DESIGN & FABRICATION OF DUAL SIDE SHAPER MACHINE

Project submitted to

National Institute of Technology Agartala

For the award of the degree

Of

Bachelor of Technology

By

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I am highly indebted to Professor **Dr. Barnik saha Roy sir.** For their guidance and constant supervision as well as for providing necessary information regarding the project & also for their support in completing the project.

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Dedicated To

To our Project Supervisor Asst. **Prof DR.BARNIK SAHA ROY** NIT Agartala for sharing his valuable knowledge, encouragement and showing confidence on us all the time. Each of the faculties of the department to contribute in our development as a professional and help us to achieve this goal. To all those people who have somehow contributed to the creation of this project and who have supported us.

REPORT APPROVAL FOR B.TECH

This report entitled "DESIGN OF DUAL SIDE SHAPER MACHINE", by RAJAN KUMAR(19UME114), MONUKUMAR (19UME087), SUNIL KUMAR(19UME051), : SURAJ KUMAR HEMBRAM (19UME096) is approved for the award of ***Bachelor of Technology*** in ***Mechanical Engineering***.

(Project Supervisor)

Dr. Barnik saha roy

Mechanical Engineering Department

NIT, Agartala

DECLARATION

We declare that the work presented in this report proposal titled "DESIGN OF DUAL SIDE SHAPER MACHINE", submitted to the Mechanical Engineering Department, National Institute of Technology, Agartala, for the award of the ***Bachelor of Technology*** degree in ***Mechanical Engineering***, 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.

May 2023 Agartala

Suraj Kumar Hembram

Rajan Kumar

Monu Kumar

Sunil Kumar

CERTIFICATE

It is certified that the work contained in the report titled "**DESIGN OF DUAL SIDE SHAPER MACHINE**", by RAJAN KUMAR(19UME114), MONU KUMAR (19UME087), SUNIL KUMAR(19UME051), SURAJ KUMAR HEMBRAM (19UME096) has been carried out under my supervision and this work has not beensubmitted elsewhere for a degree.

(Project Supervisor)

DR.BARNIK SAHA ROY,

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CONTENTS

ABSTRACT

The objective of this project is to design and fabricate a dual side shaper machine that can perform shaping operations on both sides of a workpiece simultaneously. The machine is designed to be compact and efficient, with a rigid frame and a precise mechanism for controlling the cutting tool. Most of the industries are having a various types of reciprocating machines for performing machine operation on small size of work. Usually shaper, broaching machine and planner are used for machining a small area of work with less quantity.These machines are used for machining very small area of plain surface, vertical surface, angular surface, grooving etc. It removes the materials from job only at forward stroke. So it takes more machining time to complete the product. In order toovercome this problem, a small dual shaper machine is developed for machining twowork pieces at a same time. In this machine, it has both the direction of ram movement and it removes a material from two work pieces simultaneously. So, the machining time will be reduced and the production rate will be increased.

INTRODUCTION:

Shaping is a widely used machining process in manufacturing industries to create flat surfaces, grooves, and contours on workpieces. Conventional shaping machines can shape only one side of a workpiece at a time, which limits their efficiency and productivity. To overcome this limitation, a dual side shaper machine has been proposed that can shape both sides of a workpiece simultaneously. The dual side shaper machine is a highly versatile and efficient machine that can shape a wide variety of materials including metals, plastics, and composites. It is designed to be compact and user-friendly, with intuitive controls and easy setup procedures. This machine is expected to improve the efficiency and productivity of shaping operations in various manufacturing industries, which will lead to cost savings and increased competitiveness. A Shaper is a type of machine tool that uses linear relative motion between the workpiece and a single-point cutting tool to machine a linear tool path. Its cut is analogousto that of a lathe, except that it is linear instead of helical. The work piece mounts ona rigid, box-shaped table in front of the machine. The height of the table can be adjusted to suit the work piece, and the table can traverse sideways underneath the reciprocating tool, which is mounted on the ram. Table motion may be controlled manually, but is usually advanced by automatic feed mechanism acting on the feed screw. The ram slides back and forth above the work. At the front end of the ram isa vertical tool slide that may be adjusted to either side of the vertical plane along thestroke axis. This tool-slide holds the clapper box and tool post, from which the toolcan be positioned to cut a straight, flat surface on the top of the work piece. The toolslide permits feeding the tool downwards to deepen a cut. The tool-slide permitsfeeding the tool downwards to deepen a cut. When a load is placed on the input rodof the scotch yoke by an actuator, sideward thrust causes the input rod and yoke armto bow and twist. This increases the friction on the sliding nut. At the extreme positions of travel of the sliding nut, the bowing and twisting become severe and theyoke arm tends to bind.

