



- (10%) Determine the head (energy) loss for flow of 140 L/s of water, through 400 m of 200-mm-diameter cast-iron pipe and the frictional coefficient f is 0.023.
- (10%) The cross-sectional area A_0 of the aorta (the major blood vessel emerging from the heart) of a normal resting person is 3 cm^2 , and the speed v_0 of the blood through it is 30 cm/s. A typical capillary (diameter = $6 \mu\text{m}$) has a cross-sectional area A of $3 \times 10^{-7} \text{ cm}^2$ and a flow speed v of 0.05 cm/s. How many capillaries does such a person have?
- (10%) What is the hydraulic radius of a 60-mm-wide by 120-mm-deep open channel?
- (10%) The sprinkler of Fig. 1 discharges $0.01 \text{ ft}^3/\text{s}$ through each nozzle. Neglecting friction, find its speed of rotation. The area of each nozzle opening is 0.001 ft^2 .

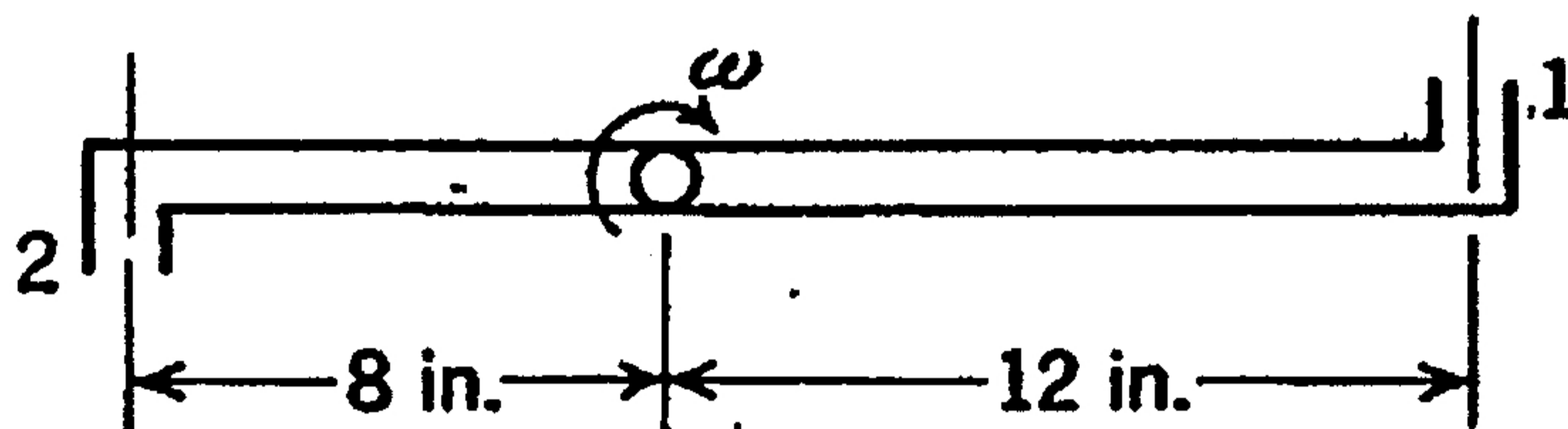


Fig. 1 rotating jet system

- (10%) A desperado fires a bullet into an open water tank (Fig. 2), creating a hole a distance h below the water surface. What is speed v of the water emerging from the hole?

