



## Automation Of Pad Printing Machine Using Programmable Logic Controller

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**Abstract—** This article mainly contain the automation of pad printing or stamping machine using programmable logic controller (PLC) as its name suggested. In this we can print automatic any symbol or name multiple times. This machine simple to maintain easy to operate to fulfil the requirement of todays automated plants. By the use of automation machine prove itself that it gives high production rate than manual production rate. In competition market everyone wants to increase their production & make their machine multipurpose.

**Keywords-** pad printing, stamping machine, embossor, Automation, Pneumatic system, PLC.

### I. INTRODUCTION

Modern large-scale printing & embossing is typically done using a printing press, while small-scale printing is done free-form with a digital printer. Though paper is the most common material, it is also frequently done on metals, plastics, cloth and composite materials. On paper it is often carried out as a large-scale industrial process and is an essential part of publishing and transaction printing.

Johannes Gutenberg started work on his printing press around 1436, in partnership with Andreas Dritzehen – whom he had previously instructed in gem-cutting – and Andreas Heilmann, the owner of a paper mill. It is not until a 1439 lawsuit against Gutenberg that an official record exists: witness testimony discussed type, an inventory of metals (including lead) and his type mould. Compared to woodblock printing, movable type page setting and printing using a press was faster and more durable. Also, the metal type pieces were sturdier and the lettering more uniform, leading to typography and fonts. The high quality and relatively low price of the Gutenberg Bible (1455) established the superiority of movable type for Western languages. The printing press rapidly spread across Europe, leading up to the Renaissance, and later all around the world Page-setting room - c. 1920. Gutenberg's innovations in movable type printing have been called the most important invention of the second millennium.

An engineer is always focused towards challenges of bringing ideas and concepts to life. Therefore, sophisticated machines and modern techniques have to be constantly developed and implemented for economical manufacturing of products. In the age of automation machine become an integral part of human being. By the use of automation machine prove itself that it gives high production rate than manual production rate. In competition market everyone wants to increase their production & make their machine multipurpose. The engineer is constantly conformed to the challenges of bringing ideas and design into reality. New machines and techniques are being developed continuously to manufacture various products at cheaper rates and high quality.

### I.

### II. WORKING OF AUTOMATIC PAD PRINTING MACHINE

As shown in fig. a frame is supports all pneumatics & embossing tool of a machine. Here we used a compressor for a generation of compressed air. A compressed air is supply to the double acting cylinder by means of hose pipe & 5/2 solenoid Direction control valve automatically using timing device.

The embossing tool is provided at end of the pneumatic cylinder rod. When compressed air is supply by the DCV to double acting cylinder due to pressure & force created by compressed air causes embossing action on work pieces. Here the advancement of the header is carried out in the upward and the downward direction using the pneumatic double acting piston and cylinder unit arrangement along with the timer operated solenoid direction control valve. In this type of machine high pressure air is used as the working fluid for the transfer of power, force and the motion to the system.

