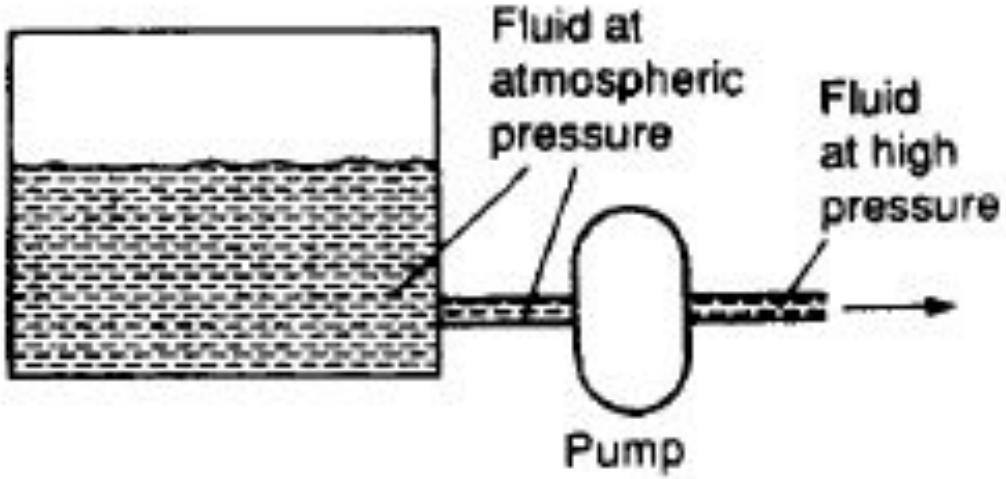
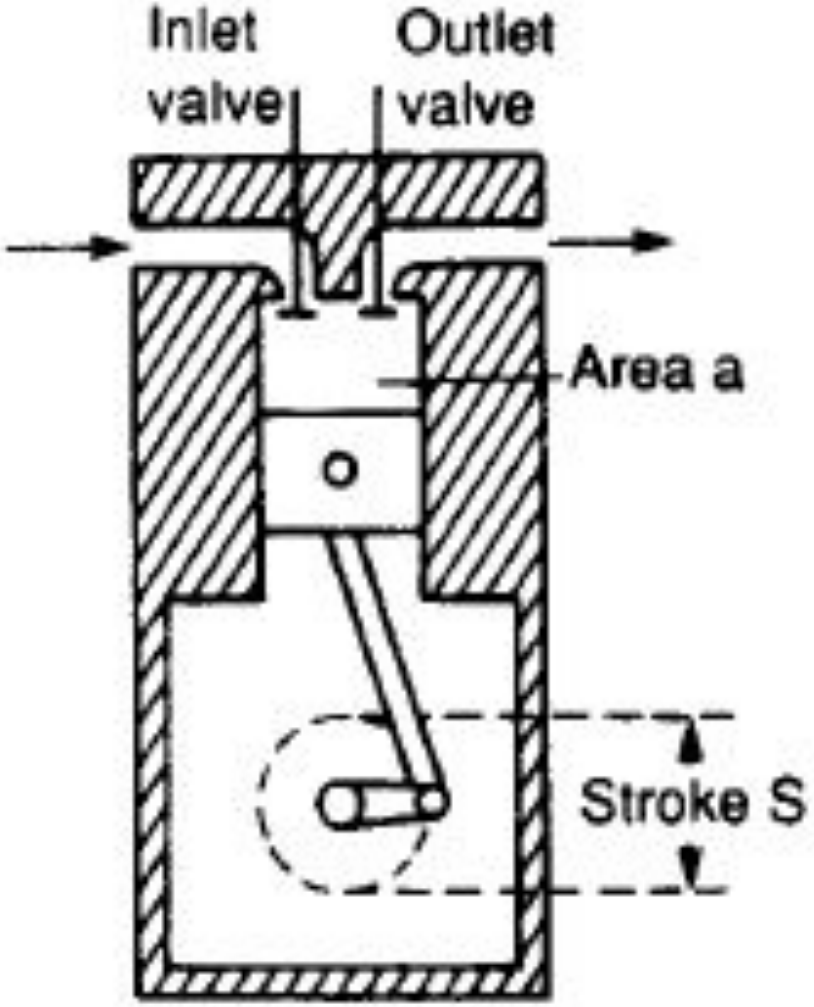
Hydraulics

