International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.03, February 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

AUTOMATION OF PAPER INSULATION INSERTING SYSTEM IN ROTOR

Rohit E. Patil[1], Nikhil N. Salunkhe[2], Abhijeet R. Mane[3], Pavan V. Jadhav[4], Prathamesh V. Dinde[5], Pratik A. Kulkarni[6], Prof. A.K. Parekh[7]

[1,2,3,4,5,6]BE Student Department of Mechanical Engineering,
Nanasaheb Mahadik Collage of engineering, Peth.
[7]Professor Department of Mechanical Engineering,
Nanasaheb Mahadik Collage of engineering, Peth.

ABSTRACT

In automobiles alternators are used to charge the battery and to power up automobiles electric system when its engine is running. The main components of an alternator are rotor assembly, stator and carbon brushes with rectifier. The rotor and the stator are the two components that generate power. The stator must be insulated before and after winding the coil on the stator in order to isolate the winding from other components. This procedure is essential to avoid any chance of short circuit. Insulation provided before the winding is called as inner insulation. This is done by inserting paper pieces inside the slots provided in stator for winding. At present a standard semi-automated paper insertion machine is used for this process. This project named 'Automation of stator insulation process in alternator manufacturing industries' is aimed at automating the insulation process and integrating the sealing operation along with insulation process hence simplifying the overall process. The scope of this process is limited to these parameters, to reduce the man power and to reduce the whole cycle time, and to increase the productivity.

I.INTRODUCTION

Now a day in the motors and generator manufacturing industries uses traditional way of paper insulation inserting for manufacturing or rewinding any motor or generator. In the traditional way of paper insulation inserting they buy a new sheet of paper and then these sheets are cropped into desired shape and size by using a design data[1]. After cropping the paper insulations are inserted in the motor by hand. This process takes too much time which increases the production timing of manufacturing. Due to increasing global competition, manufacturing industries are now more concerned with their productivity and are more sensitive to their investment with respect to flexibility and efficiency of production equipment. Industries believe that increasing the quality of production and reducing the cost and time of production are very important factors in achieving higher productivity. Achieving this goal requires reconsidering the current production methods that could lead to introduction of new production techniques and methodologies.

So we are designed a system that able to insert the paper insulations in the rotor automatically. Automation is done by using microcontroller and stepper motors. So through automation all above problems are overcome. Automation is mainly intended to reduce the burden of work on human beings and increase the comfort level. Automation makes control of process better, helps to improve qualities of products, enhance the reliability and performance, reduces wastage of resources and improves labor safety. Production and reducing the cost and time of production are very important factors in achieving higher productivity. We are doing the work on this problem and making a successful automation machine for inserting the insulation paper in electric rotor. For high production, this automated system is best solution and is considered as most economic method of production. This project aimed at automating the insulation process hence simplifying the overall process.

1.1 SIGNIFICATION OF WORK

At present, the process of insulating the stator is carried out by a semi-automated paper insulation machine. The time wasted in handling the parts plays a big role in high production time. The aim of this project is to reduce the cycle time and in turn increase the productivity and to integrate two individual processes simplifying the process line.

1.2 OBJECTIVES OF THE PROJECT:

Objectives of this project are limited to following parameters

- No man power consumed:

The task of operator to only press the switch not to insert in the traditional method .So less man power is needed for this operation.

- Easy to repair:

Easy to repair as no complicated component is used to design automatic system for inserting the insulated paper.

- To reduce the overall cycle time:

Using the automation system and microcontroller process is used to reduce the cycle time.

- To increase the production rate:
- Easy to assemble and disassemble:

Most of the joints are bolted instead of welding it is leading ease of assembly.

- To understand the existing system.
- To simplify and automate the existing system.

II.LITERATURE SURVEY

1) AUTOMATION OF STATOR INSULATION PROCESS IN ALTERNATOR MANUFACTURING INDUSTRIES

Dr. MITHUL NATH PU & DR. THOMAS PINT

Professor & HOD, ME Department, Srinivas Institute of technology, Valachil, Mangalore

The rotor and the stator are the two components that generate power. The stator must be insulated before and after winding the coil on the stator in order to isolate the winding from other components. This procedure is essential to avoid any chance of short circuit. Insulation provided before the winding is called as inner insulation. This is done by inserting paper pieces inside the slots provided in stator for winding. At present a standard semi-automated paper insertion machine is used for this process. This project named 'Automation of stator insulation process in alternator manufacturing industries' is aimed at automating the insulation process and integrating the sealing operation along with insulation process hence simplifying the overall process. The scope of this process is limited to these parameters, to reduce the man power and to reduce the whole cycle time, and to increase the productivity.

