International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 04 Issue: 04 | April -2020 ISSN: 2582-3930

Design and Fabrication of Lorry Unloading System

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Abstract: The main aim of this paper is to study of unloading system and their various components and find effects on various parameters. As we found for unloading the cement, grain bags, humans have been used which is a slow process of unloading of the bags. Due to which ideal time of trucks increases. So to fulfil requirement we have to make such system which will eventually reduce the ideal time of lorry and faster unloading takes place rather than traditional unloading in which human workers are used or waiting for workers which requires a lot of time. And, finally we are going to design the system which can easily unload heavy bags. In this system an overall design of the lorry unloading mechanism has been carried out. The dimensions of the main components have been determined for a load capacity of 50kg (490.33 N) having rope fall. Various dimensions for cross section of various shapes for unloading have been found. In this project we tried our best to design, fabricate and to make working model of lorry unloading system.

Keyword: I-Section, actuator, wire rope, dc geared motor, battery.

INTRODUCTION

Components of our system are I- section, actuator, wire rope, drum, battery, clamping device, remote this all parameter are to make an successful system. Cranes are used for different purpose depending upon application purpose.
Mostly unloading systems are used in industries to unloading heavy loaded objects and components. Such system take more space and required more cost depending upon an application purpose. Mini cranes are used in trucks like hydraulic and pneumatic cranes it also takes more place and higher rate of cost consideration. Mini crane is used to unloading and loading heavy object from one place to another with some suitable attachment.
Jib crane also takes place in consideration that the main purpose of such crane is to carry an heavy loaded object and it will delivered that object to particular position it's play an very important role in industries to carry out lot of bags from one place to another. There are various types of cranes which are get used as per application purpose. This type of system can carry weight up to 1000-1200 kg.
Cranes are also used for unloading purpose but it work at some altitude in such case it carry an object from an lock out point and take it and unload it too suitable medium such as Marine drive spot. In such case this kind of cranes are used to carry out an heavy load itself. But in such system separate well specified operator is required and such operator must have license to operate such system.
As per our study we conclude there are no such system which is easily capable to carry out with lorries and take less space as compare to other system. If we have to unload lorry which fulfil of bags such case traditional method is used to unloading purpose and it takes more time to carry out such bags and same process required in warehouse application. There were always take placed used of workers for such unloading purpose which cause back pain, fatigue etc.
To overcome such problem we will designed that system which will applicable to lorries for unloading bags. This system will be flexible and can be used to any lorries it will be easy ti clamp in lorry and easy to remove after work done. Driver can also unload bags without looking for an workers to unload bags and it is capable to carry out such system itself. Driver can also unload lorry with help of remote within less time.

LITERATURE REVIEW

This literature review about the lorry unloading system and the most of the work has been conducted using knowledge based system to select the most appropriate system for unloading bags.
As we take a survey we found that in big plant 40% cranes are used for heavy loaded unloading purpose and the system having very high capacity.

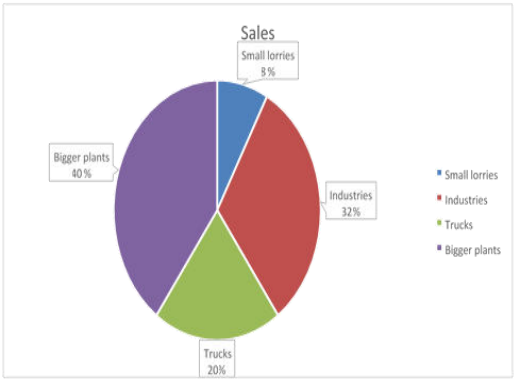

Figure 01: Space Occupy By System

As per our survey we also recognised that in industries on unloading purpose small unloading systems are used and the overall percentages is 32.
Small mini crane for lifting purpose or to move the heavy loaded parts from one place to other this system used which having overall 20%
As per our survey we found that in small lorry any kind of system is not considerable for unloading purpose labours are used for unloading heavy bags so we focus in this field and try to design such system which can fulfil requirement.
As we know that traditional system has been getting used since long period of time just take an example of lorry. If lorry is fully of bag such as grain and cement bags as it came to it final position as desired location and in such case we are going looking for workers for unloading bags. But, workers not get find easily it takes time due to which ideal time of lorry get increases and number of trip done by lorry get decreases. To fulfil such requirement we will design such system that will reduce ideal time of lorry and fastly unload bags.

