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The Scotch Yoke Technique for Modeling and Making a Bi-Faceted Form

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ABSTRACT

For machine operations on tiny sizes, most industries use a variety of reciprocating machines. The tools, which might be angled, horizontal, or vertical, are primarily shaped using a shaping machine. Compared to a standard shaper, a dual shaper machine has the benefit of being able to shape materials from both sides. Businesses may save time and money while increasing their production rate with the aid of a dual shaper machine. Time and money saved during manufacturing are both attributed to the Dual Shaper machine. Using the Scotch Yoke Mechanism, this project's designers created a dual-side shaper machine that can shape materials held in a vice from both sides by converting the motor's rotating action into linear motion. In contrast to the crank and slider, the forward reciprocating motion of the Scotch Yoke Mechanism is slower than the return stroke, but it still transfers rotational motion into reciprocating motion. The mechanism is linked to the DC motor via a chain and sprocket. A metal frame supports the whole machine.

Keywords–Design, fabrication.

1. Introduction:

The shaper machine is a reciprocating type of machine basically used for producing the horizontal, vertical or flat surfaces. The shaper holds the single point cutting tool in ram and the work piece is fixed in the table. During the forward stroke, the ram is holding the tool is reciprocating over the work piece to cut into the required shape. During the return stroke, no metal is cutting. In the shaper machine, the rotary motion of the drive is converted into the reciprocating motion of the ram holding the tool. Usually, a single point cutting tool will be used in these machine tools.

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During the forward stroke of the tool, job will be machined and during the backward stroke of the Tool, the tool will be idling. To achieve this, the cutting tools are mounted over an arrangement called clapper box. In other words, the return strokes are ineffective and non-machining strokes. In order to utilize the idling time and increase the productivity, and decrease the cost and production time a small Scotch Yoke mechanism has been thus used to demonstrate. Due to this mechanism both sides of shaper machine shaping operations are possible.

Shaper Machine:

Shaper Machine is a production machine in which the single point cutting tools are attached and the work piece is fixed and while moving forward the tool cuts the work piece and in return, there is no cut on the work piece and used for producing Flat And Angular Surfaces.

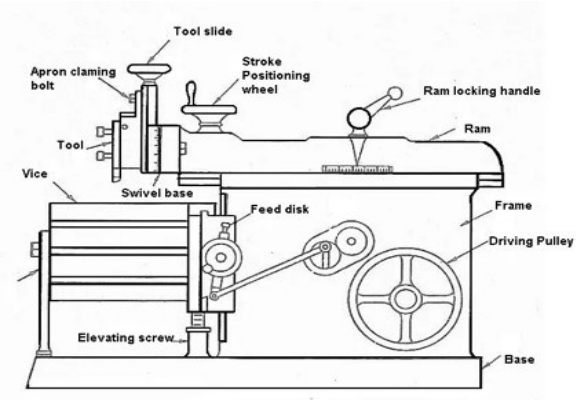

Fig.1. Shaper Machine

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2. Design of dual side shaper in ptc creo:

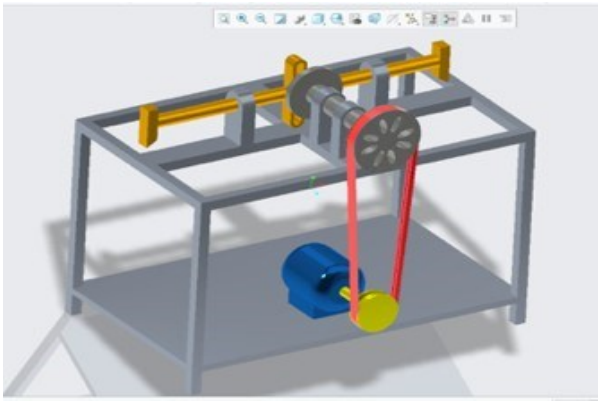

Fig.2. Model design

Command used in CREO:

i. Drawing lines: The following commands allow you to draw lines: Line by 2 Pts,

Tangent, Line by Two Points: This is the default option. Press creates, Pick 2 Pts or the LINE command. Indicate the start and end point of the line required.

ii. Rectangle: Rectangles can be created as whole entities, but the system treats them as four individual line elements. This means the sides of a rectangle can be deleted or manipulated individually. To draw a **rectangle**: Press creates, Pick Rectangle. Indicate two diagonal corner points. You will see that the rectangle moves with your cursor until the second point is defined.

