

**MINE MACHINERY-1 LAB**  
**Semester: 5TH**



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## EXPERIMENT-01

**AIM:** Pieces of strand and non-strand wire rope

**APPARATUS:** 1) Pre-formed wire ropes  
2) Strand wire rope  
3) Non-strand wire rope

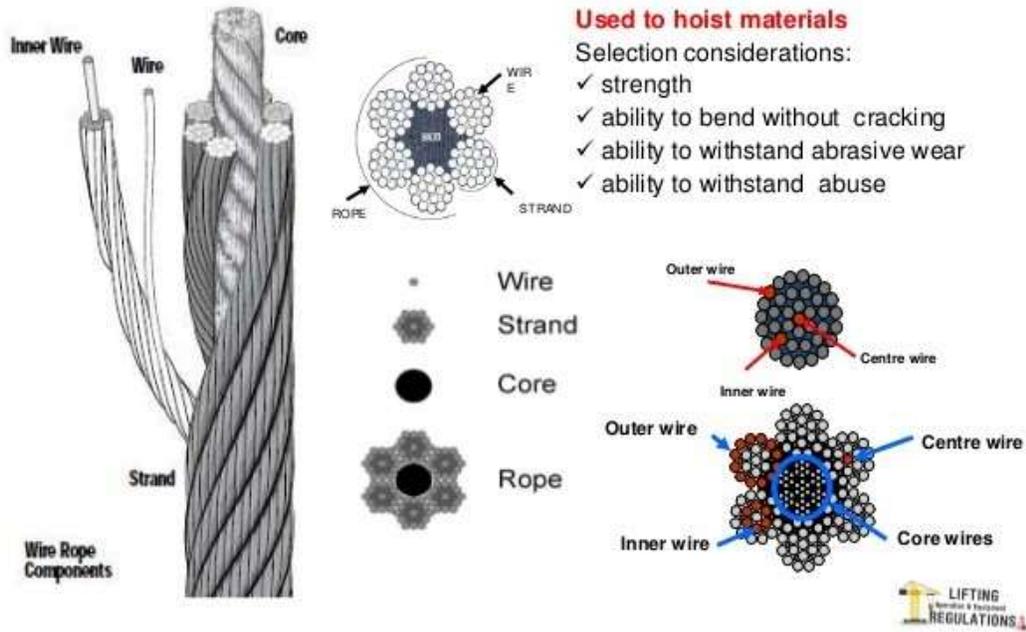
**THEORY:** **Wire rope** is several strands of metal **wire** twisted into a **helix** forming a composite **rope**, in a pattern known as *laid rope*. Wire ropes are composite construction of strands of fibre or steel or both, bunched to form a core surrounded by stranded and twisted cores. Steel wires for wire ropes are normally made of non-alloy carbon steel with a carbon content

### **Types of Rope:**

- 1) Round strand rope
  - a) Simple round strand
  - b) Compound strand
- 2) Flattened-strand ropes
- 3) Multi-strand Non-rotating ropes
- 4) Locked-coil ropes
- 5) Guide rope

### **PARTS OF WIRE ROPE:**

- The **core** at the center of the rope
- **Strands**, which are groups of individual wires that wrap around the core
- **Wires**, which are single, individual pieces of metal that are drawn to a small diameter and are grouped to make the strands



**Round strand rope:** A strand is when two or more wires are wound concentrically in a helix. These strands are typically wound around a center wire and then around the core. It consists of six similar strands laid around a central core of fibre or soft metal. Each strand consists of six wires around a similar central wire.

- **Lay of rope:** The helix or spiral of the wires and strands in a rope is called the lay. Regular lay denotes rope in which the wires are twisted in one direction, and the strands in the opposite direction to form the rope. Right or left lay refers to the direction in which the strands rotate around the wire rope.

**Compound strand:** These wire ropes contain wires commonly of different diameters and may be arranged in different ways. In a 6\*8/6/1 wire rope, there are eight larger outer wires per strand over a core of seven(6 around 1) thinner wires to give flexibility.

