

“A REVIEW ON APPLICATION OF HOIST FOR DOMESTIC PURPOSE”

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1. ABSTRACT

Conservation of energy and improvement of efficiency has always been the major area of concern for the mechanical engineering. Domestic hoist is the device used to minimize the human efforts of lifting load. The load is lifted by means of hoist. People who can't afford expensive equipments such as industrial hoist, pneumatic hoist, hydraulic hoists, the domestic hoist is the best option for them to minimize the efforts required and time consumption. The domestic hoist is cheaper in comparison to industrial hoist. The literature survey of all those papers is given below.

2. INTRODUCTION

A hoist is simply a machine which is used for the lifting and lowering of heavy loads. In most applications, the hoist is usually suspended overhead by means of a hook, lug, or trolley. A hook or lug can be used to permanently mount a hoist in one location, or affix it to a trolley. A trolley is a vehicle which travels on an overhead rail or beam, normally used to move the hoist and its load from place to place. Hoists and trolleys can be powered by hand, electricity, or air and are available in various shapes and configurations. The lifting means to suspend and move the load up or down in a hoist are normally link chain (coil chain), roller chain (similar to bicycle chain), or wire rope, but other materials such as high strength fabric, can be used in specialized applications.

A hand hoist, being a force multiplier, gives you the ability to lift very large loads (up to 5 ton) with ease by using mechanical advantage. Most hand hoists are used for infrequent maintenance applications where speed is not a requirement. They are considerably less expensive than powered hoists, but they require physical effort (operated by the hand-wheels) to lift the load. They are not fast and should not be specified for continuous lifting applications, especially when long lifts are required.

Many domestic hoist offers overload protection for hand operated, either as standard equipment, or as an added cost option. In industry, manually operated hoist such as hand chain hoists are most often used as an in-plant tool for periodic maintenance applications. A typical use might be for lifting pumps, generators, or other heavy equipment in water treatment facilities.

3. DESCRIPTION OF THE HOIST

The components used in hoist are described below:

3.1 Shafts

Shafts are used to mount the main components of hoist such as gears, rope drum, pulley, etc.



3.2 Gears

Gear drive is used for speed reduction and better distribution of efforts being applied.



3.3 Wire Rope

Wire rope is used as a load lifting medium.



3.4 Rope Drum

Rope drum is used to wind or unwind the wire rope according to ascending or descending of the load being lifted.



3.5 Hand Lever

It is used to apply initial torque to the gear drive so as to operate the hoist.



3.6 Pulley

Pulley provides the smooth motion of wire rope over it, sustaining the load.



3.7 Ball Bearings

Bearings are used between the shafts and couplings which provide smooth rotational motion to the shafts.



4. PROCESS INVOLVED IN FABRICATION

1. Cutting
2. Turning
3. Threading
4. Arc Welding

4.1 Cutting

Cutting is performed on the lathe machine. When total stress developed by the cutting implement exceeds the ultimate strength of the material, material gets cut. The stress generated by a cutting implement is directly proportional to the force with which it is applied, and inversely proportional to the area of contact.

4.2 Turning

Turning is a machining process in which a cutting tool, typically a non-rotatory tool bit, describes a helix toolpath by moving more or less linearly while the work piece rotates.

4.3 Threading

Threading is the process of creating a screw thread. Single point threading is an operation that uses a single point tool to produce thread form on a cylinder or cone. The tool moves linearly while the precise rotation of the work-piece determines the lead of the thread.

4.4 Arc Welding

Arc welding uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is sometimes protected by some type of inert or semi-inert gas, known as a shielding gas, and/or an evaporating filler material. The process of arc welding is widely used because of its low capital and running costs

5. APPLICATIONS

1. Lifting and lowering loads from floor to floor.
2. The hoists find their applications on cranes, forklifts.
3. Maintenance of high rise buildings.

6. LITERATURE SURVEY

Reshma Kharche explains that wire rope hoists are simpler to use than hydraulic hoists, because there is no air in system to worry about, no checking of fluid level, no leakage, filtration or contamination problems. On the basis of total deformation, equivalent stress, shear stress, maximum shear stress, maximum principle stress, optimized mass, analysis done using two materials. These materials are Alloy Steel and Cast Iron. From the comparison of analysis results of two materials, Alloy Steel proved better at working condition with optimized weight. [1]

M. Barakat explains that two damage quantification methods were used for study of failure of wire rope: the method of calculation of static damage and the method of calculation by unified theory. Comparisons of results have shown good agreement, that wire rope may be failed in three stages due to tensile stress. Wire rope can be used even after breakage of 1-2 strands, but its life becomes limited. Hence it should be replaced before the risk of failure. [2]

Pooran Singh Dhakar concluded that the body of the hook to be used in hoist should be of triangular or trapezoidal cross section for better strength. Ball bearing should be used to prevent spinning action of load relative to wire rope. Generally, there is one rope drum, motor and gearbox used in hoisting mechanism. It means that only single drive mechanism is used for lifting purpose & displacement of over objects. [3]

Digvijay D. Patil states that All theories of failure should be understood so as to calculate stresses induced in Rope Drum and Drum Shaft. The loadings acting on rope drum induce the stresses in the shaft. This effect is studied in order to make a safe structural design of this assembly. [4]

Shyam Lal Sharma researched that to distribute the stresses induced in the rope, more no. of ropes can be used, but more no. of ropes can lead in increase in the diameter of the Rope Drum. Hence we can double the winding keeping Rope Drum diameter the same. Using more no. of rope falls divide the load and make the tension less. Also it makes the work faster. [5]

Anupam Patel studied that the hand-wheel should be designed in such a way that the initial torque required to lift the load should be provided by the operator without reverse impact. For this body weight can be used as the medium for necessary initial torque. In addition, by laws of physics, torque produced by a force is increased with a greater moment arm. [6]

Smt. Rosy Dawn explains that Gear Blank of the gear can be of 'Arm Type' instead of 'Solid Type' to reduce the weight of Gear. Facility for easy application of lubrication should be provided for regular lubrication. The allowable stress should be taken as 50 percent of the ultimate tensile strength of material used for the manufacture of the gear for the normal operating condition. [7]

S. N. Tripathy studied that during fabrication process, considering all conditions, bolting instead of welding wherever possible can be used, so that hoist can be dismantled easily for easy transportation. The rope drum should have provision for guiding the wire rope while lifting and putting down the load. [8]

Sam Hutcheson described that while building project one major concern was matching the bolt holes on the upright and the beam. Even though the holes were drilled through the plates and the beam at the same time, and tacked together, the finish welding was done while the upright was off the beam, causing the gusset to move. This made matching up the bolt holes hard to do and required some manipulating of the upright with a pry bar to line up the holes. Drilling slightly oversized holes would make the assembly process easier and give the pattern some room to adjust. A good way to prevent this would be tack welding a piece between the plates, fully welding them, bolting it to the beam, and then knocking the piece out. [9]

7. CONCLUSION

Various component of hoist mechanism has been made so proportional as to take the worst load coming on individual component. Here gear pair being used is spur type. Since the hoist is hand powered, there is no need of helical type gear pair which is used for high speed operations. Worm gear could be used but due to excess generation of heat additional cooling is required which increases the cost of running and hampers the portability. Also spur gears can work faster than worm gears. Due to slow speed operation heat generation is low, hence ball bearings are used. Standard wire rope of dimensions 6x19 is being used since around 1.5KN load is to be lifted easily by wire rope.

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