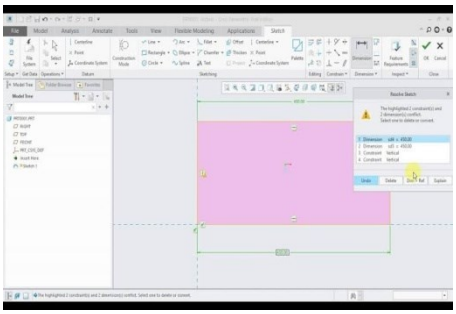

Fig.3.Drawing a Rectangle

iii. Drawing circles: The following commands used for drawing circles are: Centre, Tan2, and concentric Diameter, To draw a circle by indicating the center and point: Presses create Pick cen & pt/r, indicatethe centre of the circle. Indicate a point on the circumference, or enter the length of the radius. The circle moves with the cursor until the circumference point is

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defined. You can createadditional concentric circles by indicating additional points or radii.

IV. EXTRUDE

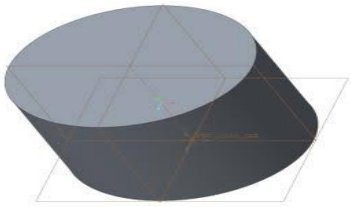

Fig.4.Extrude model

Extrusion is a method of defining three- dimensional geometry by translating a two dimensional sketch normal to the sketch plane, for a pre-defined distance or up to a specified reference. Use the Extrude tool to create a solid or surface feature, and to add or remove material.

3. Assembly:

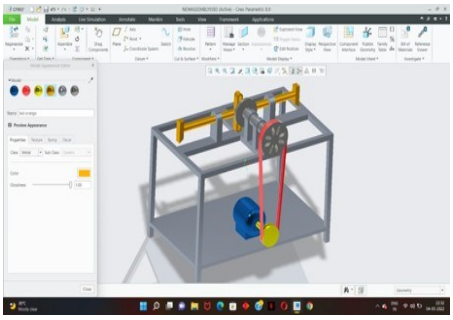

Fig.5.Assembly

The job is rigidly fixed on the machine table. The single point cutting tool held properlyin the tool post is mounted on a reciprocating ram. The reciprocating motion of the ram is obtained by a scotch yoke mechanism. As the ram reciprocates, the tool cuts the material during its forward stroke. During return stroke there is no cutting action and this stroke is called idle stroke. The forwardstroke of the one side of the machine is the return stroke of another side of the machine. One half cycle gives the forward stroke to one work and the return stroke to another work. The another half cycle gives the return stroke of the first work and the forward stroke of the next work. Thus, the machining takes place on both works in one complete cycle. This component changes over pivoting movement of a wrench convert into

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straight movement. The force supplies is to be associated in A.C. motor, when the pole to begin in pivoting second, the wrench turns the opened bar within burden part and furthermore moves in forward and in reverse heading. At the point when the wrench will be turn clockwise way and burden will get dislodging second at forward. The A.C. motor consistently is dependent upon the little difference in speed.

Parts involved in fabrication:

The following are the parts which are used for the fabrication of Dual Side Shaper using Scotch Yoke Mechanism.

- Metal Frame
- AC Motor
- Pulleys
- Belt Drive
- Solid Shafts
- Bearings
- Tool Holders
- Single Point Cutting Tools
- Vices
- Electrodes
- Scotch Yoke Mechanism

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Metal Frame:

Fig.6.Metal frame

Metal Frame is a rigid member used for the support of the machine. The entire frame is made up of alloy pipes of 3mm square pipes. Alloy pipes are tubular with higher percentages, than standard carbon steel pipes, of alloying elements as Molybdenum (Mo), Chromium (Cr), Nickel, etc. Actually, the ASTM A335 covers "low-alloy" steel pipes, i.e pipes that have a total amount of alloying elements below 5%.

