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Automation of Manufacturing Welding Electrode Extruder Control Panel with PLC

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***Abstract*—The manual process of manufacturing the welding electrode takes more time and work. It also occupies more space for the control panel with the installation of PLC in the welding electrode manufacturing control panel the size of the panel is reduced to the great extent. It has reduced the cost of the panel and has increased the rate of the production. Here the entire process of electrode manufacturing is done automatically. The contol panel includes three major controls. They are wire feeder control, extruder control and conveyor control. In the above PLC is used for the extruder control. The sequences of forward and reverse operations of the extruder are controlled by PLC with the suitable program fed in it. The wire feeder and conveyor are control with the help of contactor, timers and variable frequency drives by direct connections with the control panel. PLC is implemented for the control of conveyor process. The conveyor process panel consist of an OMRON PLC(12/8), SMPS, proximity sensors, MCB and relays. For application purpose light indicators buzzers, exhaust fan and a model showing conveyor process are used. Any sequence of operation can be performed on the light indicator, buzzers, exhaust fan and conveyor model by feeding suitable program on PLC. The PLC program of this project are done and executed in CX-programmer on real time basis.**

***Keywords*—PLC OMRON,ELECTRODE ROD MANUFACTURING, CX-PROGRAMMER.**

INTRODUCTION

Today automation plays a major role in all fields, especially in the production field. in earlier days more number of persons were involved in production field. To reduce the time consumption and working of more labours, the automation comes into play. Programming logic controller play major role in automation field. Implementing the PLC is very simple with the help of programming knowledge, if the system to be controlled is thoroughly studied. In real time applications PLC works along its feedback coming from the sensors for position, speed, etc. The input and output cards of the PLC are cheap so that the healthy and spare capacity can be built into allow for the inevitable omissions and future developments. Most of the changes in PLC can be made simply and quickly. PLC program will automatically document the changes that have been made. PLC reduces the cost of over all system.

In this project, PLC is programmed to move the conveyor for a desired distance either in forward or in reverse direction. Position of the conveyor is sensed using proximity sensors and it is feed back to PLC for the movement of conveyor a AC motor is used.

COMPONENT OF AUTOMATED SYSTEM

As the name implies the automation is done using PLC and variable frequency drives. The automation of the system is divided into two types:

- Hardware
- Software

The hardware includes into nine parts:

- Programmable Logic Controller:It is an industrial computer control system that continuously monitors the state of input devices and make decisions based up on a custom program to control the state of output devices.
- Drives:In this automation variable frequency drives are used in electro-mechanical drive system to control AC motor speed and torque by varying motor input frequency and voltage.
- Current Transformer:It is used for measurement of electric current.When current in a circuit is too high to directly apply to the measuring instruments, a current transformer produces a reduced current accurately proportional to the current in the circuit.
- Overload Relay:Electric motors need over current production to prevent damage from over -loading the motor or to protect against short circuits in connecting cables or internal faults in the motor windings.

The software includes:

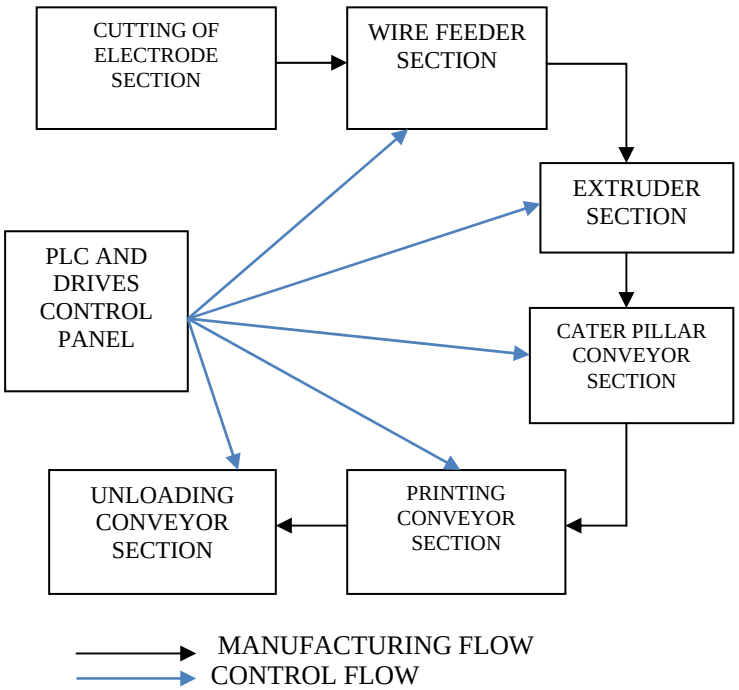
- CX-Programmer:It is a PLC programming tool for the creation, testing and maintenance of program associated with OMRON CS/CJ-series PLCs, CV-series PLCs and C-series PLCs.
- CX-Programmer operates on IBM compatible personal computers with Pentium or better central processors, including Pentium II. It runs in a Microsoft Windows environment.
- It supersedes the OMRON application SYSWIN and SYSMAC-CPT.

- Ladder Logic:It is the one of logic used in the PLCs.The other two logics are state logic and programming logic.
- The standard features of the Ladder program are Cursor, Rung, Bus-bar, grid dots, rung margin area, utomatic error detection.

CX-Programmer supports the mechanism for sharing symbol definitions with other compliant applications. This could allow for example, the symbols declared within CX-Programmer to be linked to a SCADA package so that the definitions and changes of addresses are synchronized.

The program under goes continual verification during its creation and any subsequent editing; this applies to both online and off line programming. Errors appears in red in the left-hand side of the ladder rung. This can happen, for example, when element has been placed on diagram window but has not been assigned a symbol or address.

BLOCK DIAGRAM AND SPECIFICATION



Block Diagram

Block Specifications

- CUTTING SECTION: In this section the electrodes are cutted into the perfect length and diemensions.
  Then the cutted electrodes are placed in the wire feeder section.
- WIRE FEEDER SECTION: The wire feeder control consist of followings, 0.5 H.P Agitator wire feeder, 3 H.P Wire feeder, 5H.P Pickup wire feeder. Initially all the wires that are cut and placed inside the agitator tub. At that time the 0.5 H.P agitator will operate in such a way that all the wires will set one by one on the 3 H.P wire feeder. The 5 H.P wire feeder is present next to the 3 H.P wire feeder. The 3 H.P wire feeder is placed behind the 5 H.P wire feeder because pickup feeder will push the wire at the faster rate than the 3 H.P wire feeders. From the wire ffeeder part the wire is moved to the extruder part through the metal tube connected in between them.
- The following are the parameters are feeded in the variable frequency drive:

Parameters	values
Voltage	415volts
Current	8.8Amp
Frequency	50Hz
Speed	950rpm
Power	4Kw

- EXTRUDER SECTION: The extruder part consist of the followings:15 H.P extruder pump, 10H.P extruder pump, 3 H.P cooler, 1 H.P pilot pump.
- Extruder part is the one where PLC is involved. It is used for extrusion process. Initially at the start of extruder operation both the 15H.P and 10 H.P pump will work and extrudr will move forward. When the extruder comes in contact with the low pressure switch, then the 10 H.P motor will stop and 15 H.P motor will alone operate. It will continue to move forward pushing the flux until it reaches the high pressure switch. After reaching the high pressure switch, the extruder stops for 10 seconds and moves in reverse direction and this reverse movement is done by the 1 H.P pilot pump.
- The 1 H.P pilot pump continues to work until it reaches the low pressure switch. After reaching the low pressure switch the extruder stops and the 3 H.P cooler beings to run to cool the extruder. In the above the 15 H.P and 10 H.P pumps star-delta connected while 3 H.P and 1 H.P pumps are directly started. The parameters are,

