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DESIGN AND FABRICATION OF HACKSAW MACHINE USING SCOTCH YOKE MECHANISM

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Abstract - Increasing the productivity is one of the main requirements of the production engineering. Either reducing operation time or improving the capability of the machine to produce the components in an increased number is essential for an industry to achieve the same. This project employs the scotch yoke mechanism in power hacksaw machine which enables it to cut two components at a time thereby improving the productivity. This device uses scotch yoke mechanism. The scotch yoke mechanism converts the rotary motion into reciprocating motion and vice versa. Double acting hacksaw increases the production rate by cutting two work pieces at a time.

Key Words: Cutting , motor , scotch yoke mechanism

1. INTRODUCTION

In industries saving the time and saving man power is an important aspects where we designed and fabricated double acting hacksaw machine to do the same in the present scenario many electrically operated power hacksaw machines of different companies with different specifications are available for the use in shop floor. These machines are so precise that they can cut metal bars with minimum time made up of different materials but they have one and major disadvantage that those are able to cut single piece of bar at a time. It is necessary to cut metal bars with high rate in order to achieve mass production in industries.

Therefore it is impossible to depend upon conventional single frame power hacksaw machines and need the improvement in technology and design of such machines. With the help of this double acting power hacksaw machine the two metal bars can be cut simultaneously to get high speed cutting rate and to achieve mass production for maximum profit in related companies.

Types of hacksaw machine:

- Gravity feed machine

This machine is usually of light construction for normal duty, the thrust load is developed by the gravity feed of saw bow. The work piece capacity of gravity feed machine is between 150 to 200 mm diameter and it is useful for small workshop, where cutting requirement is not required continuously. The application for this type of machine is comparatively low.

- Hydraulic machines

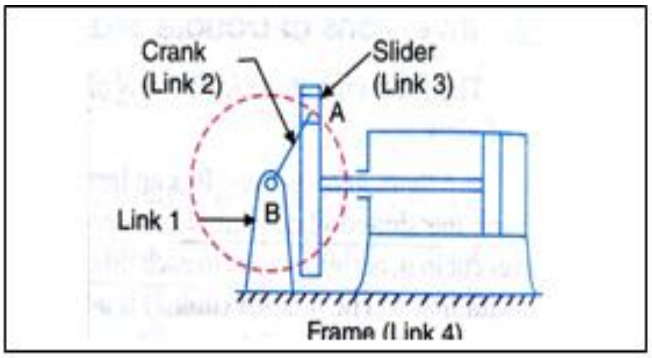
This hydraulic machine requires low operators skill and have greater flexibility compare to gravity feed machine. These machines have wide range of applications and it is suitable for cutting the steel and its alloys. These machines are available in both semi-automatic or fully automatic forms.

1.1 Hacksaw Blade

A hacksaw is a fine-toothed saw, originally and principally for cutting metal. They can also cut various other materials, such as plastic and wood; for example, plumbers and electricians often cut plastic pipe and plastic conduit with them. There are hand saw versions and powered versions. Most hacksaws are hand saws with a C-shaped frame that holds a blade under tension. Such hacksaws have a handle, usually a pistol grip, with pins for attaching a narrow disposable blade. The frames may also be adjustable to accommodate blades of different sizes. A screw or other mechanism is used to put the thin blade under tension.

1.2 Scotch Yoke Mechanism

The scotch yoke mechanism is a reciprocating motion mechanism, converting the linear motion of a slider into rotational motion, or vice versa. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part. In many internal combustion engines, linear motion is converted into circular motion by means of a crankshaft, a piston and a rod that connects them. The scotch yoke is considered to be a more efficient means of producing the rotational motion as it spends more time at the high point of its rotation than a piston and it has fewer parts.



2. METHODOLOGY

The appropriate method has to be used for the design and fabrication of this system. Mainly the process planning has to be listed out. This act has a guideline to be followed for this projects and the final model meets the requirement and time that can be managed. This would increase the efficiency of the project to be done.

Drawing

- Sketching: The idea for the 4-way hacksaw machine are sketched on the paper to make sure that idea of selection can be made after the selected design choose.
- Solid edge work application: The design and concept of the sketch are transferred into solid edge modeling and drawing using solid edge application.

Fabrication process

After design fabrication process takes place. This process is about material selections and getting materials to make the product according to the design and followed by the design dimensions. In this many methods are used to fabricate the product like welding, cutting, grinding, drilling and many more methods.

- Material selection: The different materials which are needed for the project are to be selected like cast iron, V belt, shaft etc.
- Measuring and marking: After getting the material marking of the material is don according to the design dimensions using measuring tape and marker pen.
- Drilling process: Mark the position to be drilled and start drilling using drilling machine.
- Welding: Welding is a process of joining two similar or dissimilar materials.

