

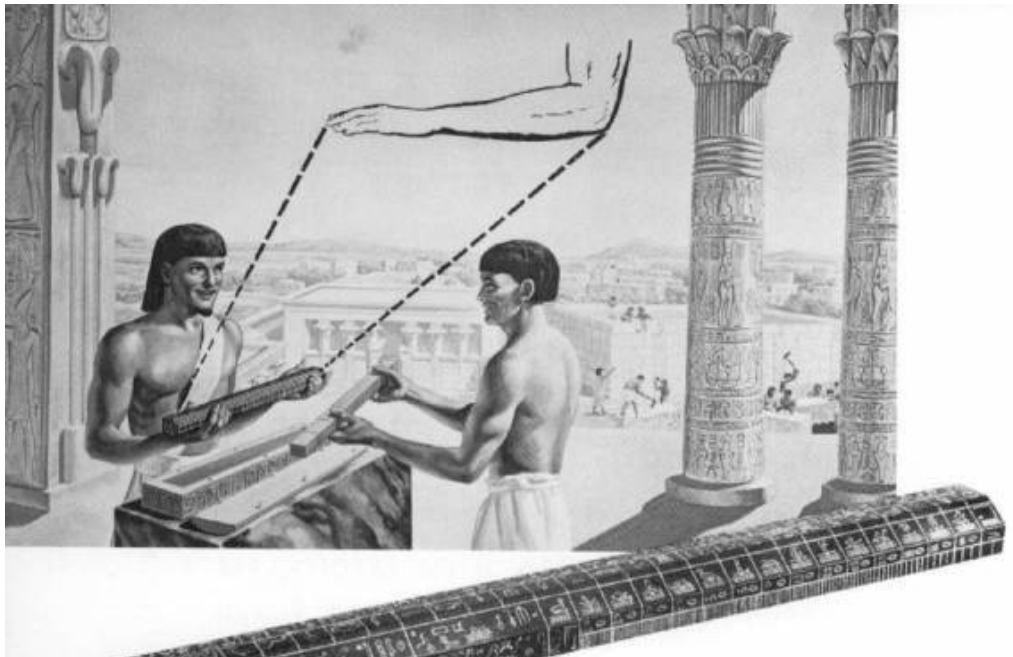


LINEAR & ANGULAR MEASUREMENTS

Course : Metrology & Measurements



EVOLUTION OF MEASUREMENTS



The 'Cubit' was the first recorded standard linear measurement. Defined by the distance from the tip of the forefinger to the middle of the elbow





EVOLUTION

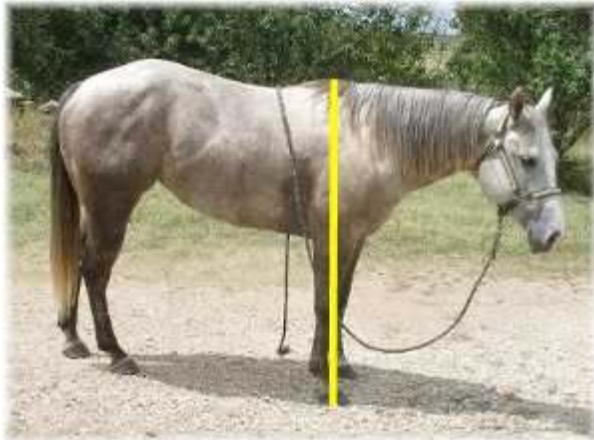
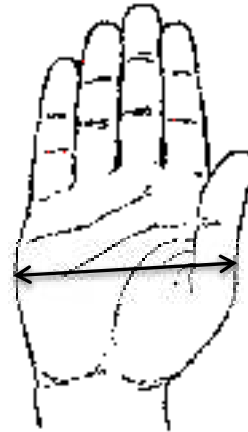
- Cubit was used by Egyptians for building pyramids (2750 B.C.)
- Mean error in length of sides of Khufu Pyramid at Gizeh in Egypt was 1.5mm





EVOLUTION

- ✓The Cubit was subdivided into several other measurements.
- ✓One hand is measured with the fingers closed and from end of the thumb to the other end of the palm.

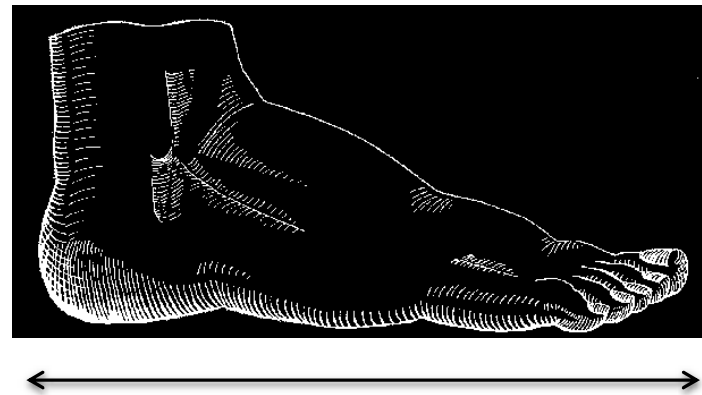


- ✓The Height of a horse is still measured in hands today.
- ✓1 hand = 4 inches = 101.6mm



LINEAR MEASUREMENTS

- ✓ History believes that the foot was given its name from the human body part.
- ✓ The length of a human foot was measured from the heel to the tip of the big toe.



