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Design of Transfer Unit in Hydraulic Machine

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ABSTRACT: The aim of this paper is to integrate the mechanical system of hydraulic transfer with hydraulic system to facilitate the ease of operation to manufacture the smaller parts in bulk. In the present scenario, time constrain is a crucial part for completion of any production process. The major sections of hydraulic system are press, transfer and spinning. In this paper express the working of transfer unit with the help of PLC controller. With the aid the production time can be reduced as well as higher degree accuracy can be of automation, achieved there by human efforts will be alleviated. Thus an attempt has been made to provide the smooth and rapid functioning of press work with the help of hydraulic system.

KEYWORDS: hydraulic press, PLC, transfer unit, hydraulic system, hydraulic transfer

I. INTRODUCTION

The hydraulic transfer system is used for pick and place of heated metal into desired object. A hydraulic transfer system follows the principle of "Electromagnetic field". The hydraulic system is mostly used in major industries like car industry, pipe industry, plate industry etc. In early days the transfer unit of hydraulic machines are manually operated but now-a-days its fully automated. The automation helps to reduce the man power and gives out the accurate product within the given time. The PLC logic work completion speed faster than the relay logic speed by changing the program in PLC. In this type of PLC doesn't have input and output ports. The 24 bytes of data is given to the PLC as command for the function of servo drives. The PLC size is very small compared to the relay logic. In automation any types of brands of controller can be used to program and control like SIEMENS, AB, ABB, MITSUBISHI, DELTA, OMRON etc. The manually operated machines are controlled by the human. By this method there is no accuracy in products and also it tends to error rate. By changing this method into automation, the problem of manually operated can be overcome.



Fig.1 Manually operated hydraulic machine

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Fig.2 Automated hydraulic machine

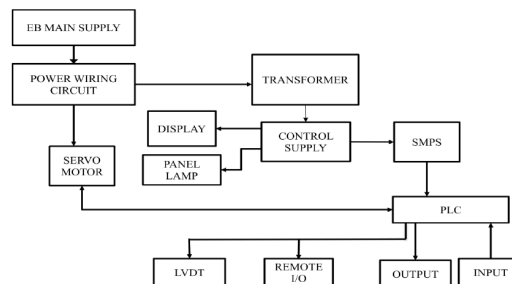


Fig.3 Blocks of Panel

PANEL DIAGRAM

The image of the panel is given below.

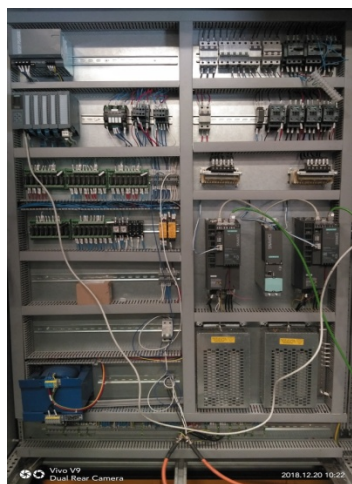


Fig.4 Image of Panel

The components used in the panel diagrams and their operations are explained below:

- A. PLC
- B. RELAY
- C. TRANSFORMER

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- D. SMPS
- E. CIRCUIT BREAKERS
- F. BRAKE RESISTOR
- G. SERVO DRIVES
- H. TERMINALS
- I. SPP

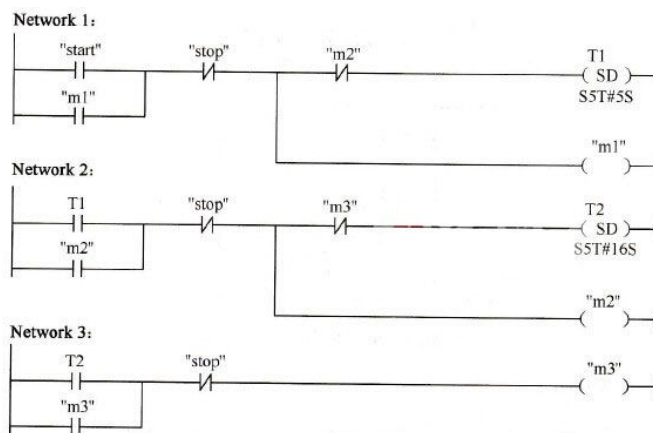
II. WORKING

The main function of the transfer unit is pick and place the heated metal from the roller stand topress. Then it move the converted metal into spinning section to remove the dust and coolant oil and further it moved into output conveyor. The transfer unit consists of 2 moving arm. Both of them is controlled by separate SERVO MOTORS. The moving arm is placed on the mounting frame. The moving arm has 2 pneumatic cylinders and 1 chuck. Pneumatic cylinders are used to magnetizing and de-magnetizing the MS plate. The above function is done by the air pressure pass through the pneumatic cylinders. After pick the MS plate, it's placed on the press unit to compress the heated metal into required shape. When the press of the MS plate is finished, then the material is picked by the cylinder and moved to spinning section. These processes are controlled by the servo motors using servo drives. Sometimes the pneumatic cylinder does not magnetize the plate when the plate is too hot. Then it is picked by the chuck and made it as required shape

PLC has 24 bytes of data to operate the transfer arm. The data send to the servo controllers is done via Profinet cable. The cable is used for accuracy and positioning. Servo motors are operated by the servo controllers using encoder cable. The data send as word, double word to the servo controllers. Ladder logic diagram was used in PLC program.

