

SIGNALS IN RAILWAYS

I—SIGNALLING

Signalling. Signalling consists of the systems, devices and means by which trains are operated efficiently, and tracks are used to maximum extent, maintaining the safety of the passengers, the staff and the rolling stock. It includes the use and working of signals, points, block instruments and other equipments.

18.1. Objects of Signalling. The various objects of providing and operating the signals are as follows :

- (i) To provide facilities for the efficient movement of trains.
- (ii) To ensure safety between two or more trains which cross or approach each other's path.
- (iii) To provide facilities for the maximum utility of the track.
- (iv) To provide facilities for safe and efficient shunting operations.
- (v) To guide the trains during maintenance and the repairs of the track.
- (vi) To safeguard the trains at converging junctions and give directional indications at diverging junctions.

18.2. Engineering Principles of Signalling. Following engineering principles should be kept in view :

(1) Every apparatus and circuit employed in signalling system should be so designed that a failure in any or all the components of the system results in most restrictive aspect i.e., alternate techniques to check the failures must be employed.

(2) In the design of apparatus, circuits and systems, the factors, like reliability, simplicity and financial aspects should be considered.

(3) The aspects of fixed signals should be distinctive and unambiguous, i.e., one aspect should not be mistaken for the other.

(4) A given signal aspect must convey the same indication to the driver at all times, at all places and under all conditions.

(5) The action required by a signal should be definite and capable of easy implementation.

(6) Each and every signal should afford the maximum possible sighting distance.

(7) The number of fixed signals for each route should be minimum.

(8) The overlaps for each system of aspects should be clearly specified and there should be gradual reduction in overlaps as the number of aspects increases.

✓ **18.3. Classification and types of Signals.** The various types of signals can be classified in the following categories on the following basis (Fig. 18.1) :

- (1) Operating characteristics,
- (2) Functional characteristics,
- (3) Locational characteristics, and
- (4) Special characteristics

1. **Operating characteristics.** Based on the way of their operation, signals can be classified as :

- (i) Detonating signals (also called Fog or Audible Signals)
- (ii) Hand signals (Visual Indication Signals)
- (iii) Fixed signals (Visual Indication Signals).

2. **Functional Characteristics.** Signals can be classified as per their functions in the following types :

- (i). Stop or Semaphore type Signals
- (ii) Warner Signals
- (iii) Shunting Signals (Disc or Ground Signals)
- (iv) Coloured-light Signals.

3. Locational characteristics. In view of the position where the signals are located, they can be divided into following categories :

(i) Reception Signal :

(a) Outer Signal

(b) Home Signal

(ii) Departure Signal :

(a) Starter

(b) Advance Starter.

4. **Special characteristics.** Special types of Signals are the following :

- (i) Repeater or co-acting signals
- (ii) Routing signals
- (iii) Calling on Signals
- (iv) Point indicators
- (v) Modified lower quadrant semaphore signal
- (vi) Miscellaneous signal.

AUDIBLE SIGNALS

Audible Signals are detonators fixed to the rails that explode with a loud sound when train passes over them , thus catching the attention of the driver of the train. They are used in foggy or cloudy weather where visibility is so bad that the driver may not be able to see the fixed signals or hand signals from sufficient distance. Usually these detonators are placed at a distance of 400 m to 500 m from the fixed signal to enable the driver to stop the train if needed. These explosives are fixed to the rails by clips.

(ii) **Hand signals.** Hand signals are given either by flags fixed to a wooden handle or by bare arms when flags are not available during the day time. During the night time, lamps are used in which movable glass-slides of green, red and yellow sheds are provided. The hand signals are generally used by guards, station masters, cabin man, gang man, key man, point man or any other authorised man.

