



Design and Fabrication of Double Disc Polishing Machine

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ABSTRACT

This study centered on the development of a laboratory metallographic grinding/polishing machine using locally sourced materials and indigenous technology to help in polishing metals for production of a flat, smooth and mirror-like surface of any metallic materials to determine their physical structure using microscopy for metallographic examinations. The designed was made, and 3-dimensional architectural design was done to obtain a clear vision of the design. The laboratory grinding/polishing machine was fabricated using the following components: angle-bars, mild steel plate, electric motor, shaft, belt, pulley, coupling, side pulley disc; following the specified dimensions from the 3-dimensional drawing; assembling of the various components follows; and finally, tested and performance evaluation was equally done. In testing the developed machine, the specimen was mounted, ground and then polished using emery paper with frequent application of water to act as a coolant while the side pulley disc is rotating.

The result obtained from the developed laboratory grinding/polishing machine showed a metallic specimen that was well ground and well-polished to mirror-like form for further metallographic examination. Based on the efficiency of this developed machine, we, therefore, recommend this research work for the end users and the metallography industry for the metallographic purpose.

Keywords: Development, Laboratory, Metallographic, Grinding/Polishing, Evaluation, and Machine.

1. INTRODUCTION

The disk polishing machines are extensively used for polishing the metallography samples for microscopic observation to study various metal structures. Disc polishing machines are finely polished to ensure smooth, scratch free and mirror like appearance that enable accurate metallographic interpretation. Polishing is the final stage in producing a surface that is flat, smooth, scratch-free and mirror like an appearance. Such a surface is necessary for subsequent accurate metallographic interpretation, both qualitative & quantitative. In this machine the drive is given the motor spindle which is mounted on the motor shaft through friction mechanism. Polishing discs are fitted on the shaft and locked by nut. Shaft has two bearings, which are fitted into bearing holder for smooth working.

This polishing machine is a double-disc desktop, applicable to rough grinding & polishing of metallographic sample. The machine has microprocessor control system, with a speed of 1200-1400 rpm. The machine is indispensable equipment in making the metallographic sample. The machine, easy to use, safe and reliable, is an ideal preparation equipment for the labs of plants, research institute & universities & colleges etc. The machine has two control systems, so it can so it can be operated by two persons.

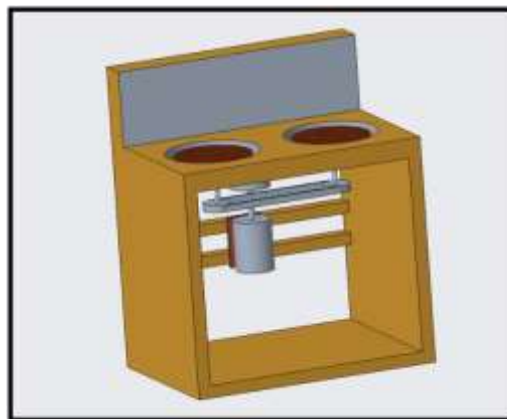


Fig -1: Creo Model of Disc polishing machine

1.1 Construction and working of proposed machine

Disc polishing machine is an electric machine same as manual machining but in these machine we get fine polishing, smooth, scratch free and mirror polish we had made this machine with the implementation of a belt, disc, pulley, rotating shaft etc. with proper alignment. This machine is made a such a way that the power from the electric board is pass to the circuit and then to the electric motor once it is pass with help of belt drive both the disc are rotated together we can control / Vary the speed of the motor. With the help of tachometer, we can measure the speed of the rotating disc before applying load and after applying load.

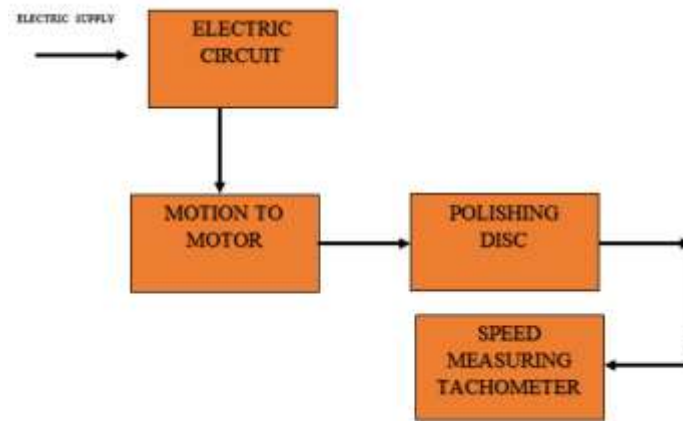


Fig -2: Block diagram

In this machine the drive is given the motor spindle, which is mounted on the motor shaft through friction mechanism. Polishing discs are fitted on the shaft and locked by nut. Shaft has two bearings, which are fitted into bearing holder for smooth working. The polishing machines also called buffing machine are machines that work with brushes and are designed to perform operations of brushing, buffing, polishing and finishing of any metal material. The polishing machines are versatile because they allow to work elements of various shapes & sizes with different types of finish, from the cleaning to the mirror finishing obtained with abrasive pastes.