**Flattened-strand ropes:** A wire rope having the wires in each strand arranged so as to form flat surfaces on the strands. The name implies, are stranded rope with strands whose individual wires gives the strand a “flattened” look.

**Multi-strand Non-rotating ropes:** Rotation resistant wire rope is composed of multi-layers of strands for minimizing the tendency to spin and rotation. Rotation resistant wire rope refers to a series of steel ropes which minimizes the tendency to spin or rotation under load. These ropes have two or more oppositely-laid strands to mutually compensate for strand torques in adjacent lays.

**Locked-coil ropes:** A locked-coil rope has no strand. It is non rotating type. The layers of single wires about a core and finishing with one or more surrounding layers of shaped wires which are interlocked to restrain the centre layer and make a smooth cover.

**Guide rope:** A locked-coil rope as a guide rope consists of 6 around 1 in the centre and the outer layer has shaped wires so that they interlocked.

## EXPERIMENT-02

**AIM:** Model of rope splicing

**APPARATUS:** 1) piece of rope  
2) splicing tool kit  
3) measuring instrument`

**THEORY:** Rope splicing in ropework is the forming of a semi-permanent joint between two ropes or two parts of the same rope by partly untwisting and then interweaving their strands. Splices can be used to form a stopper at the end of a line, to form a loop or an eye in a rope, or for joining two ropes together.<sup>[1]</sup> Splices are preferred to knotted rope, since while a knot typically reduces the strength by 20–40%,<sup>[2]</sup> a splice is capable of attaining a rope's full strength. However, splicing usually results in a thickening of the line and, if subsequently removed, leaves a distortion of the rope. Most types of splices are used on 3-strand rope, but some can be done on 12-strand or greater single-braided rope, as well as most double braids.

### Types of splicing:

- back splice (also called an end splice) – A splice where the strands of the end of the rope are spliced directly back into the end without forming a loop. It is used to finish off the end of the rope to keep it from fraying. The end of the rope with the splice is about twice the thickness of the rest of the rope. With nylon and other plastic materials, the back splice is often no longer used; the rope strands are simply fused together with heat to prevent fraying.<sup>[4]</sup>



- cut splice (originally called cunt splice) – A splice similar to the eye splice. It is typically used for light lines (e.g., the log-line) where a single splice would tend to come undone, the rope being frequently wet.<sup>[5]</sup> It makes a very strong knot. A cut splice is a join between two ropes, made by side splicing the ends slightly apart, to make an eye in the joined rope which lies shut when the rope is taut. Its original name was bowdlerised to "cut splice".