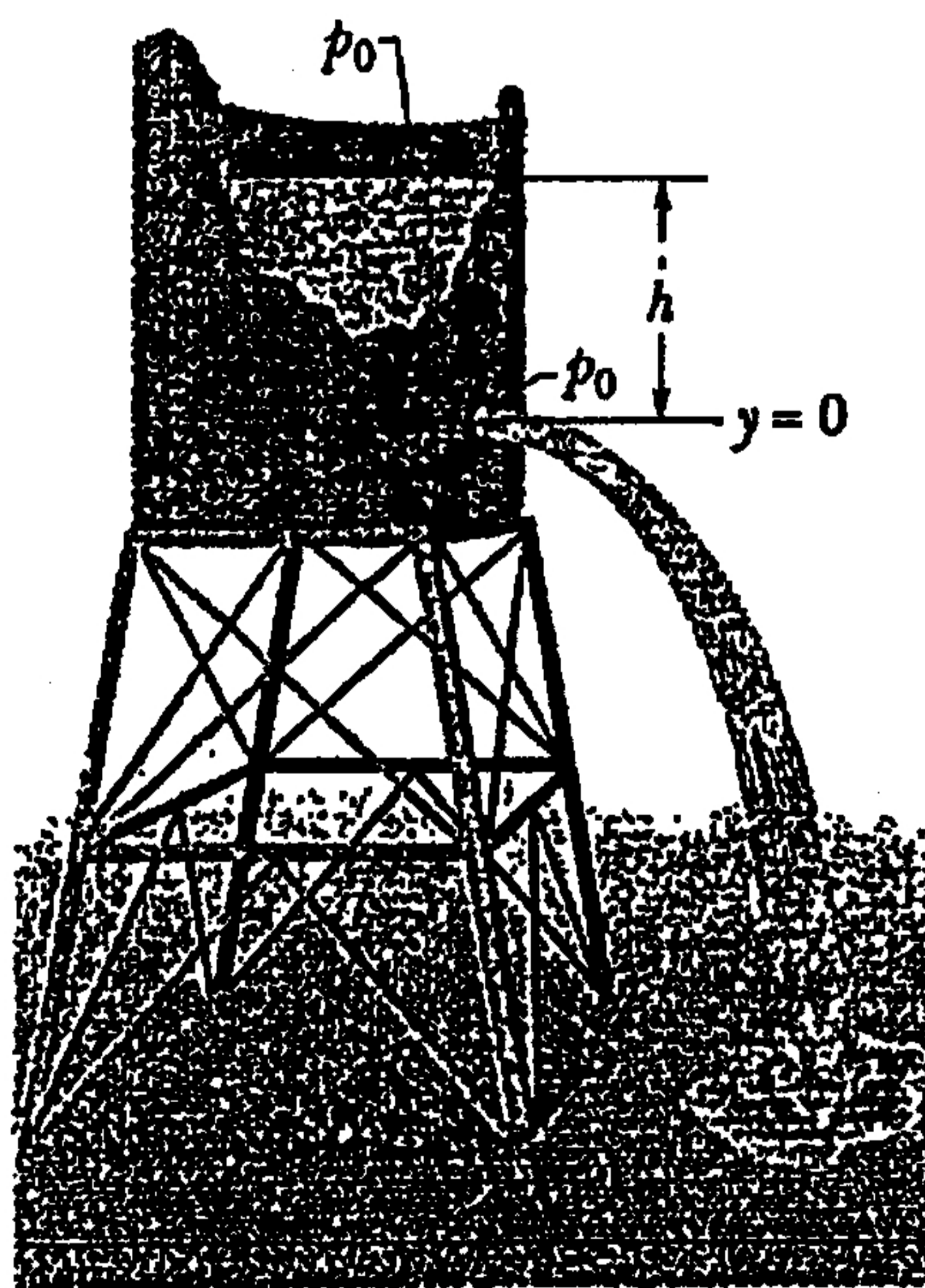


Fig. 2

Water pours through a hole in a water tank, at a distance h below the water surface. The pressure at the water surface and at the hole is atmospheric pressure p_0 .



6. (10%) 請解釋下列名詞：

- Pascal's law
- Terminal velocity
- Elevation
- Shear stress
- Buoyancy

7. (10%) 考慮一彎管之受力分析。如 Fig. 3 所示之彎管，其進入端之管徑為 40 cm、錶壓力為 200 kPa，若排出端之管徑為 25 cm，流量為 $0.85 \text{ m}^3/\text{s}$ ，試求當流體為水時，對於彎管所產出之水平方向推力。 $(\gamma_{\text{H}_2\text{O}} = 9,810 \text{ kg/m}^3)$

