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"Improved Automated Conveyor With Auto Separation System For Oil Packaging Industry"

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Abstract - *In shell India oil industry requires improvement in their existing system for sorting the defective oil cans on the basis of their weight because improved quality of products, improved production rate, reduce cost of production. Today higher speed of the operation and accurate weighting of packages during crossing a conveyor belt has been getting more important in the food and distribution industries. Automation is the use of control system like a computer or robot for handling different process and machinery to replace a human being and provide a mechanical assistant. Meanwhile, Automated Conveyor system it has ability to sorting defective products and improved the quality of products and This is not only reduces manual effort, time consume, but also more time for marketing prevents danger which might occur which human being work-in hazardous environment. Today Sorting of an object based on a weight basis is an integral requirement of most of the industry, which turns production line more effective ended up with great profit to industry.*

Key Words: **Conveyor Belt, Geared D.C Motor, Industrial Scalar , Microcontroller, Conveyor Pulley.**

1.INTRODUCTION

Conveyor belt scales are most important for the production of a great variety of prepackaged product the main aspect of this project is to increase the accuracy and speed of the checking weight of job in industry and accept or reject the job as per predetermined standard set by industry based on scalar and pneumatic system.[1] There are various types of weighing machine are available in the market. This weighing machine are not suitable for the industrial application, because the every industry required automatic weighing control machine are the weighing machine should have automatic control of weight in order to accept of reject the job as per standard weight.[3] This problem sort out by stating design of production lines. Introduction to the increasing level of automation, automatic control technology application in the production of quantitative packaging more and more in food, fertilizer, oil bottle packaging are widely used in industry. Automation system nowadays chosen to overcome this problem and more our design system produces efficient and productive results.

2. EXISTING SYSTEM

Major headings should be typeset in boldface with the words uppercase. In Existing System Some Following Problems are:

In Shell India Marketing Pvt. Ltd at present automated weighing conveyor is used for measuring the weight of the oil bottle carton. This weighing conveyor only weights the oil bottle cartridge and compare the weight manually with the standard predetermined weight of oil bottle. Automated Filling System might filled bottle underweight or overweight, which is sealed and then shift to weighing conveyor and there after if the weight of the cartridge of weighing conveyor according to prescribed standards, then it will accept and transported to packaging otherwise rejected, Which might turn into losses.

3. LITERATURE REVIEW

The automated sorting machine using conveyor belt is integral part of manufacturing industry in many fields is a very complex process. Conveyor belt has ability to detect the object of different sizes having different specifications. Sorting system not only increases the production rate of manufacturing industry, but also reduces the effort of material handling reducing overhead expenses. [6] The objects of different sizes are passed through the sensors and the object having specified size is sorted and other will be terminated. The belt is driven by circular roller drive circuit unit which is controlled by microprocessor and load cell. This modification in object detection system has led to increased in the production volume of the manufacturing industry since these sorting systems replaced by human error detection unit. Also the accidents on the shop floor can be reduced since human operator on manufacturing shop floor had been reduced.

4. PROPOSED SYSTEM

This proposed system gives the convenient approach of automatically detecting the weight of oil bottle on the conveyor system using a Microcontroller for high reliability and fast operation without interruption. This System checks oil bottle weight with load unit cell and if this weight is accurate with predetermined set the value in

microprocessor control unit then this can goes for packaging otherwise terminated for new volume filling.

4.1 Proposed System Components

1) Conveyor Belt:

The conveyor belt consists of two cylindrical roller wheels operated by servo motor which serves the function of pulleys, with a continuous loop of oil bottles which is to be measured is maintained. The conveyor belt rotates over cylindrical wheels .one of the wheels is powered by a DC motor, moving the belt and the oil bottles on the belt forward. Here, the conveyor DC motor receives power and signal from the plc through the rectifier and load cell measured weight accurately.

