DUAL SIDE SHAPER MACHINE AND GRINDING WHEEL ATTACHMENT USING SCOTCH YOKE MECHANISM

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Abstract: *This paper explains about DUAL SIDE SHAPER MACHINE AND GRINDINGWHEEL ATTACHMENT USING SCOTCH YOKE MECHANISM. The shaper machine is used to remove metal chips in the blank of high speed steel to get a definite structure. The ordinary shaper machine will remove the metal in blank only in the forward stroke, while in the backward stroke the tool will not remove the chips. Whereas the dual side shaper machine will remove the chips during both forward and backward strokes. In industries for achieving shaping and grinding operations they are using individual machines. While in this mechanism both operations can be achieved in a single machine. It will reduce the operating time, manufacturing cost and increase the production rate compare to other machines.*

Key Words: *Grinding wheel, shaper machine, high speed steel, scotch yoke mechanism*

1. INTRODUCTION:

A shaper is a reciprocating type of machine tool in which the ram reciprocates the cutting tool back and forth in a straight line. In general, the shaper can produce any surface consisting of straight line element. Modern shaper can produce contour surface.

A grinding wheel is a wheel composed of abrasive particle and used for various grinding and abrasive machining operations. Such wheel is used in grinding machine. The grinding effect of wheel periodically releases individual grains of abrasive. The wear in this process is predictable and measurable for good performance in metal surface finishing. The project has following objectives

- Reducing the Production time
- Shaping and grinding can be done in same machine.
- Minimizing Production cost.
- Improving the productivity.

2. MATERIALS:

S.NO	NAME OF THE MATERIAL	TYPE OF MATERIAL
1	FRAME	MILD STEEL
2	CRANK	MILD STEEL
3	SHAFT	STEEL
4	CONNECTING ROD	MILD STEEL
5	GRINDING WHEEL	ABRASIVE PARTICLE
6	SLOTTED BAR	MILD STEEL
7	SHAPER TOOL	HIGH SPEED STEEL

TABLE 1.1 MATERIAL SELECTIONS

3. MATERIAL DESCRIPTION:

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

BEARING:

Bearing is a element is used to rotate the shaft freely without any friction between the moving parts and provide linear motion

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.

GRINDING WHEEL:

It is composed of abrasive compound and the wheels are generally made from composite material.

4. 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.

5. PRINCIPLE:

Working principle of mechanism:

This mechanism converts rotating motion of a crank convert into linear motion. The power supplied is to be connected in A.C. motor, when the shaft to start in rotating moment, the crank rotates the slotted bar inside of yoke part and also moves in forward and backward direction. When the crank will be rotate in clockwise direction and yoke will get displacement moment at forward.

The A.C. motor always relies on the small difference in speed between the stator rotating magnetic field and the rotor shaft speed called slip to induce rotor current in the rotor A.C. winding. As a result, the induction motor cannot produce torque near synchronous speed where induction is irrelevant to exist. In contrast, the synchronous motor does not rely on slip-induction for operation and uses either permanent magnets, salient poles or an independent excited rotor winding. The synchronous motor produces its rated torque at exactly synchronous speed. The brushless wound rotor doubly fed synchronous motor system has an independently excited rotor winding that does not rely on the principles of slip induction of current. The brushless wound rotor doubly fed motor is a synchronous motor that can function exactly at the supply frequency or sub super multiple of the supply frequency.

6. WORKING:

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.

