DESIGN AND FABRICATION OF INTERNAL GRAINDING ATTACHMENT IN LATHE

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ABSTRACT

Everyone knows a tool post grinder is one mighty handy item to have as an addition to a lathe, however, if you ever priced one, you know they run in to some serious amounts of money.

So, with this in mind, I set off to build my own. Pictured below is the outcome of that project. I have to say the tool post grinder works extremely well. By varying the pulley sizes I can get a high end speed of over 10,000 rpm if needed. The only change I would make is to have a totally enclosed motor to keep out the grit.

Our project is design and fabrication of Multi Use Tool Post Grinder. It is used to grind the machining surfaces to super finish and accuracy. It can be used as an internal and external Grinder by fixing the attachment on the Carriage of a center Lathe.

The principle parts of this attachment are main body, Spindle shaft, bearings, rope pulley and grinding wheel etc.

Keywords: *design, 2d diagram cad, grinding attachment*

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1. INTRODUCTION

Generally some components in engineering field require high surface finish and accuracy. For example a cylindrical part requires high finish inside the bore or outside the body; it requires cylindrical grinding machine and center less grind machine.

The above machinery cost will be more, and also unless we have lot of similar jobs, we equity keep these costly machines idle. To avoid this heavy investment and also to fill our requirement in grinding of such above jobs, we can manufacture this attachment.

As the cost of this attachment is less, we can keep this idle when we don't have enough jobs. There won't be any loss for us, due to this attachment.

2. GRINDING

SLOW GRINDING:

Grinding is widely regarded as a necessary evil, an art rather than a science. The oldest machines in any shop are typically grinding machines because there isn't enough justification to invest in new ones. Until now, any increase in productivity on a grinding machine has been made in small steps-a different wheel might yield more parts per dress and a few more parts in the pan at the end of the day; some experimentation with feed rates might yield a few more parts. But with some unconventional modifications, that same grinding machine has the potential to remove twice the material in the same amount of time.

FAST VS SLOW GRINDING:

Lately the focus has been on high-speed grinding and machining. The theory is that a grinding wheel, which is literally millions of tiny cutting tools, will remove more material the faster it is rotated. We have all read about research initiatives using special wheels at 30,000 rpm or more. But the higher the wheel speeds, the higher the temperatures in the grinding zone.

So along with the high-speed spindles and wheels, high-pressure coolant systems with special delivery nozzles had to be developed to overcome the air turbulence caused by the high-speed wheel. This is all very expensive and difficult to justify in a production-oriented environment where today's profit margins are slim. Has anyone ever considered that maybe we are going in the wrong direction? Slow speed grinding has been discussed in the past, and some experimentation was done years ago.

But it never really caught on, perhaps because people had a perception problem with the word "slow," relating it to the feed and production rates rather than simple wheel speed. Add that older grinding machines have no precise control over wheel speeds, especially in the 1000 to 2500 rpm range, and you have a highly efficient grinding process that has been largely ignored.

A new technology (Cool Cut, developed by Machine Tool Specialists) has been developed that might change all that. By making electrical and mechanical modifications to existing grinding machines, the technology provides superior control and high cutting rates at slow wheel speeds. It is particularly useful for hard materials, such as carbide and ceramic.

3. WORKING PRINCIPLE

This attachment is used on center lathes. This whole arrangement is fixed on the carriage where the component rests. A grinding wheel is mounted on the spindle which is supported by two bearings, and is rotated by a motor through ‘V’ rope in high revolution.

While we are introducing the rotating grind wheel inside the bore of a job which is also rotating on the chuck, Material will be removed according to the cut which we select. The operation is similar to grinding operation. In turning, a single point tool removes the material, but in this process, a grinding wheel is used to super finish the jobs, where high accuracy is necessary.

4. DESCRIPTION AND FABRICATION OF COMPONENTS

- Main Body.
- Spindle Shaft.
- ‘V’ rope pulley
- Bearing Stand.
- Bearing Cap. 5a. Bearing.
- Grinding Wheel.
- Adopter.
- Motor

1. Main Body:

This is made of MILD STEEL material.