Following are the conventions used (Table 18'1) :

TABLE 18'1
Indications of hand signals

<i>S.N.</i>	<i>Colours of flags/lights</i>	<i>Meaning of Signals</i>
1.	Red flag or light	Stop
2.	Green flag or light	Proceed
3.	Yellow light	Proceed cautiously

FIXED SIGNALS: SEMAPHORE SIGNAL

A Semaphore Signal is a fixed signal used for stopping the train or giving clearance to proceed. It consists of

- A movable arm pivoted to a pole at a height of 7.5 m from the ground with a horizontal pin known as spindle. This arm is usually horizontal, known as “ON” position, but can be lowered by 45° or 60° . When lowered, it is called in “OFF” position.
- This arm is normally 1.2 m to 1.7 m long and 23 cm to 27 cm wide. The face of the arm seen by the approaching driver is painted with red with a vertical white band. The other side is painted white with a vertical black band.
- The end of the arm close to the spindle, contains a spectacle frame with two lenses or glasses, one with Red colour and the other with Green colour. A lamp is provided at the back of the spectacle such that either Red or Green glass comes in front of the lamp depending on arm position.
- The arm can be rotated at the spindle through a crank rod connected to a cam lever with a balancing weight at the middle of the pole, that can be operated through a chain and pulley mechanism from the cabin.