2) MACHINE AND METHOD FOR INSERTING INSULATING PAPER IN THE SLOTS OF ARMATURES OF ELECTRIC MOTORS

Mr.PONZIO, MASSIMO & CRESTI, FABRIZIO

A machine and a method for inserting insulating paper in the slots of armatures for electric motors operating the devices for feeding, cutting, inserting the insulating paper and for indexing the armatures, wherein the automatic change and adaptation of the strokes of such devices according to the dimensions of the armature and the production rate is met. Means are provided for: feeding a continuous web of insulating paper, transversal cutting of the web into portions of predetermined length; inserting the cut and bent portions in the slots, and indexing the armatures.

III.BLOCK DIAGRAM

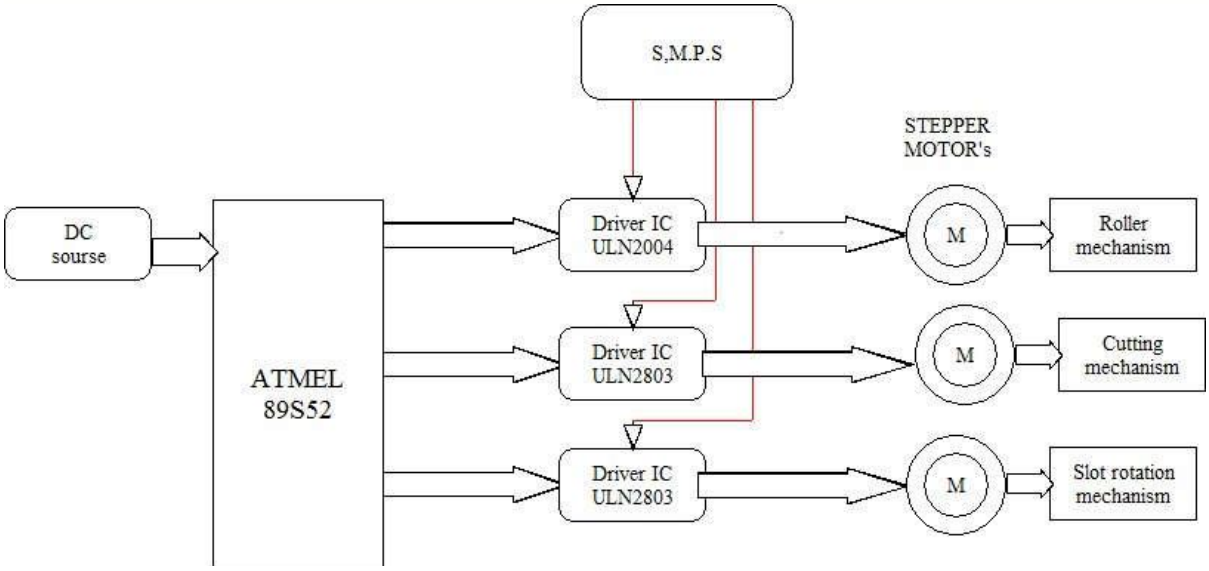


Fig.3.1 Block Diagram

As shown in above figure-1 we are designing the "Automatic Paper Insulation Inserting System", by using the Microcontroller ATMEL 89s52. The DC source of 5 volts is given to controlling and for operation of Microcontroller. Driver Circuits are used to interface the Stepper Motors to the Microcontroller, because it is not possible connect the Stepper Motor directly to the Microcontroller. There are three Stepper Motors are connected in the system to drive the Mechanism. Switched Mode Power Supply is used to drive the Stepper Motor. Various Mechanisms are used in this system to make Mechanical Operation more efficient and reliable. These Mechanisms are successfully worked by taking the help of Stepper motors.

IV.WORKING MECHANISM

A machine for forming electric motor stator insulating material and inserting it horizontally directly into the stator placed on the pallet of a transportation system, without removing the stator from its pallet. The machine includes a guiding system for the paper feed from a feed roll, with the following elements working in sequence: a pair of rollers for trimming the paper to the required width; a pair of paper shaping and pulling rollers, at least one of which is motor-operated and the other of which can be moved away from the first during insertion of the paper into the machine; a paper cutter operating in a substantially vertical direction for cutting across the paper; a former for forming the cut paper inside horizontal guides and operating parallel to the cutter; and an inserter for inserting the cut and bent paper into the stator slot and operating in a horizontal direction moving through the paper former.

