A PROJECT REPORT

ON

"INCREASING THE PRODUCTIVITY OF IMPELLER BLADE EMBOSSING THROUGH AUTOMATION"

Submitted to

UNIVERSITY OF MUMBAI

In Partial Fulfillment of the Requirement for the Award of

BACHELOR'S DEGREE IN

MECHANICAL ENGINEERING

BY

ANSARI NOMAN	16DME126
KAMIL MOHAMMED YAHYA	16DME141
KAZI ARFAT ASHFAQUE	16DME142
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UNDER THE GUIDANCE OF

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DEPARTMENT OF MECHANICAL ENGINEERING

Anjuman-I-Islam's Kalsekar Technical Campus

School Of Engineering & Technology

Plot No. 2 3, Sector - 16, Near Thana Naka,

Khandagaon, New Panvel - 410206

2018-2019

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CERTIFICATE

This is certify that the project entitled

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Submitted by

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Is a record of bonafide work carried out by them, in the partial fulfilment of the Requirement for the award of Degree of Bachelor of Engineering (Mechanical Engineering) at Anjuman-I-Islam's Kalsekar Technical Campus, Navi Mumbai under the University of MUMBAI. This work is done during year 2018-2019, under our guidance.

Date:30 /04 /2019

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ACKNOWLEDGEMENT

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We are grateful to him for his timely feedback which helped me track and schedule the process effectively. His time, ideas and encouragement that he gave is help us to complete our project efficiently.

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At last we must express our sincere heartfelt gratitude to all the staff members of Mechanical Engineering Department who helped us directly or indirectly during this course of work.

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Project Approval for Bachelor of Engineering

This project entitled "INCREASING THE PRODUCTIVITY OF IMPELLER BLADE EMBOSSING THROUGH AUTOMATION" by Ansari Noman, Kamil Mohammed Yahya, Kazi Arfat, Khan Adnan is approved for the degree of Bachelor of Engineering in Department of Mechanical Engineering.

Examiners

1 ....

2 ....

Supervisors

1 ....

2 ....

Chairman ---------------------------

DECLARATION

We declare that this written submission represents our ideas in our own words and where others ideas or words have been included; we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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ABSTRACT

The following work is an experimental study towards finding methods to increase the productivity of conventional processes with minimum additional arrangements. The problem taken for this specific project is all about the elimination of a certain bottleneck in the assembly line that produces metallic impellers that are coupled to three phase induction motors and are used for heavy duty industrial applications. These impellers were being batch produced at the manufacturing unit we procured the problem statement from.

The objective is a decent opportunity for the manufacturer to implement methods of improving productivity of the overall process. Hence, in our literature survey, a vital chunk of guidance has been taken from various productivity improving tools like Lean Manufacturing.

The study initiated with a detailed survey of literature related to Power Press machines and their use. Since this project is related to automation and that too, using customized data, a survey regarding other competent machines and solutions to the given problem statement.

As per the standard design methodology protocols, we have made an attempt to design, fabricate and test a mechanism that works well as a solution to the given problem.

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CHAPTER 1

1. INTRODUCTION

1.1 Background

The focus of a company is to add value to its customers and society. And, simultaneously generating profits and a competitive market that looks forward to continuous improvement in the standard of living of human beings as a community.

A manufacturing company thrives to serve its customers in a very pleasant manner that is always accentuated towards getting the right results.

A good business will typically seek to minimize its process time for a particular manufactured good without compromising to the point where the customers would purchase or consume less of it.

The manufacturing sector employs about 30% of the non-agricultural work force in our country. Lately, because of the world economic crises, the growth rate of the mechanical manufacturing sector has become stagnant and the market is become vaguely saturated.

We, as engineers don’t control markets and national economics, but as sound moral and technical thinkers we can definitely try to reduce the rate of this downfall. Or, if things get better with time, even kick start a positive growth that proves us as game changers on the global map.

A little more thought sessions paved way to the mild conclusion that due to the recent fall, the most suffering are local and small scale vendors and manufacturers. The top multinational players (about 10% of the market) remain somewhat unaffected because of their manufacturing sector employs about 30% of the non-agricultural work force in our country. Lately, because of the world economic crises, the growth rate of the mechanical manufacturing sector has become stagnant and the market is become vaguely years of research and development in automation.

Our sole thought behind taking such a project is to find solutions that will empower the small and medium scale manufacturing plants by providing automation solutions at justified costs. These, in our view will at least start uplifting these types of firms.

This project is an attempt towards designing and fabricating an automated feed mechanism to facilitate quicker mass production at an optimized cost.

1.2 Motivation

Currently in today scenario, there are shortages of skilled workers and this thing is the verge of extinction. This creates major issue related shortage of manpower as well as heavy demands of the present workforce. So, manufactures are now a days investing time and assets towards finding ways to minimize worker involvement in manufacturing processes. Also, automatic mechanism produce increased quality of jobs in lesser time

1.3 Aim and objective

The aim an objective of the present study is to find a way through experiment that devices new methodology for providing reduced human effort and speeding up the overall assembly process and also eradicating bottlenecks present in the assembly line.

1.4 Literature Review

1.4.1 Types of embossing and embossing dies

Multilevel die

A die with a number of distinctive levels is called a multilevel die. It can be engraved by machine and does not require hand-tooling. Multilevel dies are often made of brass. An example of a multilevel emboss is designs that have a "texture" in the background.

