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"DESIGN OF A SIMPLIFIED VERTICAL CONVEYOR SYSTEM"

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Abstract - *This project is related to transferring goods from a first horizontal to second horizontal conveyor comprising a substantially upright extending frame- endless drive arranged on the frame and drivable by a motor; at least one support member which is connected to endless drive and which is drivable in a circuit by means of the endless drive.*
At least one product carrier connected to the support member, wherein the product carrier is connected to the support member for rotation about lying shaft extending transversely of the frame, wherein the product carrier is connected drivably to no more than only one trolley.
So, it is basically a vertical conveyor with a carriage which is mounted on endless chain and it lift boxes in vertical direction and dispatch them on another horizontal conveyor synchronized with it.

Key Words: **Cart, Back mechanism, Path, Case, bucket chain, fork.**

1. INTRODUCTION

A vertical conveyor is a machine which can be used to move products automatically from one level to another. In internal logistics, there are various ways for getting product flows up or down. A solution which is often used is the deployment of incline or lowering belts. When placed at an angle in order to bridge a height difference, such belt conveyors also have the advantage of covering a certain distance. A disadvantage is the loss of much useful floor space as a result of the presence of the necessary supports for the belt conveyor. A bigger distance over a smaller floor area can be bridged using a product lift or a vertical conveyor. A continuous conveyor or a discontinuous conveyor can be chosen as a vertical conveyor. Continuous conveyors can take the form of a spiral conveyor, an L-shaped conveyor or platform lift or a product lift fitted with a fork. But, the complexity of the design along with the manufacturing and maintenance cost associated with it does not attract the small scale industries.

1.1 Types of conveyors

1. Belt conveyor
2. Inclined conveyor
3. Vertical conveyor
4. Screw conveyor
5. Spiral conveyor

1.2 Specific requirements which the above mentioned systems cannot fulfill completely.

1. Continuous operation.
2. It should occupy minimum surface area.
3. Synchronized operational speed.
4. Must carry and deliver fragile material safely without vibration or shocks.
6. Provision needs to be there to maintain required tension in the drive.
7. Minimum travel distance and time.
8. Minimum cost.
9. Easy to assemble and disassemble.

2. Proposed Design

The above mentioned requirements can be fulfilled by using an advanced vertical conveyor system which uses a chain drive for an effective continuous operation .Two sprockets separated by the required distance (depending upon the required height of the conveyor system) are linked by the chain with bucket chain links placed meticulously to mount the carts which has the carrier fork as an integrated part of it in order to carry the material. The Back Mechanism is design specifically to make sure that the orientation of the fork which carries the material remains the same irrespective of the cart's position.

2.1 Design over view

A detailed design has been made with an integrated set of parts which works collectively to obtain desired results.

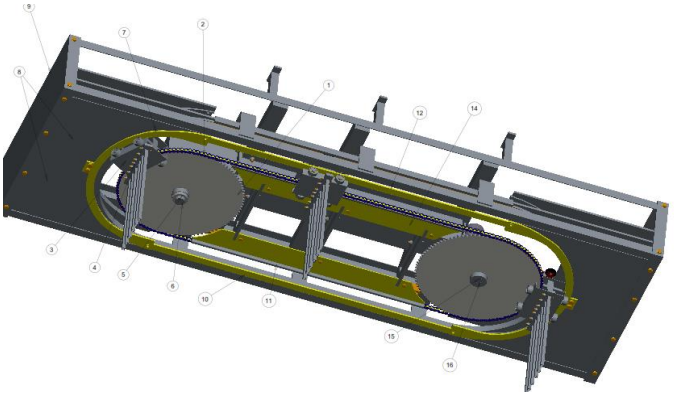

Fig -1: Final assembly

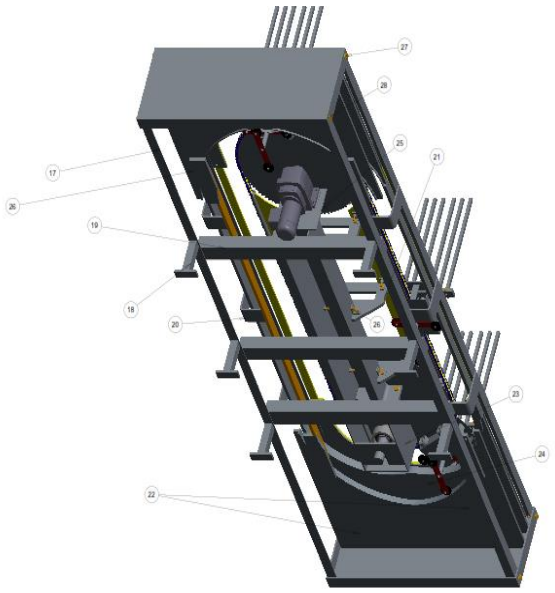

Fig -1.1: Final assembly (another angle)

Table -1: Parts used in the Conveyor.