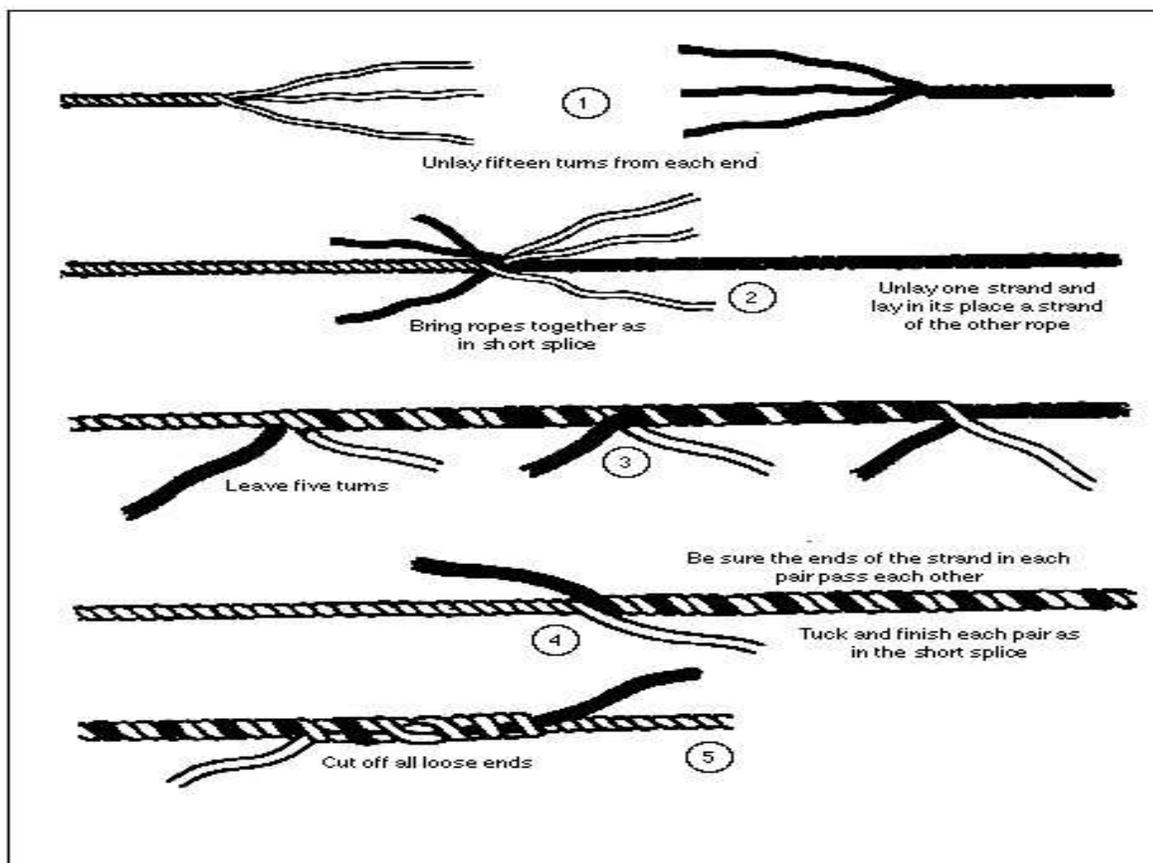


- eye splice – A splice where the working end is spliced into the working part forming a loop.
- ring splice – Attached the working end of a rope to a ring or clew.<sup>[6]</sup>
- chain splice – Attached the working end of a rope to a chain.<sup>[7]</sup>
- figure-eight "splice" knot- A splice-like bend knot used for joining two ropes.
- horseshoe splice – A cut splice where the two sides of the loop are of unequal length.
- long splice – A splice used to join two rope ends forming one rope the length of the total of the two ropes. The long splice, unlike most splice types, results in a splice that is only very slightly thicker than the rope without the splice, but

sacrifices some of the strength of the short splice. It does this by replacing two of the strands of each rope end with those from the other, and cutting off some of the extra strands that result. The long splice allows the spliced rope to still fit through the same pulleys, which is necessary in some applications.



- short splice – Also a splice used to join the ends of two ropes, but the short splice is more similar to the technique used in other splices and results in the spliced part being about twice as thick as the non spliced part, and has greater strength than the long splice. The short splice retains more of the rope strength than any knots that join rope ends.