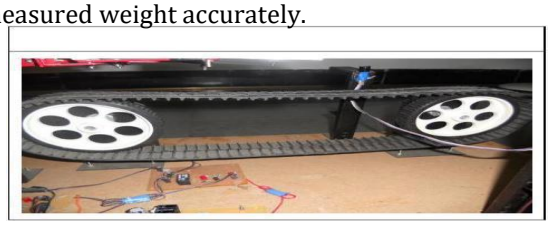

Fig-1: Conveyor Belt

2) Sensor:

A sensor is a device that converts the data (Analog) into data that a computer can understand using ADC (Analog to Digital converter).[7] Some sensors are mechanically controlled, but most sensors are electronically operated receives a voltage signal that can be converted into an accessible output signal detected by the operator. Sensors are used in as detecting agent in the measurement unit of manufacturing industry as well daily stuffs. There are also wide applications of sensor in today's rapid growing world, which include electronically operated cars, machines, aerospace, medicine and robotics.

3) Geared D.C Motor

The Geared Motor is 30 RPM Side Shaft 37mm diameter compact DC Gear Motor is suitable for small robots or automation systems, motor runs smoothly from 4V to 12V and gives 30 RPM at 12V.Motor has a 6mm diameter for excellent coupling. The motor must accelerate the filler mechanism in the direction the bottles are moving, match their speed, and track the bottles. After the bottles have been filled, the bottles go for induction sealing, and then onward goes for packaging.[1]

4) Indicators:

Indicators are used to monitor the system attributes to prescribed value or state condition and acts as an indicator signal, accident signal, fault signal if it is not accordance with system design.

Green indicator: To indicate the oil can weight is accurate.

Red indicator: To indicate oil can weight is not accurate to set the value.

5) Load Cell :

A load cell is a transducer it used to convert a force into an electrical signal. The electronic signal can be a voltage change and frequency change depending on the type of load cell. Load cells are used for a quick and precise measurement. A Strain Gauge is a device used to measure the strain of an object. Resistive load cell is working on the principle piezo-resistivity. When a load/force/stress is applied to the sensor , it changes its resistance. The object is deformed by a fool is deformed, causing its electrical resistance to change. At the heart of electronic scales or weighing machines is a sensor called load cell.

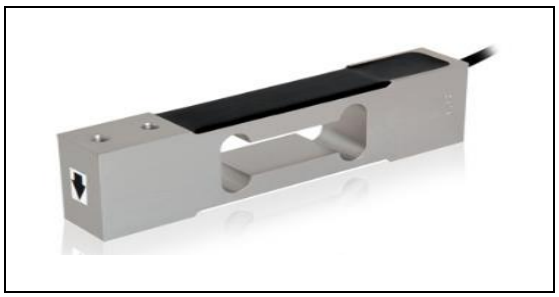

Fig-2: Load Cell

6) Conveyor Pulley:

A pulley is a mechanical device used to change the direction of the belt in the conveyor system, to drive the belt, to tension the belt. The Modern pulleys are made of rolled shells with flexible end disks and locking assemblies [4]. a pulley at the discharge end of a conveyor belt; may be either an idler or a drive pulley. The larger diameter of pulleys in the system and is often lagged to increase traction and pulley life. A pulley at the tail of the belt conveyor is opposite to the normal discharge end; may be a drive pulley or an idler pulley.

7) Sprocket:

Sprockets are used in machinery, tracked vehicles, to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Early automobiles were also largely driven by sprocket and chain mechanism. Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys.

Fig-3: Sprocket

6) Pneumatic Cylinder:

In a pneumatic system, energy is stored in a potential state under the form of compressed air. Working energy (kinetic energy and pressure) results in a pneumatic system when the compressed air is allowed to expand. To perform any applicable amount of work then, a device is needed which can supply an air tank with a sufficient amount of air at a desired pressure.

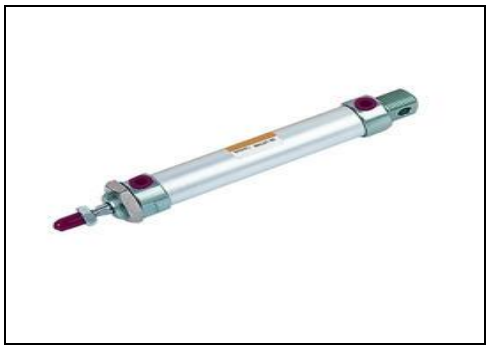

Fig -5: Pneumatic Cylinder

8) Microcontroller: The first and the foremost criterion for selecting a microcontroller is that it must meet the task at hand efficiently and cost effectively. In analyzing the need of a microcontroller based project we must see whether an 8 bit, 16 bit, 32 bit microcontroller can best handle the computing need of the task most efficiently.

