IMPROVEMENT FOR ROBOPAC WRAPPING MACHINE USED FOR WRAPPING THE PALLETS LOADED WITH GLASS CONTAINERS

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ABSTRACT

This project is based on use of Programmable Logic Controllers (PLC) to improve the performance of robopac wrapping machine used at a glass company. The PLC is an electromechanical processer used for automation. PLCs are widely used in many industries and machines due to fast process, ability to stay for severe conditions such as dust, moisture, heat and cold, facilitate extensive input and output, ability to connect to sensors and actuators. PLC reads limit switches, analog process variables like temperature and pressure and the position of complex positioning system. PLC can operate electrical motors, pneumatic or hydraulic cylinders, magnetic relays, solenoids or analog outputs. Hence, a PLC was used for the project to achieve objectives. The machine's output sensors were used to control the PLC. Ladder language was used as PLC language. Variable Speed Drives (VSD) are used to control the three phase induction motors.

Keywords: *Programmable Logic Controller, Ladder Language, Variable Speed Drives*

1.0   INTRODUCTION

The Robopac stretch wrapping machine is a material handling system suited for packing operations, large scale handling, storage or transportation of glass containers.

The system consists of

- A turntable for rotating the loaded pallet.

- An elevator for lifting and lowering the film spool carriage along   elevator mounting part.

- A film spool carriage for pre -stretching the film prior to its wrapping.

- Programmable logic controller (PLC) for control panel[1] presently, the PLC of the machine is not working and input sensors of machine are also not working. So two variable speed drives are used to operate the turntable and the elevator. Also turntable, elevator and film spool carriage are not working up to the standard. The machine is operated manually. A circuit diagram and a PLC program were designed for proper machine operation.
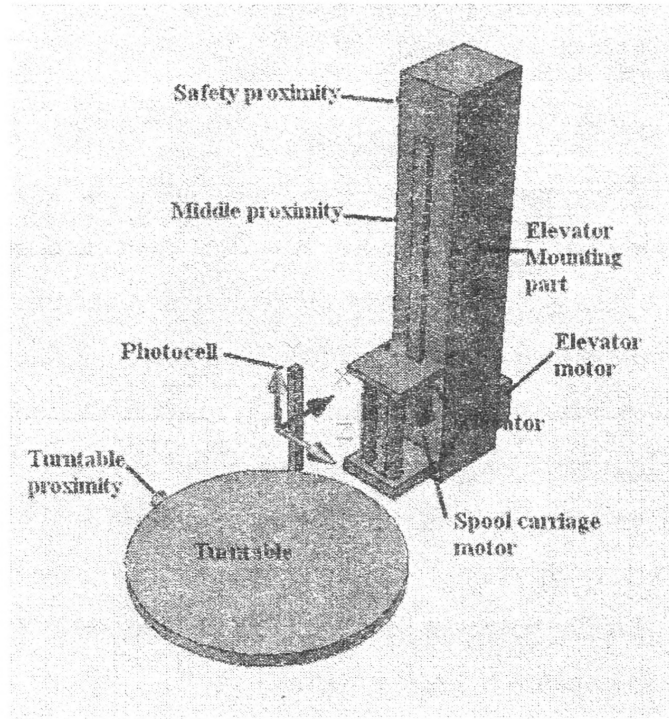

Figure 1: Robopac wrapping machine
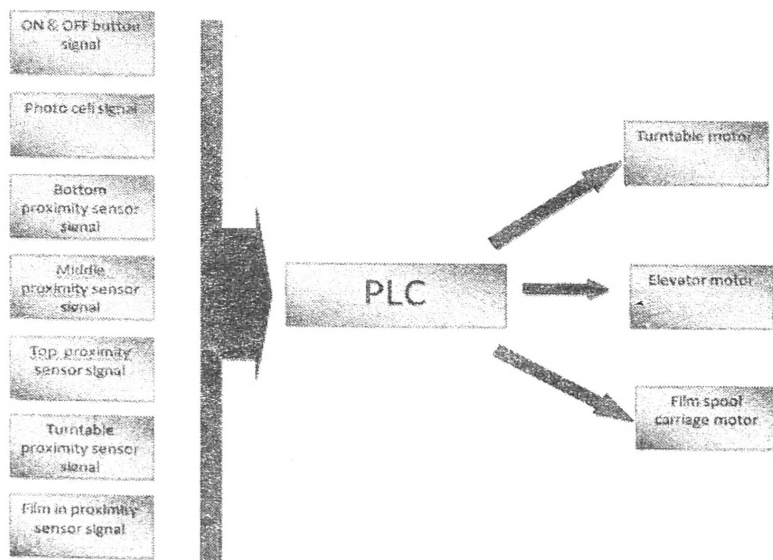
2.0 EXPERIMENTAL