Scotch Yoke Mechanism:

Scotch Yoke Mechanism is the reciprocating mechanism that converts rotational motions to reciprocating motion or vice-versa. It is also known's as a slotted link mechanism. This mechanism is an inversion of the double slider crankshaft. It can be used to either convert the linear motion of a slider to the rotational motion of a crank, or itcan be used to convert the rotational motion of a crank to the linear motion of a slider. This mechanism is commonly used in control valve actuators in high pressure gas and oil pipelines. This is a simple mechanism; the rotary motion of the pin is converted to linear motion.Firstly, the power is supplied to the DC motor

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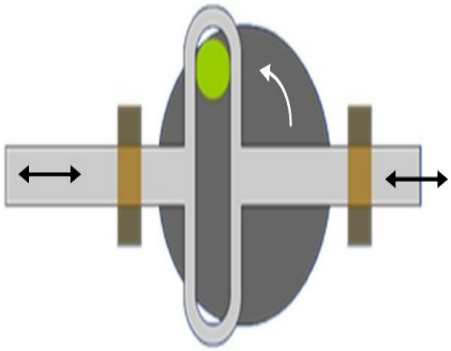

Fig.7.Scotch Yoke Mechanism.

to be connected; when the shaft starts at the momentof rotation, now the crankpin rotates the slider inside the yoke part and also moves in the forward direction. When the crank will be rotated in a counterclockwise direction, and the yoke will be a forward-facing displacement moment. The maximum displacement of the yoke depends on the length of the crank. The crank has completed the revolution of the clock at the same time as yoke sliding completely moved forward. When this position takes longer to initiate the return stork, after spending time, thecrank will be rotated continuously to return to its initial state of rotation. Therefore the yoke movesin a backward direction and returns to the starting position.

4. Specifications

i. Design specifications:

Diameter of crank = 0.30m

Length of slotted bar = 0.202m

Length of connecting rod = 0.51m

ii. Cutting Force:

Power = 630 watts

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Speed = 210 rpm

Power P =2πNT/60

T= 28.64 Nm

We know that,

Torque = Force × Radius of crank

F= 190 N

iii. Design of shaft:

Diameter of the shaft = 0.03 m

Permissible shear stress for mild steel = 34 N/m2

$T1 = \pi/16 \times (fs) \times d^3$

$fs = 6573688.612\ N/m^2$

$Fs = 6.573\ N/mm^2 < fs\ permissible = 34\ N/mm^2$ Therefore, the design is safe

iv. Cutting speed:

Cutting speed v = NL (1+m)/1000 m/min

N = the number of double strokes or cycle of the ram permin (take N = 100)

L = length of the ram stroke in mm

m = return stroke time/cutting stroke, time, m =1, v = 0.021 m/min

5. Result and discussion:

i. The dual side shaper machine is look like assembling of two existing shaper machines.

ii. For the same amount of work produced by the existing shapers the labour costs

and power consumption are decreased and also the overall machining time is reduced to 40% compared tothe existing shapers.

iii. This project is made with pre planning, that it provides flexibility in operation. This innovation has made the more Desirable and Economical.

iv. This project is designed with the hope that it is very much economical and it also helped us to know the periodic steps in completing a project work.

v. Thus, we have completed the project successfully and can be shown in below figure.

Fig.8.Fabricated dual side shaper

6.CONCLUSION:

In this project, we build and construct a dual-side shaper, which is a machine that can make parts just like any other shaper. On the other hand, this dual shaper uses less machining time than the standard shaper. Consequently, the dual side shaper machine outperforms the standard shaper in terms of production rate. There has only been experimental manufacture of the intended dual shaper. Industrial and commercial manufacturing will make use of it in the future.

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