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Design and Fabrication of Orbital Wrapping Machine

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Abstract –A stretch-wrapping machine consists of a revolving ring with a packaging material dispenser mounted to it. The ring revolves about a horizontal axis to dispense the stretch wrap material around a load that is supported by conveyor. The revolving ring is mounted on a track to allow the ring to travel back and forth in a direction perpendicular to the ring. This allows the machine to wrap any load that fits within the ring. Thus, the length and the weight of the load do not limit the wrapping capability of the machine.
A system designed to offer high productivity and the best quality in packaging through advanced technology industrial machinery. The system allows two types of packaging; we can totally wrap the product for those cases in which the package obtained must be closed, or we can only treat the upper face (the front and rear parts are also protected).In this second case, we obtain a significant saving in the quantity of packaging material used. The operation of the system is simple but effective. The product will arrive with the protective material arranged in the position in which it will be finished, either by wrapping it with our orbital stretch wrapper or by bagging it with a shrink tunnel.

Keywords-Stretch-wrapping machine.

1. INTRODUCTION

Orbital Wrapping Machine and approach discipline of the Invention This technology relates to a packaging machine and method and is also notably associated with a method and machine for wrapping several products over a pallet with a packaging cover material for shipping and delivery and storing.Track record of your Innovation A lot of packaging techniques happen to be utilized to safely wrap a lot fortransportation and storage, and stabilization. One of the approaches employed entails a stretch wrapping machine, which wraps packaging materials, for instance a stretch place, around the stress. These appliances appear in a variety of designs which include equally automatic and manual devices.

2. LITERATURE REVIEW

The purpose of this literature review is to know the importance of wrapping machines, various types of wrapping machines, the problems that came across while inventing new machines, different methods used in the machinery to resolve various problems. The literature has been taken from US patent Silbernagel 1988, US patent Wiley 2004 and IPC packaging and automation website, also from Lantech Blog.More particularly, the present invention provides an orbital stretch wrap machine that includes a stretch wrap dispenser movable around a load in a wrapping plane, and also movable in a travel direction generally transverse to the wrapping plane.In one embodiment of the invention, the dispenser is mounted on a rotatable ring and the load is extended into the ring for wrapping. The ring defines the wrapping plane and is mounted on a track for movement in the travel direction. The only limitation on the size of the load is that it must fit within the ring.
By allowing the wrapping ring to move back and forth on the track, the machine can wrap loads of any length with minimal or no movement of the material handling equipment. If the load is extremely long (longer than the length of travel of the ring on the track), additional track can be added, and the invention can wrap loads of an almost infinite length without moving the load.

3. METHODOLOGY

An orbital stretch wrapper is a means of applying stretchable plastic film to a load, consisting of a roll (or rolls) of stretch wrap supported on a vertical rotating ring and a means of passing a load through the ring's eye horizontally. Several designs are available.
The item or load can go through the ring on a conveyor or can be placed into the ring by a pallet truck. Small loads can be suspended within the rotating

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ring by hand. Stretch is achieved by creating tension between the load and film roll using a brake or gear ratio system.

4. EXPERIMENTATION AND SPECIFICATION

Fig. 1- Schematic of Experimental Set-up

5. COMPONENTS

Ring: -Ring is main part of orbital wrapping machine. Which rotate with the stretch film and wrap the bar which is feed towards the ring.

Conveyor: - It is used to feed the pipe towards ring with the constant speed and torque, the supporting rollers are mounted on the conveyor which gives the direction to the pipes, bar, etc.

Horizontal Roller (follower): - Rollers are used in the conveyor belt which is connected with the motor to drive in forward direction or towards the feeding direction.

Vertical rollers (supporting rollers): - Supporting rollers are used to guide the pipe towards the ring and support from misguide while wrapping. These are the free rollers.

SMPS: -SMPS is the Switched Mode Power Supply circuit which is designed for obtaining the regulated DC output voltage from an unregulated DC or AC voltage. There are four main types of SMPS such as. DC to DC Converter. AC to DC Converter. We use ac to dc smps.

Bearing:-A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. The simplest form of bearing, the plain bearing, consists of a shaft rotating in a hole. Lubrication is used to reduce friction.

Stretch film:-Stretch wrap or stretch film is a highly stretchable plastic film that is wrapped around items. The elastic recovery keeps the items tightly bound. In contrast, shrink wrap is applied loosely around an item and shrinks tightly with heat.

Pipes:-Hollow steel pipes are available both in rectangular and square shape. These hollow steel pipes are used in various industries vigorously. The advantage of the hollow steel tubes and pipes lies in their trimming process. We use the hollow mild steel pipes to make the frame of the conveyor and ring.