Diagrammatic representation of tool feed direction. The main objective of this project is to design and fabricate a fully functional dual side shaper machine. The project involves a comprehensive design process, including 3D modeling, simulation, and prototyping. The fabrication process includes cutting, welding, and machining of various components. The final product is a fully functional dual side shaper machine that meets the project objectives and is ready for use in various manufacturing applications.

LITERATURE SURVEY

1. R M Lathe Investigated that the conventional machining process consumes very high time and increases the labor cost, to overcome these problems and difficulties he used automated electric pneumatic devices and PLCs in shaper machines. He developed an electro-pneumatic circuit for performing shaping operations, which makes the operation semi-automatic by using a single-point cutting tool. Automation of the machines is made with the help of pneumatic devices, sensors, mechatronics and PLCs, etc.

2. M.V.NSrujanManohar presented in his paper that pneumatic shaper is used for high production of automatic gear cutting with the auto-indexing workpiece. A small ratchet gear structure has been thus devised to demonstrate the gear cutting attachments in shaping machines. The pneumatic source of power with control accessories is used to drive the ram or the cylinder piston to obtain the forward and return stroke.

3. S. Ravindran presented to improve the productivity and energy conservation of shapers and planers with modified tool heads. The quick return mechanism of shaper and planer machines reduces the ineffective time and wastage of energy. Further reduction of the idling time, modified tool post with two clapper boxes and with two tools was designed, fabricated, and tested. The size of the clappers was made small, crushing strength.

4. Anand Shukla investigated that optimizing the cutting force and power consumption of shaper machines by varying different parameters during cutting operation using a computer interface. He developed a methodology to find out the cutting force and power required by the tool to perform shaping operations on the workpiece.

MATERIALS.

S.NO	NAME OF THE MATERIAL	TYPE OF THE MATERIAL
1	Frame	MILD STEEL
2	Crank	MILD STEEL
3	Shaft	STEEL
4	Connecting rod	MILD STEEL
5	Slotted bar	MILD STEEL
6	Shaper tool	HIGH SPEED STEEL
7	Motor	½ HP
8	Ball bearing	UCP205
9	Belt	A Type
10	Pulley	Cast iron

FRAME

The components are mounted on the frame, which is made up of Mild steel. The some of the components are assembled on the frame by using Arc welding.

CRANK

The crank is an element attached at directly to a rotating shaft by which linear motion is received from shaft. It is used to convert circular motion into linear motion

SHAFT

Shaft is a circular section solid or hollow bar used for the transmission of motion or power. Shaft coupling is a solid or flexible device to cause adjacent parts of a body to slide relative to one another in the direction of the force.

CONNECTING ROD

A connecting rod also converts rotational motion into linear motion. It moves forward and backward.

HIGH SPEED STEEL

High speed steel is a single point cutting tool is used to remove metal from the work piece and having high wear resistance.

PULLEY

A pulley is a wheel on the axle that is designed to support movement and changes of direction of a taut cable or transfer of power between the shaft and cable. The pulley supported by a frame which does not transfer power to shaft, but it is used to guide the cable and transfer power to shaft

BALL BEARING

A ball bearing is a type of rolling-element bearing that uses balls to maintain separation between the bearing races. The balls are typically made of steel or ceramic and are held in place by a cage or retainer. When a load is applied to the bearing, the balls roll between the inner and outer raceways, reducing friction and allowing the load to be transmitted smoothly and efficiently.

Ball bearing specification: UCP205

A TYPE BELT

A-type belt is a type of V-belt that is commonly used in power transmission applications. It is a wedge-shaped belt with a trapezoidal cross-section, designed to fit into V-shaped grooves on pulleys. The A-type belt is also known as the "Classical V-belt" or "Standard V-belt.