The Hydraulic Pump



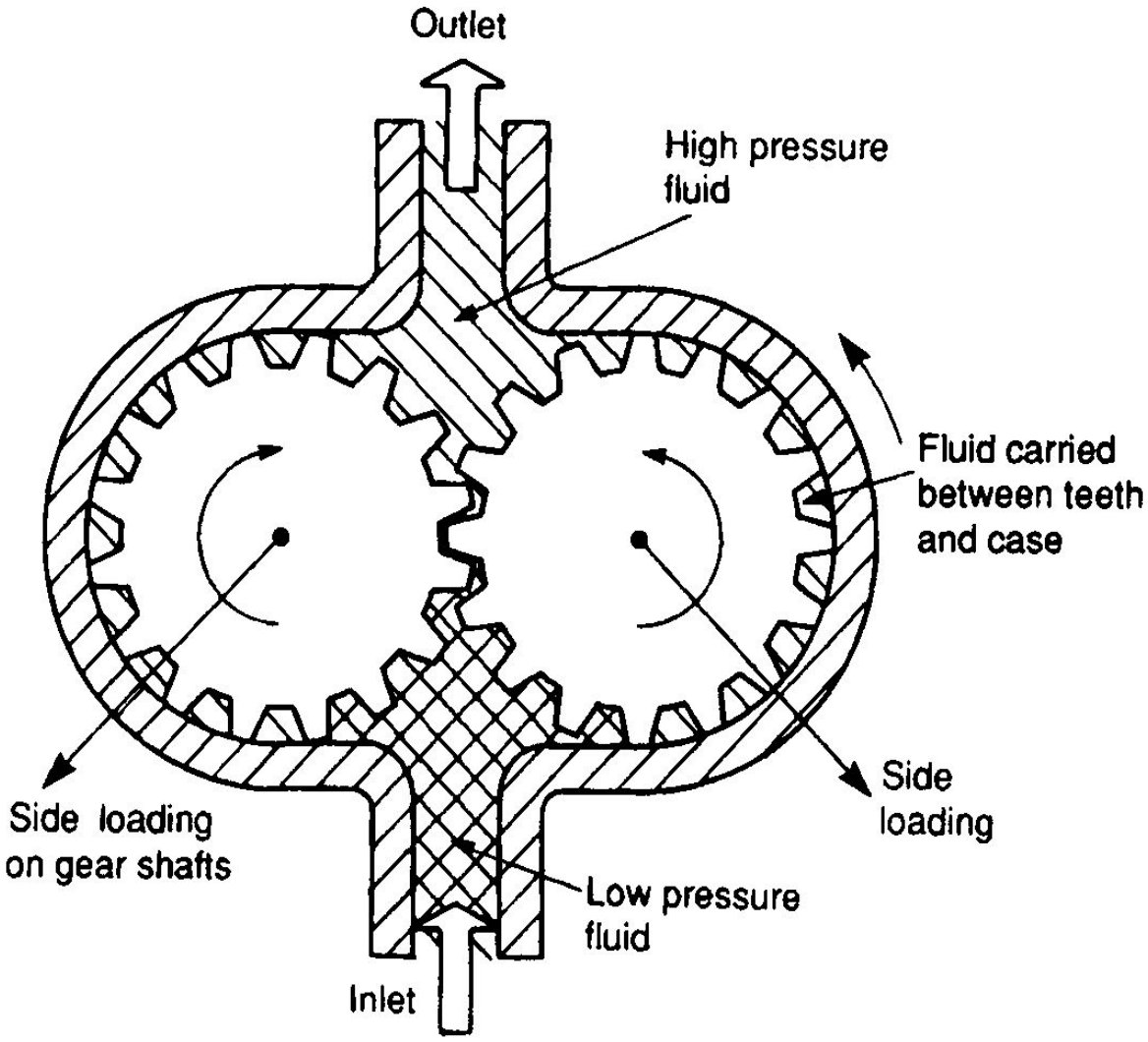
(a) Operation of a pump

(b) Pump symbol, arrow shows direction of flow

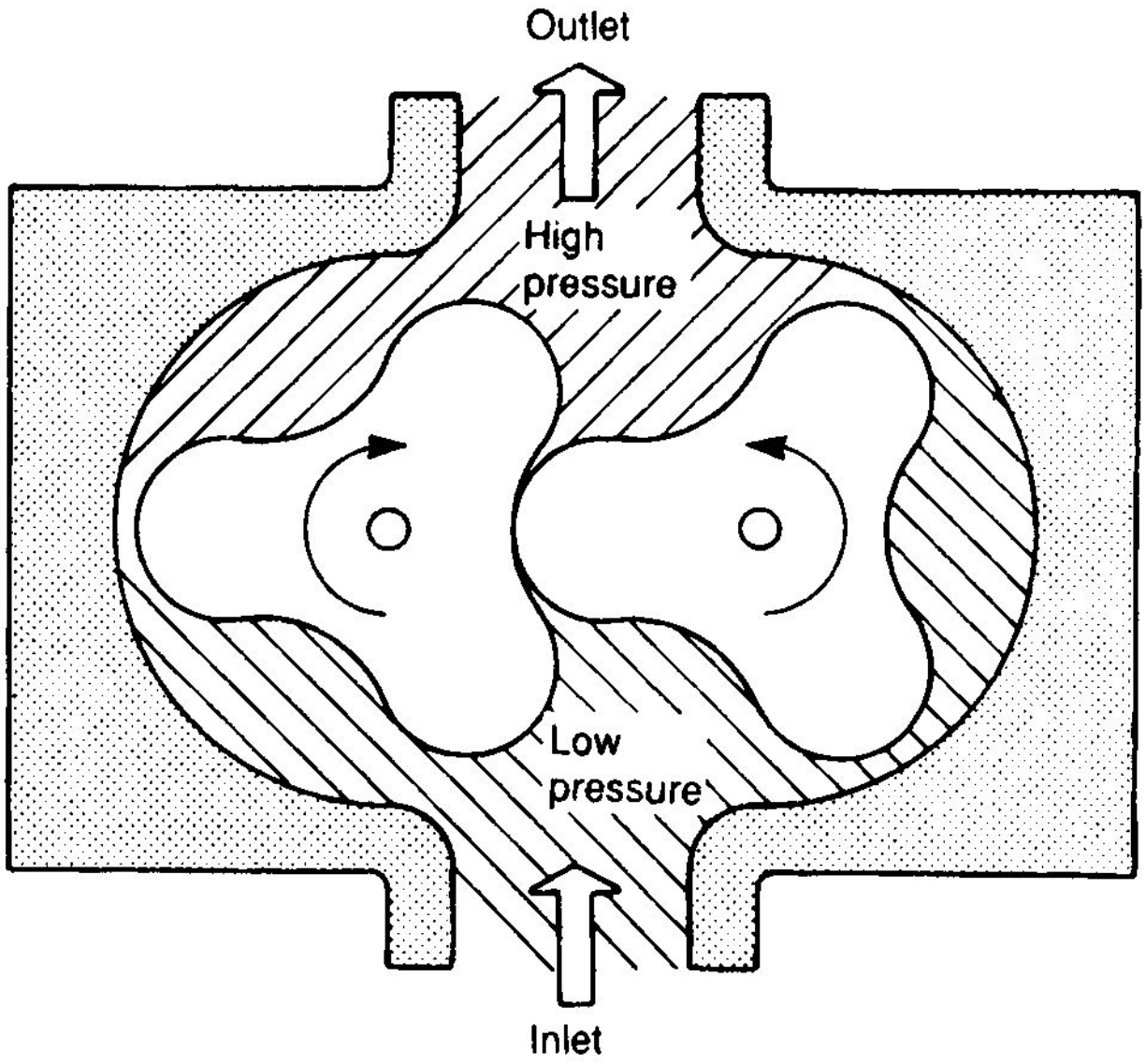


(b) Positive displacement pump