III. LADDER DIAGRAM

Totally Integrated Automation (TIA) is the world's leading automation concept. Totally integrated automation (TIA) is the interaction of extensive single components, tool and the services to achieve an Automation solution.



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IV. SERVO MECHANISM

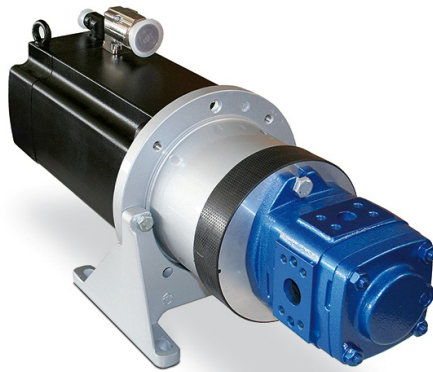


Fig 6. Servo motor

A servomotor is a linear actuator that mainly used to control of angular or linear position, velocity and acceleration.

It is a closed-loop servomechanism that uses position. The servo motor has a specific encoder to provide position and speed feedback to the controller. The measured speed and rating of the output is compared to the command position, the external input to the controller. The very simplest servomotors use position-only sensing through a potentiometer the motor always rotates at full speed or it is stopped. This type of servomotor isn't wide utilized in industrial management .More servomotors use optical rotary encoders to measure the speed of the output shaft and a variable-speed drive to control the motor speed. Both of those enhancements, usually in combination with a PID control algorithm, allow the servomotor to be brought to its commanded position more quickly and more precisely, with less overshooting. Simple servomotors might use resistive potentiometers as their position encoder. These area unit solely used at the terribly simplest and most cost-effective level, and are in close competition with stepper motors. They suffer from wear and electrical noise within the potentiometer track. Modern servomotors use rotary encoders. Instead of servomotors, generally a motor with a separate, external linear encoder is employed. These motor with linear encoder systems avoid inaccuracies in the drive train between the motor and linear carriage, but their design is made more complicated as they are no longer a pre-packaged factory-made system

V. PROGRAMMABLE LOGIC CONTROLLER

Programmable logic controllers (PLCs) have been an integral part of factory automation and industrial process control for decades. PLCs control a wide array of applications from simple lighting functions to environmental systems to chemical processing plants. These systems perform many functions, providing a variety of analog and digital input and output interfaces, signal processing, data conversion and various communication protocols. All of the PLC's components and functions are centered on the controller, which is programmed for a specific task. The basic PLC module must be sufficiently flexible and configurable to meet the diverse needs of different factories and applications. Input stimuli (either analog or digital) are received from machines, sensors, or process events in the form of voltage or current. The PLC must accurately interpret and convert the stimulus for the CPU which, in turn, defines a set of instructions to the output systems that control actuators on the factory floor or in another industrial environment.

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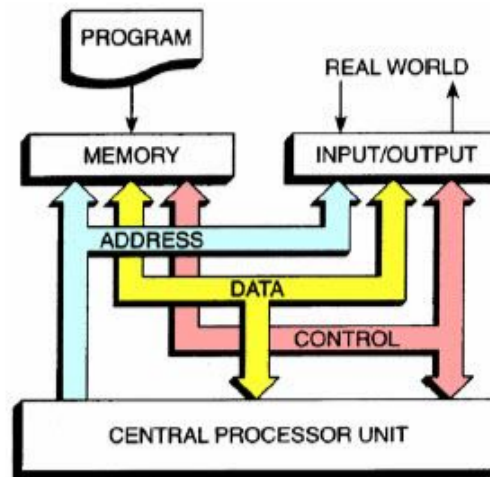


Fig.6. Architecture of PLC

The PLC stands for Programming Logic Controller here we use Master as CPU SIMATIC S7-1200 PLC. This PLC consists of 14 pins input and 10 pins as output operating voltage is 24V DC supply and maximum permissible operating voltage (upper limit) is 28.8 V DC. The minimum permissible operating voltage (lower limit) is 20.4V DC. The rated current when the CPU alone is operated is 500mA. The maximum amount of current consumption is about 1500mA, when all the expansion modules are operated or connected. There is no expandable memory only 100 KB is used for the program.

VI. RESULT

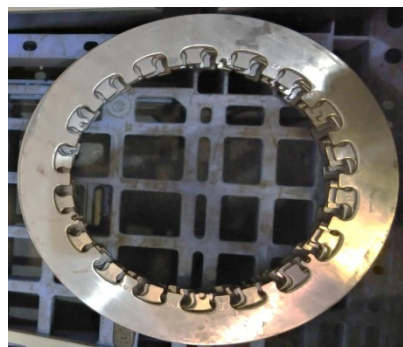


Fig.7 Output of heated metal

VII. CONCLUSION

Thus in all the industries the product manufacturing operation is done by manual, which cause the accident due to lack of concentration. To overcome this machines are introduced to perform the operation automatically. Here the machines are monitor by the way of PLC program. PLC program was designed for controlling Thus with the aid of automation, the performance time can be reduced as well as higher accuracy will be achieved. By using this method,

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High level of flexibility and output can be obtained. On this method different size of dies can be used. Automatic and fast die change can be done.

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