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Design of Label Numbering Machine

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Abstract: This machine comprise of both electrical as well as mechanical parts. This machine is used to print the serial numbers and barcodes in the sticker labels. This paper comprises of design and full working of the machine. Three phase induction motor with variable frequency drive is used in this machine. With the help of variable frequency drive, speed of the motor is adjusted easily. Unprinted label roll is placed in one side of the machine. The motor pulls the label roll and after crossing the printer unit the printed labels are winding and placed into the other side of the machine. So speed variation of the motor plays major role in the machine. This machine is also embedded with sensors, so it will easily count how many labels are printed and also the length of label roll in meters. Manual counting of labels takes time consumption and error may occur. It is possible for winding the labels in both forward and reverse direction. These numbering barcode stickers are easy for usage and they are very accurate and durable.

Index terms: **Label Numbering Machine (LNM), Barcode Printing, Serial Number Printing, Induction Motor Speed Control.**

I. INTRODUCTION

In sticker printing industry this machine plays a major role for printing the barcodes and serial numbers in the sticker label roll. The movement of the sticker label roll from one end to other end is done by the induction motor. So the induction motor speed control is the main part in this machine. When the diameter of the sticker roll increases the speed of the motor gets varied so periodically change the speed is required this is fulfil by variable frequency induction motor drive.

This paper based on application of variable speed requirement .Due to smooth operation it has widely used in the application of speeds control of motor. It is a device in electrical system which performs the conversion of single phase or three phase supply of Fix frequency into three phase with variable frequency. This paper is based on Variable frequency drive is basically used where the variable speed is essential [1]. In this paper they focus on reducing drive losses and increasing efficiency. Power loss in induction motor comprised of three components: copper loss of stator and rotor, core loss and mechanical loss. Due to induction motors special design, core loss and copper loss are not well balanced in loads. This model is comprehensive and accurate comprising of all power loss related to flux in drive [2]. This paper the method of speed control of three phase Induction motor using V/F control method which is fed through the direct matrix converter. The open loop V/F control of an induction motor is one of the most common methods of speed control [3].They proposed controller is composed of an adaptive feedforward control term which compensates for the nonlinear and uncertain factors and a feedback control term which guarantees the system stability. This scheme is not only simple and easy to implement, but also it guarantees a precise and fast speed tracking. Fuzzy Pre Compensated Proportional Integral (FPPI) is used to improve motor's dynamic performances during the activation of optimal energy control [4], [5].

This paper is on the design of a paper slitting and rewinding machine for a developing economy which targets small to medium enterprises (SMEs).The current problem is the high cost of this machines on the market hence most SMEs in a developing economy cannot afford them. Through careful analysis of current machines, use of alternative cheaper materials and use of more energy efficient drive mechanisms [6]. This machine is similar to our project but Paper winding machine is one of the simplest machines which winding the paper in needed amount. The winding mechanism is used for different purpose such as winding the coils, winding the silk in textile industries. It takes more time and the accuracy of the production was very less [7].

They design the silk winding machine is that to reduce the time for the winding of silk. The job of winding the silk is very tiresome. Also time required for the winding varies largely from worker to worker, thus making process is time unpredictable. Their silk winding machine, controlled electronically. The paper starts with review on the existing rewinding machines and understanding affective analysis in surrounding work [8], [9].

II. Block Diagram of Machine

The below Fig.1.shows the general block diagram of Label Numbering Machine.

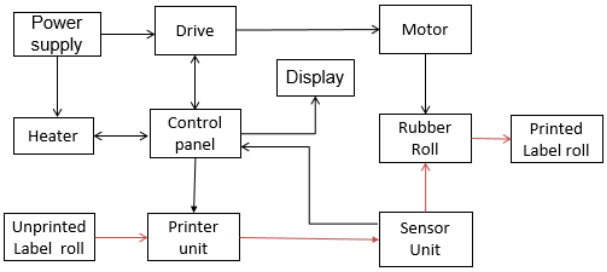

Fig.1. Block diagram of LNM

The Power Supply is given to drive and heater. The drive is used to control the speed of the induction motor. Control panel is the brain of this machine. Because all the operations should be done only through the control panel. It includes Motor control switches, Heater control switches and Display devices. The heater will generate heat with the help of fringed Steel. Power supply is given to the steel so the steel is heated. Centrifugal fan is used here to pass hot air from heater to printer unit. Inside heater temperature will sense by the Sunbeam Switch (or) Thermostatic switch it has placed in the control panel.

The Thermostatic switch which helps to control the temperature of heater. Set the value of temperature in Thermostatic switch (100,200,300…). Now comes to the Main work of machine. It helps to print the Barcode and serial number in Labels. The motor pulls the unprinted label roll. In between the unprinted roll to Rubber roll the Printed unit and Data logic sensor is placed to count the number of Labels in meters. After crossing the Printed Labels it has winded on other side. Finally the expected output printed labels will obtained.