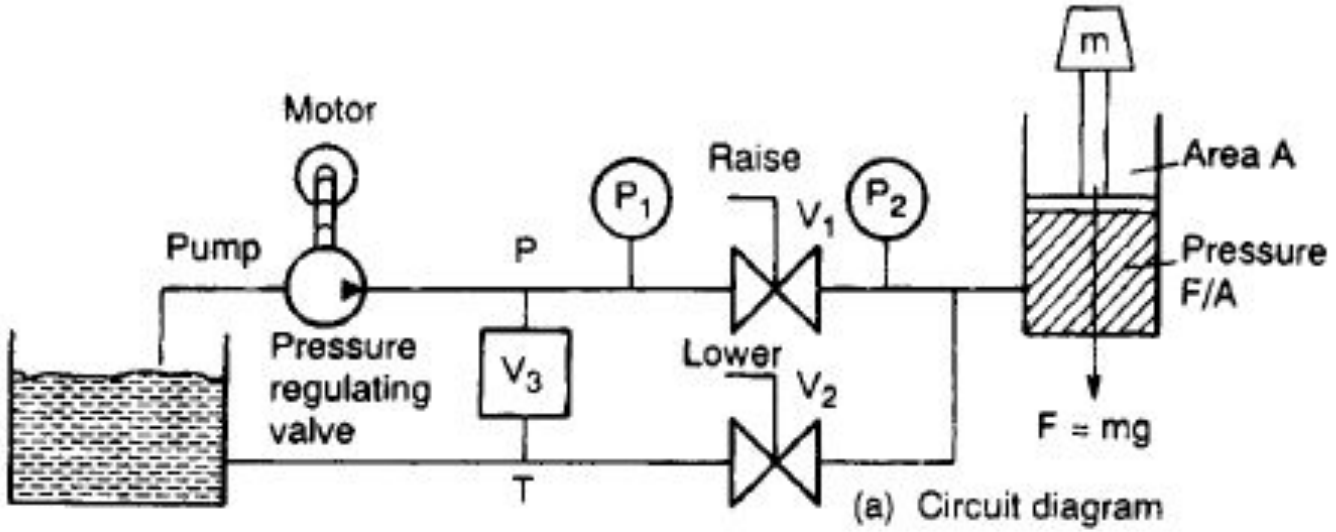
Gear pump


Outlet
High pressure fluid
Fluid carried between teeth and case
Side loading
Side loading on gear shafts
Low pressure fluid
Inlet