Sr No.	Part	Material	Quantity
1	Sprocket	Cast Iron	2
2	Roller Chain	As per catalogue	length
3	Cart	Mild steel	10
4	Fork	Steel	10
5	Adjusting ring	As per catalogue	2
6	Dead shaft	Steel	1
7	Front wheel curve	Mild steel	4
8	Front Curve	Mild steel	4
9	Base Plate	Mild steel	2
10	F.W strip	Mild steel	1
11	Chain guide	Mild steel	2
12	F.W strip 2	Mild steel	1
13	Bearing housing	As per catalogue	1
14	F.W path	Mild steel	2
15	Barrel bush	Brass	1
16	Gear box shaft	Steel	1
17	L-clamp support	Mild steel	4
18	Wall support	Mild steel	6
19	Horizontal support	Mild steel	3
20	Clamp support	Mild steel	6
21	Trapezium	Mild steel	3
22	Vertical curve	Mild steel	4
23	Dead shaft block	Mild steel	1
24	Horizontal curve	Mild steel	4
25	Motor base plan	Mild steel	1
26	Connectors	Mild steel	15
27	Bolt Dia:16mm	Steel	45
28	Nut size:17	Steel	45
29	Washer D:17	Steel	45
30	Nut size 24	Steel	45
31	Nut size:17	Steel	45
32	Washer Dia:13	Steel	45
33	Back mechanism	Mild steel, Steel, nylon	10
34	Vertical path(back wheel)	Steel	4
35	Motor	Manufacturer	1
36	Gear box	Manufacturer	1
37	Vertical support	Mild steel	1
38	Pin(shaft block)	Mild steel	2

3. Methodology

The computer aided design software Creo-2.0 was used to make the detailed design so that analysis and manufacturing can be done easily.

3.1 Selection of Chain

Assumption: 10 boxes (or pallets with material) would be handled by the system at any an instance.
Thus,
Weight of Material + weight of Cart mounted along with the trolley=50kg
Tensile load acting at an instance=50*10
=500kg

ASME/ANSI B29.1-2011 Roller Chain Standard Sizes

Size	Pitch	Maximum Roller Diameter	Minimum Ultimate Tensile Strength	Measuring Load
25	0.250 in (6.35 mm)	0.130 in (3.30 mm)	780 lb (350 kg)	18 lb (8.2 kg)
35	0.375 in (9.53 mm)	0.200 in (5.08 mm)	1,760 lb (800 kg)	18 lb (8.2 kg)
41	0.500 in (12.70 mm)	0.306 in (7.77 mm)	1,500 lb (680 kg)	18 lb (8.2 kg)
40	0.500 in (12.70 mm)	0.312 in (7.92 mm)	3,125 lb (1,417 kg)	31 lb (14 kg)
50	0.625 in (15.88 mm)	0.400 in (10.16 mm)	4,880 lb (2,210 kg)	49 lb (22 kg)
60	0.750 in (19.05 mm)	0.469 in (11.91 mm)	7,030 lb (3,190 kg)	70 lb (32 kg)
80	1.000 in (25.40 mm)	0.625 in (15.88 mm)	12,500 lb (5,700 kg)	125 lb (57 kg)
100	1.250 in (31.75 mm)	0.750 in (19.05 mm)	19,531 lb (8,859 kg)	195 lb (88 kg)

Fig -2: ASME/ANSI B29.1-2011 Roller chain Standard Sizes

Calculation:
Pitch=1 inch
Tensile strength=5700kg
Tensile strength considering factor of safety=5700/9
=950kg.
Taking the distance between the two sprockets=12 meters
Hence,
Chain Length= 2*1200+ 2(Semi circumference of Sprocket)
= 2400+2(125.6)
= 2651.2 cm
Number of kinks = Chain length/Pitch
= 2651.2/2.54
= 1043 links

3.2 Determining sprocket diameter

Considering the size of the trolley and also keeping the fact in mind that two trolleys will pass side by side. It was necessary for us to keep some distance between the two.
Thus,
Diameter=80cm
Pitch =1 inch

3.3 Design of bucket chain

Type: Roller bucket chain
Pitch=1 inch
The chain link has been shown in green colour. This link helps us to mount the cart over the chain easily.

