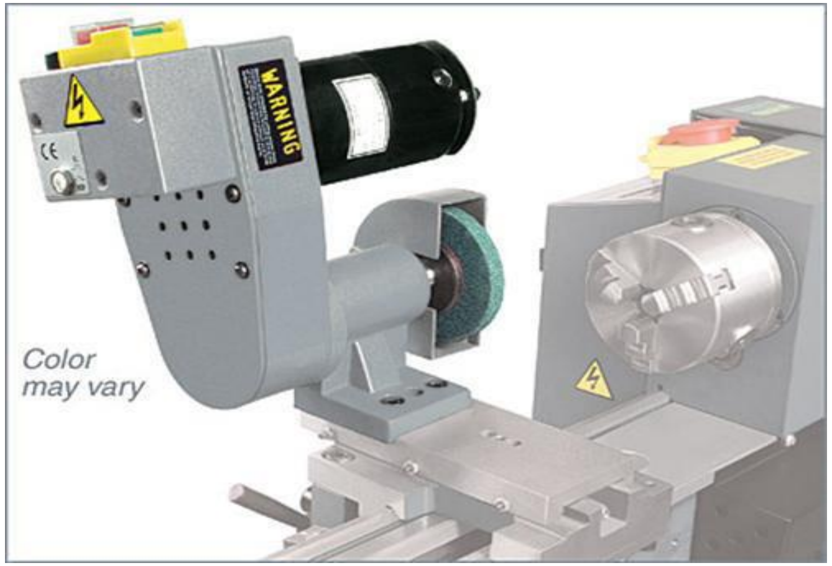
DEPARTMENT OF MECHANICAL ENGINEERING
ANJUMAN-I-ISLAM'S KALSEKAR TECHNICAL CAMPUS NEW PANVEL.

"DESIGN AND FABRICATION OF ATTACHMENT MADE FOR LATHE MACHINE"



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UNDER THE GUIDANCE Of **Prof. ASLAM HIRANI**

Overview

- **Introduction**
- **Problem definition**
- **Aim/Objective**
- **Literature survey**
- **Total cost of the project**
- **Methodology**
- **Experimentation**
- **Result and Conclusion**
- **Future scope**

References

Introduction

Tool Post Grinder

The tool post grinder is a portable grinding machine that can be mounted on the compound rest of a lathe in place of the tool post. It can be used to machine work that is too hard to cut by ordinary means or to machine work that requires a very fine finish.

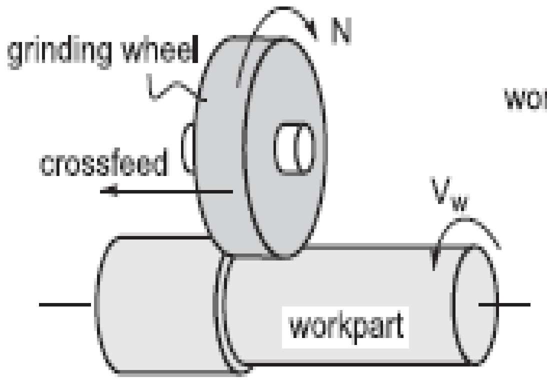
Its consists of

- High rpm(around 2880), three phase, AC motor
- V-belt
- Two pulleys for holding belt
- Grinding wheels
- Shaft with bearing block to support it.

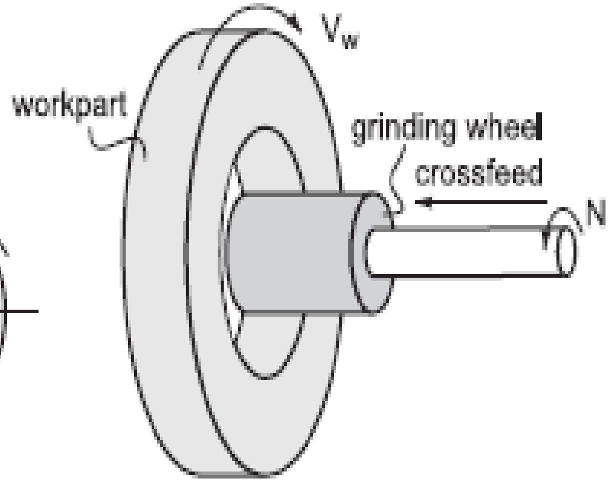
Tool Post Grinder

Cylindrical Grinding

Cylindrical Grinding is defined as grinding the periphery of rigidly supported and rotating work piece. It generally refers to work that is ground when held between center and chuck.

