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BOX TRANSPORT MECHANISM

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ABSTRACT

Here work is done by converting rotary motion into reciprocating motion by means of a single slider crank mechanism. The main motive behind this prototype is to replace conventional conveyer systems by fully mechanical, highly efficient, having low initial and maintenance cost conveyer systems. These small scale mechanical conveyer box transport systems are mainly focused towards the small scale manufacturing plants and businesses. Conventional conveyer systems consist of belts, large input/output motors etc. which increases the initial as well as maintenance cost. This prototype is solely based on four bar mechanism and with use of a simple small motor rotary motion is converted to reciprocating motion. This prototype will surely reduce the efforts for small scale industries.

Keywords: Box Moving Mechanism, Conveyer System, DC Motors, Four Bar Mechanism, Single Slider Crank Mechanism.

I INTRODUCTION

The need of moving the manufactured components of any industrial plant is one of the basic needs that need to be fulfilled in order to ensure the efficiency of the plant as a whole. There has been various prototypes dedicated solely for the in-plant transport of components/ equipment/ totally manufactured final products. But the thing which does not comply with most of the conveyor belt systems is that they are not cost efficient. They require a large amount of capital investment which is not something that is affordable by everyone. Our design for the "**BOX TRANSPORT MECHANISM**" is dedicated to the small scale industries for whomconventional conveyor belt systems are not accessible or simply who do not need such a large scale systems such as in-house assembly line. The advantage of our design is the stop and go motion which provides a time delay for each box. Time delay actually allows the attendant to perform alterations with packaging if there is a need to do so. Conventional system is not equipped with this stop and go motion unless they are programmed to stop at a designated stop which again increases the cost.

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II LITERATURE REVIEW

2.1. Crank rocker mechanism for BOX TRASNPORT MECHANISM

Four bar chain mechanism also known as crank rocker mechanism is one of the best, most useful and suitable mechanism for the prototype. The mechanism is composed of rigid bodies which are connected to form linkages. Four bar mechanism consists of three moving links, one fixed links and four pin points.

Generally, when the links move in parallel planes then the assembly is called as planar four-bar linkages. The link moves in concentric spheres when the axes of the hinged joints are set in an angle where their axes intersect.

2.2. Inversion of Four bar Mechanism

The traditional definition of mechanism basically sums up as where there is a link which is fixed and the other links are moving then it is a mechanism. In four bar different mechanism can be obtained when we adjust the intersecting paths of the axes of the linkages. These are called as inversions of the mechanism. By changing the fixed link, the number of mechanisms which can be obtained is equal to the number of links. Therefore except the original mechanism, all other mechanisms are inversions of original mechanism..

2.3 Functions of linkages

Obviously the function of any link mechanism is to produce rotating, oscillating or reciprocating motion from the rotation of crank or vice versa.

Linkage functions are as follows

- Function generation: To provide relative motion
- Path generation: path of the tracer point
- Motion generation: motion of coupler link

III TRANSMISSION ANGLE

If *AB* is the input link, the force applied to the output link, *CD*, is transmitted through the coupler link *BC*. (That is, pushing on the link *CD* imposes a force on the link *AB*, which is transmitted through the link *BC*.) For sufficiently slow motions (negligible inertia forces), the force in the coupler link is pure tension or compression (negligible bending action) and is directed along*BC*. For a given force in the coupler link, the torque transmitted to the output bar (about point *D*) is maximum when the angle βbetween coupler bar *BC* and output bar *CD* is $\pi/2$. Therefore, angle BCD is called **transmission angle**.

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$$\alpha_{max} = |90^\circ - \beta|_{min} < 50^\circ$$

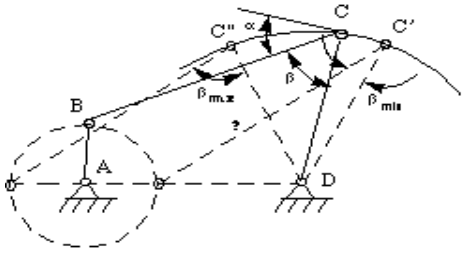

Fig.1 angle BCD representing transmission angle

IV SPECIFICATIONS OF MECHANISM

- DC Motor Speed : 10 RPM
- Box Size : 220mmx80mmx80mm
- One to other box distance: 85mm (inner), 245 mm (outer)
- Rail distance : 44 inches (length), 36 inches (height)
- Mechanism : Crank with linkages
- Crank Angle : 220 degrees
- Materials : MS (Mild Steel) and Wood
- Total mechanism weight: 11 Kg (approx.)
- Box transmission: step wise movement (delay between moving boxes)

V DESIGN OF FOUR BAR MECHANISM

Design for the four bar chain mechanism is very important in order to get a desired output motion for a specific input motion. We chose a simple mechanism to minimize the cost and maximize the efficiency.The picture shown below is for illustration purpose only. The actual model may not be exactly same as shown below.

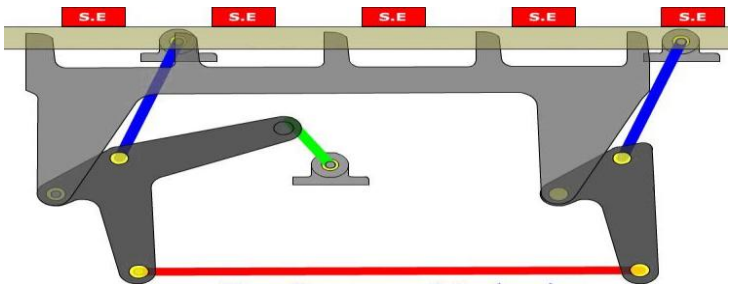

Fig.2. Box Transport Mechanism

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5.1. Selection of Materials

- Linkages
- DC motor
- Wooden Frame
- Bearings

5.1.1. DC motor

DC motors are widely used because of their efficient performance, and easy to operate and control speeds. The motors such as used in the windshield wipers can provide continuous to and fro motion and where speeds are adjustable. The motor used requires a supplyof +12V DC, which is derived from the single phase supply of 230V AC.

5.1.2. Wooden frame

Wooden frame acts as the skeleton to the whole prototype providing support to the mechanism either on the floor or anywhere else where it is required to be mounted.

5.1.3. Bearings

Bearing constrains relative motion between moving parts to only the desired motion. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis.

VI FUTURE SCOPE

According to us this easy and simple to use prototype design will revolutionize the concept of box transfer mechanism. As it is easy to use and fabricate small scale industries will be able to utilize this product for the betterment in the plant management. As transporting boxes from the assembly line will get more manageable industries could easily increase their production rate and so their revenue. Further advancements and modifications can be done as per the requirements as well as scale of the use.

VII CONCLUSION

The box shifting mechanism plays a major role in industries, the process of transporting or shifting products from one place to another was to be maintained by conveyors only. So we just successfully altered this with a box shifting mechanism using the kinematics links and a motor. We used basic mechanical knowledge and design capabilities to make it possible. Thus this project work will be useful in all industries. For practical application it's height, weight are suitable for light duty operations. But with time and with few modifications as the prototype will demand in future, it's efficiency and capabilities could be enhanced. The project works with satisfactory conditions. We are

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able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities.

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