### EXPERIMENT-03

**AIM:** Rope splicing tools

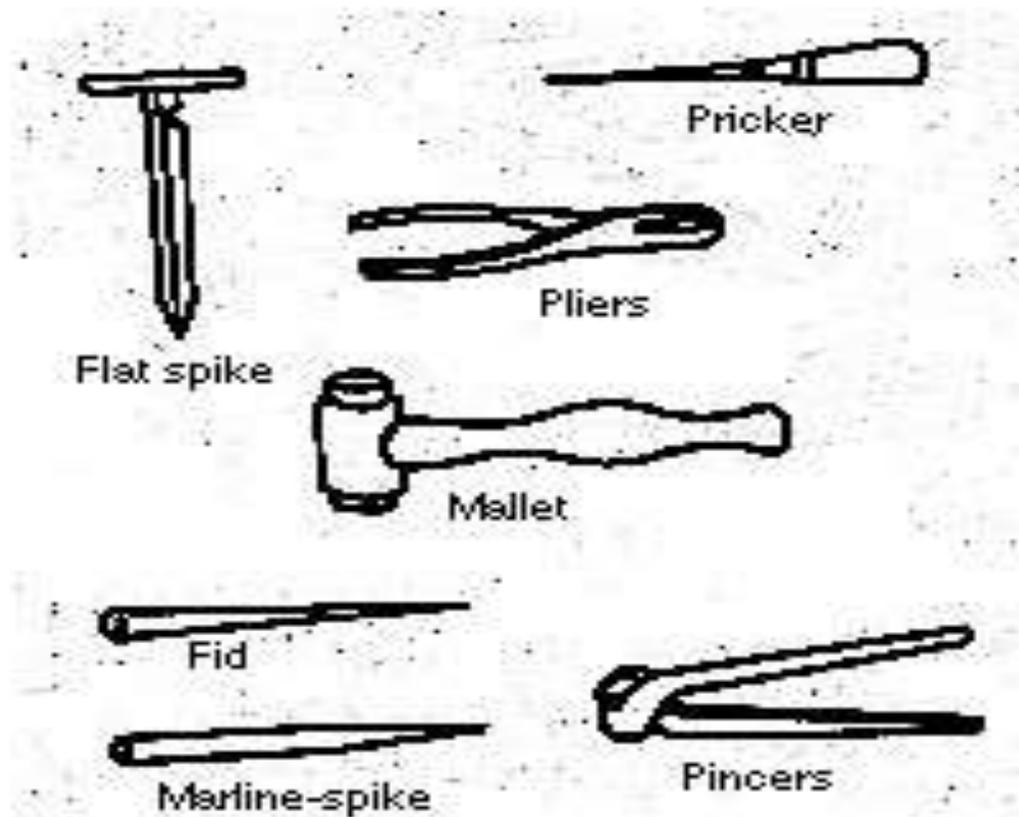
**APPARATUS:** 1) Alluminium  
 2)Iron & steel  
 3)Hammer  
 4)wood/plastic

**Types of tools:**

- 1) Fids
- 2) Wire Fid
- 3) Swedish Fid
- 4) Tubular Fids
- 5) Toss Splicing Wand
- 6) Marline Spik
- 7) Pusher

## THEORY:

- The length of splicing tool is called fid. A fid is a conical tool traditionally made of wood or bone. It is used to work with rope and canvas in marlinespike seamanship. A fid differs from a marlinespike in material and purposes. A marlinespike is used in working with wire rope, natural and synthetic lines, may be used to open shackles, and is made of metal. A fid is used to hold open knots and holes in canvas, and to separate the "lays" of synthetic or natural rope for splicing. A variation of the fid, the gripfid, is used for ply-split braiding. The gripfid has a jamming cleat to pull a cord back through the cord split by the fid's point.
- Wire fid : These are available in various sizes depending upon rope size and diameter. The fid length is calculated as 21 times of rope diameter.
- Swedish Fid: These are stainless steel Swedish fids. They are used primarily for separating the strands of three strand rope in order to make a splice. Even though it is a pretty basic tool, they are invaluable for doing three strand splices.
- Tubular Fid : metal splicing fids that accommodate ropes ranging from 1/4 to 3/4 in diameter. With the fids designed to meet splicing requirements, measurements are determined in fid-lengths so its important to get the right-sized fids for the rope being spliced.
- The Splicing Wand is basically a long tube containing a hidden snare. You slide the tool into the rope, grab the end you want to tuck, and slide the tool out. There's a specially shaped tip on the tube to keep you from snagging yarns along the way as well as an ingenious mechanism in the handle to hold the tube in place while you work. You can clamp the tool in a vise if you want, leaving both hands free to deal with the rope. There's no taping or un-taping, no fid lengths to decipher, and very little physical effort needed to tuck. Example 1 piece of 3mm diameter round head paracord lacing needle, 1 piece of 5mm diameter round head paracord lacing needle, 1 piece of 5mm diameter flat head paracord lacing needle etc..
- Pusher is Made with a wooden handle to easily grip and hold while working on rope . steel pusher helps to maintain the quality of the rope while completing each project. Improve accuracy and skill with this easy to use tool, and create cleaner and more precise works of art.
- **wire rope cutters:** It is a tool/equipment cutting the wire rope, wire rope cutters provide the perfect solution for cutting wire ropes of all diameters. The most popular range are "hand-held.
  - 1) Ensure that the cable cutter can handle the thickness of the copper or aluminum cable.
  - 2) Open the cutter jaws, place the cable in between the jaws at the selected point for cutting.
  - 3) Grip the handles and squeeze them together allowing the jaw to cut through the cable with ease.