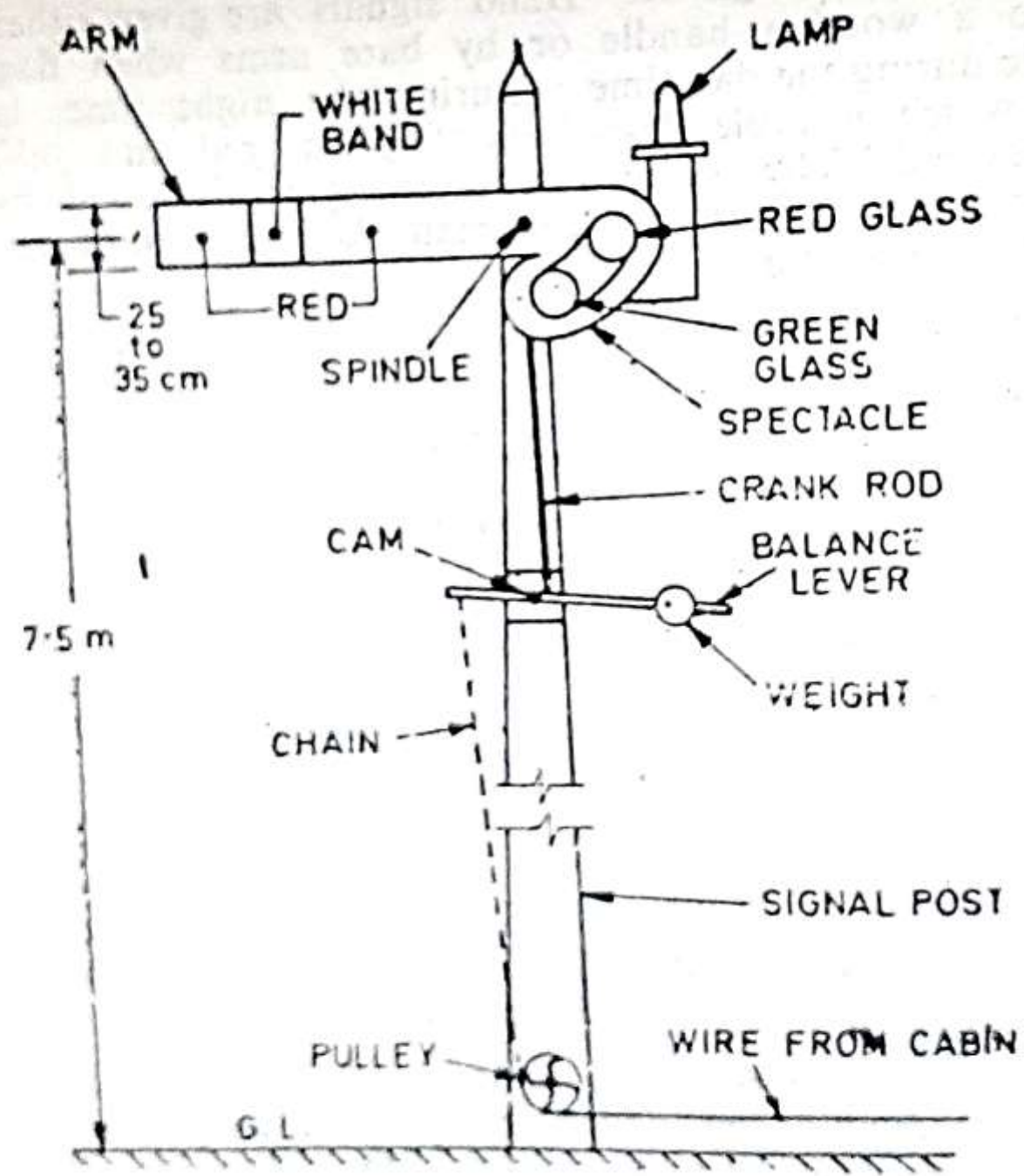


Fig. 18.2. Semaphore signal.

Indications of semaphore signals

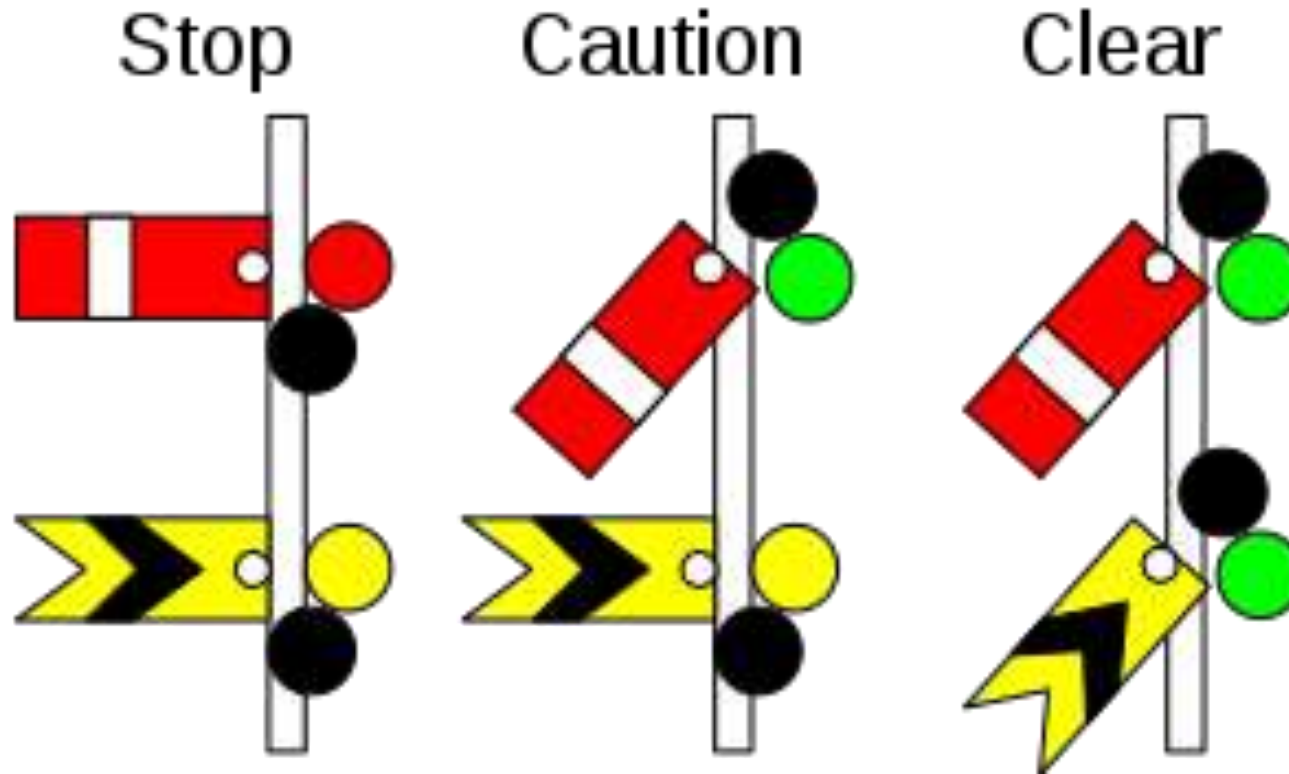
S. No.	Operation Time	Position of arm Or Colour of Light	Position of Signal	Indication Given
1.	Day Time	(i) Horizontal arm (ii) Inclined arm 45° to 60°	"On" Position "Off" Position	"Stop" or Danger "Proceed" or line clear
2.	Night Time	(i) Red light (ii) Green light	"On" Position "Off" Position	"Stop" or Danger "Proceed" or line clear



