AJCSE
ASIAN JOURNAL OF COMPUTER SCIENCE ENGINEERING

www.ajcse.info

Asian Journal of Computer Science Engineering 2016; 2(1):01-05

RESEARCH ARTICLE

Design and Fabrication of Automated Industrial Conveyor Using Double Crank Rocker Mechanism

[1]Jyotiraditya Singh Solanki*, [2]Bhanu Pratap Singh Pundir, [3]SantoshPatel

[1, 2, 3]ME Students, Shri Vaishnav Institute of Technology and Science, Gram Baroli, Indore (M.P.)*

Received on: 25/10/2016, Revised on: 20/11/2016, Accepted on: 09/01/2017

ABSTRACT:

Industries all around the world use conveyors as a mechanism to transport boxes from one place to another. With increasing need of different types of conveyors in industry there is a serious demand of sporadic movement mechanism besides continuous movement. The aim of this study is to design and fabricate an automated conveyor targeting small scale industries based on double crank rocker mechanism without using modular programming. The intermittent motion and time difference between moving packages can be obtained by using mechanical linkages and by varying speed of source motor. This machine helps in transfer of parcels intermittently by use of four bars with a simple arrangement. The four bar mechanism includes four links. One link is fixed and the other links act as crank, follower and connecting rod. The rotational motion of the crank link is transferred to the follower by using connecting rod and is converted to the same rotary motion. This machine requires an electric motor to provide input to the system. The advantage of this mechanism over conventional conveyor belts will allow to introduce alterations in shifting cartons or packages or move the parcel for any other purpose and likewise. While in conventional conveyor belts to achieve such mechanism modular programming or programming control will be needed which will add an extra cost in manufacturing and productions.

INTRODUCTION:

This machine works on the principle of Single Slider Crank Mechanism. A four bar mechanism consists of 4 rigid links connected end to end creating a closed loop. Further, one of the links, called the ground link, is in a fixed stationary position. Four bar mechanisms can produce a large variety of paths of motion depending on the lengths and orientation of its links. It is for this reason that four bar mechanisms are used for a large number of applications, particularly in manufacturing. The type of motion produced from a 4 bar mechanism is determined by the Grashof's conditions. Grashof conditions will determine the type of motion based on the position and length of links in the mechanism. Determining the Grashof condition begins with the calculation of link lengths:

Table -1: Classification of Four Bar Mechanism:

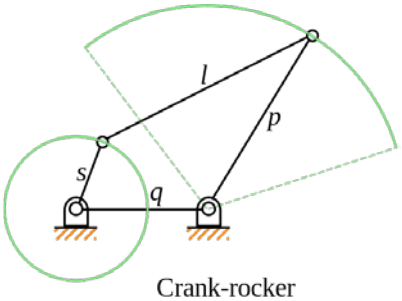
Case	l + s versus p + q	Shortest Bar	Type
1	<	Frame	Double-crank
2	<	Side	Rocker-crank
3	<	Coupler	Double rocker
4	=	Any	Change point
5	>	Any	Double-rocker

We refer to the line segment between hinges on a given link as a bar where:

1. s = length of shortest bar
2. l = length of longest bar
3. p, q = lengths of intermediate bar

***Corresponding Author:** Jyotiraditya Singh solanki**, Email**:jyotirsolanki@gmail.com

This mechanism is based on case 3 using coupler as shortest bar (l+s<p+q).With a little modification we can achieve elliptical motion



Crank-rocker
$s+l < p+q$
(continuous motion)

which can be used for stop and moving motion of parcels on conveyor.

The framework design requires DC motor, shafts, frame body and platform on which the parcels are transported. The mechanism is operated with crank and links arrangement. All the links are made up of mild steel including the head which is in a direct contact with the boxes that are to be transported. The prototype is expected to move parcels of 500gm to 1Kg approximately

This invention relates to improvements in transfer and conveying devices, and it relates particularly in transfer of packages in industry which needs sporadic movement as of box wrapping industry , quality check process etc. Usually, the operation in these industries is carried out by programmed conveyor belts with means of a switch which gives higher handling cost. It has been estimated that average material handling cost is roughly 20 to 40 % of the total cost. Thus, we can enormously reduce the cost of production of an item by making a saving in the material handling cost.