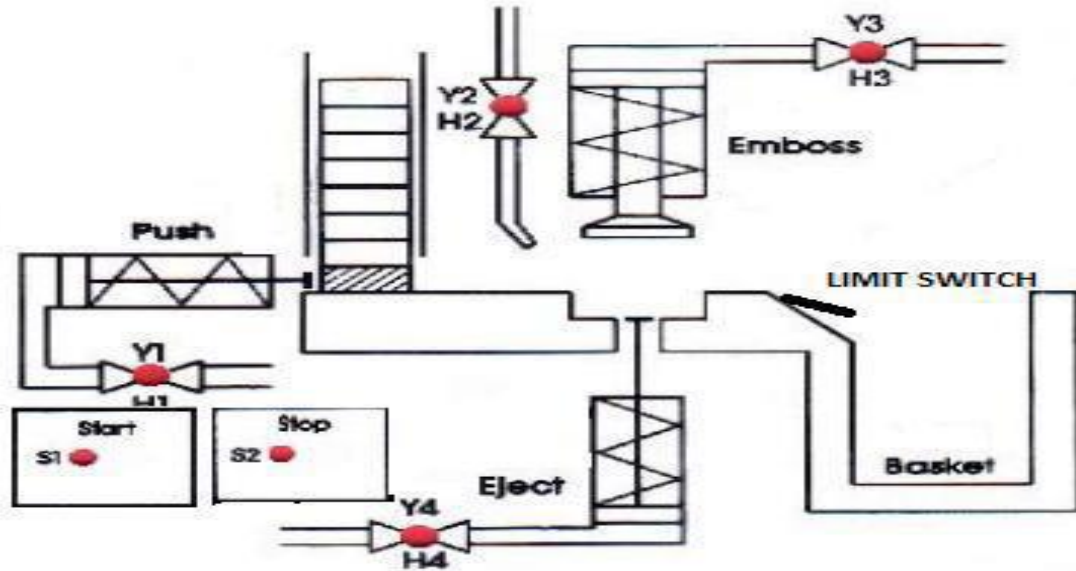


Fig. Working principle of automatic pad printing

### III. COMPONENT OF AUTOMATIC PAD PRINTING

#### 3.1 Double acting cylinders

Cylinders are linear actuators which convert fluid power into mechanical power. They are also known as JACKS or RAMS. Hydraulic cylinders are used at high temperature and produce large forces and precise movement. For this reason they are constructed of strong materials such as steel and designed to withstand large forces. Because gas is an expensive substance, it is dangerous to use pneumatic cylinders at high pressures so they are limited to about 10 bar pressure. Consequently they are constructed from lighter materials such as aluminium and brass. Because gas is a compressible substance, the motion of a pneumatic cylinder is hard to control precisely. The basic theory for hydraulic and pneumatic cylinder is same.



Fig. Double acting cylinder

#### 3.2 Solenoid valve

A valve is a device that regulates the flow of fluid(gases, liquids, fluidized solids or slurries) by opening and closing or partially obstructing passage ways.

A 5/2 way directional valve from the name itself has 5 ports equally spaced and 2 flow positions. It can be use to isolate and simultaneously bypass a passage way for the fluid which for example should retract or extend a double acting cylinder. There are variety of ways to have this valve actuated. A solenoid valve is commonly used, a lever can be manually twist or pinch to actuate the valve, an internal or external hydraulic or pneumatic pilot to move the shaft inside, sometimes with a spring return on the other end so it will go back to its original position when pressure is gone, or a combination of any of the mention above.

