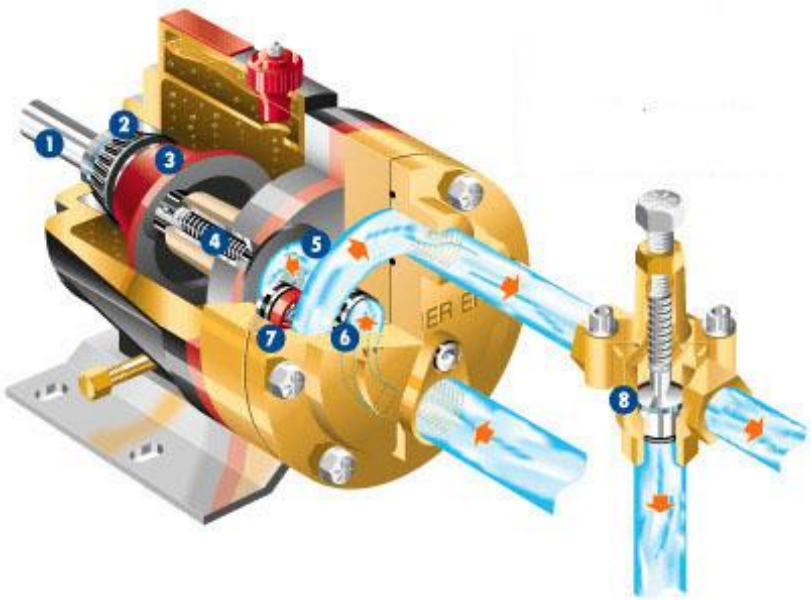
POSITIVE DISPLACEMENT PUMPS

Positive-displacement pumps are another category of pumps. Types of positive-displacement pumps are reciprocating, metering, and rotary pumps. Positive-displacement pumps operate by forcing a fixed volume of fluid from the inlet pressure section of the pump into the discharge zone of the pump. These pumps generally tend to be larger than equal-capacity dynamic pumps. Positive-displacement pumps frequently are used in hydraulic systems at pressures ranging up to 5000 psi. A principal advantage of hydraulic power is the high power density (power per unit weight) that can be achieved. They also provide a fixed displacement per revolution and, within mechanical limitations, infinite pressure to move fluids.

Positive displacement means that, when the pump piston or rotor moves, fluid moves and displaces the fluid ahead of it. Because of its operation, a positive displacement pump can build up a very high discharge pressure and, should a valve in the discharge system be closed for any reason, serious damage may result - the cylinder head, the casing or other downstream equipment may rupture or the driver may stall and burn out.

A Positive Displacement pump must therefore be fitted with a safety relief system on the discharge side.



TYPES OF POSITIVE DISPLACEMENT PUMP

- ROTARY PUMPS
- RECIPROCATING (PISTON) PUMPS

Rotary Pumps

In Rotary pumps, movement of liquid is achieved by mechanical displacement of liquid produced by rotation of a sealed arrangement of intermeshing rotating parts within the pump casing.

THE GEAR PUMP

Construction and Operation:

In this pump, intermeshing gears or rotors, rotate in opposite directions, just like the gears in a vehicle or a watch mechanism. The pump rotors are housed in the casing or stator with a very small clearance between them and the casing. (The fluid being pumped will lubricate this small clearance and help prevent friction and therefore wear of the rotors and casing).

1. In this type of pump, only one of the rotors is driven. The intermeshing gears rotate the other rotor. As the rotors rotate, the liquid or gas, (this type of machine can also be used as a compressor), enters from the suction line and fills the spaces between the teeth of the gears and becomes trapped forming small 'Slugs' of fluid between the teeth.
2. The slugs are then carried round by the rotation of the teeth to the discharge side of the pump.
3. At this point, the gears mesh together and, as they do so, the fluid is displaced from each cavity by the intermeshing teeth.
4. Since the fluid cannot pass the points of near contact of the intermeshed teeth nor between the teeth and casing, it can only pass into the discharge line.
5. As the rotation continues, the teeth at the suction end are opened up again and the same amount of fluid will fill the spaces and the process repeated. The liquid at the discharge end is constantly being displaced (moved forward).

