

# DECORATIVE PRINTING MACHINE USING HOT FOIL TECHNOLOGY

Mr. Pankaj V. Jadhav, Electronics & Telecommunication Engineering

Mr. Sunil P. Kale, Electronics & Telecommunication Engineering

Mr. Raj S. Patil, Electronics & Telecommunication Engineering

Prof. Revati C. Rathi, Electronics & Telecommunication Engineering

*Matoshri College of Engineering & Research Centre Nashik, Eklahare,  
Nashik (Maharashtra, India)*

## ABSTRACT

*An automatic stamping machine working on the principle of electro-pneumatics, up-down and roll-on and PLC which is successfully designed and developed. The sequencing of three actuators of the system was achieved effectively using PLC. The simple double acting cylinder gave good output for linear clamping, stamping and ejection of work pieces. The stamping was successfully commissioned, although the concept of using PLC in pneumatic is new, it was successfully proved that the sequential operation can be achieved. A device for hot-foil stamping on printing materials includes a heated stamping cylinder, a counter pressure cylinder, and a device providing for stamping foil. The device for providing the stamping foil has an adjustable guide element. That is disposed downstream of the stamping cylinder and of the counter pressure cylinder for guiding the stamping foil. The hot foil stamping device advantageously allows the stamping quality to be optimized. [1] This allows the attracting attention and retention it for longer durations compared to products and packaging without foil decoration.*

**Keyword-** *Stamping machine, Decorative printing machine, PLC, Cylinder, Foils.*

## 1. INTRODUCTION

Automation plays a very important role in manufacturing industry especially where repeatability is of great concern. The automated machines works in hazardous environment that is, in extreme temperature which is beyond the human conveniences. These machines are controlled by PLC (Programmable Logic Controller) which is programmed using ladder logic. Were as HMI (Human Machine Interface) provides control of the machine. A PLC ensures that equipment cannot be started unless all the permissive conditions for safe start have been established. It also monitors the equipment whenever any abnormality in the system is detected. [2] Pneumatic method is used to stamp the foil on to material. Printing & embossing is a process for reproducing text and images using a master form or template. In a hot foil stamping process, smooth and shiny surface elements in metallic colors such as gold, silver, copper, and aluminum may be transferred to the printing material. Foil stamping is also known as flat stamping, hot stamping, gold stamping, and leafing it does not produce a raised image. Foil is then placed between the die and the material to be imprinted different. Since ink, paper die and color selection are all the key elements in the success of an embossed or foil stamped product. Different foils have different characteristics in terms of durability, scratch resistance, fade resistance, chemical resistance, brittleness, opacity, adherence, along with color surface characteristics. Even the foils that appear the same can have different characteristics that are not immediately recognizable, as they are intended for different applications. Foil stamping is an incredibly versatile process that allows versatile process that allows you to explore imaging on any number of surfaces to which conventional printing techniques cannot be applied. Some surfaces do not accept foil well, if at all. Inks and varnishes that contain high percentage of wax, Teflon or silicon will prove resistant to the foil's adhesive. Additionally stamping over UV

or catalytic coatings, lacquers and certain film laminations can be difficult as well. And if you're looking for optimum quality, use cast coated paper for your stamping project. The results will be very satisfying. [3] The mechanics of the stamping process vary depending on the type and shape of the work piece to be enhanced. Depending on the type of hot stamping process used (vertical stamping, circumferential making bottle stamping, roll of stamping) and the surface design of the work piece (plain, concave, convex), the stamping components on the stamping Dies, can lie on a flat convex or concave plain. The difficulties in manufacturing curved stamping tools do indeed have an effect on the price, but the basic demands placed on the hot foil stamping on the tools are much same for the all different types. [4] The hot foil stamping operation is a function of four variables: die temperature, dwell time, pressure and stripping time (stripping time is not so important in graphic arts application).