1.2 Equipment used in machine

a) Motor: A power level of 1 hp is approximately equivalent to 746-watt s (W) or 0.746(kw). Motor is a machine which gives out mechanical output when electrical input is fed to it. So during the time of its manufacturing, the motor is tested against various loads and accordingly rated for its power and efficiency etc. HP is a unit of power. Actually 1 HP = 746 Watt. Watt can be explained as Joule - Second, this signifies that when the motor with 1 HP rating is operated for 1 second, we will get 746 joules of work done.

b) Belt: A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave or pulley wheel.

c) Disc: Very little material is removed during the polishing process, normally measured in microns. The surface finish of the work-piece to be polished must be of a high quality prior to the polishing process taking place, so the pre-polishing process is often a "lapped" surface.

d) Pulley: A pulley is a wheel that carries a flexible rope, cord, cable, chain, or belt on its rim. Pulleys are used singly or in combination to transmit energy and motion. A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt, or transfer of power between the shaft and cable or belt. In the case of a pulley supported by a frame or shell that does not transfer power to a shaft, but is used to guide the cable or exert a force, the supporting shell is called a block, and the pulley may be called a sheave or pulley wheel.

e) 12V DC SMPS: SMPS is an electronic power supply system that makes use of a switching regulator to transfer electrical power effectively. It is a PSU (power supply unit) and is usually used in computers to change the voltage to the appropriate range for the computer. When we give AC Input to an SMPS, then initially it converts it into DC. This process of converting AC to DC is called rectification. It will be skipped when we give DC voltage. as the rectifier produces an unregulated DC voltage, it is sent to a filter capacitor. current drawn from the mains supply is in short pulses around the AC voltage peaks. It works on semiconductor switch. to switch on-off the supply voltage at a particular switching frequency to control the output voltage. When you change the switching frequency it will change the output voltage.

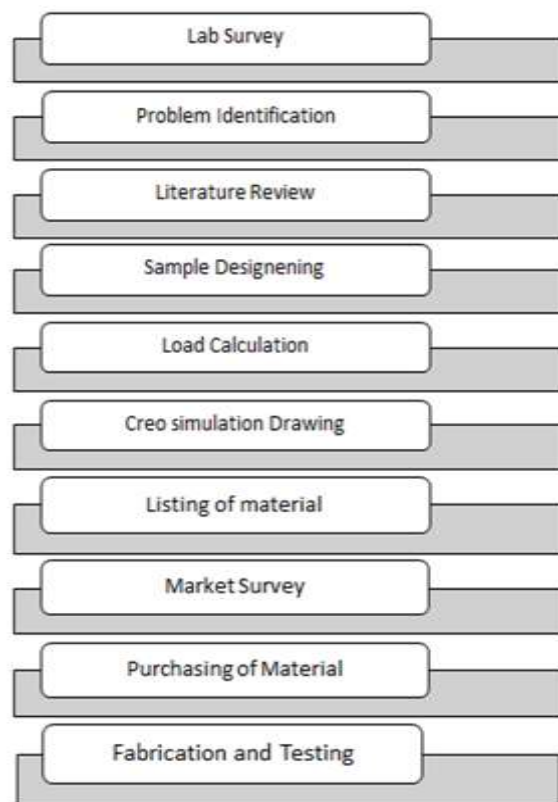
f) Speed Controller: Motor speed controllers are electronic devices that control motor speed. They take a signal for the needed speed and drive a motor to that speed. There are a variety of motor speed controllers available. We come across speed control of electric motors everywhere in a modern society. The list of speed control comprises a wide range of appliances, beginning with household electrical appliances used in the garden and garage, and ending

with large industrial plants with conveyor belts, pumps and machine tools. We will quickly see how essential and important this type of speed control is for various machines.

g) Tachometer Display: A tachometer is an instrument that measures the working speed of an engine, typically in revolutions per minute (RPM). It is commonly used in cars, boats, planes, and other vehicles. Most tachometer gauges have either an analog (dial) or digital (LCD or LED screen) display. Tachometer is a device which measures the speed of a rotating object like an electric motor or a crank shaft of a vehicle engine. Speed of an electric motor is determined by the number of revolutions made by the motor in one minute. In other words, speed is measured in RPM (Revolutions per Minute). Here, in this project, we designed a simple Non – Contact or Contactless Digital Tachometer using 8051 Microcontroller, which can measure speed with an accuracy of 1 rev/sec. The basic principle behind the Contactless Digital Tachometer involves a simple embedded system with a sensor, a controller and an actuator. The sensor used here is Infrared (IR) transmitter.

h) Polishing Disc papers: For heavy sanding and stripping, you need coarse sandpaper measuring 40-to 60-grit; for smoothing surfaces and removing small imperfections, choose 80- to 120-grit sandpaper. To finish surfaces smoothly. Grinding should be done using different Grit emery papers in order. (Grit Size: 220, 320, 400, 600, 800, 1000, 1200... 1/0, 2/0, etc.)

