

Gravity Powered Material Handling Trolley using Conveyor System

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Abstract: *Material handling equipment is the media of transportation of material from one location to another in a commercial space. Weight operated material handling equipment has huge load carrying capacity, large covering area simplified design, easy maintenance and high reliability of operation. This paper is mainly based on for material handling, it not required external power i.e., electricity. On account of this, a machine and its physical description is covered here. Applications of material handling trolley are increasing day by day in manufacturing industries due to its flexibility and accuracy in working. Industries like packaging and food processing, manufacturing production workshops uses material handling trolley for the rapid production and less power utilization. The main objective was to build a vehicle of capable of transporting weight of a materials up to 10 kg of travelling to some distance with varying speed.*

Keywords: Structural Strength, Material Handling Systems, Rack & Pinion motion, Spring operated, Self-powered and Easy Maintenance, Less Cost

I. INTRODUCTION

Basically material handling equipment is used to the picking an object from one location and travel to it and place at another location without much power of man wasting. Material handling equipment is generally separated into four main categories: storage and handling equipment, engineered systems, industrial trucks, and bulk handling. According to industrial review the power which has been utilized for production out of which 32 to 35% of power is only utilized for material handling during the production which is unnecessarily wasted and hence the total cost of final product will increases. So if we want to decrease the total cost as well as the unnecessary power consumption either we have to reduce material handling or try for alternative handling. This paper discusses the research carried out on material handling system design, MH equipment selection, Analysis and simulation form last decades to get the best solution for implementing the design of MH system in the existing facilities.

II. METHODOLOGY

Step 1:-Identification of Problem: Most of the industries facing the problem of electricity, cost, manpower, & time in material handling system. Some of the conventional equipments require excess manpower to operate them e.g. hand trolleys, etc. While some highly automated system require excess electricity as well as more cost. In order to solve the problems of future energy crisis and to increase the profit of the company(reducing the cost of material; handling), our aim is to provide the low cost automation equipment to solve these problems.

Step 2: Design of Mechanical Part: This phase involves the design of various elements such as spring, shaft and Rack & Pinion gear.

Step 3:-Software Modelling: Detailed drawing using AUTO-CAD Software, CREO. Designed part is drawing using AUTO-CAD.

Step 4:-Fabrication: All the designed elements are manufactured in the workshop such as frame, shaft, as per design and also select the part as specification for e.g. Rack & Pinion, support rod, chain and sprocket etc. Upper frame and lower frame, are manufactured in workshop.

Step 5:- Assembly: All the manufactured and selected parts are assembled together.

Step 6:-Testing and trial & error devolvement of project model.

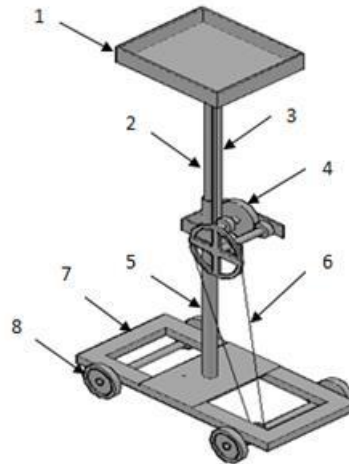


Figure 1: CAD Drawing of Device

III. LITERATURE REVIEW

3.1. The Current State and Future Trends in the use of Pallets in Distribution Systems by Javad Mokhlesi Saman Lohrasebi (University of Boras School of Engineeringse-50190borastelephone +46 033 435 4640)

The main idea behind developing such a research is to demonstrate the situation of pallet utilization in industries and related affecting factors. Pallet plays a very important role in Logistics chains or Distribution systems. Regardless of the application purposes of pallets there are a lot of other factors in pallet usage that draw a great attention for the users and also producers of pallet. These factors can be considered from so many different aspects. Pallet is a part of a cargo carrier concept. This concept is broadly taken into account since individual transportation and handling of materials is costly. It can also reduce the speed of handling process to a very low level. It also decreases the efficiency of the desired logistics chain (Stjernman & Torstensson, 2006)

3.2. Gear (terminology of spur gear) by S. Mahendran, K.M. Eazhil, L.Senthil Kumar51(2): 55-62.

Gears are machine elements used to transmit rotary motion between two shafts, normally with a constant ratio. The pinion is the smallest gear and the larger is called the gear wheel.

The gear stress analysis, the transmission errors, and the prediction of gear dynamic loads, gear noise, and the optimal design for gear sets are always major concern in gear design. The polymer gear wear rate will be increased, when the load reaches a critical value for a specific geometry. The gear surface will wear with a low specific wear rate if the gear is loaded below the critical one. The possible reason of the sudden increase in wear rate is due to the gear operating temperature reaching the material melting point under the critical load condition.

IV. CONSTRUCTION

4.1. Following is the list of components:

1. Trolley
2. Inner pipe
3. Rack
4. Compound gear train
5. Outer pipe with Spring
6. Chain drive
7. Base frame
8. Wheel

4.2. Manufacturing & Assembly Procedure

- i) First Spring is manufactured as per the designed load.
- ii) Inner and outer pipes are bought as per the spring size.
- iii) Base frame is manufactured by welding square channels.
- iv) Wheels are attached to that frame by means of shaft and pedestal bearings.
- v) Outer pipe is bolted to the base frame and spring is inserted in it from bottom of the frame.
- vi) Compound gear train and chain sprocket are attached to the top portion of the outer pipe.
- vii) Rack is attached to the inner pipe and pipe is mounted on spring.
- viii) Finally trolley is manufactured and mounted on the inner pipe.

