Fabrication of Grinding Wheel Attachment for Lathe Machine

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Abstract- Now a days every one want to reduce the cost and time required for manufacturing of any product. Grinding operation is performed to obtain a fine surface finish in this project we are use this grinding process for resharpening of industrial HSS cutter and we replace the machine by direct attachment on lathe machine which is available in industry, so reduction of cost for resharpening and machine. The component designs to use in this project are base plate, induction Motor, Sleeve, stud, nut and bolts. Motor is attached to lathe tool post by using base plate and rubber pad and job is attached on center of lathe by using supporting shaft and tilting angle is given by swiveling base plate. Grinding wheel is attached on motor by using sleeve and bolt for fitting.

Keywords- *Grinding Attachment, Surface Finishing, grinding wheel, motor.*

1. INTRODUCTION

Lathe is a machine tool which is used to provide shape to an article (metal/wood/other materials). In early times, lathe was the only machine which was used for most of the major operations. The turning operation on lathe is most frequently performed, and then it's transferred to grinding machine for fine surface finish. For providing fine surface finish, the required grinding wheel is selected depending upon work piece to be used. Since the motor runs at high rpm causing lot of vibrations, thus it will be necessary to damp these vibrations using damper. Also, appropriate rigidity should be provided to clamp the motor on lathe bed. Since the whole sequence of operation, i.e. machining a work piece on lathe and then surface finishing it on the grinder, takes a lot of time and causes human fatigue. Therefore, there comes a need of creating an attachment of these two machines together to save power, money, labours and also good efficiency of machine. The attachment is designed specifically keeping in mind the use of attachment in workshops, for definite dimensions of the job and quality of surface finish. Every attempt is made to overcome the faults and make the m/c as precise as possible. Special attention was concentrated on the rigidity of the machine which would result in improper functioning of the attachment if not considered. Beside this the important thing which was kept in mind while designing and the manufacturing the unit was that it should be capable of taking sufficient load and forces which it would face while in operation. The attachment though small in size the appearance is really a unique piece of skill and hard work.