2. METHODOLOGY



3. DESIGN

1. Determination of the speed of polisher -

$$N1/N2 = D2/D1 \dots \dots \dots (eq1)$$

Where :

N1= Speed of the motor in revolution (rev/mins)

N2= speed of polisher in revolution per minutes (rev/mins)

D1= Diameter of the motor pully in (mm)

D2= diameter of the polisher pully in (mm)

Data:

$$N1=1500(\text{rev}/\text{mins})$$

$$N2=?$$

$$D1=80(\text{mm})$$

$$D2=60(\text{mm})$$

(Using equation 1)

$$N1/N2 = D2/D1$$

$$1500/N2 = 60/80$$

$$60 * N2 = 1500 * 80$$

$$N2 = (1500 * 80)/60$$

$$N2 = 2000 \text{ rev}/\text{min}$$

2. The tension in the belt –

T1= tension in the tight side of the belt

T2= tension in the slack side of the belt

Determine the maximum tension (T)

Data:

$$\theta=1.7\text{N}/\text{mm}^2 \text{ for rubber belt}$$

Assuming:

$$H=15\text{mm}$$

$$T=10\text{mm}$$

$$A=b*t$$

$$A=15*10$$

$$A=150\text{mm}^2$$

Recall:

$$T=\theta*A$$

$$T=1.7*150$$

$$T=255\text{N}$$

Table -1: Cost estimation of materials

| Cost estimation of materials | | | |
|------------------------------|------------------------------|----------|-----------|
| Sl. No. | Material name | Quantity | Cost (Rs) |
| 1 | (3000) rpm AC motor | 01 | 3500/- |
| 2 | (2.5 sq mm) Three core cable | 01 | 100/- |
| 3 | 10A MCB (Double Pole) | 01 | 200/- |
| 4 | 10A Push switch | 02 | 40/- |
| 5 | Red indicator | 01 | 130/- |
| 6 | Green indicator | 01 | 130/- |
| 7 | Tachometer display | 01 | 2200/- |
| 8 | 1.5 sq mm Wire | 10 mtrs | 100/- |
| 9 | 12v DC SMPS | 01 | 130/- |
| 10 | Three pin top | 01 | 30/- |
| 11 | Speed controller | 01 | 1800/- |

4. ADVENTAGES, DISADVANTAGES, APPLICATIONS, FUTURE SCOPE

4.1 Advantages

- A polishing operation will reduce time.
- The operation helps to keep the material bright and good luster.
- There is not a skilled worker or operator is required for this operation.
- Flatness guaranteed, Surface machined is necessarily flat.
- No Tool marks on the surface machined.
- Even polishing on surface.
- Less Time consuming, suitable for mass production.
- Dimensional accuracies maintained.

4.2 Disadvantages

- Both the disc moves simultaneously The operation helps to keep the material bright and good luster.
- Abrasive particle is required for an operation.
- It is not a long-lasting operation
- Polishing operation is little costly operation.

4.3 Applications

- Used for lab development.
- Used for small and medium industries.
- Used for polishing small materials.
- Easy to operate safe and reliable is an ideal equipment for the lab of plants research, institutes and universities and colleges.
- To remove the fine scratches on the specimen surface.
- To get the mirror finished surface for specimens for microstructural study.

4.4 Future scope

Polishing is often used to enhance the appearance of an item, prevent contamination of instruments, remove oxidation, create a reflective surface, or prevent corrosion in pipes. In metallographic and metallurgy, polishing is used to create a flat, defect-free surface for examination of a metal's microstructure under a microscope. Silicon-based polishing pads or a diamond solution can be used in the polishing process. Polishing stainless steel can also increase its sanitary benefits.

5. CONCLUSIONS

Making a disc polishing machine will give team member lot of practical knowledge and study of mechanism with handsome experience. By working on this project we will understand the different type of grit size paper which are used to polish the material and their surface finish rate. This machine will be very useful for college and workshop for completing experiment which will make easy for teachers & students for teaching & understanding practical for student. The machine increase scope of future in Yashwantrao Bhonsale Polytechnic to develop experiment & try new things.

References

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- [1] K.J. Sharif, H.P. Evans and R.W. Snidles, "Wear modeling in worm gears," IUTAM Symposium on Elastohydrodynamics and Microelastohydrodynamics, Springer, 2006, 371–383.
 - [2] Polishing, Buffing & Burnishing Work, http://platers.org/polishing_buffing.php, 2009, retrieved on 11th May, 2016.
 - [3] Metallography, specimen preparation, <http://www.materialography.org>, assessed on 11th May, 2016.
 - [4] Leonard E. Samuels, "Metallographic polishing by mechanical methods", fourth edition, ASM International, 2003.

[5] 9. Antonio Barrero-Gil, Santiago Pindado, Sergio Avila, "Extracting energy from Vortex-Induced Vibrations: A parametric study"; Universidad Politecnica de Madrid, Plaza Cardenal Cisneros 3, E-28040 Madrid, Spain.

[6] Saurav Bobde, Sameer Jadhav, "Study of Vortex Induced Vibrations for Harvesting Energy" IJRST –International Journal for Innovative Research in Science & Technology| Volume 2 | Issue 11 | April 2016.