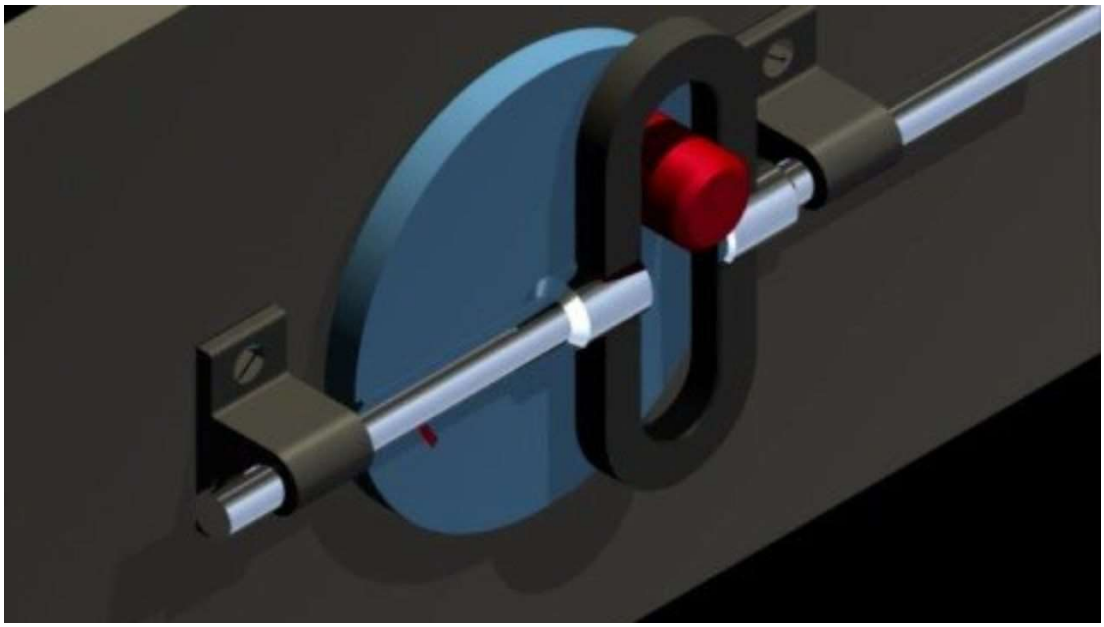
MOTOR

½ HP Motor and rpm is 1440.

METHOD

Scotch yoke mechanism

The scotch yoke mechanism is a reciprocating motion mechanism, is converting the rotational motion of the shaft into linear motion. The reciprocating part is directly coupled to a slotted bar yoke with a slot that engages a pin on the rotting part.



Working principle Mechanism

The scotch yoke mechanism is a reciprocating motion mechanism, is converting the rotational motion of the shaft into linear motion. The reciprocating part is directly coupled to a slotted bar yoke with a slot that engages a pin on the rotting part.

Slotted bar

WORKING PRINCIPLE

A single point cutting tool is held in the tool holder on both sides that is mounted on the ram. The work piece is held in a vice on the frame. The ram reciprocates and cutting tool mounted on the tool holder travels forward and backward strokes over the blank specimen HSS. The High speed steel is fixed in both sides. The feed is given to the work piece and the depth of cut is controlled by moving the tool downward towards the work piece. The both sides of the tool will remove the metal in work piece. The grinding wheel is attached to the shaft at the back side of the pulley. When the shaft rotates in clockwise direction shaping will be done in front side and backward grinding will be done in back side. Thus, in single machine two machining operations can be done in same time with good machinability & surface finish

