HOISTS AND WINCHES

1. Hoists Definition, Characteristics and Uses

Hoist is an apparatus for raising or lowering a load suspended from a hook on the end of a chain or wire rope. A hoist may be fixed i.e., stationary, base mounted or supported from overhead by a clevis or hook. It may be travelling type mounted on a track (Fig. 1). Hoists are rugged, dependable, simple to operate and inexpensive. Their installation is easy. Operation of a hoist can be by hand through pulling of chain, compressed air or electricity (operated by pendant switch box).

Hoists are truly the basic hoisting equipment. These are extensively used in manufacturing industry, workshop, godown, truck terminal, construction & erection site and even in small garage for handling relatively light loads.

These are used for loading and unloading of varying jobs from machines, transfer of loads between work places. Hoists supplement overhead travelling cranes, when put on a monorail.

Limitations of hoists are that they are used for relatively lighter loads (2 to 3 tonnes), they are relatively slow, have limited travel distance and fixed direction determined by the track.

(a) (b)

Fig. 1. (*a*) Fixed hoist, (*b*) travelling electric hoist

Go to the outline

2. Constructional Features of the Hoists

Hand operated Hoists: A hand operated hoist essentially consists of a large diameter welded chain sprocket which is rotated by pulling of an endless chain. The sprocket is connected to another smaller chain sprocket through a system of gearing with large speed reduction. The gearing may be planetary spur gear system or may be

worm-worm wheel arrangement. For this gearing system, the torque applied at the input sprocket is multiplied at the output sprocket, and a heavy load may be lifted with comparatively lighter pull at the input chain. When a worm-worm wheel is used, the gearing system is self locking, but in spur gearing system an arresting arrangement (generally ratchet-pawl) is provided to avoid descend of the load by its own weight. The entire sprocket and gearing system is enclosed in a frame.

In case of a travelling hoist, the main hoist frame is fixed to the bottom of a 4 wheeled trolley frame. The wheels are supported on the track. The bottom flanges of an I-beam is the most commonly used track. Pair of wheels on one side are provided with two spur gears which are connected by a smaller gear in the middle. On the shaft of this small gear is fitted a chain sprocket. On rotating this sprocket by pulling of an endless chain, the trolley moves on its track, and carries the load to the desired point.

Fig. 2 shows the constructional features of a typical hand operated worm-geared trolley hoist.

In smaller capacity hoists, the trolley may be moved by simply pulling it by a chain. These are termed as hand pushed trolley hoist.

Electric hoists: An electric motor driven hoist has one or two rope drums for coiling and uncoiling the hoisting wire rope. The hoisting motor drives the drum through a planetary gearing system. The gearing system with high reduction ratio serves dual purpose of increasing torque as well as reducing speed of hoisting. 2-speed motors may be used for obtaining two hoisting speeds. The lower speed is employed at the start of hoisting or at the finishing stage of lowering the load, to avoid heavy jerk on the rope and pulley system or impact of the load with the floor. The rope is connected with a hook. The trolley for travelling hoist may also be powered by another motor. Motion from the motor is generally transmitted to the wheel through three pairs of spur gears. The motors of an overhead electric hoist is controlled by a pendant switch box hanging from the hoist frame at a convenient height for operation from floor level.

