

# A Review Paper on Development towards Automation- Pneumatic Pad Printing Machine

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## ABSTRACT

Basically, pad printing can be used on 3-d substrates; it has attracted the attention of many researchers in the field of printed electronics. This paper presents developments in the automation of a pad printing machine that improve its specifications for use in scientific fields and equip it with some unique features. Users of this machine can obtain graphs of printing force and printing step durations for tracing and analysing the printing process. If we introduce this basic arrangement with pneumatic system than quality and quantity of printing plates is increase, increase in printing speed ratio, control of stroke is possible at any height, spoilage of printed plates is prevented as well as efficiency of machine is also improved. Pneumatic system makes our machine bulky. Lower maintenance cost than existing mechanism which is gear type arrangement. So, to gain all above mentioned benefits it is necessary to replace gear attachment by pneumatic system.

**Keywords:** Pad Printing Machine, Automation, Pneumatic Pad Printing Machine.

## I. INTRODUCTION

Pad printing is a printing process that may transfer a 2- D image into a 3-D object. This is accomplished using an indirect offset printing process that involves an image being transferred a silicone pad into a sub-tracts. Pad printing is used for printing on otherwise difficult to print on products in many industries including medical, automotive, promotional, apparel, and electronic objects, as well as appliance, sports equipment and toys.

The another properties of the silicone pad not able to pick he image up from a flat plane and transfer it to a variety of surface like; flat, cylinder, spherical, compound angles, texture, concave, or convex surface.

The image is now on the surface of the silicone pad. Silicone rubber does not allow ink to penetrate its surface area and therefore when the pad presses down onto the product to be printed it releases the ink as a clean film. The range of inks and solvent water used enable the inks spread to the surface after releasing the ink the pad is then clean and independent to repeat the process.

Because such a wide range of inks are available almost any material can be printed and due to the flexibility of the silicone rubber pads uneven, curved and awkward shaped surface and complex surface may be printed. As the ink is frequently drying element, pad printing is capable of 'wet on wet' printing and high quality multicolor designs can easily be obtained including four color process.

The more recent research work development of closed cup machine has made the process 'cleaner'

and enabled the process to become more user friendly and automated.

The main components are used in pad printing machine.

1. Silicone pads
2. Pad printing ink / solvent water
3. Fixture (jig / mould)
4. Air tight ink cup
5. Air compressor
6. Polymer plates / cliché
7. Pneumatic cylinder
8. Pressure sensor
9. Programmable logic controller (PLC).

### 1.1 Mechanism

Mechanism which is previously used is gear type attachment. The gear type attachment has a through and through input shaft which is rated to handle the full power that would be handled by the main drive or the line shaft. A right angle turn, through gears of appropriate design and ratio is required to power the print cylinder.

By using pneumatic system quickly controlling action is gain. At any height control action of stroke is obtained. Quick speed ratio is obtained. Productivity is also increases by using pneumatic system because speed ratio is high than more number of plates are printed at the same time compare to the electric pad printing machine less maintenance cost is required by using pneumatic system & pneumatic system makes our system bulky effectiveness & efficiency of machine is improved.

If we use gear attachment than during engagement & disengagement of gear sometime there are chances of leakage of ink because leakage of ink occurs spoilage of printed plates. For every organization rejection of components are not accepted & it's not feasible for their. So reduce rejection of plates it is necessary to implement gear attachment with pneumatic.

### 1.2 Features

- Less and easy maintenance.
- High output.
- Heavy duty precision model.
- Simplified controls & easy operation.
- Close ink cup system.
- Stable ink viscosity.
- Inductive proximity switches.
- Save electricity up to 80% on monitories models.
- High speed ratio.
- Increase productivity.
- Less time consumption for operation.
- Easy stroke control at any height.
- No chance of ink leakage.
- Increase image quality.

### 1.3 Applications

- For identification plate or name plates used for machines.
- Labelling.
- Decorating machine.
- High quality printing works.
- Electronic micro components, such as cable, connectors, IC chips, relays, etc.
- Industrial button and keys as found on calculators, telephone and computer keyboards.
- Electrical household appliances such as iron, VCR, TV, coffee pots, telephone, etc.
- Large industrial appliance panels such as on dishwasher, washing machine and dryers.
- Toys such as figurines, doll, cars, infant bottles, pacifiers, rattle and night light.
- Advertising specialty items like pens, lighters, key chain, clock, watch faces.
- Sporting good such as golf ball, baseballs, tennis, and football.