Rope splicing tool

#### EXPERIMENT-04

**AIM: King detaching safety hook**

**APPARATUS:** 1) steel  
 2) plate  
 3) Catch Plates or Bells  
 4)Hing pin

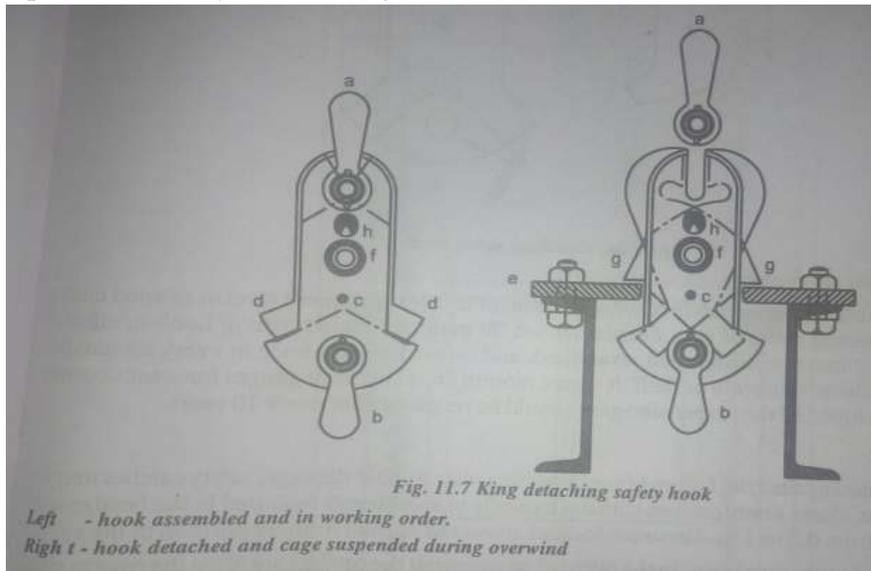
**THEORY:** It is a safety device which acts when an over wind takes place. Its purpose is to suspend the cage or skip in the headgear if an over winding occurs & at the same time to release the rope capel to go over the headgear pulley. It is always placed just below the rope capel.

It consists of two inner plates & two outer plates, which can rotate around a common point 'H'. The outer plate is fixed & inner can move. The inner plates are arranged face to face on each other

between 'H' & through all the plates assemble the hook. A copper pin is placed through the hole 'C' in all the four plates.

In case of over winding, the hook passes through the detaching plate, which is fitted in the headgear, while pulling through detaching plate, the lower portion of the hook is pressed inside & the copper pin is sheared. The inner plate moves around 'H' so that rope capel release from the top & the catches of inner plates are fill apart. The cage rests on detaching plate with the help of catches. Thus the cage & the persons travelling in the cage are safe.

