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Design and Fabrication of Tractable Conveyor System for Sack Handling.

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Abstract- Belt Conveyors' are used for transporting heavy and bulky materials from one place to another at a longer distance faster without much human labor. By, designing a belt conveyor system which can change its orientation in terms of the angle of inclination to transport materials and also providing mobility to the conveyor, the cost of installing every time a new system to transport materials gets eliminated. Therefore, by using "Lead Screw Link Mechanism" and mounting the whole conveyor on Brake wheels the main aim for designing such a system gets fulfilled.

Index Terms- Conveyor, Inclined Conveyor, Sack Handling, Lead Screw Mechanism, Battery Operated.

I. INTRODUCTION

Among all the transportation systems, the use of conveyor to transfer material from a place to another within an industry or over a long distance speedily is done through conveyors'. At, construction sites and in food processing industries, airports, the goods are transported through long belt conveyors'. But, the belt conveyors' once installed at a particular place cannot be moved or its orientation cannot be changed. So, if the need arises to transport material from a different spot, another conveyor or other transportation mechanism needs to be installed at that place increasing the capital cost of the concerned industry for its application. So, in context to the above problem, designing of a belt conveyor system particularly for sack handling which will be mobile and its angle of inclination to transport materials can be changed is the objective for achieving solution to the problem. Therefore, by applying the use of a "Lead Screw Link" mechanism and mounting the whole conveyor on brake wheels,
the design can be fabricated to fulfill its aim. This type of conveyor system once installed can solve the need for another transport system and also reduce the man power for sack handling. This designed system also reduces the capital cost at a construction site or within the premises of an industry where there is a need to transport sacks at different heights.
The functionality of this conveyor was tested and it was found that the type of belt selection becomes the main criteria of design for the conveyor as the material is transferred to a height at an inclination greater than 30˚, the chance of slipping of sack becomes a main issue for the system.
The following research paper is written on the basis of a scaling model designed and fabricated which can be scaled to a larger ratio and can be applied in industries.

II. DESIGN METHODOLOGY

1. Principle: The working principle for the multiple angle of inclination of this system is the "Lead Screw Link Mechanism". The Lead screw is operated by a battery which rotates the lead screw. The lead screw is connected to the shaft through a link and that link is connected through a linear bearing bracket mounting on both the sides of the frame.

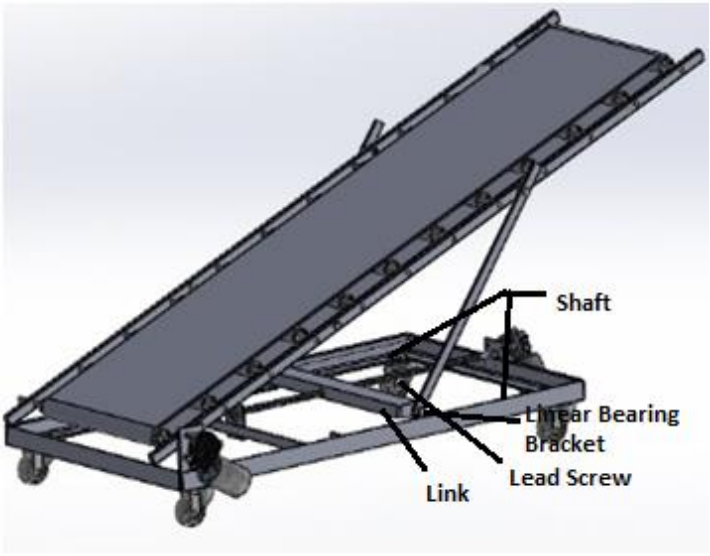

Fig 1. Conveyor Isometric View

2. Methodology:

(i) The existing system as shown in Fig 2. was the main problem identification at the industries or at the construction sites in loading sacks of cement, sugar or other material transferred through conveyor.

(ii) The next task was to formulate a design suitable for solving the problem of variable orientation of the conveyor on basis of inclination and mobility.

Fig 2. Existing system

(iii) Search for the current research in the field of conveyors' was referred and several patents were searched relevant to finding the mechanism to incline the conveyor.

