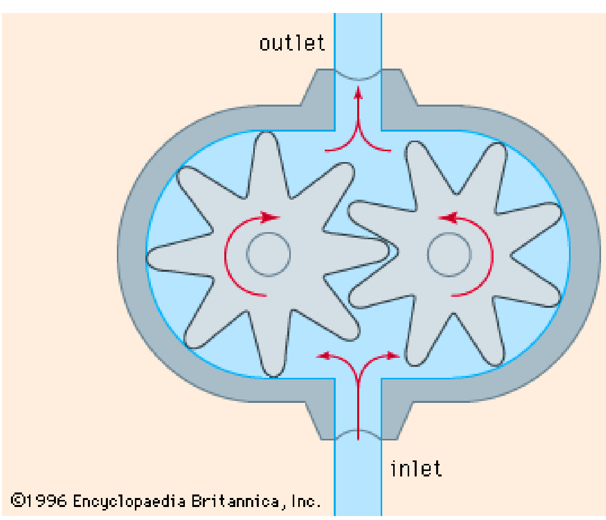
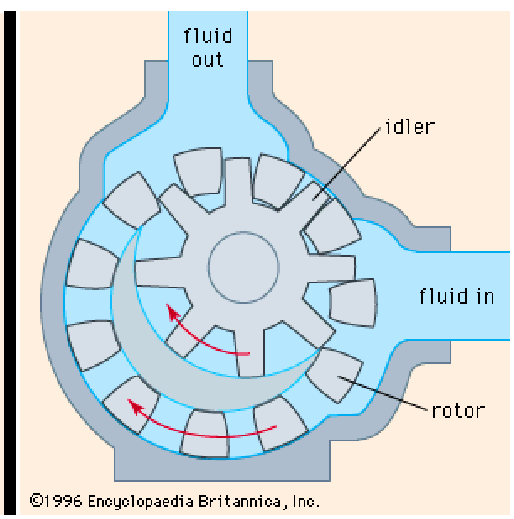
Rotary Pumps

By definition, positive-displacement (PD) pumps displace a known quantity of liquid with each revolution of the pumping elements. This is done by trapping liquid between the pumping elements and a stationary casing. Pumping element designs include gears, lobes, rotary pistons, vanes, and screws.
PD pumps are found in a wide range of applications -- chemical-processing; liquid delivery; marine; biotechnology; pharmaceutical; as well as food, dairy, and beverage processing. Their versatility and popularity is due in part to their relatively compact design, high-viscosity performance, continuous flow regardless of differential pressure, and ability to handle high differential pressure.
Pump School® is made up of information from a variety of sources including manufacturers, governmental agencies, industry trade organizations, and common PD industry knowledge.

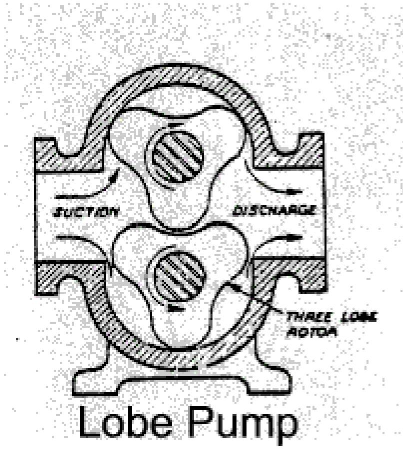
A rotary pump traps fluid in its closed casing and discharges a smooth flow. They can handle almost any liquid that does not contain hard and abrasive solids, including viscous liquids. They are also simple in design and efficient in handling flow conditions that are usually considered to low for economic application of centrifuges. Types of rotary pumps include cam-and-piston, internal-gear, lobular, screw, and vane pumps. Gear pumps are found in home heating systems in which the burners are fired by oil. Rotary pumps find wide use for viscous liquids. When pumping highly viscous fluids, rotary pumps must be operated at reduced speeds because at higher speeds the liquid cannot flow into the casing fast enough to fill it. Unlike a centrifugal pump, the rotary design will deliver a capacity that is not greatly affected by pressure variations on either the suction or discharge ends. In services where large changes in pressure are anticipated, the rotary design should be considered.

