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PLC Based Watch Case Design

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Abstract:
This Project Emphasize the operation of the hydraulic press is regarding with the PLC ladder program. The PLC will decrease the complexity of the circuit when compared to the relay logic. This seems to be an excellent solution for different problems to improve the production. The force of hydraulic press MEYER 150T machine contains a servo solenoid pressure control valve for maintaining the pressure in cylinder champers. The pressing force of servo hydraulic press is indirectly measured by the pressure sensor which is equipped in champers. Pilz is a safety relay, which is used to monitor a specific function. By connecting them to other relays, one can achieve total monitoring of a machine or plant. Pilz furnished for different automation and safety related function. They are used to detect the defect occurs during the pressing operation of hydraulic press. By this press, it is possible to measure the position of the upper plate by using a linear variable displacement transducer, which creates a precondition for the realization of a hybrid force and position control algorithm.

Keywords: Hydraulic press MEYER machine, pressure control valve, Programmable Logic Controller.

I. INTRODUCTION

The particular topic that we have chosen gave us a chance to work very closely with a watch manufacturing sector and forming methodology in an MEYER machine. The defining characteristics of an MEYER machine is forming and trimming. Part of our project is about Forming of more number of watch cases using MEYER simultaneously. To perform Forming process MEYER machine plays great role. MEYER machine is controlled by X –DESIGNER SOFTWARE in which the operating person enters numerical values in the system. The MEYER auto gauged with feedback and offset capability. It consists of two fixtures for parallel operation (machining and loading). It configured with independent six Valves. The system that interfaced with MEYER can be expandable upto four working modules. It has many applications like instruments, Jewelry, spectacles, etc. In wrist watch case one of the main problem is watch case Dimension. During forming process in MEYER machine it is highly possible to change in Case Dimension. To avoid this Problem need to give required press in piston in MEYER. Manual entering of wrong values in MEYER machines lead to accident like breakage of tools watch case rejection and sometimes causes collision even damaging the whole functioning of machine which leads to major loss. The program has been done to eradicate all these problems. The idea is to prevent the machine break down by means of PLC programming that alerts the operating personnel. And also the most important thing is, during Forming process we have to ensure the case dimension. The Forming process gives correct dimension by pressing. The press is adjusted in the program. During this manual entry when there is erroneous value the MEYER machine gets damaged. The developed Program in PLC is used to run the MEYER machine without Break Down.

II. EXISTING METHOD

The hydraulic press is one of the oldest of the basic machine tools. At present a price and weight benefit over the equivalent electro-mechanical systems needed to generate the same force or torque. Hydraulically actuated systems are used in a wide range of industrial applications, and continue to be a popular and relatively inexpensive power source and modern hydraulic presses offer good performance and reliability. The machine used in this paper is MEYER 500T Hydraulic Press Machine. It is used to generate up to 500bars of pressure. The press has two hydraulic servomechanisms: a hydraulic cylinder, driven by a servo solenoid flow control valve, to support the punch tool; a hydraulic cylinder, where the chamber pressure is controlled by a servo-solenoid pressure control valve, to support the operations of loading and unloading of the press blank holder. The hydraulic press depends on Pascal's principle: the pressure throughout a closed system is same. At one end of the system is piston with a small cross-sectional area driven by a lever to raise the force. Tiny-diameter tubing leads to the other end of the system. A fluid, such as oil, is displaced when either piston is pushed inward. The tiny piston, for a given distance of movement, displaces a smaller amount of volume than the large piston, which is proportional to the ratio of areas of the heads of the pistons. Therefore, the tiny piston must be moved a large distance to get the large piston to move significantly. The distance of the large piston will move is the distance that the tiny piston is moved divided by the ratio of the areas of the heads of the pistons.

III. PILZ SAFETY RELAY

PILZ Safety Relay is a small and exquisite complete control system and so easy and simple to handle, flexible in usage and guaranteeing security automatic regulation, safe protection, chance-over circuit, etc. Figure1 shows the PILZ safety relay. when energization is applied to both ends of the coil with certain voltage, then the electric current will flow through the coil, thus produce electromagnetic induction under the function of electromagnetic force, the armature will be sucked to the core, drive the attracting of normally-open contact and normally closed off-contact. On the contrary after the de energization of the coil, the electromagnetic suction disappears, then return to the original position in the reacting force

armature of the spring, enable normally closed closing of contact, normally open off-contact, thus reach safe protection.