(iv) Finalizing the mechanism to incline any system out of hydraulic motors, jacks and forklifts; the easy and economical solution was to select the lead screw mechanism.

(v) Using Solidworks to make a 3-D model of the new conveyor with a lead screw and brake wheel.

(vi) Selecting material for the belt so as the sack does not slip at a higher inclination.

(vii) Fabricating the conveyor and taking trials at different inclinations and finding the weight carrying capacity at different angles.

3. Design and Calculations: The fig 1. Portrayed the designed 3-D solid model; the following figure is the fabricated model.

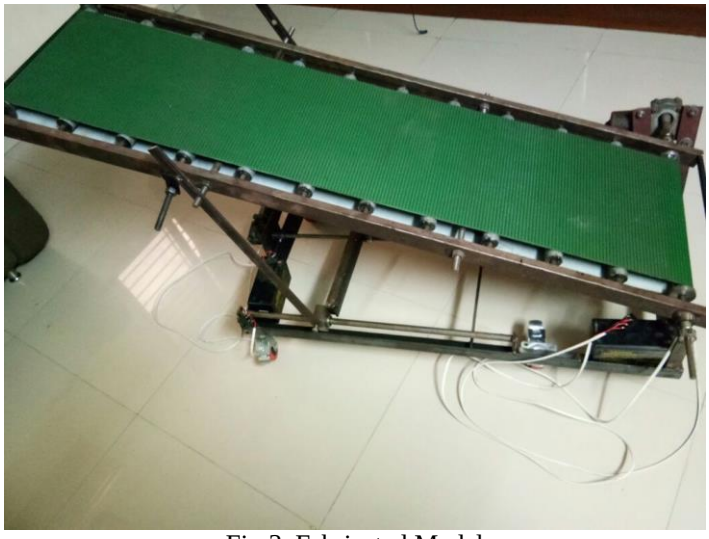

Fig 3. Fabricated Model

III. PROBLEMS FOUND/MODIFICATIONS

After taking trials, the following problems were found in the conveyor:

1. The Conveyor used to tilt one side while inclining.
2. While transporting the sack, the conveyor used to bend from the top end thereby destabilizing the whole frame.
3. The nut attached at the bottom with the lead screw and the link attached with it used to create vibrations during the operation of the lead screw through motor.
4. The sack used to slip due to the less thickness of the belt.

Modifications done based on the problems found are in the same order as the problems mentioned in above points (i.e the solution to problem 1. is mentioned in (i)):
(i) The conveyor is operated with a lead screw of higher pitch of 12mm.
(ii) At both the ends a supporting bar is welded so as to bear the forces and the bending.
(iii) The use of linear contact bearings is done with the rectangular brackets on the shaft and is welded to the link.
(iv) Roof top belt with a thickness of 5mm is used instead of the ordinary belt with low thickness.

IV. RESULTS

By applying the above modifications and again taking trials of the conveyor, we get the following results:

Sr.No.	Angle of inclination	Weight Carried(in kg)
1.	18˚	15
2.	25˚	15
3.	30˚	10
4.	45˚	10
5.	55˚	8
6.	60˚	6
7.	75˚	5
8.	80˚	5

Note:
1. The angle of inclination is considered in terms of angle made by the links.
2. The angle cannot be less than 16˚ because by the attachment of the links the conveyor gets lifted to 16˚ and any angle less than that would hinder the attachment of link.
3. The attained height of the conveyor is 3.2 ft as maximum from ground.
4. All the results are obtained considering this as a small scaling model.

V. ADVANTAGES

The advantages of the designed belt conveyor are as follows:
1. Easy change of angle of inclination.
2. The conveyor can be moved anywhere.
3. The sack doesn't fall off at angle greater than 30˚.
4. Reduces Manpower is applied at large scale.

VI. CONCLUSION

From the trials taken and the result obtained, it can be concluded that:
1. The proposed conveyor has a good weight carrying capacity which decreases with increased inclination.
2. The proposed system is easily affordable and can be applied to an industry.
3. The objective of developing this kind of conveyor is fulfilled.

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