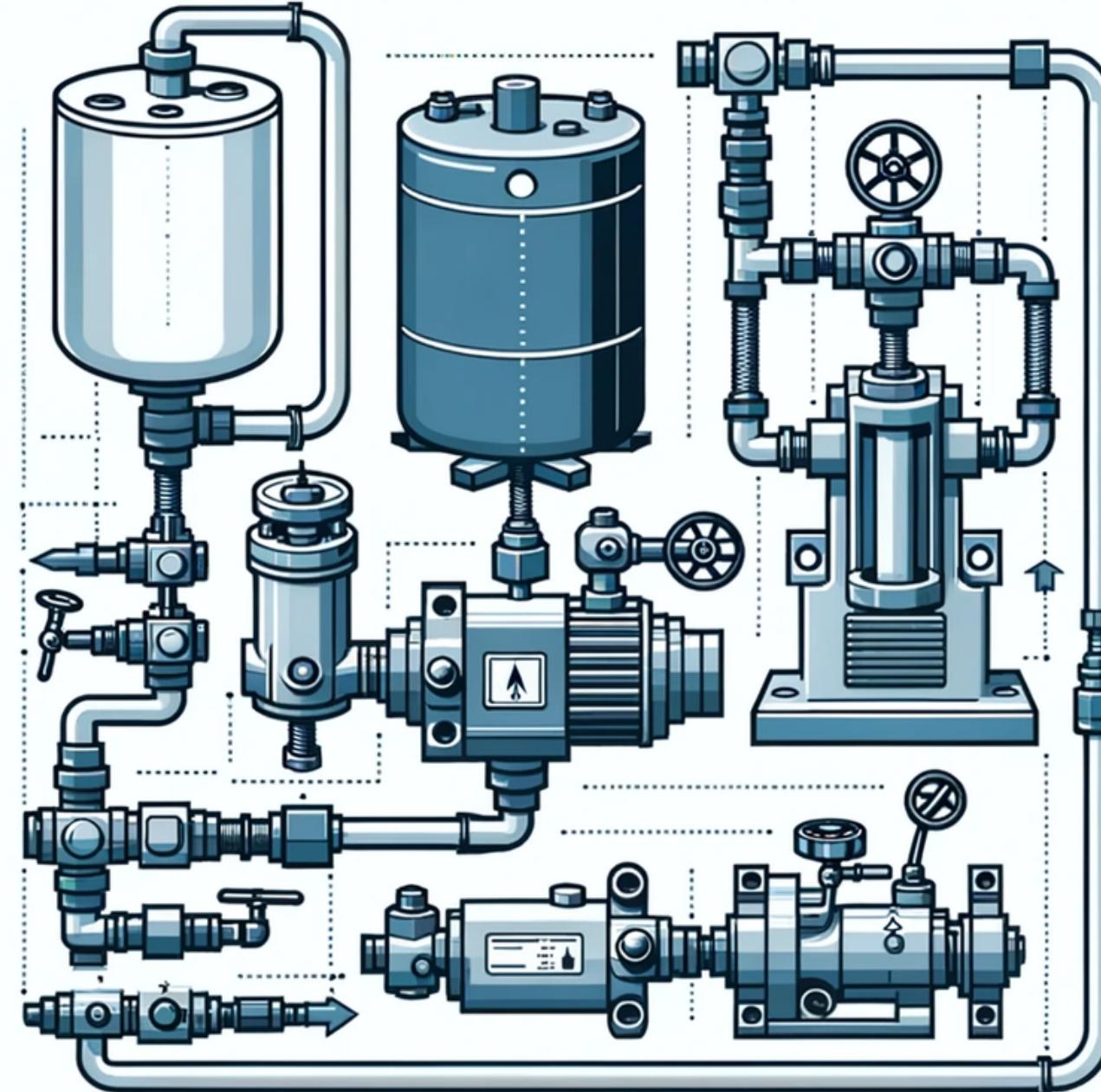


Hydraulic Systems

MACHINE LAB

BY EHTISHAM UL HAQ





What is a Hydraulic System

Hydraulic system is a technology that uses liquid (or fluid) to generate power or movement

Why Hydraulic Systems

They can handle heavy loads and generate extreme force with compact equipment

They also offer precise control over speed, torque, and position.



Pascal Law

In 1647, a French mathematician named Blaise Pascal discovered that the pressure applied to any part of enclosed liquid would be transmitted equally in all directions through the liquid.

That's because liquids are incompressible: their volume does not change significantly under pressure

Second force is 10 times original force

$$F_2 = P_2 A_2 = 10 \times F_1$$



Original force

$$F_1 = P_1 A_1$$



Area A_1

Area A_2
($A_1 \times 10$)

