DESIGN AND FABRICATION OF FOUR WAY HACKSAW MACHINE

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ABSTRACT:
Objective of the project is to fabricate a motorized high speed 4-way hacksaw machine and to automate and to modify the conventional power hacksaw machine in order to achieve high productivity of work-pieces than the power hacksaw machine using cam mechanism. The operator need not measure the length of the work-piece that is to be cut and to load and unload the work-piece from the vice each time after a piece has been cut. This machine is built with the 4 hacksaw machines such that all the machines are operated simultaneously with the help of a motor and cam mechanism.

Keywords: hacksaw machine, mechanism, load, unload, motor & cam mechanism

I. INTRODUCTION

The hacksaw is a metal cutting machine tool designed to cut multiple metals simultaneously by applying cam mechanism. The machine is exclusively intended for mass production and they represent the faster and more efficient way to cut a metal. Hacksaws are used to cut thin and soft metals. The operation of the unit is simplified to a few simple operations involving a motor and a cam mechanism. There are numerous types of cutting machines in Engineering field, which are used to fulfill the requirements. We are interested to introduce multiple hacksaw cutting operation in Hacksaw machine. The main function of this hacksaw machine is to cut thin and soft metals by motor power.

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased. Degrees of automation are of two types, viz.

- Full automation.
- Semi automation.

In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

II. PROCESS

Manufacturing processes are the steps through which raw materials are transformed into a final product. The manufacturing process begins with the creation of the materials from which the design is made. These materials are then modified through manufacturing processes to become the required part. Manufacturing processes can include treating (such as heat treating or coating), machining, or reshaping the material. The manufacturing process also includes tests and checks for quality assurance during or after the manufacturing, and planning the production process prior to manufacturing.

Metal Cutting:
Metal cutting or machining is the process of by removing unwanted material from a block of metal in the form of chips. Cutting processes work by causing fracture of the material that is processed. Usually, the portion that is fractured away is in small sized pieces, called chips. Common cutting processes include sawing, shaping (or planning), broaching, drilling, grinding, turning and milling. Although the actual machines, tools and processes for cutting look very different from each other, the basic mechanism for causing the fracture can be understood by just a simple model called for orthogonal cutting. In all machining processes, the work piece is a shape that can entirely cover the final part shape. The objective is to cut away the excess material and obtain the final part. This cutting usually requires to be completed in several steps – in each step, the part is held in a fixture, and the exposed portion can be accessed by the tool to machine in that portion. Common fixtures include vise, clamps, 3-jaw or 4-jaw chucks, etc. Each position of holding the part is called a setup. One or more cutting operation may be performed, using one or more cutting tools, in each setup. To switch from one setup to the next, we must release the part from the previous fixture, change the fixture on the machine, clamp the part in the new position on the new fixture, set the coordinates of the machine tool with respect to the new location of the part, and finally start the machining operations for this setup.
Therefore, setup changes are time-consuming and expensive, and so we should try to do the entire cutting process in a minimum number of setups; the task of determining the sequence of the individual operations, grouping them into (a minimum number of) setups, and determination of the fixture used for each setup, is called process planning.

These notes will be organized in three sections:

(i) Introduction to the processes,
(ii) The orthogonal cutting model and tool life optimization and
(iii) Process planning and machining planning for milling.

Sawing:
Cold saws are saws that make use of a circular saw blade to cut through various types of metal, including sheet metal. The name of the saw has to do with the action that takes place during the cutting process, which manages to keep both the metal and the blade from becoming too hot. A cold saw is powered with electricity and is usually a stationary type of saw machine rather than a portable type of saw.

![Diagram](image)

Fig 2a – Manufacturing Process[8].

![Diagram](image)

Fig 2b – Metal cutting Process[8].

The circular saw blades used with a cold saw are often constructed of high speed steel. Steel blades of this type are resistant to wear even under daily usage. The end result is that it is possible to complete a number of cutting projects before
there is a need to replace the blade. High speed steel blades are especially useful when the saws are used for cutting through thicker sections of metal. Along with the high speed steel blades, a cold saw may also be equipped with a blade that is tipped with tungsten carbide. This type of blade construction also helps to resist wear and tear. One major difference is that tungsten tipped blades can be re-sharpened from time to time, extending the life of the blade. This type of blade is a good fit for use with sheet metal and other metallic components that are relatively thin in design.

Welding:
Welding is a process for joining similar metals. Welding joins metals by melting and fusing 1, the base metals being joined and 2, the filler metal applied. Welding employs pinpointed, localized heat input. Most welding involves ferrous-based metals such as steel and stainless steel. Weld joints are usually stronger than or as strong as the base metals being joined.