WARNER SIGNALS

Warner signal, as the name itself indicates, are used to caution or warn about any danger ahead. They are similar to semaphore signal except a slight change in size, shape and colours of paint.

It is also a movable arm fixed to the post with a v-shaped notch at free end. The warner signal is normally used along with regular semaphore and painted with yellow colour with a black v band.



SHUNTING SIGNALS: DISC SIGNAL

These signals are used in shunting operation in station yards or marshalling yards. They are in the shape of a circular disc with a red band on a white background. The disc can be rotated on in a vertical plane by pulling a lever. Two lenses are provided, one for red lamp and the other for green lamp. If the red band is horizontal, it indicates “STOP” with red light.



COLOURED LIGHT SIGNALS

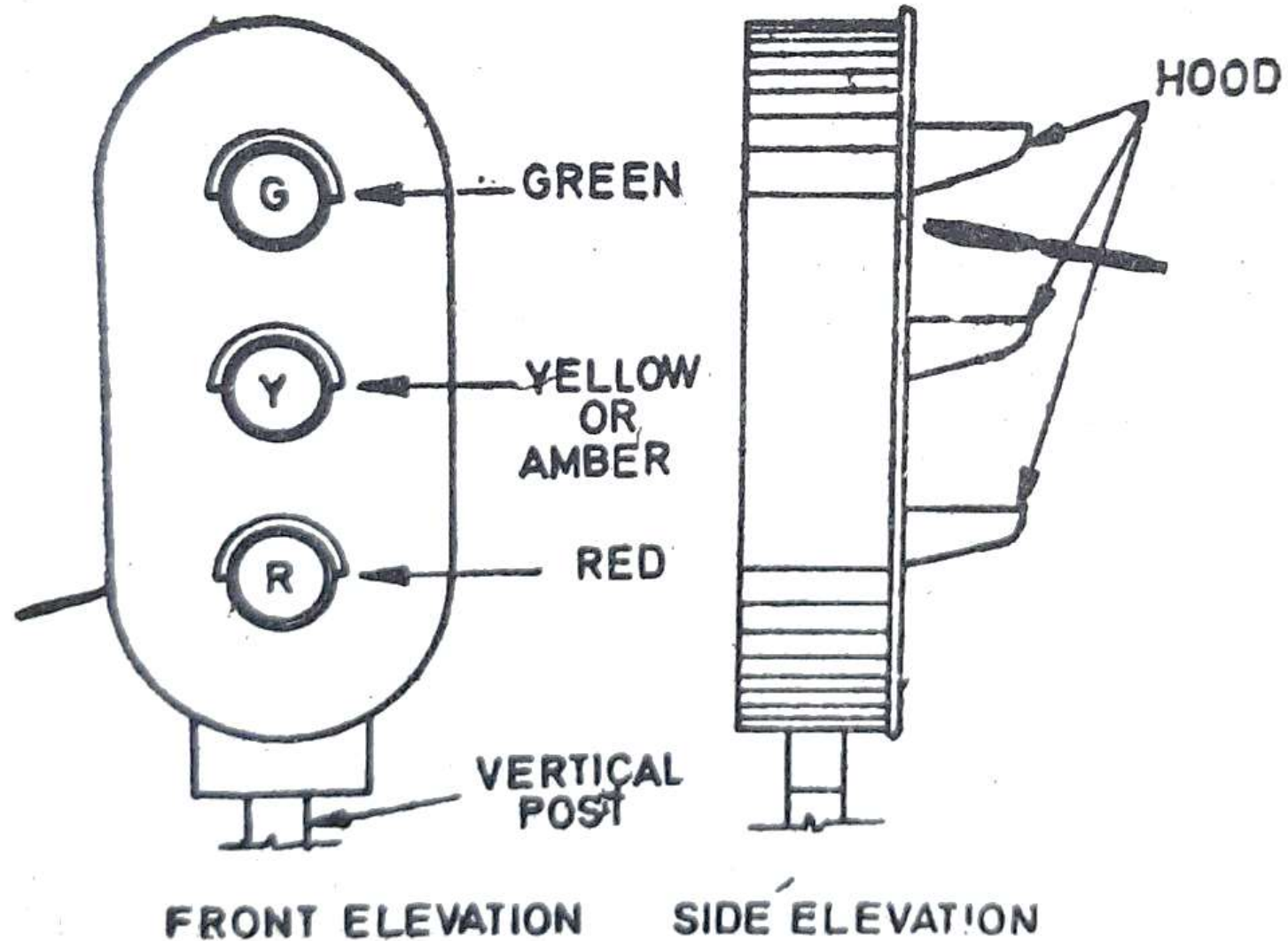


Fig. 18.7. Three-aspects of colour light signals.

LOCATIONAL SIGNALS

Based on the location, the railway signals can be classified into:

Reception Signals: **Outer Signal**
 Home Signal

Departure Signals: **Starter**
 Advanced Starter

SPECIAL SIGNALS

Routing Signals: When a track diverges into different tracks in a station yard, the routing signals are used to indicate for which track points are set. Normally, the semaphore for the main line is kept higher than other semaphores.