Figure 1.1. Multilevel Die [2]

Bevel-edge die

This die is similar to a single level die, but with a precise bevel on the image edge, usually between 30 and 60 degrees. The broader the angle, the greater is the illusion of depth. Very deep dies must have beveled edges to prevent cutting through the paper.

Figure 1.2. Bevel-edge Die [2]

Chisel die

An embossing die with a V-shape, using two bevels without a flat bottom surface. It is most frequently used in de embossing. It’s also sometimes referred to as a “roof” die.

Figure 1.3. Chisel Die [2]

Single-level die

It is an embossing die that changes the surface of the paper at one level. This is both the most common and the cheapest of all embossing dies. The process for creating the die is that the image is inverted. Single level dies are made usually from magnesium or copper. A magnesium die can be half the price of copper, but caps out at somewhere between 5 and 10 thousand impressions. Moreover, a magnesium die can be destroyed with a single mistake in the feed in the stamping machine. Copper dies are stronger than magnesium and will last for far more impressions.

Figure 1.4. Single-level Die [2]

Rounded die

A rounded die is an embossing die that imparts a rounded configuration to an embossed image. It is commonly used for logos and typographical effects. It is like an extrusion used to emboss a desired impingement on a work piece.

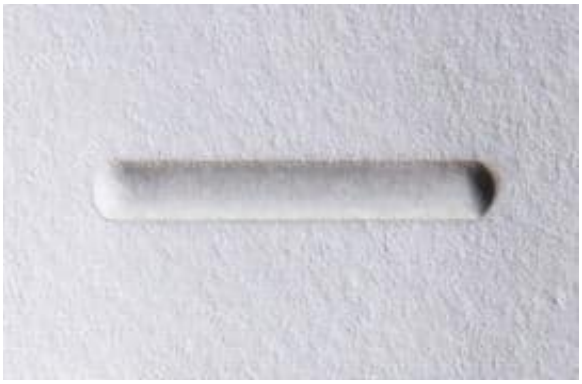


Figure 1.5. Rounded Die [2]

Textured die

An embossing die with an etched texture is known as a textured die. Although this might look similar to a sculpted die, it isn't. It is essentially a single level emboss die with very detailed artwork. These work best for artwork that don't depend on the detail to look refined. Organic patterns, skin textures and other single level textures can be done with a textured die.

Figure 1.6. Textured Die [2]

Sculptured die

A hand-tooled die, usually made of brass that embosses many levels through the use of curves, angles, and varying depths. These dies are the most expensive as they require someone to hand sculpt the die based on image references provided (these images usually being transferred to the metal through a photo-etching acid bath for use as a template). They also have the nicest effect, looking like a bas-relief in paper.

Figure 1.7. Sculptured Die [3]

1.4.2 Types of Press work operations.

BLANKING : Stamping having an irregular contour must be blanked from the strip. Piercing contour must be blanked from the strip. Piercing, Embossing and various other operations may be performed the strip prior to the blanking station.

- PUNCHING (piercing): Piercing tools pierce holes in previously BLANKED, Formed or Drawn parts. It is often impractical to pierce holes while forming because they would become distorted in the forming operation. In such cases they are pierced in a piercing tool after forming.

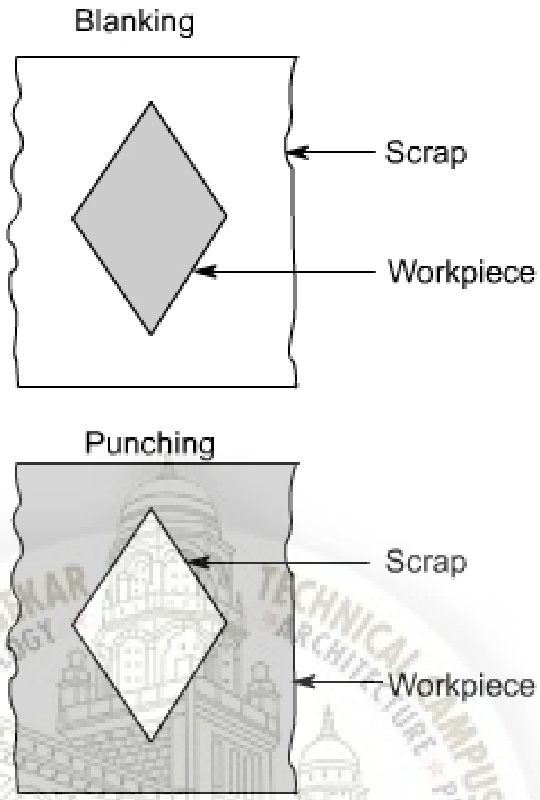


Figure 1.8. Punching and Blanking [2]

- BENDING: Bending is defined as shaping the material around straight axis which extends completely across material. Metal flow is uniform in this operation.

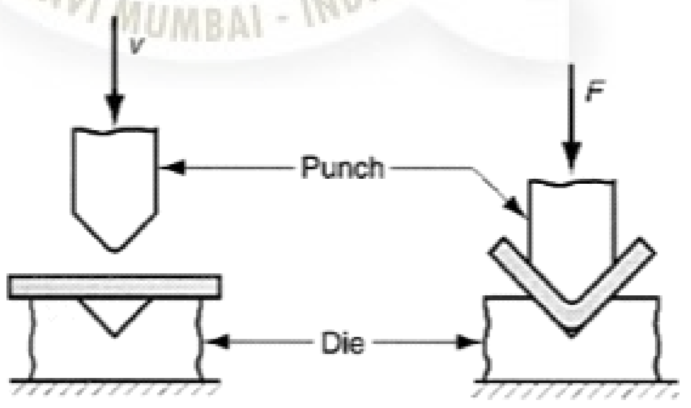


Figure 1.9. Bending [3]

- FORMING: Forming tools apply more complex forms to work pieces. The line of bend is curved inside of straight and the metal is subjected to plastic flow or deformation. Metal flow is not uniform in this operation as Bending.