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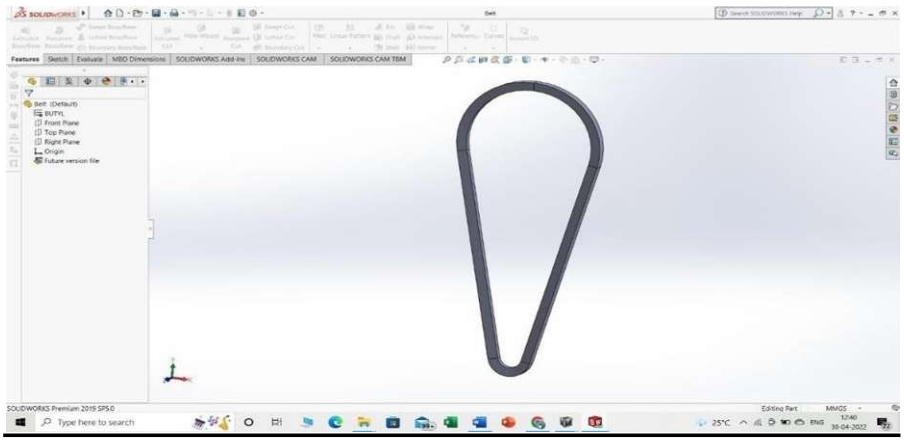
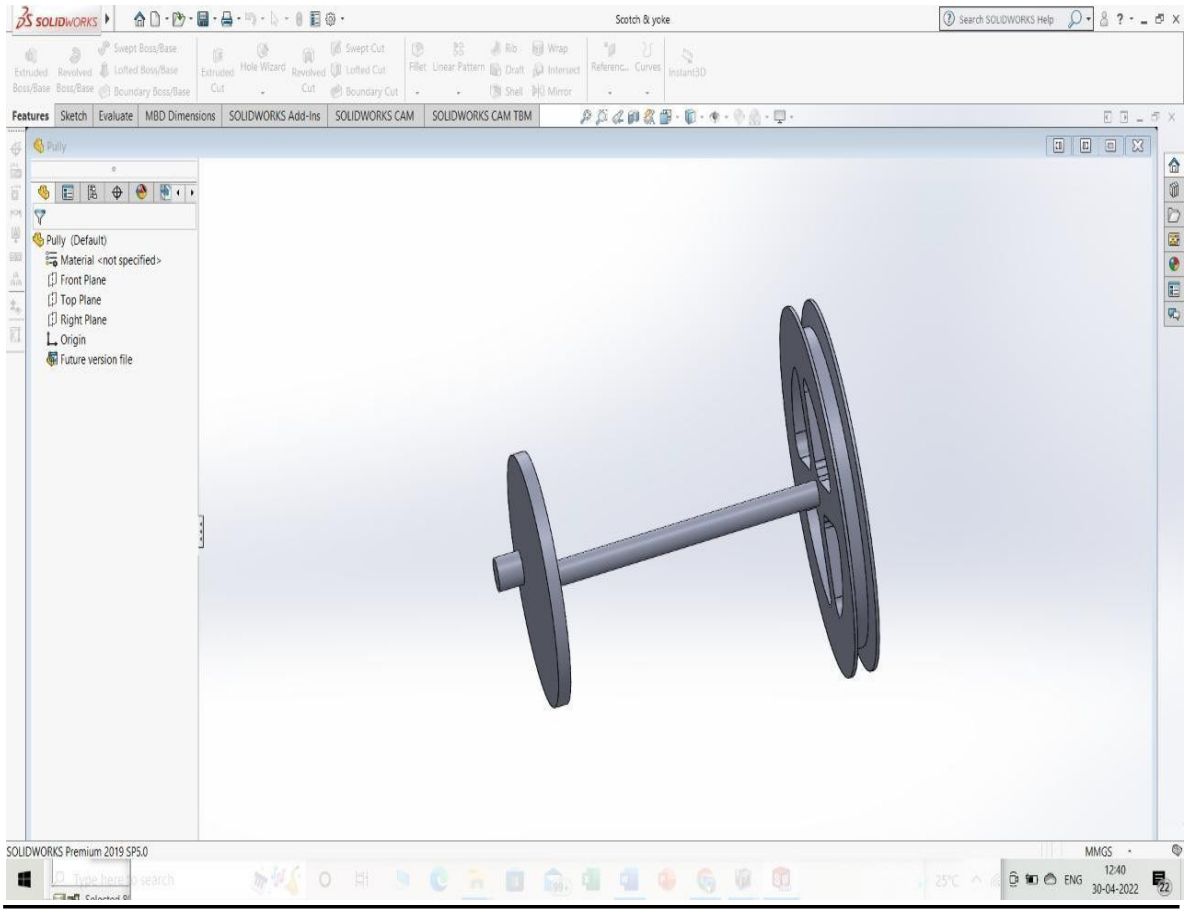
DESIGN VIEW