PROBLEM IDENTIFICATION:

Existing material handling and assembly line systems are quite versatile and robust, majorly because of growing industrial needs, modern technologies and R&Ds rigorously carried out to get better, more efficient, worker friendly and cost effective material handling systems.

Currently the typical systems in use are-

1. Conveyor roller.
2. Chain Conveyor
3. Conveyor belt

Also along with these systems, they employ various methods and mechanisms to obtain intermittent motion-

1. Geneva drive
2. Stepper motor

All this existing technology carries some disadvantages which can be overcome by our automated industrial conveyor

- Shortcomings and disadvantages of Geneva drive:
  - There is a discontinuity in the acceleration when the drive pin enters and leaves the slot. This generates an "infinite" peak of jerk (Dirac peak), and therefore vibrations.
  - Dwell period for a particular assembly cannot be changed.

- Shortcomings and disadvantages of stepper motor:-
  - Require a dedicated control circuit
  - Use more current than D.C. motors
  - Reduced torque at increased speed
  - Probability of resonance under certain conditions.
  - Not easy to operate at extremely high speeds.

- Replacing human operators in mundane tasks:-
  It can replace humans in tasks that are done in treacherous environments (i.e. fire, space, volcanoes, nuclear facilities, underwater, etc) Making tasks that are beyond the human capabilities such as handling too heavy loads, too large objects, too hot or too cold substances or the requirement to make things too fast or too slow.

- Advantages over programming:-
  Current technology is unable to automate all the desired tasks. Unpredictable development costs. The research and development cost of automating a process is difficult to predict accurately beforehand. As this cost create a huge impact on revenue generation, it's possible to finish automating a process only to discover that there was no financial profit in doing so. Initial costs are relatively high. The automation of a new product required a huge initial investment in comparison with the unit cost of the product, although the cost of automation is

AJCSE, Jan-Feb, 2017, Vol. 2, Issue 1

spread in many product batches. The automation of industry requires a high initial investment too, although this cost is distributed in the materials to be produced.

SOLUTION:

Automated Industrial Conveyor mechanism can be an easy to manufacture and assemble material handling mechanism and with the Make In India campaign on rise in India, there is a wide scope for acceptance for this project as no import or engineering team from other countries is required.
Also it can be helpful at inaccessible by human assembly lines because of its very definitive placement and transfer of each unit.
Small scale and workshop level manufacturing can easily exploit this technology and with proper research and development, the mechanism can be fruitful for major industries too. A less noise producing and easy to maintain box transfer mechanism with long operation life can be easily designed.

METHODOLOGY:

DESIGNING

There is a necessity to develop the design, procedure and production of four bar mechanism which provides output motion for a specific input motion. In order to minimize cost and maximize efficiency, a designer will choose the simplest mechanism possible to accomplish the desired motion.
Mechanical Design is the processes of conception, visualization, determination, calculation and specification which can be defined as the process by which resource is converted into useful mechanical devices, or mechanisms which are used to obtain a particular design which facilitates the need of the common folk. Machine design can lead to the formation of the entirely new machine or it can lead to up-gradation or improvement of the existing machine. Let's say if the existing gearbox has varying weights and cannot sustain the ideal loads, entirely new gearbox can be designed. But if the same gearbox has the potential to lift more loads, it can be upgraded by making certain important changes in its design. We have built a design based on principle mechanism on solid works software.
The several parts of the machine are as follows:

1. Carrier
2. Turning Pair Link (shaft 1)
3. Sliding Pair Link(shaft 2)
4. Hangar
5. Coupler
6. Crank

When selecting a mechanism type to be designed, link lengths must be determined by a process called dimensional synthesis. Dimensional synthesis involves an iterate- and-analyze methodology which in certain circumstances can be an inefficient process; however, in unique scenarios, exact and detailed procedures to design an accurate mechanism may not exist. The pictures shown below are for illustration purpose only.
The actual parts may not be exactly same as shown below.