3. FEATURES OF HACKSAW MACHINE

- Power efficiency
- High productivity
- Super performance
- High operational fluency
- Speed variation
- Minimum vibrations

4. ADVANTAGES AND APPLICATIONS

ADVANTAGES

- Simple in design.
- Skilled workers are not required.
- Time consumption is less.
- Production rate is high.
- Speed can be varied.
- Fewer moving parts.
- Smoother operations.

APPLICATIONS

- Small scale industries.
- All manufacturing plants.
- Highly used for production industries and workshops.
- This setup is most commonly used in control actuators in high pressure oil and gas pipelines.

4. SPEED VARIATION IN DC MOTOR

Speed can be varied by varying flux, armature resistance or applied voltage. Different speed control methods for different DC shunt and series methods are there.

Methods

- Flux control method
- Armature and Rheostatic control method
- Voltage control method

VOLTAGE CONTROL METHOD

In this method the shunt field is connected to a fixed exciting voltage, and the armature is supplied with different voltages.
So the voltage across armature is changed with the help of a suitable switch gear devices. Armature speed is approximately proportional to the voltage across the armature.

5. SCOPE OF FUTURE WORK

The 2-way hacksaw machine can be made use of at any of the industries like pump manufacturing industries that involve the bulk amount of shafts that have to be cut frequently. For high productivity, we have to use the motor having higher capacity and also in future work we will add grinding and drilling operations also.

6. CONCLUSION

As per the above discussions, it was concluded that to overcome problems in conventional hacksaw machines, due to high efficiency, easy to operate and affordable price the proposed model of two-way power hacksaw machine is helpful and completes all the expectations needed in the mini-industries. Future scope of proposed research work to increase the production rate cuts the metal bars easily. It can withstand the vibrations, no hazards from a jerk, no special training required to operate it.

7. CAED MODELS

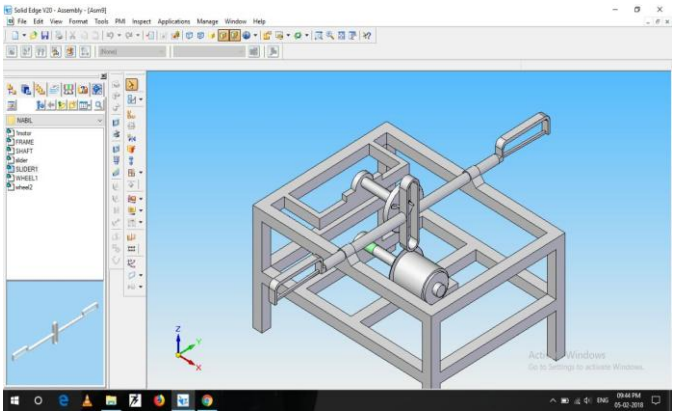


Figure 4.1 Dimensional representation

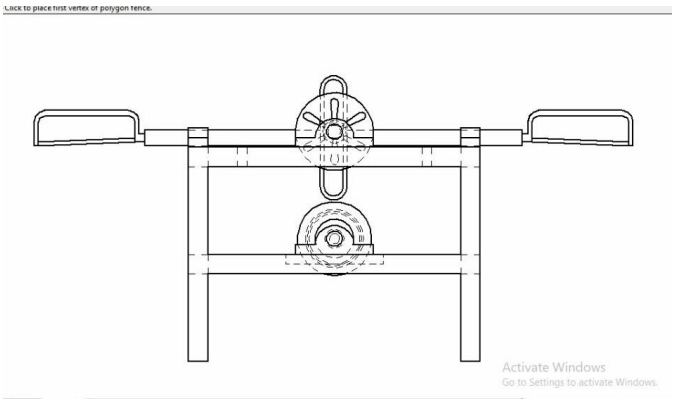


Figure 4.2 CAED Model

8. EXPERIMENTAL CALCULATIONS

8.1 Formulas

Velocity V= (3.14*d1*n1)/60000

Speed Ratio: i=d2/d1

Power Capacity: N= V ((1.47/V^0.09) – (143.27/d1) – (2.34*V^2/10000))

8.2 Calculations

Speed Ratio: i=d2/d1 = 220/50 = 4.4

d2/d1 = n1/n2, 220/50 = 1400/n2, n2=318.18rpm.

Velocity: V= (3.14*d1*n1)/60000

V= (3.14*220*1400)/60000

V=16.12m/s

Power Capacity: N= V ((1.47/V^0.09) – (143.27/d1) – (2.34*V^2/10000))

N= v ((1.47/16.12^0.09) – (143.27/220) – (2.34*16.12^2/10000))

N=6.97KW

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