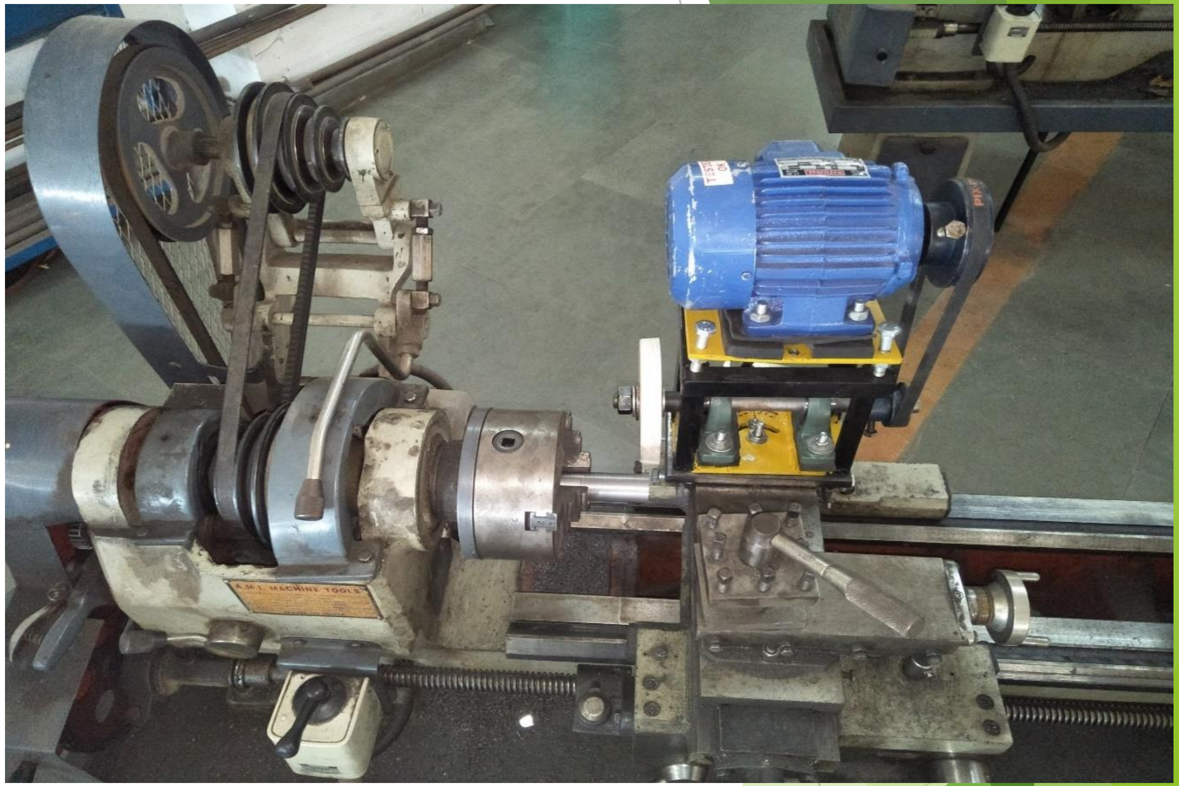


External grinding.



Internal grinding.

We have focused our study in development of such a grinding setup which gets fit in the available space of lathe machine without having the need of removing the tool post also the cost of this grinding setup is way less as compared to that of the available grinding machine in the market. our grinding setup will be capable of performing cylindrical grinding operations and also there will be no interference of our grinding setup with the conventional operations on lathe machine such as turning, facing etc.



GRINDING SETUP MOUNTED ON LATHE MACHINE

Problem Definition

- For doing grinding operation on a workpiece it is needed to load and unload the workpiece from lathe machine to this grinding setup’s which consumes considerable amount of time.
- Due to the time lost in loading and unloading of workpiece, there is a decrease in rate of production of the workpiece.
- The cost and space taken by this grinding setups is hindrance for small scale industrialists.
- The space available on light duty lathe machine in front of the tool post was not utilized properly.

Aim/Objective

AIM:

- To design and fabricate grinding attachment for lathe.

OBJECTIVE:

- To manufacture an attachment for lathe which perform grinding operations.

PURPOSE OF THE STUDY:

- To minimize time by 2-3 min per job of equipment's and workers.
- To perform grinding operations on single shaft such as external, internal. With work piece material as mild steel.

Literature Review

The Overview of literature review is as follows:

- **Market Survey** -To Find the cost of various components and material with their availability.
- **Industrial Survey** -To find if the Project we are making is already available in the firms and also to find the commercial aspects of our project.
- **Expert Advice** -To take help from people who are expert in the field of our project.
- **Internet Survey** -To find various information needed from time to time.

Total Cost Of The Project

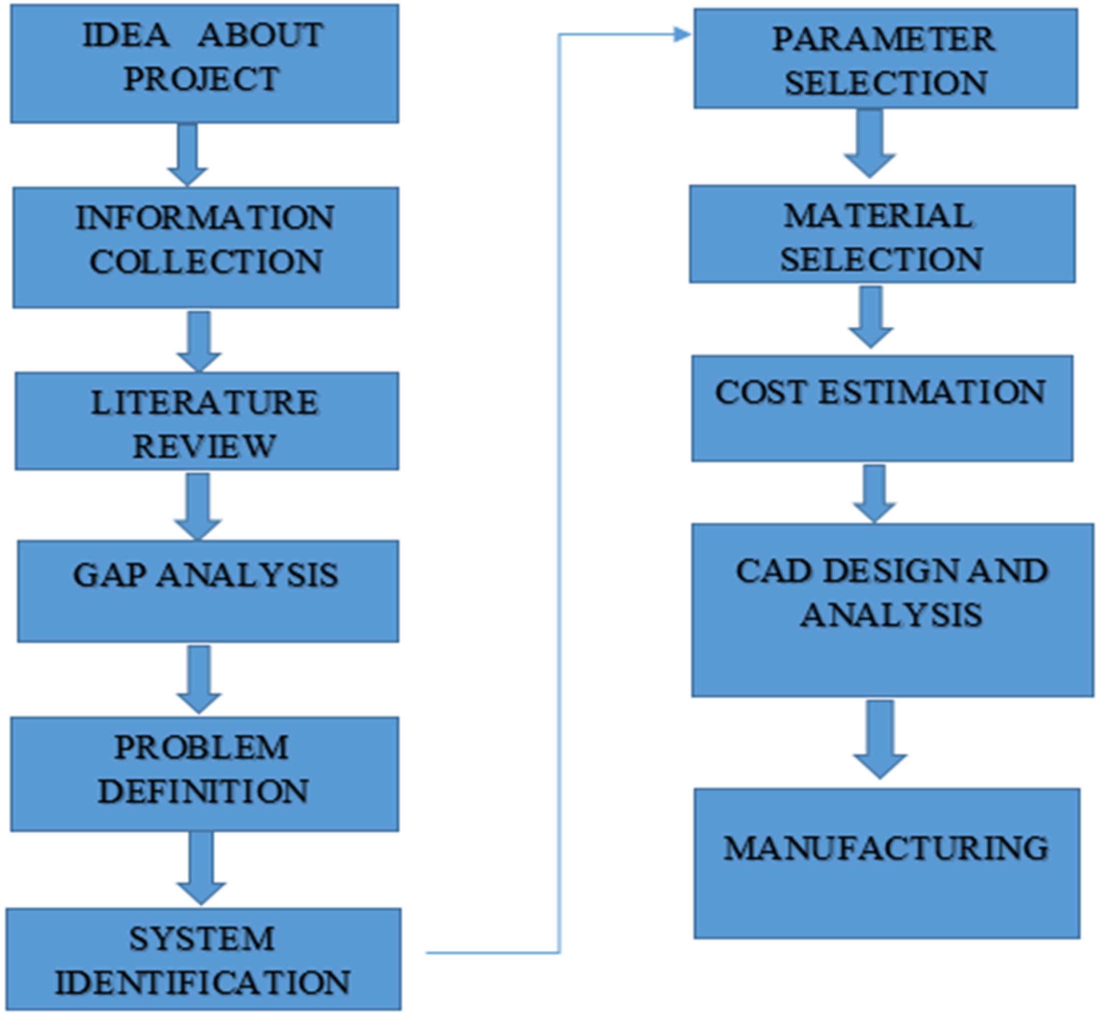
SR. NO.	COMPONENT	MATERIAL	QUANTITY	COST
1	Motor (Three phase AC 0.5 HP,1440 RPM)	Cast Iron Body	1	2700
2	Small V- Belt Pulley φ50mm	Cast Iron	1	80
3	Large V-Belt Pulley φ100mm	Cast Iron	1	160
4	V-Belt A-25	Oleo static	1	130