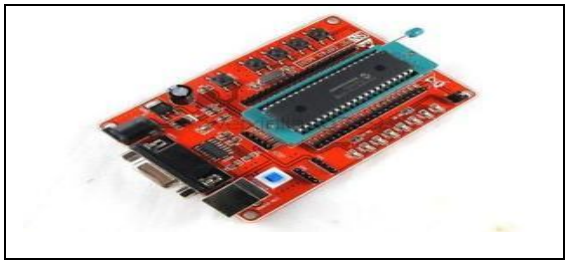

Fig- 4: Microcontroller

9) Solenoid Valve:

A solenoid valve is an electromechanical controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core in its center. This core is called the plunger. In rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts a force on the plunger. As a result, the plunger is pulled toward the center of the coil so that the orifice opens. This is the basic principle that is used to open and close solenoid valves. The term solenoid usually refer to coil used to create magnetic field when wrapped around a magnetic object or core. The solenoid describes transducer mechanism used to convert energy in motion. Solenoid valve are controlled by the action of solenoid and typically control flow of air as a switch. If solenoid is active (Current is applied), it open the valve. If solenoid is inactive (Current does not exist), the valve stay closed. The action of pneumatic solenoid is controlled by pneumatic cylinder.

Fig- 5 Solenoid Valve

4.2 Design Calculations For Proposed System

1) Design of Motor:

Power of motor = 100 w

Rpm of motor = 60 rpm

$$P = \frac{2\pi NT}{60}$$

Where, T is torque generated in N.m

$$= \frac{100 \times 60}{2 \times \frac{22}{7} \times 60}$$

$$T = \frac{50 \times 7}{22}$$

T= 16 Nm

Where T is torque generated on driving sprocket of chain drive.

2) Design of Chain Drive:

Torque of motor to smaller sprocket = 16 Nm

No of teeth on smaller Sprocket = 13

No of teeth on larger Sprocket= 26

Smaller sprocket diameter=25mm

Larger Sprocket diameter = 64 mm

Pitch (P) = 6.25 mm

Velocity of Chain= 300m/Min (Given)

Power On Smaller Sprocket = 100 w

Tooth Load = $\frac{(P)d}{V} = \frac{100}{300\ m/min} = \frac{100}{150} \times 60$ = 20 N

Where P_d is design power in watt.

V is velocity of chain in m/min.

Center Distance (c) = 10 inch = 10×2.54 cm

(c)= 25.4 cm = 254mm

Length of Chain in pitches

Lp= $\frac{T1+T2}{2} + \frac{2C}{P} + \frac{P(T2-T1)}{40\ c}$

Lp= $\frac{13+26}{2} + \frac{2*254}{6.25} + \frac{6.25(26-13)}{40\times25.4}$

Lp= 101mm

Recommended wear load = Fw= 0.35

$(P)^2 = (6.25)^2$ =13.67 N

$$\frac{T1}{T2} = \frac{13}{26} = 0.5 = \frac{N2}{N1}$$

N2= 0.5×60= 30rpm

Torque on output sprocket of chain drive

Torque = $\frac{100}{2\pi\times30/60} = 31.84\ N.m$

3) Design Of Bearing (Ball Bearing)

Dynamic load (c) =6800 N

Equivalent Load (Fe)= 3050 N

Life (L) = $(\frac{C}{Fe})^a$

Where C is dynamic load in N.

Fe is equivalent load in N.

a= 3 (Ball Bearing) Constant.

(L)= $(\frac{6800}{3050})^3$

= 11 million revolutions.

4) Design Of V Belt: Load on belt= 5kg

Belt size= 1"×28"

Belt width= 1.25"

Rpm of pulley = 30 rpm.

(P)= 31.84×$\frac{2\pi\times30}{60}$

(P)= 100w

VR = $\frac{\pi DN}{60} = \frac{\pi\times60\times60}{1000\times60}$ = 0.19 m/s

Fb = $\frac{17.6\times10^3}{60}$

= 293.33 N

6) Design of Pneumatic Cylinder:

Pressure (p) = 4 bar

Cylinder bore = 20mm

Cylinder of stroke= 100mm

A= $\frac{\pi}{4}d^2$

Where d is diameter of cylinder in mm.

