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Hot Foil Rolling Machine

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Abstract: Packaging plays a crucial role in communication product benefits to consumers. Often time designers use high visibility to differentiate packaging within competitive array. Although luxury brands commonly use enhanced graphical and printing techniques to convey high quality products, many private labels package designers also utilizing enhancements to attract attention to their products. This research sought to understand how incorporating foil printing to the primary panel of fast-moving consumer good packaging will affect consumer attention and purchase preference. it is a type of machine which rolls the product or the workpiece over the die which gives the impression coating. The impression coating material will be gold and silver foil. Discussing about the coating color it can be either golden and silver. The type of golden or silver foil material is glossy and mat color. The main components of machine are motor, spindle, heat control board, lock handle, forward reverse switch and the bearing. The spindle rotates the workpiece or product at a fixed and stable speed. The speed needs to be constant, because if the speed is increased the product will not rotate the workpiece on the foil plate or sheet properly.

***IndexTerms*–Heating Plate, Foil Holders, Locking Handle.**

I. INTRODUCTION

Printing is the process of applying color to fabric in definite patterns or designs. In properly printed fabrics the color is bonded with the fiber, so as to resist washing and friction. Textile printing is related to dyeing but, whereas in dyeing proper the whole fabric is uniformly covered with one color, in printing one or more colors are applied to it in certain parts only, and in sharply defined patterns. In printing, wooden blocks, stencils, engraved plates, rollers, or sunk-screens are used to place colors on the fabric. Colorants used in printing contain dyes thickened to prevent the color from spreading by capillary attraction beyond the limits of the pattern or design.

What is foil printing?

Applying foil to fabric has been revived in Italy. In this system, the design is first printed by rotary or flatbed screen onto the substrate using a special water-based or plastisol adhesive. Then the foil is transferred to the pattern and bonds only where the adhesive has been laid down. The foil consists of a thin polyester carrier film onto which the finishing system is coated using gravure printing and vacuum metalizing processes. Foil printing is a special kind of printing procedure where heat, pressure, and a metallic paper (foil) is used to create different shiny designs and graphics on various materials.

Foil stamping gives the stamped design a shiny and incredible look and is increasingly becoming the preferred method of printing in many an industry. ' Foil printing is also referred to as hot stamping (because of the use of heat), foil stamping, dry stamping, and leaf stamping. There are various types of foil stamping that can be used depending on your design needs. Foil. printing is called dry printing because it does not use any sort of ink for printing purposes. It is a dry stamping process where ink, some sort of

magnetism, or plates are not used to print letters and pictures as is used in traditional printing methods. In place of all these things, foil stamping uses dies or carved metal plates, heat, and foil in the stamping process. In the foil printing process, the die or the sculpted metal plate comes in contact with the foil and transfers a thin layer of the foil film onto the intended surface. As the metal plate is heated, the foil stuck to the surface only in the design of the plate and in the required areas with the desired imprint.The basic concept behind foil stamping is simple. The process is achieved when a die is mounted on a platen and heated.

Foil is then placed between the die and the material to be imprinted. When the die presses against the foil, the heat releases the coloring layer from the foil roll and binds it to the end product. Foil stamping, which is also known as flat stamping, hot stamping, gold stamping, blocking, and leafing, does not produce a raised image. But when it's combined with embossing, as discussed on the next page, it is called foil embossing or in the industry, combination work. Foil stamping is the only printing process capable of applying bright, non-tarnish able metallic effects to paper, plastic, paper board and other surfaces. Foil printing is to print some pattern with the foil on the fabric or paper for shinny effect. There are 2 kind of foil printing method. First, pattern is printed by glue on the fabric or paper, and then pressed with foil paper by hot steel roller. Second is printing on the foil paper first, and then press the foil on the fabric or paper. Of course, with hot steel or iron. The reproduction of graphics requiring a high-quality reflective image can be effectively achieved by using foil films rather than metallic inks. Foil stamping is also referred to as flat stamping, hot stamping, gold stamping, blocking, and leafing .Foil can be used for logos or accents surrounding logos, borders or highlights surrounding images, and elegant accents for distance symbols, images, graphics, on your custom presentation folders.