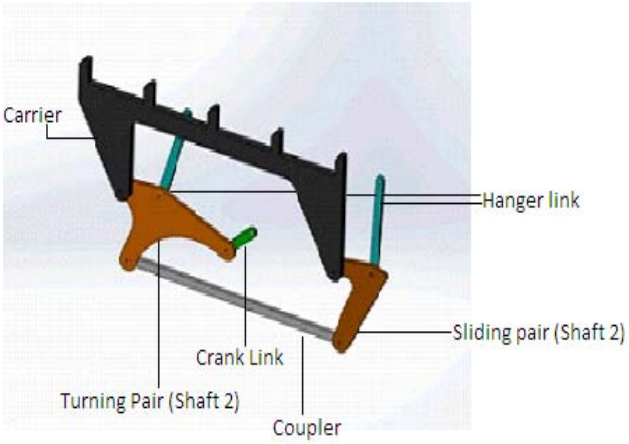


Fig: 4.1. Design of Main Frame

FABRICATION:

Selection of materials was crucial element in fabrication of model. Deferent materials and tools were selected according to their strength and stability. Following tools and materials were used in fabrication.

- MS SHEET, STEEL GRADE ALUMINIUM, HAMMER, DRILLING MACHINE, STEEL RULE, TAPE MEASURE, MARKING GUAGE, ANVIL, ROUGH FLAT FILE, SPANNERS, RIVETS, BOLTS,DC motor, LINKAGES.

Fabrication was carried out in two stages first of supporting frame in which MS sheet was machined under various operations to produce a robust supporting body for the mechanism. Second stage included fabrication of main frame of linkages consisting of both shafts and coupler with hangers and carriers.

Fig: 4.2. Supporting Frame

Fig: 4.3. Main Frame

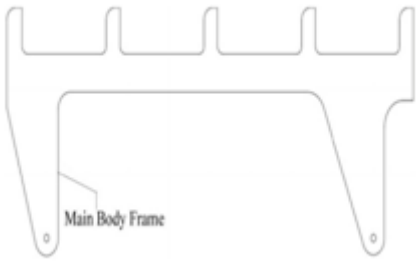
These are the operations which were done on the machine:

- Machining
  In this project it is used to cut the raw material such as plates, rod. This is done by arc cutting machine.
- Drilling
  Drilling is used to produce holes in objects. In this project the square type pipe required the holes for making rake assembly. These holes are done by vertical type drilling machine.
- Fine Grinding
  It is nothing but a grinding process, which is done as smooth with fine grains. It is done by convention grinding machine.
- Cleaning
  It is the operation to clean the all machined parts without burrs, dust and chip formals. By cleaning the parts they are brightened and good looking.

ASSEMBLING:

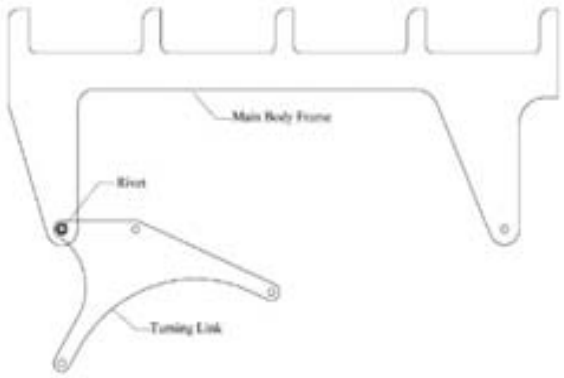
We have five steps to complete assembly of Metal Body Frame.

STEP: 1



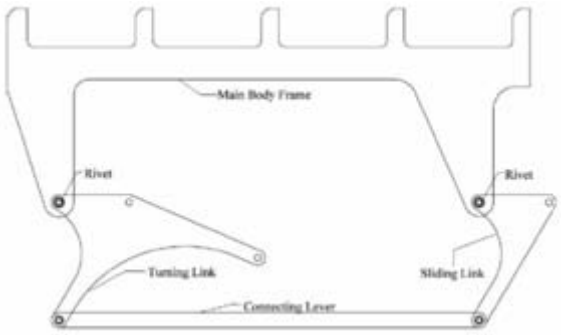
This is a first step to doing Sub-Assembling of our Metal Body Frame.

STEP: 2



This is a second step for sub-assembling of metal body frame. In this sub assembling Turning Link is connected to left side of the main body frame by using rivet and while assemble we should maintain some gap between this two links for a free movement turning link this gap maintain with the help of bush. Here, we use “loose running fit” between links.

