

# Solar Operated Box Transportation Machine

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## Abstract

Now days the industries are worldwide use conveyors as a mechanism to transport boxes from one place to another place. This mechanism includes strong belts, pulleys and heavy motors to rotate the pulley to move the conveyor. As an alternative to this conveyor type, more simple and comfortable machine using eight bar mechanism can be used. This project helps to transfer the boxes smoothly by use of eight bars with a simple arrangement. In this project eight bar mechanism is the heart of the machine and it converts the rotary motion into reciprocating motion. It requires electric motor which is operated by solar power system.

**Keywords: Material Handling, Eight Bar Mechanism, Rotary Motion, Solar, Renewable Power**

## I. INTRODUCTION

There has been a serious demand for intermittent movement of packages in the industries right from the start. Though the continuous movement is more or less important in the same field the sporadic motion has become essential. The objective of our project is to produce a mechanism that delivers this stop and move motion using mechanical linkages. The advantage of our system over the conveyor system is that the system has a time delay between moving packages and this delay can be used to introduce any alterations in the package or move the package for any other purpose and likewise. While in conveyor system such actions cannot be performed unless programmed module is used to produce intermittent stopping of the belt which basically is costly. The prototype design requires electric motor, shafts and the frame of which the frame and platform on which the packages are moved is fabricated. All the links are being made of Aluminum which reduces the weight of the whole system including the head which has a direct contact with the boxes being moved. The system is expected to move as heavy packages as 2-3kgs approximate.

## II. LITERATURE SURVEY

### A. *Design of Machinery, 3rd, by Norton, R.L.McGraw-Hill, 2004*

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. 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. 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 Eight link. Different simple planar linkages are identified by function: K2. [R.L. McGraw-Hill, 2004].

### III. CRANK-ROCKER MECHANISM USING BOX TRANSPORT MECHANISM

The Eight bar linkage is the simplest and often times, the most useful mechanism. As we mentioned before, a mechanism composed of rigid bodies and lower pairs is called a linkage. In planar mechanisms, there are only two kinds of lower pairs: revolute pairs and prismatic pairs. This mechanism has eight moving links. Two of the links are pinned to the frame which is not shown in this picture. In Sim Design, links can be nailed to the background thereby making them into the frame. How many DOF does this mechanism have? If we want it to have just one, we can impose one constraint on the linkage and it will have a definite motion. The eight linkage is the simplest and the most useful mechanism. The simplest closed-loop linkage is the bar linkage which has four members, three moving links, one fixed link and four pin joints. A linkage that has at least one fixed link is a mechanism.

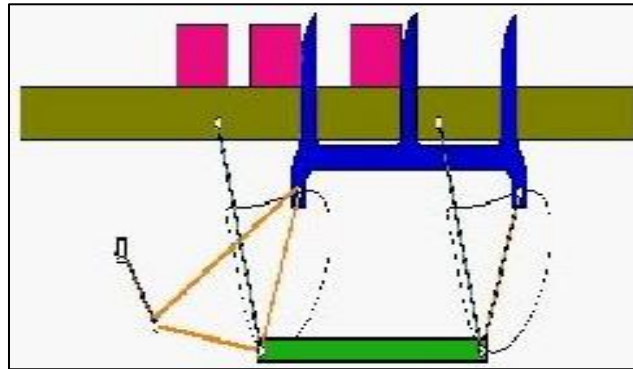


Fig. 1: Box Transport Mechanism in parallel motion.

A mechanism is composed of rigid bodies and lower pairs called linkages. In planar mechanisms there are only two kinds of lower pairs: turning pairs and prismatic pairs.

#### A. Link Mechanism

One of the simplest examples of a constrained linkage is the eight link mechanism. A variety of useful mechanisms can be formed from an eight link mechanism through slight variations, such as changing the character of the pairs, proportions of links, etc. Furthermore, many complex link mechanisms are combinations of two or more such mechanisms. The majority of eight link mechanisms fall into one of the following two classes:

- 1) The eight bar linkage mechanism, and
- 2) The Slider Crank mechanism.

The link opposite the frame is called the coupler link, and the links which are hinged to the frame are called side links. A link which is free to rotate through 360 degree with respect to a second link will be said to revolve relative to the second link (not necessarily a frame). If it is possible for all four bars to become simultaneously aligned, such a state is called a change point.

Some important concepts in link mechanisms are:

##### 1) Crank:

A side link which revolves relative to the frame is called a crank.

##### 2) Rocker:

Any link which does not revolve is called a rocker.

##### 3) Crank-Rocker Mechanism:

In an eight bar linkage, if the shorter side link revolves and the other one rocks (i.e., oscillates), it is called a crank-rocker mechanism.

##### 4) Double-Crank Mechanism:

In an eight bar linkage, if both of the side links revolve, it is called a double-crank mechanism.

- 1) Reverse-motion linkage 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.
- 2) Push-pull linkage 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 an eight bar linkages, it can be rotated through 360° without changing its function.
- 3) Parallel-motion linkage 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 an eight 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.

- 4) Bell-crank linkage can change the direction of objects or force by  $90^\circ$ . 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  $90^\circ$  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 gained.