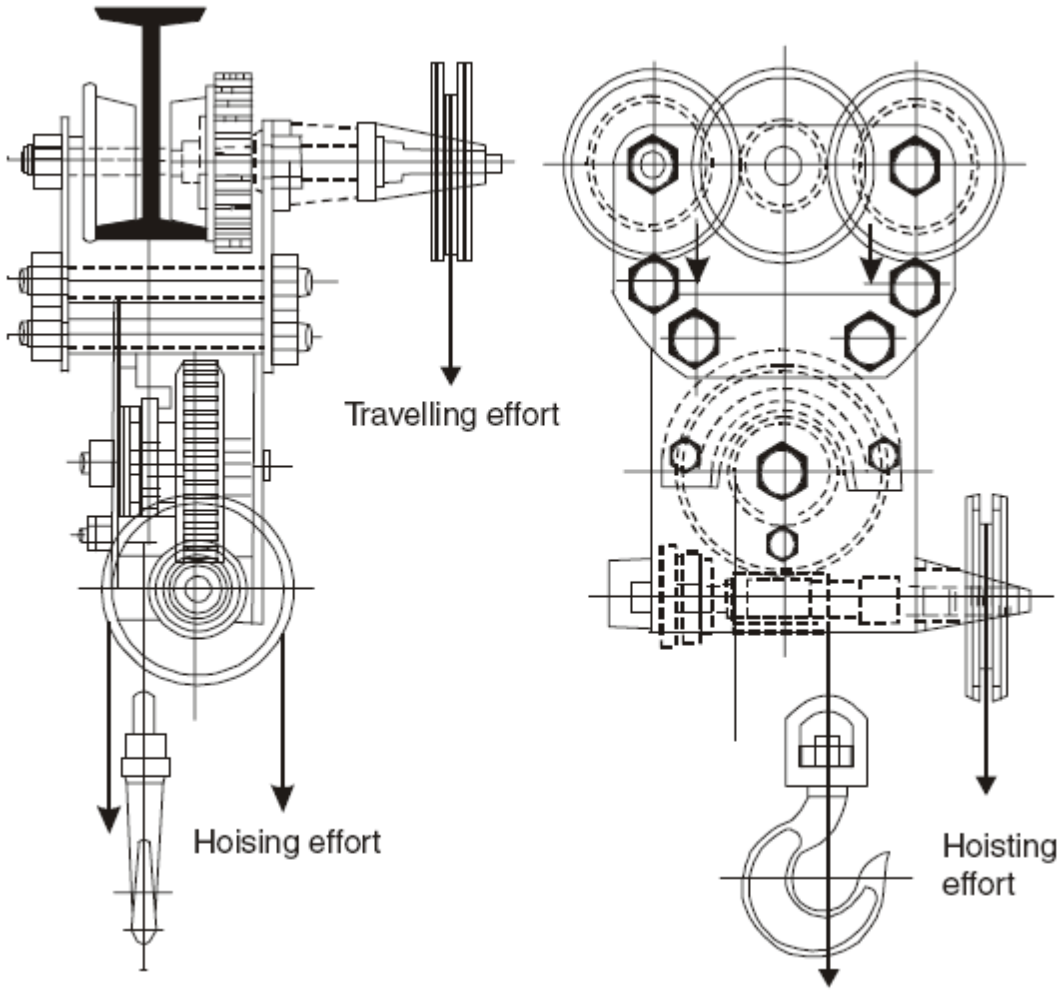

Fig. 2. Constructional features of a typical hand operated worm-geared trolley hoist

Go to the outline

3. Hoists Specifications

Irrespective of its type (hand or electric or pneumatic), the most important specification of a hoist is its maximum load hoisting capacity. The next important specification is maximum operational lift or height. For travelling hoist, the important specifications are the size of I-beam track and the minimum radius of curvature through which the trolley can be maneuvered. For electric hoist, the hoisting speed/s and travelling speed are two important specifications. Overall size of the hoist, chain or wire rope size etc. are the other specifications an user will be interested in.

Hoist manufacturers manufacture different types of hoists in different standard capacities and lifts and all the relevant specifications are indicated in their product catalogues.

Go to the outline

4. Winches Definition, Uses and Constructional Features

Winch is an equipment for pulling a heavy load by winding one or two ropes on a rope drum. It is a stationary equipment which is fixed to the floor or wall.

Winches, like hoists, are rugged and simple equipment with minimum maintenance. Winch may be hand operated or motor powered. Winches are used as an independent pulling equipment at construction sites. However, they are also used as an integral part of various other equipment like skip hoist, certain types of cranes etc.

The main component of a winch is the rope drum, supported by bearings at two ends mounted on the winch frame. The frame may be made of cast iron or fabricated from steel plate. The rope drum is generally single and plain, where rope is wound in multiple layers. In sophisticated application as in a carne, the drum is grooved in two halves (double drum) for winding two ropes simultaneously. Suitable mechanism is provided for guiding the rope for proper laying on grooves during winding. The drum is connected to input effort through a series of gearing of suitable reduction ratio, which determines the ultimate pull in the rope corresponding to the torque applied at the input. In hand operated winch, the torque is applied by a handle of suitable arm length. A ratchet-pawl type arrestor mechanism is an essential feature for a winch. The arrestor ensures no unwinding of the drum when the input effort is withdrawn. In power-operated winch, a motor of suitable power-torque capacity is connected to the gear train through a coupling. In an electrically driven winch, a magnetic or thrustor brake is used inplace of pawl-ratchet mechanism for parking as well as controlling load lowering. The coupling between the motor and drive system is used as a brake drum on which the brake is applied. Such couplings are called **brake-drum coupling**.

Multiple -drum winches: when a winch is an integral part of a crane or derrick, a multiple-drum winch may be used. The number of drums is determined by the number of independent operations used in the crane or derrick. One drum is required to handle the main load. Another drum may be added when the main load is double-reeved and two drums lift the load simultaneously by winding two ends of the wire rope. Another drum is used where a crane or derrick boom needs to be raised or lowered. Line diagram of a typical double-drum hand operated winch is shown in Fig. 3.