Machine according to above wherein the motor-driven shaping and pulling roller is connected to a gear wheel which can be rotated for the insertion of the paper between the two shaping and pulling rollers; and wherein the gear wheel meshes with a rack which automatic paper feed between said shaping and pulling rollers. Machine

according to above wherein said means for forming the cut paper comprises a plate movable by a cylinder guides. The plate being equipped with arms hinged to it for rotation about horizontal axes at the end of the plate for bending the paper around projections of said former reproducing the stator slot profile.

V. DESIGN AND ASSEMBLY

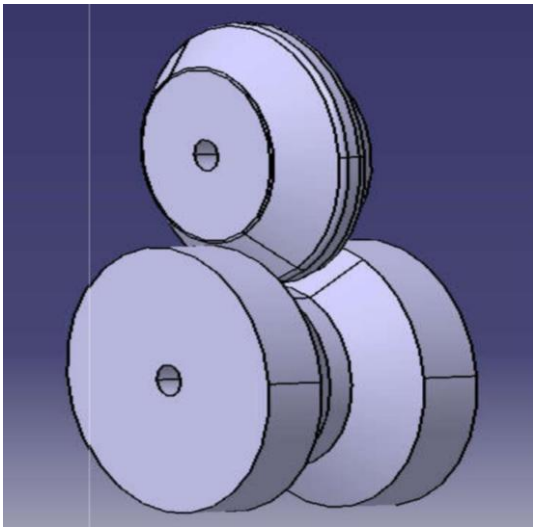
5.1.Design of folding mechanism

The roller assembly is used for folding the insulating paper.

- Roller assembly is for folding the insulation paper 2mm on both side
- Die is used for obtain required U shape of insulation paper.
- In pair the lower roller is replica of upper roller and the roller is driven by stepper motor and gear drive mechanism.

The clearance between two rollers is less than the paper thickness so it is easy to push paper forward and folding will take place.

Roller Assembly



5.2. Design of Cutting Mechanism

A hot wire cutter foam cutter is a tool used to polystyrene foam and similar materials. The device consist of thin, taut metal wire, often made of nichrome or stainless steel, or a thicker wire formed into a desired shape, which is heated via electrical resistance to approximate 200^0 c. The dimension of cutter mechanism is as follow:

Wire length = 125mm,

Cutter mounting plate: 300 × 40 × 5 mm,

Adjuster: 180 × 20 × 5 mm.

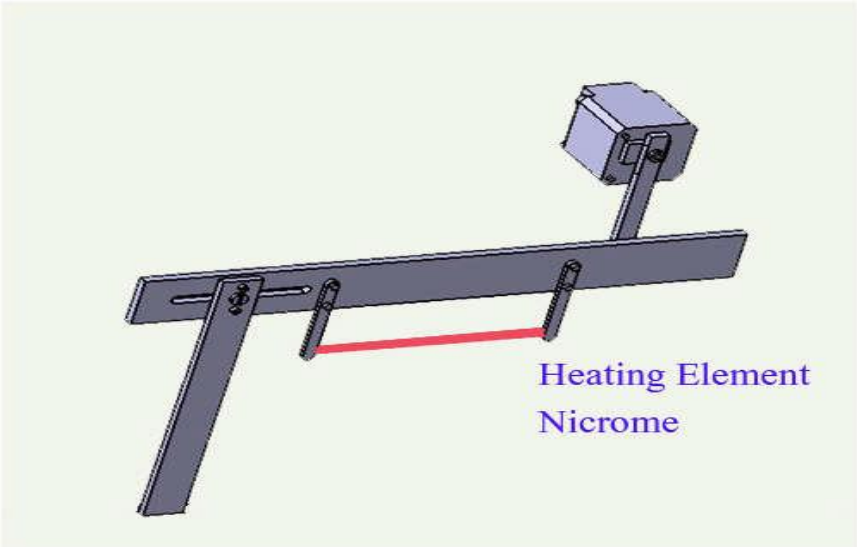
Disc diameter: 35mm.

Cutter movement = 20mm.

Mechanism:

- Cutter is used to cut the insulating paper after the filling each armature slot.
- Stepper motor is used to drive the cutter. The cutter is connected to the motor via a disc.
- One plate is used which convert the rotary motion disk to linear motion of cutter. At the one end disc is exist and at the other end cutter is fixed.
- As the disc start rotating the cutter also start to move in downward direction. The depth of cutting is depends upon the diameter of disc.
- An adjuster slot is exists in adjusting plate to adjust the length of cutter.
- The cutting operation is carried out by micro controller, for starting and ending of cutting mechanism at accurate time.
- Cutting mechanism is carried out after completion of paper folding and feeding mechanism.