- DRAWING : Drawing operation transform the flat sheets of metal into cups, shells or other drawn shapes by subjecting the material to severe plastic deformation.

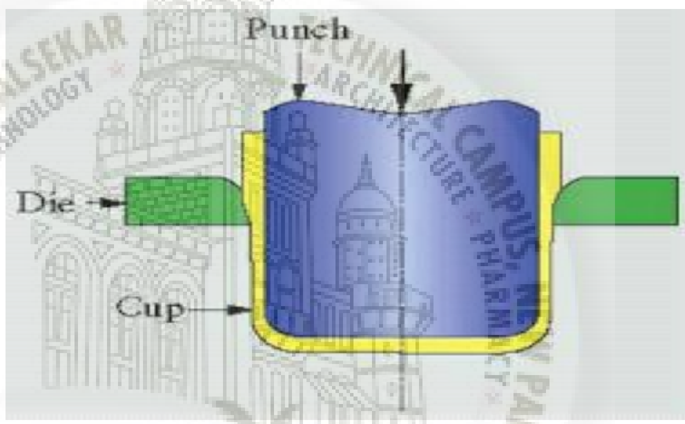


Figure 1.10. Drawing [3]

- SHAVING: Shaving is a secondary operation usually flowing punching In which the surface of the previously flowing punching in which the surface of the previously cut edges is finished smoothly to accurate dimensions. There is little clearance between punch and edge and only a thin section of the edge is removed from the edges of the pieces.

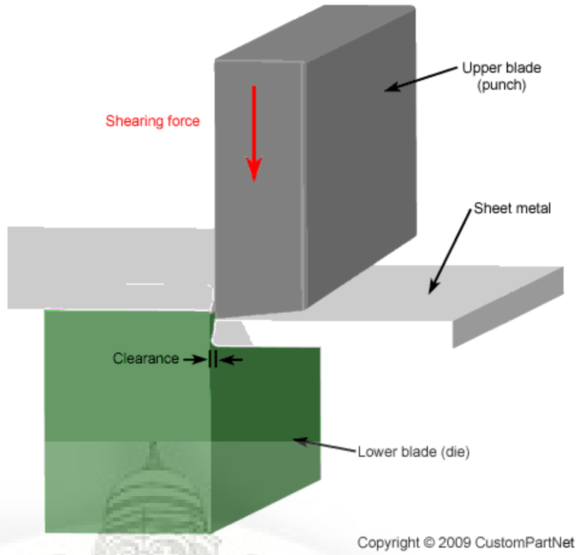


Figure 1.11. Shaving [3]

- EMBOSSING : It is shallow forming operation in which the material is stretched over a male die and caused to conform to the male die surface by a female die surface. It results depressed detail on one side and raised detail on opposite side of the work piece.

- COINING (squeezing) : Coining is the process of pressing material in a die so that it flows into the spaces in the detail on the die face.

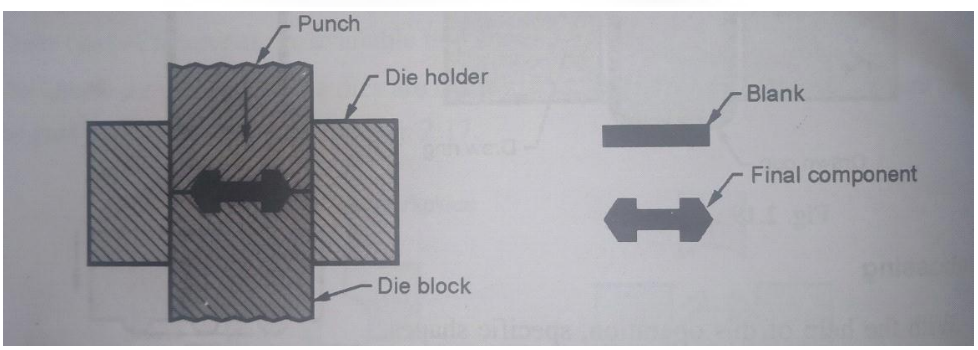


Figure 1.12. Coining [3]

- CURLING: A curling die rolls the raw edges of the sheet metal into a roll or curl. The purpose is to strength than the raw edges provide protective edges and improve the appearance of the product.

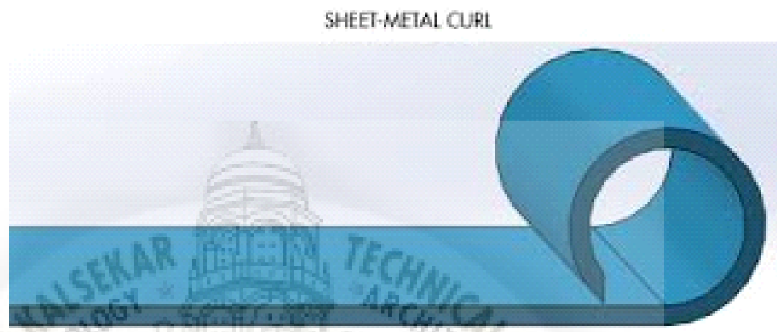


Figure 1.13. Curling [3]

- NOTCHING : It's one of the cutting operations, in which material cut at the edges of the blank.