Figure.1.Pilz Safety Relay

A key benefit of safety relays is their ability to specialize a clear, self-contained task to fulfill, so specific customer requirements have led to a wide range of safety relays with particular functions and features: these include devices with maintaining function, with safe monitoring of speed, monitored disconnection, as well as safety relays with special properties for the Execution area.

IV. DRAWBACKS OF RELAYS IN HYDRAULIC PRESS

- Multi functionality is impossible.
- High voltages causes breakdown.
- They cannot be switched ON and OFF at High speed.
- The back-emf created when the relay coil switches off can damage the components.

V. PROPOSED METHOD

PLC Based automation of typical industrial electromechanical processes has been introduced, such as control of machinery on factory assembly lines, amusement rides. It is used in many industries. Eight inputs and four outputs are used for proposed system. The interlocking between the limit switch is given for continuous motion of the machine. In this automatic control process, the motor is started by pressing the start button. The solenoid is always in up position while starting the motor. By using the controller action the solenoid starts to move downward direction. The movement of the solenoid valve is controlled by the limit switches, which is connected with the control unit of the PLC, open and close the contacts. After completing the process of assemble or de-assemble process the motor is turned off. This is the operation of the system. When the solenoid reaches the particular position, the limit switch opens the contact. After remove the bearing of the motor from the shaft, the limit switch closed the contact. Now the solenoid moves in upward. This is the continuous process which is automatically happened. The limit switch controls the movement of the solenoid by open and closing by using PLC.

VI. PRESSURE RELIEF VALVE

The most widely used type of pressure control valve is the pressure-relief valve because it is found in every hydraulic system. Schematic diagram of simple relief valve is shown in 4.4a it is normally a closed valve whose function is to limit the pressure to a specified maximum value by diverting pump flow back to the tank. A poppet is held seated inside the valve by a heavy spring. When the system pressure reaches a high enough value, the poppet is forced off its seat. This permits flow through the outlet to the tank as long as this high pressure level is maintained. Note the external adjusting screw, which varies spring force and thus, the pressure at which the valve begins to open (cracking pressure)(Fig.2.a). It should be noted that the poppet must open sufficiently to allow full pump flow. The pressure that exists at full pump flow can be substantially greater than cracking pressure. The pressure at full pump flow is the pressure level that is specified when referring to the pressure setting of the valve. It is the maximum pressure level permitted by the relief valve.

Figure 2.a.Simple Pressure-Relief Valve

Figure 2.b.Simple Pressure-Relief Valve

If the hydraulic system does not accept any flow, then all the pump flow must return to the tank via the relief valve. The pressure-relief valve provides protection against any overloads experienced by the actuators in the hydraulic system as shown in figure 2.b. A relief valve is not needed if a pressure-compensated valve pump is used. Obviously one important function of a pressure-relief valve is to limit the force or torque produced by hydraulic cylinders or motors. The main advantage of direct-acting relief valves over pilot-operated relief valves is that they respond very rapidly to pressure buildup. Because there is only one moving part in a direct-acting relief valve, it can open rapidly, thus minimizing pressure spikes.

VII.COMPOUND PRESSURE RELIEF VALVE

A pilot-operated pressure-relief valve consists of a small pilot relief valve and main relief valve. It operates in a two-stage process: The pilot relief valve opens when a preset maximum pressure is reached. When the pilot relief valve opens, it makes the main relief valve open. The pilot-operated pressure-relief valve as shown in figure.3 has a pressure port that is connected to the pump line and the tank port is connected to the tank. The pilot relief valve is a poppet type. The main relief valve consists of a piston and a stem. The main relief piston has an orifice drilled through it. The piston has equal areas exposed to pressure on top and bottom and is in a balanced condition due to equal force acting on both the sides. It remains stationary in the closed position. The piston has a light bias spring to ensure that it stays closed. When the pressure is less than that of relief valve setting, the pump flow goes to the system. If the pressure in the system becomes high enough, it moves the pilot poppet

