

# Design and Fabrication of Job Weight Operated Material Handling Equipment

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**Abstract** - An Material handling is one of the main operations in industry. Material handling involves transfer of material or jobs from one station to another for various operations, storage and packaging etc. Weight operated material handling device has large load carrying capacity and less maintenance. This project is basically weight operated material handling device. This device is simple in construction. This material handling device does not require external power i.e. electrical energy, it totally operates and depends on weight of material or job. Industrial material handling devices are operating on electrical power which requires more electricity and because of that final cost of the product increases. This device solves the different problem related to material handling equipment in a typical material handling system. Spring operated material handling equipment has large load carrying capacity, easy maintenance and high reliability of operation. This material handling equipment uses potential energy of the job for its transportation from one point to another in a commercial point or space.

**Key Words:** Material handling, Electricity, Potential energy

## 1. INTRODUCTION

The material handling system is categorized as non-value added activities which implying that the less material handling involved is the better. Various studies have been made in different industries to indicate that the cost of handling alone accounts for about 20-25% for the total manufacturing cost. However it is impossible to totally eliminate the material handling activities in any manufacturing operation. Hence an efficient and effective material handling system is always the ultimate objective by many companies. Manual Handling involves any transporting or supporting of a load by one or more employees, and includes lifting, putting down, pushing, pulling, carrying or moving a load, which by reason of its characteristics or unfavourable ergonomic conditions, involves risk, particularly of back injury, to employees. Once the design of a production process (exclusive of material handling considerations) is completed, alternate material handling system designs are generated, each of which satisfies the material handling requirements of the production process. The least cost material handling system design is then selected. The appropriateness of the use of material handling system cost as the sole criterion to select a material handling system design depends on the degree to which the other aspects of the production process are able to be changed. If a completely new facility and production process is being designed, then the total cost of production is

the most appropriate criterion to use in selecting a material handling system. The lowest cost material handling system may not result in the lowest total cost of production. If it is too costly to even consider changing the basic layout of a facility and the production process, then material handling system cost is the only criterion that need be considered. Self-weight acting material handling device is working on the weight of the material to be carried. It will not require any kind of fuel or electrical energy for moving from one place to another place. Hence, the cost required for the material handling system will be minimum.

### 1.1. Problem statement:

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### 1.2 Objectives:

To ensure safe, effective and flexible material handling system.

- To make use of mechanical material handling equipment to reduce manual work.
- To reduce the electricity consumption in industries which can reduce the overall cost of the final products.
- To reduce manual handling risk like musculoskeletal injury such as a back injury.
- To reduce manpower required in manual material handling.
- To reduce investment cost.

## 2. WORKING

At initial position the fabricated material handling equipment will be at initial position from where the material is to be transported to another place. Chain rack can be provided with suitable locking arrangement to have movement of equipment according to requirement. Locking arrangement will also help in case there are no. of small jobs having less weight of one job. In that case vertical movement of rack can be locked and then no. of jobs can be placed in it. After certain no. of jobs kept inside lock can be opened to allow for movement. After placing weighted jobs or job chain rack will move in downward and as sprocket pinion is in mesh with that rack, movement of rack in vertical direction will rotate the sprocket pinion.

The big sprocket wheel is mounted on same shaft which carries the sprocket pinion. Rotation of sprocket pinion causes rotation of big sprocket wheel. This big sprocket wheel is connected to small sprocket located and mounted on wheel shaft through chain (i.e. chain sprocket assembly similar to bicycle). As the big sprocket wheel rotates which in turn rotates small sprocket wheel through chain. Small sprocket wheel is mounted on shaft carrying wheels, rotates the shaft and hence the wheels on track. During this motion tension spring connected at bottom expands. Thus, ultimately vertical movement of chain rack due to weight placed on plate causes rotary motion of the wheels. Track is used to provide linear path of movement. By this way this equipment moves from one place to another place due to weight placed on it.

