

5.5 AERIAL TRANSPORTING EQUIPMENT

In hoisting equipment, use of arresting gears or brakes is of paramount importance to prevent the raised load from getting lowered of its own weight, when the raising effort is withdrawn. Arresting gear is used to hold the load lifted by winches.

The common arresting gears are

(a) Pawl and ratchet mechanism i.e. ratchet gearing. This comprises of ratchet wheel and a pawl. The ratchet teeth can be arranged external or internal to the wheel. The teeth are so designed that the ratchet wheel runs free over the pawl when the load is being raised, but the pawl gets engaged with ratchet tooth when the ratchet wheel tries to rotate in opposite direction (lowering direction of load). During lowering of load, the pawl has to be kept deliberately away from ratchet path.

(b) Roller ratchet or roller clutch is used as an arresting gear in combination with a brake. Brakes are used for dual purpose of holding the suspended load at rest and for controlling the speed of lowering of load. Some of these brakes are to be operated while some are automatic. Operated brakes include shoe, band, cone, disk brakes etc. Centrifugal brakes and brakes applied by weight of the load are the automatic types. Actuation of the operated brakes may be through pulling a handle or by pressing a pedal which are termed as mechanical brakes.

Actuation can be through energizing magnet by AC or DC electricity (electromagnetic brakes) or may be by hydraulic means (electro-hydraulic thruster brakes). The electromagnetic brakes and electrohydraulic thruster brakes can be used as controlled brakes.

Moreover, these brakes can also be used as fail safe device. Normally these are in open condition (brake is not engaged), but actuates when the power fails. Fig. shows line diagrams of an electromagnetic brake and a thruster brake.

Load Handling Attachments The common attachments used with various hoisting equipment are

- (A) hooks,
- (B) grabs of different types,
- (C) grab buckets for bulk load,
- (D) ladles for liquid materials,
- (E) electro magnets etc.

These different attachments are discussed below:

(A) Hooks: The common method of lifting unit load by hoisting equipment is to sling the load by chain or rope and suspended it from the hook of the hoisting equipment. To facilitate handling of loads by hook, many manufactured goods or packages are provided with hooking facilities (rings, bails, holes etc. through which a hook may be readily introduced).

After forging and machining operations, the hooks are annealed. The inner diameter of the hook should be sufficient to accommodate two strands of chain or wire rope. The load is always carried by four elements sling with two loops. The body of the hook is generally of trapezoidal section while it ends at the top in a round section working under tension.

The top part of the shank is threaded for suspension from a crosspiece. Hooks are mandatorily to be tested under testing load and got certified before use. Some of the common types of hooks are as follows:

- o Standard hooks are the most commonly used hooks which have a single curved horn
- o Ramshorn hooks have two horns like that of a ram.

Saddles of each horn is smaller than the saddle of a standard hook of same capacity.

- o Solid triangular eye hooks are used in cranes of capacity over 100 tons. The disadvantage of these hooks is that the sling rope must be passed through the eye first, before they are attached to the load.
- o Hinged triangular hooks are made up of a few components, and are much simpler to produce.

Fig. Standard, ramshorn and hinged triangular hooks Suspension of hooks

The cylindrical shank portion is generally fitted to a crosspiece provided with machined turnions at the ends.

If the hook is fitted with a thrust bearing resting on crosspiece top, the hook may be rotated freely even with load. The crosspiece is pivoted in the side plates of casings usually reinforced with straps or shackles made of plate steel. Two or more rope pulleys/sheaves may be mounted on the extended turnions of the crosspiece or multiple pulleys may be fitted in the casings. Fig. 8.1.10 shows a few of the many different arrangements of suspending hooks with crosspieces and casings with sheaves. Fig.

Different arrangements of suspending hooks with crosspieces and casings with sheaves. Grabs: For quick suspension and release of typical types of loads, certain specific grabs are used. The special performance requirements of these grabs are:

- (i) conformation to the shape and properties of the load.
- (ii) quick grabbing and releasing.
- (iii) adequate strength and reliability.
- (iv) safety to men and loads.
- (v) convenience of use.
- (vi) low weight.

Some of the common grabs in use are briefed below:

(a) Carrier beams are employed to lift long and heavy loads. Fig. shows a carrier beam with adjustable shackles from which the loads are suspended. Carrier beam with adjustable shackles for a foundry crane

(b) Crane grabs and clamps of different styles are used for handling different types of load.

(i) carrier type grabs are used for carrying short or long shafts.
(ii) Clamps are used to grip sheet or plate type loads. Following Fig. exhibits a few types of grabs and clamps

(c) self closing tongs are used for automatic grabbing of different shapes.

The tongs are made self closing to avoid manual intervention during grabbing. Fig. shows a few self closing tongs.

(B) Grabbing attachments are used for lifting loose/bulk materials by means of a crane and transferring them. There are basically two types of these grabbing attachments for loose materials:

(a) Tubs: These are box type structures made from steel sheets. The tubs are provided with doors at the bottom or sides which can be opened by pulling a rope from the crane for automatic dumping of the contents inside the tub.

However, these tubs have to be filled up manually or by using some other materials handling equipment. The tubs are provided with bails for suspending them from a crane hook.

(b) Grab buckets: These are specially designed bucket attachments which scoop loose materials and dump them mechanically through manipulation of ropes from the crane. Grab buckets are used for handling large amount of loose materials through cranes.

The bucket essentially consists of two clam shell like scoops with rounded bottoms which are hung by four rods from a top cross-member. The inner ends of the scoops are also hung from another movable cross-member. All the joints are provided with pins for pivot action.

The top and bottom crossmembers are suspended through ropes from a crane. The principle of operation of a double-rope grab bucket is shown in Fig.. When the rope S1 for bottom cross-member is loose, the grab buckets open up due to its own weight.

At this position the bucket is lowered until the two scoops gets into the material. The rope S1 is then tightened when the lower cross-member moves up and closes the scoops with material inside.

In this closed condition the grab bucket is transferred, and at desired point, the rope S1 is again loosened when the buckets open on its own and scooped materials' weight and discharges the materials. There are many designs of

clamshell buckets where number of ropes may be 1, 2 or 4, or scoops are operated by special mechanisms. Fig. also shows an asymmetric grab bucket design which are simple in design and close the scoop edges well.