**Fig 2c – Lathe Machine Process[8].**

**Fig 2d – Sawing Cutting Machine Process [8].**
Welding is used for making permanent joints. It is used in the manufacture of automobile bodies, aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work and ship building.

III. OPERATION

NEED FOR AUTOMATION

Nowadays almost all the manufacturing process is being atomized in order to deliver the products at a faster rate. The manufacturing operation is being atomized for the following reasons.

- To achieve mass production
- To reduce man power
- To increase the efficiency of the plant
- To reduce the work load
- To reduce the production cost
- To reduce the production time
- To reduce the material handling

COMPONENTS AND DESCRIPTION

The components that are used in the project FOUR WAY HACK SAW are as follows,

- DC motor,
- Battery,
- Bearing with bearing cap,
- Cam mechanism,
- Frame,
- Machine vice,
- Shaft.
A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines.

The material used for shafts should have the following properties:

- It should have high strength
- It should have good machinability
- It should have low notch sensitivity factor
- It should have good heat treatment properties
- It should have high wear resistant properties.

Shafts are generally manufactured by hot rolling and finished to size by cold drawing or turning and grinding. The cold rolled shafts are stronger than hot rolled shafts but with higher residual stresses. The residual stresses may cause distortion of the shaft when it is machined, especially when slots or Keyways are cut. Shafts of larger diameter are usually forged and turned to size in a lathe.

The shafts may be designed on the basis of:

- Strength
- Rigidity
- Stiffness

In designing shafts on the basis of strength, the following cases may be considered:

(a) Shafts subjected to twisting moment or torque only.
(b) Shafts subjected to bending moment only.
(c) Shafts subjected to combined twisting and bending moments.
(d) Shafts subjected to axial loads in addition to combined torsional and bending loads.
IV. WORKING PRINCIPLE

The experimental setup of our project consists of a frame on which the hacksaw blades are mounted. The hacksaw blades are mounted on the four sides of the frame. The circular cam plate is mounted in the centre of the frame which is operated by a motor. The power to the DC motor is given with the help of a battery. Connecting rods are used to connect the cam wheel and the hacksaw blades. The cam mechanism is used to convert the rotary motion into the reciprocating motion.

Hence when the motor is switched on, the power from the motor is delivered to the cam wheel. The cam wheel rotates such that the hack saw blades reciprocate. The work pieces are mounted on the machine vice firmly and the entire system is switched on. Thus the four workpieces are cut simultaneously using the motor and the cam mechanism.

![2D drawing of 4way hacksaw machine [8].](image)

The main objective of our project is to fabricate a motorized high speed four way hacksaw machine. The objective of this work is to automate and to modify the conventional power hacksaw machine in order to achieve high productivity of work-pieces than the power hacksaw machine using cam mechanism. The operator need not measure the length of the work-piece that is to be cut and to load and unload the work-piece from the vice each time after a piece has been cut. This machine is built with the four hacksaw machines such that tall the machines are operated simultaneously with the help of a motor and a cam mechanism.

The cam mechanism converts the rotary motion into the reciprocating motion. This concepts is used to convert the rotary motion of the motor to the reciprocating motion of the hacksaw blades. All the sour hacksaw blades are connected with the cam mechanism in such a way that when the motor is switched on, all the blades receive power and cut the materials according to the requirement.

ADVANTAGES
- Simple in construction.
- Easy to fabricate.
- The components used for the fabrication of the are easily available.
- Repairing and replacing is not a difficult task.
- Multiple work pieces can be cut simultaneously.
- The time taken for cutting operation is less.
- Increased productivity.

DISADVANTAGES
- More number of moving parts.
- Must be handled with care.
- The loading and unloading of the work pieces must be done manually.
APPLICATIONS
These types of motorized high speed four way hack saw machines have a wide range of applications in the fields like,
• In all industries.
• Small scale industries.
• All manufacturing plants.
• Highly suitable for production industries and workshops.

V. CONCLUSIONS
A strong multidiscipline team with a good engineering base is necessary for the Development and refinement of advanced computer programming, editing techniques, diagnostic Software, algorithms for the dynamic exchange of informational different levels of hierarchy.
This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work.
We are proud that we have completed the work with the limited time successfully. The “FABRICATION OF FOUR WAY HACKSAW MACHINE” is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality.
We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work. Thus we have developed a “FOUR WAY HACK SAW MACHINE”. By using more techniques, they can be modified and developed according to the applications.

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REFERENCES