

- 5) The number of survey lines is to be made minimum as far as possible.
- 6) Survey stations should not be fixed on thoroughfares.

## 2.9. Different Operations in Chain Surveying

**2.9.1. Ranging :** In measuring the length of a survey line, it is necessary that the chain should be laid on the ground in a straight line between the end stations. If the line is short, it is easy to put the chain in true alignment. But if the line is long, it is necessary to place intermediate ranging rods to maintain the direction. Fixing of intermediate points in a straight line between the two end stations is known as ranging.

Ranging is of two types: a) Direct ranging b) Indirect ranging.

### (a) Direct Ranging

Direct ranging is adopted when the two end stations are mutually visible. The ranging is carried out by an eye or a line ranger.

#### Ranging by Eye

The ranging by eye is done by the following steps.

- 1) Fix ranging rods at each end of the line.
- 2) Stand about 1.5m beyond the first ranging rod.
- 3) Direct the assistant to hold the ranging rod vertically where the intermediate point to be fixed.
- 4) Direct the assistant to move left or right using code of signals until the three ranging rods are in straight line.
- 5) Check the verticality of the rods by sighting the lower ends of the rods.
- 6) As and when the intermediate point is in straight line, signal the assistant to fix the ranging rod.

The following code of signals may be used in directing the assistant into line.

Rapid sweep with right hand – move rapidly to the right.

Rapid sweep with left hand – move rapidly to the left.

Slow sweep with right hand – move slowly to the right.

Slow sweep with left hand – move slowly to the left.

- Right arm extended – move continuously to right.  
 Left arm extended – move continuously to left.  
 Right arm up and moved to the right – plumb the rod to the right.  
 left arm up and moved to the left – plumb the rod to the left.  
 Both hands up and brought down – correct.  
 Both arms extended forward  
 horizontally and the hands depressed – fix the ranging rod in position.  
 briskly.

### Ranging by Line Ranger

Line ranger is an optical instrument used for fixing intermediate points on a chain line. It consists of two right angled isosceles triangular prisms placed one above the other.

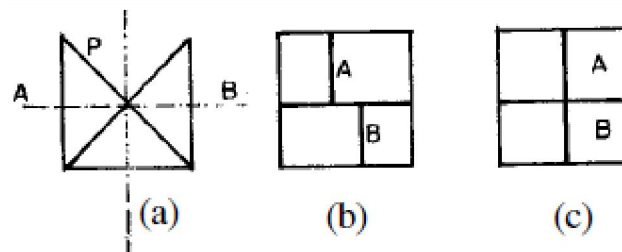


Fig. 2.7

For fixing an intermediate station P on the line AB, the observer stands as near P as possible and holds the instrument at his eye level. Rays of light coming from the ranging rods at A and B are reflected by the upper and lower prisms respectively and reach the eye. If the images of A and B are in separate lines as shown in fig (b), the observer moves a little perpendicular to AB such that both images will be in the same line as in fig(c).

The required position of P will be then exactly below the center of the instrument. One of two prisms can be adjusted by a screw. To test the instrument it is held at the mid point of a line and the ranging rods at the end station observed. If both rods appear in the same line, the instrument is in adjustment. Otherwise, the fixing screw of the movable prism is slackened and the prism slightly rotated so that both ranging rods appear in one line. Then the prism is fixed by tightening the fixing screw.

### (b) Indirect Ranging

Indirect ranging is adopted when the ends of the line are not mutually visible due to high intervening ground or the distance is too long. The process is also known as reciprocal ranging.

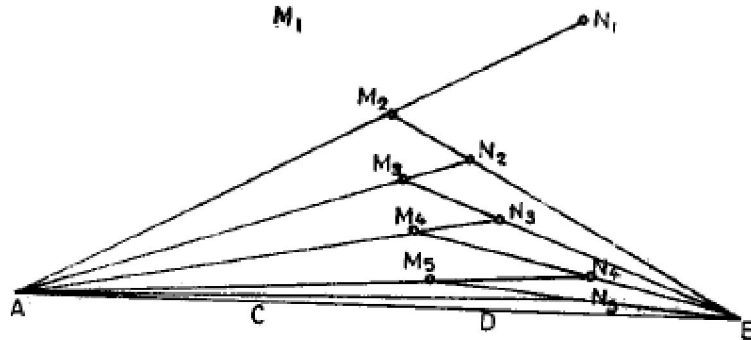


Fig. 2.8

Let A and B are the ends of a chain line which has a rising ground intervening between them. Two chainmen with ranging rods take the position  $M_1$  and  $N_1$  such that they are as nearly in line with A and B as they could judge and such that the chainman at  $M_1$  could see  $N_1$  and B and chainman at  $N_1$  can see  $M_1$  and A. First chainman at  $N_1$  directs  $M_1$  to  $M_2$  so that he comes in line with A and  $N_1$ . Then the chainman at  $M_2$  directs  $N_1$  to  $N_2$  such that he comes in line with B and  $M_1$ . This process is repeated so that they align each other successively directing each other until they are in the line AB.

### 2.9.2. Chaining a Survey Line

To chain a survey line the follower holds the chain in contact with the peg at the beginning of the line and then leader moves forward in line with the ranging rod fixed at the end of the chain line. The follower gives necessary directions in this regard so that leader moves in correct alignment. The leader takes ten arrows in one hand and the handle in the other hand along with a ranging rod. At the end of the chain the leader holds the ranging rod vertically in contact and the instructions are given by the follower to move left or right using the code of signals. The leader then holds the handle in both the hands keeping himself in a straight line and straightens the chain by jerking it and stretches over the mark. He then fixes an arrow at the end of the chain. The leader then moves forward with the remaining nine arrows in hand. The follower holding the rear handle of the chain comes up to the arrow fixed by the leader and calls chain so that the leader stops moving forward. The process is repeated till all the arrows are