Top plate and Bottom plate are connected by the four bars by welding. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

Four numbers of slots are machined as in the drawing on the top plate. Two Numbers of slots are machined as in the drawing on the bottom plate. These slots are used to fix the motor on this main body and fix the attachment on Lathe respectively.

2. Spindle Shaft (or) Main Shaft:

Spindle is manufactured from E N steel. This is machined as per the drawing. One end is machined to hold the ‘V’ belt pulley and the other end is threaded, to tight the grinding wheel on the spindle. Middle portion is machined to suit the bearing. This spindle with bearings is assembled in main body. This spindle will be rotated through the ‘V’ belt pulley during the operation. Whole Spindle is turned in between centers to avoid run out.

3. ‘V’ Rope Pulley:

This is made of MILD STEEL material and machined to standard type if single ‘A groove. Spindle is rotated by the motor through this pulley and ‘V’ rope. Diameter of this pulley is design to run the spindle to 3840 rpm. A key way is done in the bore of the pulley to key with the spindle.

4. **Bearing Stand:**

This is made of MILD STEEL material. This is machined as per the drawing. This covers the bearings and also tights the bearings with the main body by welding.

5. **Bearing Cap:**

This is made of MILD STEEL material. This is machined as per the drawing. This covers the bearing stand by means of three screws. Grease and lubrication oil will not come out side during the operation.

Bearings:

This is a standard size hall bearing No.6202 NBI. This enable the spindle to rotate and wear the Load smooth and rigidly.

6. **Grinding wheel:**

This grinding wheel is manufactured in various grades. We have to select the grades according to the material which we have to grind.

7. **Adopter:**

This is made of MILD STEEL material. The adopter can hold the grinding wheel (Internal). The adopter is used to grind the internal surfaces.

8. **motor:**

It is found to drive the main shaft which fixed on the end of the tilting plate. The free end of the shaft in the motor a large pulley is found around which the belt runs. The other specification about the motor is discussed in design part of the machine.

Three-Phase Motor:

The presence of three phase-shifted currents allows a rotating field to be produced in the stator by connecting successive poles to the three supply lines. The moving magnetic field induces a magnetic field in the rotor, which "chases" the rotating stator field.

NEMA Design Motors

The National Electrical Manufacturers Association has assigned a simple letter designation to four of the most common three-phase AC electric motors. These vary in starting torque and speed regulation. They are all of squirrel-cage construction, and are available in many sizes. The figure at the right shows the performance curve for each type. Note that this figure has torque on the vertical axis and speed on the horizontal.

NEMA Design A

Design A has normal starting torque (typically 150-170% of rated) and relatively high starting current. Breakdown torque is the highest of all NEMA types. It can handle heavy overloads for a short-duration. Slip ≤5%. A typical application is powering of injection-molding machines.

NEMA Design B

Design B is the most common type of ac induction motor sold. It has normal starting torque, similar to Design A, but offers low starting current. Locked rotor torque is good enough to start many loads encountered in industrial applications. Slip ≤5%. Motor efficiency and full load power factor are comparatively high, contributing to the popularity of the design. Typical applications include pumps, fans, and machine tools.

NEMA Design C

Design C has high starting torque (greater than previous two designs, say 200%), useful for driving heavy breakaway loads. These motors are intended for operation near full speed with-out great overloads. Starting current is low. Slip ≤5%.

NEMA Design D

Design D has high starting torque (highest of all the NEMA motor types). Starting current and full-load speed are low. High slip values (5-13%) make this motor suitable for applications with changing loads and attendant sharp changes in motor speed, such as in machinery with flywheel energy storage. Speed regulation is poor, making the D design suitable for punch presses, cranes, elevators and oil well pumps. Several design subclasses cover the rather wide slip range. This motor type is usually considered a "special order" item.

5. CONSTRUCTION OF ATTACHMENT & WORKING UNIT

Top plate and bottom plate are connected by four rods by welding. Spindle is machined as per the drawing. In this, provisions are made to fit the two bearings. Spindle is welded on the top plate. Bearings are covered by bearing stand and bearing cap. These are tightened by six screws.

