

Box Transport Machine

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Abstract- Box Transfer Mechanism relates to improvements in transfer and conveying devices. It relates particularly to devices for transferring set-up cardboard boxes from a box folding or forming machine to the operator of a semi-automatic box. In this Project, we will make the box transferring mechanism by Four Bar Kinematic Chain Mechanism.

This system transfers and includes shifting of boxes by using simple and basic mechanical principles. The main advantage is that it can transfer box with much more efficiency than the conveyer belt system in all aspects. Unlike conveyer belt system it only focuses on shifting of boxes. Also we make 7 or 8 transfer boxes in it. We can reduce the human load and increase the work efficiency by implementing this system.

IndexTerms- fourbar mechanism, link, kinematic mechanism, folloer

I. INTRODUCTION

In an organization, Manufacturing plays a vital role, hence the focus of our project focuses on “DESIGN AND FABRICATION OF BOX TRANSPORT MACHINE”. The box moving or shifting set up has a simple mechanism, implementing a crank and lever arrangement. The rotary motion of the motor is used to actuate the links enabling the to and fro motion of the teeth. . The rotary motion is converted in to linear motion by the crank and mechanical linkages arrangement. The conveyor system is either continuous movement or if the time delay is to be produced there will be definite requirement of software programming which will be costly. So a basic module of moving packages is designed with time delay which can be used to do alterations if required in the package or move the package for any other purpose.

Linkages can be classified according to their primary functions:

- Function generation: the relative motion between the links connected to the frame.
- Path generation: the path of a tracer point.
- Motion generation: the motion of the coupler link.

II. PRINCIPLES OF MATERIAL HANDLING

Material handling principles are as follows:

1. Orientation Principle:
It encourages study of all available system relationships before moving towards preliminary planning. The study includes looking at existing methods, problems, etc.
2. Planning Principle:
It establishes a plan which includes basic requirements, desirable alternates and planning for contingency.
3. Systems Principle:
It integrates handling and storage activities, which is cost effective into integrated system design.
4. Unit Load Principle:
Handle product in a unit load as large as possible
5. Space Utilization Principle:
Encourage effective utilization of all the space available
6. Standardization Principle:
It encourages standardization of handling methods and equipment.
7. Ergonomic Principle:
It recognizes human capabilities and limitation by design effective handling equipment.

8. Energy Principle:

It considers consumption of energy during material handling.

9. Mechanization Principle:

It encourages mechanization of handling process wherever possible as to encourage efficiency.

10. Flexibility Principle:

Encourages of methods and equipment which are possible to utilize in all types of condition. Simplification Principle: Encourage simplification of methods and process by removing unnecessary movements

11. Gravity Principle:

Encourage the usage of gravity principle in movement of goods.

Safety Principle: Encourages provision for safe handling equipment according to safety rules and regulation

12. System Flow Principle:

Encourages integration of data flow with physical material flow

13. Layout Principle:

Encourages preparation of operational sequence of all systems available

14. Ecology Principle:

It encourages minimum impact upon the environment during material handling

III.BOX TRANSPORT MACHINE

Linkage mechanism

A linkage is a mechanism formed by connecting two or more levers together. Linkages can be designed to change the direction of a force or make two or more objects move at the same time. Many different fasteners are used to connect linkages together yet allow them to move freely such as pins, end-threaded bolts with nuts, and loosely fitted rivets. There are two general classes of linkages: simple planar linkages and more complex specialized linkages; both are capable of performing tasks such as

describing straight lines or curves and executing motions at differing speeds. The names of the linkage mechanisms given here are widely but not universally accepted in all textbooks and references.

Four different simple planar linkages are identified by function:

Reverse-motion linkage:

It can make objects or force move in opposite directions; this can be done by using the input link as a lever. If the fixed pivot is equidistant from the moving pivots, output link movement will equal input link movement, but it will act in the opposite direction. However, if the fixed pivot is not centered, output link movement will not equal input link movement. By selecting the position of the fixed pivot, the linkage can be designed to produce specific mechanical advantages. This linkage can also be rotated through 360°.

4.1.2 Push-pull linkage:

It can make the objects or force move in the same direction; the output link moves in the same direction as the input link. Technically classed as a four-bar linkage, it can be rotated through 360° without changing its function.

Parallel-motion linkage:

It can make objects or forces move in the same direction, but at a set distance apart. The moving and fixed pivots on the opposing links in the parallelogram must be equidistant for this linkage to work correctly. Technically classed as a four-bar linkage, this linkage can also be rotated through 360° without changing its function. Pantographs that obtain power for electric trains from overhead cables are based on parallel-motion linkage. Drawing pantographs that permit original drawings to be manually copied without tracing or photocopying are also adaptations of this linkage; in its simplest form it can also keep tool trays in a horizontal position when the toolbox covers are opened.

Bell-crank linkage:

It can change the direction of objects or force by 90°. This linkage rang doorbells before electric clappers were invented. More recently this mechanism has

been adapted for bicycle brakes. This was done by pinning two bell cranks bent 90° in opposite directions together to form tongs. By squeezing the two handlebar levers linked to the input ends of each crank, the output ends will move together. Rubber blocks on the output ends of each crank press against the wheel rim, stopping the bicycle. If the pins which form a fixed pivot are at the midpoints of the cranks, link movement will be equal. However, if those distances vary, mechanical advantage can be gain

IV.DESIGN CALCULATIONS

1. Degree of freedom

Degree of freedom is the number of input required to get constrained output in a chain.

According to Kutzbach Eqn:

$$F = 3(L - 1) - 2J - H$$

Where

F = degree of freedom

L = no of links

J = no of binary joint

H = no of higher pair

2. Transmission Angle

V.CONCLUSION

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

Thus the work design and fabrication of the BOX TRANSPORT MECHANISM system has been made in accordance to the need. The initial mechanical setup of the project is made with mild steel material.

The translating link which specially arranged to transfer the box on the table. The final box transferring operation is obtained at the last translating link. The DC motor is used to produce the actuation of material transferring translating link by using four bar mechanism. They are placed accordingly to produce slip free actuation.

ADVANTAGES:

- Lubricants are not required
- Simple to construct
- Low speed motor is sufficient
- Easy maintenance
- Less skilled operator is sufficient
- Noise of operation is reduced

- The length between the teeth can be adjusted

DISADVANTAGES:

- Technology limits ,current technology is unable automate all desired task.
- Unpredictable development cost
- The research and development cost of automating a process is difficult predict accurately beforehand.
- The automation of a new preoduct requires a huge initial investment in comparison with the unit cost of the product.

APPLICATION

- Transferring the boxes from one place to another for the requirement of worker within the industry
- Heavy tools easily transport to one work station to another work station.

Generally during decision making process taking