7. FLOW CHART:

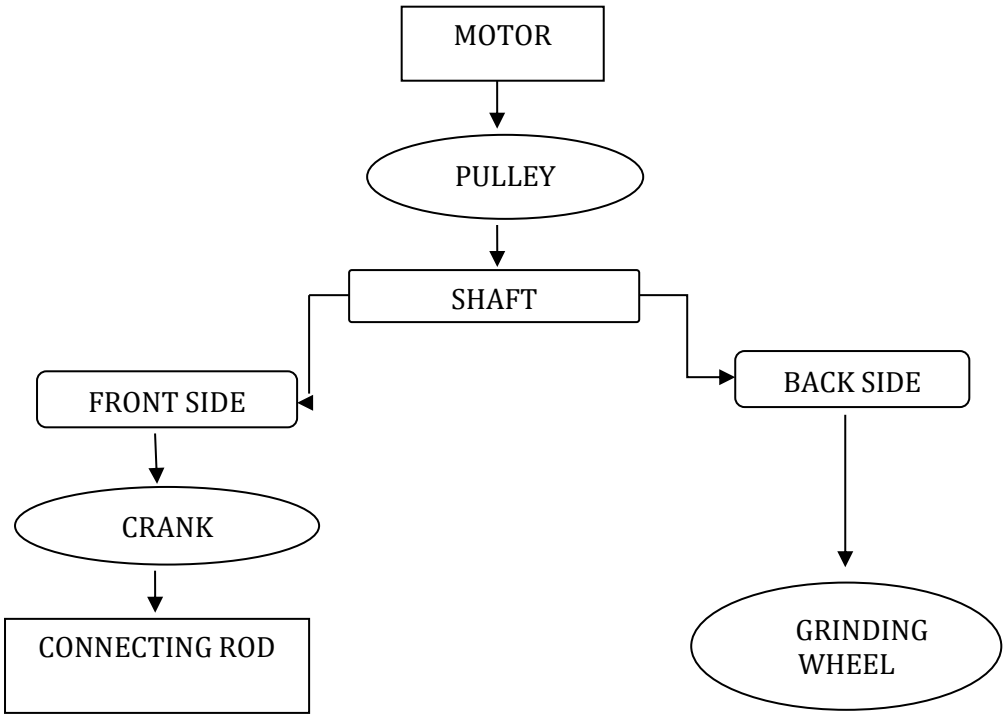

FIGURE 1.1 Flow Diagram of scotch yoke mechanism dual sided shaper power flow.