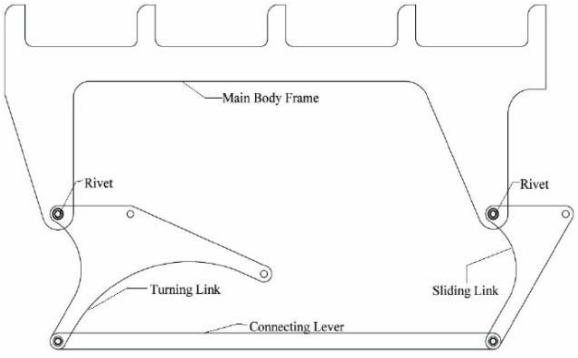
STEP: 3



This is the third step for sub-assembling of metal body frame. In this assembly, sliding link is connected to right of the main body frame by using rivet and we also maintain some gap between these two links for free movement of sliding link when it slides over the main body frame this gap maintain with the help of bush.

Here we should maintain equal gap between turning link (shaft 1), sliding link (shaft 2) and main body frame (carrier).We use “loose running fit” between links.

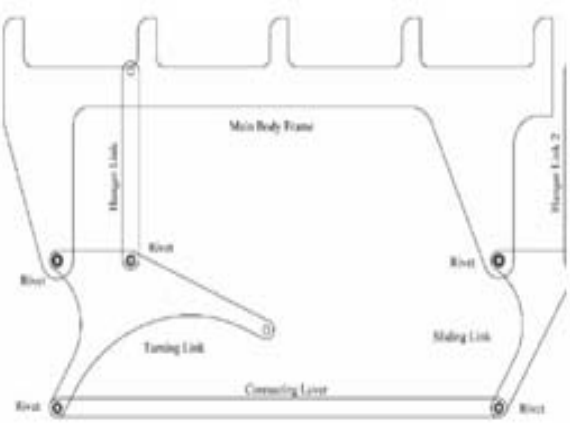
STEP: 4



This is the fourth step for sub-assembling of metal

body frame. In this assemblage, sliding link is connected to right of the main body frame by using rivet and we also maintain some gap between this two links for free movement of sliding link when it slides over the main body frame this gap maintains with the help of bush.
Here, we should maintain the equal gap between shaft 1(turning link), shaft 2 (sliding link) by using washers. We use "loose running fits" between links.

STEP: 5



This is fifth step for sub-assembling of metal body frame. In this assemble, two hanger links are connected to right of the sliding link as well as right side of the turning link by using rivet and we also maintain some gap between this links for free movement of links and other side of this hanger are connected to wood frame 1.

CONCLUSION:

Dynamic analysis is of great importance in designing of the system. A computational model and simulation can give optimal understanding of rigid system parameters. Development of a perfect mechanism can be achieved through accurate mathematical modeling with varied simulations required for the kinematic and dynamic analysis of the mechanical systems and are used for accuracy and precise application in the industrial works.
In the industrial processes automation is one step ahead of mechanization. Mechanization only provides muscular support which reduces muscular work needed while performing an operation, thereby reducing the mechanical work to be done whereas automation not only assists the mechanical support but also the psychological support reducing the mental stress of varied mental problems which entails while working on a production. Processes and systems can also be automated. Automation though may be a minute difference in the system process but provides a transcendental role in the sphere of economy and daily life. We strive to combine automated devices with mechanical systems and organizational tools to create unique system in a rapidly changing world of technology.

REFERENCE:

1. "A Review on Kinematic and Dynamic Analysis of Mechanism" by Shrikant R. Patel, D. S. Patel, B. D. Patel.
2. SOLIDWORKS 2016 and Engineering Graphics: An Integrated Approach by Randy shih.
3. https://en.wikipedia.org/wiki/Four-bar_linkage.
4. Parallel Kinematics: Type, Kinematics, and Optimal Design by Xin-Jun Liu, Jinsong Wang.
5. Kinematics: Theory and Applications by Jens Wittenberg.
6. A Text Book of Theory of Machines by R. S. Khurmi, J.K. Gupta.
7. Mechatronics – Electronic Control Systems in Mechanical and electrical Engineering by W. Bolton