Figure 2: Block Diagram of Robopac machine controller system

Above diagram shows the simple block diagram of Robopac machine controller system. The machine was controlled by using a PLC. PLC has seven inputs and three outputs to operate the machine. The PLC logic was constructed using these seven inputs. After learning about Robopac machine and its operation, a pulse diagram was drawn for the Robopac machine operation. Then, the suitable program was written using ladder language. The circuit diagram was implemented using AutoCAD software. Finally, the circuit was set up and tested by using test bench. Reducing the operation time was the main objective of this project. So then, time for one cycle (Time for wrapping one pallet) was observed to measure the operation time of the system.

3.0   RESULTS AND DISCUSSION

3.1. Results

Table 1: Time Duration for wrapping process

Height of the pallet (m)	Operation time(min) (before)	Operation time(min) (after)
1.64	2.31.24	2.19
1.40	2.12.57	2.02
1.24	1.40.93	1.21
1.05	1.32.01	1.20
1.35	1.59.14	1.36

Time duration for wrapping a pallet depends on its height and therefore, time durations were observed for different heights.

3.2   Discussion

At first the circuit did not work. Two reasons were identified for that situation. One is due to the circuit design which was for both auto and manual operations. Therefore, some technical errors with controller circuit occurred. Both auto and manual current paths for one function connect to the common contactor and so, sometimes current passed through the unnecessary power path. When start push button was pushed then (K2) contactor activated self holding path through the contactor. At that moment, current may be able to pass through the (R6) relay no six (Fig. 3) To avoid that, the circuit was changed as

shown in Fig. 4. Two diodes were connected to block the current path. It provides safety for the circuit[2,3] Other reason is complexity of the controller circuit. In this controller circuit the PLC input signals were handled with using seven contactors and thirteen relays. At the some places more than four signals were controlled using one relay or one contactor. Also one contactor output or one relay output was used more than two places in the controller circuit. It is disadvantage of the controller circuit. That circuit consists of thirteen relays. Electromagnetic relays have fast operation and past reset operating speed which has the ability to operate in milliseconds are also can be possible, so that it is larger advantage for reduced the operation time of Robopac machine[4]. Safety is an important factor for this machine. For ensure the safety of the operator include some safety steps to controller circuit. When a bottle pallet is not present on the turntable a signal send to the PLC from photocell. (Photocell was mounted near the turntable to detect pallet with glass bottles) If the pallet was not presented system cannot active, PLC logic was written to control it. The middle proximity sensor use to detect elevator and then turn off the elevator motor, when it is not working elevator be thrown away from the machine with spool carriage motor. Therefore safety proximity was installed above the middle proximity for detect elevator.

Stretch wrapping was used for wrapping the pallet with lorded pallet. Some time stretch wrapping was broken but elevator and spool carriage motors not turn off. This system improved to turn off the elevator motor and spool carriage motor when stretch wrapping was broken, also display the error massage on the PLC screen.
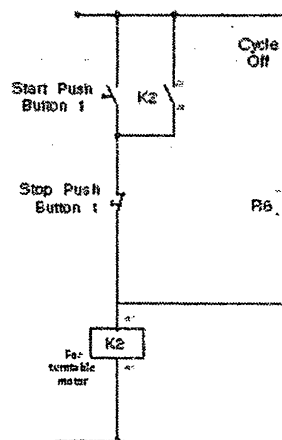

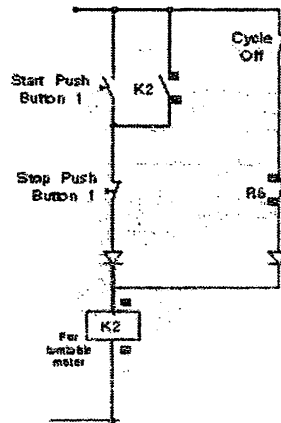**Figure 3**: Current path through a contactor

Figure 4: Correct current path through a contactor

4.0   CONCLUSION

The Robopac wrapping machine handles large amount of pallets with glass containers per day (at least about two hundred pallets per day). Therefore the efficiency of the packing division was depending on efficiency of the Robopac wrapping machine. To enhance the efficiency of the machine, the operating time must be kept low. The circuit designed in the study could achieve that target to some extent. That is the operation time of the machine was decreased by approximately from 5% to 10%.

ACKNOWLEDGEMENTS

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