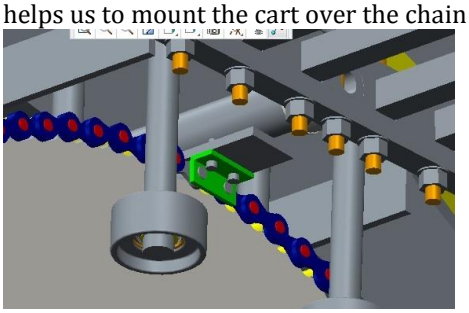

Fig -3: Bucket chain

3.4 Design and Assembly of Cart

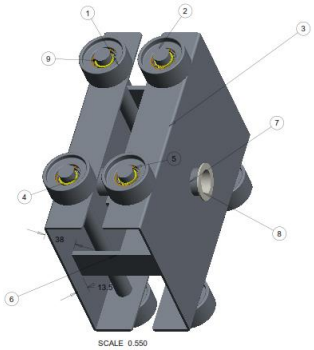

Fig -4: Cart assembly

Table -2: Parts used in the cart

Sr No.	Part	Material	Quantity
1	Cart wheel	Nylon	8
2	Cart shaft	Mild Steel	2
3	Cart plate	Mild Steel	2
4	Snap Ring ID 19.55mm	Steel	8
5	Snap Ring ID 30mm	Steel	8
6	Supporting element	Mild Steel	3
7	Cart pipe	Mild Steel	1
8	Flanged bush	Rubber	2
9	Bearing skf 61804	Steel	8

The assembled cart is fixed with the chain my the means of the bucket chain links. The cart can move along with the chain which is actuated by the rotating sprocket.

3.5 Fork

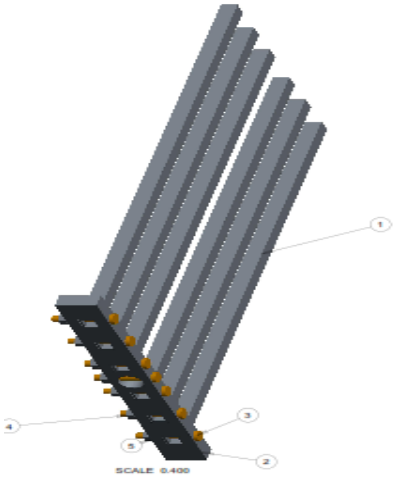

Fig -5: Fork Assembly

It basically carries the material over the entire travel distance. The design has been made such that it can be dismantled easily.

Table -3: Parts used in the fork

Sr no.	Part	Material	Quantity
1	Part 1	Mild steel	6
2	Part 2	Mild steel	1
3	Bolt D10	Steel	7
4	Nut Size 17	Steel	7
5	Washer ID 11mm	Steel	7

3.6 Back mechanism assembly

Being in direct contact with the fork, it makes sure that the fork's orientation does not change over the entire travel distance. The interface between the path and the wheels of the back mechanism helps the fork to stay steady irrespective of the cart's position

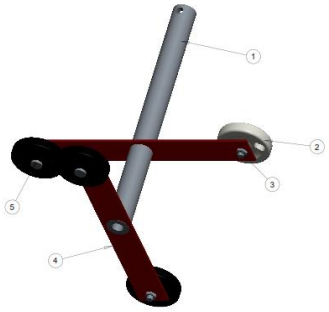

Fig -6: Cart assembly

Table -4: Parts used in the Back mechanism

Sr no.	Part	Material	Quantity
1	Cart Shaft	Mild steel	1
2	Back wheel	Nylon	4
3	Nut	Steel	4
4	Plate	Mild steel	2
5	Bolt	steel	4

3.7 Case

The case not only provides a strong support to the entire assembly but also has the "paths" as the integrated parts of the case. The interface between the path and the wheels of the back mechanism helps the fork to stay steady irrespective of the cart's position. The yellow colored paths have no role to play in stabilizing the fork, they are merely provided to stabilize the movement of the cart along with the chain. The case, largely consisting of parts made of mild steel requires a very minimum welding as most of the parts including the paths have been connected by the means of hexagonal nuts and bolts of suitable sizes. It is also provided with wall supports so that the mechanism can be rigidly installed at the end user's facility.