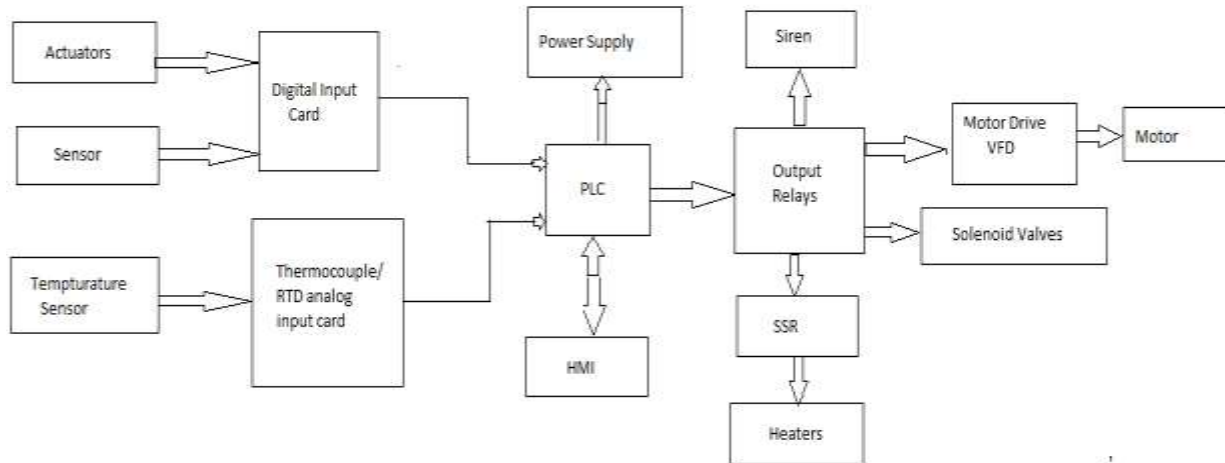
## 2. LITERATURE SURVEY

Dr. Ernest Oeser first patented the production of both gold and colored stamping foil using 23 carat gold or bronze (copper and zinc) powder with a Dye to obtain necessary color. Both this foil's were supported by a glassine (paper) carrier strip. This process had some limitation real gold was too expensive, being approximately 8 to 10 times more costly than the vacuum metallized type foil used today; and also bronze powder foil tarnished. Tarnishing is caused by the copper oxidizing, also the Dyes available at that time were not completely light suitable and so the foil faded. Other alternatives were considered and then layer on vacuum metallized foils, using aluminum were developed and it is still surveyed till today's time. Same with the systems which were half automated (semi manual) previously were also carried out and transformed into fully automated machine. It boosted the way of stamping whether it may be in batch printing or in different type of dimensions like 2D or 3D. Device for Hot Foil Stamping. A device for hot-foil stamping on printing materials includes a heated stamping cylinder, a counter pressure cylinder, and a device for providing stamping. [1]

PLC for Hot Foil Printing Machine with System Monitoring. PLC's are widely used in industries as it can withstand electrical disturbances, mechanical vibration and high temperature. Ladder logic is implemented for the hot foil printing machine. [2] Designers Guide for Foil Stamping & Embossing. (FSEA).FSEA is dedicated to growth of the foil stamping and embossing industries. The association increases the awareness about both this stamping and embossing. [3]The Guide for Hot Stamping and Foil Selection. Management for selection of appropriate foils. Operations of each and every foil are specified with its stamping substrate. Stamping Dies, Method of manufacture all this topics are been explained in brief. [4]Automatic Stamping and Pad Printing Machine. Automatic stamping machine is working on principle of microcontroller. We can use varieties of substrate like leather, plastic articles crafts by using pad printing tool. [5]Arduino Controlled Automatic Paper Stamping Machine. Automation has been boosted in last few decades. This project aims at developing a working model of an Arduino Controlled paper stamping machine that works on an Arduino controller which controls feed and stamping mechanism of paper useful in many kinds of organization. [6]Stamping Foils and methods. A stamping foil for forming printed circuit patterns on insulating or poorly conductive substrate comprises an electrically conductive layer made of a highly conductive metal. [7] Hot Stamping Printing Device. Heating elements bring a stamping tool integral with the stationary platen to a given temperature for a stamping operation. The heating element is displaced between the stationary platen and each stamping tool associated with that platen, and a maintenance position in which heating element is outside the platen press. [8]Method and Device for Hot Stamping. The invention relates to a method for hot stamping at least one band-shaped stamping foil onto a band shaped substrate, as well as a corresponding hot stamping device. [9]Foil Stamping Machine. A stamping machine is configured for stamping with a stamping head onto an article. A user selects a symbol using the computer system prior to the stamping onto the article. [10]

## 3. SYSTEM OVERVIEW

### 3.1 Block Diagram



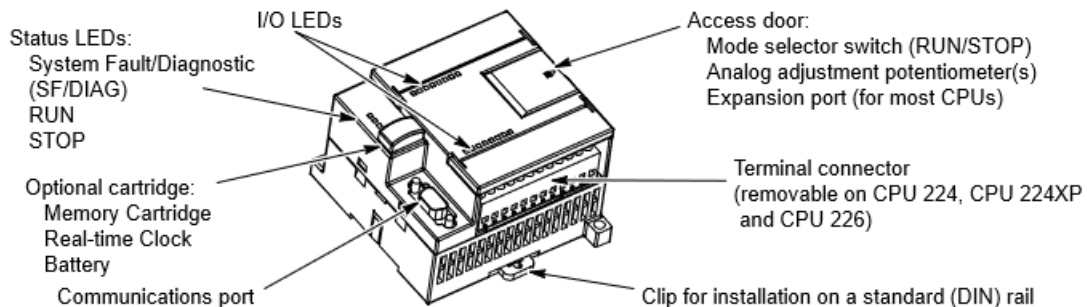
**Fig. 3.1-Block Diagram**

**3.2 Block Diagram Description**

PLC is the main operator over here. Every calibration and conversion takes place from here. At input side the input module like actuators, temperature sensors etc. are connected. Thermocouple and RTD are used as temperature sensor. By appropriate power supply the PLC (Siemens) is been turned on for its function. The logic of the system can be implemented by using the ladder logic. HMI makes the interface between the User and the PLC by providing display panel, and controlling keys etc. Solid state relay (SSR) converts the particular voltage into 0-230V. It also maintains the required range for operating heater. Heater is operated as per the foils because different foils have their various temperature characteristics. The function of pneumatic pressure is carried out by solenoid valves. The VFD drives the Induction motor by adjusting the motor frequency, and also tightens the foil by this motor.