Fluid

$$P_1 = \frac{F_1}{A_1}$$

Pascal's principle
 $P_1 = P_2$

$$P_2 = \frac{F_2}{A_2}$$



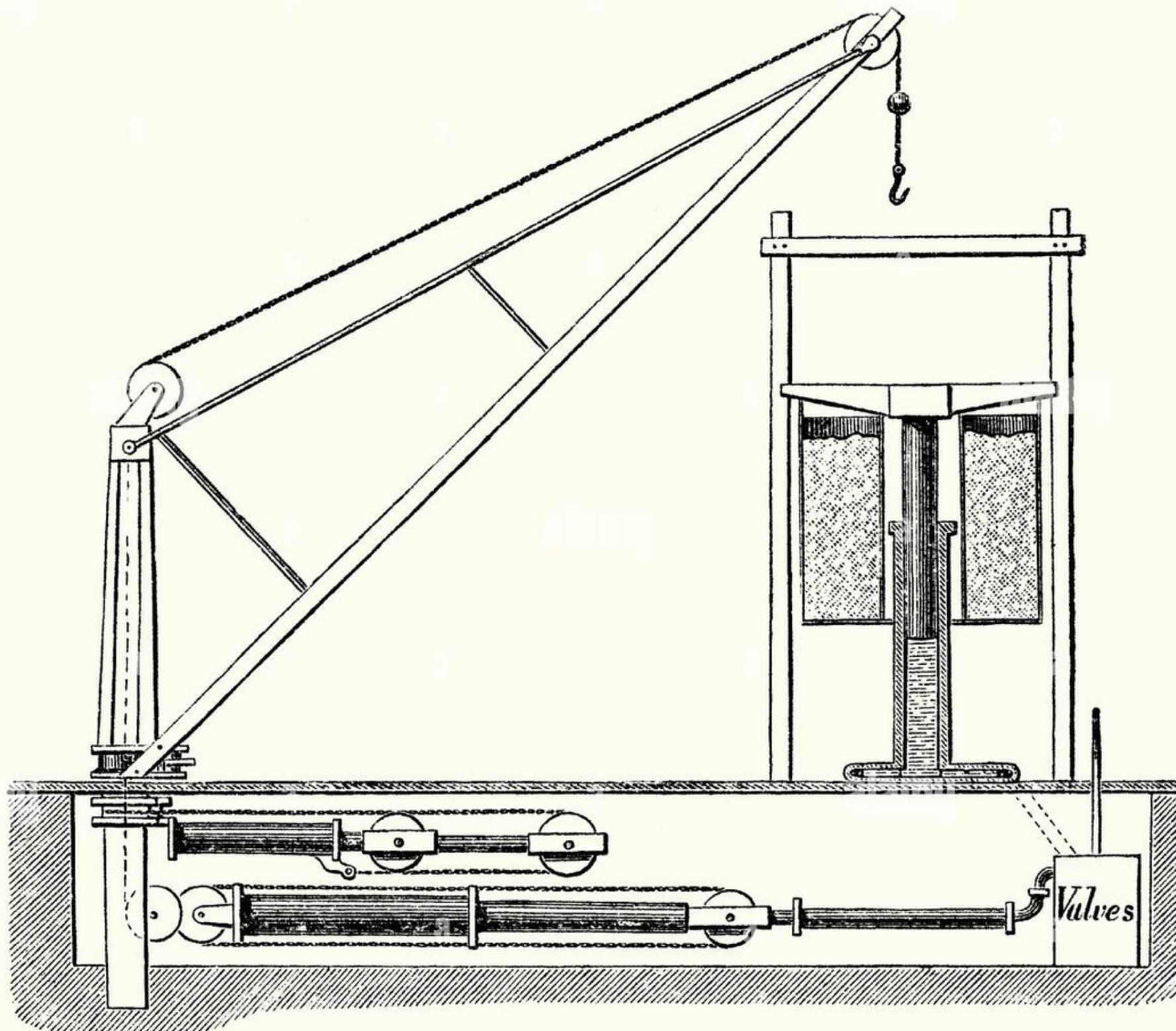
By Dr. Edward Bailey, University College London

Hydraulic Press

by Joseph Bramah

In 1795, Joseph Bramah invented the hydraulic press.

The press had two cylinders and pistons of different cross-sectional areas. If a force was exerted on the smaller piston, this would be translated into a larger force on the larger piston.