Foil Selection:

The selection of foil depends on many factors such as:

Different foils have different characteristics in terms of durability, scratch resistance, fade resistance, chemical resistance, brittleness, opacity, adherence, along with colour and surface characteristics. Every manufacturer's colours are different unless made to an international colour reference like Pantone®. Even foils that appear the same can have completely different characteristics that are not immediately recognizable, as they are intended for different applications. Foil can be used for many different applications and can be printed on various materials including paper/ card, plastic, leather, fabric, felt, vinyl, rubber and wood. Foil selection is very dependent on the substrate you will be printing onto. When coating onto plastic caps, choosing the right foil is very important. You will need to use a foil that is resistant to high temperatures if the substrate is going to feed through a laser printer and or photocopier. Foil may not be compatible with each other. If you are using two different kinds of foil, which overlap one another, then you need to choose a foil that will stick to each other. The colour of the substrate or product you wish to coat on will limit your selection of foil colours. The range of colours available for foils are limited, especially for obscure foil grades, so that may determine your foil / substrate selection. As in most artistic medium, these characteristics should be accepted as an opportunity for innovation. The selected foil and substrate characteristics, and the depth and complexity of the artwork and dies, are all variables, which will control the final result. Foil printing is an incredibly flexible process that allows you to discover imaging on any number of surfaces to which conventional printing techniques cannot be applied. Your local raw material suppliers are best placed to help and guide you through the selection process.

Most foils for stamping are comprised of five layers:

- A thin Polyester Film Carrier is used to protect the foil layers and to permit rolling.
- The Release Coat allows the other layers to release from the film carrier upon application of heat and or pressure.
- The Lacquer or Colour Coat carries the colour tint in the form of dyes or pigments. Most often this layer is transparent or translucent, which allows the introduction of the metallic layer in metal foils.
- The Metal Coat is generally composed of aluminium to provide the reflective qualities and opacity desired in metallic foils.
- The Adhesive Coat serves to bond the foil to the substrate being stamped. The printability characteristics of foils are primarily determined in this coat by employing more or less adhesive.

Types of Foil:

There are a range of printing foils available for use in hot foil rolling. Foils are available in plain single colours, multi-colour to patterns of all sorts. These are:

Metallic Foils: Metallic foils have a metallic mirror like gloss finish and gives a gleaming look to the foil printed image. The foils are available in a large range of different metal shades such as gold, silver, bronze, and copper with a variation of shades within each color. In addition, metallic foils are also available in other colors such as white, green, blue, black, brown, red, orange, yellow, pink, purple and much more, again with a variation of shades within each color.

Gloss Pigment Foils: This type of foil does not have a metallic look but has a very high lustrous finish. Using this type of foil gives a glossy look to the imprint. Gloss foils are available in a large range of different colors and shade variations.

Matte Pigment Foils: The range of colors available, are the same as the gloss pigment range, but in a dull finish, hence the name matte foil. The solid white pigment color foil is classified as a matte foil and so is available in this range.

Holographic Foils: A multi-dimensional image foil made photographically with the use of lasers and special optics to produce a hologram. Such hologram images are transferred on unique foils, which are then known as holographic printing foil. These kinds of foils give a very special, motion effect to the foil designs.

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II. Literature survey

Foil printing plays an essential part during the point-of-sale because the visual elements of a package play a key role in communicating product benefits to the customer [1]. Embellishments like foil stamping, which influence attention, thus, can strengthen this moment [1]. This is especially true in low involvement situations when the consumer has little time to consider other aspects of the product. In addition, the trend toward hypermarkets and the movement of packaged food products into these larger stores create a more competitive market, thus emphasizing the need for enhanced design features to strengthen branding at the point of sale [2].Previous research suggests that packaging form, function, and appearance can be a powerful influence on consumer attention and purchase choice, more influential at the point of purchase than other communication tools because of their ease of availability [3]. For example, a recent study found that the location of the product image on the package influences consumer perception of the visual “heaviness” of the product and evaluation of the package [4]. As this finding suggests, packaging design is influential Journal of Applied Packaging Research 46 during the decision-making process, guiding consumer involvement with a retail category [5].Embossing, holography, and foil stamping may directly impact each of these attributes, creating a rich, elegant effect that has the potential to separate a package from its competitors. The foil stamping technique can be applied to fiberboard, metal, or plastic substrates in which brand identity, text, and/or images are typically foil stamped on a package [6]. The use of foil stamping in a consumer environment can increase the probability that shoppers change or interrupt existing patterns of choice and behavior [7], demonstrating a positive effect on consumer attention by exhibiting characteristics that contrast with other stimuli within the same product category (e.g., cereal or beverages) [8,9]. Since foil stamping is intended to enhance the premium image of a package, it should be tested in a retail environment to evaluate its effect[8], the purpose of the research reported here. This study investigated the use of foil stamping on three different products, cereal, popcorn, and boxed past a dinners, to determine if it generated a positive impact on consumers by increasing their attention and decreasing the time to find the package compared to identical packages without foil stamping. Several studies have used eye tracking to collect quantitative consumer attention data