5	Shaft (φ20mm,L=310 mm)	Mild Steel	1	100
6	Grinding Wheel (D=150mm,d=32mm, width=20 mm)	(Aluminum Oxide Abrasive)	1	250
7	Plumber Block(P204)	Cast Iron	2	400
8	Baseplate (190.05mm*108mm*16m)	Mild Steel	1	190
9	Rotary Base Plate (177.80mm*101.60mm *8 mm)	Stainless Steel	1	100
10	Mounting Plate (177.80mm*152.40mm*6m)	Mild Steel	1	120

11	L-Angle (L= 160mm,t=5 mm, b = 20 mm)	Mild Steel	8	100
12	Isolators (150x150x10 mm)	Rubber	10	60
13	Bolts & Nuts (M8,M10)	Cast Iron	8	60
			COST	**4450**
			other operational cost (welding)	400
			TOTAL COST	**4850/-**

This total cost can be reduced to **20%** if this machine made in mass production because the machining cost would be very less and material cost would be less if bought is bulk.

Methodology



Methodology

- **Design Methodology**

  Selection Of Grinding Wheel

  Design of fixture Based on Specification Of Lathe Machine

  Calculation based selection of components

  - Motor
  - V- Belt Pulley
  - Belt
  - Design of Shaft
  - Selection of Bearing and Bearing Block

- **Software Analysis**
- **Fabrication**
- **Experimentation**

Selection Of Grinding Wheel **A60K5V20**

Specifications of Grinding Wheel :

- **Abrasives :** Aluminum Oxide
- **Grit :** selected Grit is 60.
- **Grade :** grade K is selected
- **Structure** : Dense
- **Bond :** Vitrified bond

- 150 mm Diameter
- 20 mm Thickness
- 31.75 mm Bore
- Max. Speed 33 m/s

Grinding Parameters :

- **Cutting Speed :**

$$V = \frac{\pi * D * N}{60} = \frac{\pi * 150 * 2880}{60}\ 22.61\ m/sec = 1357.16\ m/min$$

- **Feed Rate :** 1 mm per sec = 0.1071 mm/min
- **Depth of Cut :** ranging 0.005 to 0.04 mm
- **Grinding time :**

$$T = \frac{L * i}{\text{feed per rpm} * \text{rpm of job}} = 4.168\ min$$

- **Material Removal Rate :**

MRR = $v_* b_* d = 10.64 mm^3/sec.$

Design Methodology

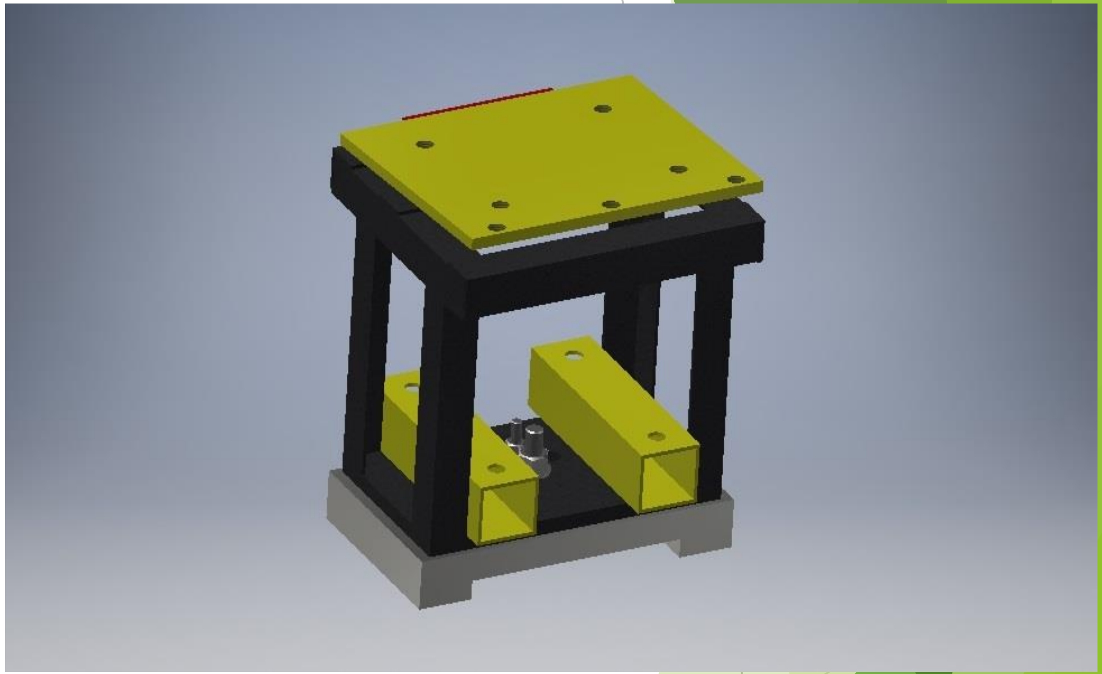
Specification Of Lathe Machine

Lathe machine size	4’6”
Height of center	6(1/2)”
Spindle bore	38 mm
Electric motor	1 HP 3 PHASE
Belt type	V-belt
R/F Switch	-
Chuck	3 JAWS
True chuck	165 mm

Design Of Fixture

Components of fixture

- **Base Plate** (190.05 mm* 108 mm *16 mm)
- **Rotating Plate** (177.80 mm*101.60 mm *8 mm)
- **Mounting Plate** (177.80 mm*152.40 mm*6 mm)
- **L- Angle**
- **Height Block For Bearing House (P204)**



layout of fixture
weight of fixture=7.3 kg
maximum load capacity of fixture=1000 N

Design Calculations

1. Motor Selection :

3 Phase AC motor

P = 0.5 HP

N_M = 1440 RPM

desired speed 2880 rpm Achieved by Belt Pulley Transmission.

