DESIGN AND DEVELOPMENT OF SILK SCREEN PRINTING

MACHINE FOR SME INDUSTRY

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Report

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SUPERVISOR'S DECLARATION

I have checked this report and the report can now be submitted to JK-PSM to be delivered

back to supervisor and to the second examiner.

Signature   :………………………

Name of Supervisor :………………………

Date   :………………………

STUDENT'S DECLARATION

I hereby declare that the final year project entitled "DESIGN AND DEVELOPMENT OF SILK SCREEN PRINTING MACHINE FOR SME INDUSTRY" has been prepare by me is an original work submitted to JK-PSM Universiti Teknikal Malaysia Melaka towards partial fulfilment of the requirement for the award of Degree in Bachelor of Mechanical Engineering. I also hereby declare that this project has not been submitted at any time to any other university or institute for the award of any Degree or Diploma.

Signature   :………………………

Name of Student   :………………………

Date   :………………………

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ABSTRACT

T-shirt printing is one of the business in Malaysia. To provide quality printing services, they use many printing methods such as dye-sublimation, silkscreen or screen printing and heat transfer. However, screen printing is the most popular technique used by the printing industry because it is easy to operate and low cost. In this study, a survey have been conducted by interviewing a small printing industry manager Mr. Muhammad Fa'iz which owner Cetak Baling Production (CBP). CBP Company always receives a lot of orders for each month that led to the work of printing to be very slow because they lack the staff to set up order on the date required by the customer. To overcome this problem "Silkscreen Printing Machine" was developed to assist CBP or other small-scale enterprise (SME) to increase their production. This machine was built to meet customers' requirement that would facilitate their work, with the adjustable block holder and handle function the block holds the squeegee during the printing process This machine can work with semi-auto system or manually for printing process It has three tables available for the production of the first prototype machine The screen size is only set at (15inch by 18inch) and for the table wood it is (16inch by 20inch). This machine can be operate by only one person. From the prototype testing this machine was able to produce 180 pieces in one hour compare to traditional method which able to produce only 120 pieces. So that, the percentage of increment is 20% and also it is help the industry to improve their production.

ABSTRAK

Percetakan t-shirt adalah salah satu pekerjaan di Malaysia. Untuk menyediakan perkhidmatan percetakan yang berkualiti, mereka menggunakan banyak kaedah percetakan seperti pencelupan pewarna, silkscreen atau percetakan skrin dan pemindahan haba. Walau bagaimanapun, percetakan skrin adalah teknik yang paling popular yang digunakan oleh industri percetakan kerana ia mudah dioperasikan dan kos rendah. Dalam kajian ini, satu tinjauan telah dijalankan dengan menemubual pengurus industri percetakan kecil Encik Muhammad Fa'iz pemilik Cetak Baling Production (CBP). Syarikat CBP selalu menerima banyak pesanan bagi setiap bulan yang mengakibatkan kerja percetakan menjadi sangat lambat kerana mereka kekurangan pekerja untuk menyiapkan pesanan pada tanggal yang dikehendaki oleh pelanggan. Untuk mengatasi masalah ini "Mesin Cetak Silkscreen" dibangunkan untuk membantu CBP atau perusahaan berskala kecil lain (SME) untuk meningkatkan pengeluaran mereka. Mesin ini dibina untuk memenuhi jangkaan pelanggan yang akan memudahkan kerja mereka, dengan pemegang blok boleh laras dan mengendalikan fungsi blok memegang *squeegee* semasa proses percetakan Mesin ini boleh berfungsi dengan sistem separa auto atau secara manual untuk proses percetakan Ia mempunyai tiga jadual tersedia untuk pengeluaran mesin prototaip pertama Saiz skrin hanya ditetapkan pada (15inch by 18inch) dan untuk kayu jadual ia (16 inci dengan 20 inci). Mesin ini boleh dikendalikan oleh hanya satu orang. Daripada ujian mesin prototaip telah menghasilkan 180 helai dalam satu jam berbanding dengan hasil dari kaedah tradisional adalah hanya 120 helai. Jadi, peratusan peningkatan adalah 25% dan juga ini membantu industri untuk meningkatkan pengeluaran produk.