[10], one observing how private and public label pack-aging affect consumer behavior. In this study, eye tracking was used to gather data to gain an understanding of how varying label types influence attention and purchase preference, the results finding that the participants preferred public- branded packaging compared to the private label brands based on eye tracking data and purchase decision [11]. A similar study explored if the amount of physical product visible from the primary display panel affected consumer attention and purchase preference. Eye tracking data were collected from four stimuli, each with a different amount of physical product displayed. The results found that participants viewed packaging with the most physical product exposure faster and longer, ultimately purchasing these products more frequently. These studies were essential in developing an eye tracking methodology to gather quantitative consumer attention data for the foil stamped products investigated here [12].

Before starting our work, we have undergone through many research papers which indicates that for a production-based industries machine installation is a tricky task as many factors being associated with it such as power consumption(electricity bill per machine),maintenance cost ,no of units produced per machine i.e., capacity of machine, time consumption and many more.

The extensive literature review will help to understand the concepts, the theorems and the different factors that influence the machine's performance. Before starting our work, we had viewed many research papers which indicate that for a production-based industries machine installation isa crafty and a skillful task as many factors are associated with it such as power consumption, time required, maintenance cost, no of units produced per machine etc. This is especially true in low involvement situations when the consumer has little time to consider other aspects of the product. In addition, the trend toward hypermarkets and the movement of packaged food products into these larger stores create a more competitive market, thus emphasizing the need for enhanced design features to strengthen branding at the point of sale [13].

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III. Problem definition

Problem objective:

The main objective of this research work is to do proper coating on plastic caps usually used in lipstick caps, deodorant caps, and perfume caps economically and accurately.

Problem Definition:

the previous research investigated the foil printing process on textile material. However the investigation of foil printing on plastic caps was not done previously. In order to bridge these gaps in the literature foil printing process is done on plastic caps.

IV. Methodology

The arrangement has electrical motors, long shaft, Quick return mechanism, heating board, forward and reverse button set up. The power is transmitted to the long shaft from the electrical motor which is driven by electrical current. The grinding wheel is attached at the one end of the shaft. The quick return mechanism is placed for forward and reverse motion. For rolling the plastic caps, which will roll over the heated dye, with the help of shaft and spindle to carry the rolling process. All the operations are carried out by giving electrical current to the motor. It converts electrical energy into mechanical energy.

In this project we will generally give the power supply to heating board and the main motor attached with belt drive to make forwarded and reverse stroke of spindle. As the heating board will heat up the dye at 90°C and then on which the foil will be kept. There will be a button of forward and reverse stoke which will make move spindle in either direction over the both side heated dye. For making movement the motor will be connected with belt drive with lead screw.

Then the foil will be heated with the help of heated dye, after attaining the required temperature we will start coating on plastic caps. To start the coating, firstly the uncoated plastic caps will be mounted on spindle which will rotate with the help of shaft, as the spindle is mounted on shaft for rolling over the dye.