III. Circuit Diagram of Machine

A. Control Panel circuit:

The below Fig.2.shows the Control Panel Circuit diagram of Label Numbering Machine. Control panel plays a major role for this machine. Because whole controlling of the machine is done through this area only.

This control panel has the following major components length counter, batch counter, thermostatic switch, pot switch for speed variation, indicator light and other control switches.

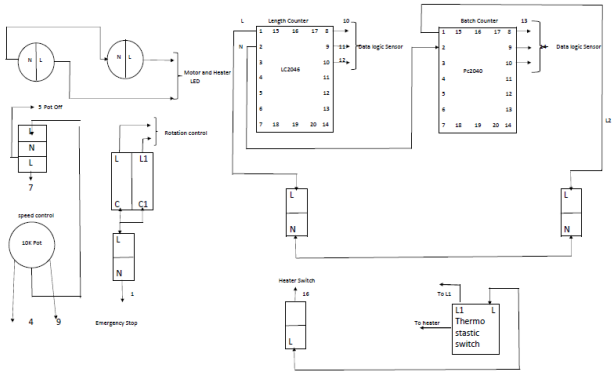

Fig.2. Control Panel circuit diagram

The length and batch counter embedded with data logic sensor. The length counter and batch counter indicates in display for that the total number of labels in meters and also individual count. The pot variation is used to adjust the sticker label winding speed. The thermostatic switch is to control the temperature in heater unit.

B. Main Circuit:

The main circuit diagram consists of induction motor drive connection. The below Fig.3.shows the main Circuit diagram of Label Numbering Machine.

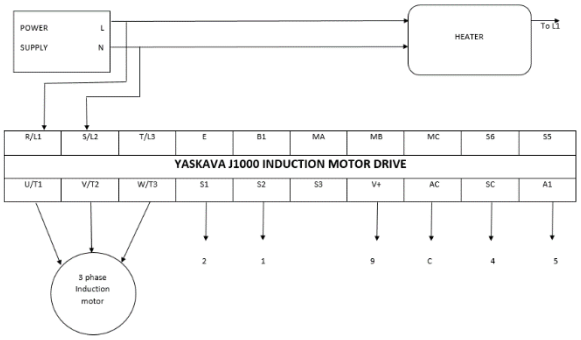

Fig.3. motor with drive circuit diagram

The single phase power supply is given to the heater and drive terminal S1 & S2. The terminal T1,T2 &T3 is output from the drive fed to the motor input terminal. The terminal A1& Ac is the speed adjustment terminal. This input is fed from the control panel terminal. The port V+ is used to change the direction of the motor rotation.

This command is also fed from the control panel .The speed variation of the motor is directly proportional to the frequency. The frequency variation is done by pot switch.

Speed α frequency ……. [1]

$N = \frac{120\ F}{P}$ ……. [2]

Where,

N= Speed

F= Frequency

P= Number of poles

IV. HARDWARE IMPLEMENTATION

The below fig.4 is the basic hardware structure of L.N Machine. This steel stand is made up of stainless steel. The length, breadth and height are 183.5cm, 46cm and 89cm respectively.

Fig.4. Basic structure of LNM

The major components used in this L.M. machine are Yaskava drive, heater and control panel. The drive and heater are placed under this structure. The printer unit is above the machine. Control panel islocated top right corner of this machine.

A. Yaskava drive:

The below fig.5 is the drive connection with motor. The function of this drive is speed adjustment and motor forward and backward control. This drive has input voltage is the range of 200v to 240v, 50Hz, 13.8A. The drive can deliver output as 0v to 240v, 400Hz, 6A.

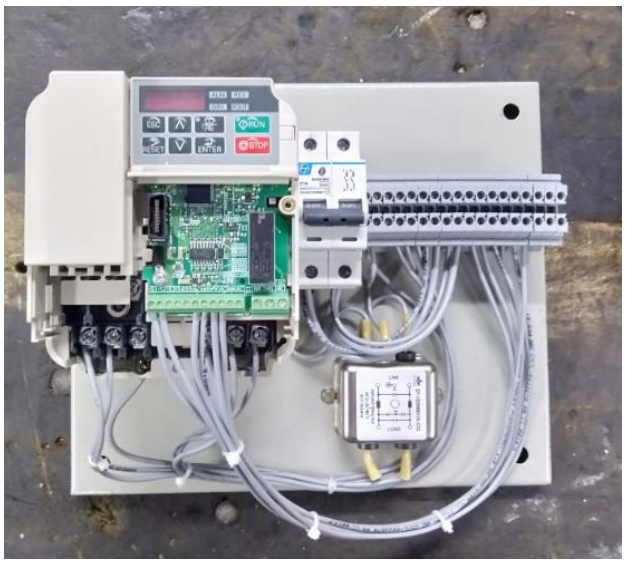

Fig.5. Motor drive connection diagram

B. Heater:

The below fig.6 represents the heater part of L.N. machine. The fringed steel is used as the heating element. When the power supply is given to this steel it is heated. So hot air is produced in this chamber.