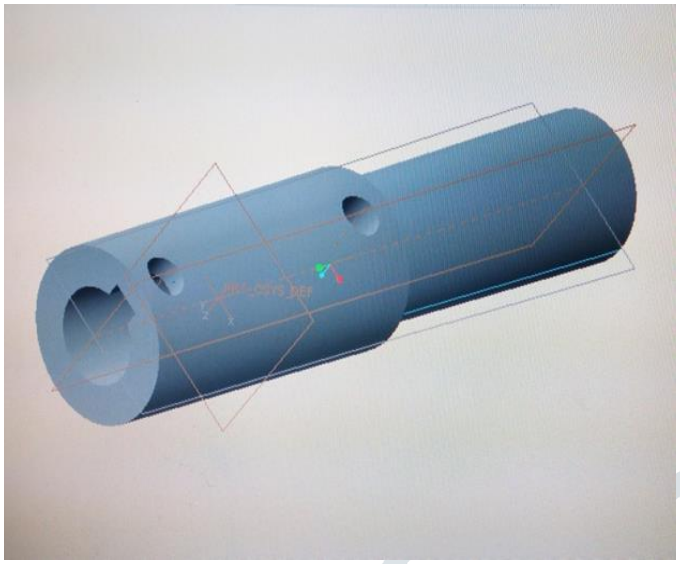
2. LITRATURE REVIEW

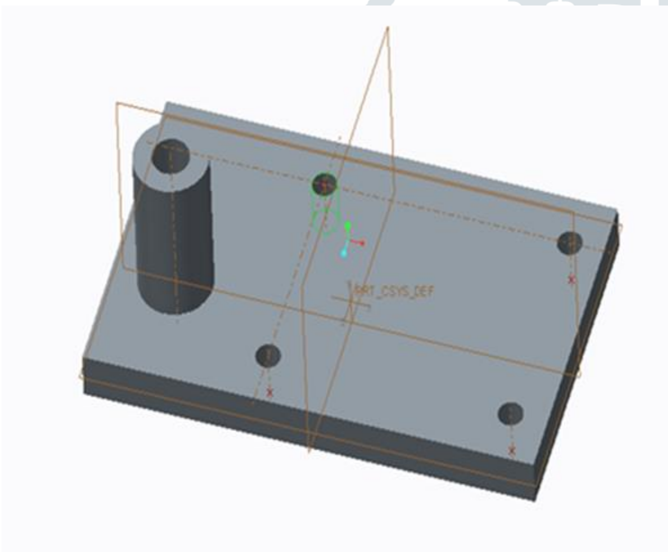
DarshanAttarde et al. (2016): Grinding operation is performed to obtain a fine surface finish after performing turning operation on lathe machine for cylindrical jobs. This is done to obtain required dimensions of part to be used in any assembly. Thus to perform these two operations on same machine the attachment is designed. To verify the design the attachment is fabricated. This work describes an attempt to decrease the time in loading and unloading of workpiece with desired surface finish. The report describes the selection of wheel for grinding. It also considers the rigidity of design, damping of vibration due to motor speed and stress analysis of critical part of design, which is analyzed on INVENTOR software and compared with theoretical calculations. It also lists the various operations performed to fabricate the attachment.

SachinBhosale et al. (2017): Any product can be finished or semi-finished by using one or more processes on the same machine or different machines. So we have idea of designing and fabricating the multipurpose machine which can be attached on lathe machine. We have selected the lathe machine because it is most basic of all machines and this is why it is called as “mother of all machines”. In our project we tried to perform operation which is perpendicular to spindle axis i.e., grinding.

Abhishek M. Kawade et al. (2016): Cylindrical grinding is a process of grinding cylindrical workpieces. Special cylindrical grinding machines are available in the markets which are quite huge and costly. For the grinding of the small workpieces, it is neither convenient nor affordable to use the special grinding machines. The objective of this project was to design and manufacture a compact, robust and economic grinding attachment for a canter lathe machine which provides a surface finish of grade N5. All components were designed as per the deterministic method of design. After the design procedure was completed, finite element analysis was performed on the component which experienced worst loading conditions i.e. the shaft. For small-sized cylindrical workpieces, it is neither economic nor preferable to use a special type of grinding machine for grinding operations. While in turning or facing process one can obtain surface finish of grade N8 with tool marks. But with this attachment, one can get a surface finish of grade N5 without tool marks and scoring marks.

3. COMPONENTS OF MODEL





4.DESIGN

4.1 Lathe Specifications:

Table No 4.1. Specification of Lathe Machine

S.R NO.	Description	Details
1	Electric motor	1HP – 3phase
2	Belt transmission	V belt
3	Low speed range	40 to 345 m/min
4	Chuck	4 jaw
5	Tool post (dimension)	182 * 112 mm

4.2 Motor Power Calculations:

Weight of grinding wheel = w = 0.5 kg = 0.5*9.81 = 4.905 N = force

Preferable speed for fine grinding = N = 2800 rpm

Distance between grinding wheel &motor = D = 40+45 = 95 mm = 0.095 m

Hence torque required to drive motor = T = F*D = 4.905*0.095 = 0.495975 N-m

Power required to drive motor = P = 2πNT/60 = (2*π*2800*0.495975)/60 = 145.42 watt

Hence, selecting the motor of 0.18 KW power rating.

Table No 4.2.Motor Specification

Sr.No	Description	Details
1.	Made	CROMPTON GREAVES LTD.
2.	Serial no.	IUG1015
3.	Frequency	50 HZ
4.	Power	0.18 KW
5.	Voltage	415
6.	Amp.	0.57
7.	Rpm	2810
8.	Efficiency	64
9.	Ambient temp (max)	50 C

4.3 Selection of Grinding Wheel:

Hence dense structure is selected of no 5

Specification of selected grinding wheel is as follow

W C 60 O 5 B 54

Where,

W= manufacturer abrasives type symbol

C =abrasive type (CBN)

60= grain size (medium)

