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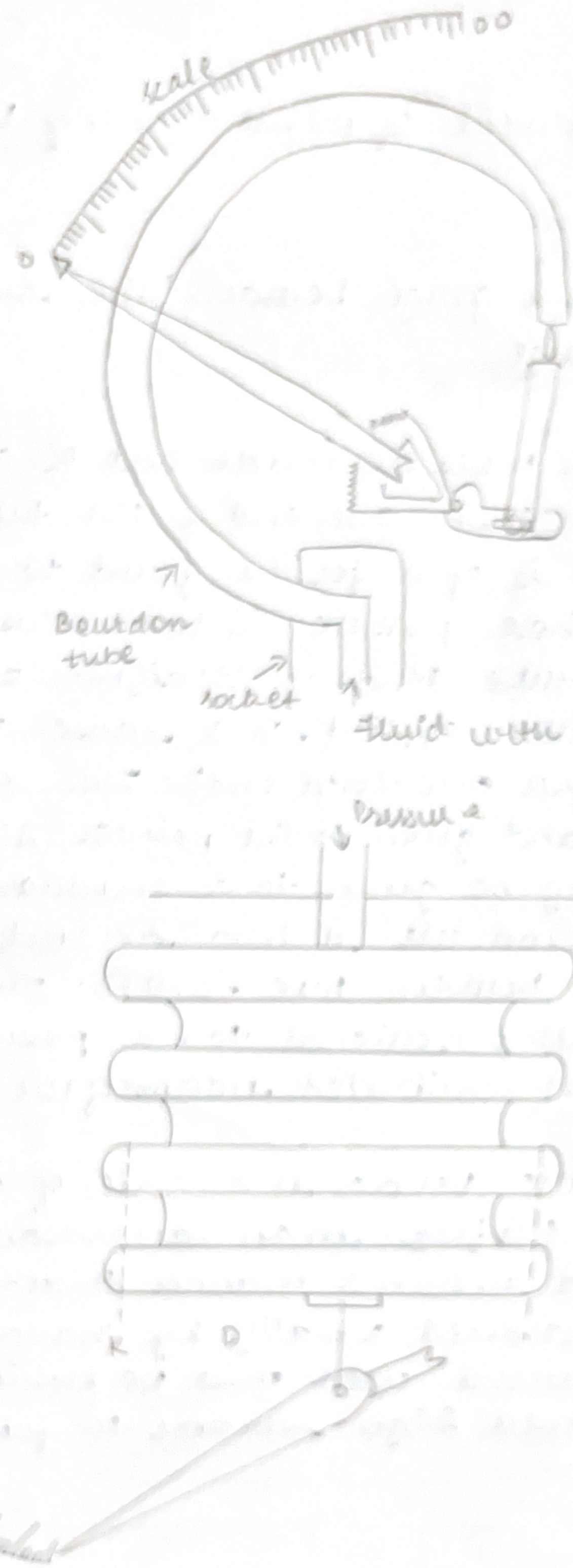
D8 /18

AIM: To study measurement of pressure using bellows diaphragm.

APPARATUS: Bellow pressure gauge, bourdon tube, diaphragm pressure gauge.

Theory: The bourdon tubes are made out of an elliptically flattened tube. One end of the tube is closed. The other end is open for the fluid to enter. When the fluid whose pressure is to be measured enters the tube, the tube tends to straighten out an account of the pressure applied. This causes the movement of the free end (closed end). This displacement can be amplified and given to the pointer scale arrangement or may be given to a secondary transducer which converts it into an electrical signal. (for exp- Bourdon tube - LVDT). This electrical output is proportional to the pressure of the fluid. So it is calibrated in terms of the pressure.

Bellows: A metallic bellow is a series of circular parts resembling the folds in an accordian. These parts are formed in such a manner that they are expanded or contracted axially by changes in pressure. The material used must be flexible, ductile and have a high resistance to fatigue failure.


scale
Bourdon tube
socket
Fluid with pressure P
Pressure P
R
D

Materials used → brass, bronze, alloys of nickel and copper, steel and Monel.

The displacement of bellows is given by

$$d = \frac{0.453\, P b\, n\, D^2 \sqrt{1-v^2}}{E t^3}$$

P → Pressure N/m^2
b → radius of each corrugation, m
n → number of semicircular corrugations
t → thickness of the wall, m
D → mean diameter, m
E → Modulus of elasticity, N/m^2

Diaphragms: Diaphragms are thin, flexible membrane typically made of metal or rubber. When subjected to pressure changes, the diaphragms deforms and this deformation is used to measure pressure. Diaphragm based pressure sensors are commonly used in various applications due to their sensitivity.

Conclusion: Measurement of pressure using bellows, diaphragm were studied.

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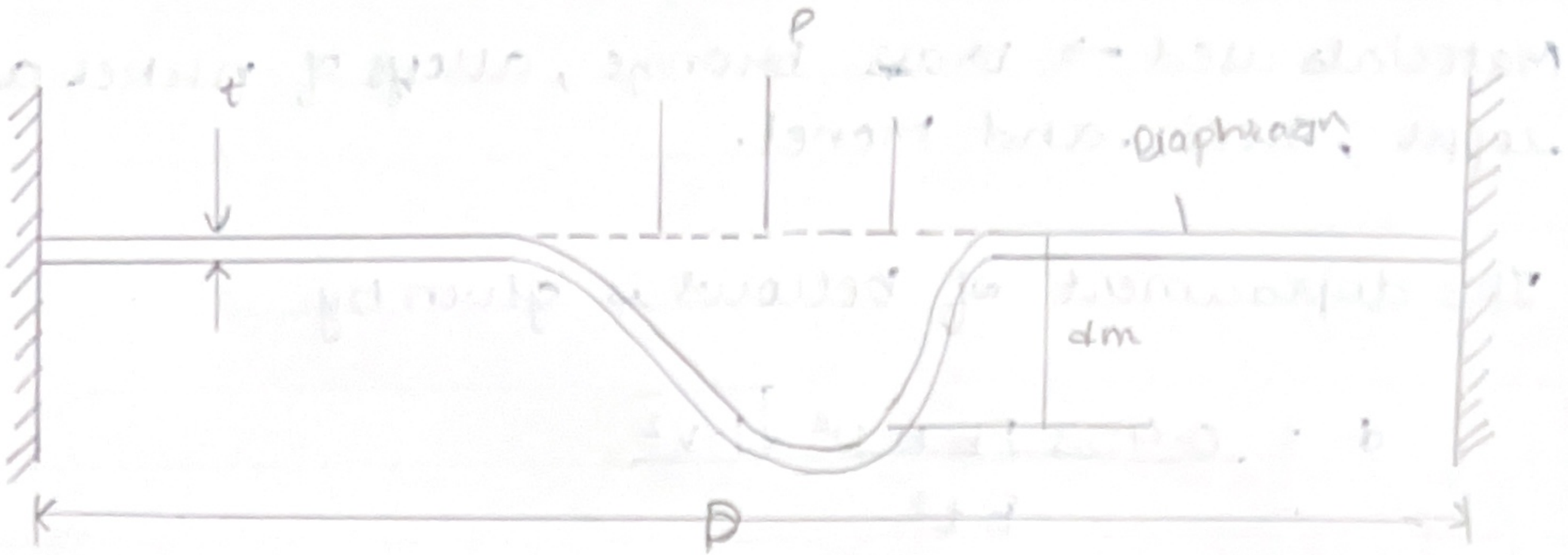

Flat diaphragm