POKA YOKE SNX BCD AUTO LINE NO.2 DEVELOPMENT

[1]Abhilash. A. Netake, [2]Nisha. S. Badhan, [3]Pratik. D. Kashid, [4]Chetan. M. Gadge
[1]Assistant Professor, [2,3,4] UG Student
Department of Electrical Engineering
Sandip Institute of Engineering and Management, Nashik

Abstract: Poka-Yoke is a Japanese term that means 'mistake-proofing'. It is a way of improving productivity by reducing errors using often very simple modification. The aim of the project is rejection control of bearing cages by using proximity sensor. There is a channel connected between two different operating machines. The bearing cages are passing through this channel from indexing machine to coining machine. When the more number of bearing cages are passing through this channel the bearing cages are gets stuck in that channel. Due to which the slots on the bearing cage were marked wrongly by the indexing machine. Because of this damage to the bearing cages are occurred. This paper focuses on the methodology used for solving the problem stated. Which resulted in improvement in the quality of bearing cages and reduction in production cost hence increase in profit.

Keywords- *poka-yoke, quality improvement, bearing cage rejection.*

I. INTRODUCTION

Poka-yoke is a Japanese term which is equivalent to "mistake proofing'' this is method that makes it impossible for an error to occurred. A poka-yoke is one mechanism in a lean manufacturing process which is useful for equipment operator to avoid (yoke) mistakes (poke). The purpose of this method is to reduced product defects by preventing, correcting, or drawing attention to human errors as they occurred while manufacturing. The main motive of the Poke-yoke concept is to stopping defects or mistakes from happening. It is not about eliminating mistakes or defects; it is about ensuring that they simply do not happen. The Poka-yoke concept is promoted in the manufacturing industry. In this method a very simple modification is done for improving productivity by reducing errors This research gives that, as Poka-yoke are designed to make process mistake proof quality control. The SNX is the operation of the indexing machine, where the BCD stands for the Bearing Cage Damage. On the 2number line the indexing operation is done. The channel is connected between the indexing machine to the coining machine. The bearing cages are passing through this channel for further processes. There are four processes which are done on the bearing cage. The process has mainly four operations:

A. Indexing Operation: Indexing is an operation of dividing a periphery of a cylindrical workpiece into equal number of divisions by the help of index crank and index plate. In this operation each bearing cage is divided into equal number of parts. There are 16 divisions marked on each bearing cage.

B. Coining Operation: Coining is a closed die forging process, in which pressure is applied on the surface of the forging. In this process the cylindrical workpiece is bearing cage. The pressure is applied on the surface of the forging, because of this pressure the slots of the bearing are pressed at 45 degree. Because of this the bearing cage gets smoother surfaces and eliminate a draft.

C. Bulging Operation: The bulging operation is a procedure that takes pressure off the spinal nerves caused by a disc that is extending out into the spinal canal. In this process the bearing cage is change its shape by applying a pressure on it. Here work piece is again pressed to obtain its definite shape. In this operation the final shape of bearing is obtained.

D. Demagnetization Operation: The permanent magnetism remaining after inspection must be removed by a demagnetization operation. If any magnetism is retained in the bearing cage this will be remove by this process.

II. LITERATURE REVIEW

With the help of "Poka-Yoke: The Revolutionary Idea in Total Productive Management" paper we found that Poka-yoke is a concept in total quality management which is related to restricting errors at source itself. It deals with "fail-safing" or "mistake-proofing". A poka-yoke is any idea generation or mechanism development in a total productive management process that helps operator to avoid (yokeru) mistakes (poka). The concept was generated and developed by Shigeo Shingo for the Toyota Production System. With the help of "Comparative Study of CNC Controllers used in CNC Milling Machine" we found that the quality of finished work piece depends on the relative positions between the work pieces, cutting tool, machining process parameters. This can be achieved if there is sufficient strength given to a CNC machine to withstand the cutting forces, stiffness against deformation and capability of CNC controller. CNC controller is the heart of the CNC machine which controls most of the functions of CNC machine. Accurate and perfect machining in minimum time is the requirement of manufacturing industries and along with other hardware and machining process parameters.