off its seat. A small amount of flow begins to go through the pilot line back to the tank. Once flow begins through the piston orifice and pilot line, a pressure drop is induced across the piston due to the restriction of the piston orifice. This pressure drop then causes the piston and stem to lift off their seats and the flow goes directly from the pressure port to the tank. The advantages of pilot-operated pressure-relief valves over direct-acting pressure-relief valves are as follows: Pilot-operated pressure-relief valves are usually smaller than direct-acting pressure-relief valves for the same flow and pressure settings. They have a wider range for the maximum pressure settings than direct-acting pressure relief valves. They can be operated using a remote while direct-acting pressure-relief valves cannot.

Figure.3. Pilot pressure relief valve

VIII. DIRECTION CONTROL VALVES

A valve is a device that receives an external signal (mechanical, fluid pilot signal, electrical or electronics) to release, stop or redirect the fluid that flows through it. The function of a DCV is to control the direction of fluid flow in any hydraulic system. A DCV does this by changing the position of internal movable parts. To be more specific, a DCV is mainly required for the following purposes: To start, stop, accelerate, decelerate and change the direction of motion of a hydraulic actuator. To permit the free flow from the pump to the reservoir at low pressure when the pump's delivery is not needed into the system. To prevent the relief valve by either electrical or mechanical control. To isolate certain branch of a circuit. Any valve contains ports that are external openings through which a fluid can enter and exit via connecting pipelines. The number of ports on a DCV is identified using the term "way." Thus, a valve with four ports is a four-way valve. A DCV consists of a valve body or valve housing and a valve mechanism usually mounted on a sub-plate. The ports of a sub-plate are threaded to hold the tube fittings which connect the valve to the fluid conductor lines. The valve mechanism directs the fluid to selected output ports or stops the fluid from passing through the valve. DCVs can be classified based on fluid path, design characteristics, control methods and construction.

IX. PERFORMANCE COMPARISON BETWEEN PLC AND RELAY

Parameters	Relay control	PLC control
Break Down	Power supply Break Down Occurs.	No Power supply Breakdown.
Delay	Often Delays occur during stroke.	Each stroke operate at a given time without any Delay.
Replacement	Often Replacement of New Relays due to Wiring Problem.	No wiring problem in PLC.

X. CONCLUSION

The proposed system provides the automatic and semi-automatic control of hydraulic machine. The pressure is controlled and operated by the valves without any damage. The time consumption and man power is reduced. Replacing the relay control system with PLC makes more efficient and effective control system. The Nature of PLC design as well as its application, offers numerous benefits to industrial users to control and troubleshoot the faults.

XI. REFERENCES

[1]. Ms.K.Divya (2016) "Implementation of PLC Control for 500 Ton Hydraulic Deep Drawing Press "in International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering.

[2]. J. A. Ferreira, P. Sun and J. J. Gracio, "Design and control of Hydraulic Press", Proceedings of the 2006 IEEE Conference on Computer Aided Control Systems Design Munich, Germany, October 4-6, 2006.

[3]. Sun, P., Gracie, J.J., Ferreira, J.A.: Control System of a mini hydraulic press for evaluating spring back in sheet metal forming, Journal of

[4]. Choux, M., Hovland, G.: Design of a Hydraulic Servo Systems in "International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering"

[5]. A.Khot and Ravindra G.Patil (2013) "Hydraulic Pressure Test on Using PLC" in "International Journal of Advanced Research in Science and Technology"

[6]. Ms.V.Preetha (2018) "Automatic Control of Hydraulic Machine Using PLC" in "International Journal of Science and Technology.

[7]. Mrs.J.Paruvathavardhini (2017) "the Automation of Servo Hydraulic Press by Using PLC with Pilz" in "International Journal of Electrical and Instrumentation Engineering"

[8]. Mrs.Zelico Situm (2011) "Design and Control of a 50-kN Hydraulic press in International Journal of Mechanical Engineering and Instrumentation".