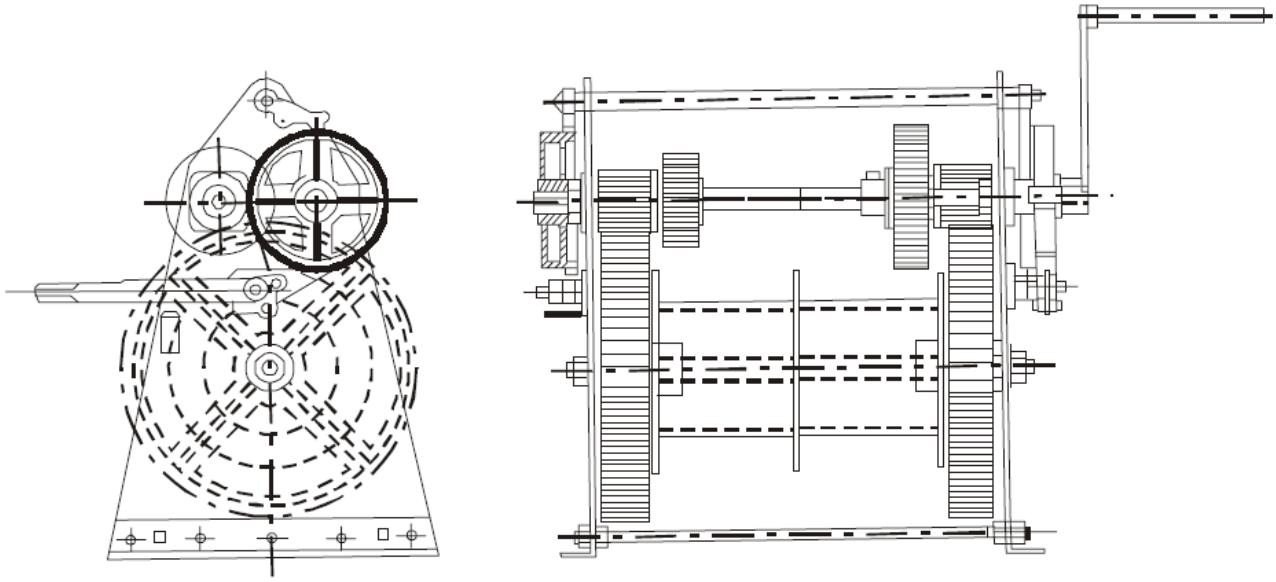

Fig. 3. Double-drum hand operated winch

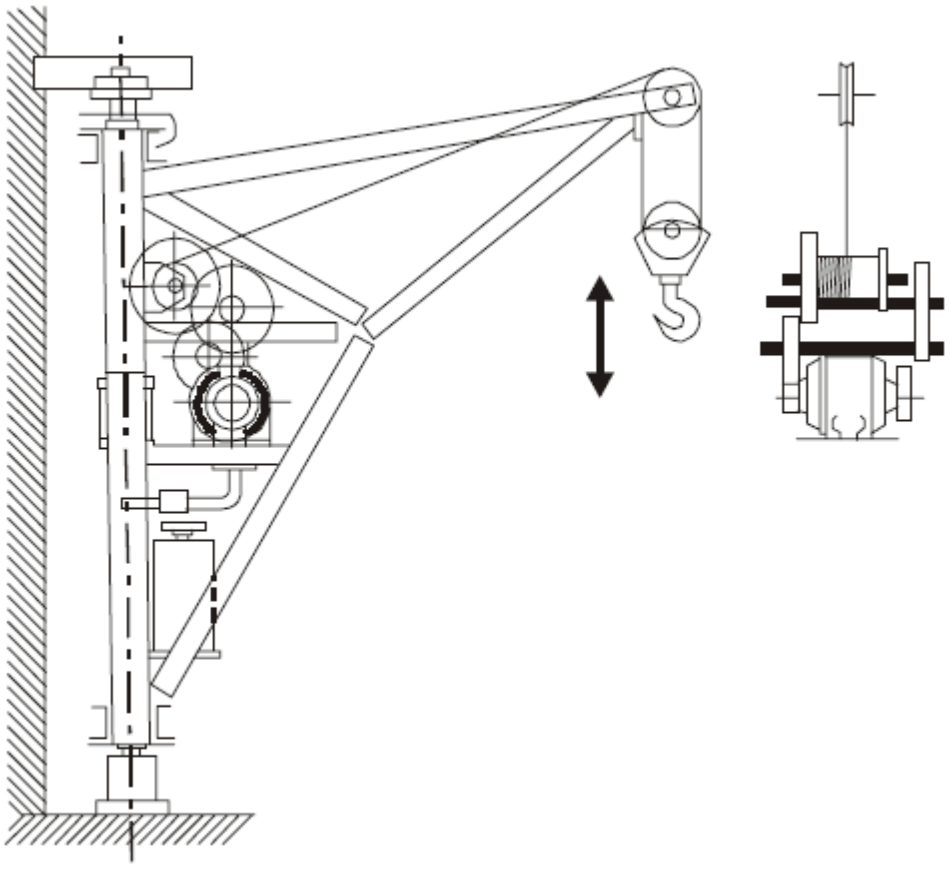

Fig. 4. Use of a winch in a stationary rotary pillar crane

Fig. 4 shows the use of a winch in a stationary rotary pillar crane. Major specifications of a winch are: pulling capacity, length of rope, rope speed (for motorised winch) and number of drum used (single or double drum). The other specifications include overall dimensions, rope size, drum size, motor power etc.

Go to the outline