Hydraulic Crane

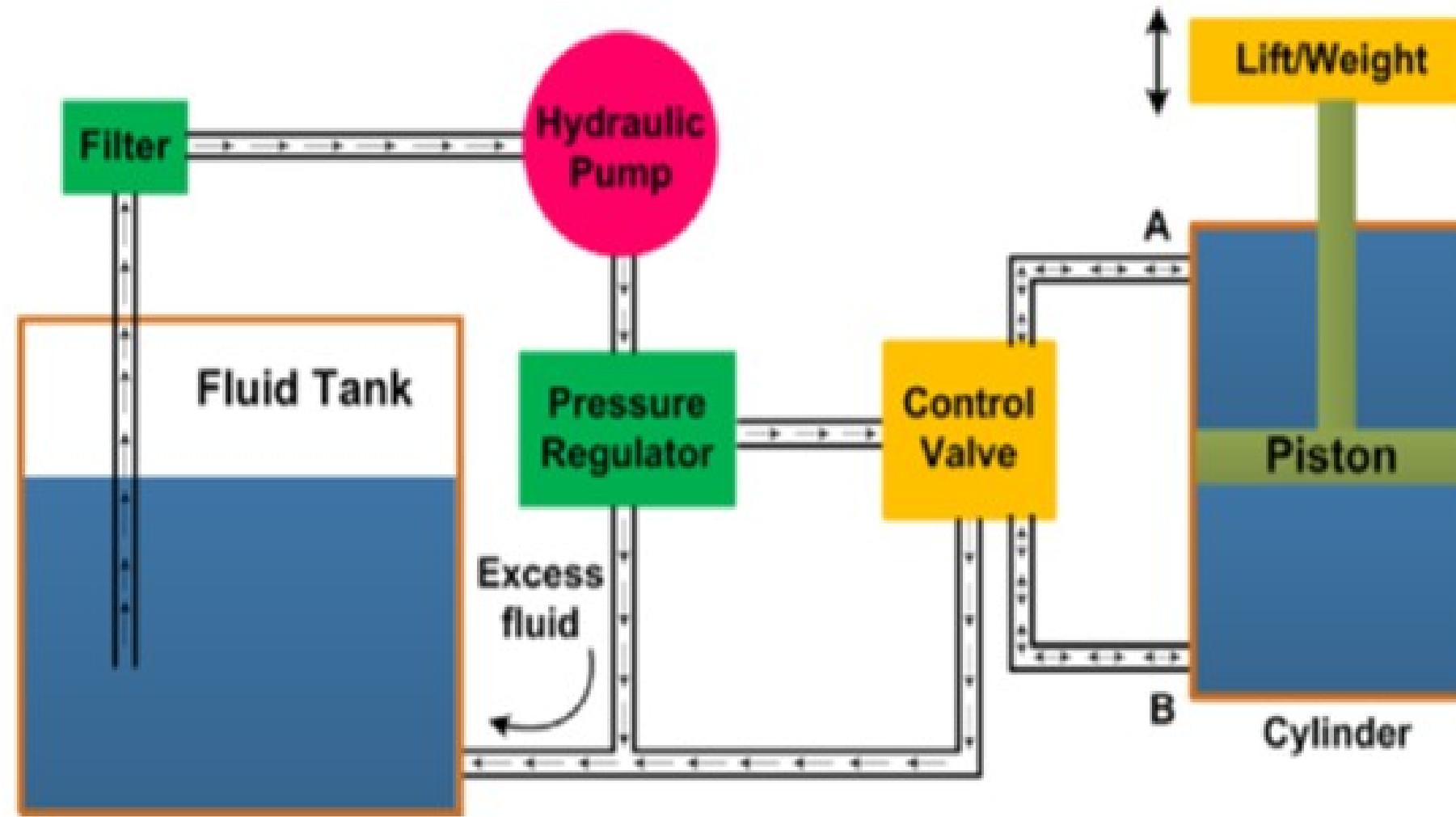
by William Armstrong

In 1838, William Armstrong invented the first hydraulic crane.

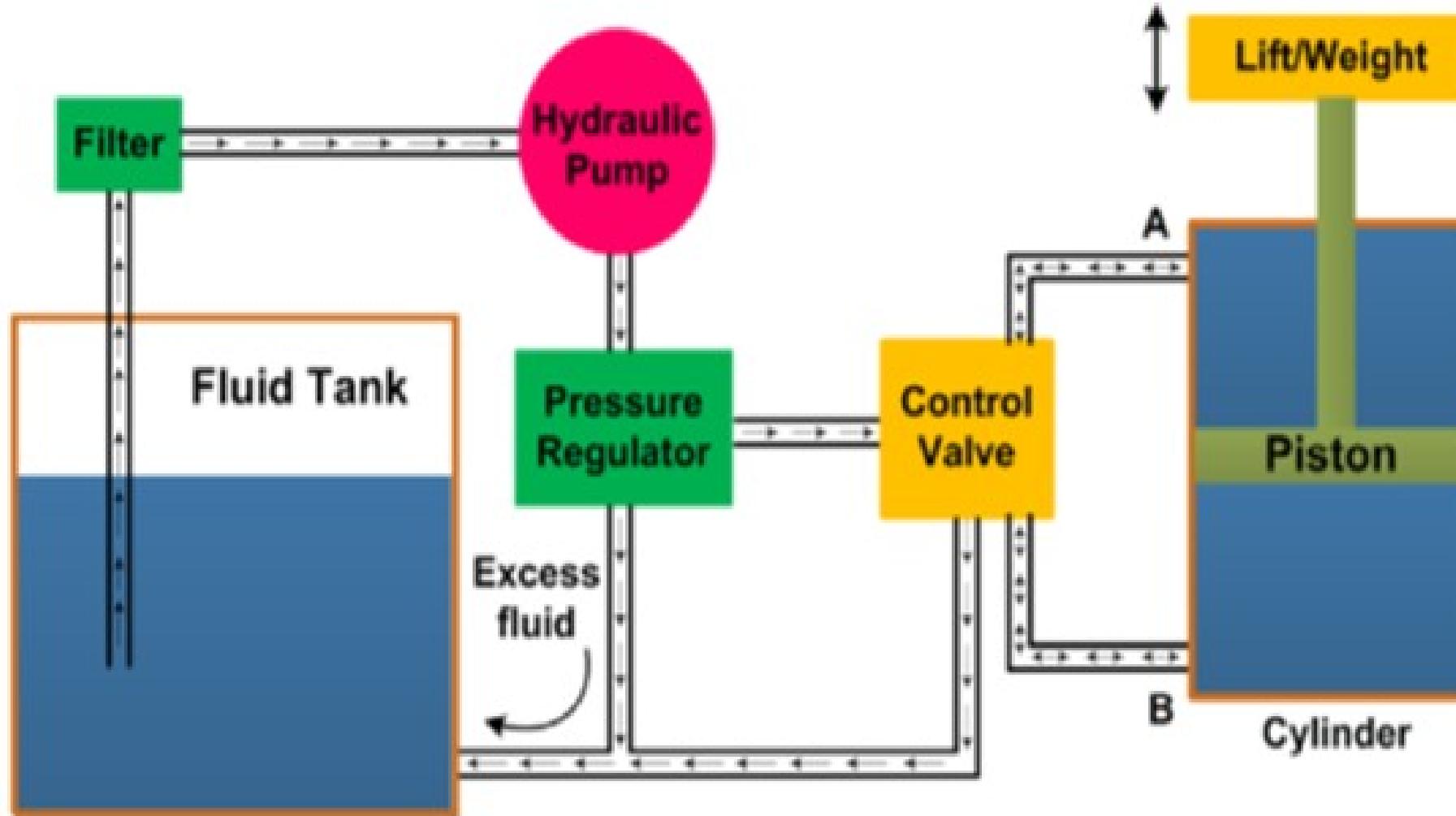
To control the movement of the piston and the arm of the crane, valves were used to regulate the flow of water into and out of the cylinder.

Water was pumped in from the reservoir to build up pressure, and released to reduce pressure.