Parameter	Value
Voltage	415volts
Current	7.5Amps
Frequency	50Hz
Speed	1450rpm
Power	7.5Kw

- CONVEYOR CONTROL: The conveyor control involves the controlling of following motors:1H.[P motor BR1 conveyor, 1 H.P motor BR2 conveyor 1H.P motor TP conveyor, 2 H.P main conveyor, 1 H.P caterpillar, 1 H.P unloading, 0.5 H.P printing and 2 H.P transfer conveyor.
- The flux coated electrode from the extruder is transfer to the main conveyor through the transfer conveyor. From the main conveyor the electrodes moved further where undergo a sequence of process such as cleaning of lower portion of rod and printing the company name on the lower portion. The caterpillar conveyor is used for

holding electrode during cleaning and printing. The BR1 and BR2 conveyor are used to make sure that electrodes are enter through the other parts of the conveyor. After all the required process is completed the electrodes are collected from the unloading conveyor. The parameters are mentioned below

Parameters	Values
Voltage	415volts
Current	1.8Amp
Frequency	50Hz
Speed	1415rpm,1360rpm,1380rpm
Power	0.75Kw

CONTROL PROCESS

WELDING ELECTRODE:Welding electrodes sre used in welding varios methods in the fabrication of equipments and allied industries, construction of steel structure such as bridges, factory shields, in the manufacture of ships, vehicles and enginnering equipment. Mild steel is welded by electrodes to a maximum among all the metals and alloys. Therefore mild steel is welding electrode is the most widely used core wire. Besides this, special grade electrodes are being developed for specific applications.

Welding electrodes comprise basically of steel core wire and coating ingredients or flux mild steel core wires are used in majority of unalloyed steel electrodes. Besides mild steel, nickel-copper, nickel irons are also used in MIG and TIG welding.in fertilizer, chemical and surgical instrument making industry. Coating ingredients bare basically rutile, potassium silicate, sodium silicate and minerals like quartz, calcite and mica. Ferro-alloys are also used in the formulations of fluxes.

Technology And Process: Wires of different chemical compositions and sizes are obtained from different steel manufacturers. In electrode making plant, they are chemically cleaned, cut to different length(30 the selling prices of welding electrodes vary according to length of the electrodes and the raw materials used).

There are two methods of applying flux coating on the core wire

a) Dipping method
b) Extrusion method

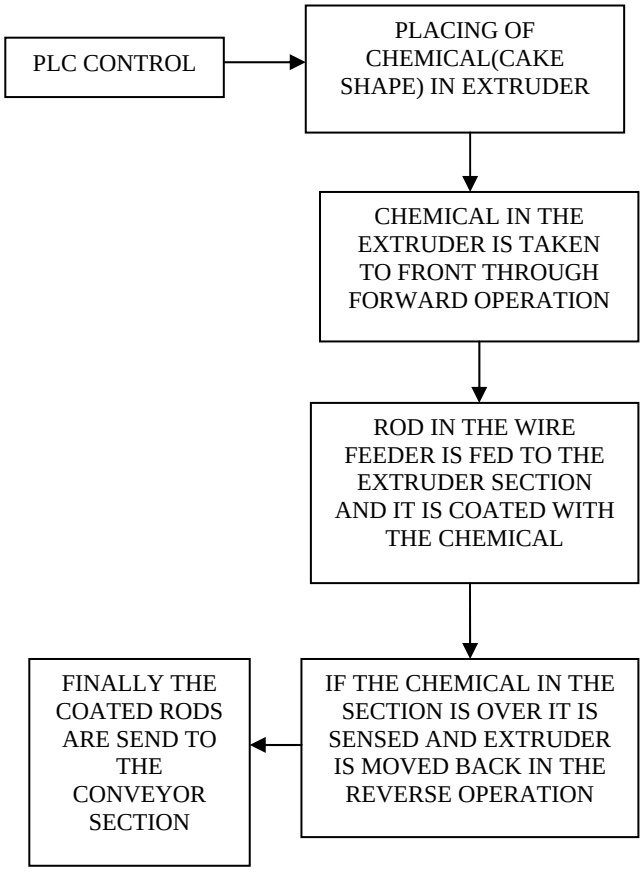
a)***Dipping Method:***Number of core wires cut to definite length is clamped vertically in a fixture and are dipping in a bath of molten flux gets adhered to the core wire, the fixture is raised and the flux is allowed to dry.