With the help of "Design of Punch and Die for Taper Roller Bearing Cage for Multi Pocketing" we found that in different industries the Taper roller is mostly used. So there is need to demand for the taper roller bearing. There are four components of it as outer race, inner race, cage and roller. The main function of Cage is to maintain rolling element at a uniform pitch, so load is never applied directly to the cage. There are three ways of manufacturing the cage are pressed cage, machine cage, and moulded cage. But mostly cage is manufactured by power press. In manufacturing of cage pocketing operation is required as per the number of pockets. In existing situation single pocket is produced in a single stroke of power press. So it has to go for the number of stroke as equal to number of pocket so production time is more for cage manufacturing. In proposed method of manufacturing for cage multi pocketing is performed in a single stroke of power press. Due to that production time for cage is reduced and productivity is increased.

III. PROBLEM DEFINITION

Fig.1 shows the channel which is connected between the indexing machine and the coining machine. Through this channel the bearing cages are passes to coining machine after completion of the indexing operation. The one bearing cage is passes in 10 second through channel from indexing machine to coining machine. When the more number of bearing cages are passes through this channel from indexing machine to the coining machine the bearing cages are get stuck in that channel. Because of this when new bearing cage is loaded on the indexing machine for indexing operation the slots on that bearing cage gets marked wrongly by the indexing machine. Thus indexing machine is not able to make proper divisions of bearing cage. As the divisions gets marked wrongly, the quality of the bearing cages are affected. Due to which wastage/damage of the bearing cages are occurred and company is facing the rejection problem of this bearing cages. This reduces the production of the bearing cages. Also the quality of the bearing cages were gets affected. Because of this company facing the losses and it affected the production cost of the company. Therefor there is need of proper methodology used there to solve this problem.

Fig .1 Bearings are stuck in Channel

IV. SYSTEM METHODOLOGY

After analysing the problem author design the methodology to solve this problem. By using the sensor we can control the damage of bearing cages. The proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. For example, a capacitive or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor always requires a metal target. As there are two types of the proximity sensors, author use the inductive proximity sensor because this sensor is able to detect the metal parts. Hence by using this sensor we can control the rejection of the bearing cages. Table I gives the names of the components which required along with the sensors like timer, relay, SMPS. The SMPS (Switch Mode Power Supply) used here is of Ideal Make. The SMPS is used to convert the 230V AC supply to 24V DC supply. We use one SMPS for supplying a 24V DC supply to the relay. The AC timer is used here is of Selec Make. The ON delay timer is used having 10 second delay time. In the 10 second the one bearing cage is passes through channel from indexing machine to coining machine.

TABLE I
Names of the components

Sr. No.	Name of the components
1.	SMPS (S-120-24) (Ideal Make)
2.	Timer 800SQ (Selec Make)
3.	Relay MK2B-INJ (Omron)
4.	Inductive proximity sensor (5mm sensing distance, PNP, NO)

The Omron company relay is used here because it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. Here two relay are used the relay-1 is connected to SMPS and relay-2 is connected to the load. The relay is used here for closing or opening the timer contact. The relay we are using is NO and NC both type. Fig.2 shows Inductive Proximity Sensor which is mounted in the company. The inductive proximity sensor is fitted below the channel so it can sense each bearing passing through the channel. The inductive proximity sensor is having the sensing distance of 5mm. The inductive proximity sensor having the PNP configuration and it's of NO type.

From using components author prepare the block diagram which is shown in the Fig.3. By using this block diagram author design a connection diagram which is shown

in the Fig.4 and implement all this components as per connection diagram in the company.

Fig.2 Inductive Proximity sensor

Fig.3 and Fig.4 shows the block diagram and connection diagram respectively the explanation of the block diagram and the connection diagram is following:

1. The input given as a 230V AC to SMPS and output comes from SMPS is 24V DC. The SMPS having 4 terminals in which 2 are positive and 2 are negative.