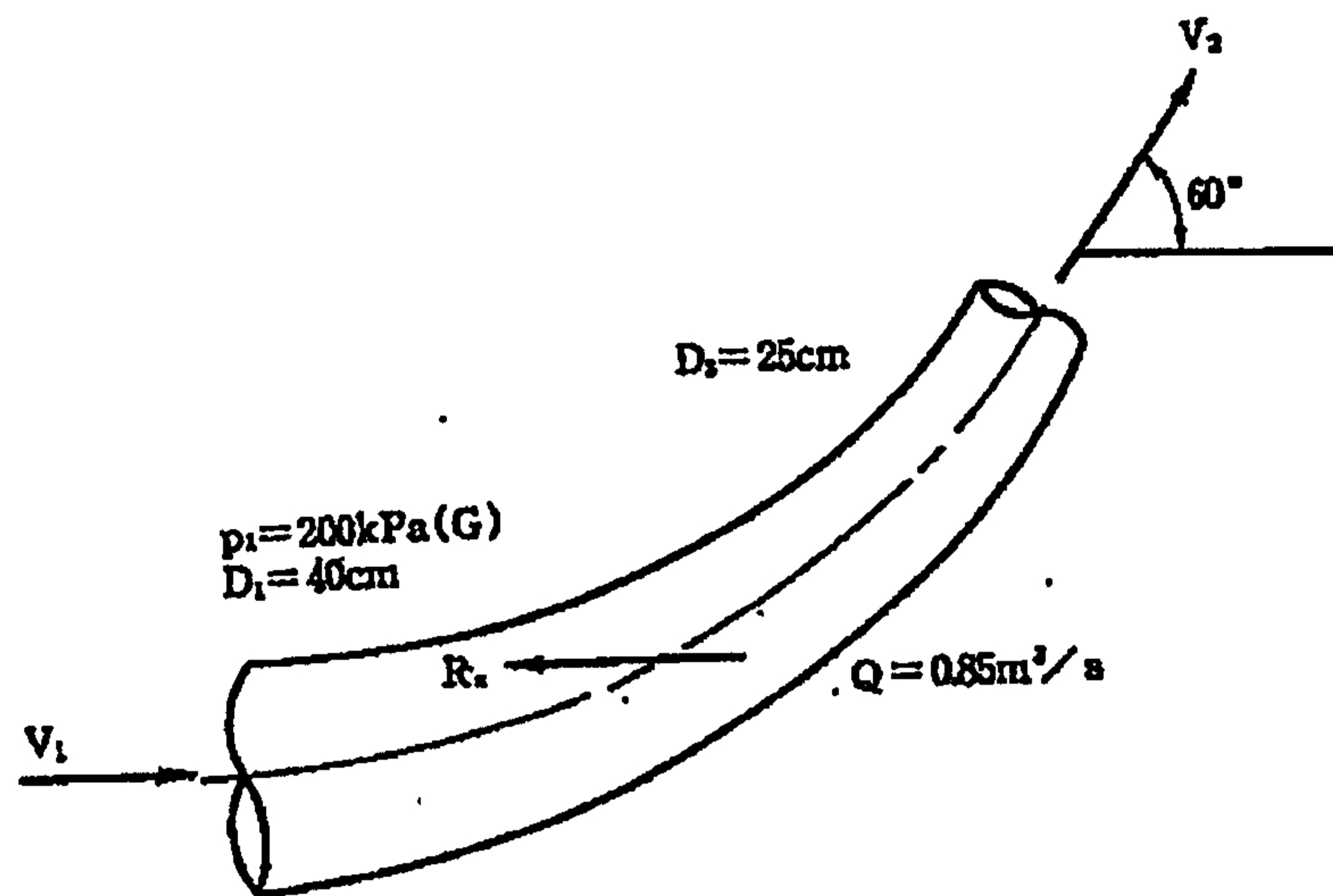


Fig. 3

8. (10%) 一水槽(Fig. 4)經由內徑 45 mm 之管線將水導引至噴嘴噴出，如圖四所示，若噴流之直徑為 30 mm，假設整個流體之流動沒有任何磨損，且忽略水位之變化，在穩流後試求 (a) 管線之流量，(b) 在 B、C、D 處之壓力大小。