After Assembling the spindle, with bearings it should rotate freely such that alignment to be made. At one end of the spindle, 'A' type single groove pulley is fitted. At other end, grinding wheel is inserted in the spindle and is tighter with nut. This grinding wheel is supported by two washers at both the sides of grinding wheel.

Two numbers of slots are made on the bottom plate to fix the attachment on the lathe carriage. Four numbers of slots are made on the plate to fix the motor.

WORKING UNIT

This attachment is fixed on the lathe carriage, where the compound rest rests. The spindle of the attachment will be parallel to the lathe spindle. It is just like a boring bar on tool post. Where the motor is on, the spindle and the grinding wheel will be rotated, on the RPM of about. Job is held on the lathe chuck, for example, if we grind a bore of a body, the body will be rotating in lower RPM on lathe spindle, and the grinding wheel will be rotating on higher RPM. The rotation of the grinding wheel will be opposite to the job rotation.

Depth of cut may be given by cross slide, and the longitudinal movement will be given by automatic feed. Normally depth per cut will be 0.02 to 0.05 MM.

6. DESIGN AND DRAWINGS

RPM of the spindle should be high

For this using standard motor having 1440 RPM, the spindle speed is converted to higher RPM.

FORMULA:

D x RPM = D1 x RPM1

Where,

D - The motor pulley diameter

D1 - Main shaft Pulley diameter

As per our design

D - 76 mm

D1 - 47 mm

Therefore,