2. The output terminal of SMPS is connected to the proximity sensor which is of PNP type. P is connected to positive terminal and N is connected to negative terminal of SMPS and other P is connected to the Relay-1 '2' number contact.

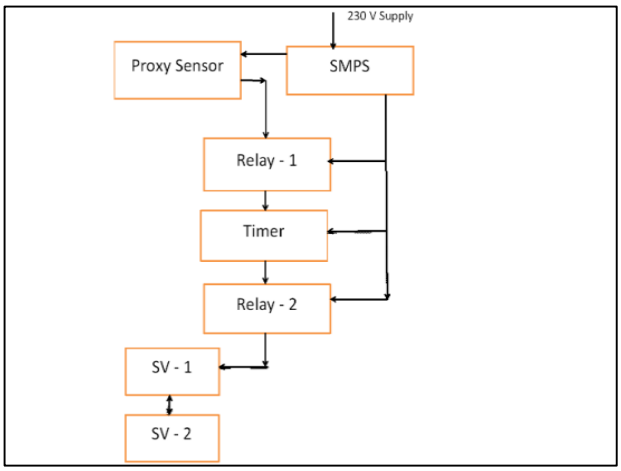

Fig.3 Block Diagram

3. In Relay-1 the relay coil is of 24V DC. The 2(positive) and 7(negative) contact of relay coli getting a 24V DC supply as a input.

4. In Realy-1 the 1 number contact is common and a 230V AC supply is given to it. Initially it is NO. and 3 number contact is connected to the Timer A1 contact which is NO.

5. In the timer 15 is common terminal and 16 is NC and 18 is NO. To this 18 the Relay-2 '2' number contact is connected.

6. In Realy-2 '1' is common and having a 24V DC supply and is connected to servo input because for continuous ON operation of servo that is 4 is NC and it connected to servo input.

7. The proximity sensor continuously sensed the passing of bearing cages in the channel. When the bearings are passes the proximity sensor sensed it and send the tripping signal to relay-1 '3'contact which is initially NO after sensing the bearings it becomes opened.

8. This 3 number contact is connected to A1 contact of timer relay coil. A1 sensed the signal and timer counts 0 to 10 second.

9. When the bearings are stuck in channel more than 10 second the timer coil is operated. The 18 number NO contact of timer becomes closed.

10. This 18 is connected to Relay-2 '2'number contact which gets trip and it was initially NC becomes opened and the servo is OFF.

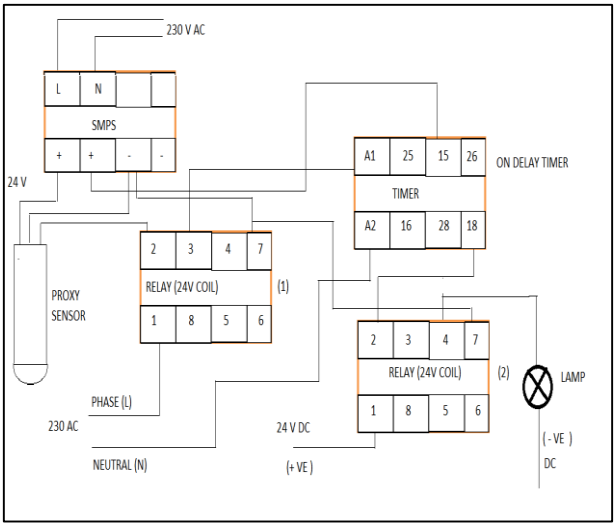

Fig.4. Connection Diagram

V. RESULT

By using this methodology stated in this paper, the wastage/damage causing to the bearing cage has been reduced which has subsequently increased the production of the company and also quality of bearing cage improved. This methodology has resulted in saving of production cost to a certain extent. Also because of improvement in the production chain at the earlier stage nearly 70-80% of problems in the same line has been resolved.

VI. CONCLUSION

From the analysis of the result the problem which company was facing earlier is solved completely by using this methodology. This saves production cost of company and increases the profit. Also the rejection of the bearing cages is controlled, which has resulted in improved quality of bearing cages and increase in production.

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