2. Selection of Standard V-belt

CATEGORY OLEO STATIC A-25

3. Selection of Standard V-belt Pulley :

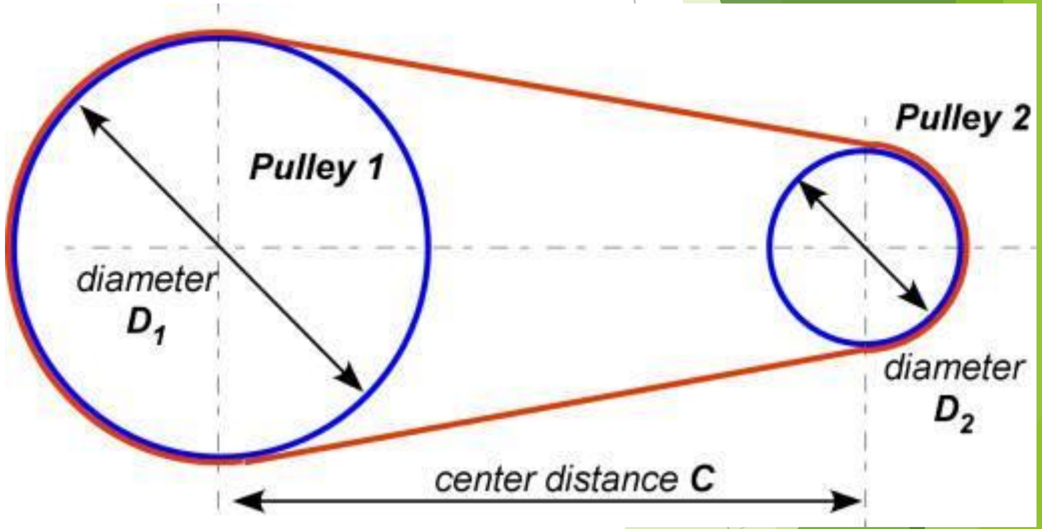
D_1 = Diameter of Larger Pulley = 4 Inch

