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Control System Upgradation with Linear Actuator in Coil Unloading Machine

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Abstract: ***In this paper, we are going to see about the project is to unload the coil for the dispatching process from metal plate to place in thermo coal with the help of linear actuator. The process of coil unloading is automated with the help of HMI, sensors, motors and linear actuator. This process is carried out through ladder logic methodology. The linear actuator application machine process is the machine based on the PLC (PROGRAMMABLE LOGIC CONTROLLER) controller. Earlier PLC controllers are huge programmed size, spare parts are rare, inbuilt programming that could not change as per the requirements and the absolute models which is difficult to learn. The cam shaft mechanism takes over time to assemble the coil position. And also coils pick up and drop step by step process is difficult.To overcome this problem used the advanced PLC controllers model SIEMENS-S7 1200 instead of earlier telemechanic PLC controller because in this SIEMENS-S7 1200 model PLC the HMI is used to display the coil positions.***

Keywords: PLC, Linear actuator, Inductive proximity sensor, Laser sensor, Relay, Reed switch, Power circuit, Control circuit, DC motor, HMI device.

I. INTRODUCTION

In this project an actuator is an electric component with in a machine, used to move and control a system. An actuator works by using a source of energy and a control signal. Here the control signal is current or voltage, human power, hydraulic liquid force, or pneumatic where as the source of energy is hydraulic force, electric current, or pneumatic force. The main function of an actuator is to change the energy of the source to mechanical motion once it gets a control signal. There are different types of electric actuators available like soft, electric, pneumatic, thermal, mechanical, a hydraulic actuators. The function of actuator in hydraulic control system is to convert the hydraulic energy supplied by the pump and processed by the control elements into useful works.

A linear actuator is used for linear actuation. They provide force or a motion with in a straight line such hydraulic actuators are called hydraulic cylinders. A rotary actuator is used for rotary actuation. They provide the torque or rotational motion; such hydraulic actuators are called hydraulic motors.

A hydraulic actuator is a device that is used to change the fluids pressure energy into mechanical energy. The hydraulic actuators includes a cylinder or a fluid motor that works through hydraulic power for mechanical operation. The mechanical motion provides an output in the form of rotary, linear otherwise oscillatory motion.

A programmable logic controller (PLC) is a specialized computer used to control machines and processes. Eliminates much of the hard wiring that was associated with the conventional relay control circuit. The program takes place of much of the external wiring that would be require for control of a process. Programmable Logic Controllers are used for continuously monitoring the input values from sensors and produces the outputs for the operation of actuators based on the programs.

II. EXISTING SYSTEM

Some time ago many coil components has been produced in the coil components producing process in the machine which is used for the watches to run. In this process we need to separate the non-defective coil components and defective coil components in the manual operation after production of the coil components. The non-defective coil means good coil and defective coil means bad coil which we will separate the coil components.

We need to check coil components which is correctly welded at the respective places and correctly sticked or coated with the glue for the non-defective coil components. In this process the resistance of the non-defective coil components must be at the range of 1550 ohm ± 80ohm.

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After the upcoming process completed we needed to a placed the non-defective coils into the tray for next process. The tray which is made up of thermocoal in which consists of hundred space to fill hundred non defective coil components in the single tray. Each coil which is used for the winding of the coil components that the winding wire diameter is 18 micron.

From the defective coil components we can identify some defects with the help of microscope. The defective coil components can be rework and corrected with the help of some equipment's and make them as a non-defective coil components.

We can identify the different type of defects in the coil components. The defects such as improper taping, gap between CEC and core, excess wire after welding, flange miss, coating spread at bottom, glue spread up to coil core, core bend downwards, loose windings, CEC position shift, one wire not welded and epoxy melt, varnish spread, excess glue spread, glue spread in core hole, core bend upwards, in corrected winding radius, CEC track melt, two wire on one track, varnishing glue spread into the hole, coating spread sideways, tape damage, core bend and hole deformed, damage on winding, CEC track and epoxy, flange inclined, coating thickness more on top, coating spread more on flange, extra wire on CEC. In case of defective coil components cannot be converted into a non-defective coil components we can move to a scrap which means damage or wasted which cannot be reworked.

A. Drawback

1) We need more man power to check the coil components.
2) More time is consumed while checking the coil components.
3) While we are separating the defected coil components and non-defected coil components the defected coil components can be at the place of non-defected coil components in the tray.
4) More challenges will occur to make a production at a target time.

III. PROPOSED SYSTEM

We are developing the coil unloading machine which is used to upgrade the machine so that the problems workers facing in day to day life will be reduced. A watches mandatory for every humans to enjoy the luxurious and auspicious life. To build a watch, it comes across several stages and operations to view a final product. The certain operation on build a watch are press shop, ebauche, gear hobbing, brushing, auto turning, stepper motor, gear assembly. The machine should be placed on flat floor. Supply voltage = 220V- 50Hz. The 7000 Caliber range watches about the unloading a coil with checking of resistance. The resistance is about 2.850 ± 1.50 for 7001 type calibers. To overcome the absolute mechanism and inbuilt programing. To set the coil positions accurately which is used to choose and place the components and to display its position in degrees by HMI. The process of coil unloading machine are explained in detail below.