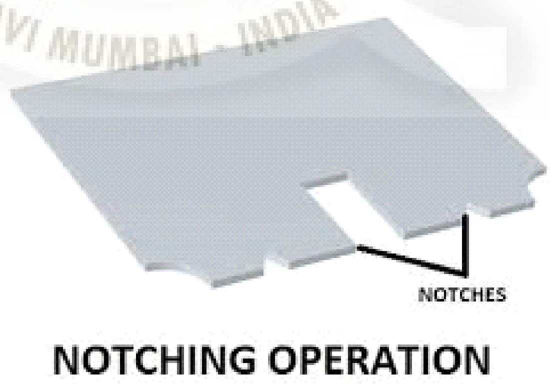


Figure 1.14. Notching [3]

- LANCING: It's one of the operations, in which it includes both cutting and non cutting operation that's one side bending with two or more side cutting.

Figure 1.15. Lancing [3]

1.5 Problem Definition

To design and fabricate an automatic feed mechanism arrangement to be fitted on a power press that facilitates quicker production at an optimized cost. The study will therefore facilitate the implementation of productivity improving methods like Lean manufacturing, a systematic method for the minimization of *waste* (muda) within a manufacturing system without sacrificing productivity, which can cause problems. [1]

1.6 Scope

The scope of present work includes

(a) Investigating the bottlenecks in method of manufacturing and the assembly line. [1]

(b) Devising new methodology for producing ease of manual labor. [1]

(c) Designing and fabricating the automatic system. [1]

(d) Obtaining insight into operational capabilities and limitation. [1]

CHAPTER 2

2. BASIC PRINCIPLE, PATH OF FLOW AND WORKING

2.1 Basic Principle

The basic method for the process earlier was by pick and place which was done by the operator by and. This method is considerably slow and will not be feasible if the process has to have closer proximity to lean manufacturing.

The worker picks one blade at a time and sets it in the die. After setting three blades in the die, the operator activates the hand press. The hand press is operated thrice or twice with maximum amount of force that the operator can apply so that embossing is done as per requirement and all the embossed products are produced up to the mark.

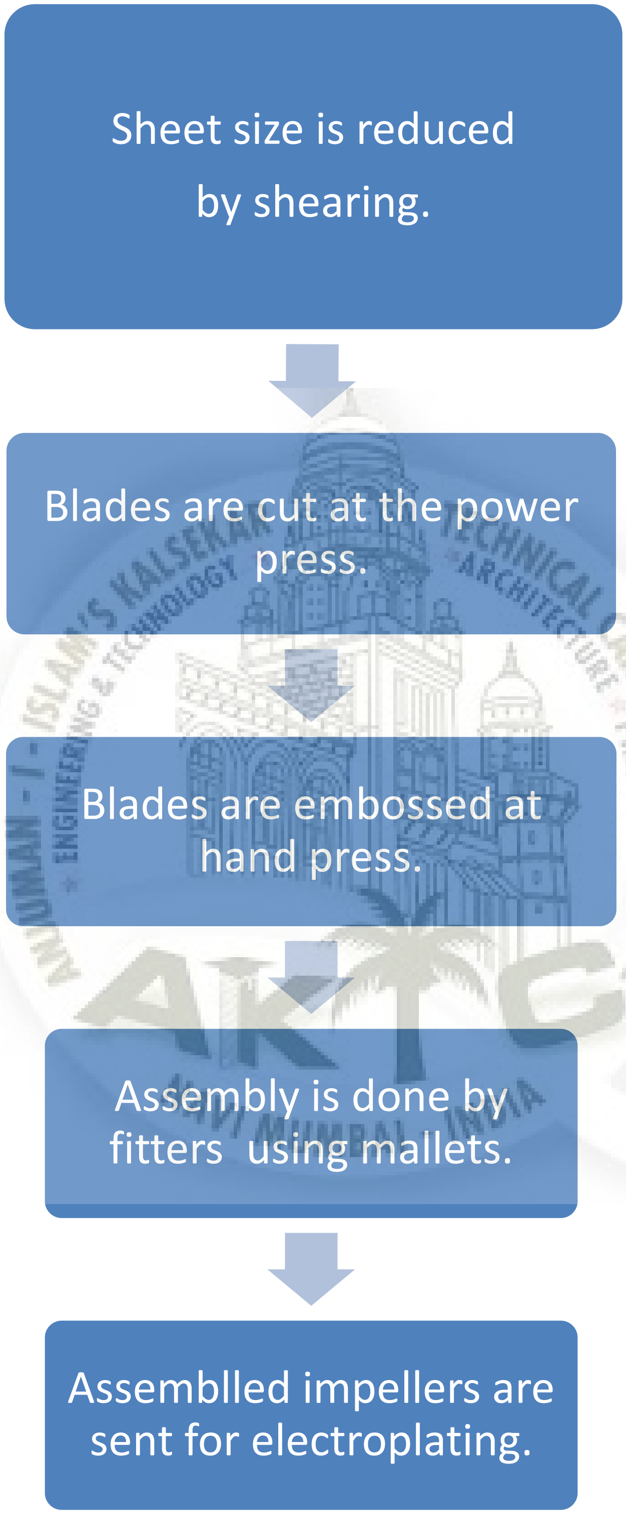
This process is very time consuming. Hence the design is kept in such a way that the unbent blade slides into the die cavity and hence it saves time.