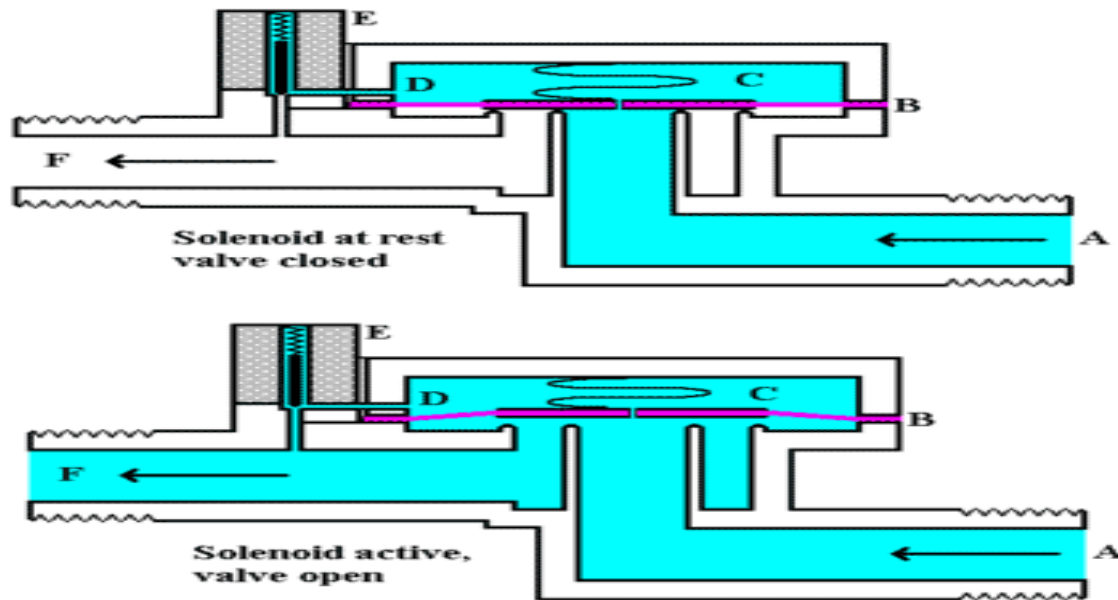


Fig. Solenoid valve operational principle

### 3.3 Timer with relay board

The repeat cycle timer was developed to control solenoid valves or other components that require periodic energization. This simple control unit will periodically energize a solenoid valve to allow flow of a liquid or a gas for an adjustable period of time. The intervals between energization of the valve is called the “dwell time” and is adjustable from 0.1 sec to 10 hours. The “energize time” of the solenoid valve is also adjustable from 0.1 sec to 10 hours.

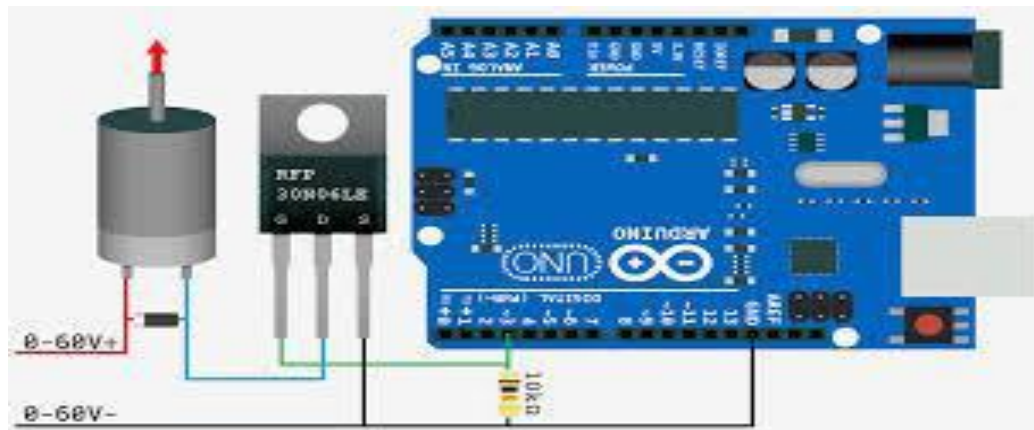


Fig. Timer

### 3.4 Pneumatic pipe fittings

Pneumatic tubing is also available in a number of other materials both with and without reinforcement for use in standard applications. SMC fittings incorporate a positive tube seal while the fitting is under pressure which allows polyurethane tubing to be used.

### 3.5 Compressor with Compressed Air Receiver Tank

Air receiver tanks are designed to provide a supply buffer to meet short-term demand spikes that can exceed the compressor capacity. They also serve to dampen reciprocating compressor pulsations, separate out particles and liquids, and make the compressed air system easier to control. In some cases, installing a larger air receiver tank to meet occasional peak demands can even allow for the use of a smaller compressor.

Air receivers in compressed air systems serves the important purposes of:

1. Equalizing the pressure variation from the start/stop and modulating sequence of the compressor
2. Storage of air volume equalizing the variation in consumption and demand from the system
3. Collecting condensate and water in the air after the compressor



Fig. Compressed air reservoir

### 3.6 Shaft

Shaft is a common and important machine element. It is a rotating member, in general, has a circular cross-section and is used to transmit power. The shaft may be hollow or solid. The shaft is supported on bearings and it rotates a set of gears or pulleys for the purpose of power transmission. The ferrous, non-ferrous materials and nonmetals are used as shaft material depending on the application.



