

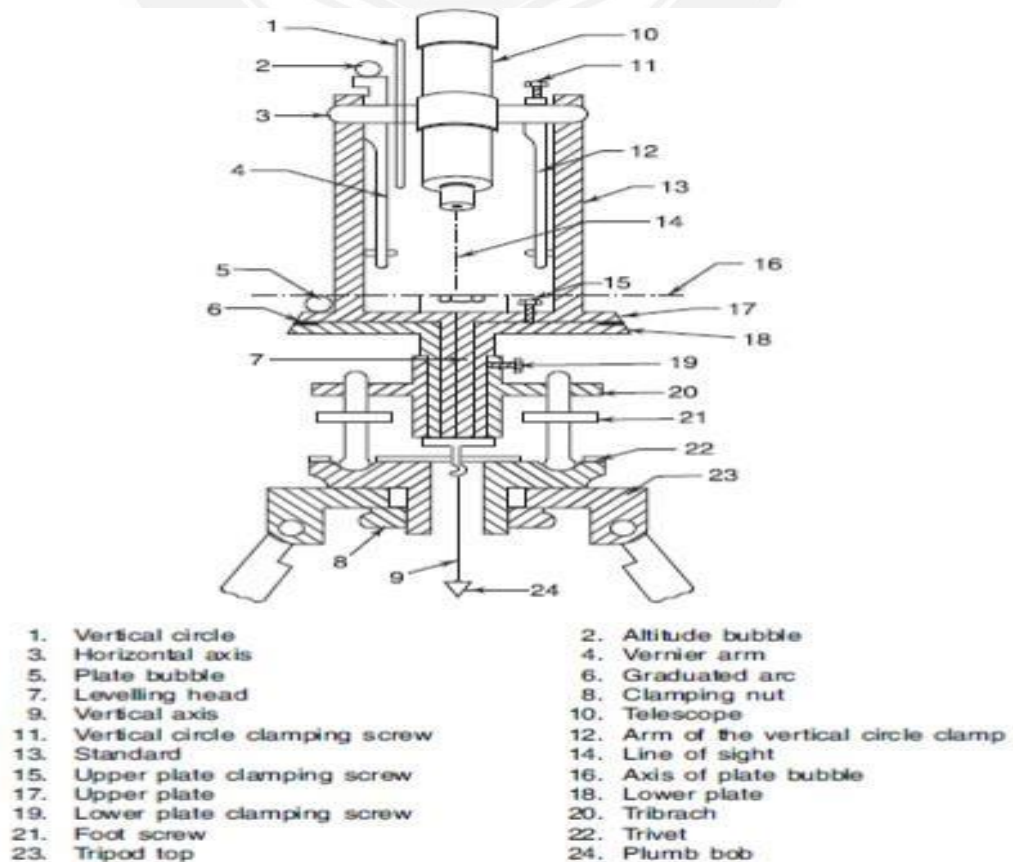
### 3.1 THEODOLITE SURVEYING

Transit or theodolite is an instrument used to measure horizontal and vertical angles. Depending upon the facilities provided for reading of observations the theodolites may be classified as simple vernier theodolite, micrometer theodolite, optical (glass arc) theodolite and electronic theodolite. Though the first two are obsolete and all the modern theodolites are of the optical or electronic digital type, this chapter mainly discusses the vernier theodolite.

**CLASSIFICATION:** Theodolites may be classified into transit and non-transit theodolites.

#### Transit Theodolite

A theodolite is said to be a transit one when its telescope can be revolved through  $180^\circ$  in a vertical plane about its horizontal axis, thus directing the telescope in exactly opposite direction. The various parts of the transit theodolite are shown in Fig. The vertical circle is rigidly fixed to the telescope and rotates with the telescope (Fig.).



**Fig. 4.1**

*Transit theodolite*

## NON-TRANSIT THEODOLITE

A theodolite is said to be a non-transit one when its telescope cannot be revolved through  $180^\circ$  in a vertical plane about its horizontal axis. Such theodolites are obsolete nowadays. Examples are Y-theodolite and Everest theodolite.

## READING A THEODOLITE

A theodolite has two verniers A and B placed on the opposite sides of the upper plate (i.e., they are placed at a difference of  $180^\circ$ ). The main scale and vernier of a typical theodolite as graduated are shown in Fig. The main scale is graduated from  $0^\circ$  to  $360^\circ$  in degrees and minutes. Each degree part is divided into three equal parts. Hence, the minimum reading that can be read from the main scale is  $20'$ . The vernier scale is graduated into minutes and seconds. Each minute division is divided into three equal parts. Hence, the least reading that can be read from the vernier scale is  $20''$ .

## DEFINITIONS

The following are the definitions of the terms that will frequently be used in the measurement processes:

1. *Transit*: It is also called plunging or reversing. This is the operation of revolving the telescope through  $180^\circ$  in a vertical plane about its horizontal axis, thus making it point exactly in the opposite direction.
2. *Face right*: When the vertical circle of a theodolite is on the right of the observer, the position is called face right and the observation made is called face right observation.
3. *Face Left*: When the vertical circle of a theodolite is on the left of the observer, the position is called face left and the observation made is called face left observation. By taking the mean of both face readings, the collimation error is eliminated.
4. *Swinging telescope*: Revolving the telescope in the horizontal plane, about its vertical axis is called swinging. A right swing means clockwise rotation of the telescope, whereas a left swing means anticlockwise rotation of the telescope. By taking the mean of the right swing and the left swing observations, the effects of error due to

friction or backlash in the moving parts is eliminated.

5. *Telescope normal*: The telescope is said to be normal or direct when its vertical circle is to the left of the observer and the bubble is up.
6. *Telescope inverted*: The telescope is said to be inverted when its vertical circle is to the right of the observer and the bubble is down.
7. *Horizontal axis*: It is also called the trunnion axis or transverse axis
8. *Vertical axis*: It is the axis about which the telescope can be rotated in a vertical plane. It is the axis about which the telescope can be rotated in a horizontal plane.
9. *Axis of telescope*: It is the line joining the optical centre of the object glass to the centre of the eyepiece.
10. *Line of sight*: It is an imaginary line joining the intersection of cross-hairs to the optical centre of the objective and its continuation.