b)***Extrusion Process***:Extrusion method is very fast and economical method. It produces strong uniform and concentric coatings and has largely replaced the dipping process. Coating ingredients as discussed earlier are mixed up in desired quantities, binder (often sodium silicate)is added and the resultant mass is brought in the form of a thick, viscous, stiff paste. This paste is shaped in the form of a cylinder which is fed into the extrusion press. Core wire and thick paste of flux simultaneously under pressure pass through a die, does attaching the flux coating on tyhe core wire. The coating thickness depends upon the die opening and can be varied. As a next step the flux from the gripping end of the electrodes are fed to ovens where they are dried and baked to remove excess moisture. The electrodes are there after sorted, wrapped in polythene paper, put into packets, and bulk is boxed into wooden cases. Packets and boxes generally have information about:electrode coding, electrode size, nature of current and polarity, batch number, name of the manufacturer, date of manufacturer, etc.

EXTRUSION WELDING

Extrusion welding allows the applicationof bigger welds in a single weld pass. It is the preferred technique for joining material over 6mm thick. Welding rod is drawn into miniature hand held plastic extruder, plasticized, and forced out of the extruder against the parts being joined, which are softened with a jet of hot air to allow bonding to take place.

Fig: Block diagram of extrusion process



The wires to the extruder which is fed from wire feeder is coated by the combination of the various chemicals with the help of extrusion process. The extruder cylinder forward and reverse operation is controlled using programmable logic controller. The chemical cake is placed in the extruder section. The forward operation of the extruder will take the chemical to front side where the wires are coated by the chemical. The coating is done in the perfect manner. The forward and reverse operations depends on the low and high pressure. In the high pressure the cylinder moves in the forward motion and in the low pressure the cylinder moves in the reverse motion.

RESULT

The movement of extruder in the forward and reverse operation is controlled by using the PLC. The electrode rod is coated with the various chemicals. The manufacturing of welding electrode is done and extrusion section is only controlled using the PLC. The final electrodes are coated, egded and in printed format is manufactured.

FUTURE WORK

Though this project is used to controlling the extruder section only. This can be extended to the wire and conveyor section in order to reduce the manual process and cost of the project can be reduced. The further controlling of conveyor and wire feeder can be implemented.

CONCLUSION

In welding electrode manufactruring, the working of extruder, wire feeder and conveyor has been done.

Programming in PLC also learned through this project. In welding electrode manufacturing, at present PLC control is involved only with the extruder. In order to decrease the panel size further, the wire feeder and conveyor must also be controlled with PLC. For conveyor process control, PLC with all its advantages was implemented. Various program logics for the conveyor control is done and the expected results are experimented and verified on real time basis. This manufacturing can be extended as conveyor with the variable speed control.

REFERENCES

[1] Petruzella,f.(2010) 'Programmable logic controller' tata mcgraw hill, fifth edition.

[2] Boltion, W(2009) 'Programmable logic controllers' fifth edition, prentice hall of India.

[3] "The father of invention:Dick morley looks back on the 40th anniversary of the PLC ".Manufacturing Automation.12 september 2008.

[4] Webb, J.and resis,(2003)Programmble logic controller principles and applications, fifty edition,prentice hall of India.

[5] M.A Laughton, D.J.Warne(ed), Electrical Engineer's Reference book, 16th edition, Newnes, 2003Chapter 16 Programmable controller.

[6] "Manufacturing Engineering and Technology" 4th edition by seropelalpakijian.