Today 1 Foot = 12 inches = 304.8 mm





LINEAR MEASUREMENTS

- ✓ Linear measurement includes the measurement of lengths, diameters, heights and thickness.
- ✓ The basic principle of linear measurement (mechanical type) is that of comparison with standard dimensions on a suitably engraved instrument or device.
- ✓ Linear measuring instruments are categorized depending upon their accuracy.
- ✓ The two categories are non-precision instruments and precision instruments.





LINEAR MEASUREMENTS

✓ Non-precision instruments include steel rule, caliper divider, and telescopic gauge that are used to measure to the line graduations of a rule.

✓ Precision instruments include micrometers, vernier calipers, height gauges and slip gauges.

➤ Non-precision instruments are limited to the measurement of parts to a visible line graduation on the instrument used.

➤ They are used where high measurement accuracy is not required.



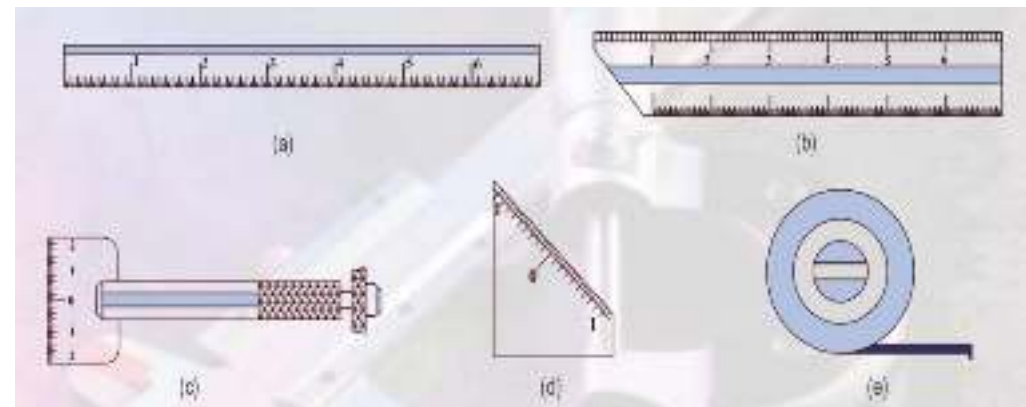


LINEAR MEASUREMENTS

Steel rule :

➤It is the simplest and most common measuring instruments in inspection. The principle behind steel rule is of comparing an unknown length to the one previously calibrated.

➤The rule must be graduated uniformly throughout its length. Rules are made in 150, 300, 500 and 1000 mm length.

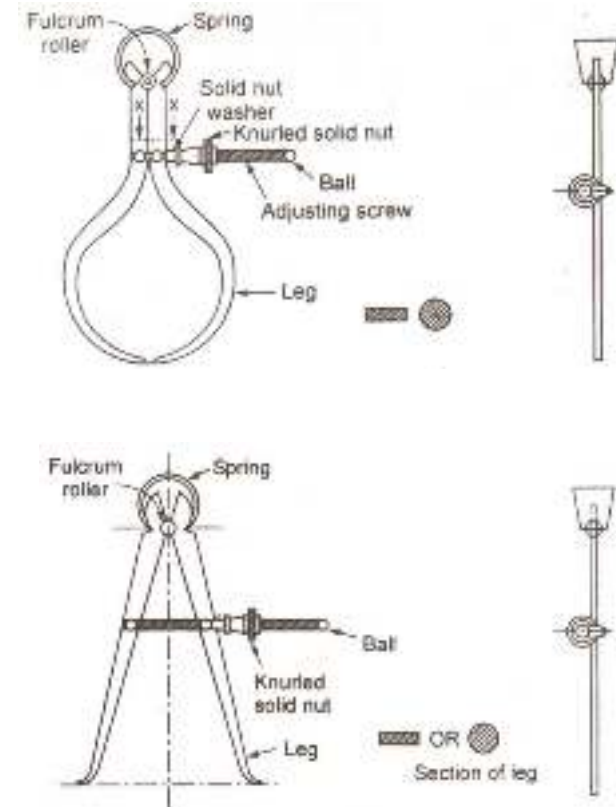


a. Narrow tempered ,b. Flexible fillet rule, C. Short rule with hanger d. Angle rule e. steel measure tape