Thus gear pumps compel or force a fixed volume of fluid to be displaced for each revolution of the rotors giving the 'Positive Displacement' action of the pump.

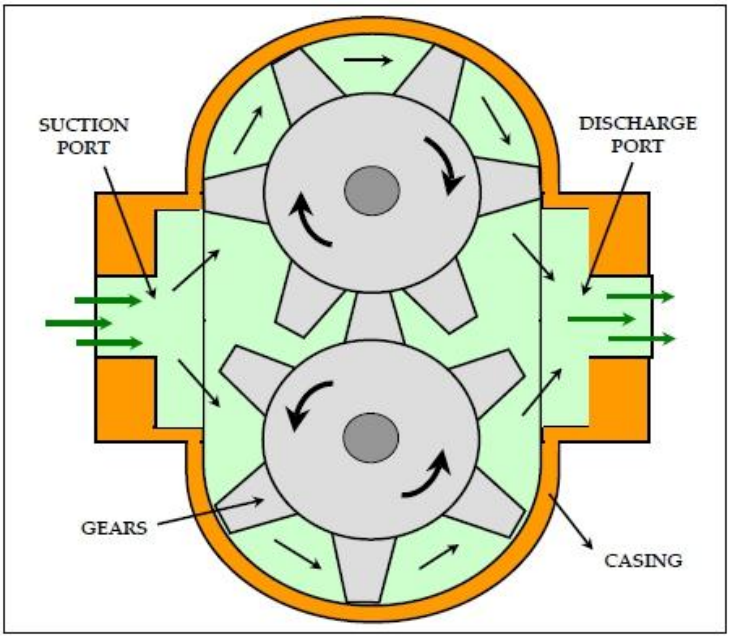
Gear pumps are generally operated at high speed and thus give a fairly pulse-free discharge flow and pressure. Where these pumps are operated at slower speeds, as in pumping viscous liquids, the output tends to pulsate due to the meshing of the teeth.

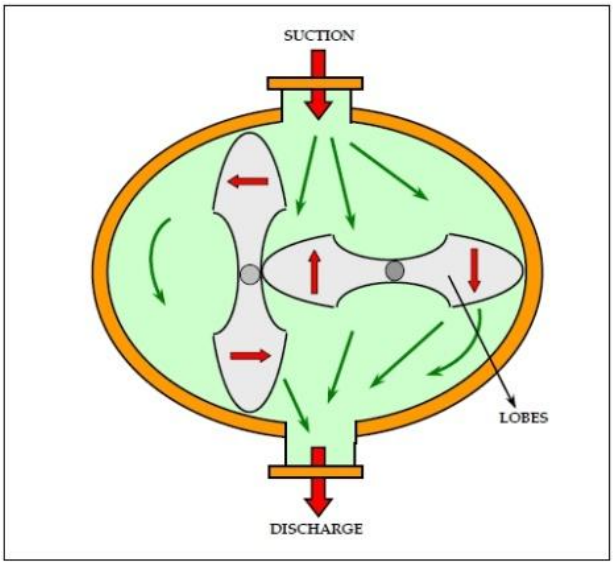
Any gas or air drawn into the pump with the liquid, will be carried through with the liquid and will

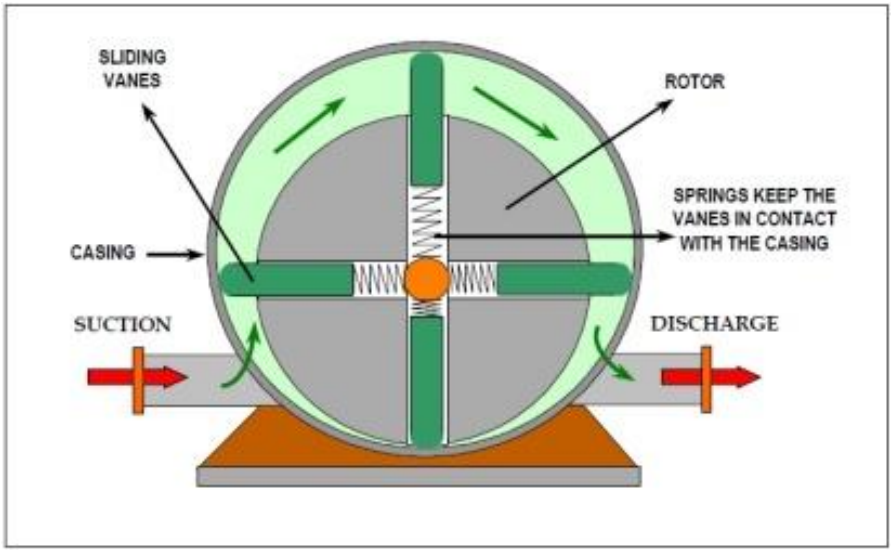
not cause cavitation. This action of the pump means that it's a 'Self Priming' pump. The discharge pressure may however, fluctuate.

