2. Tape: The tapes are divided according to the materials used as following

(i)) Metallic tapes (ii) Steel tapes (iii) Invar tapes

(i) Metallic tapes: This tape is made with water proof linen with brass, copper wires to avoid stretching. The tapes available in lengths 2, 5, 10, 20 and 30m.

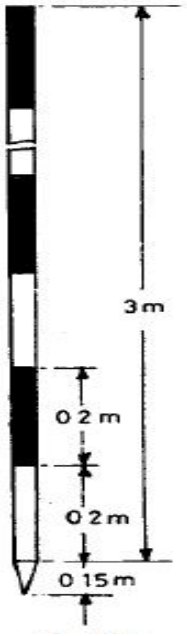

Fig. 2.2 Ranging rod

(ii) Steel tapes: This is most accurate tape for taking measurements. If carelessly handled it gets broken.

(iii) Invar tapes: If the measurements are to be made with highest precision this tape is used. These are 6mm wide and available in lengths of 30, 50 and 100m.

3. Ranging rods: Theses are wooden or metal poles 2m or 3m long and having a diameter of 30mm. They are provided with iron shoes at the lower ends to facilitate easy driving in the ground. They are painted in bands alternatively in black and white or red and white. Ranging rods used for ranging a line.

4. Offset rods: This is mainly used to measure offsets of shorter lengths. It is usually 2m long.

5. Cross staff: Cross staff is an instrument used for setting perpendicular offsets. These are three types.

i) Open cross staff

iii) Adjustable cross staff

iii) French cross staff

Fig. 2.3 Open Cross Staff

(i) Open cross staff: It consists of 4 metal arms at right angles to each other having eye vane at two adjacent ends and object vane at the other ends.

(ii) Adjustable cross staff: With this cross staff the object can be set at any angle.

(iii) French cross staff: This cross staff is an octagonal brass tube with slits on its eight faces. With this cross staff we can set the object at an angle of 45^0 also.

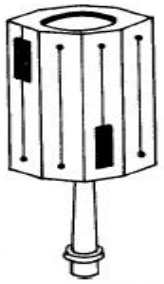

Fig. 2.4 French Cross Staff

Optical Square: This is an instrument used for setting out right angles to the chain lines and to find out the foot of the perpendicular on the chain line from an object. It works on the principle of reflection.

6. Arrows: These are used for marking the ends of a chain during the process of chaining. These are steel pins 400mm long and are pointed at one end.

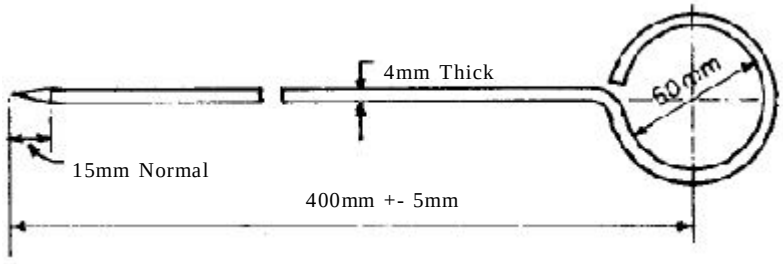

Fig. 2.5 Arrows

7. Pegs: These are made from hard timber and tapered at one end. The lengths varies from 120 to 600mm. these are driven into ground to mark the instrument stations.

8. Plumb bob: It is used to define the vertical line while measuring distance along slopes.

2.3 Coventional Signs

Conventional signs are symbols of objects represented on a map or in the field book.

Some of the common conventional signs used in chain surveying are given in fig.2.15.