CALIPERS

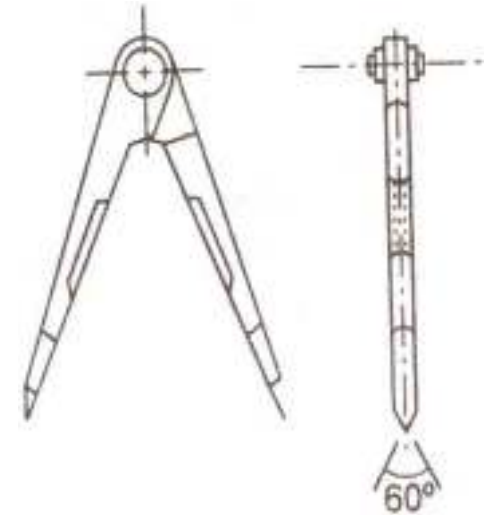
- Calipers are used for measurement of the parts, which cannot be measured directly with the scale. Thus, they are accessories to scales.
- The calipers consist of two legs hinged at top, and the ends of legs span part to be inspected.





DIVIDERS

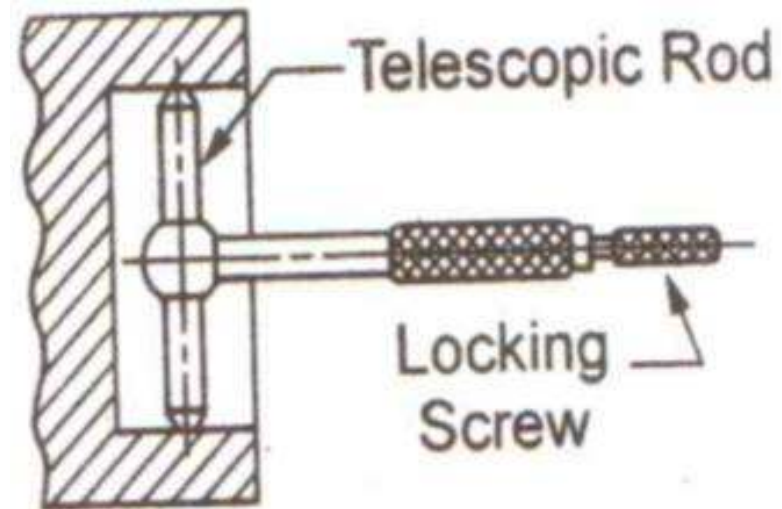
- A divider is similar in construction to a caliper except that both legs are straight with points at the end.
- These are used for scribing arcs and circles and general layout work.
- The distance between the fulcrum roller centre and the extreme working end of one of legs is known as the *nominal size*
- Dividers are available in the sizes of 100, 200, 300 mm.





TELESCOPIC GAUGE

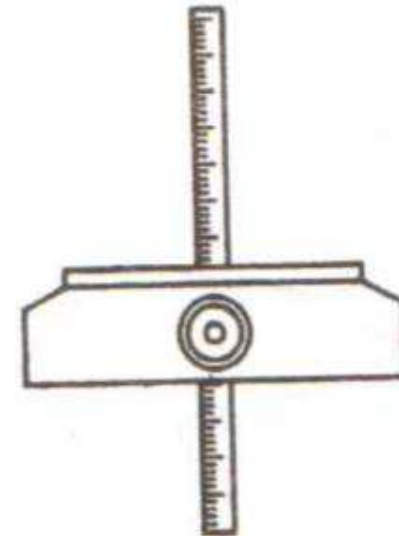
- ❖ The telescopic gauge is used for the measurement of internal diameter of a hole during machining operation.
- ❖ It consists of a handle and two plungers one telescopic into the other and both under spring tension. Ends of the plungers have spherical contacts.





DEPTH GAUGE

- ❑ This tool is used to measure the depth of blind holes, grooves, slots, the heights of shoulders in holes and dimensions of similar character.
- ❑ This is essentially a narrow steel rule to which a sliding head is clamped at the right angles to the rule



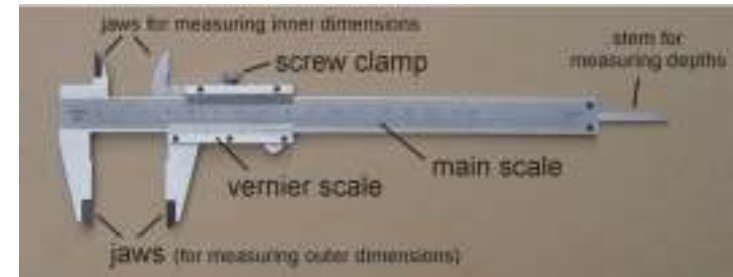


PRECISION LINEAR MEASUREMENTS

Precision measurement instruments use different techniques and phenomena to measure distance with accuracy.

Vernier Calipers

- Vernier calipers are precision measuring instruments that give an accuracy of 0.1 mm to 0.01 mm. The main scale carries the fixed graduations, one of two measuring jaws, a vernier head having a vernier scale engraved on.
- The vernier head carries the other jaw and slides on main scale. The vernier head can be locked to the main scale by the knurled screw attached to its head.





REFERENCES

1. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 2009.

