Design and Fabrication of Power Hacksaw and Shaper Using Scotch Yoke Mechanism

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Abstract- **This project presents the concept of two directional operating machine mainly carried out for production-based industries. Industries are basically meant for production of useful goods and services are low production cost machinery and low inventory cost. Today in this world every task has been made quicker and fast due to technology advancement but this advancement also demands huge investment and expenditure, every industry desires to make high productivity rate maintaining the quality and standard of the product at low average cost.**

The objective of this work is to automate the conventional power hacksaw machine in order to achieve high productivity of work-pieces than the power hacksaw machine. The automated machine acquires two inputs from the user namely the number of pieces to be cut and the length of each piece that is required to be cut.

The inputs are given by the user with the help of a manual control, which needs more accuracy and keen concentration for performing the operation. In our proposed system "DESIGN AND FABRICATION OF POWER HACKSAW AND SHAPER USING SCOTCH YOKE MECHANISM", A quick return mechanism is used for activating the motion of the hacksaw frame during its strokes, that is forward is used for shaper and its backward stroke is used for hacksaw and thus by performing the cutting and shaping operation at both sides. This mechanism is powered by an electric motor so working with this system is quite easy when compared to normal machines. The cutting operation is easy and efficient because of the performance of quick return mechanism.

Index Terms- **inventory cost, expenditure, strokes, conventional**

1. INTRODUCTION

Power hacksaws & Shaping Machine are used to cut large sections of metal or plastic shafts and rods. Cutting of solid shafts or rods of diameters more than fifteen millimetres is a very hard work with a normal hand-held hacksaw. Therefore, power hacksaw machine & shaping machine was invented during 1920s in the United States to carry out the difficult and time-consuming work.

This power hacksaw & Shaping are considered as an automatic machine because the operator need not be there to provide the reciprocating motion and downward force on the work-piece in order to cut it. Once the operator has fed the work-piece till the required length in to the machine and starts the machine, then the machine will cut until the work-piece has been completely cut in to two pieces. The fact that the operator has to feed the work-piece to the required length in to the vice is one aspect that motivated us to automate the feeding of work-piece automatically.

Another one aspect is that after a shaft has been cut for one time, the operator has to unload the work-piece and advance the rest of the work-piece to the required length again and again till the end of the work-piece is reached. The Power hacksaw & Shaping machine though being able to cut the shaft or rod without requiring any human effort to cut, it does require a human intervention to feed the work-piece many times with measurements being taken each time before feeding. Therein, arose a need to completely automate the process of cutting, and here we are with a proposal which will aid in eliminate the effort of the people associated with it.

2. COMPONENTS AND DESCRIPTION

2.1Components Used

- A.C motor

- Belt drive
- Scotch yoke mechanism
- Shaping tool
- Shaft
- Frame
- Hacksaw

3. DESIGN AND DRAWING

3.1 Motor Specifications

Voltage	-	230 V
Frequency	-	50 HZ
Current	-	2.5 AMPS
Power	-	¼ HP
Watt	-	180W
Speed	-	1440rpm
Phase	-	1ph

3.2 Motor Calculation

Electrical power equation:

Power P=I*V

Where,

I=25amps

V=230v

P=I*V

Power P= 5750 Watts

To find torque of motor:

$P=2\pi NT/60$

$T=5750*60/2\pi*1440$

T=38.15 N-m

3.3 Specifications of Components Used

FRAME L-405mm B-405mm H-480mm

SQUARE TUBE Thickness-25mm

SHAFT Length-180mm Diameter-15mm

ROLLER BEARING ID-9.5mm OD-40mm

CRANK DISC D-120mm T-3mm

LENGTH OF BELT 300mm

THICKNESS OF BELT 5mm

DIAMETER OF SMALL PULLEY 30mm

DIAMETER OF LARGE PULLEY 270mm

TYPE OF BELT V-BELT

3.4 Time Calculation

Time required for cutting wooden job of 50mm base and 25mm thickness manually = 30.2sec.

4. WORKING PRINCIPLE

In the conceptual model of "DESIGN AND FABRICATION OF POWER HACKSAW AND SHAPER USING SCOTCH YOKE MECHANISM" we are giving supply to the main shaft as we can see that the scotch yoke mechanism is directly fabricated to the main shaft and have same angular velocity as that of main-shaft When the A.C Motor is started the rotational power is transmitted through the belt drive with the help of pulley to the main shaft. The shaft is connected to the scotch plate. The nob which is present in the scotch plate pushes the yoke to transfer the rotational motion into linear motion for shaping and sawing operation at the same instance.

When the power is supplied to the 12v Dc motor, shaft and crank attached to the shaft start rotating. As the crank rotates the pin slides inside the yoke and also moves the yoke forward. When the crank rotates through in clockwise direction the yoke will get a displacement in the forward direction. The maximum displacement will be equal to the length of the crank. When the crank completes the next of rotation the yoke comes back to its initial position. For the next of rotation, yoke moves in the backward direction. When the crank completes a full rotation the yoke moves back to the initial position. For a complete rotation of crank the yoke moves through a length equal to double the length of the crank. The displacement of the yoke can be controlled by varying the length of the crank.

5.OVERALL DIAGRAM

Fig 5.1 Power Hacksaw and Shaper machine

6. CONSTITUTES

6.1 Advantages

- High torque output is achieved.
- Fewer moving parts.

- Smoother operation.
- Simple in construction.
- Maintenance is easy.
- Reduced friction.
- Easy to operate.
- Reduces time and high production rate.
- Components used for fabrication are easily available.

6.2 Disadvantages

- The slot in the yoke wears rapidly due to sliding friction.
- Uneven forces act on the work piece.
- Only small components can be machined.
- Loading and unloading of work piece done manually.

6.3 Applications

These type of Power Hacksaw and Shaper have wide range of applications in the fields like,

- It can be used in small, medium as well as large scale industries.
- Highly suitable for production industries and workshops.
- It can perform variable operation in a single time.
- Operations such as grinding, shaping, cutting can be done with a single drive.

7. COST ESTIMATION

Table 7.1 Cost Estimation

Sl. No.	Parts	Qty.	Material	Amount (Rs)
i.	A.C motor	1	Electrical	1200
ii.	Belt drive	1	Rubber	65
iii.	Scotch yoke	1	Mild steel	460
iv.	Shaping tool	1	Mild steel	50
v.	Hacksaw	1		120
vi.	Shaft	1	Mild steel	100
vii.	Frame	1	Mild steel	500

TOTAL = Rs. 2,500

7.1 Labour Cost

LATHE, DRILLING, WELDING, GRINDING, POWER HACKSAW, GAS CUTTING:
Cost = 1000/-

7.2 Overhead Charges

The overhead charges are arrived by "Manufacturing cost"

Manufacturing Cost=Material Cost + Labour cost
=2500 +1000
=3,500/-

Overhead Charges = 20% of the manufacturing cost = 500/-

7.3 Total Cost

Total cost =Material Cost + Labour cost + Overhead Charges
= 2500+1000+500
= Rs. 4,000/-

Total cost for this project =Rs. 4,000/-

8. CONCLUSION

We can see that all the production based industries wanted low production cost and high work rate which is possible through the utilization of multi-function operating machine which will less power as well as less time, since this machine provides working at different center it really reduced the time consumption up to appreciable limit.

In an industry a considerable portion of investment is being made for machinery installation. So in this project we have proposed a machine which can perform shaping and sawing operation in two different working centers simultaneously which implies that industrialist have not to pay for machine performing above tasks individually for operating operation simultaneously.

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