Recovery of over winding cage: Before starting the recovery operation, the shaft top is covered with rails. Now the winding rope is brought up to the hook & the rope capel is attached to the hole 'F' through the 'D' link, when the winding rope is pulled slightly. The inner plate comes in their original position since the hole 'F' is inclined. The catches are now inside & the safety hook can freely pass down through the detaching plate. The cage is now slowly lowered on the rails placed over the pit top. After the over wind, the safety hook is to be inspected & refitted with new copper pin & the rope is to be replaced after every over winding.



## EXPERIMENT-05

**AIM:** Headgear structure

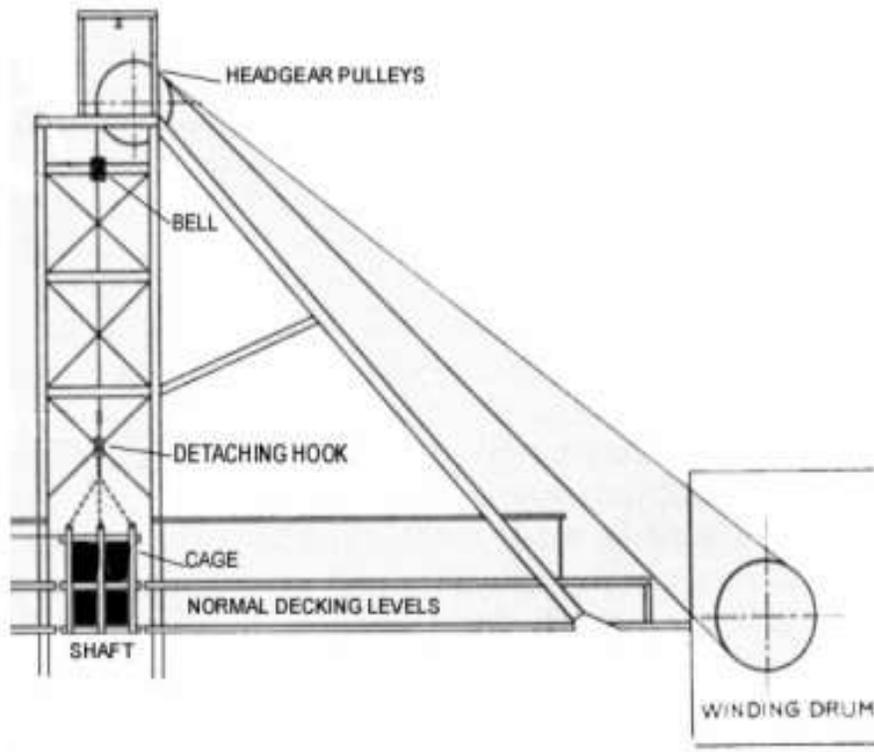
**APPARATUS:** 1) Iron steel legs  
2) Pulley  
3) Cage  
4) Rope guide

### **THEORY:**

**Headgear structure:** It is a steel or concrete framework on the mouth of the shaft. The purpose of headgear is to:-

- a) Support the headgear pulley, the weight of cage, ropes & rope guides.
- b) Guide the cage to banking level.
- The headgear consists of four girders inclined towards the centre of the shaft at an inclination of **1 in 8 to 1 in 10.**
- A network of steel girders joins these four girders to each other. Two rear legs situated towards the winding engine room are connected to the headgear to prevent its building. These rear legs are also used as ladder way.
- Two headgear pulleys are installed at the top of the headgear & a bell plate is installed below the headgear pulley.
- **Six-leg Headgear:** These types of headgears are used in drum winding & are known as six legs tied headgear.
- **Four-leg Headgear:** This type of headgear is used in friction winding. The construction is same as that of six-leg type headgear but only the difference is that it does not have two rear legs.
- **Two-leg Headgear:** It consists of only two legs inclined towards the shaft. The headgear pulley is installed on a cross member mounted between two legs. This type of headgear is not used.
- **Headgear Pulley:** It is made up of hard steel. Its construction should be such that its weight is less. Its diameter should be such that it should minimise the bending stresses in the rope.
- 2) **Cage:** It is a lift like structure suspended from winding rope by means of suspension gear arrangement. It is used for the transportation of men & materials.  
It is made up of steel & very strong in construction. A track is provided on the floor with catches to prevent the movement of the tubs. It is open with two sides & provided with collapsible door. Man travelling in the cage provides a hand bar on the sides for holding. The types of cage are as follows:
  - a) Single deck single cage (only one tub).
  - b) Tandem cage – two tubs or more in one cage.
  - c) Double deck single cage (one tub on each floor).

d) Double deck tandem cage (two or more tubs on each floor).