The machine starts with the help of HMI. The coil loaded tray will placed on the carrier, then tray moves linearly to the process. Inductive proximity (metal) sensor can placed near to the end of the carrier. The tray moved away from the carrier the sensors can sense the signal then next tray will be loaded. Unloaded thermo coal tray will placed on carrier this operation is processed by the stepper motor. Here capacitive proximity (non-metal) sensor will be used. Further resistance checked by RCU, if resistance in between the range (2.67ohm – 2.83ohm) coils are good, actuator pick the coil and placed in thermo coal tray (capacity – 100coils) when coils are loaded completely then moves to carrier. If the resistance value are not exists in the range they select as a bad coils and they are rejected. The block diagram shows a clear view about the replacement done in the area of linear actuator previously cylinder has been used. We are accomplished that our upgrade reduces the space congestion and error can be found easily.

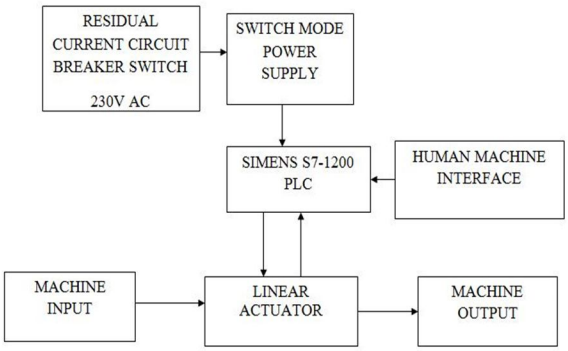


Fig 1.1 Block diagram of coil unloading machine.

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A. Linear Actuator

A linear actuator is an actuator that creates motion in a straight line, in contrast to the circular motion of a conventional electric motor. Linear actuators are used in machine tools and industrial machinery, in computer peripherals such as disk drives and printers, in valves and dampers, and in many other places where linear motion is required. Hydraulic or pneumatic cylinders inherently produced linear motion. Many other mechanisms are used to generate linear motion from a rotating motor.

Actuators are devices that convert an electrical signals from a controllers, such as a PLC, into a physical condition. Actuators are connected to the PLC output, the motors started either provides power to the motors or prevents power flowing to the motors.



Fig 1.2 Actuator

B. Programmale logic Controller (PLC}

A programmable logic controller (PLC) is a specialized computing system used for control of industrial machines and processes. It uses a programmable memory to store the instructions and specific function that include on/off control, timing counting, sequencing, arithmetic, and data handling. PLC's are equipped with special input/output interfaces. A PLC is computer design to work in an industrial environment. It is the absolute version. Telemechanic PLC controllers are mainly to control the arms, vibrator bowl feeder, riveting rod and anvil which contains in the VIB application machine. In this machine, arms positions are decided by "cam shaft" (baumer control).

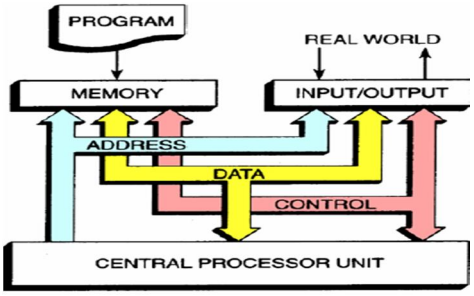


Fig 1.3 Block diagram of telemechanic PLC architecture

C. HMI Device

HMI devices are used to operate and monitor machinery and plants. The machine or plants stats are visualized on the HMI device by means of graphic objects or single lamps. The operator controls of the HMI device enable intervention in machine or plant processes and sequences. The HMI device is file that can be transferred from the configuring PC to the HMI device. The HMI device image contains the operating system of HMI device including the elements of the run time software required for the executable project file.



Fig 1.4 HMI device

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D. Relay

A relay is an electrically operated switch that are necessary to control a circuit by a low power signal or where several circuit must be control by one signal. The principle of relay logic is built on relay which energize and de-energize related contacts.

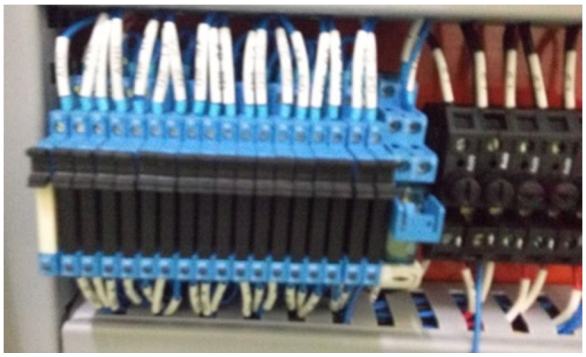


Fig 1.5 Relay

E. Reed Switch

The reed switch is widely used because it operates an applied magnetic field. By actuating the coil from the switch the reed relay are magnet brought closed to the switch. In switch, the magnet is pulled off, and it comes back to its previous position.