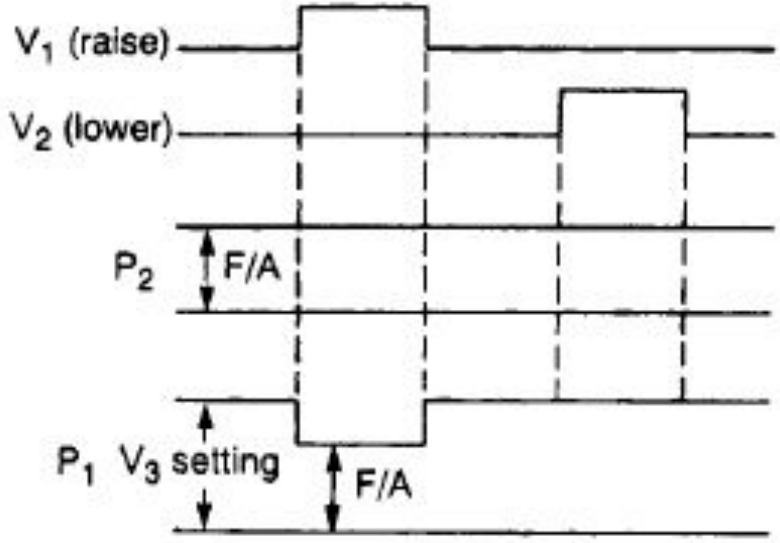
The lobe pump



Action of pressure regulation

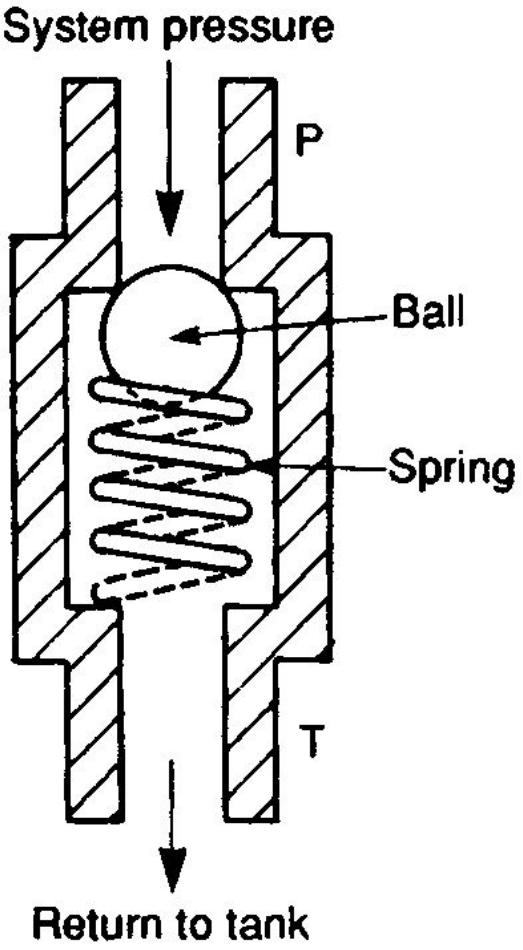


(a) Circuit diagram

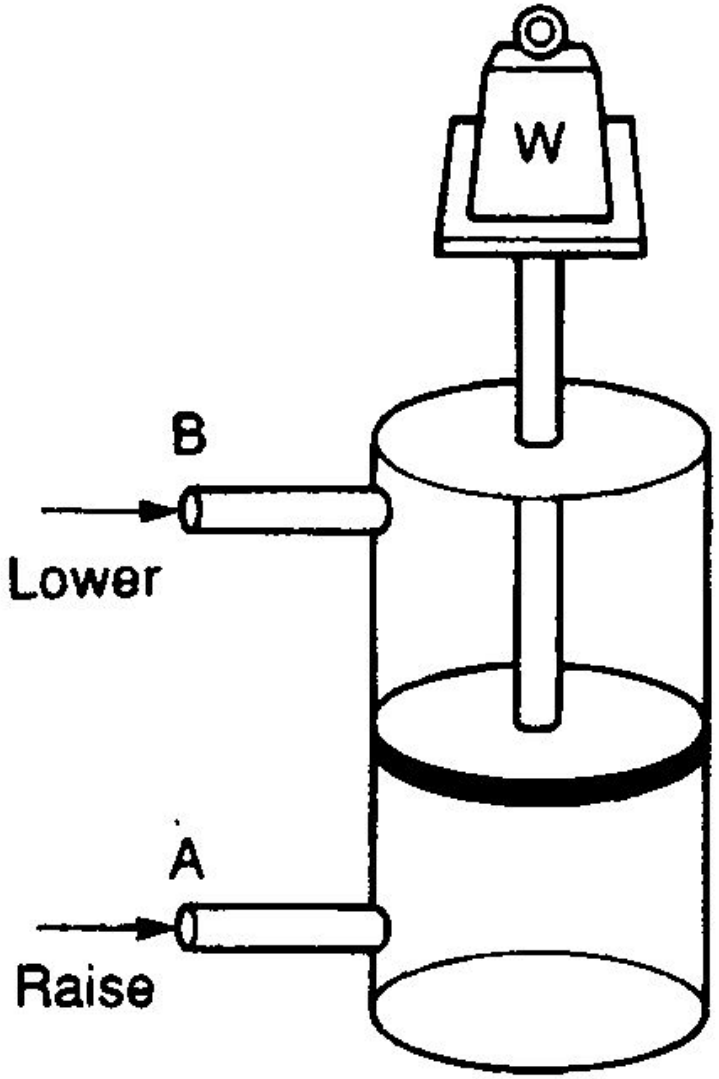


(b) Pressure recording

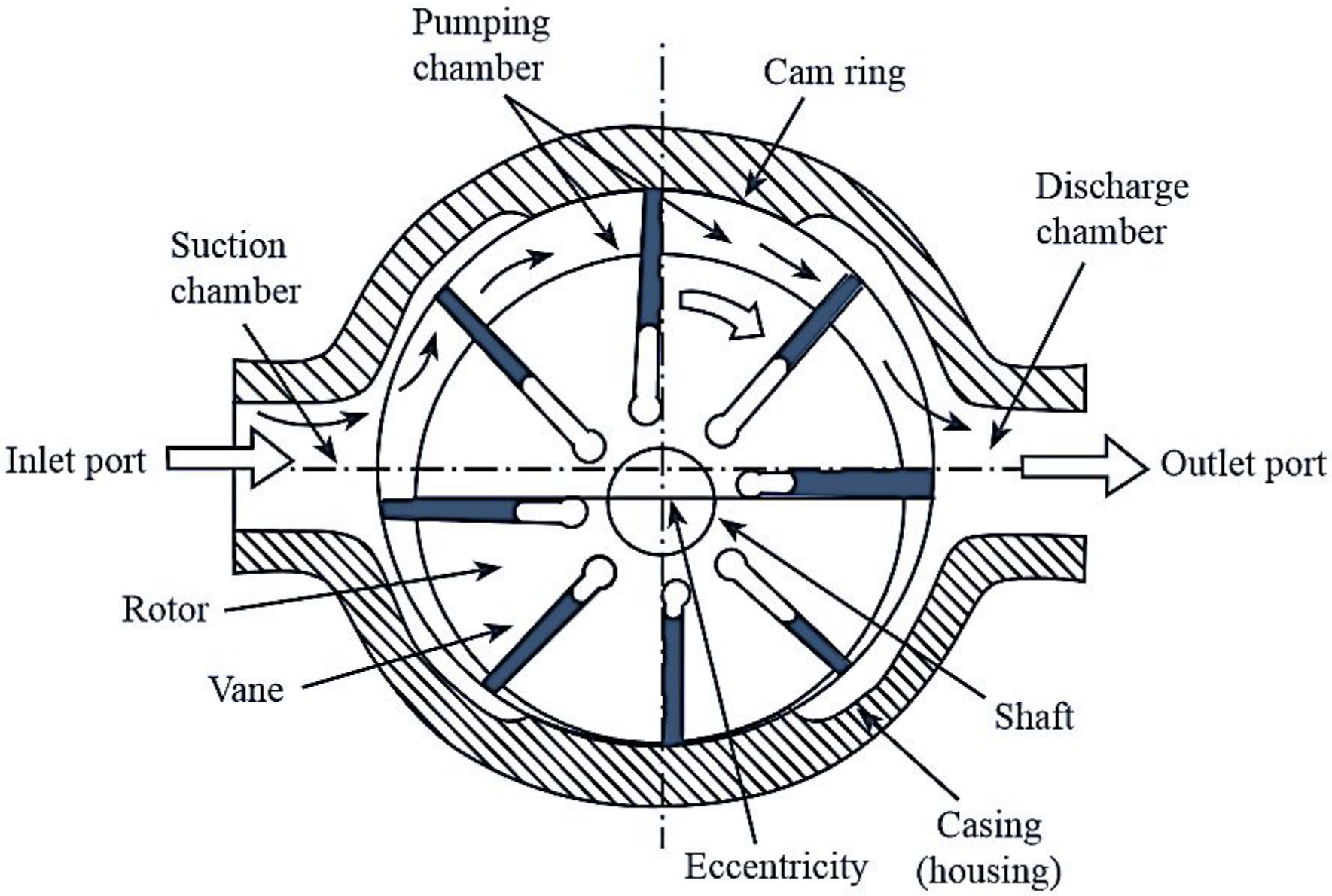
Pressure regulation



(a) Simple regulator



(a) Hydraulic cylinder


Pumping chamber
Cam ring
Discharge chamber
Suction chamber
Inlet port
Outlet port
Rotor
Vane
Shaft
Casing (housing)
Eccentricity

Hydraulic System	Pneumatic System
A hydraulic system is a closed-loop system.	Pneumatic System is an open-loop system.
It is robust in construction and maintenance cost is high.	It is simple in construction and maintenance cost is less.
The working fluid is hydraulic oil.	The working fluid is air.
As oil is incompressible, it can be pressurized to very high pressure.	Air is compressible and hence air can be pressurized to lesser pressure.
The system is bulky due to high pressure.	The system is less bulky as compared to a hydraulic system.
The accuracy of the system is high.	The accuracy of the system is not high.
Hydraulic oil is flammable.	Air is inflammable.
To protect against rust, the system needs special attention.	This system does not require any special attention.
Contamination control is required in this system.	Contamination control is not required in this system.
The power to size ratio is more.	The power to size ratio is small.

Characteristics	Pneumatic	Hydraulic	Electric
Complexity	Simple	Medium	Medium/High
Peak power	High	Very high	High
Size	Low size/force	Very low size/force	Medium size/force
Control	Simple valves	Simple valves	Electronic controller
Position accuracy	Good	Good	Better
Speed	Fast	Slow	Fast
Purchase cost	Low	High	High
Operating cost	Medium	High	Low
Maintenance cost	Low	High	Low
Utilities	Compressor/power/ pipes	Pump/power/ pipes	Power only
Efficiency	Low	Low	High
Reliability	Excellent	Good	Good
Maintenance	Low	Medium	Medium

Table 1A: Linear Power Transmission Comparison