Design and fabrication of dual side shaper machine

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Abstract— **This document In a shaper machine a job can be machined at forward stroke but during return stroke it remains ideal so in this project utilizes the ideal time by using scotch yoke mechanism to demonstrate the dual side machining time reduction in shaping machines. This shaping machine has an idle stroke during its return motion. Most of the industries are having various types of reciprocating machines for performing machine operation on small size of work. A shaping machine is mainly used for shaping the tools, which may be horizontal, vertical or inclined. In a dual shaper machine, materials are shaped from both sides, which makes it more advantageous than usual shaper. Dual Shaper machine helps industries to achieve high production rate at a minimal amount of time and cost. Dual Shaper machine reduces the production cost as well as the time. In this project, a dual side shaper machine is designed with the help of quick return mechanism, the rotary motion of the motor is converted into linear motion of the tool which shapes the material mounted on the vice from both the side. The quick return mechanism converts rotary motion into reciprocating motion, but unlike the crank and slider, the forward reciprocating motion is at slower rate than the return stroke. DC motor is connected with the mechanism with the help of chain and sprocket. Whole mechanism is built on rugged metal frame.**

Keywords— **shaping,machine,quickreturn,linear-motion,motor**

Introduction

A Shaper is a type of machine tool that uses linear relative motion between the work piece and a single-point cutting tool to machine a linear tool path box and the hieght of the tool can by tool holder which is mounted on ram the ram slides back and forth above the work. At the front end of the ram is a vertical tool slidethat may be adjusted to either side of the vertical plane along the stroke axis. This tool-slideholds the clapper box and tool post, from which the tool can be positioned to cut a straight,flat surface on the top of the work piece. The toolslide permits feeding the tool downwards todeepen a cut. The tool-slide permits feeding the tool downwards to deepen a cut. Usually a single point cutting tool will be used in these machinetools. 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 stroke twin mounted double Page sided reciprocating shaping mechanism is provided which is formed in the shape of an acute isosceles triangle whereby the bottom is opened to the ground and each cutting mechanism is bent or deformed along the longitudinal axis to form to a conical shape when rotated about the center axis of the isosceles triangle. The twin mounted double sided reciprocating shaping mechanism is adapted to be used for cutting and shaping and forming trees, bushes and thelike in the contour of a cone.

Aim & Objectives

The major goal and objective of the project was to develop a multi-use dual sider shaper machine with as little time wastage as possible, because the return stroke was conducted while the machine was idle. However, by attaching a tool-post and a workpiece to their respective ends, we were able to convert that idle return stroke into a productive stroke.

Problem Statement

Nowadays, industries strive for a high output rate with the least amount of time, money, and effort. A shaper is a machine that is used to shape (remove metal from) a work piece and to machine a single job with a single point cutting tool, therefore it cannot be utilised for large production rates. The work will be machined during the forward stroke of the tool, and the tool will be idle during the reverse stroke. Both sides of shaper machine shaping operations are possible in order to utilise idling time and enhance productivity while lowering cost and production time. Another advantage is that there are fewer moving parts than in a traditional machine. We may make minor adjustments to our project "Design of Dual Slider Shaper Machine" and attach another tool post to conduct the dual operation (both forward and back stroke) in the shaper machine. As a result, manufacturing time, labour, and expenses will be reduced, resulting in increased efficiency and production rate.

Literature Review

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

[2] M.V.N Srujan Manohar: Studied that pneumatic shaper is used for high production of automatic gear cutting with auto indexing work piece. A small ratchet gearstructure 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 obtainthe forward and return strokes [3] S. Ravindran: Studied to improve the productivity and energy conservation of shaper and planer with modified tool heads. The quick return mechanism of shaper and planer machines, reduce 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. Size of the clappers were made small, crushing strength

[4] Anand Shukla: Investigated that optimizing of the cutting force and power consumption of shaper machine by varying different parameters during cutting operation using computer interface. He developed a methodology to find out cutting force and power required by the toolto perform shaping operation on work piece

[5] Dharwa Chaitanya Kirtikumar: Investigated that energy is the most vital aspect in the development of modern technological civilization. The conventional energy sources are being scarce, so alternative energy sources are found which must be cheap, easily

available and must satisfy the technical requirements. Power required for pedalling is well below the capacity of an average healthy human being.

[6] R.Maguteeswaran: Investigated that the various machining process in manufacturing industries are carried out by separate machining machine. It need more space requirement and time with high expenses. But the fabrication of multi operation machine, which contains three operations in a single machine. The operations are namely drilling, slotting and shaping

[7] Devanand R. Tayade: Investigated that evaluation of cutting and geometric parameter is one of the most important elements for quality and productivity which play significant role in todays manufacturing market. From customers view point quality is very important because the extentof quality of the procured item (or product) influences the degree of satisfaction of the consumers during usage of the procured goods.

[8] Deepak Lathwal: Investigated that the finite element method is used to study the effects of different of rake angles on the force exerted on the tool during cutting. This method is attracting the researches for better understanding the chip formation mechanisms, heat generation in cutting zone, tool chip interfacial friction characteristics and integrity on the machined surfaces.