When weight is removed on it on another side, locking arrangement can be used to remove the small pieces one by one without movement of the equipment. Spring will remain in stretched position until lock is removed. When lock is removed spring will try to come to its normal position. This will cause upward movement of chain rack. Hence, the complete motion of parts will be in reversed direction and equipment will come to the initial position from where weight is kept on it.

## 3.CONSTRUCTION

Components of the system are given below:

### 1.Weight Carrying Plate: -

This plate is mounted on the pipe on which chain is welded acting as a rack. This plate carries the weight of the jobs which are to be moved from one place to another.

### 2. Chain welded on pipe which acts as a Rack

To reduce the cost of total assembly and the availability of chain is easy, it is welded on pipe to act as a rack. Sprocket along with this chain rack together act as rack and pinion assembly.

### 3. Sprocket as a pinion

Sprocket is used as pinion. This assembly is simple in construction which used to convert linear motion to rotary.

### 4.SprocketWheel

Sprocket Wheel is rotating machine part which is used to change speed and torque of the system. Here the main function of sprocket wheel is to transmit torque to lower shaft having wheels connected to it through another small sprocket. It is mounted on same shaft carrying the sprocket pinion.

### 5. Wheels

Wheels used rotates because of motion transmitted to it through chain and sprocket assembly.

### 6. Main Frame

Main frame is supporting structure. Main frame supports whole assembly of material handling equipment.

### 7. Chain & Sprocket Mechanism

This mechanism is used to transmit the motion from rack and pinion assembly to shaft carrying wheels, so that vertical movement of rack transmitted to wheels for movement of equipment from one place to another.

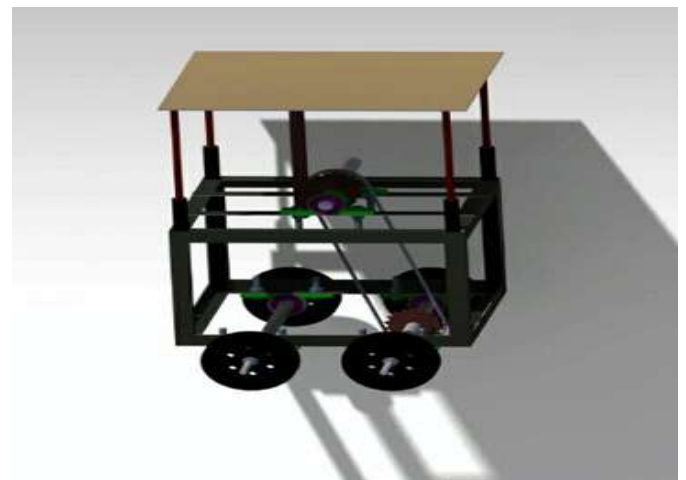
### 8. Springs

Tension coil spring is used to retract the upper plate of the device. Two coil springs are used at two supports.

### 9. Bearings

Bearings are used to support rotating shaft at their end during operation.

Initial construction that was considered for the design



**Fig -1: Material Handling Model**

#### 4. ADVANTAGES & LIMITATIONS

##### 4.1 ADVANTAGES

- It allows easy movement of the load without any accidents.
- No use of electrical energy as in other cases most of the equipment use electricity which adds cost to final product.
- Low cost compared to other equipment available.
- Lower investment cost if this equipment is used to replace manual handling.
- Easy maintenance of the parts as each part is easily accessible.
- Also reduce the prices of the product by minimizing material handling cost.

##### 4.2 LIMITATIONS

- As it is a complete mechanical system there is friction between various parts of the assembly. Therefore timely lubrication is required for components.
- Proper alignment between parts is required to reduce transmission losses.
- Track is required to make motion of equipment in desired path.

#### 5. APPLICATION

- This equipment can be used for transfer of material between two stations without need of worker.
- Can be used for unloading purpose from transport vehicle to the storage.
- Can be used for transfer of finished products from working stations to storage.
- This equipment can be used in shops which has their storage facility at the end.
- Can be used effectively for storage and distribution.

#### CONCLUSION:

It works on the weight of job or object which has to transfer from one machine station to another machine station without consumption of any type of fuel or electricity. By the use of this equipment which is helpful to reduce the overall cost of equipment.

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