Fig. Shaft

### 3.7 Washer

A washer is a thin plate (typically disk-shaped) with a hole (typically in the middle) that is normally used to distribute the load of a threaded fastener such as a screw or nut. Other uses are as a spacer, spring (wave washer), wear pad, preload indicating device, locking device, and to reduce vibration (rubber washer). Washers usually have an outer diameter (OD) about twice the width of their inner diameter (ID). Washers are usually metal or plastic. High quality bolted joints require hardened steel washers to prevent the loss of pre-load due to Brandling after the torque is applied. Washers are also important for preventing galvanic corrosion, particularly by insulating steel screws from aluminum surfaces.

### 3.8 Nut and Bolt

As nuts and bolts are not perfectly rigid, but stretch slightly under load, the distribution of stress on the threads is not uniform. In fact, on a theoretically infinitely long bolt, the first thread takes a third of the load, the first three threads take three-quarters of the load, and the first six threads take essentially the whole load. Beyond the first six

threads, the remaining threads are under essentially no load at all. Therefore, a nut or bolt with six threads acts very much like an infinitely long nut or bolt.

### **3.9 Programmable Logic Controller PLC:**

Programmable Logic Controller PLC is a solid state device. They are well-adapted to a range of automation tasks. All control operations are done using the PLC. The entire bottling process is automated by feeding the necessary conditions into the PLC using ladder logic. Ladder logic is one of the methods of programming a PLC. PLC consists of an I/O unit, central processing unit, and a memory unit. All logic and control operations, data transfer and data manipulation operations are done by the central processing unit. The results and statuses are stored in the memory of the PLC. PLC's are used for a wide range of applications especially in the field of control and automation.

## **IV. ADVANTAGES**

*Advantages: -*

- 1) Machine work on the low power consumption as compare to the old machine.
- 2) The operation of the new machine is well controlled.
- 3) Well balanced system.
- 4) It approximately matches the efficiency of old machine in low cost application machine.
- 5) Machining time is less depending on operator speed.
- 6) Only simple support structures are required Design & fabrication is easy.
- 7) It is a faster process.
- 8) Initial investment is low.
- 9) More accurate and economical in mass production.
- 10) It minimizes misalignment & Less floor space is required.
- 11) It increases the safety and working condition.

## **V. APPLICATIONS**

- 1) By using this machine we can easily emboss our own initial, logo or print name on leather card board, papers, crafts by using hot embossing tool.
- 2) By using this machine we can easily print our logo or name on leather, card board, papers, plastic articles crafts by using pad printing tool.





## VI. FUTURE IMPROVEMENTS

### 1. Automated Machine By Using Programming:

The machine developed by us is pneumatically operated. Thus in this machine it is needed to give full attention of worker to operate the machine. This machine can be modified to fully automate pneumatic machine by using the pneumatic controls and programming. This automated pneumatic machine can perform any specified printing or embossing work in minimum time, speed and with high accuracy. It can be used to transfer the job from one work station to another using conveyer system. If the path of the operation is given through programming. This machine does not need any regular attention. Line tracker machine is another improvement that can be done for specific work.

## 2. Actual Industrial Prototype:

We developed just a model of the pneumatic printing or embossing machine. In this we have used piston-cylinders and pneumatics with required specifications. But if we want to develop a machine that is to be used in the factory floor, we can use the highly automatic electronics control to increase the efficiency of the printing or embossing system.

## VII. CONCLUSION

While concluding this report, we feel quite fulfill in having completed the project assignment well on time, we had enormous practical experience on fulfillment of the manufacturing schedules of the working project model. We are therefore, happy to state that the in calculation of mechanical aptitude proved to be a very useful purpose.

Although the design criterions imposed challenging problems which, however were overcome by us due to availability of good reference books. The selection of choice raw materials helped us in machining of the various components to very close tolerance and thereby minimizing the level of balancing problem. Needless to emphasis here that we had lift no stone unturned in our potential efforts during machining, fabrication and assembly work of the printing or embossing machine project model to our entire satisfaction.

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