AKNOWLEGDEMENT

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CHAPTER 1

INTRODUCTION

1.1   BACKGROUND OF STUDY

Silkscreen printing is the process to apply or transfer the ink onto a substrate like T-shirt. There is a lot of method in printing technique to produce the design on products. But silk screen method it is easy compared to others method. There are have a lot of methods of printing that can be used to print the design such as dye sublimation, heat transfer, and screen printing. The screen printing is usually used by industries because it is low cost.

Eventually the process screen printing in traditional method is slow and they are needs more worker time to fulfil the order from the customer. From that, we need build-up the silkscreen printing machine that easier for the industry to conduct the progress and decreasing the time of production. It is also to improve the marketing strategy in business and expanded the product out of the country.

1.2   OBJECTIVE

The main objective of this study is to design a semi-auto system of silk screen printing machine for SME industry.

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1.3   PROBLEM STATEMENT

Screen printing is one of the methods commonly used by T-shirt printing industry, as it does not require a very high cost. In this study, a survey was interview from customer about their problem occur in this business. Firstly, in this company mostly using the silkscreen printing as the method to print the design onto the t-shirt, and the problem is they are still use the process as manually to print the t-shirt. So, by using manually process they are need a lot of time to finish their order and sometime they need to delay other job that coming. Secondly, from the existing machine printing have a high cost to purchase by small industries, it is not proper to buy it for small production like company Cetak Baling Production (CBP). Eventually, the all problem from customer will solve by using the engineering method and produce the machine with affordable price and it will help the small industry can increase their production.

1.4   SCOPE

The scope of this project is:

- Simple design machine with a semi-auto system.

- The machine is portable and can be operate by only one person.

- Target production output around 180pcs/hour.

- The maximum size of screen printing is A3 size.

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CHAPTER 2

LITERATURE STUDY

2.1 OVERVIEW

The previous of chapter discusses the current machine that created by some company and the problem that occur related from this study. It further highlights the requirement and importance of customer needed.

This chapter to introduce the history of screen printing and how the process to follow the step by step. The process of silkscreen printing has an information from the book as a reference by the Biegeleisen and Busenbark. Inside the book, they provide the technique of silkscreen printing process follows the proper method.

Besides, in this section will clarify about printing method that utilized by industries. This review may related literature from various sources such as articles, books, and the internet.

2.2 HISTORY OF SCREEN PRINTING

Screen printing, to begin with, showed up in a recognizable form in China during the Song Dynasty (960-1279 Ad). It was at that point adjusted by other Asian nations like Japan and was encouraged by making a more current strategy. Screen printing was generally presented to Western Europe from Asia at some point within the late 18th century but did not pick up expansive acknowledgment or utilize in Europe until silk work was more

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accessible for exchange from the east and a productive outlet for the medium found. (Sheng, Angela, 1999).

Early within the 1910s, a few printers testing with photo-reactive chemicals utilized the well-known actinic light–activated cross-connecting or solidifying characteristics of potassium, sodium or ammonium chromate and dichromate chemicals with pastes and gelatin compounds. Roy Beck, Charles Dwindle and Edward Owens examined and tested with chromic corrosive salt sensitized emulsions for photo-reactive stencils. This trio of engineers would demonstrate to revolutionize the commercial screen printing industry by presenting photo-imaged stencils to the industry, in spite of the fact that the acknowledgment of this strategy would take numerous a long time. Commercial screen printing presently employments sensitizers distant more secure and less harmful than bichromates. Right now there are expansive determinations of pre-sensitized and "client blended" sensitized emulsion chemicals for making photo-reactive stencils. (Gordon Robert, 2006).

A gather of specialists who afterward shaped the National Serigraphic Society, counting WPA craftsman Anthony Velonis, coined the word Serigraphy within the 1930s to distinguish the creative application of screen printing from the mechanical utilize of the process."Serigraphy" may be a compound word shaped from Latin "sēricum" (silk) and Greek "graphein" (to compose or draw). ("Serigraphy | Define Serigraphy at Dictionary.com", 2012).