Components of a Hydraulic System

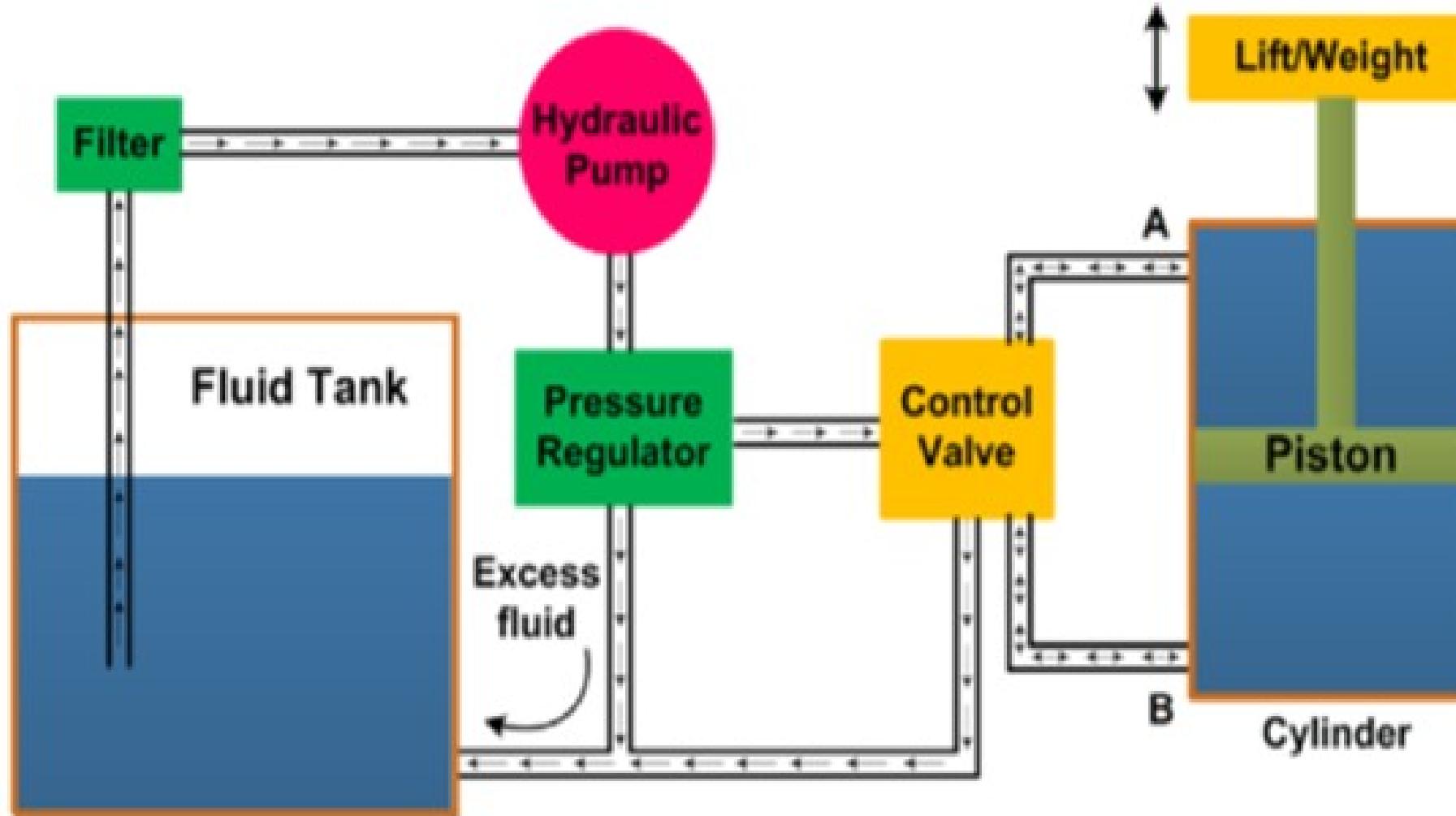


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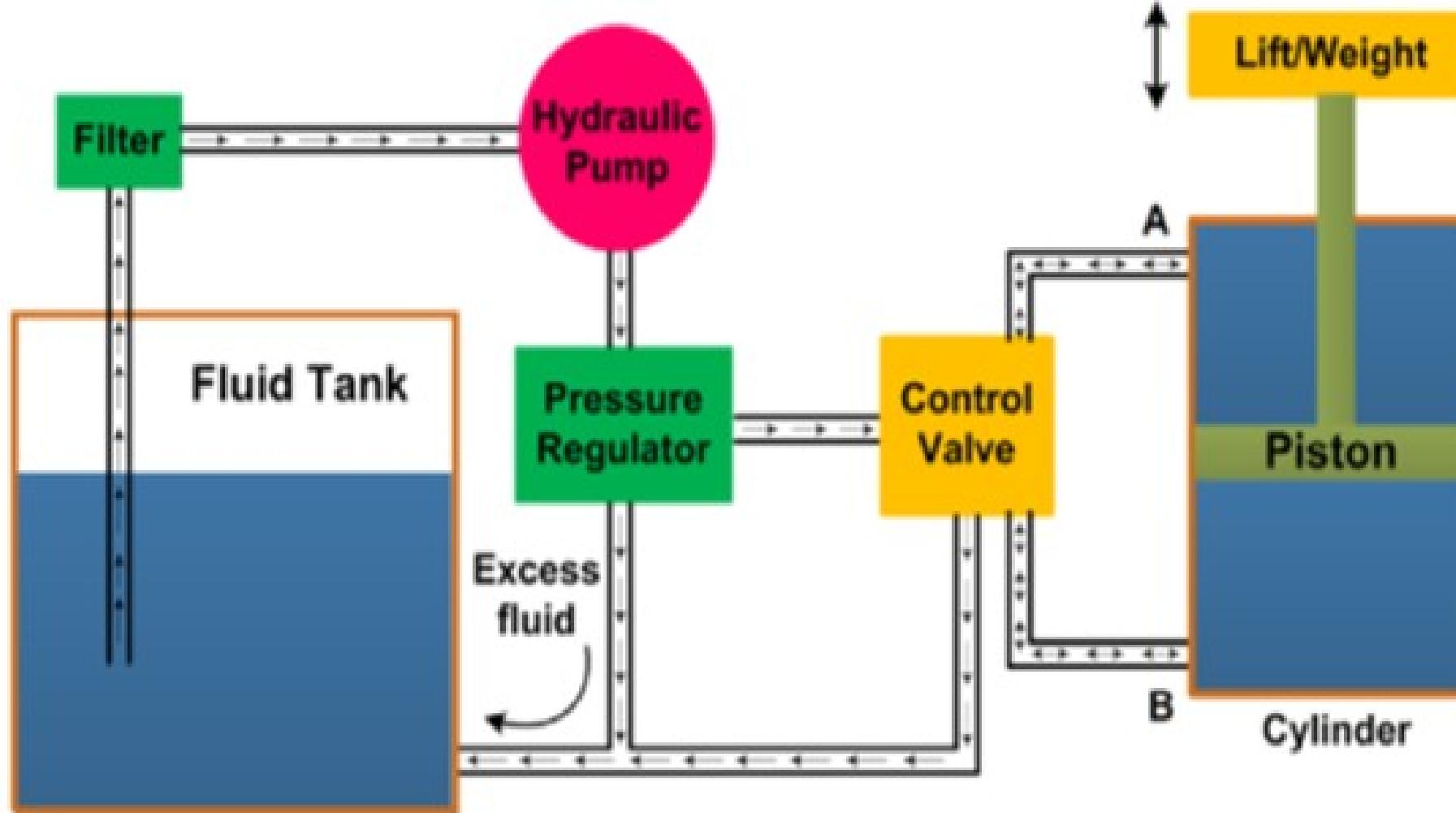
