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Experiment No-3

To Find The law of Machine Of A Simple Lifting Machine

* Questions -

Q1) Define the following terms: a) Mechanical Advantage b) Velocity Ratio c) efficiency of the machine

Ans → a) Mechanical Advantage -

The ratio of Load upon Effort for overcoming a large resistance by application of small effort is called as Mechanical Advantage.

$$\text{Mechanical Advantage} = \frac{\text{Load}}{\text{Effort}} \quad \text{i.e.} \quad \frac{w}{p}$$

b) Velocity Ratio

The ratio of the velocity of Effort to the velocity of Load is defined as the velocity ratio denoted by 'v'

$$\text{velocity ratio} = \frac{\text{velocity of Effort}}{\text{velocity of Load}} = \frac{b/t}{a/t} = \frac{b}{a}$$

c) Efficiency of a Machine

The ratio of useful work got out of machine to the work put in by the effort is defined as the efficiency (η) of the machine and is usually expressed as a percentage efficiency.

$$\text{Efficiency} = \frac{\text{useful work got out of machine}}{\text{work put in by Effort}} = \frac{\text{output}}{\text{input}}$$

$$= \frac{w \cdot a}{p \cdot b} = \frac{w}{pb/a} = \frac{w}{pb/a} = \frac{w}{p \cdot v}$$

→

$$= \frac{W/P}{V} = \frac{\text{Mechanical Advantage}}{\text{velocity Ratio}}$$

$$\therefore \text{Percentage efficiency } (\eta\%) = \frac{W}{PV} \times 100$$

Q2) What is the difference between reversible and irreversible machines?

Ans → ① Reversible machine:
A machine which is capable of doing work in the reverse direction even after the removal of effort, load get lifted is called Reversible machine.

② Irreversible machine:
A machine which is not capable of doing work in the reverse direction is called irreversible machine or also known as self-locking machine.

Q3) What is the law of a machine?

Ans → If efforts (P) corresponding to varias loads W are plotted, it will generally be found that the relationship between the two is a linear one, which can be expressed as $P = mW + C$, where m = slope of the load effort, graph and C = Intercept on effort axis.

Q4) State the practical applications where simple lifting machines are commonly used.

Ans → The practical applications are -

① Lever - It is a rigid bar that can rotate around a fixed point, the fulcrum. Used to lift heavy objects.

② Pulley - The pulley is used to lift heavy objects to a certain height. It is a wheel through which a rope passes through its external part.

③ Inclined plane - Here, the force of the weight is broken down into two components. In this way, the effort required to lift the load is less.

Q5) Why is the efficiency of the machine less than one?

Ans → Since a machine does not contain a source of energy, nor can it store energy, from conservation of energy the power output of a machine can never be greater than its input, so the efficiency of the machine is always less than one.