Regulator: - An electronic speed control (ESC) is an electronic circuit that controls and regulates the speed of an electric motor. It may also provide reversing of the motor and dynamic braking. Miniature electronic speed controls are used in electrically powered radio controlled models.

6. CONSTRUCTION AND WORKING PRINCIPLE

It consists of an input and output table, between which a rotating crown (ERL) is located. Its operation is very intuitive: once the product to be packed is located in the center of the entrance table, the process starts automatically. The product advances to the crown, where it is wrapped by the stretch film. In this way, the package is closed and protected on all 4 sides.

The primary wrap is ideal where the material contrasts with the product, such as a package of loose letters. The secondary wrap refers to a situation in which the product is already wrapped using a different style in which this time you need to add a wrap on the top. Then, transit wrap, which is mainly used for the collection of loose products. Then, understanding these functions provides you with a basis for knowing how this particular **stretch wrapping machine** works. Speaking of how it works, the principle is that the product is pushed through a sheet of film that is cut from a single real. What happens is that a longitudinal or base thermal seal is created where the film tends to overlap. Therefore, this equipment consists mainly of different mechanisms. It has a wrapping mechanism, a transport device that receives moves and also downloads the items.

Therefore, the items are wrapped in a turntable or in a line, depending on the construction of the wrapping

machine. This wrapper presents a periodic displacement of an operative member of the wrapper mechanism to another member of this type. This allows one, two or three layers of packaging to take place.

7. DESIGN CALCULATION

Maximum length of the pipe/bar = 200cm.

-length of the feeding and receiving conveyor = 120cm is sufficient.

-Height of the conveyor = 64cm according to the human comfort and ergonomics.

-Width of the conveyor = (max diameter of pipe or width of pipe) + 2 x (diameter of vertical rollers) + (clearance)= 18cm + 2(2.6) cm +1.9cm**Conveyor Width = 27cms.**

- Diameter of Ring = 3 x max (diameter of rod) = 3 x 18= 54cms.= **55cm approx.**

Ring supporting rollers:width = 2.6cmsdiameter= 7cms.Groove diameter= 4cm

Vertical Frame: Height, width of frame = dia. of ring + clearance= 55cms. + 15cms. = **70cms.**

For balancing of vertical frame, **thickness of frame= 20cms.**

Motor selection (drives ring): Outer diameter = 55cms.Inner diameter = 52.5cms.Volume of ring = 412.12 cubic cm.

Mass of ring = Volume of ring x Density
= 412.12 x 8050 x 10^{-6}**= 3.31 kg**

Total mass = mass of ring + mass of stretch film + mass of film holder= 3.31 + 1kg + 0.072kg= **4.38kg**

Torque = Force x radius of driving roller= 4.38 x 9.81 x 2= 85.93 N-cm= **8.76 Kg-cm**Required torque found out to be 8.76 kg-cm

Volume of pipe = Length x πx ($outer\ radius^2$- $inner\ radius^2$)= 120 x 3.14 x ($8.5^2 - 8.3^2$)**= 1266 cubic cm**

Mass of pipe = Volume of pipe x density of material= 1266 x 8.92 x 10^{-3}**=11.29 kg**

Torque = Force x Radius= 11.29 x 9.81 x 1.3=143.98 N-cm**= 14.67 kg-cm**

Bearing calculation: The relationship between the dynamic load carrying capacity, the equivalent dynamic load and the bearing life is given by,

P = equivalent dynamic loadL10 = rated bearing life (in million revolutions) p = 3 (for ball bearing)

The relationship between life in million revolutions and life in working hours is given by,L10 = 60nL10h/106 L10h = rated bearing life (hours)n = speed of rotation (rpm)

For equivalent dynamic load

P = (Wt. of load +Wt. of rollers) × 9.81Wt. of load = 11.29 kg Wt. of rollers= 0.5 kg= (11.29+ 0.5) × 9.81=115.65 N.

Speed of motor (n)= 30 RPM

Velocityv = πDn/60= π × 0.026 ×30/60 = 0.04 m/s

8. CONCLUSION

The aim of the project is to protect the final product came out from the factory or industry by providing a protecting layer of stretch film around the surface of the product.
The purpose of this project is to reduce cost of the wrapping machine which will benefit the small-scale industries or small factories to protect their products from any kind of damage. Industries bear losses while handling the products, thus encasing the product in a stretch film reduces loss of the industries.
After referring to these literatures we have studied various inventions, method, and its importance in Orbital wrapping machine which we will take into consideration while proceeding in to our project.

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