## HEADGEAR STRUCTURE

### EXPERIMENT-06

**AIM:** Model of different types of clips

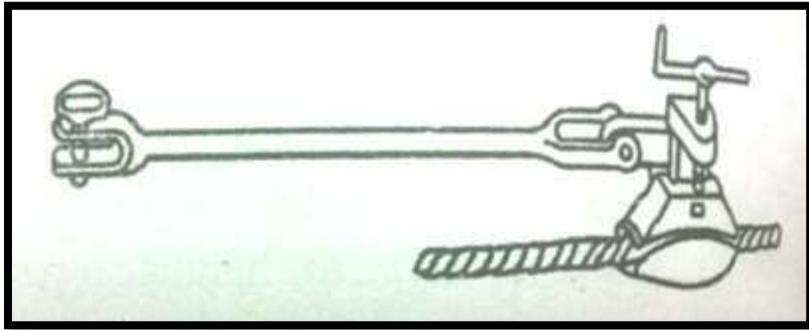
**APPARATUS:** 1) two jaws plate  
2) Plate  
3) Knot  
4) Bolt  
5) Chain

#### ❖ Types of Clips

- 1) Screw clip.
- 2) Small-man clip.
- 3) Lashing chain.
- 4) Goose neck clip

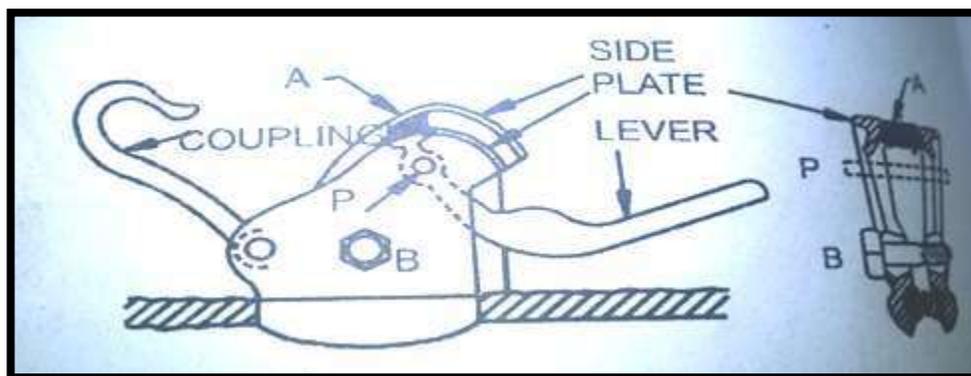
## THEORY:

1. **Screw clip**:-It consists of two jaws i.e. lower jaw & upper jaw. When the distance between two jaws is enough to accommodate the rope, the



moving rope is placed in between the jaws & the handle operated which reduces the distance between the two jaws. Hence the two jaw grips the load rope, due to this grip as well as tub starts moving with the rope because the clip is connected to the tub & through a rod or lever.