Motor RPM - 1440

Main shaft RPM = (D *Motor RPM)/D1

= (76 *1440)/47

= 2300 RPM

BEARING 2D- DRAWING

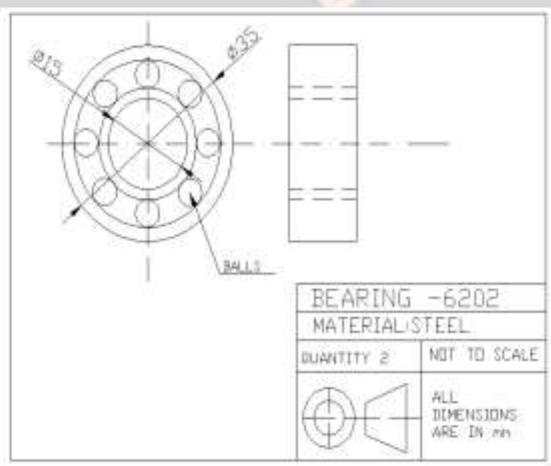

Fig.1-Bearing-6202

MAIN SHAFT PULLEY

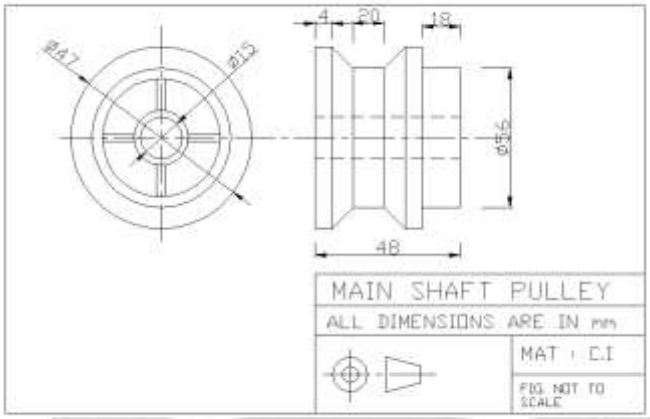

Fig-2 Main Shaft Pulley

MOTOR PULLEY

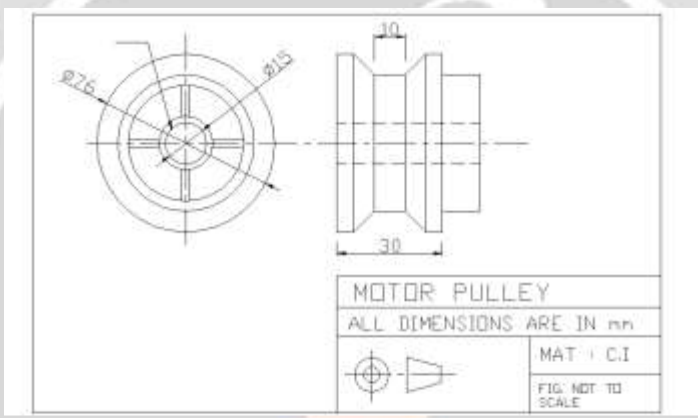

Fig.3-Motor Pulley

MAIN SHAFT

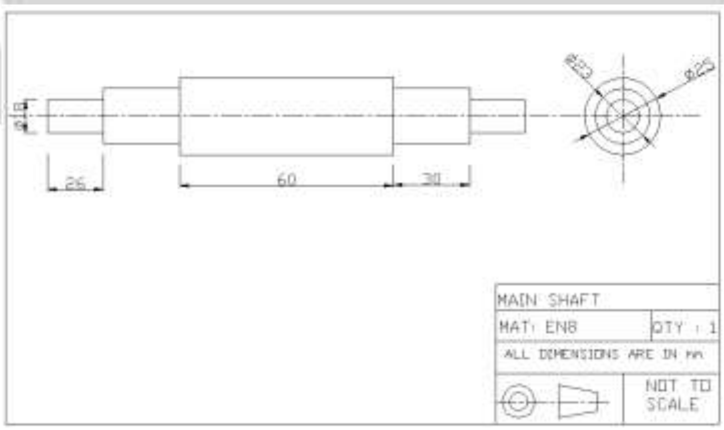

Fig.4-Main Shaft

ATTACHMENT DIAGRAM

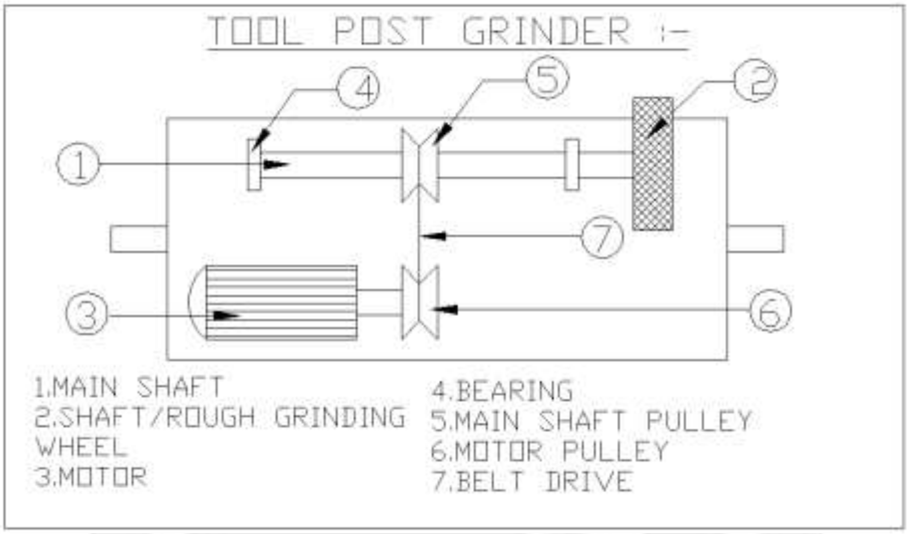

Fig.5-Assembly Diagram

LINE DIAGRAM OF LATHE

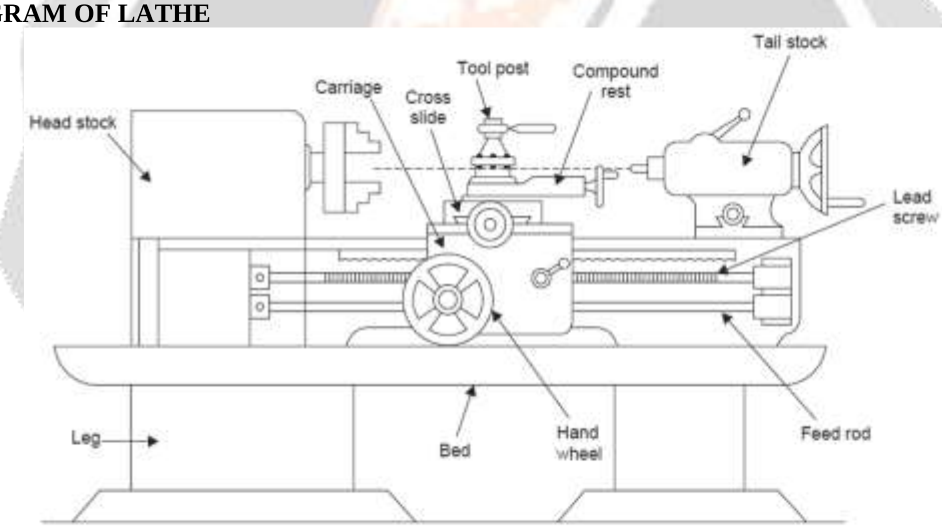

Fig.6.Line diagram of lathe

7. MAINTENANCE AND LUBRICATION

This multi-use tool post grinder attachment required less maintenance. Bearings only to be take care. So the bearing is packed with grease of good quality. The grease need not be changed often. Once in 350 hours is enough to run.

ADVANTAGE AND DISADVANTAGE

ADVANTAGES:

- The attachment is compact and rigid in size.
- Maintenance is less.
- It can be used on any lathe by small change in center heights.

DISADVANTAGES:

- This attachment is not used for taper job to grind but it can grind by using extra taper thread turning attachment.

APPLICATION

- Grinding inside the bore in any size of body can be done.
- As the feed is given automatic, 0.8 micron finish may be achieved.
- By changing the grades of grinding wheels it can be used to grind the carbon steel, Alloy steel and stainless steel etc.

FIELD OF APPLICATION

- Wherever grinding finish is required it can be used. For example, bore of industrial valves, outer diameter of spindle of varies machines.