Credit is for the most part given to the craftsman Andy Warhol for promoting screen printing as a creative strategy, distinguished as serigraphy, within the Joined together States. Warhol was bolstered in his generation by ace screen printer Michel Caza, an establishing part of Fespa, and is especially recognized with his 1962 portrayal of on-screen character Marilyn Monroe, known as the Marilyn Diptych, screen printed in gaudy colours. Realistic

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screen printing is broadly utilized nowadays to make mass or expansive clump created illustrations, such as blurbs or show stands. Full-colour prints can be made by printing in CMYK (cyan, fuchsia, yellow and dark ('key'). Screen printing loans itself well to printing on canvas. Andy Warhol, Arthur Okamura, Robert Rauschenberg, Roy Lichtenstein, Harry Gottlieb, and numerous other craftsmen have utilized screen printing as an expression of imagination and imaginative vision. (Michel Caza, 2010).

2.3   PRINTING METHODS

There are numerous other strategies of T-shirt printing such as airbrush, screen printing embroidery, applique, impressing or embossing, heat transfers, or dye-sublimation transfers. Laser printers are also utilized, to begin with to print on plain paper employing an uncommon toner which contains sublimation dyes and then permanently heat-transferring it on a t-shirt. The type of method you selected depends largely on what design you want to print and the number of t-shirts to be printed.

2.3.1   Screen Printing

Usually still a common strategy of printing. It is frequently utilized on all the odd materials. Strong letters on plastics, T-shirts and clothing materials, a parcel of signs and others utilize screen printing. The thought behind screen prints is fundamentally a screened fabric such as silk or nylon is extended over an outline and secured into put. A stencil, cut my hand or made electronically, is put over that screen to piece out non-printing regions. As you can see the example of process silk screen printing as shown in **Figure 2.1**. Ink (frequently elastic based) is put interior the

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outline and rejected over the stencil with a rubber squeegee. The ink goes through the screen and onto the fabric.
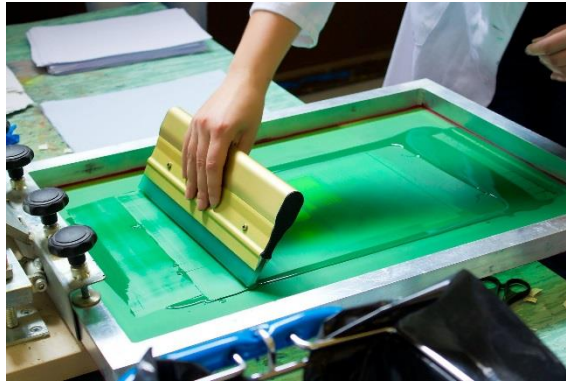
Figure 2.1 show the process of screen printing (dadsprinting, 2018).

2.3.2 Dye Sublimation

Dye sublimation is to print full-colour plans on the light coloured t-shirt, the dye sublimation is the leading strategy. However this method is a bit more expensive than the others, it has no feel to the design and it is a little difficult to master than inkjet heat transfer as shown in **Figure 2.2**. Dye sublimation cannot be used for most of the natural fabrics and is most suitable for fabrics like polyester

Figure 2.2: Dye sublimation printer (brantinstore, 2016).

2.3.3 Computerized Printing

Using computerized printing as shown in **Figure 2.3** that the strategies for a printed t-shirt is leading for little orders as this strategy is appropriate to print complex plans and multi colours. The distinctively printed t-shirt can be effectively customized utilizing this strategy. Printing strategy utilizing vinyl cutters. However, another procedure to print redone t-shirt in little amount. In this strategy, a machine is utilized to cut out plans on extraordinary strong colour vinyl sheets. At that point, warm is utilized to stay- cut vinyl onto a paper and afterward warm squeezed on the texture. This sort of print is tall quality, solid and can be utilized effectively to customize diverse t-shirt which is extraordinary for little orders.

Figure 2.3: Computerized printing machine (indiaMART, 2018)

2.3.4 Direct Printing

Direct printing is most commonly utilized at homes is coordinate printing on the texture. In this strategy, distinctive sorts of inks are specifically connected onto the cloth by hand to urge the required comes about. This strategy diminishes different steps included in another printing strategy. The plan designs in coordinate printing do not have overwhelming feel like screen printing. Be that as it may be a small

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troublesome to cover a huge region of the cloth in this strategy and the cloth itself is the brightest part of the design. As shown in **Figure 2.4** the direct printing is very expensively and further difficult depend on others method.