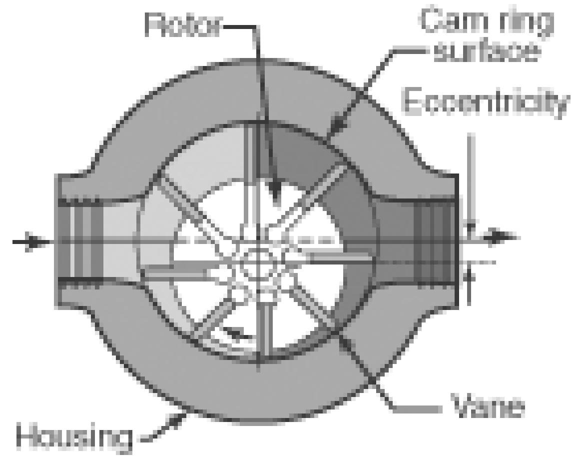


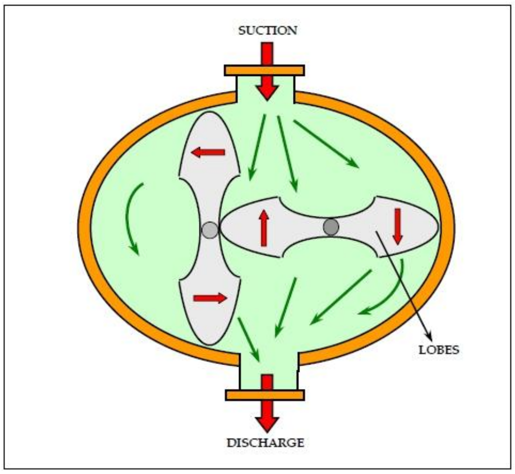


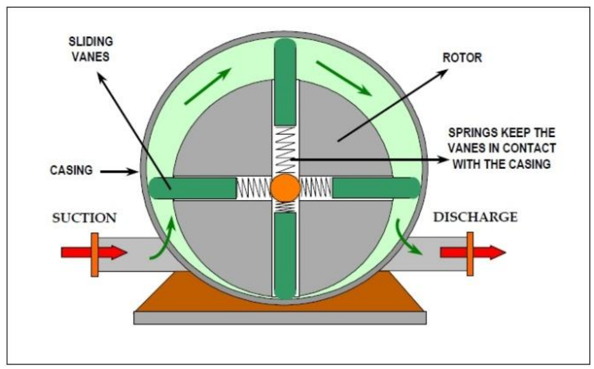
External gear Pump

Internal gear Pump









Advantages of Rotary Pumps

- They can deliver liquid to high pressures.
- Self - priming.
- Give a relatively smooth output, (especially at high speed).
- Positive Acting.
- Can pump viscous liquids.

Disadvantages of Rotary Pumps

- More expensive than centrifugal pumps.
- Should not be used for fluids containing suspended solids.
- Excessive wear if not pumping viscous material.
- Must NEVER be used with the discharge closed.

A rotary vane pump is a positive-displacement pump that consists of vanes mounted to a rotor that rotates inside of a cavity. In some cases these vanes can be variable length and/or tensioned to maintain contact with the walls as the pump rotates

Types

The simplest vane pump is a circular rotor rotating inside of a larger circular cavity. The centers of these two circles are offset, causing eccentricity. Vanes are allowed to slide into and out of the rotor and seal on all edges, creating vane chambers that do the pumping work. On the intake side of the pump, the vane chambers are increasing in volume. These increasing volume vane chambers are filled with fluid forced in by the inlet pressure. Often this inlet pressure is nothing more than pressure from the atmosphere. On the discharge side of the pump, the vane chambers are decreasing in volume, forcing fluid out of the pump. The action of the vane drives out the same volume of fluid with each rotation. Multistage rotary vane vacuum pumps can attain pressures as low as 10^{-3} mbar (0.1 Pa).

Uses

Common uses of vane pumps include high pressure hydraulic pumps and automotive uses including, supercharging, power steering and automatic transmission pumps. Pumps for mid-range pressures include applications such as carbonators for fountain soft drink dispensers and espresso coffee machines. They are also often used as vacuum pumps for providing braking assistance (through a braking booster) in large trucks, and in most light aircraft to drive gyroscopic flight instruments, the attitude indicator and heading indicator. Furthermore, vane pumps can be used in low-pressure gas applications such as secondary air injection for auto exhaust emission control, and in vacuum applications including evacuating refrigerant lines in air conditioners, and laboratory freeze dryers, extensively in semiconductor low pressure chemical vapor deposition systems, and vacuum experiments in physics. In this application the pumped gas and the oil are mixed within the pump, but must be separated externally. Therefore the inlet and the outlet have a large chamber – maybe with swirl – where the oil drops fall out of the gas. The inlet has a venetian blind cooled by the room air (the pump is usually 40 K hotter) to condense cracked pumping oil and water, and let it drop back into the inlet. It eventually exits through the outlet.

Source : http://nprcet.org/e%20content/mech/FMM.pdf