D_2 = Diameter of Smaller Pulley = 2 Inch

4. Selection of Shaft :

Material selection for shaft

Mild Steel ASTM-A-36

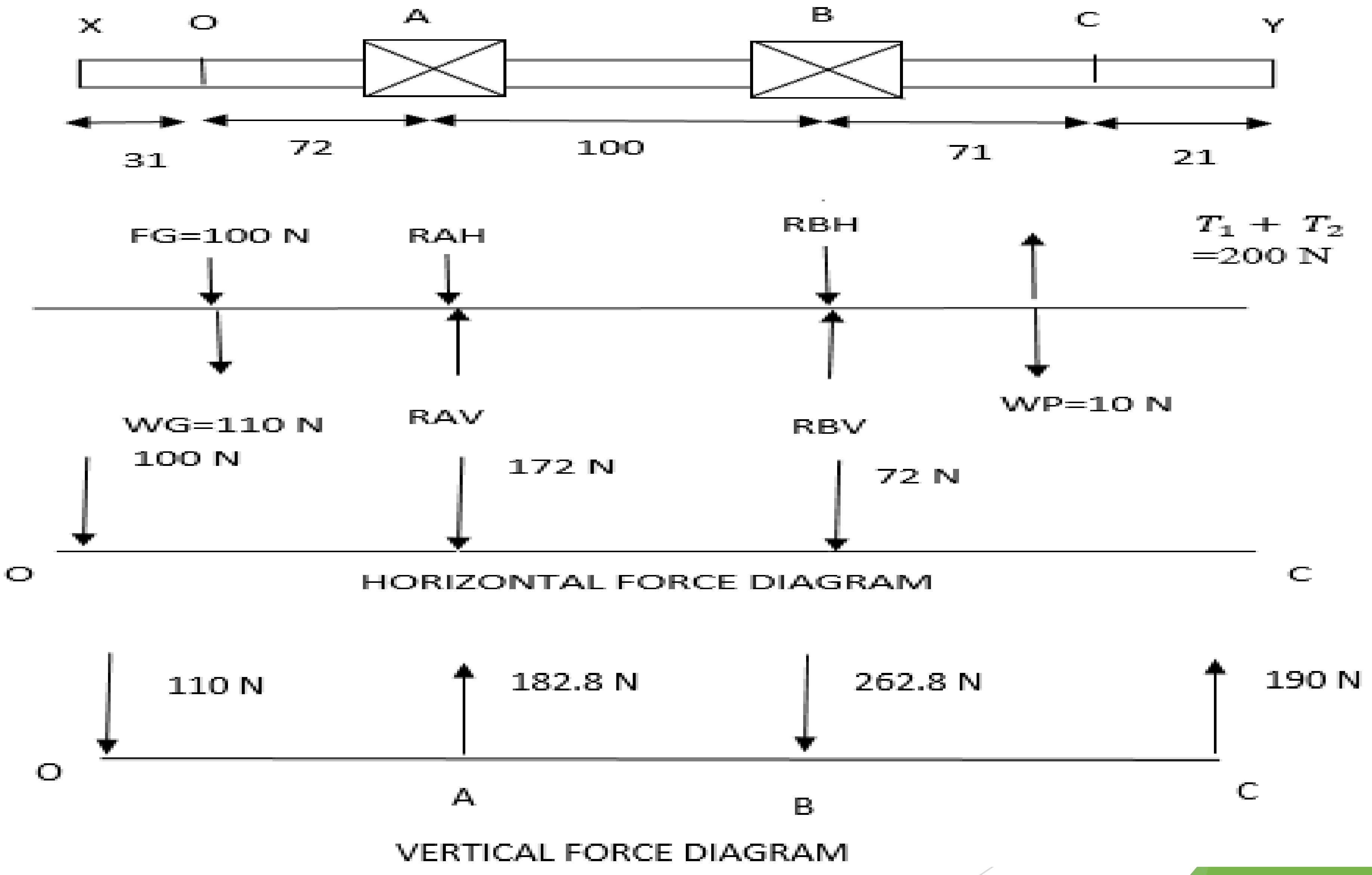


σ_{ut} = Ultimate Tensile Strength = 450 MPa

σ_{yt}= Yield Tensile Strength = 250 MPa

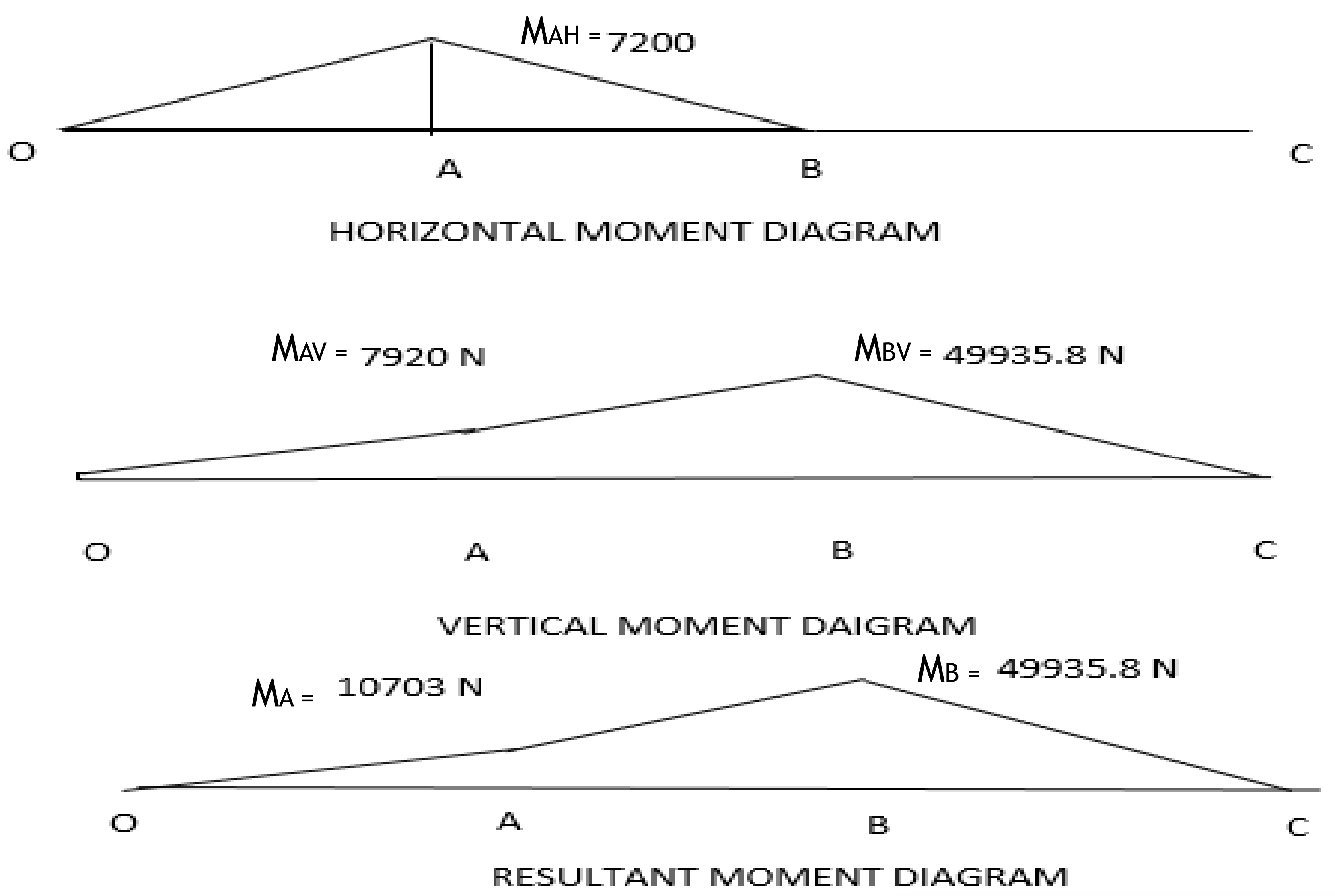
$\Gamma_d = 0.3*\sigma_{yt} = 0.3*250 = 75\ N/mm^2$

F.B.D. Of Shaft



X
O
A
B
C
Y
31
72
100
71
21
FG=100 N
RAH
RBH
$T_1 + T_2$ =200 N
WG=110 N
RAV
RBV
WP=10 N
100 N
172 N
72 N
O
C
HORIZONTAL FORCE DIAGRAM
110 N
182.8 N
262.8 N
190 N
O
A
B
C
VERTICAL FORCE DIAGRAM