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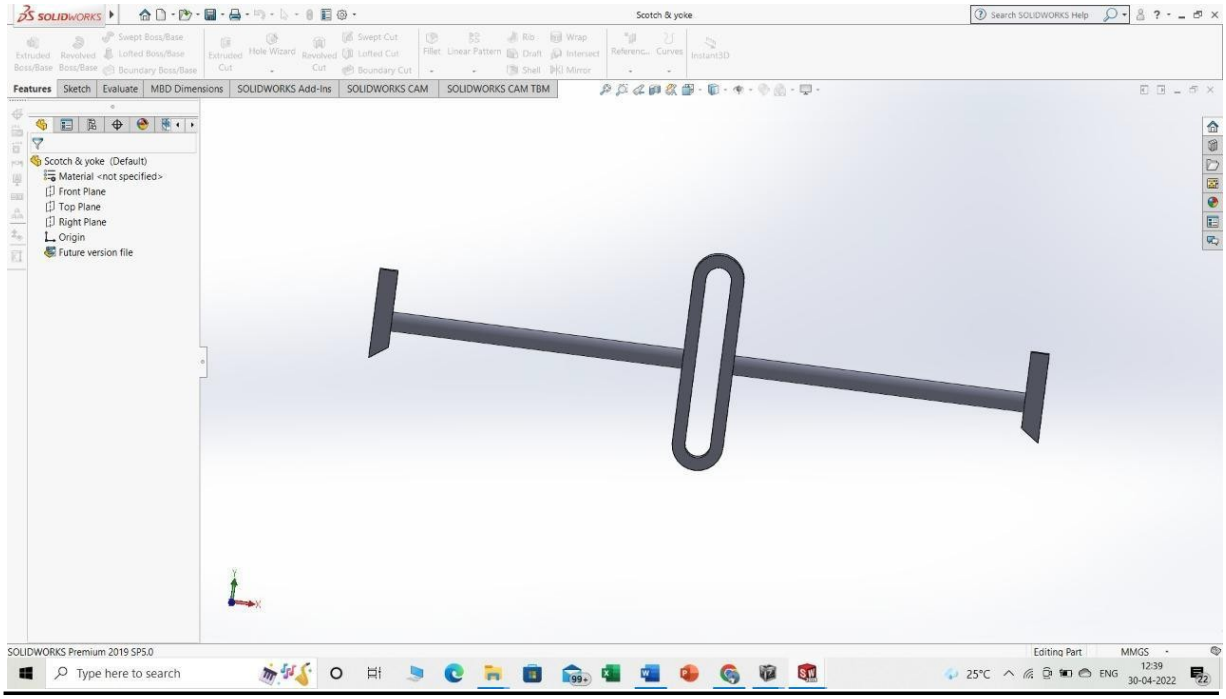
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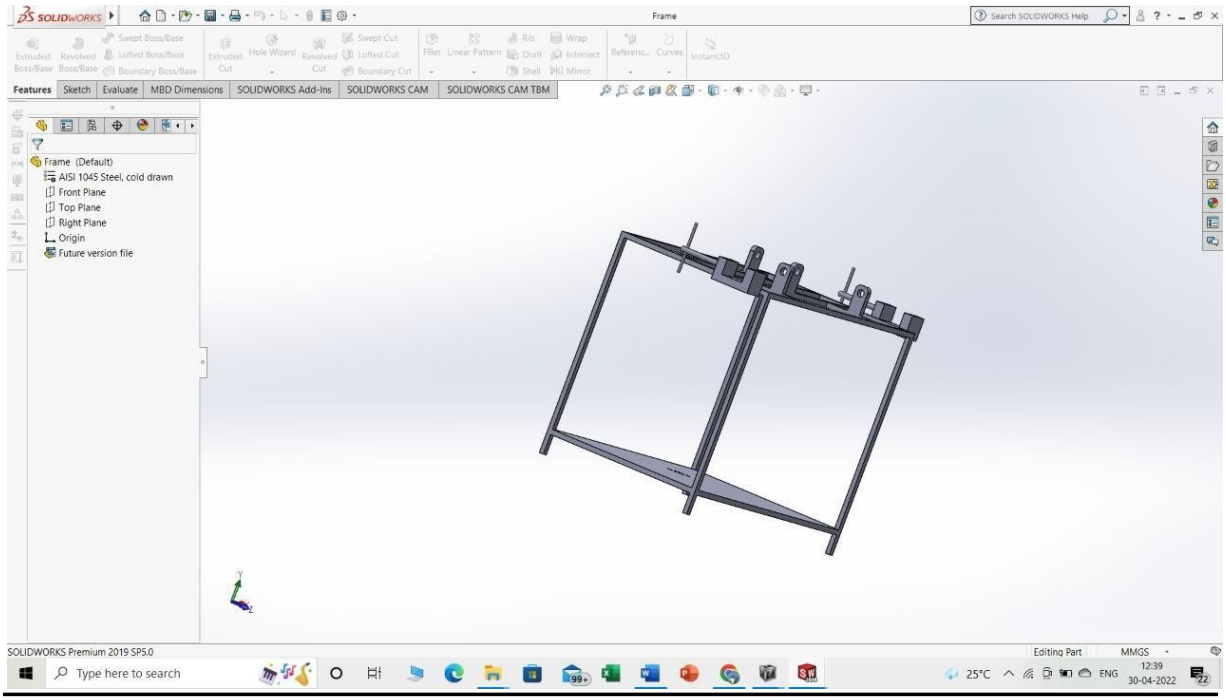
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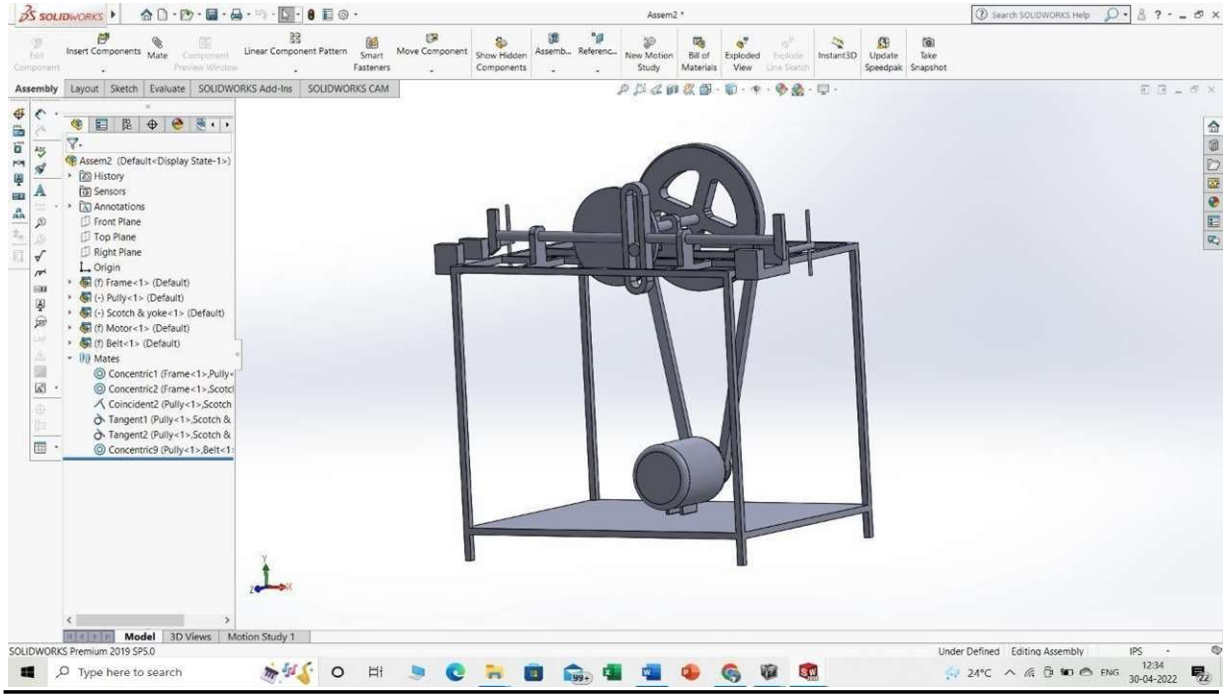