### B. Eight Bar Mechanism

In this project eight bar mechanism are used to operate the box transportation process. An Eight bar linkage mechanism is a one degree-of-freedom mechanism that is constructed from eight links and 10 joints. These linkages are rare compared to four-bar and six-bar linkages, but two well-known examples are the Peaucellier linkage and the linkage designed by The Jansen for his walking machines. The linkage bars of identical colour are of equal length Classification of eight-bar linkages Eight-bar linkages are classified by how many binary, ternary and quaternary links that they have. A binary link connects two joints, a ternary link connects three joints and a quaternary link connects four joints.[L.W.Tsai, CRC press,2000].

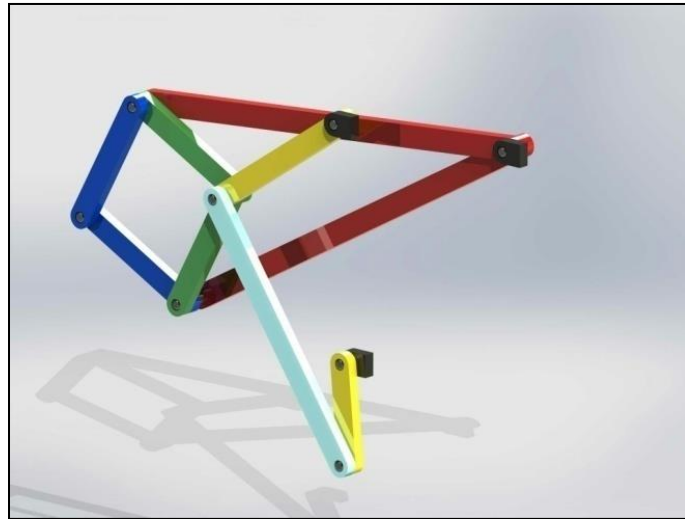


Fig. 1: Eight Bar Mechanism

#### 1) Peaucellier Linkage:

The Peaucellier linkage is a (4, 4, 0, 0) eight-bar linkage, which means four of the bars have two joints and four bars have three joints. The Peaucellier linkage (or Peaucellier–Lip kin cell, or Peaucellier–Lip kin Inverse), is an eight-bar linkage constructed from hinged joints that traces a pure straight line from a rotary input.

An eight-bar linkage must have 10 single degree-of-freedom joints, while the Peaucellier linkage appears to have only six hinged joints. This is resolved by noting that four of the hinged joints each connect three bars. This is considered to be a special case of two joints that are located in the same place. Thus, six plus four provides the 10 one degree-of-freedom joints. It is named after Charles Nicolas Peaucellier (1832-1913).

#### 2) Jansen Linkage:

The eight bars of the Jansen linkage, which include the ground frame, are readily identified, and include two triangular links. In this case only seven of the 10 hinged joints are readily identified. However, there are three joints that connect three links. The first is the end of the drive crank, the second is the other base pivot and the third is one side of the triangle that forms the lower leg. Separating these overlapping joints provides three additional joints so there are 10 single degree-of-freedom joints.

### C. Working Procedure

The eight bar linkage has a crank that rotates at a constant angular speed. The crank is connected to the coupler which is connected to the rocker. The frame does not move. First of all we have prepared the drawing for the machine transporter machine. Then we make the measurement for the bed of the box transport machine. We took the iron angles and cut them in the given measurements using the cutting machine. Then we took that pieces and weld them in the prepared shaped drawing. After making the welding of the iron angles bed for the machine was ready. Then we took the mild steel plate and then taking the measurement of box transport machine we cut the pieces in the given length. After cutting the plate in the given size we put it in the lathe machine for giving it the shape of shaft. We also prepared the hanger and crank using the lathe machine as per of dimension.

After preparing the shaft, hanger and crank we take it over the drill machine to make the holes in them as the given dimension in the drawing. After this we had prepared the shaft which is going move the boxes to the next level with using it edges on the top of it. We cut the mild sheet plate in the given dimensions and then edges also, after cutting we make the welding to attach these edges with the plate on the given distance dimensions. Then with the help of file we rub these welding points to give them

a good look. Now all of the things for the machine are prepared. On this step we took the electric motor and fix that on the bed of the machine on the given place. After fixing the motor we fixed the crank with it from one side and other side was attached to the shaft.



Fig. 2: Box Transport Mechanism Setup

Then we took the hanger link and attach it with the shaft, while the other edge of the hanger link is attached to the shaft. Then both of the shafts were attached to the transporting shaft. Two other hanger links was also attached to the shafts. Other two hanger link and transporting shaft was attached to the top of the bed in the bearing gear. Out box transporting machine is ready now. We give the current to the electric motor and put the boxes on the top of the machine for testing it. It was working well and boxes are moving to the next level.

This machine is basically works on the principle of Single Slider Crank Mechanism which is the heart of this machine and it converts rotary motion into a reciprocating machine to crush the Cans/Plastic bottles. This is the inversion of single slider crank which is obtained by fixing link.

#### IV. FUTURE SCOPE

Dynamic analysis is one of the very important phase in design the systems. A computer base modeling and simulation gives better understanding regarding rigid system parameters. There is much scope in development of an accurate mathematical model and subsequent simulations for the kinematic and dynamic analysis of the mechanical systems for the precise application in the industry.

##### A. Application

- 1) We can use this mechanism in medical production fields.
- 2) We can use this mechanism in cool drinks production companies and bottle filling Process.

#### V. CONCLUSION

Our main aim behind the designing of this project is reached successfully and having some limitations. The process of transporting or shifting of products from one place to another was to be maintained by conveyors was modified with a box transfer mechanism using the kinematic links and motor which has successfully run by solar power. In future this project can be developed in the area of Material handling and Packaging unit for mass production.

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