Components

Sr.no	Part	Material	Dimension
1	Frame	Mild steel	400*350mm
2	Shaft	steel	Dia -0.03m
3	Cutting tool	High speed steel	
4	Motor		350 watts
5	Crank	Mild steel	Dia- 210mm
6	connecting rod	Mild steel	450mm

Calculation

1. Design Parameters: Diameter of

Crank = 0.21m

Length of slotted bar = 0.185 m Length of

connecting rod= 0.45m

2. Cutting Force:

Power = 350 WattsSpeed =

200 RPM

P = 2πnt/60 = T=16.72NM

We Know that, Torque = Force X Radius of crankF =160.23N

3. Design of Shaft:

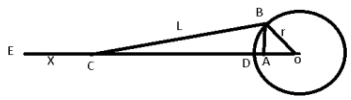
Diameter of the shaft =0.03m Permissible permissible shear stress for mild steel = 34 N/mm2T1 = π/16*(f

s)*d3

16.72=π/16*(fs)*0.03^3=fs=3,143,448.02n/m^2

Fs = 3.145N/mm2 < Fs (permissible)=34 N/mm2Therefore,
the design is safe

4. Cutting Stroke Calculations:



Scotch yoke mechanism: Let X is the length of the cutting strokeX = OD +

DE – AC – OA

r – Radius of the Crank.

L – Length of the link AB. Angle AOB = θ Angle ACB = Φ

Assume, Radius of the crank, r=105 mm Length of the CR = 450 mmAt Ø = 0, θ =

0 X = 450 + 105 = 555 mm

At Ø = 0, θ = 180 X = 450 + 105 + 0 – 100Cosine180 = 555mm
The length of the cutting stroke= 555 – 450 = 105 mm = 10.5 cm

5.Cutting Speed:

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

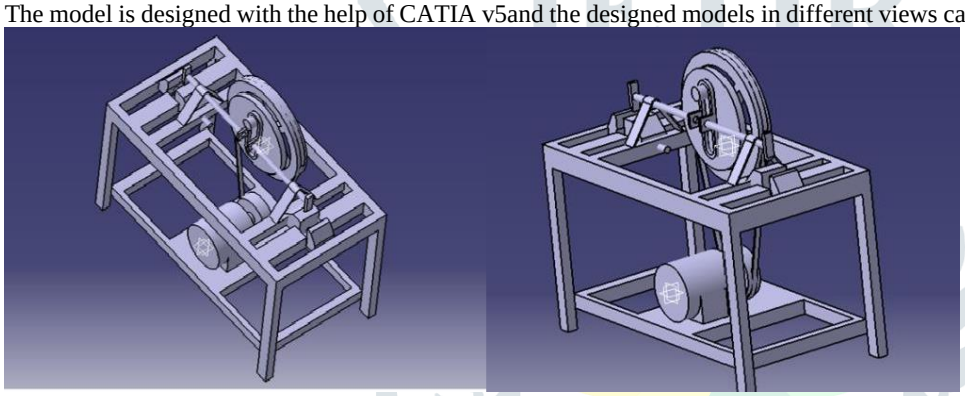
N= the number of double strokes or cycles of the ram per min (take N= 100)

L = Length of the ram stroke in mm

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

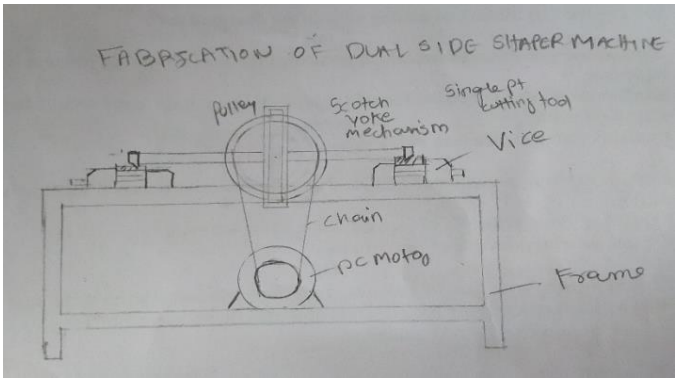
Design and Fabrication

The model is designed with the help of CATIA v5and the designed models in different views can be seen



WORKING PROCEDURE

The job is rigidly fixed on the machine table. The single point cutting tool held properly in 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 forward stroke 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



RESULTS AND DISCUSSION

Due to rapid growth in production industry it's very important that we use the time in a best manner so this dual side shaper machine helps in making the best use of time. It also increase the production rate than before where it would only done the shaping operation on one side and now by using this dual side shaper two side shaping operation can be done and it results in increased rate of production in manufacturing industry.

CONCLUSION

The dual side shaper machine resembles like assembling of two existing shaper machines. Hence, the machine occupies less space, number of equipment's are reduced. For the same amount of work produced by the existing shapers the labor cost and power consumption are decreased and also the overall machining time is reduced.

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