Work performed in workshop

Fig: cutting performed by power hacksaw.

Fig: welding

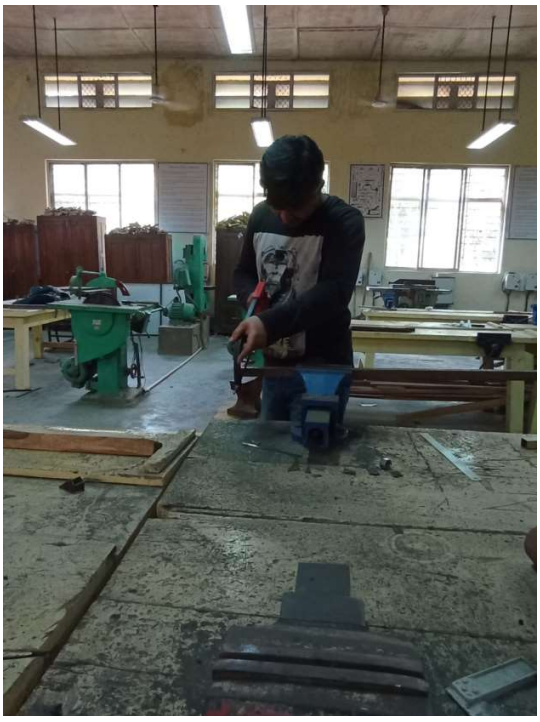

Fig: cutting by hacksaw

Fig: Frame

CALCULATIONS:

Cutting speed:

Cutting speed, v = N L (1+m)/1000 m/min
N= the number of double strokes or cycles of the ram per min (take N= 60)
L = Length of the ram stroke in mm
m= return stroke time/cutting stroke time m= 1
v =60×100(1+1)/1000
v=12m/min

Cutting Force calculation:

Run	V(m/min)	f(mm/stroke)	d(mm)	Fp(kg)	Fq(kg)
1	5.34	0.30	0.5	9.25	3.99
2	11.63	0.30	0.5	7.46	2.96
3	5.34	0.30	1.0	20.48	7.50
4	11.63	0.30	1.0	15.84	5.02
5	5.34	0.35	0.5	9.78	4.94
6	5.34	0.35	1.0	21.13	7.92
7	11.63	0.35	0.5	9.31	3.77
8	11.63	0.35	1.0	16.13	5.42

Fig: Effects on cutting forces in shaping operation

So cutting force at v=12m/min , depth of cut(d=1mm) is 16.13kg
Force(N)= Fp× g

Force=16.13×9.81
Force=158.235N

Torque calculation:

Diameter of crank=250mm
Torque=Force× radius of crank
Torque=158.235N×0.125m
Torque=19.77 Nm

Angular speed(ω)=2πn/60
(ω)=(2×3.14×200)/60
=20.933rad/s

Power

Power=torque× ω
Power=19.77×20.933
Power=413.84watt

Design of shaft

Diameter of shaft=25.4mm
Permissible shear stress for mild steel=34N/mm^2
Shear stress=16T/πd^3
Shear stress=6.147N/mm^2 < shear stress permissible
Therefore design is safe.

Project advantage

1. In this machine, materials are shaped from both sides, which is more advantageous than the usual shaper.
2. Dual Shaper machine helps industries to achieve high production rates at a minimal amount of time and cost.
3. Increase the work efficiency.

Applications of Dual side shaper machine:

1. Production of keyways: Dual side shaper machines are used for creating keyways in shafts and other components. Keyways are used to transmit torque and prevent slippage between two components.
2. Cutting slots: Dual side shaper machines can cut slots of various shapes and sizes in metals. These slots can be used for holding parts or for attaching components.
3. Machining of splines: Dual side shaper machines are also used for machining splines on shafts. Splines are used to transmit torque and prevent slippage between two components.
4 Production of flat surfaces: Dual side shaper machines can be used to produce flat surfaces on metal components. This is useful for creating mating surfaces for other components or for achieving a specific surface finish.

Discussion:

- This advantage of this machine is “time saving ”
- The cost is low compare to other machines
- Require less power
- Comfortable to use.
- Less skilled labour is enough to operate the machine.
- It will be useful to increase production
- Good machinability
- Tool will not get damage in machining

Analysis:

1. Material**:** Mild steel is selected due to its withstanding of more strength
2. Cutting force=158.235N
3. Cutting speed=12m/min
4. Surface finish=Good surface finish

Conclusion:

In conclusion, the design and fabrication of a dual side shaper machine was successfully completed, and the machine is capable of performing a wide range of metalworking operations. The project involved the selection of appropriate materials, components, and manufacturing techniques, as well as the consideration of safety factors and ergonomic design principles. The machine was designed to be robust, durable, and easy to operate, with a user-friendly control system and efficient power transmission system. The machine's cutting capacity and precision were also optimized to ensure that it can produce accurate and high-quality workpieces. We have designed a dual side shaper with appropriate dimensions and analysed various properties for a cutting tool (Shaper tool) using scotch yoke mechanism. We have applied various rapid wear of the slot in the yoke caused by sliding friction and high contact pressures. This wear can be reduced or controlled by maintaining lubricant near yoke. Scotch yoke mechanism plays an important role in shaping, planning, and slotting machine. This Mechanism is also used in scotch yoke engines. This can also be used in valve actuators in high-pressure oil and gas pipelines. It has been used in various internal combustion engines, such as the Bourke engine, SyTech engine, and many hot air engines and steam engines. It is best suitable for machining brittle materials like iron, copper, zinc etc.

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