8. DESIGN VIEW (CATIA V5 SOFTWARE):

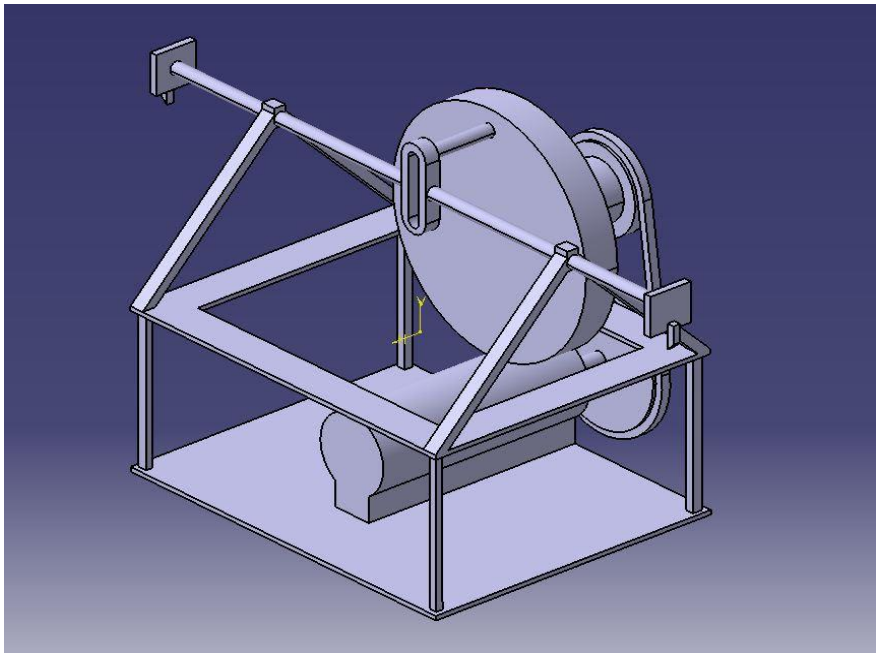

Fig.2 Design isometric view of scotch yoke mechanism dual sided shaper

9. VIEW PORT ANALYSIS OF FULL MECHANISM:

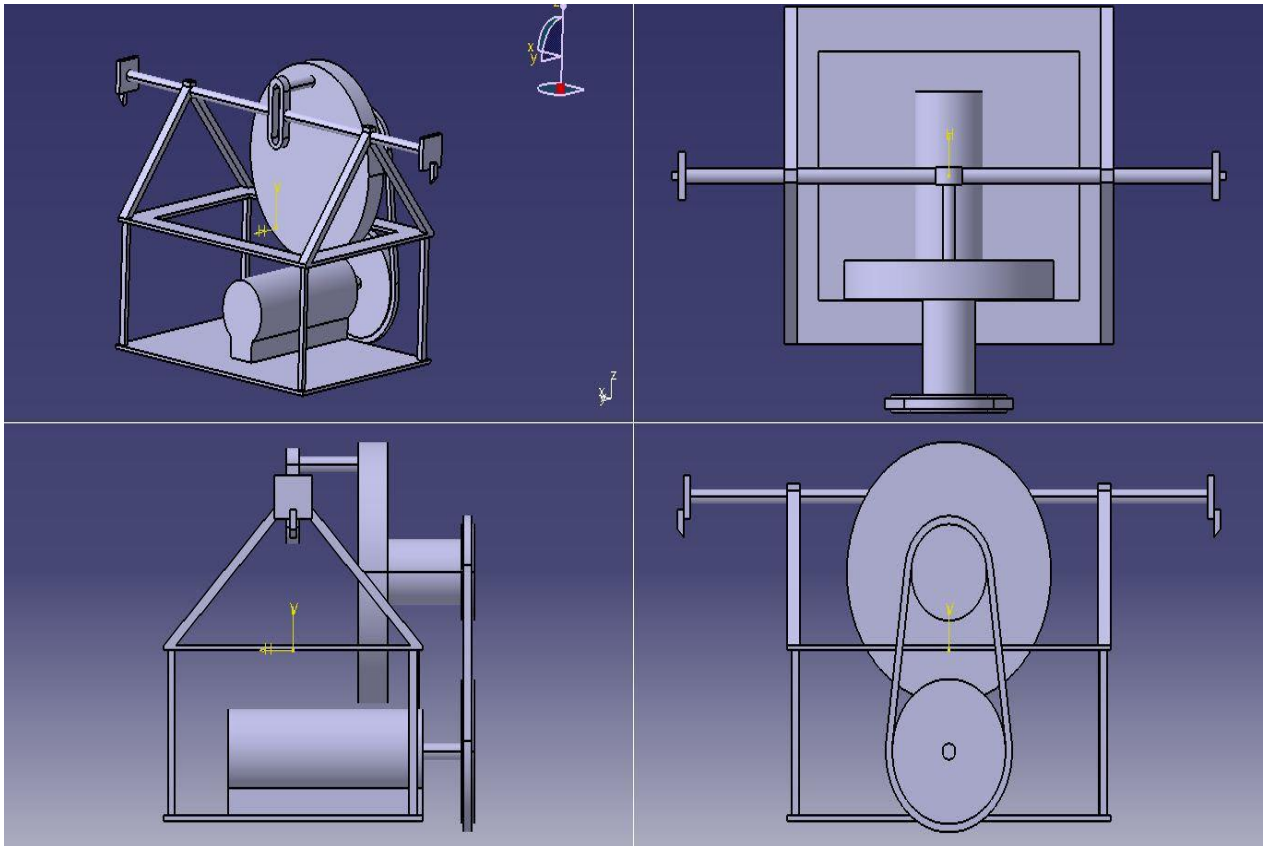

Fig.3 Design views of scotch yoke mechanism dual sided shaper

10. DESIGN CALCULATION:

Design specifications:

Diameter of Crank = 150mm
Length of slotted bar = 176mm
Length of connecting rod= 240mm
Length of shaft =430mm
Diameter of shaft =28mm

Cutting Force:

Power = 720 Watts
Speed = 250 RPM

$P = 2*3.14*N*T/60$

$T = 27.5$ Nm

Torque = Force X Radius of crank

$F = 183.33$ N

Design of Shaft:

Diameter of the shaft = 28mm
Permissible shear stress for mild steel = 34 N/mm^2

$T = \pi/16*(f_s)*d^3$

$27.5 = \pi/16*(f_s)*0.03^3$

$Fs = 5198487.7$ N/m^2

$Fs = 5.198$ N/mm^2 which is less than Fs (permissible) 34 N/mm^2

Therefore, the design is safe.

Cutting Speed:

Cutting speed, V = N L (1+m)/1000 m/min

N= Number of double strokes or cycles of the ram per min
N= 100
L = Length of the ram stroke
m= return stroke time / cutting stroke time
m= 1
v = 0.019 m/min

11. DISCUSSION:

- This advantage of this machine is "time saving "
- The cost is low compare to other machines
- Shaping and grinding can be achieved in a single machine.
- 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.

12. ANALYSIS:

- **Material** **:** Mild steel is selected due to its withstanding of more strength
- **Cutting Force** **:** 183.3N
- **Cutting Speed** **:** 0.019 m/min
- **Surface Finish** **:** Good surface finish

13. CONCLUSION:

The main objective is to reduce the time and to increase the production rate. From the above project it can be concluded that "Dual side shaper machine and grinding wheel attachment" is having good machinability and it will be useful in industries

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