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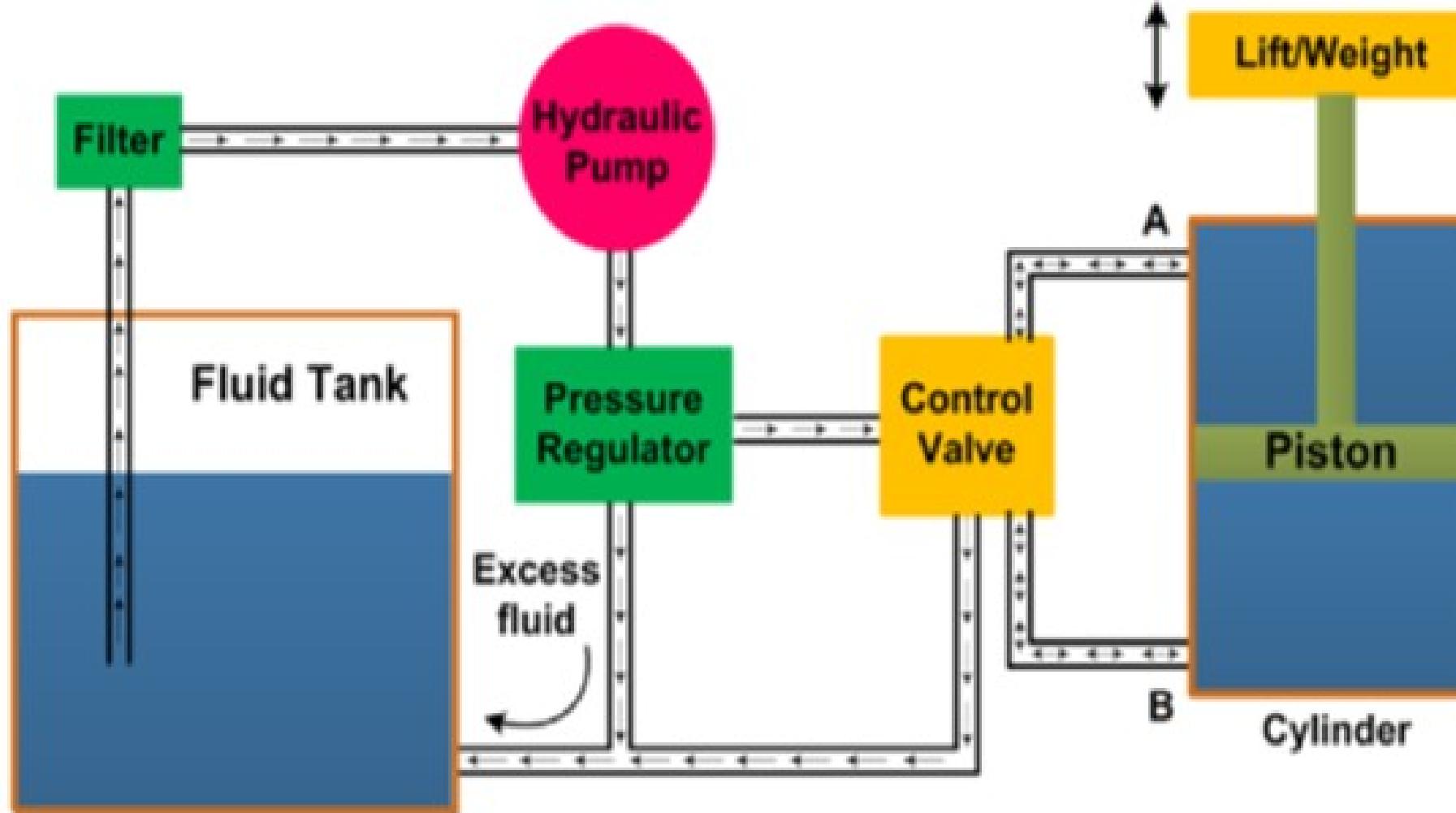
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