O= grade (medium grade)

5= structure (Dense)

B= Bond (resonoid)

54= suffix number

Cutting speed of grinding wheel = V =πDN/1000 = (π*0.1*2800)/1000= 0.8796 m/min

Depth of cut = 0.005 mm

Total stock to be removed = 0.02 mm

No. of passes = 4

Table No 4.3.Dimension of grinding wheel

Sr.No.	Description	Dimension(mm)
1.	Inner diameter(h)	20
2.	Outer diameter(d)	100
3.	Width(t)	25
4.	Thickness of abrasive(x)	10
5.	Thickness(e)	10

4.4 Bush Design:

Material Selection = Plain Carbon Steel (30C8)

Ultimate tensile strength = 750 MPa

Yield strength = 400 MPa

Factor of Safety = 4

Diameter of motor shaft = d = 11 mm

Hence Diameter of sleeve = D= 2d+13 = 2*11+13 = 35 mm

Allowable shear stress = τ all = (0.5 Syt)/FOS = (0.5*400)/4 = 50 MPa

Checking sleeve for torsional shear stress :

Induced shear stress = τ = (16 Mt)/(π*d^3)

Where , Mt= torsional torque = (60* 〖10〗 ^6*P(kw))/2πN =

= (60* 〖10〗 ^6*0.18)/(2π*2800) = 613.88 N-mm

τ = (16*613.88)/(π* 〖11〗 ^3) = 2.34 MPa

hence, τ < τ all

hence sleeve is safe in torsional shear stress

Table No: 4.4.Dimension of Bush

Sr.No.	Description	Dimension(mm)
1	Inside diameter of sleeve	11
2	Outside diameter of sleeve	35

3	Length of muff	40
4	Locking nut for hole	5
5	Distance between two hole	30
6.	Extended shaft	20
7.	Shaft length	45

4.5 Design of key:

Material selection = plain carbon steel (30C8)

Ultimate tensile strength = 610 MPa

Yield strength = 400 MPa

FOS = 4

Diameter of motor shaft = 11 mm

For flat key,

Width = w = d/4 = 11/4 = 2.75 = 3mm approx.

Height = h = d/4 = 2.75 = 3 mm approx...

Length of Key = 1.5*d = 1.5*11 = 16.5 mm

Permissible shear stress = τ per = (0.5*400)/4= 50 MPa

Permissible Crushing Stress = ɕc per = 610/4 = 152 MPa

Checking Shear stress induced in the key = τ = (2*Mt)/dwl = (2*613.88)/(11*3*16.5) =2.25MPa

Hence, τ < τ per.

Hence key is safe in shear stress.

Checking crushing stress induced in key, ɕc = (4*Mt)/dhl =(4*613.88)/(11*3*16.5) = 4.50 MPa

Hence, ɕc<ɕc per

Hence, design is safe in compression consideration.

.Table No.4.5. Dimension of key

Sr.No	Description	Dimension(mm)
1.	Width	3
2.	Height	3
3.	Length	16.5

Table No 4.6. Dimension of Base Plate

Sr. No	Description	Dimension (mm)
1.	Length	182
2.	Width	112
3.	Thickness	15
4.	Stud(ID,OD)	18,30
5.	4 hole	6

4.6 Design of Bolt:

Material Selection: Plain Carbon Steel (30C8)

Yield strength = 400 MPa

FOS= 2

Permissible tensile stress = σ_{tper} = 400/2 = 200 MPa

Total load acting on plate, P=5kg =49.05 N

Calculating the diameter of bolt:

$\sigma_{tper} = P/(\pi/4 * {dc}^2)$

$200 = 49.05/(\pi/4 * {dc}^2)$ hence, dc = 4.32 mm

Diameter of bolt = d = dc/0.8 = 5.41 mm

Hence from standard size of bolt, M6 bolt is selected.

4.7 Selection of Nut:

Material- Steel with carbon 0.50% , phosphorus =0.060

ID =M20

Thickness = 13mm,

Pitch = 2mm,

Angle = 60 deg.

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