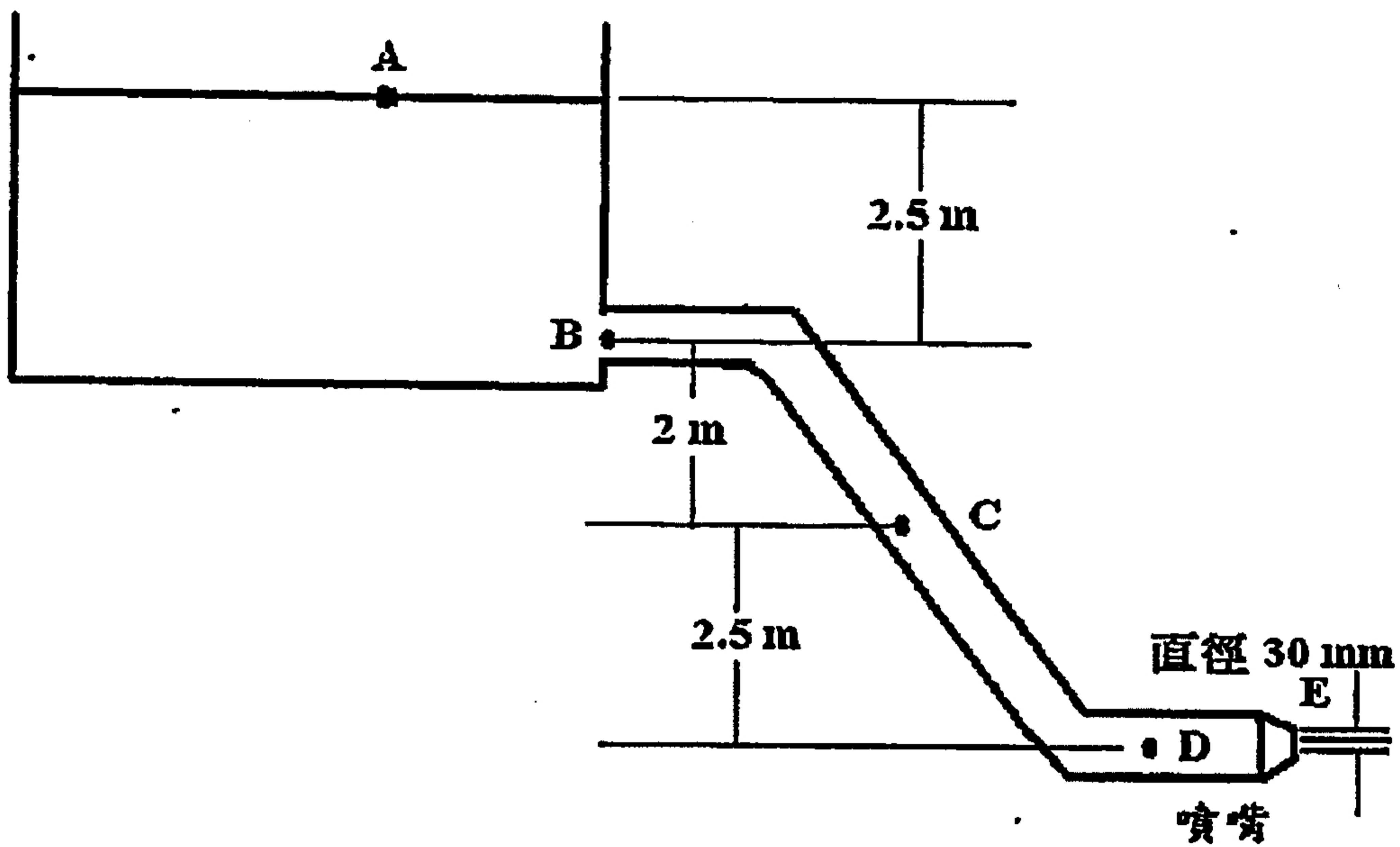


Fig. 4

9. (10%) 如 Fig. 5 所示，管內之流動流體為比重 0.8 之油，差壓計內為比重 13.6 之水銀，試求此管路流量大小。

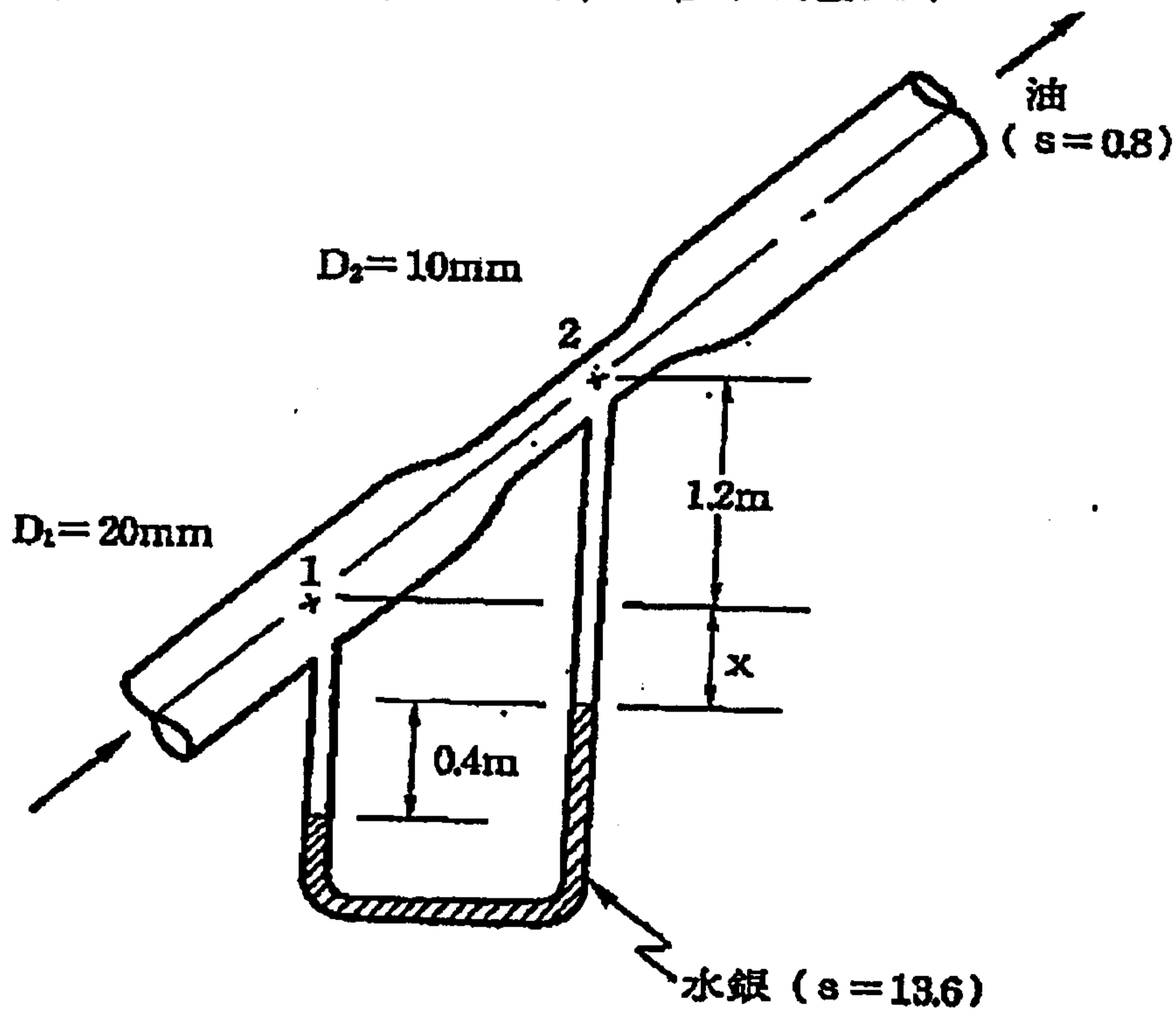


Fig. 5



10. (10%) Fig. 6 所示具有 v_1 速度之噴流，衝擊在以 v_0 速度移動的葉片上，若 $v_1 = 20 \text{ m/s}$ 及 $v_0 = 8 \text{ m/s}$ 且噴流直徑為 50 mm 。試決定葉片作用於流體之作用力。