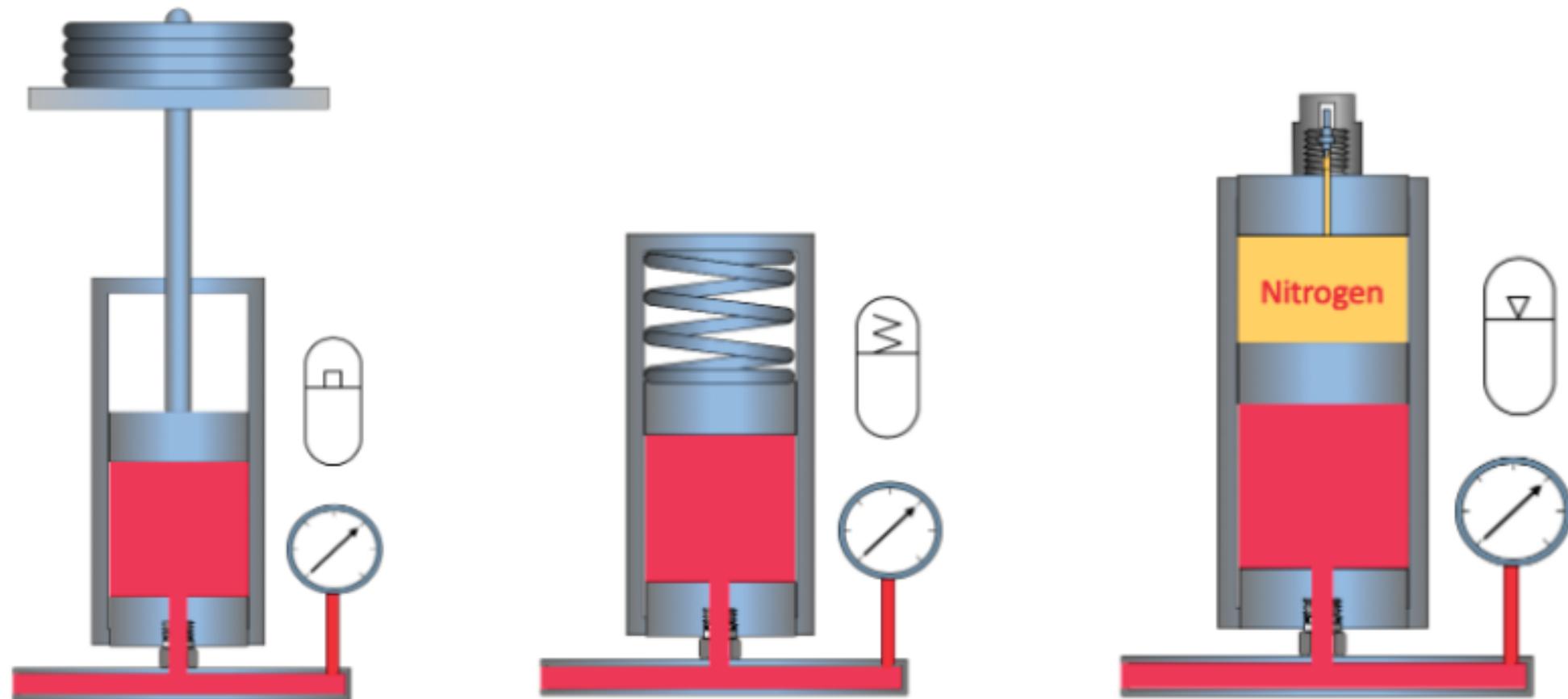
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- The fluid returns to the reservoir to be reused.