V. WORKING

When we put the weight in terms of jobs and machined components on tray at loading point, it acts as a working load for the device. This load acts on the spring, causing its compression. The inner pipe is mounted on the spring. Compression of the spring causes downward motion of a pipe on which the tray rests. At the same time rack moves vertically downward as it is also attached to the inner pipe. The pinion meshes with the rack hence the vertical downward movement of rack causes the rotary motion of the pinion.

This rotary motion is then given to the bigger chain sprocket by means of compound gear train. Then this rotary motion of sprocket is given to the front axle through chain drive. Front and rear axles have wheels on both ends; thus it causes forward motion of the device. Device travels the certain distance with respect to the spring compression and stops at its unloading point. Now, when the weight is taken off; the spring releases and starts to come its original position. This causes the vertical upward motion of rack so that the meshing pinion rotates in opposite direction. This inverse rotary motion is again given to the front axle as same manner as above. Thus the backward motion of the device is achieved.

We have attached the pinion to the wheel shaft of Material handling trolley, this will rotate the shaft and hence tyres of trolley will move in the front direction. After certain distance coverage rack will be fully in downward direction.

At the same time when we remove the weight from trolley the spring which is attached to the rack will decompress and it will pull the rack in upward direction as shown in design. It's simple rack and pinion motion. Main advantage is that you can use it's own weight to get energy to move forward. No need an external power source to the trolley to move in forward and reverse direction. Also there will be screw attachment to the rack so that we can restrict its motion to particular distance.

ACTUAL MODEL PHOTO :



Figure No. 2

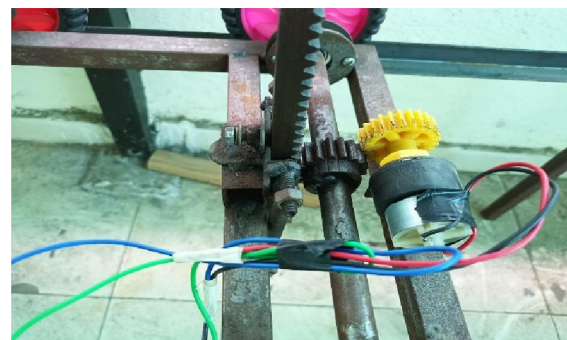


Figure No. 3

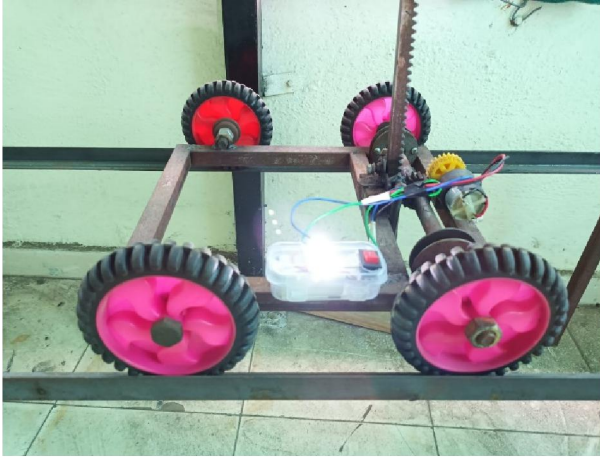


Figure No. 4



Figure no. 5



Figure 6

VI. FUTURE SCOPE

“Weight operated material handling trolley” provides wide range for future advancements. Some of these are as follows :

- i) By just changing the helical compression spring we can make the equipment to work under the different loads (Just we have to change the stiffness of spring)
- ii) By providing the curved tracks and wheels with free alignment, we can also use this equipment where we have to take the turns in material handling.
- iii) In case to handle huge load of about 200 Kg or more we can provide more than one spring in parallel, let us say 4 parallel springs can be used to increase the capacity.
- iv) Parts which is used can be minimized so that weight can be minimized.
- v) Modification can be done by aligning the axis of board and motor and wheel.
- vi) Material handling equipment can be transfer maximum weight by increasing the torque of motor and supply current.

VII. CONCLUSION

The purpose of weight operated material handling device is to move the object from one workstation to another on an industrial assembly line. After taking trial of weight operated material handling device, it gives out following **benefits**:

- 1) This system eliminates power cost of external energy.
- 2) It is suitable for small as well large scale industries.
- 3) Material handling of engine blocks, flywheels, gears, castings etc.
- 4) Ease of maintenance, ease of operation.
- 5) Particularly economical operation as it eliminates extra man power.
- 6) High degree of operational safety.
- 7) Environment friendly operation.

VIII. ACKNOWLEDGEMENT

We express our deep sense of gratitude to our guide Prof. S. M. DHANESHWAR for his valuable guidance rendered in all phase of project. We are thankful for his wholehearted assistance, advice and expert guidance towards making our work success.

Our special thanks to honorable Principal Dr.R. K. JAIN & Head of Department Prof. Dr.S. N. KHAN for their keen interest, encourage and excellent support.

We would also like to express our thanks to all of other staff members of college & friends who helped us directly & indirectly during the completion of this Report.

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