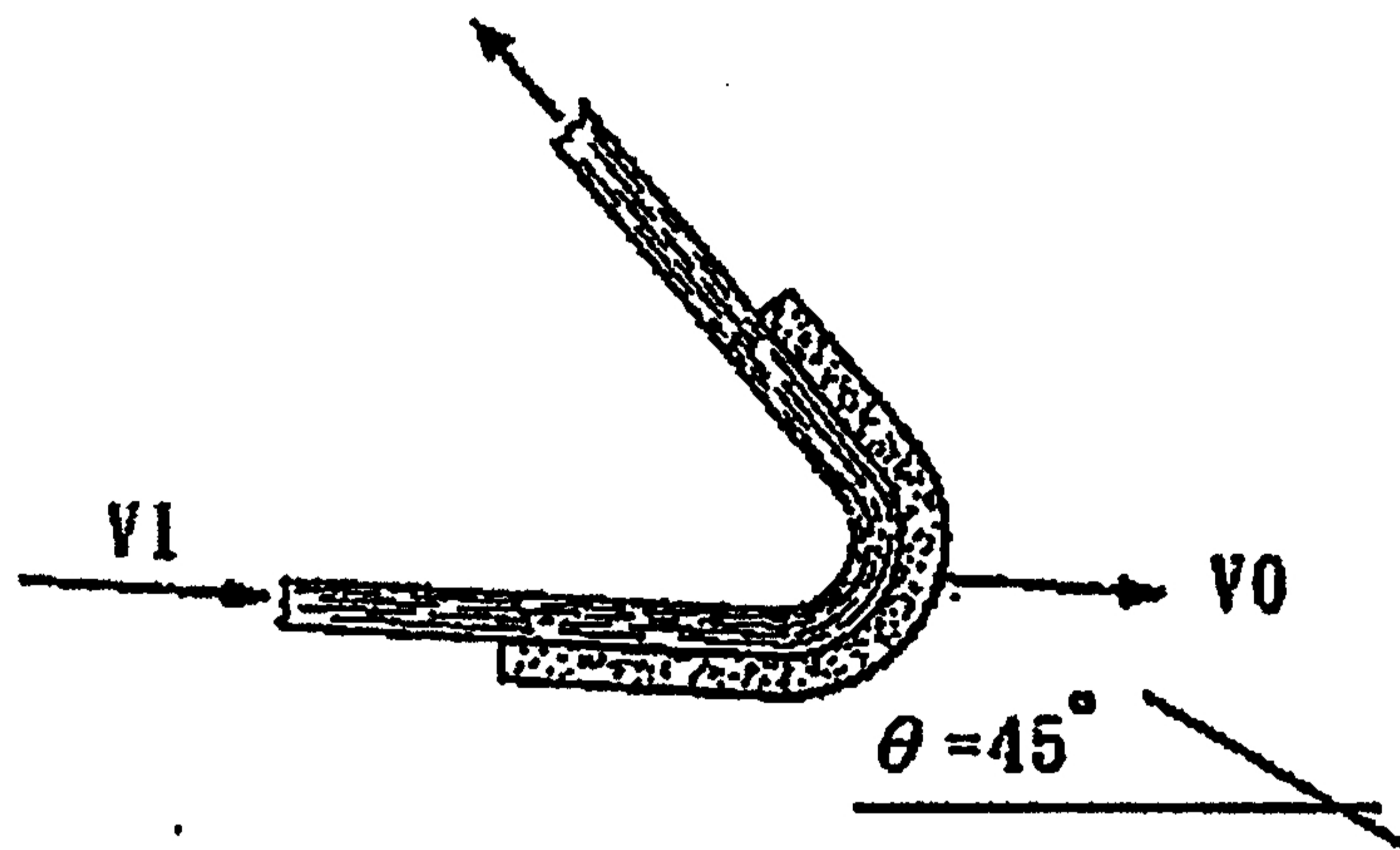


Fig. 6