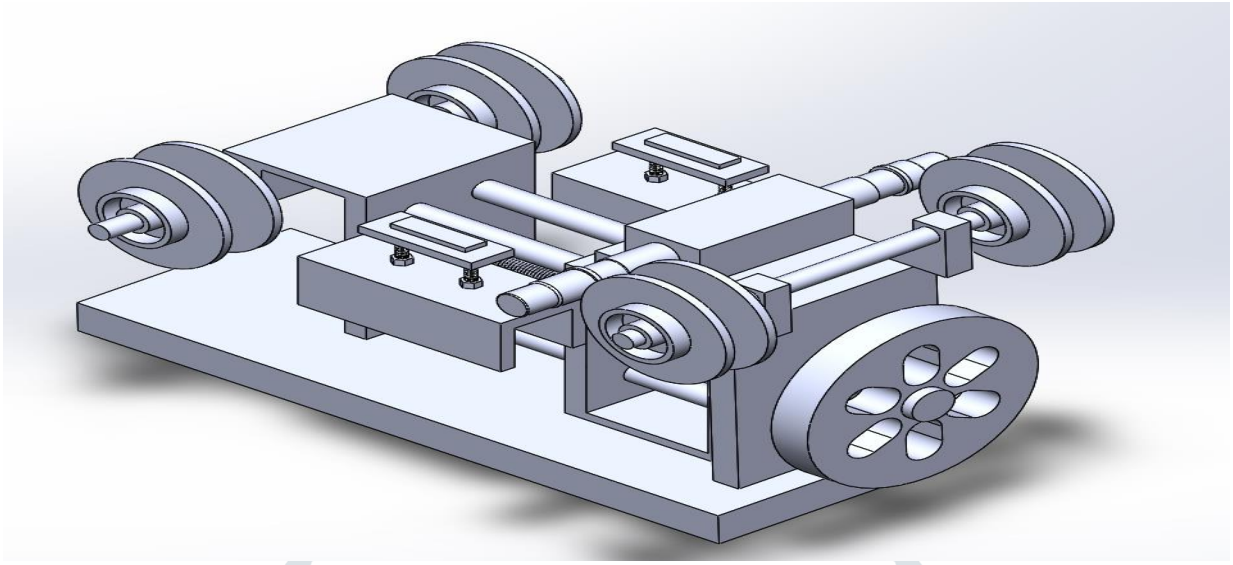

Fig. 4.1: 3D Model of Hot Rolling Machine

After the mounting of uncoated plastic caps, they are then locked with locking system on spindle, so that to make sure, at the time of coating the plastic caps are not shaking or moving, neither the coating can go waste.

As there are 2 spindle on which 2 plastic caps are coated, once they are rolled and coating, the locking system opens it and the 2 coated plastic caps are removed, and now the spindle is in one end, to do coating again, the reverse switch will be pressed and the again the plastic caps will be mounted, with this, 4 plastic caps are made in one forward and one reverse stroke.Foil rolling is a specialty coating process which uses heat, pressure and metallic paper (foil). This is used to create different shiny designs and graphics on plastic materials. Foil printing gives the focus area an incredible look and is quickly becoming the preferred method of printing in many industries.

