To Measure Diameter of a Given Wire Using Screw Gauge

Aim
To measure diameter of a given wire using screw gauge.

Apparatus
Screw gauge, wire, half-metre scale and magnifying lens.

Theory
1. If with the wire between plane faces A and B, the edge of the cap lies ahead of Mb division of linear scale.
Then, linear scale reading (L.S.R.) = N.
If nth division of circular scale lies over reference line.
Then, circular scale reading (C.S.R.) = n x (L.C.) (L.C. is least count of screw gauge)
Total reading (T.R.) = L.S.R. + C.S.R. = N+n x (L.C.).
2. If D be the mean diameter and l be the mean length of the wire,Volume of the wire,

$$V=\pi\left(\frac{D}{2}\right)^2 l.$$

Diagram

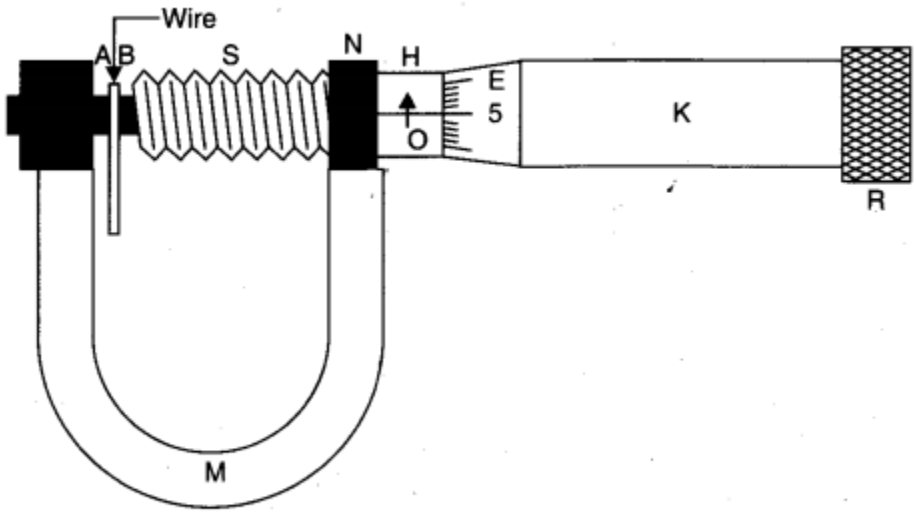

Fig. Screw gauge measuring diameter of the wire.

Procedure

1. Find the value of one linear scale division (L.S.D.).

2. Determine the pitch and the least count of the screw gauge and record it step wise.
3. Bring the plane face B in contact with plane face A and find the zero error. Do it three times and record them. If there is no zero error, then record zero error nil.
4. Move the face B away from face A. Place the wire lengthwise over face A and move the face B towards face A using the ratchet head R. Stop when R turns (slips) without moving the screw.
5. Note the number of divisions of the linear scale visible and uncovered by the edge of the cap. The reading (IV) is called linear scale reading (L.S.R.).
6. Note the number (n) of the division of the circular scale lying over reference line.
7. Repeat steps 5 and 6 after rotating the wire by 90° for measuring diameter in a perpendicular direction.
8. Repeat steps 4, 5, 6 and 7 for five different positions separated equally throughout the length of the wire. Record the observations in each set in a tabular form.
9. Find total reading and apply zero correction in each case.
10. Take mean of different values of diameter.
11. Measure the length of the wire by stretching it along a half-metre scale. Keeping one end of wire at a known mark, note the position of other end. Difference in position of the two ends of the wire gives the length of the wire. Do it three times and record them.

Observations

1. Determination of Least Count of the Screw Gauge . 1 L.S.D. = 1 mm
   Number of full rotations given to screw = 4
   Distance moved by the screw = 4 mm
   Hence, pitch p = 4 mm/4 = 1 mm
   Number of divisions on circular scale = 100
   Hence, least count, =1 mm/100 = 0.01 mm = 0.001 cm.
2. Zero Error. (i)…….mm,(ii)…… mm, (iii)…….mm.
   Mean zero error (e) =……..mm
   Mean zero correction (c) = – e =……mm.

3. Table for diameter (D)

Serial No. of Observations	Linear Scale Reading (N) (mm)	Circular Scale Reading		Total Reading	
		No. of Circular Scale division on reference line (n)	Value [n × (L.C.)] (mm)	Observed $D_0 = N + n$ × (L.C.) (mm)	Corrected $D = D_0 + c$ (mm)
(a) A ⊖ B					$D_1(a)$ =
1 (b) ①					$D_1(b)$ =
(a) A ⊖ B					$D_2(a)$ =
2 (b) ①					$D_2(b)$ =
(a) A ⊖ B					$D_3(a)$ =
3 (b) ①					$D_3(b)$ =

Calculations

Length of the wire, l = (*i*) ..... cm, (*ii*) ..... cm, (*iii*) ..... cm.

Mean diameter of the wire,

$$D = \frac{D_1(a) + D_1(b) + ... + D_3(a) + D_3(b)}{6} = ... \text{ mm} = ... \text{ cm}$$

Mean length of the wire,

$$l = \frac{l_1 + l_2 + l_3}{3} = ... \text{ cm}$$

Volume of the wire,

$$V = \pi\left(\frac{D}{2}\right)^2 l = ... \text{ cm}^3.$$

Result

The volume of the given wire is……. cm^3.

Precautions

1. To avoid undue pressure; the screw should always be rotated by ratchet R and not by cap K.
2. The screw should move freely without friction.

3. The zero correction, with proper sign should be noted very carefully and added algebraically.
4. For same set of observations, the screw should be moved in the same direction to avoid back-lash error of the screw.
5. At each place, the diameter of the wire should be measured in two perpendicular directions and then the mean of the two be taken.
6. Readings should be taken at least for five different places equally spaced along the whole length of the wire.
7. Error due to parallax should be avoided.

Sources of error

1. The screw may have friction.
2. The screw gauge may have back-lash error.
3. Circular scale divisions may not be of equal size.
4. The wire may not be uniform.