= $\frac{\pi}{4} \times (0.02)^2$

= 3.14×10^{-4} m^2

Force

F= PA= $4\times10^5\times\frac{\pi}{4}\times(0.02)^2$

Where pressure act on cylinder in N/m^2

F= 125.6 N

Rpm of Motor = 60rpm

V (m/s) = $\frac{\pi DN}{60}$

= $\frac{\pi\times20\times60}{1000\times60}$

= 0.06 m/s

7) Discharge

Q= AV

= $\frac{\pi}{4}d^2 \times V$

= $3.14\times10^{-4}\times0.06$

= 1884 mm^3/s

8) Stress act on stand

Total weight on stand = 6kg

Total force act on stand is =6*9.8=59N

So weight act on each stand =Total weight/4=14.75N

And hence stress act on each leg = Weight act on each leg/(cross sectional area= 14.75/ (2.54×2.54) =2.54N/cm^2.

5) Experimental Results:

Fig-6: Prototype Setup

In system check the every bottle weight and compare to standard predetermine weight of oil bottle. In case the oil bottle weight is correct then this bottle are goes the cap sealing, otherwise weight is underweight or overweight then pneumatic cylinder is reject the oil bottle The prototype is required the 5 sec per bottle inspection. The automated conveyor belt are move by the D.C motor and then load cell is calculated the weight of product. The load cell is connect to the microcontroller and then this load cell send signal to microcontroller. Microcontroller is control the belt motion and pneumatic system. This system is requiring time to check the every bottle weight is 5sec/ bottle. Hence in one min 12 bottles are check on this prototype.

5.1) Existing System Results:

- Length of belt actually Travel=1 feet= 30.48 cm , Velocity of belt= 0.6 m/s
- Cycle Time= L/v = 30.48/60 =0.5 sec/ Carton.
- In 60 Sec, 0.5*60= 30 Cartons.
- For 30 Cartons, Human Inspection takes 30 sec.
- So total in 1 Min 30 sec for 30 Cartons are Inspected.
- The defective cartons (12 Bottles) sorting time is 2 min per carton.
- So total time is require for accepted carton is 1 min 30 sec and in case the carton is rejected then require one carton (12 bottles) inspected time is 2 min and repassing time is 1 min. So total 4 min 30 sec required if bottle is rejected.

5.2) New System Results:

- In new system 30 sec of human inspection of carton weight measurement is removed.
- In proposed model we reduce cycle time by vanishing human inspection time completely, so in new system I reduce cycle time by 30 sec for 30 carton , so new system is 50% efficient.(personnel resource basis).
- In new system accepted cartons cycle time is only 1 min.
- Also after rejection of carton ,each bottle in carton also measured individually which takes almost 2 min which is also reduced so time reduced drastically in new proposed design.
- So total time is reduce 30 sec (human inspection) + 2 min (Reject cartons sorting time) + 1 min (repassing on serrac line) = 3 min 30 sec is totally reduces in new system.
- Design analysis show the design value of prototype.
- Simulated model of motion tracing done on catia software to depicts requisite motion of different components of product.

5.3 Validation of Results:

- In Existing model for one carton measurement acceptance, rejection takes 1 min 30 sec and also take defective cartons sorting time per carton (12 bottles) is 2 min. And repassing time is 1 minute. Now total time is 4 min 30 sec.
- New system is automatically sort the defective bottle hence 30 sec human inspection time is reduced and also reduced the defective carton 12 bottles sorting time 2 min. And also the repassing time of 1 min.
- Now in New modified system takes only 1 min for entire process completed. Also 2 man required one for rejecting cartridge from serac line and other is for reweighted each bottle in cartridge.
- Each man wage = 10,000 Rs.
- Enterprise overhead expenses reduced by 10000*2 = 20000 Rs. Per Month.
- Expense reduced for per year = 20000×12= 2,40,000 Rs

6) CONCLUSION

In Proposed system is for reducing inspection time on serac line of production. The daily wages for human inspection also reduced. Overall inspection time and enterprise overhead expenses reduced aids in speed up the process as well as improving efficiency of serac line. In proposed system to check the every bottle weight and decide the bottle is passed or fail. The decision to pass or fail a manufactured part based on automatically inspection is extremely important to a production operation. Inspection Improvement are necessary to increase the accuracy of product and improve the performance of inspection processes. This system also reduce the human inspection time and also reduce defective carton sorting time hence reduce the cycle time in these system.

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