Methodology

As per our study we see that number of systems are used for unloading purpose depending upon its application and we found that no such system is designed for lorries to unload bags in such case traditional method has been used for unloading purpose to overcome such problem. Therefore we take an study in following parameter.
Problem identification: As we found that whenever there is an unloading takes place of heavy loaded bags number of workers are used for unloading purpose and cost per person is high and after some period of time worker felt fatigue and they need to rest. Due to this ideal time also gets increases to reduce this ideal time we design a lorry unloading mechanism.
Survey: As per our survey conducted we found that workers are used for unloading purpose, we have decided to design and fabricate a machine especially for heavy loaded bags
Testing: Testing shall be compliance. Additional technical principles and specifications for mobility and for load lifting.

Components of system

Sr No	Name of component	Quantity
1	I-section	1
2	Dc gear motor	2
3	Worm gear	1
4	Actuator	1
5	Chain	1
6	DPDT Remote box	1
7	Battery	1

I-SECTION

The system consisting of an I- section which having an length of 8 meters long 6mm (Flange and web thickness). The overall weight of it 49 kg.
There are various types of section but we only select I-section, because it distribute the load

overall cross-section and causes minimum bending moment.
As per our study we found that lorry carries this section unto 6 m and another lag on that corner so we decided that lagging part must be getted cut and to joint such two parts clamping device is used to join such parts. Due to which another parts can be getted easily fold.

$$S = \frac{Mmax}{\sigma max} = \frac{I}{C}$$

Where I is the moment of inertia of the beam cross-section and c is the distance of the top of the beam from the neutral axis.

High torque dc motor

High torque dc motor will used in such system. Motor has 100 rpm and it consisting an gear mechanism due to which rpm reduced and high torque occurred. System will consisting an two motor one for lifting purpose and another for sliding purpose. Dc work on 12V so it can be easily apply to lorry. Motor is connected to worm and spur gear arrangement as motor get rotate it will rotate that worm gear and rope drum also get rotate and it will pull that bag.
For sliding mechanism same motor is used chain is connected to rotate an sliding mechanism that one end of sprocket is connected with chain and another with sliding mechanism as motor get operated it will operate overall assembly.
Specification:
Dc motor is an electronic device, it works on 12V having 100 rpm and gives high torque which is capable to lift an load up to 50 kg.
It having an weight up to 700gm, 10 cm width and 10 cm height.

Worm Gear

Worm gear plays an important role in lorry unloading system its main purpose is to reduce the rpm an increase torque of the system. One end of the motor is connected to the spur gear and it will rotate an worm gear another end of the gear is connected to drum mechanism that will help to lift bags from lorry and unloading it.

There will be an angle of 90 degree between such attachments in such proper attachment of gear system will high torque ratio.
Calculation for initial design torque;

$[M_t] = M_t . K. K_d$

Where, torque

[Mt] = transmission

K = Load factor,

Kd = Dynamic load factor

Assume K. Kd =1.3 (if not given)

Actuator

The function of actuator is to provide thrust and positioning in machine used for give linear motion. It is a one type of electromagnetic actuator which converts the torque of an electric rotary motor into linear mechanical thrust. We are using the actuator having weight of 1.5 kg operating at 12v, maximum capacity is 500N to lift 50kg load and having stroke length of 100mm.

Wire rope

This system consisting and steel wire rope having diameter of 6mm which is capable to lift an load up to 200kg without any breaking condition. In unloading system steel wire play an important role to lift an weight up to 50kg. One end of the rope is connected to the drum and another one to clamping mechanism as drum is connected
Gear mechanism it will also rotates an drum and wire will get wound in that particular drum.
This wire rope is designed such a way that it three small piece of steel wire is used to makes an one strong wire as per it designed it can carry heavy load without braking and sustained for long period of time.