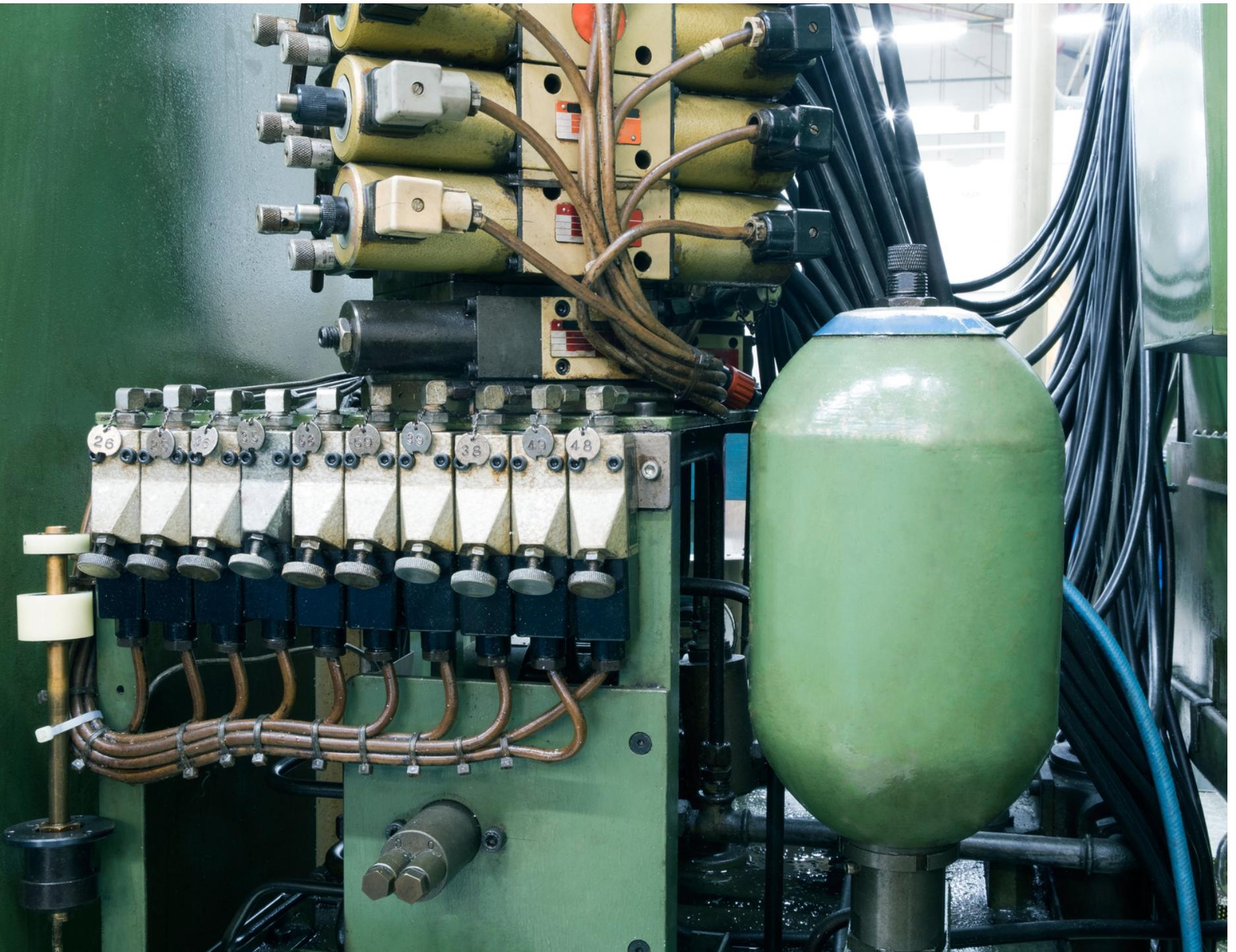
Hydraulic Accumulators



A hydraulic accumulator is a pressure storage reservoir in which a hydraulic fluid is held under pressure by an external source. The external source can be a raised weight, spring, or a compressed gas.

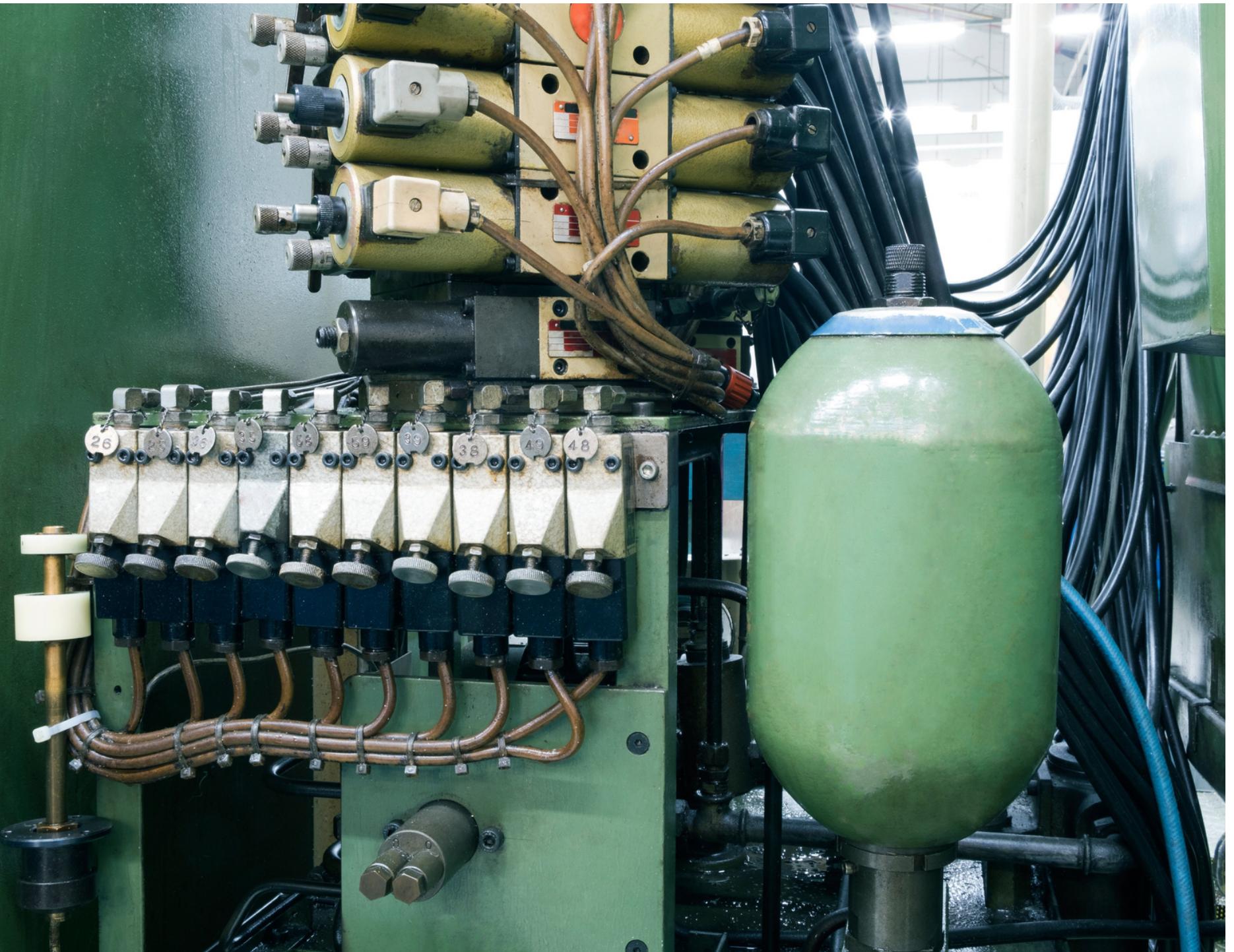
Functions of Hydraulic Accumulators

- Accumulators can store and discharge hydraulic energy. The pressurized fluid stored can be released into the system when there are fluctuations in demand or pump output. Hence, they smooth out the delivery of power.