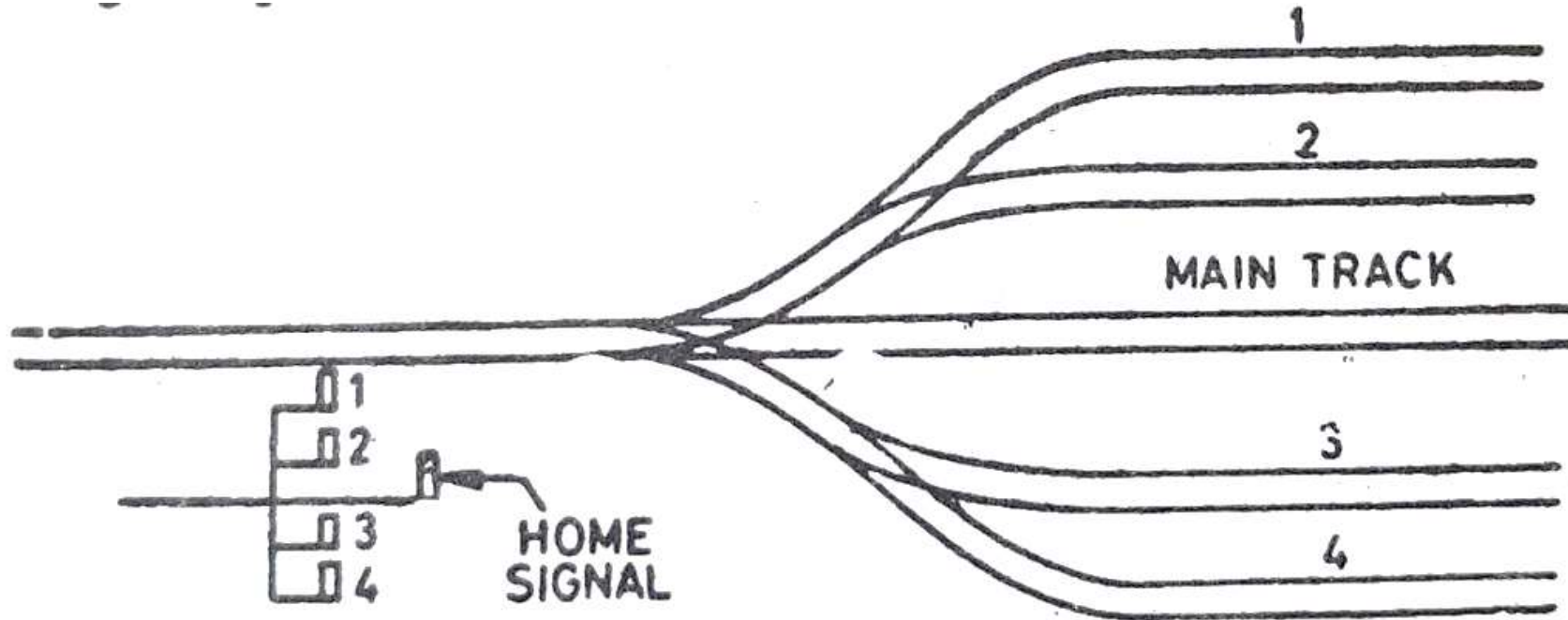


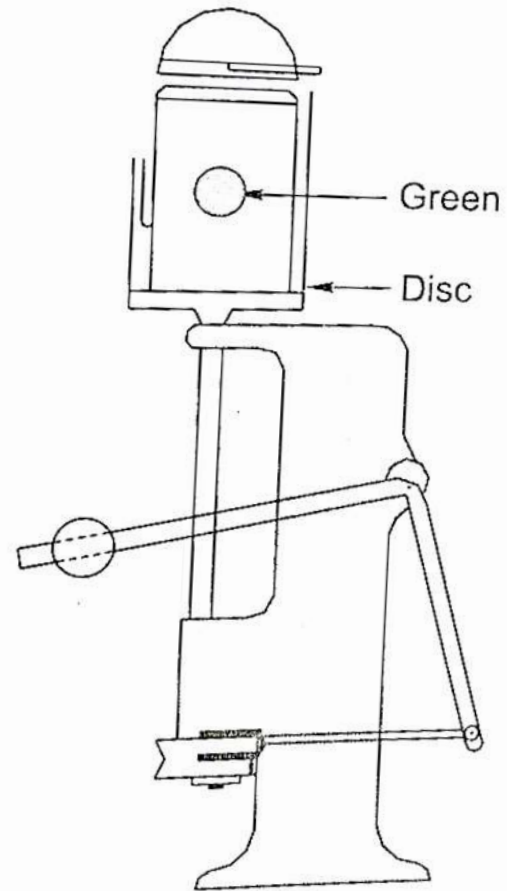
Fig. 18·11. Position of routing signals.

ROUTING SIGNAL

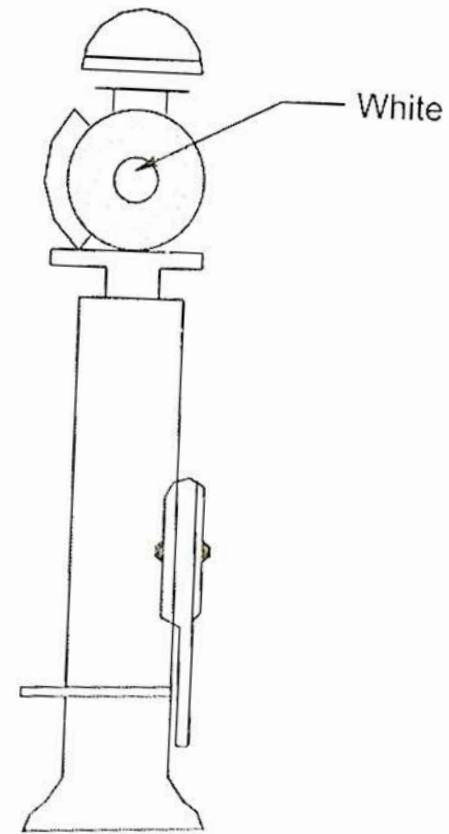


REPEATER SIGNAL or CO-ACTING SIGNAL





(A) Turnout



(B) Main line

POINT INDICATOR SIGNALS



POINT INDICATORS

THANK YOU