The basic operation works on the basis of a plunger that pushes unbent blades into the die cavity. This plunger is a bit of lesser gauge than the gauge of the blades. To be specific, the gauge of the blades is 1.2 millimeters and the gauge of the plunger that pushes the blades into the die cavity is 0.8 millimeter.

Figure 2.1. Flat blade

Figure 2.2. Embossed Blade

2.2 Path of flow



2.3 Working [6]

Nowadays, conventional machines are used for the embossing of the strips of the fan and hence more time and skilled worker are used for the conventional machining and machines. To avoid this electrical system is used for automation

Rack and pinion, stacker and die are used in the same. To avoid interruption stacker are fully filled with the unbend trips. The rack is attached to the plunger which is at one end of the stacker. [6] Pinion is attached to the rack which moves as per the movement of the servo motor. Servo motor rotates 180 degree to push the strip from the stacker to the cavity of the die

Foot pedal is attached at the bottom of the power press. This pedal was operated by worker which is now operated by motor which are connected electrical circuit for automation based on time. This motor is operated by Arduino UNO. When switch is "ON" servo motor starts to rotate due to which the pinion is rotated. Due to meshing with rack the rack moves forward horizontally and rotary movement is converted into linear motion.

At initial stage one strip is present in front of plunger attached to rack. When rack pushes the plunger the strips get carried or conveyed to the die cavity .As the unbend strip get entered into the cavity an electrical signal is giver to motor attached to foot pedal due to which it is operated and the ram is moved in the vertical direction against the strip and ramming action takes place on the strips and they get curve shape according to the cavity of die.

At this time the pinion rotates in opposite to which rack comes back as well as plunger and a strip from the stack gets in front of plunger. Again above mentioned operation takes place but this time this unbend strip pushes the strip which is present in the die cavity. The push action take place at two end contact point and the speed of motor attached to pinion is adjusted accordingly so that the unbent strips should not overlap with the strip already present in the die.

CHAPTER 3

3. DESIGN AND DEVELOPMENT

3.1 Specifications of Tool

3.1.1 Tool design considerations

- The accuracy and surface finish of stampings should confirm to the drawing and specification. [4]
- The working part of the die must be adequately strong, durable in operation and easily replaceable when worn-out. [4]
- The tool should ensure the required hourly output, easy maintenance, safe operation and reliable fastening on the press. [4]
- The die should be designed preferably of standard items, using as less parts as possible. [4]
- The scrap should be kept in minimum. [4]

3.1.2 Design of press tool involves the following steps.

- Determination of the force. (Press tonnage) required for the operation. [3]
- Selection of press for requisite force, work piece size and shape. [6]
- Determination of shut height of the tool.
- Calculating the die thickness and margin. [3]
- Designing of locating elements. [5]
- Selection of hardware items.
- Selection of pillar dies set.
- Deciding punch length and mounting. [3]

3.1.3 Tool design procedure

- **Study of component**: The first step in the design procedure is to define the problem in a clear and simple statement of the functional needs. The tool design will receive the part print, information on which tool is needed, what the capabilities of the tool must be, the type of the press on which tool is used, the number of parts to be produced and pertinent information concerning the part.

- **Concept design** : The research and sketches should be combined to one or two attentive design solution, which may consist of rough working showing the side and top view if needed. The best selected and reworked and the final design decided upon.

- **Design consideration** : Before start in any design some major considerations are required to be made which can solve majority of the problems while designing the press tool, mold, jigs and fixtures.

- **Manufacturing process** : In any design, manufacturing process should be easy, simplified and majority of the operations should be carried out in house. By considering this point we made our tool as simple as possible for manufacturing.

3.1.4 The following design points should be considered carefully.

- Controlling location of the scrap strip.
- Guidance should be extended at least two scrap width in front of first station
- The type of stripper used.
- Channel clearance should be accurate to allow the strip to move freely.
- Location of figure and stage stoppers.

- Die block should be longer and wide enough so that the location of the holes will be at least one and half times the thickness of the die block away from the edge
- Small profile punch should be guided in the stripper plate.

3.2 Analysis of collected data

At the manufacturing unit, the requirement of blades is a major factor in taking this problem statement as a study.

On an average 80 blowers are on the requirement list. One fan uses 38 blades in the assembly of the heavy duty air blower.

The manufacturing of the impeller blade requires the blade to be given a specific radius of curvature so the impeller vibrates Maximum amount of air effectively. If this radius of curvature is not embossed on the blades it won’t work as efficiently as it would with bent blades.

The blades are first cut out from blank sheets into long strips they are then punched on power press these un bent blades then are sent to embossing station which basically is a hand press on which a worker operates continuously until the requirement is fulfilled.

CHAPTER 4

4. FABRICATION

4.1 Design and Fabrication of feed mechanism

Design of feed system

To get a glimpse of how the feed mechanism works a 3D CADD model was made and simulation was done to ensure the working of feed mechanism enhancement of the design was made during this to ensure that the system works properly without error and with improved efficiency.

4.1.1 Stacker

- **Shape**

  Ideal shape of the stacker must have enough capacity so that larger quantity of strips or raw goods can be stacked in it and it must provide variation in its dimension so that it can be adjusted for varying sizes of strips or raw goods. Keeping its height fixed at about 25 inches and making the cross-section at the maximum size of the strip and adding packing from inside with required size of the strips to be used at the bottom of the stacker in line parallel to the die opening slot have been made.