8. LIST OF MATERIAL

Table.no-1-list of material

SL. NO.	PART NAME	MATERIAL	QTY
1	Top plate	M.S	1
2	Bars	M.S	1
3	Main Shaft	M.S	1
4	Motor	Aluminum (Body)	1
5	Bearing	Steel	2
6	Pulley	M.S	2
7	V-Belt	Rubber	1
8	Bearing cap	M.S	2
9	Grinding Wheel	Abrasive	2
10	Bolt and Nut	----	-----

9. PROCESS CHART

Table.no-2-Process chart

SL. NO.	MACHINE	operation	TOOLS	GAUGES	JIGS AND FIXTURES
1	Lathe	Boring Operation	Boring bar with tool	1. Inside micrometer 2. Depth Vernier 3. Vernier	Face plate with “L” Bracket
2	1. Centre Lathe 2. Milling M/c	1. Turning 2. Threading 3. Milling	1. Turning Tool 2. Threading Tool 3. Slott Cutter	1. Outside micrometer 2. Vernier	1. Chuck 2. Centers 3. “V” Block with clamps
3	1. Lathe 2. Slotting M/C	1. Turning 2. Slotting of key way	1. Turning Tool 2. Slotting tool	1. Vernier	1. Chuck 2. Clamps
4	Lathe	Turning Boring	1. Turning Tool 2. Boring Bar	Vernier	Chuck
5	Lathe	Turning Boring	3. Turning Tool	Vernier	Chuck

			4. Boring Bar		
6	Lathe	1. Turning 2. Boring	1 Turning Tool 2. Boring Tool	Vernier	Chuck

10. CONCLUSION

The project **"DESIGN AND FABRICATION OF MULTI USES TOOL POST GRINDER"** is that designed and erected.

The design and erection if this attachment involved a great deal of effort to make the project successful and useful.

We conclude the project report on **"DESIGN AND FABRICATION OF MULTI USE TOOL POST GRINDER"** that it will be very useful machine shop.

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