Fig.6. fringed steel & centrifugal fan used as heater

The centrifugal fan is used here this fan delivers hot air to printer unit. The gas filled Thermostatic switch is placed inside the heater chamber. This is used to control the temperature of heater.

C. Control panel:

Control panel is not a component it is one of the major part of this L.N machine.The below fig.7 shows the control panel of L.N machine.

Fig.7. Control panel of LNM

In this control panel it is easy to viewhow many number of labels printed in batch as well as length in meters.

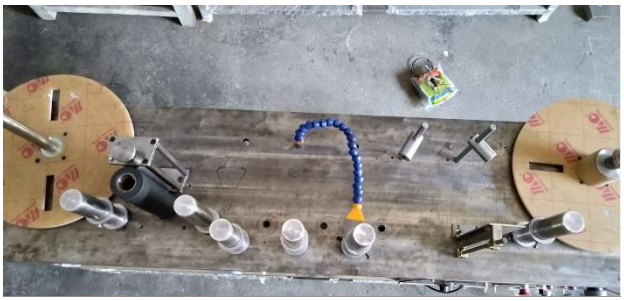

Fig.8. Top view of LNM

The above fig.8.shows the top view of L.N. machine. From this top view it has been seen that two end label roll winder, rolling rod,nip roll and rubber roll. The printer unit and data logic sensor unit also placed near to the rolling rod. There are 5 to 7 rolling rods are used to carry the label roll from unprinted to printed winding. The nip roll and rubber roll used to pull the printed sticker labels.

The below fig.9.shows the sectional view of L.N. machine. The unprinted label roll is placed one edge of this machine shows fig.9. A small roll adjustment has been fixed in the control panel. This adjustment helps to improve the tightness of the sticker label roll. In this machine can load up to 60 to 70 meters of the unprinted sticker label roll. The output is also same printed label roll.

Fig.9. Cross sectional view of LNM

Fig.10. Front view of LNM

This machine has Capable of handling wide range of Labels and papers.More number of Labels can printed easily.The printed barcode labels are used in various industry.

Fig11. Side view of LNM

V. Three Dimensional model of LNM

The below three fig 12, 13& 14 shows three dimensional model of L.N.M.

Fig12. Front side model of LNM

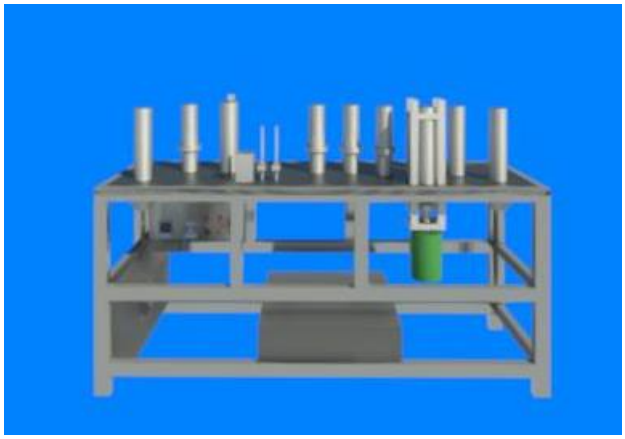

Fig13.Back Side model of LNM

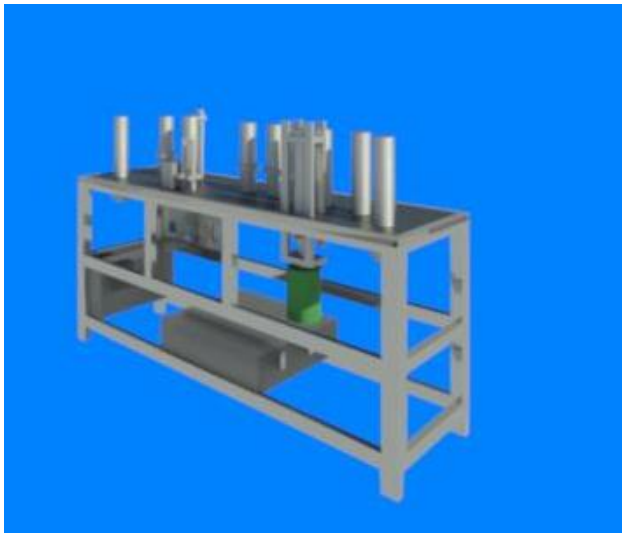

Fig14.Cross Back Side model of LNM

VI. CONCLUSION

This machine is able to count the total number of sticker labels and also measure the sticker labels in meters. Manual counting of labels to cause time consumption and sometime error may occur. In this machine automatically count the sticker labels quickly with short time. It is capable of handling wide range of sticker labels. From this project can assure that machine wind the labels up to 50 to 60 meters. Already existing machine wind the labels tightly. By the use of speed control to wind the labels freely. It has been used to avoid the spreading of ink. This machine will be used for printing industry.

VII. ACKNOWLEDGMENT

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