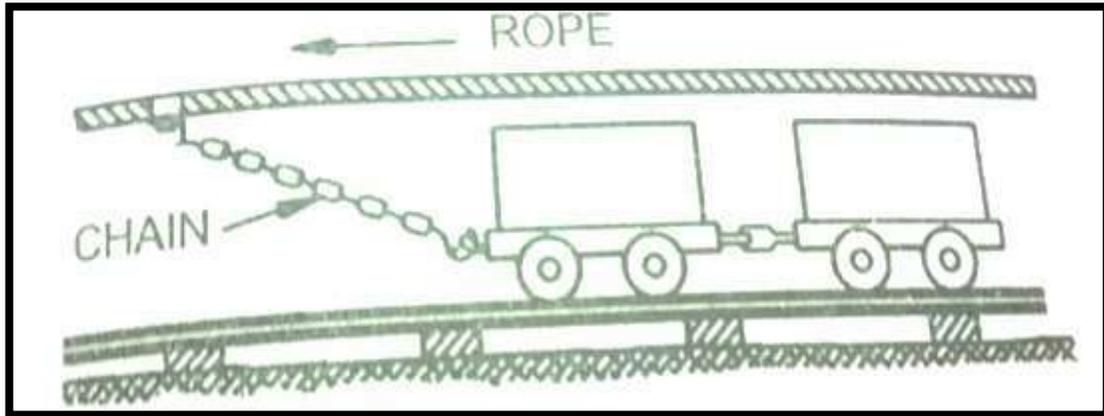
## 2.Small man clip: -



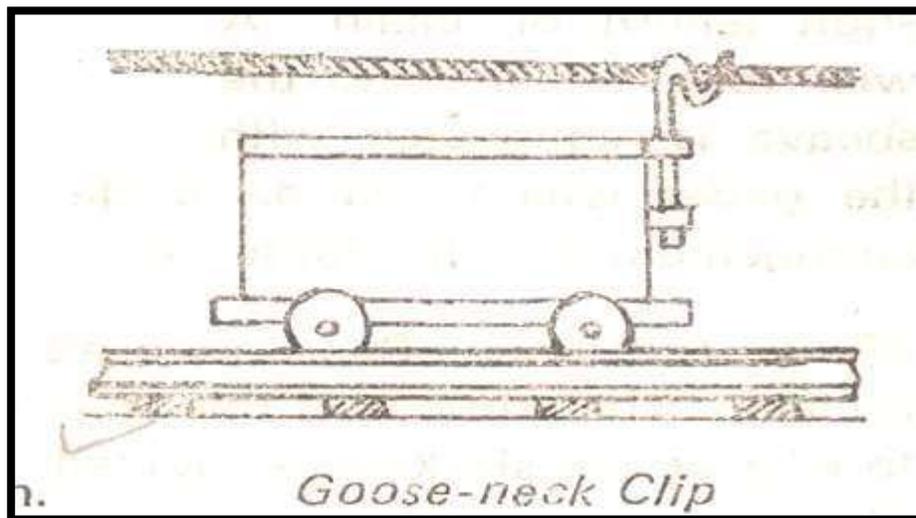
It consists of two side plates loosely held together by a bolt which has a spring which keeps the two plates apart. A hand lever pivoted at 'P' & carries a wedge at its upper end. When the hand lever is depressed, the wedge enters between the two plates to grip the rope. The clip can be detached automatically from the rope by fixing a trite bar to the sleeper which raises the hand lever to release the rope.

## Lashing chain-

It consists of a chain 2.5 to 3.0 meter long with a hook at each end. One hook is attached to the tub & other end of the chain is coiled 3 to 4 times around the rope & the hook is linked to the chain. On undulating roads chain should be used at both the ends. Generally in this case a set of tubs is attached with the rope at a time.



2. **Goose neck clip-**It consist of an 'S' shaped hook loosely into the holders mounted on the end of the tub as shown. When the rope is placed in position in the hook at either end or at both end of the tub, the hook turns through about 30° & grips the rope. The grip on the rope is proportional to the tension in the rope. But this grip bends the rope which reduces the rope's life.



### 3. Cam clip

It consist of a plate having its one edge bent over to form a groove into which the rope is pressed a gripped by a lever which is pivoted & other end of the lever is connected to the tub to a chain. The pull on the chain turns the lever to grip the rope. The grip on the rope is proportional to the load.