Figure 4.1. Stacker (Representation)

- **Material**

  The material used for stacker should have following properties

  - Lowest gram per square meter(GSM)
  - Enough strength to sustain load
  - Good shock absorbing capacity or elasticity to sustain vibration
  - High strength to increase durability
  - Enough rigidity to sustain damage from outside impact over its period of life cycle

- **Fabrication**

  The stacker is fabricated by bending the metal sheets into rectangular shape and then by spot welding or riveting its open edges to create a closed rectangle section .Then according to the inlet dimensions and shape of die a slot is made in the bottom side of stacker such that a strip can be inserted from bottom which is then bend according to dimension and inside of stacker and welded just below the slot opening so that the strips may lie over the base and can be fed directly into the die. The stacker is than directly welded to the base frame to attain rigidity and form outside all three stacker have been welded together from their place due to excessive vibration caused by power press during impact in forward stroke and the force crated by the feeding mechanism

Figure 4.2. Actual Fabricated Stacker

4.1.2 Rack and Pinion

Rack and Pinion comprises the main feeding system. Design of rack and pinion is done by calculating the distance required to complete the feed and the speed of the feed as the gear ratio between the rack and pinion decides the speed

- **Material**

  The material used rack and pinion is cast iron

  The material possess following properties to ensure safe and beneficial operation

  - Lowest gram per square meter(GSM)
  - Enough strength to sustain load
  - Good shock absorbing capacity or elasticity to sustain vibration
  - High strength to increase durability
  - Enough rigidity to sustain damage from outside impact over its period of life cycle
  - Resistance to environmental action on it such as oxidation and other

- **Shape**

  The shape of rack is rectangular in length and square in cross section. Teeth of 2mm depth have been machined in the rack using milling machine. The pinion is circular in shape and is of 2inch in diameter with same module and gear profile as of rack. The pinion has step carried on it so that it can be tighten on the shaft of the motor.

Figure 4.3. Rack and Pinion

- **Fabrication**

  - **Rack**

    Rack is fabricated from single rectangular rod of length of 1feet. Its surface have been machined using a shaper machine and then it have been machined on a milling machine to make teeth on it. Then it have been tempered so that the teeth does not get damaged due to continuous operation it gives soft core and hard case.

  - **Pinion**

    The pinion is fabricated from a round block of 1 ½ inch diameter and then fin machined on a letter of the required diameter. Then a step is made on the half of the pinion to reduce its weight and to provide section which can be machined on a milling machine and then taken to case hardening is done on it.

Figure 4.4. Rack and Pinion

4.1.3 Die

Die is the main part of the system in which the embossing process is done. Initial design of die which was used by industry was a single cavity die of long section in which strips was laid one after another in a single line. This design is changed into a three cavity parallel to each other on capacity of single strip at a time which can be ranged from different size which will be easy of switching of strips and automation. We have used oil hardened steel in this specific study as oil hardened steels are more resistant to shock loading. This property makes these types of steels more useful in press working operations. The material removal process was done on wire cut electron discharge machining. This process is expensive, but is required for precise machining of the die contours. The die also has to have a specific gauged gap so that material gets properly bent rather than failing materialistically. [3]

- **Material [3]**
  - High density material.
  - Least reactive to oxidation.
  - Easy to fabricate.
  - Enough strength to sustain vibration.
  - Least reactive to environmental variables such as temperature and humidity.
  - Enough rigidity to sustain damage or impact from power press during forward stroke over long period of operation.
  - Can be easily heat treated for case hardening or tempering.

Figure 4.5. Actual Die

- **Fabrication**

In previous approach of manufacturing there were several losses which lead to high investment cost as well more lead time .Below CADD model represents the conventional design of die. In order to eradicate those loss new design was prescribed and designed which was beneficial in total initial cost which were save in material cost.

Figure 4.6. Old Die

Below the CADD model gives an idea of actual die dimension and travelling of goods to be fabricated over it.

Figure 4.7. Revised Die.

- **The steps for fabrication are as follow** :

  - **Stock Strip Layout & Design**

    The first step in a die manufacturing involves designing the embossing die or “tool.” The designer optimizes the positioning of each punch, bend and hole. CAD/CAM engineering is used to design the cavity or curvature and determine dimensions, tolerances, feed direction, scrap minimization and more.

  - **Material to be considered according to need**

    There are several materials available for manufacturing of die with several properties such as steel, alloy steel, tool steel, iron (for prototyping) , manganese (for thin paper sheets) . Of these several choices tool steel (Oil Hardened steel) were considered because of their following nature. With carbon content between 0.5% and 1.5%.The presence of carbides in their matrix plays the dominant role in the qualities of tool steel. The four major alloying elements that form carbides in tool steel are: tungsten, chromium, vanadium and molybdenum. The rate of dissolution of the different carbides into the austenite form of the iron determines the high-temperature performance of steel. The manganese content is often kept low to minimize the possibility of cracking during water quenching. Tool steels are used for cutting, pressing, extruding, and coining of metals and other materials. Their use, such as the production of injection molds, is essential, due to their resistance to abrasion, which is an important criterion for a mold that will be used to produce hundreds of thousands of moldings of a product or part. Oil Hardening Steel earns its name from being hardened by quenching in oil after being at high temperature. These steels are usually designated by the letter “O” followed by a number to designate their specific composition or properties in the oil hardening category. The most common alloy used for blades that we see is O-1 tool steels. Oil hardening steel is an optimal choice for blade material because it is cheap, readily available, minimal warping during quenching, and has great wear resistance. Proper of heat treating oil hardening steel is important because it ensures minimal warping and also minimizes surface contamination at elevated temperature. Surface contamination can take the form of decarburization, carburization, or inter granular oxidation; all of which will lead to a poor surface condition of a blade and promote easy wear, cracking or brittleness.