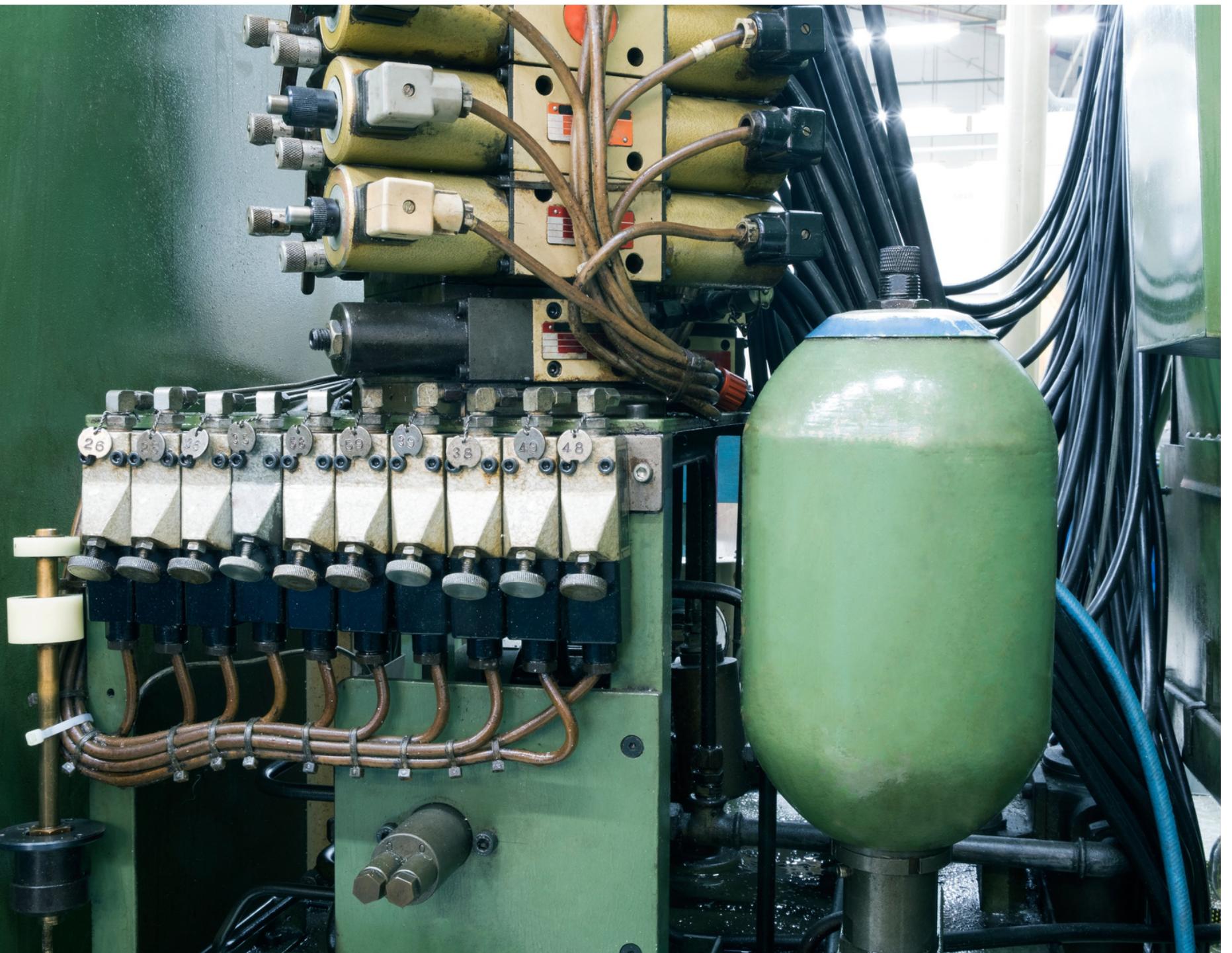
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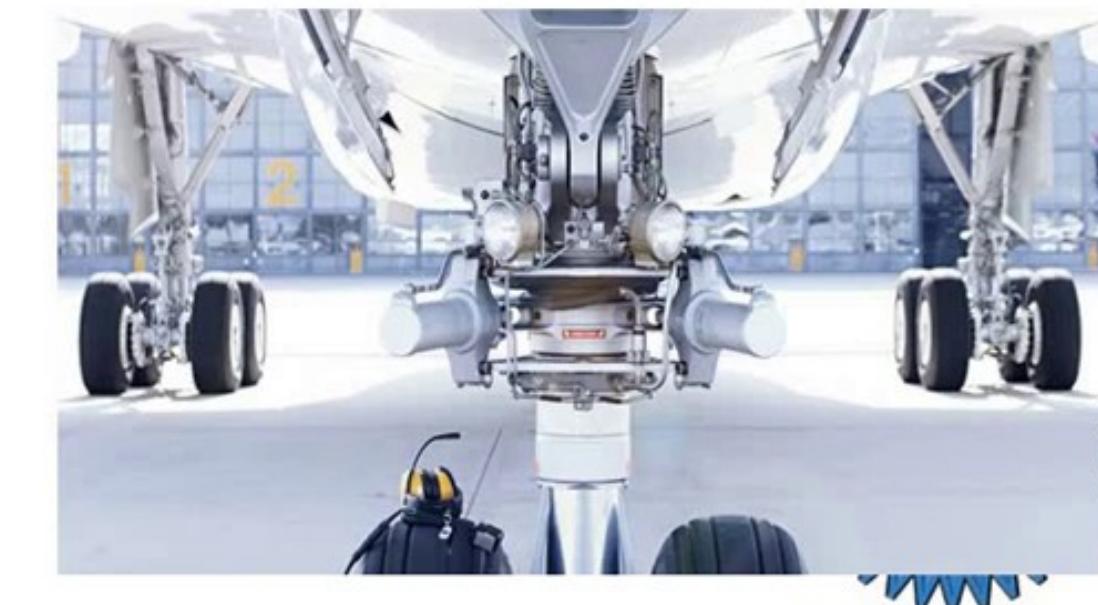


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- Protects hydraulic systems from shocks caused by sudden changes in pressure, as the compressed gas can expand or compress to absorbs the shocks.



Application of Hydraulic Systems





Dangers and Limitations of Hydraulic Systems

- Fire/explosion and environmental hazard if the system leaks or ruptures (fluid leaks are common)



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- Less energy-efficient than electric actuators
- Hydraulic fluids are affected by temperature changes, which can alter their viscosity and performance.
- Small impurities in fluid can cause permanent damages



Thank You

References

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