**3.2.1 PLC (S7-200) Programmable Logic Controller**

The S7-200 CPU combines a microprocessor, an integrated power supply, input circuits, and output circuits in a compact housing to create a powerful Micro PLC. After downloading program, the S7-200 contains the logic required to monitor and control the input and output devices in your application. programmable controller is an industrial digital computer which has been ruggedized and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.



**Fig.3.2 -PLC (S7-200) Programmable Logic Controller**

### 3.2.2 Solid state relay (SSR)

A solid-state relay (SSR) is an electronic switching device that switches on or off when a small external voltage is applied across its control terminals. SSRs consist of a sensor which responds to an appropriate input (control signal), a solid-state electronic switching device which switches power to the load circuitry, and a coupling mechanism to enable the control signal to activate this switch without mechanical parts. The relay may be designed to switch either AC or DC to the load. It serves the same function as an electromechanical relay, but has no moving parts. Packaged solid-state relays use power semiconductor devices such as thyristors and transistors, to switch currents up to around a hundred amperes. Solid-state relays have fast switching speeds compared with electromechanical relays, and have no physical contacts to wear out. Application of solid-state relays must consider their lower ability to withstand momentary overload, compared with electromechanical contacts, and their higher "on" state resistance. Unlike an electromechanical relay, a solid-state relay provides only limited switching arrangements (SPST switching).

### 3.2.3 VFD (M200)

A variable-frequency drive (VFD) also termed adjustable-frequency drive, "variable-voltage/variable-frequency (VVVF) drive", variable speed drive, AC drive, micro drive or inverter drive) is a type of adjustable-speed drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage. VFDs are used in applications ranging from small appliances to large compressors. About 25% of the world's electrical energy is consumed by electric motors in industrial applications, which can be more efficient when using VFDs in centrifugal load service, however, VFDs' global market penetration for all applications is relatively small. Over the last four decades, power electronics technology has reduced VFD cost and size and has improved performance through advances in semiconductor switching devices, drive topologies, simulation and control techniques, and control hardware and software. VFDs are made in a number of different low- and medium-voltage AC-AC and DC-AC topologies.

## 4. CONCLUSIONS

The hot stamping process is ideally suited to the decoration of many of many products. Being dry printing process, parts can be packed immediately at the machine. Stampings are permanent and inexpensive. As it is fully automated operator training is minimized. By following the procedures outlined in this catalogue, trouble-free hot stamping can be achieved.

## REFERENCES

- [1] H. Schadl Device for Hot-Foil Stamping US20170210118 A1.
- [2] Santana Fernandes and Sangam Borker. PLC for hot foil printing machine with system monitoring. ICCREST.
- [3] Brandtjen & Kluge the Designers guide to Foil stamping (FSEA) <http://kluge.biz/brouchers-guides>.
- [4] Milford Astor The guide to hot stamping and foil selection 2005 <http://www.ferret.com/./14028>.
- [5] D.S.Welker, Lalit S. Saindane Vishal P. Sonawane Automatic Stamping and Pad Printing Machine, Vol. No.6, Issue No.2, Feb 2017.
- [6] Yusha Patel, Prajakta Atale Arduino Controlled Automatic Paper Stamping Machine, Vol. 8, Issue 2, (IJSER).
- [7] H Bausar, E Kurz, Bernd Schindler Stamping foils and Methods US4495232 A.

[8] J. Wening P. Muhlfelder Hot Stamping Printing Device US9579914 B2.

[9] J. Chretien Method and Device for Hot Stamping US9511619 B2.

[10] Y. Miller, Y. Adar Foil Stamping Machine US9649874 B2.

## BIOGRAPHICS

	<p><b>Mr. Pankaj Vilas Jadhav.</b> Student of last year E&amp;Tc of MCOE&amp;RC-Nashik under Savitribai Phule Pune University, Pune. His major fields of studies are PLC, Computer Networks, Embedded Systems, and Digital Signal Processing.</p>
	<p><b>Mr. Sunil Parlad Kale.</b> Student of last year E&amp;Tc of MCOE&amp;RC-Nashik under Savitribai Phule Pune University, Pune. His major fields of studies are PLC, Computer Networks, Embedded Systems, and Digital Signal Processing.</p>
	<p><b>Mr. Raj Sunil Patil.</b> Student of last year E&amp;Tc of MCOE&amp;RC-Nashik under Savitribai Phule Pune University, Pune. His major fields of studies are PLC, Computer Networks, Embedded Systems, and Digital Signal Processing.</p>
	<p><b>Revati C Rathi</b> (ME VLSI &amp; Embedded Systems) Assistant Professor, MCOERC, Nashik. Working area- Wireless Sensor Network, Embeede Systems.</p>