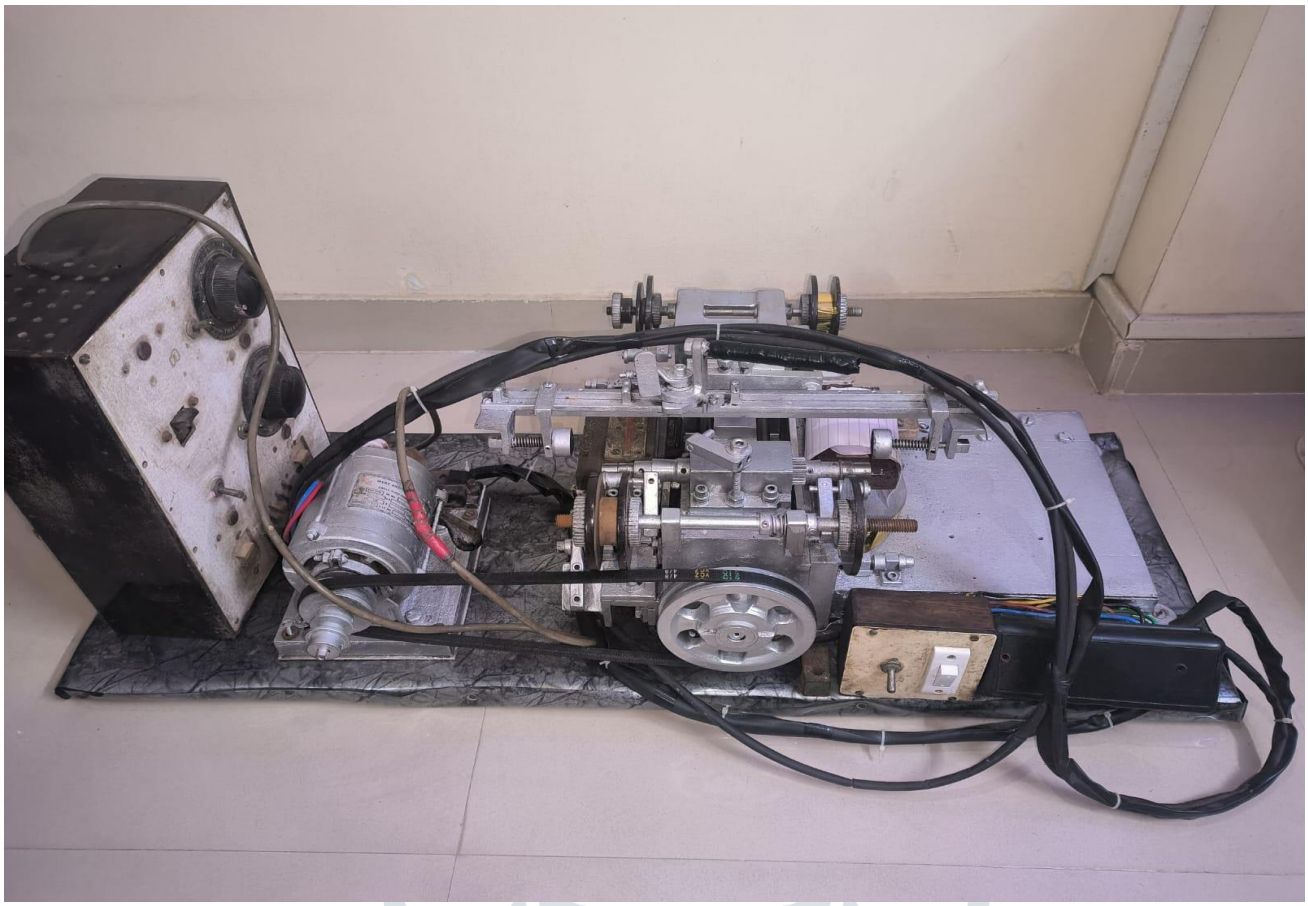

Fig. 4.2: Actual Model of Hot Rolling Machine

So, this technique is an application of metallic or pigmented foil on to a solid surface by applying a heated die on to the foil. This makes it permanently stick to the surface below which leaves the design of the die, regardless of whether it's a small, intricate design or a larger surface area.The unique thing about foil rolling is that they come in a wide selection of colours and finishes. Although the most popular colours are clearly gold and silver foils, they also come in many other colours and effects, such as holographic and pearlescent which all help to replicate the look of precious metals.

V. Results and Discussion:

Caps

Fig.5.1 Uncoated Cap

Fig. 5.2 Coated Cap

This work entitled "Hot Foil Rolling Machine" can perform the coating on plastic caps of round shape with the help of heating die.Hot foil rolling is a very effective procedure for a label that requires a more complex, elaborate design with fine lines and smaller images since the die to be used will maintain the clarity of the edges. This procedure lends a label a decorative finish and is often associated with higher-end products, so it can be a very effective marketing tool to set your product apart and catch the consumer's gaze.

To get the best value for the cost of production, it is helpful to understand the uses and processes involved in creating hot stamp labels. The various physical properties concerned are melting point. thermal Conductivity. Specific heat. While hot foil can be successfully applied to many different materials, some are more suitable. With man-made substrates, hot stamping is often used effectively on different plastics, including polyester, polyethylene, and polypropylene, as well as vinyl, since these materials are softer and offer better adhesion.

VI. Conclusion:

Foil printing is used to provide excellent printing on a number of fabrics. The foil printing is done with the help of special machines, perfect for small to medium run printing jobs. The machines have been manufactured in a way that they an contain foil of varying thickness. Foil printing can be done in single, multiple colors, rainbow color or in a holographic pattern. The process entails relocation of foil onto different surface as a result of heat and pressure application, and transfers foil onto the desired fabrics. Carryout this transfer of the foil by using a metal die, heat and pressure.

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