### 1.4 Types of Pad printing machine

#### A] According to color application

- Single color pad printing machine

- Double color pad printing machine.
- Multi-color pad printing machine.

**B] According to cup position**

- Open ink cup
- Close ink cup

**C] According to driving mechanism**

- Electrical pad printing.
- Pneumatic pad printing.
- Hydraulic pad printing.

**D] According to operating method.**

- Manually operated.
- Semi automatic.
- Automatic.

**E] According to method of cycle**

- Open cycle
- Close cycle

**F] According to controlling device**

- Pneumatic rams
- Servo motor
- Electro mechanical cams
- Touch pad control
- Manually control
- Bladder control

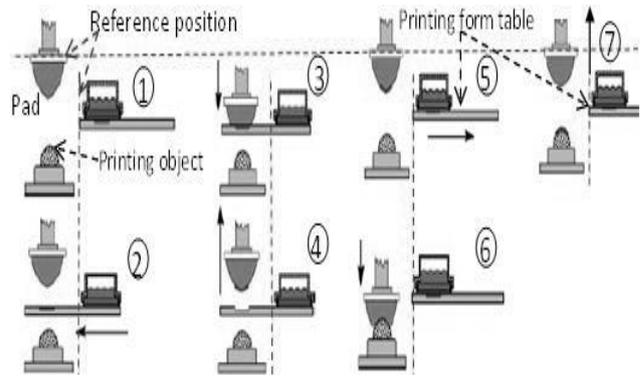


Figure:- 1.1

**Micro Print LC GMBH** [2], had investigated the:

**Open ink system:-** The ink is no longer transfer manually to cliché and the excess removed. The open system uses a doctor blade to transfer the ink and remove the excess. This process is fully automated.

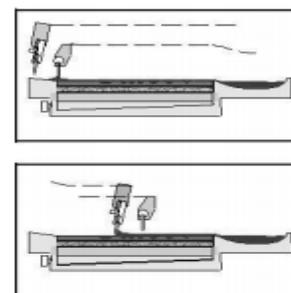


Figure:- 1.2

**II. LITERATURE REVIEW**

**Arash Hakimi Tehrani** [1], had investigated that, pad printing machines come in two type pad transfer printing and rotary pad transfer printing. This paper focuses on pad transfer printing. A schematic diagram of pad printing is given in figure 1.1. As shown, the pad printing from is initially located in their reference position. The printing form table then advance (step 2). Next, the pad comes down to pick up the ink, (step 3) a movement reversed in step 4. In step 5, the printing from table return to its reference position. Finally, the pad descanted to transfer the ink film to the substrate [5] (step 6), and then returns to its reference position in step 7.

**Close ink cup system:-**

The close system consists of an inverted cup with a doctor ring. The doctor ring is made either of hard metal or ceramics and has the task of removing excess ink from the cliché the cup is field with ink and simply dragged over the cliché. Cup systems have become widely accepted today the advantage is that the ink is completely sealed in and needs much less maintenance.

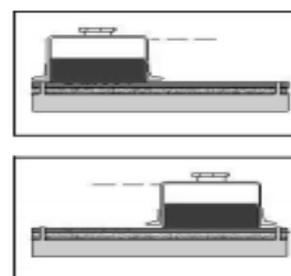


Figure:- 1.3

Pad material (Gelatine to silicone):-

Material which is previously used is gelatine (as shown in figure 1.4). By using gelatine material ink particles are not spread and stick with ink particles properly. So, if we replace it with silicone material (as shown in figure 1.5) than particles of ink are stick properly on pad material and ink will spread properly with pad material. So, it is beneficial to use silicone material because gelatine is a flexible material and ability to stick is more. Thus, proper printing image is obtained.

The type the pad silicone mass is responsible for its characteristics, such as the aging process, the anti-static properties, the ability to resist mechanical loading, as well as its properties against aggressive ink and also the deforming or rolling process.



Figure:- 1.4 Gelatine pad



Figure: - 1.5 Silicone pad

Cliché:-

There is various types of clichés. This is differentiated by the material and the thickness of the materials used:

- Synthetics clichés
- Anodized aluminium
- Steel cliché
  - Hardened tool steel with low chrome contain and
  - Surface tempered steel strips.
- Ceramic clichés

Cliché selection:-

A selecting has to be made depending on the requirement profile regarding quality, planned number of prints, costs and whether the cliché will

be produced in-house or externally and the advantages and disadvantages weighed against each other.