While cutting is in operation only the motor which is used for cutting is start and other two motor stop. This starling and stopping of all motor at accurate timing micro controller is used.



. Fig, Hot wire cutter mechanism

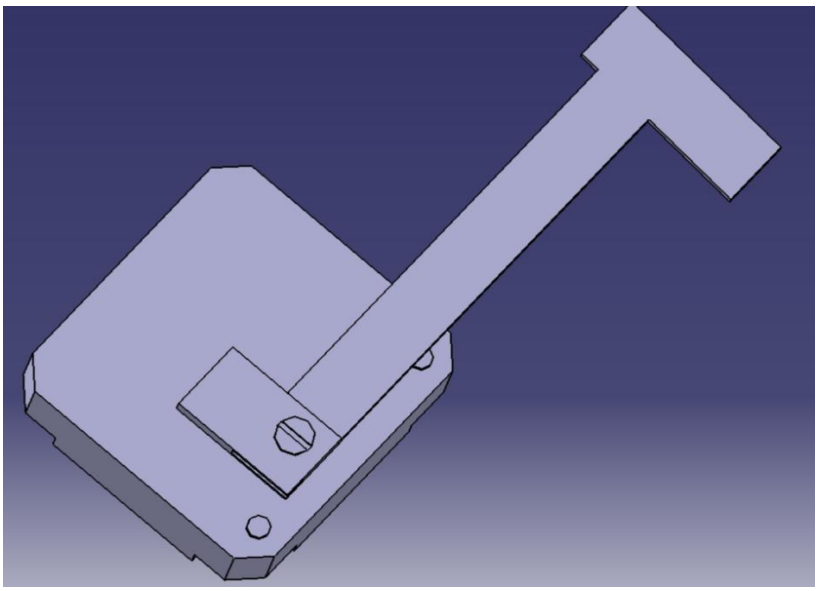
5.3. Design of Indexing Mechanism

Indexing mechanism generally converts a rotary motion or oscillatory motion to a series of step movement to the output shaft. For the indexing purpose stepper motor is used. A stepper motor is brushless dc electric motor that divides as full rotation into a number of equal steps.

The stepper motors vary in the amount or rotation of the shaft each time winding is energized. The amount of rotation is called step angle and can vary from as small as 0.9° (1.8° is more common) to 90°. The step angle determines the number of steps per revolutions

Ex. There are 12 slots in the electric rotor is the step angle is calculated as follow:

$$\text{Step angle} = \frac{360^\circ}{\text{Number of slots}} = \frac{360^\circ}{12} = 30$$



Indexing Mechanism

VI.CONCLUSION

The project presents the details of work done on designing, manufacturing. Fabricating and materials used for automating the insulation process of stators in alternator manufacturing industries.

There are several important conclusions drawn out of this project:

- By implementing automation principles that is Understand Simplify and Automate principle this project is carried out successfully.
- It is worthy automation migration case.
- Available space has been optimally used.
- Number of workers is reduced to mitigate the labour shortage.
- Microcontroller provides most convenient way of controlling and economical means of operating the different workstations simultaneously.

All the set objectives are met satisfactorily at the end of project.

VII.ACKNOWLEDGEMENTS

The authors are grateful to Nanasaheb Mahadik College of Engineering, Peth for supporting this work.

REFERENCES

[1] Patent US4878292 - Armature paper feeding, cutting, and inserting device http://www.google.com/patents/US4878292

[2] John Henry Brems," Rotary Indexing Mechanism', 32867 White Oaks Trail,Birmingham, Mich.Dec. 17,1971.

[3] Heinz Maier,' Rotary Indexing Mechanism' Sulzbach Germany July 21, 1972

[4] Howard J. Voegelin, 'Rotary Indexing Mechanism', Voegelin, Cheshire, Conn.Sept 26 1974

[5] 5. Armature Insulation Paper Inserting Machine Wholesaler Manufacturer Exporters Suppliers Zhejiang' China http://www.tradekeyindia.com/ningbo-nide-Mechanical-equioment-co-ltd/armature-insulation-paper-inserting-machine.htm

[6] "Design of machine element "; V B Bhandari: Mc Grew Hill Publications:

[7] Page no.; 334,342,569,572,573,574,575,647,648.658.

[8] "HCH BEARINF SELECTION CATALOGUE" For series 60 and 69.

[9] www.astrosyn.com for stepper motor selection.

[10] http://cooking-ez.com/make-your-own-hot-wire-styrofoam-cutter.php.

[11] International Journal of Science, Engineering and Technology Research (IJSETR), Volume 3, Issue 6, June 2014