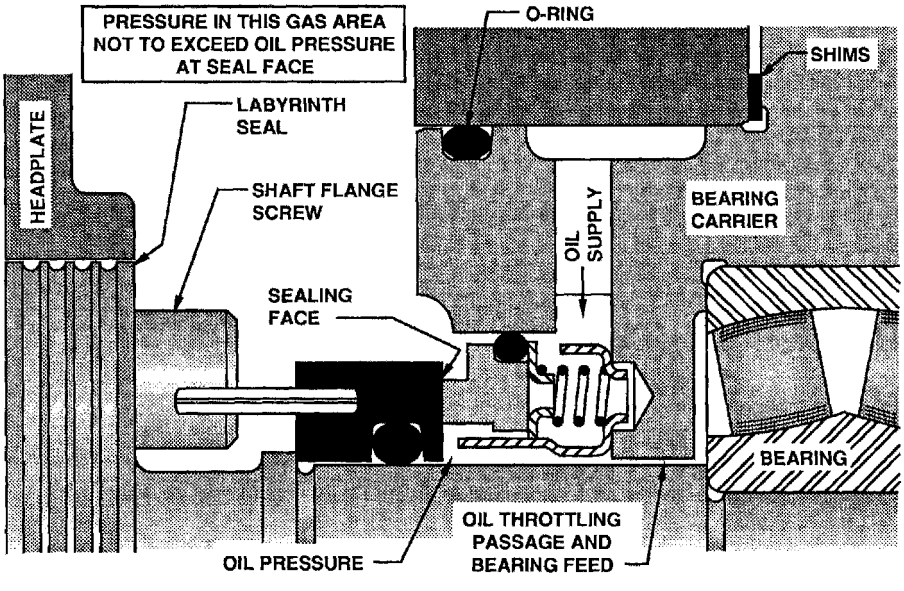


FIGURE 7.4 Mechanical seal installed on a modern lobe blower. *(Dresser Industries, Inc., Roots Division, Connersville, Ind.)*

A large variety of sizes and models cover the capacity range from 30 to 85,000 m^3/h (approximately 18 to 50,000 cfm). Drivers include electric motors, internal combustion engines, and hydraulic motors.

Sliding vane compressors* (Fig. 7.7) are typically found in such applications as air blast hole drilling, pneumatic conveying, chemical and petroleum vapor recovery, gas transmission,

* Based on information provided by A-C Compressor Corporation, Appleton, Wis.

FIGURE 7.5 Operating principle of lobe blowers. *(Dresser Industries, Inc., Roots Division, Connersville, Ind.)*

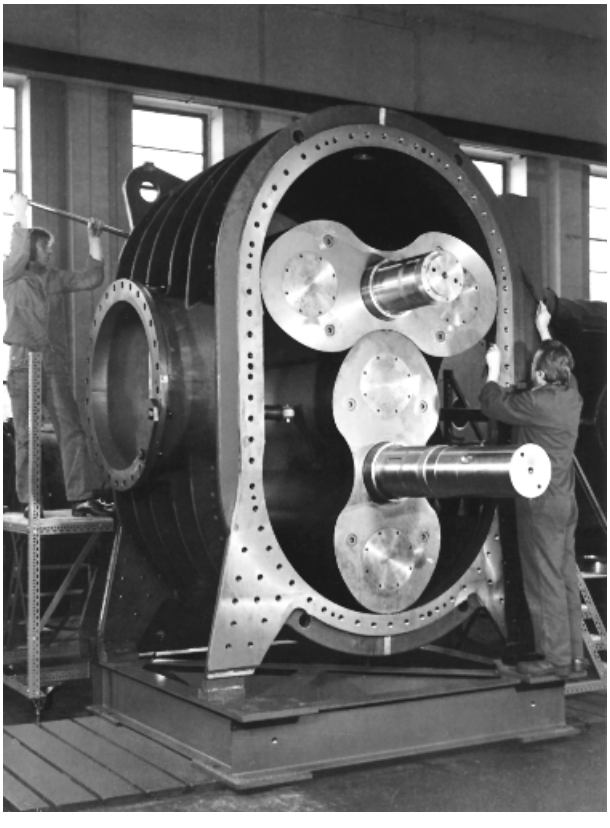


FIGURE 7.6 Large lobe rotary piston blower. *(Aerzen USA Company, Coatesville, Pa.)*

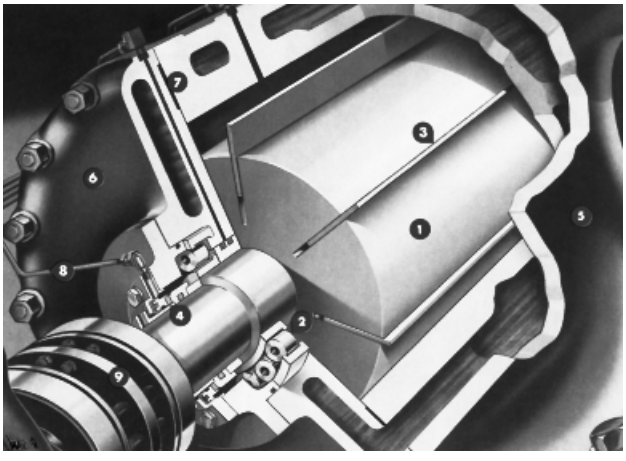


FIGURE 7.7 Sliding vane compressor and principal components: rotor and shaft (1), bearings (2), blades (3), mechanical seals (4), cylinder and housing (5), heads and covers (6), gaskets (7), lube supply line (8), coupling (9). *(A-C Compressor Corporation, Appleton, Wis.)*

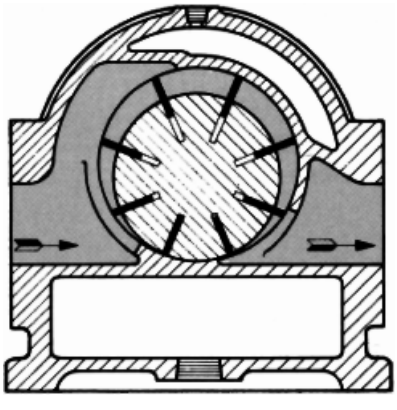


FIGURE 7.8 Operating principle of a sliding vane compressor. *(A-C Compressor Corporation, Appleton, Wis.)*

and small plant air systems. Each unit has a rotor eccentrically mounted inside a water-jacketed cylinder. The rotor is fitted with blades that are free to move radially in and out of longitudinal slots. These blades are forced out against the cylinder wall by centrifugal force. Figure 7.8 illustrates how individual cells are thus formed by the blades, and the air or gas inside these cells is compressed as the rotor turns.

Sliding vane compressors are available in single- and multistage geometries. Typical single-stage capacities are ranging through 3200 cfm and 50 psig; two-stage compressors deliver pressures from 60 to 150 psig and flows up to approximately 1800 cfm.