The output from this type of pump is directly proportional to the speed of operation. If the speed is doubled, the output will be doubled and the pressure will have very little effect. (*At higher pressures, due to the fine clearances between the teeth and between the casing and the rotors, a small leakage back to the suction side will occur resulting in a very small drop in actual flow rate. The higher the discharge pressure, the more likely that internal leakage will occur*).

Rotary pumps are widely used for viscous liquids and are self-lubricating by the fluid being pumped. This means that an external source of lubrication cannot be used as it would contaminate the fluid being pumped. However, if a rotary pump is used for dirty liquids or slurries, solid particles can get between the small clearances and cause wear of the teeth and casing. This will result in loss of efficiency and expensive repair or replacement of the pump.







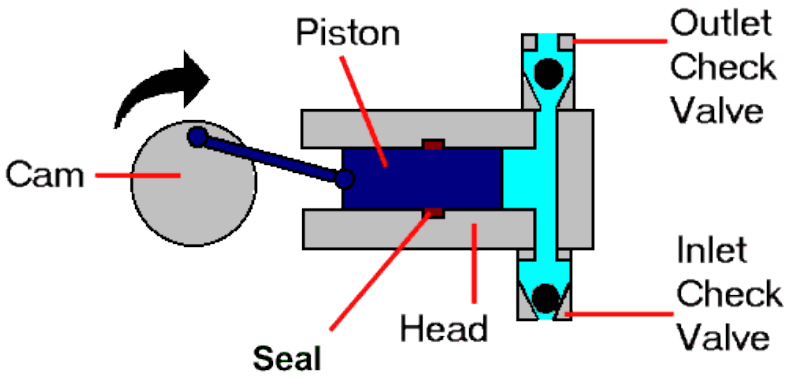
Reciprocating Pumps

In a reciprocating pump, a volume of liquid is drawn into the cylinder through the suction valve on the intake stroke and is discharged under positive pressure through the outlet valves on the discharge stroke. The discharge from a reciprocating pump is pulsating and changes changes only when the speed of the pump is changed. This is because the intake is always a constant volume. Often an air chamber is connected on the discharge side of the pump to provide a more even flow by evening out the pressure surges. Reciprocating pumps are often used for sludge and slurry.

One construction style of a reciprocating pump is the direct-acting steam pump. These consist of a steam cylinder end in line with a liquid cylinder end, with a straight rod conection between the steam

piston and the pump piston or plunger. These pistons are double acting which means that each side pumps on every stroke.

Another construction style is the power pump which convert rotary motion to low speed reciprocating motio using a speed reducing gear. The power pump can be either single or double-acting. A single-acting design discharges liquid only on one side of the piston or plunger. Only one suction and one discharge stroke per revolution of the crankshaft can occur. The double-acting design takes suction and discharges on both sides of the piston resulting in two suctions and discharges per crankshaft revolution. Power pumps are generally very efficient and can develop high pressures. These pumps do however tend to be expensive.



To 'Reciprocate' means 'To Move Backwards and Forwards'.
A 'Reciprocating' pump therefore, is one with a forward and backward operating action. The most simple reciprocating pump is the 'Bicycle Pump', which everyone at some time or other will have used to re-inflate their bike tyres. The name 'Bicycle PUMP' is not really the correct term because it causes compression.

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