Figure 2.4: Direct printing machine (EM, 2016)

2.4   SCREEN PRINTING MACHINE

There are several existing machines in the market to produce the T-shirt. They come in a lot of forms and shapes of the machine. As shown in **Figure 2.5** the concept of spider screen machine they are utilizing at the machine and no need more person to handle it. Also using the same concept with others machine but have a differences function and characteristic.

Figure 2.5: Spider screen machine (Abuja aba, 2018)

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With the method using on the spider screen machine we are improving the process of printing then simplify the material using and design of the machine. As you can see as shown in **Figure 2.6** that the process screen printing by using concept line production. It is more efficient compared to spider screen printing due to use full auto systems.

Figure 2.6: Silkscreen printing machine fully auto (allforprinting, 2016)

2.5 THE PROCESS OF SCREEN PRINTING

Biegeleisen and Busenbark (2007) Silkscreen stencil printing is essentially a process in which the stencil bearing the design to be reproduced is permanently affixed to a screen or ground consisting of silk, organdy, or metal cloth. Paints or other printing mediums are forced through the stencil and deposited on the printing surface, thus forming a facsimile of the original design. The method is known as the silk screen process because, originally, silk was exclusively employed for the screen.

The process of silk screen it is more simple from others method of printing. But how screen work, for example when it was, to begin with, created, screen printing utilized screens made of silk, consequently the term silk screen printing; but these days, the screens are made of engineered polyester work. You have got to start by pre-processing the work, which

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should be drenched in a purpose-mixed light-sensitive emulsion and cleared out to dry in a dark-room. Once this emulsion has set, you put a dull print-out negative of the design you need to print, or non-transparent stencil cut-outs of it, on the work and uncover it to solid light: the light solidifies the emulsion assist, but the dim colour or stencil cut-outs prevent the light from coming to the ranges through which ink will get to be squeezed. You then wash the screen off in water, and these non-hardened regions are washed absent, clearing out non-coated layer crevices which can hold ink, but through which ink can too be crushed.

And lastly, the mesh screen is presently prepared to be utilized, so you set it up in a printing press, taped at the edges so that no undesirable additional paint leaks over the sides. The press both holds the substrate beneath the screen on a strong base and fixes the mesh. Once you've got clamped the press down fair over the surface to be printed, you pour a little store of ink onto the screen and utilize a bar to drag the ink over the screen so that it streams into the non-coated layer holes: now that fair sufficient ink is within the holes, you press the screen onto the substrate and utilize a squeegee to constrain ink through the layer. The substrate is presently printed and you'll be able to remove it. (Saxoprint, 2013)

2.6   THE EQUIPMENT OF SILKSCREEN PRINTING

Usually, in this screen printing is very simple equipment that are needed for run this method or process. After that, as you know the several of equipment that already created with the industry it may be just buy it. But when you want create your own design machine surely you are required the equipment follow your design in order to you can do the maintenances. The equipment for screen printing that you need to know it:

2.6.1　Printing Frame

It use for attach with the screen or mesh and it have a lot of size that are need follow your requirement size of your product target. Usually, the traditional method use printing frame that build from wood. But the new technology many people are prefer use printing frame from material like aluminium. Because it is have highest of the durability material dependent wood material. As shown in **Figure 2.7** the aluminium printing frame is probability use in industry printing. More lighted and strength.
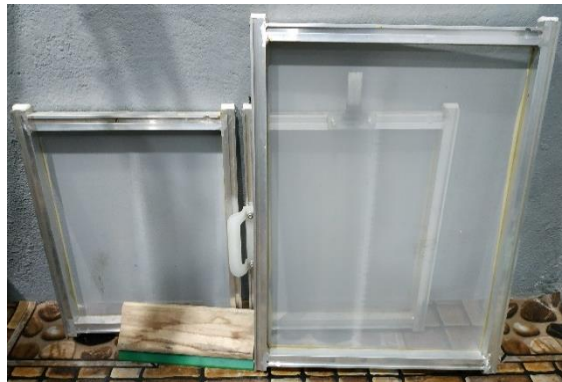

Figure 2.7: Printing Frame with mesh (CBP, 2019).