- **Secondary Processing: Grinding & Heat Treating**

  Heat treating is applied to metal parts to enhance their strength and make them more durable for their application. Metal alloys are heated above the material's critical transformation temperature, then cooled rapidly to improve their dimensional stability and toughness. It also give characteristics to material as we need such as to harden case only with soft core which gives hardened case on outside which resist wear and tear and sore core gives elasticity to remove brittleness character Grinding is used to finish parts requiring high surface quality and dimension accuracy. The abrasion generates a significant amount of heat, as seen by the sparks in the video below, so the process also requires a coolant to be applied

- **WIRE EDM for accuracy**

  Wire electrical discharge machining shapes metal materials with an electrically-charged strand of brass wire. The wire carries one side of the electrical charge and the work piece carries the other, creating a controlled spark that results in a fine surface finish with no burrs. Wire EDM can cut the most intricate shapes, including small angles and contours. EDM machines can achieve cutting tolerances of ±2 µm and surface quality as fine as Ra 0.1 µm, as well as taper cuts at full height up to 45 degrees. The die is submerged entirely in deionized water to continuously cool the metal, while a high-powered flushing nozzle clears away scrap during the process.

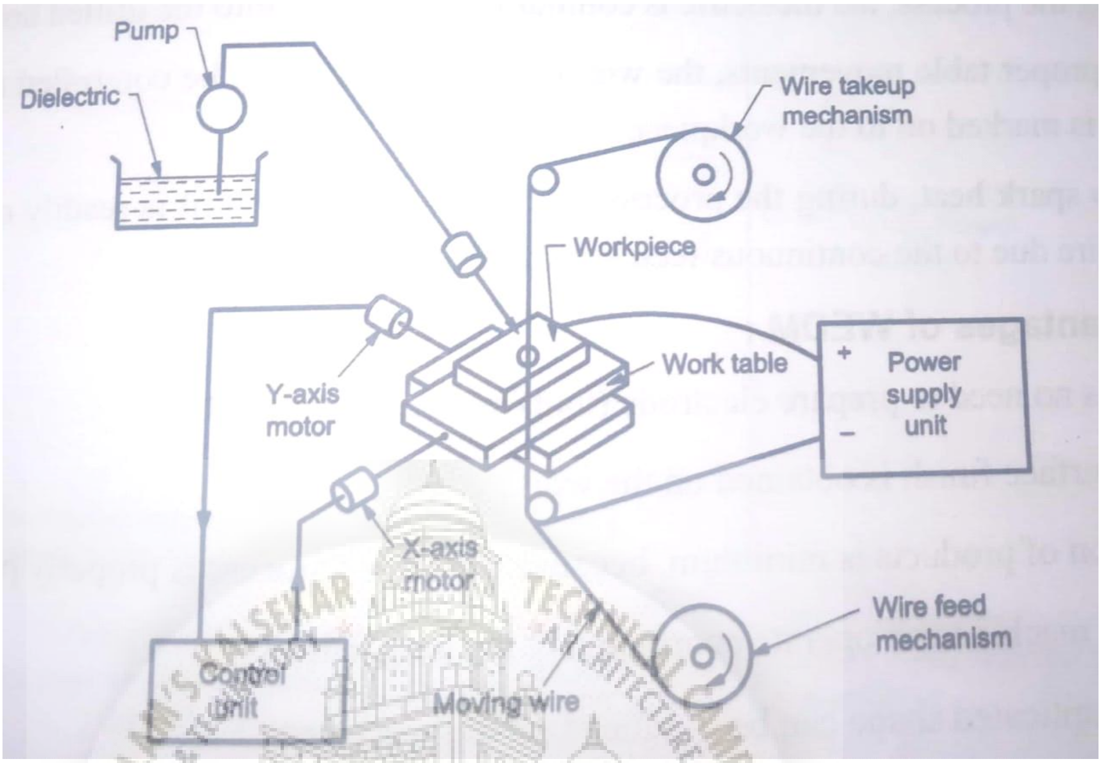


Figure 4.8. Graphical Representation of W-EDM.

4.2 Electronic Details

4.2.1 Microcontroller. [8]

The Arduino UNO is an open-source microcontroller board based on the Microchip Tmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The

Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Specifications

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts.
- Input Voltage: 7 to 20 Volts.
- Digital I/O Pins: 14 (of which 6 provide PWM output).
- Analog Input Pins: 6.
- DC Current per I/O Pin: 20 mA.
- DC Current for 3.3V Pin: 50 mA.
- 32 KB of which 0.5 KB used by boot loader.
- SRAM: 2 KB.
- EEPROM: 1 KB.
- Clock Speed: 16 MHz
- Length: 68.6 mm.
- Width: 53.4 mm.
- Weight: 25 g.

General Pin functions

- LED: There is a built-in LED driven by digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.
- VIN: The input voltage to the Arduino/Genuine board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V: This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 20V), the USB connector (5V), or the VIN pin of the board (7-20V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage the board.
- 3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND: Ground pins.

- IOREF: This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.
- Reset: Typically used to add a reset button to shields which block the one on the board.