Fig 1.6 Reed switch

F. Inductive Proximity Sensor

A proximity sensor is a sensor able to detect a presence of nearby object without 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 sensors target. Different proximity sensors targets demand different sensors.



Fig 1.7 Inductive proximity sensors

G. Laser Sensor

Laser sensor emits a light on the surface and this laser beam is reflected from the surface and falls and the detector through the lens. Depending on the position of the beam and detectors the angle is calculated and hence the height from the sensors to the target surface is detected.



Fig 1.8 Laser sensor

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IV. EXPERIMENTAL OUTPUT

The above shown figure 1.9 is the output of coil unloading machine. Which will display automatically the total number of coils and show good coils and bad coils separately shown in HMI device.



Fig 1.9 Output of coil unloading machine.



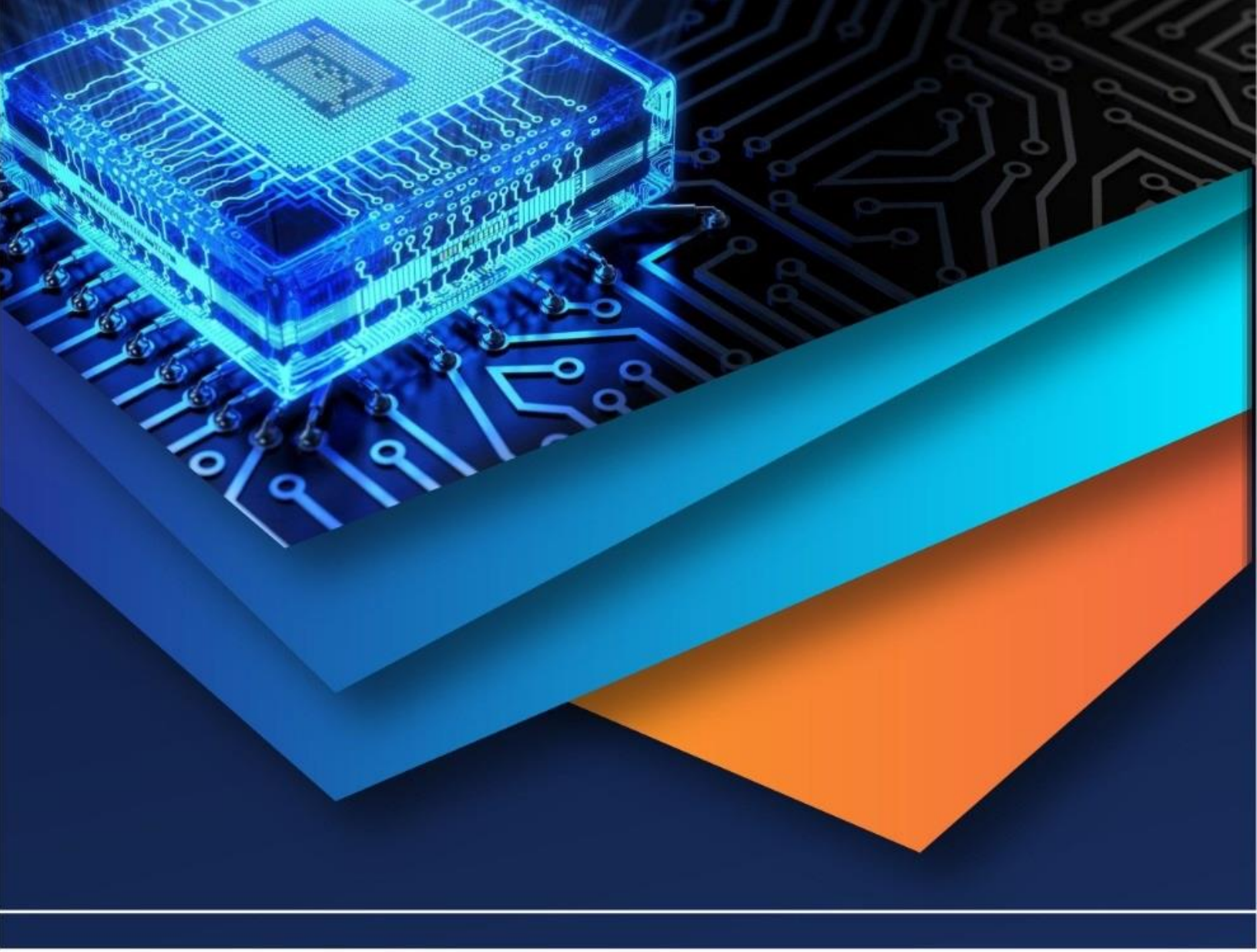
Fig 1.10 Coil unloading machine

V. CONCLUSION

We have done the project on coil unloading machine using the PLC's with the support of linear actuators. We have done the conversion on reducing the cylinder. By this conversion it is easy to find error accurately and space congestion is reduced.

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