Control and Intel pad print:-

When analysing the control aspect of the Intel padprintproject it was instructive to consider what actuators might be included in the printing, how they would be used and what date would be available to make control decision. A number of methods have been employed in existing printers to move the pad and cliché: electro-mechanical cams, pneumatic rams and servo motors driving machine-screws. It is likely that servo motors would selected as the primary actuators to provide flexibility in the print cycle, cope with the high printing rate demand by intelpadprint and rapidly apply the high load required to deform the printing pad. There might be a second actuator to rotate the cliché to compensate for printing inaccuracies, perhaps caused by an uneven substrate surface; and there would be an actuator to press the ink-pot against the cliché. As a printing process is being discussed there will probably be automated valves to add solvent or ink, in order to alter the viscosity of the ink. It will be demonstrated that it can be beneficial to warm the ink, and this can be achieved using a coil embedded in the cliché.

**Claus Morlok** [3], when the cleaning operation is performed before or after a printing operation, the cleaning operation will inevitably lead to a lengthening of the overall cycle time. The total cycle time is an important component. This is also reflected in the fact that repeatedly multicolour presses are used, even if only one color is printed in order to carry out the integrate cleaning cycle within the time of the printing cycle can.

Normally, two drives are required, namely a drive for a printing plate and a drive for moving the

tampon. Mostly this linear movements are carried out pneumatic or by a motor.

The invention according related to a pad printing machine, which comprises at least a single color printing unit, said printing unit for the automatic performance of printing operation is formed, and for this purpose has a first tampon holder for holding first tampon and a plate holder for holding a printing plate, and using the same printing unit is designed for automatically carrying out of cleaning operation and this has a cleaning device for cleaning the first tampon, characterized in that the same printing unit comprises a second pad holder a second tampon, and is to swap the position of the two tampon holder is designed such that in a first exchange position of a tampon holder with its one tampon in a position to carry out at least one printing operation while the concerned other tampon holder is in a position to carry out at least one cleaning operation with its other tampon, whereas with a second exchange position of a tampon holder its other pad in a position to carry out at least a printing operation, while the concerned a tampon holder is provide with its one pad in a position to a carry out at least one cleaning operation, a cleaning operation during a printing operation can be executed.

The invention has the advantage that when a color tampondruckmaschinen the cleaning cycle time falls in the printing cycle time and hence the overall cycle time for a cleaning cycle and a pressure cycle and then only correspond to the print cycle time period when is performed in addition to a pressure cycle and a cleaning cycle.

However, the invention is also applicable for printing of multi-color pad printing machine, because then in each printing unit individually, a cleaning a cycle can be performed, depending on the degree of contamination of the respective pads and / or depending on the type of ink used. Each of the

tampon of the printing unit can be used as long as for printing operation, to be removed for cleaning. Thereafter, the tampon to be substituted each other. This can be done for example by a rotary movement of a pad carrier during of advancing the cliché. Since this process takes place parallel in time, there is no loss of time.

**Udo Vogt** <sup>[4]</sup>, accordingly the present invention concerns a pad printing machine comprising at least one displaceable sub-assembly configured displaceable relative to at least one second sub-assembly, further an electric, adjusting linear-actuator which is mechanically connected to the minimum of one displaceable first sub-assembly to drive it, characterized in that the electric, adjusting linear actuator is fitted with an inverted planetary roller threaded drive.

Furthermore the present invention relates to the application of at one linear adjusting actuator fitted with an inverted planetary roller threaded drive to move at least one displaceable first sub assembly relative to at least one second sub-assembly of a pad printing machine.

The electric, adjusting linear-actuator (electric adjusting cylinder) containing inverted planetary roller thread drive offers the advantage over compressed air control that the speed and position of displaceable component of the pad printing machine can be controlled accurately. Accurate time-dependent and /or path-dependent compressive forces may be set and holding duration for displaceable components can be defined. Moreover they may exert large forces while being very compact.

### III. CONCLUSION

We can be concluded from the literature review that

- We have introduced our machine from open ink system to close ink system.

- The material of the pad is changed from gelatine to silicone as on silicone material ink does not spread and ink is properly stick to the material. Main advantages of properties of silicone material are their absorbing, dispensing, larger strain, flexibility.
- We have improved the machine from gear system to pneumatic system, to improve the efficiency and production of machine. Thus, Rejection and spoilage of plates are prevented; high speed ratio is obtained, so production rate is increase as per requirement. And less maintenance and machine make lighter in weight.

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