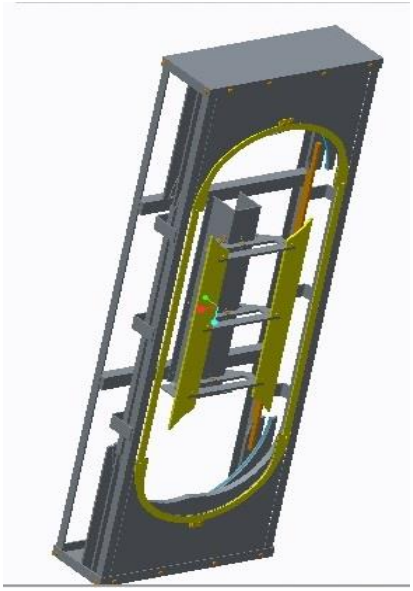

Fig -7: Case

3.8 Interfacing the wheels of Back mechanism and the paths of the case.

The minimum of two wheel stays in direct contact with the carefully designed paths so as to make sure that the fork remains steady irrespective of the cart's position. Each wheel is provided its respective path integrated with the casing. In fig-8, it can clearly be seen that the orange colored path obstructs the clockwise and anti-clockwise motion of the back mechanism which is connected directly with the fork. Thus, the steadiness of the back mechanism results in the steadiness of fork.

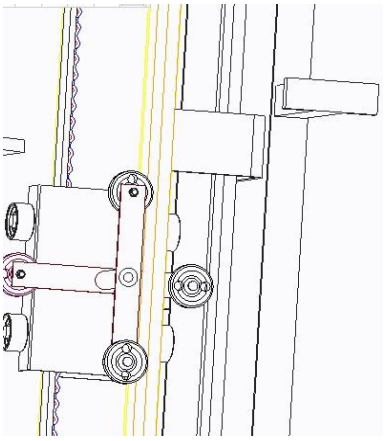

Fig -8: Cart position-1

The fig-8.1 and fig-8.2, shows the same principle of two wheels of the back mechanism being in direct contact with their respective paths even at the curves that has been precisely design by using Creo2.0 so as to make that sure that the movement can be achieved with minimum vibrations.

Each and every path has been designed individually so that the manufacturing can become simple.

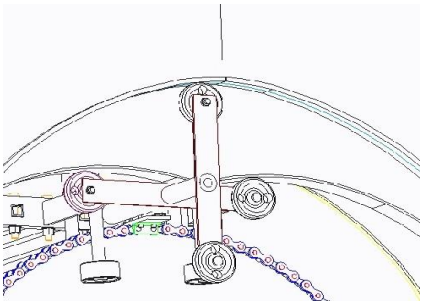

Fig -8.1: Cart position-2

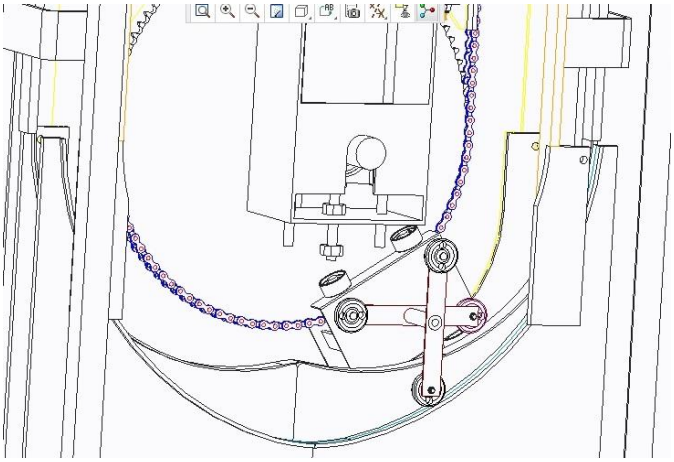

Fig -8.2: Cart position-3

4. CONCLUSIONS

Hence, it can be concluded that the proposed design is relatively simple as compared to the ones available in the market. Thus, it is easier for the local manufacturers (INDIAN) with very basic machine tools to manufacture this product. Also, design is compact and robust. The parts used in the design including bearing, chain, sprocket, gearbox, motor etc. are easily available in the market. The chain drive ensures a continuous and safe operation. The number of boxes to be delivered varies upon the number of carts connected and the gearbox & motor specifications. The design is created in such a way that modifications can be made according to the ever changing requirements.

REFERENCES

[1] R.S Khurmi, J.K Gupta. A Tetxbook Of Machine Design. Chapter- Chain drive.14th edition. New Delhi. S. Chand & Company Pvt. Ltd. 2013

[2] V.B Bhandari. Design Of Machine Elements. 2nd edition. Chapter-Chain drive New Delhi. Tata Mcgraw-Hill Publishing Limited.2008