Bending Moment Of Shaft



Calculation For Diameter Of Shaft

According to **Maximum Principal Shear Stress Theory**,

$$\Gamma_d = \frac{16}{\pi * ds^3}\sqrt{(k_b * M_b)^2 + (k_t * M_t)^2}$$

$$75 = \frac{16}{\pi * ds^3}\sqrt{(1.5 * 49935.8)^2 + (1 * 2473.53)^2}$$

d_s= 17.20 mm

Taking **Diameter of Shaft** $\boldsymbol{d_s}$ **= 20 mm**

$$\Gamma = \frac{16}{\pi * ds^3}\sqrt{(k_b * M_b)^2 + (k_t * M_t)^2}$$

$$\Gamma = \frac{16}{\pi * 20^3}\sqrt{(1.5 * 49935.8)^2 + (1 * 2473.53)^2}$$

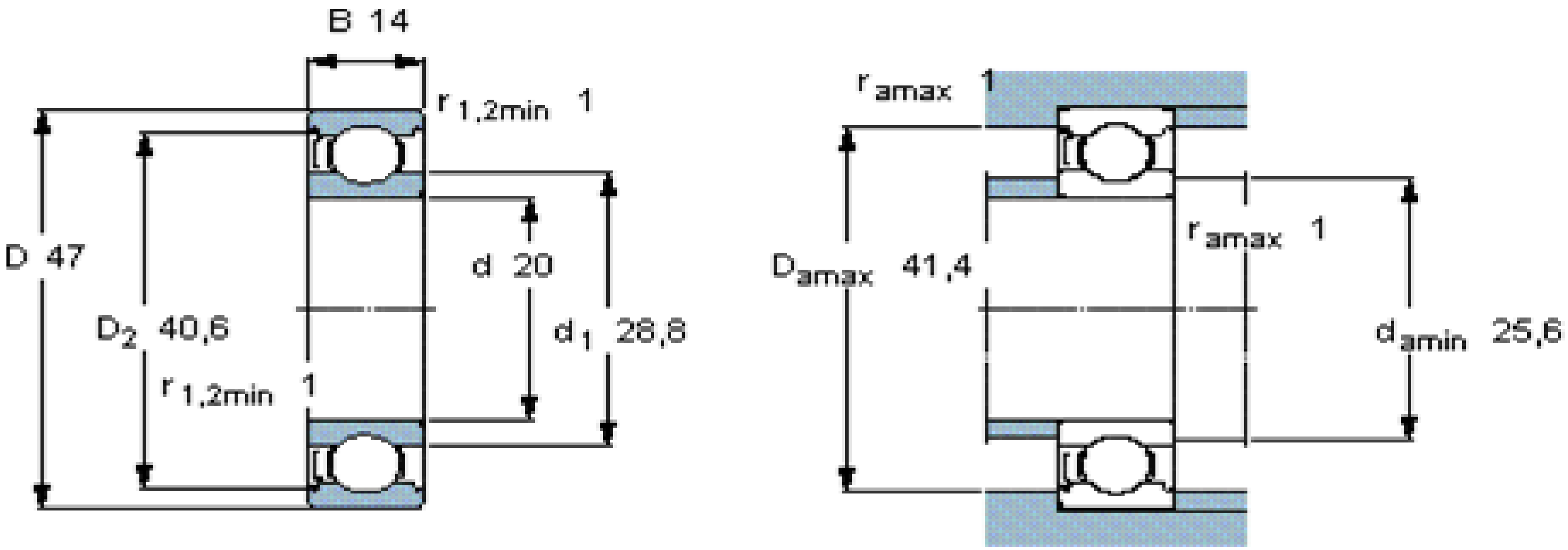
$\Gamma = 47.71 N/mm^2$

$\Gamma = 47.71 N/mm^2 < \Gamma_d = 75\ N/mm^2$
hence, it is **safe.**

5. Selection of Bearing Block

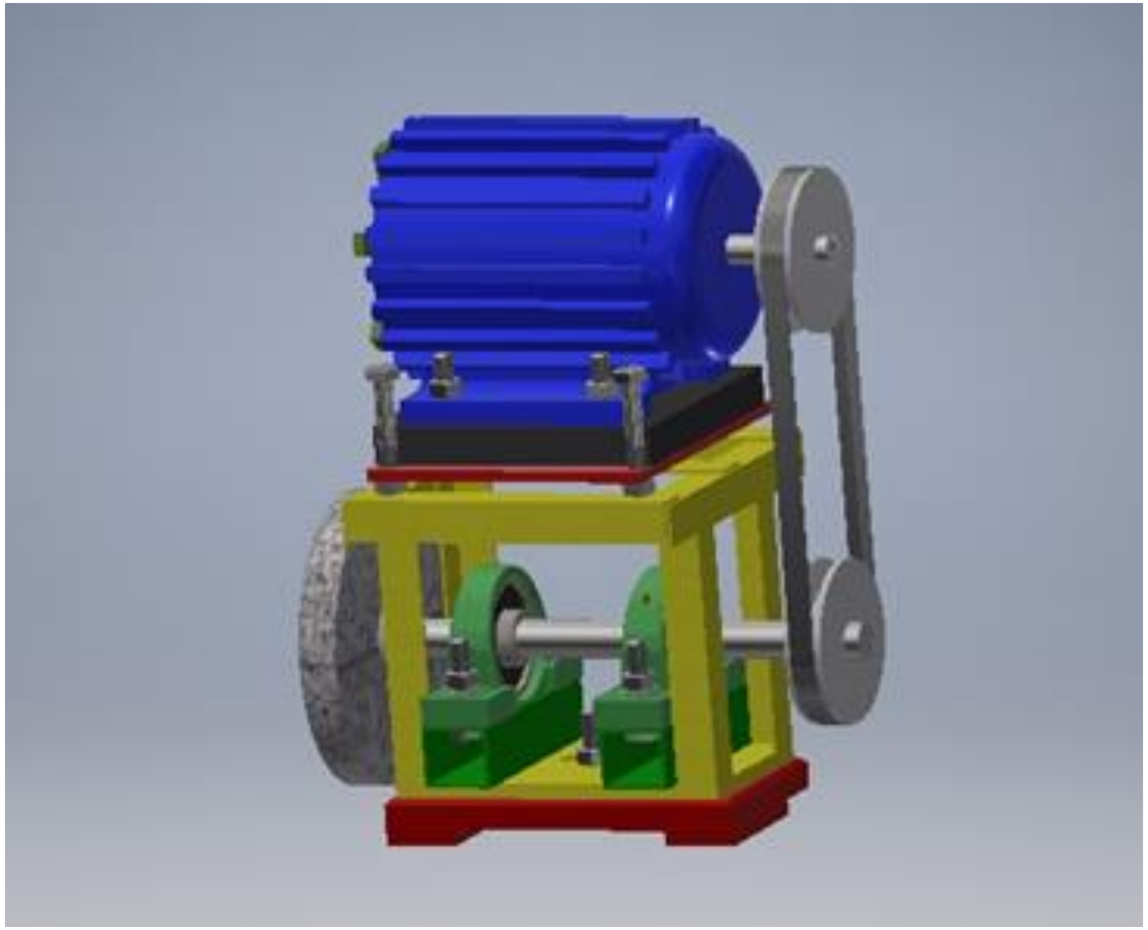
Based on calculation we have selected ball bearing

- **Specifications of bearing**
- SKF 6204
- C = 1000 kgf
- C_0 = 655 kgf
- Max. Permissible speed =16000 rpm