Figure 4.10. Arduino UNO [8]

4.2.2 Motor controller

The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

This depends on the voltage used at the motors VCC. The module has an onboard 5V regulator which is either enabled or disabled using a jumper. If the motor supply voltage is up to 12V we can enable the 5V regulator and the 5V pin can be used as output, for example for powering our Arduino board. But if the motor voltage is greater than 12V we must disconnect the jumper because those voltages will cause damage to the onboard 5V regulator. In this case the 5V pin will be used as input as we need connect it to a 5V power supplies in order the IC to work properly. We can note here that this IC makes a voltage drop of about 2V. So for example, if we use a 12V power supply, the voltage at motors terminals will be about 10V, which means that we won't be able to get the maximum speed out of our 12V DC motor.

So first we need to define the pins and some variables needed for the program. In the setup section we need to set the pin modes and the initial rotation direction of the motor. In the loop section we start by reading the potentiometer value and then map the value that we get from it which is from 0 to 1023, to a value from 0 to 255 for the PWM signal, or that's 0 to 100% duty cycle of the PWM signal. Then using the analog Write () function we send the PWM signal to the Enable pin of the L298N board, which actually drives the motor.

Next, we check whether we have pressed the button, and if that's true, we will change the rotation direction of the motor by setting the Input 1 and Input 2 states inversely. The push button will work as toggle button and each time we press it, it will change the rotation direction of the motor.

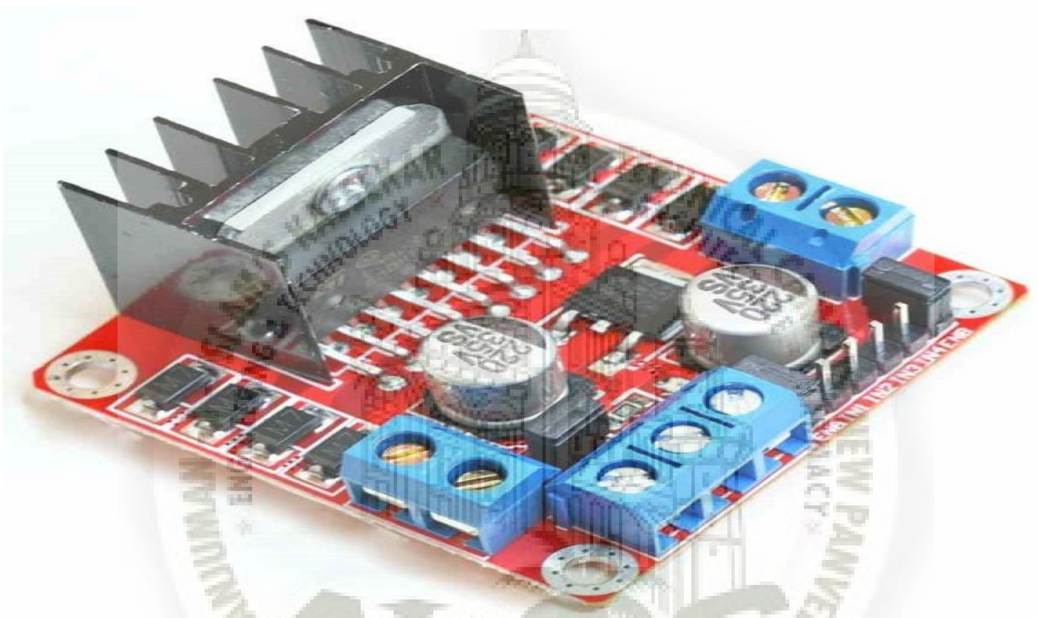


Figure 4.11. Picture of Motor Controller

CHAPTER 5

5. RESULTS AND CONCLUSION

After the system was integrated on a 10 ton power press, the first loop hole in our design was about the spacing of the attachment. It is not possible to run this setup on a power press with an inclined bed. This is because the whole arrangement is based on free flow and gravity is the thing which will complicate things further. So, on a flatbed power press, this arrangement can be assembled on.

The second thing worth considering was that the space of the power press is too less for a big arrangement to fit in. we could not accommodate the attachment in perpendicularity to the axis of the bed. So, the arrangement now fits in a forty five degree angle to the axis of the press.

As far as the functioning is concerned, we have successfully found out a way to merge two systems into one by using electronic circuits. The feed system has to be synchronized with the clutch of the power press. A minor timing difference is showing amid the setup made according to the theoretical plans.

The objective of the study was about increasing productivity of the specific assembly line by using customized means to achieve the required results and make the process quicker. Now that this arrangement can be used on presses, the productivity will be increased without a lot of worker interference.

Figure 5.1. Actual Model

CHAPTER 6

6. COST DETAILS

1. Die

Description	Unit price	Quantity	Total
Tool Steel	500/Kg	15kg	7500
Machining			2500
Tempering			1000
W-EDM			6000
Total			

2. Stacker

Description	Unit price	Quantity	Total
Sheet (.8mm)	54/kg	4kg	214
bending			40
Welding			60
Total			314

3. Frame

Description	Unit price	Quantity	Total
Angle bar	15/kg	25kg	375
Total			375

4. Rack and Pinion

Description	Unit price	Quantity	Total
Rectangle bar	50/ft.	3ft	150
Circular block	80	1	80
Machining			200
Total			430

5. Electronics

Description	Unit price	Quantity	Total
Arduino UNO	450	1	450
Driver circuit L298	250	1	250
Wires			100
Adaptor	200	1	300
Buttons			100
Total			1200

6. Machining and fabrication

Description	Total
Fabricator	1000
Welder	800

7. Grand Total = 21120

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