DPDT Remote Box

We will used an DPDT remote box it consisting an three button and each button has different key function such as forward and backward, lifting and lowering, clamping and unloading it has an separate battery wire and operate in one directional way it is easy to use and simple to operate.

Battery

A battery is a device consisting of one or more electrochemical cells with external connections provided to power electrical devices such as flashlights, smartphones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the energy difference is delivered to the external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to include devices composed of a single cell.Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to small, thin cells used in smartphones, to large lead acid batteries or lithium-ion batteries in vehicles, and at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone exchanges and computer data centres.

Analysis

We take analysis on some part of system and we found that components is able to perform work in suitable manner. We applied various force on component, but we found that it is capable to sustain at that force.

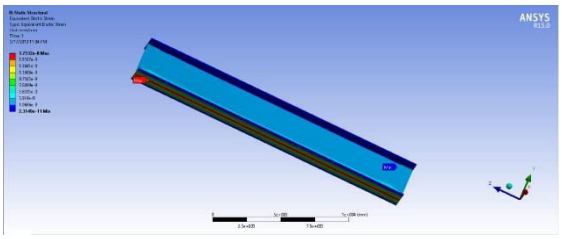

Fig: 02 Analysis of I-section

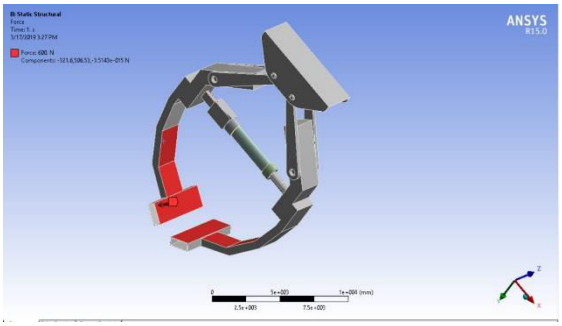

Fig: 03 Analysis of Clamping Device

Material Selection

Selection of material for lorry unloading system was done according to design conditions. Also material should be capable to withstand stresses act during operating. Material is selected according to manufacturer's recommendation for the design of I – section for the structure of unloading system.

Safety Procedure

Safety parameter plays an very important role in an lorry unloading system such that if a system capable to lift an load up to 50 kg so in such case we should not allow to carry an load greater that capacity of system. Various components used in such kind of system must attached properly and should take care if any kind of failure occurs in system in such case no physical damage takes plays with human being. So as per our design factor of safety plays an very important role that overall system mounted on section should be capable to carry system load and other weight came on it

Advantages

The main purpose of lorry unloading system is to reduce the ideal time of lorry or any other

vehicles which had been used for unloading purpose

To involve only one person (Especially Driver) to unload the vehicle, hence as lorry came driver can easily unload the bags.

It also reduced the human effort and fatigue caused during lifting of cement bag, etc.

Number of workers required to unload the bags and the cost required per person get reduced.

Conclusion

As per our survey we found that in small lorry, retail shops does not have such facilities. For unloading purpose human workers are used for unloading cement, grain bags like material. At such places there is unavailability of workers to unload the vehicle. Hence, the ideal time of the vehicle and driver is increased which causes the decrease in productivity of the vehicle.

So, focusing on retail shops and small lorries where productivity of the vehicle is considerably low due to lack of manpower. Therefore, we have targeted this particular problem to be resolved and optimum solution that can be operated by driver only is taken into consideration.

Result

The proposed system will be flexible for small vehicles which are used to transport the bags from warehouse to retail shops such vehicle includes TATA 407, TATA 307, Pick-up vans, etc. There will be no need of extra labour to unload the vehicle. The driver itself will be capable of operating the proposed lorry unloading system

As per our study that traditional system has been used for an unloading purpose so we take an comparison between traditional system conclude and total time taken by lorry system.

Sr No	Type of vehicle	Capa-city	Time taken by worker(mm)	Time taken by lorry system(mm)	Difference(mm)
1	TATA 407	120	176	120	56
2	TATA 307	80	125	85	40
3	Pick up vehicle	70	90	54	36
4	Mahindra Jeeto	110	163	117	46
5	Mahindra Bolero	140	186	127	59

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