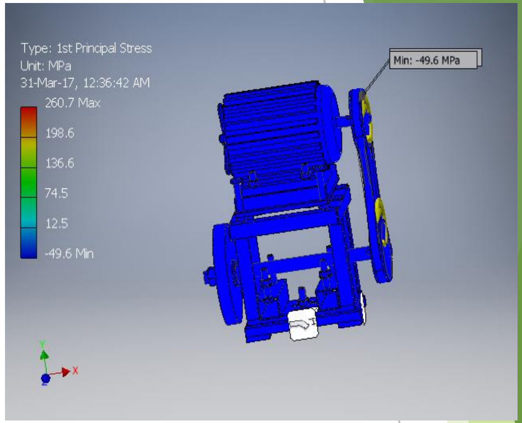
Dimension of Bearing 6204

Software Analysis

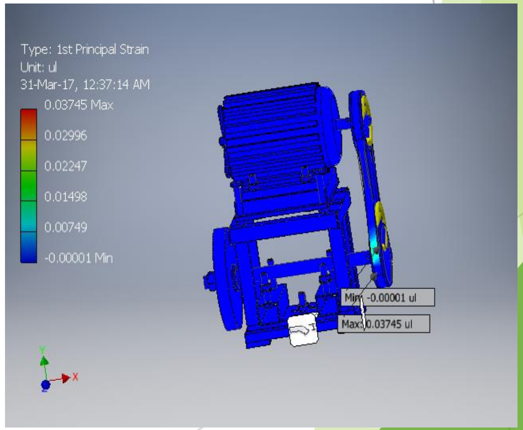


Assembling Of Components To Make

Cylindrical Grinding Attachment



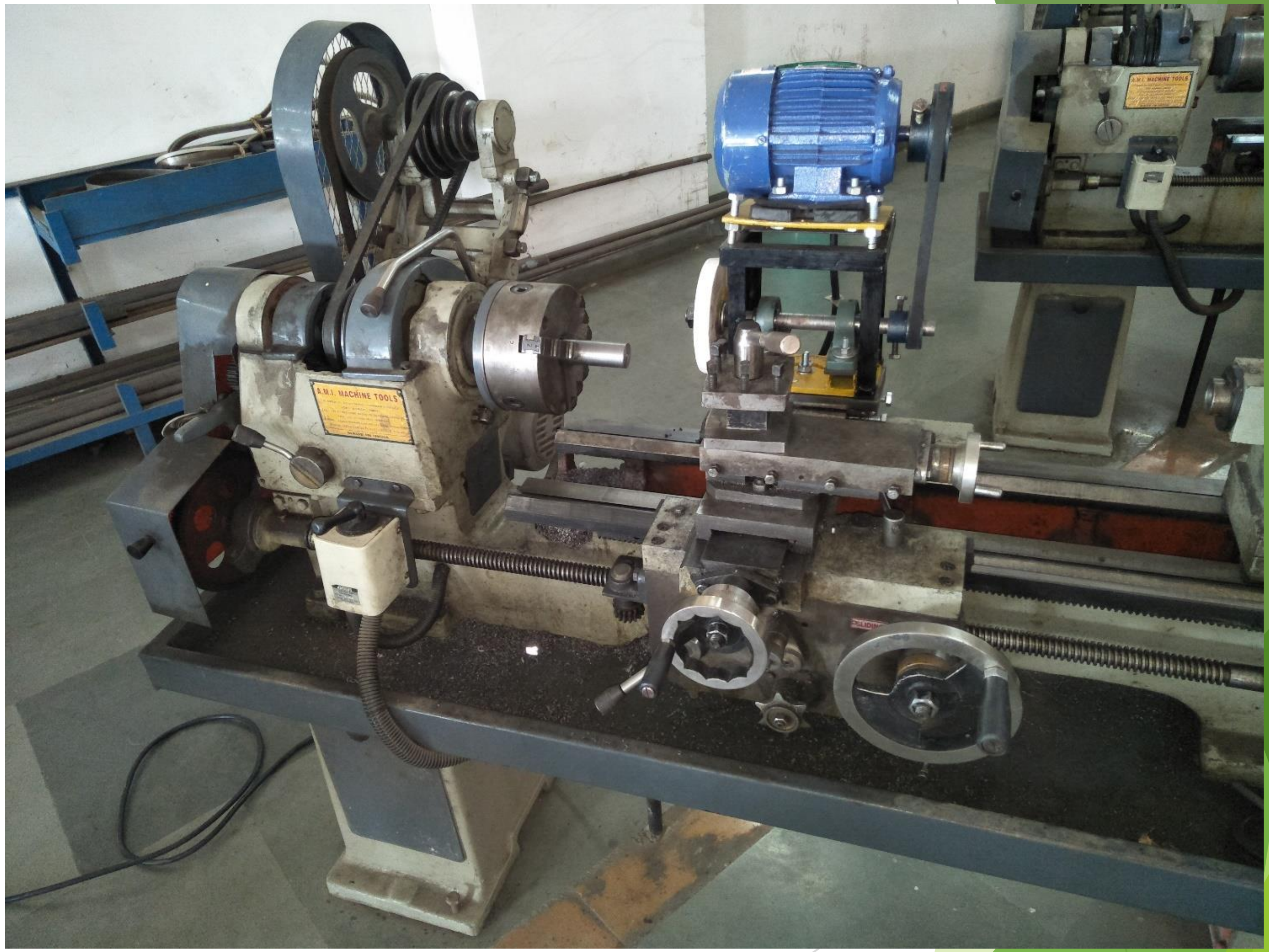
1st Principal Stress



1st Principal Strain

Fabrication Procedure

- Design Fixture And Fabrication
  - C-slot For Angular Grinding
  - Arrangement Made For Belt Tightening
- Motor mounting on fixture
- Belt pulley arrangement
- Bearing house fix on block
- Attachment Of Grinding Wheel On Shaft
- Attachment Of Shaft And Bearing
- Attachment Of Fixture On Lathe Cross Slide
- Aesthetics



Experimentation

Diameter of raw work piece -

(D_{raw}) = 24 mm

(L_{raw}) = 102 mm

Operations perform on raw material

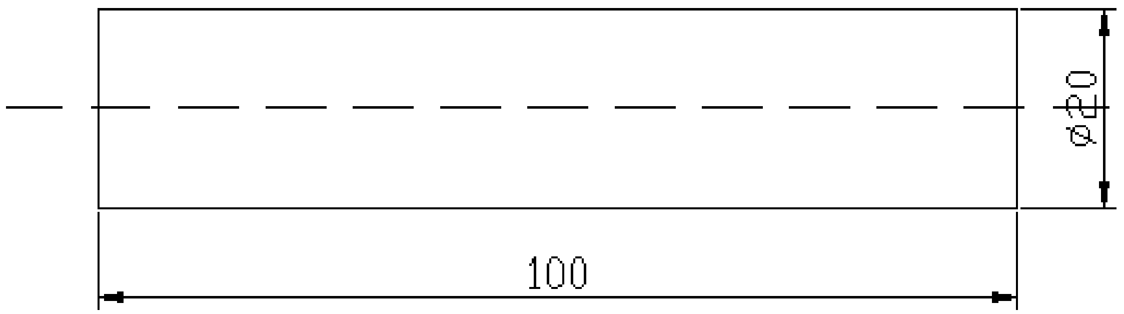
Facing B. Turning C. Cylindrical Grinding

1. First two operations A and B performed on lathe machine and grinding operation performed cylindrical grinder

2. All operations A, B and C performed on lathe machine

Description of Work piece:

Length of Job (L)	:100 mm
Diameter of Job (D)	:20 mm
Rpm of Job (N)	:560 rpm
Rpm of Grinding Wheel	:2880 rpm
Depth of Cut (mm)	:0.005 mm
Feed (mm/Rev)	:0.1071 mm/rev



All Dimensions in mm

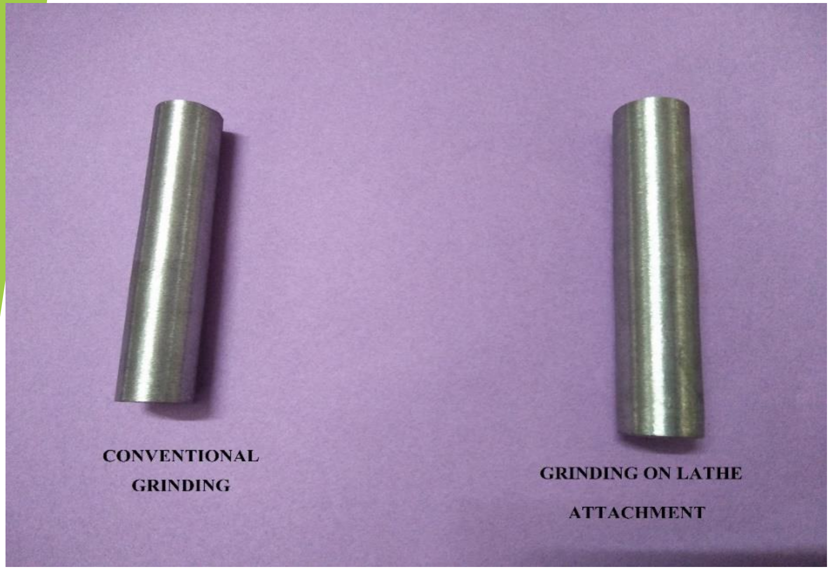
Observation Table for Time:

SR. NO.	PARAMETERS	CONVENTINAL GRINDING TIME(min)	GRINDING ATTACHMENT TIME(min)
1.	SETUP TIME		
	A. Unloading Job from Lathe M/C	0.233	0
	B. Travelled Time	0.450	0
	C. Loading of Job	0.916	0
	D. Job Clearance Checking	0.366	0
	E. Other Time I. set up time II. Inspection Time	 0.166 0.208	 0.216 0.208
	TOTAL	2.339	0.424

2.	**OPERATION TIME**		
	A. M/C Time	9.6	9.6
	B. Unloading Time	0.233	0.233
3.	**MISCELLANEOUS TIME**		
	A. Checking and Inspection	0.96	0.96
	B. Fatigue Allowance	0.48	0.48
	C. Preposition of Operator on Lathe	0.45	0
	TOTAL TIME (1+2+3)	T_1=14.062	T_2=11.697
	TOTAL TIME SAVE FOR ONE JOB T_{save} =T_2-T_1	**T_{save} =2.365 min**	

For production of <u>**100 jobs**</u> time saving goes to more than <u>**3.5 hours**</u> in a day

Surface roughness tester



Observed specimen

Observation Table for roughness:

SR. NO.	PARAMETERS	CONVENTINAL CYLINDRICAL GRINDING ROUGHNESS(microns)	GRINDING ATTACHMENT ROUGHNESS (microns)
1	R_a(Arithmetic mean deviation)	6.575	17.83
2	R_z(maximum height of roughness)	18.59	28.92
3	R_q(root mean square deviation)	6.74	14.15
4	R_t(total height of roughness profile)	18.77	53.25

Results

TIME

- Time is the most important factor affecting every manufacturing process manual grinding machines are mounted at specific location and we have to take job at that location and have to done grinding process. It consumes time as compared to grinding wheel attachment has easy setup it has to remove check post of lathe it consumes less time than manual grinding process. After successful operations we saved 2.365 min per job for above mentioned dimensional job. For production of 100 jobs time saving goes to more than 3.5 hours in a day

ACCURACY

- For attaining highest surface accuracy up to 20 microns if we compare manual grinding process with our attachment of grinding wheel on lathe for manual grinding process we have to remove job from chuck of lathe and have to be take up to that grinding machine which is mounted at specific location in workshop it affects the accuracy of final product because of human errors.

- Surface finish is good in special purpose cylindrical gridding machine which is 6.74 microns whereas on grinding attachment is 14.15 microns. We achieved desired roughness in range of 10-20 microns. Rather than if we used same parameter in both machining process like feed, rpm , cutting speed ,grinding wheel for same job then we can achieved same roughness in both cases.

Conclusion

- Human efforts will get reduced.
- Time for production will decrease by 2.365 min for one job.
- Angular grinding gets done on set up.
- Cost of equipment's will get reduced considerable.
- Desired surface finish will be achieved 10-20 microns.
- Production rate will get increased.

Future Scope’s

- This attachment can be modified for different material with different shape and size.
- Milling, drilling, operations can be made possible by suitable modifications.
- Hydraulic system can be implemented for height adjustment for these attachments.
- Taper grinding can be done by attachment of taper cross- slide attachment on lathe.
- These attachment can be used in small scale industry.
- By modifying base plate it can be attached on any type of lathe machine

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- DESIGN AND FABRICATION OF GRINDING ATTACHMENT FOR LATHE MACHINE TOOL (International Journal of Science, Technology & Management Volume No.04, Issue No. 04, April 2015)
- DESIGNING AND FABRICATION OF MULTIPURPOSE TOOL POST FOR LATHE MACHINE(IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 03, 2014 | ISSN (online): 2321-0613)
- MACHINING TIME REQUIRED FOR TAPER GRINDING AND ITS COST ANALYSIS IN G17-22U GRINDING MACHINE (International Journal of Scientific and Research Publications, Volume 3, Issue 3, March 2013 1 ISSN 2250-3153
- PREDICTION AND OPTIMIZATION OF CYLINDRICAL GRINDING PARAMETERS FOR SURFACE ROUGHNESS USING TAGUCHI METHOD(IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE
- FABRICATION OF CYLINDRICAL GRINDINGATTACHMENT ON LATHE MACHINE AND OPTIMIZATION OF GRINDING PARAMETERS BY REGRESSION (ISSN 2278 – 0149 www.ijmerr.comVol. 4, No. 1, January 2015© 2015 IJMERR.)

PUBLICATION OF PAPER

The paper titled **“Increase in productivity by attachment of grinding setup on lathe machine”** publishing in the IOSR Journal (current status – manuscript id-cp72194)

Thank you