VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"Jnana Sangama", Belgaum-590018

A

PROJECT REPORT

ON

"FABRICATION OF FOUR-WAY HACKSAW MACHINE"

Submitted in Partial fulfillment of the Requirements for the VIII Semester of the Degree of Bachelor of Engineering

In

MECHANICAL ENGINEERING

For the academic year 2016-17

Submitted By

MD. AREEF	**(1GV13ME034)**
MOHAMED ZAHEERUDDIN	**(1GV13ME036)**
MUZAMMIL AHMED	**(1GV13ME038)**

Under the Guidance of

Dr. P. D. SUDERSANAN

Professor & HOD

Department of Mechanical Engineering

Dr. TTIT

DEPARTMENT OF MECHANICAL ENGINEERING

Dr. T.THIMMAIAH INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

CERTIFICATE

This is to certify that the Project entitled **"FABRICATION OF FOUR-WAY HACKSAW MACHINE"** has been carried out by

MD. AREEF	**(1GV13ME034)**
MOHAMED ZAHEERUDDIN	**(1GV13ME036)**
MUZAMMIL AHMED	**(1GV13ME038)**

the students of **Dr. T.THIMMAIAH INSTITUTE OF TECHNOLOGY** in partial fulfillment for the award of **Bachelor of Engineering** in **Mechanical Engineering** of the Visvesvaraya Technological University, Belgaum during the year **2016-2017**. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

Guide	Head of The Department	Principal
Dr. P.D. Sudersanan	Dr. P.D. Sudersanan	Dr. Syed Ariff

Name of the External Viva Examiners	Signature with Date
1. GOPALA GOWDA HK	1.
2. Dr. P.D. Sudersanan	2.

ACKNOWLEDGEMENT

I express my sincere gratitude to the following people and acknowledge them for having helped us in completing the project successfully.

With warm hearts and immense pleasure I first thank the ALMIGHTY for his grace and blessings, which drove me to the success and pray for the showers all through my life.

I would like to express my deep gratitude to **Dr. T. THIMMAIAH INSTITUTE OF TECHNOLOGY** for providing excellent infrastructure for the successful completion of this project.

I am very much thankful to **Dr. SYED ARIFF, Principal, Dr. T. THIMMAIAH INSTITUTE OF TECHNOLOGY,** for providing support for all project related activities.

I sincerely thank by heart and soul to my guide **Dr. P. D. SUDERSANAN, Head of the Department, Mechanical Engineering, Dr. TTIT,** for his guidance, valuable advice, support and constructive suggestions that were useful in building the project work.

I would like to thank project, coordinator **Mr. Kiran Divakaran, Dept. of Mechanical Engineering, Dr. TTIT** whose timely support and suggestions went a long way in the completion of project.

I would like to thank all the teaching and non-teaching Staff of **Department, Mechanical Engineering, Dr. T. THIMMAIAH INSTITUTE OF TECHNOLOGY** for their constant support and of course, nothing could have come true without the support and cheerful encouragement of our parents and friends.

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ABSTRACT

In this project work an effort has been made to develop a modernized four-way hacksaw machine and less stress full operation for cutting wood, metal and plastic material. The aim of this work is to develop a hacksaw machine that will use a less effort to produce uniform cutting of PVC pipes, metals and wood. This model implies a conversion of rotary motion of crank to reciprocating motion of hacksaw blades, which is done by using Scotch Yoke Mechanism. This motion is used for hacksaw machine and in this model, we can operate four hacksaws at same time.

This model will overcome the traditional hacksaw machine which does material cutting of a single piece at particular times by cutting more material and leads to mass production. This machine works significantly with minimum vibration and jerks. Hence the proposed model of hacksaw machines will be welcomed by many industries due to compactness and efficiency and affordable price.

This project is about cutting the wood, metal, pipe, angle, channel, flat plates, rods and such other things. Due to its versatile features, it will be very useful to industries.

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CHAPTER 1

INTRODUCTION

1.1 General

There are many industrial applications where round bar or square bars are required to be operated on different machines to make machine components such as Shafts, Bolts, and Screws etc. This needs more and more number of pieces to be cut for mass production of those components. Four-way hacksaw blade machine is basically a cutting device, which cut in four directions at a same time .A hacksaw is a fine –toothed saw, originally and principally for cutting metal. They can also cut various other materials, such as plastic, wood and steel etc.

This paper proposes the prototype model of four-way hacksaw machine which can cut four pieces simultaneously without any jerk and minimum vibrations. The prototype model implies conversion of rotary motion into the reciprocating motion for proper working of hacksaw. This prototype model overcomes the limitations of conventional hacksaw machines which can cut single piece at a time. It can cut metal bars of different materials at same time and will be helpful in many industries due its compatibility, reliability and efficiency.

In present condition, many electrically operated power hacksaw machines of different companies with different specifications are available for the use in shop floor. These machines are so precious that they can cut metal bars with minimum time made up of different materials but they have one and major disadvantage that those can cut single piece of bar at a time. For industries to achieve the mass production, it is necessary to cut metal bars with high rate. So, it is impossible to depend upon conventional single frame power hacksaw machines and need the improvement in technology and design of such machines.

Four-way hacksaw machines over comes all the limitations and drawback of conventional hacksaw machines. It is also helpful for small scale industries due to its simple working and operating conditions along with its compatibility, efficiency and affordable price.

1.2 Scotch Yoke Mechanism

Scotch yoke is a mechanism for 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. The shape of the motion of the piston is a pure sine wave over time given a constant rotational speed.

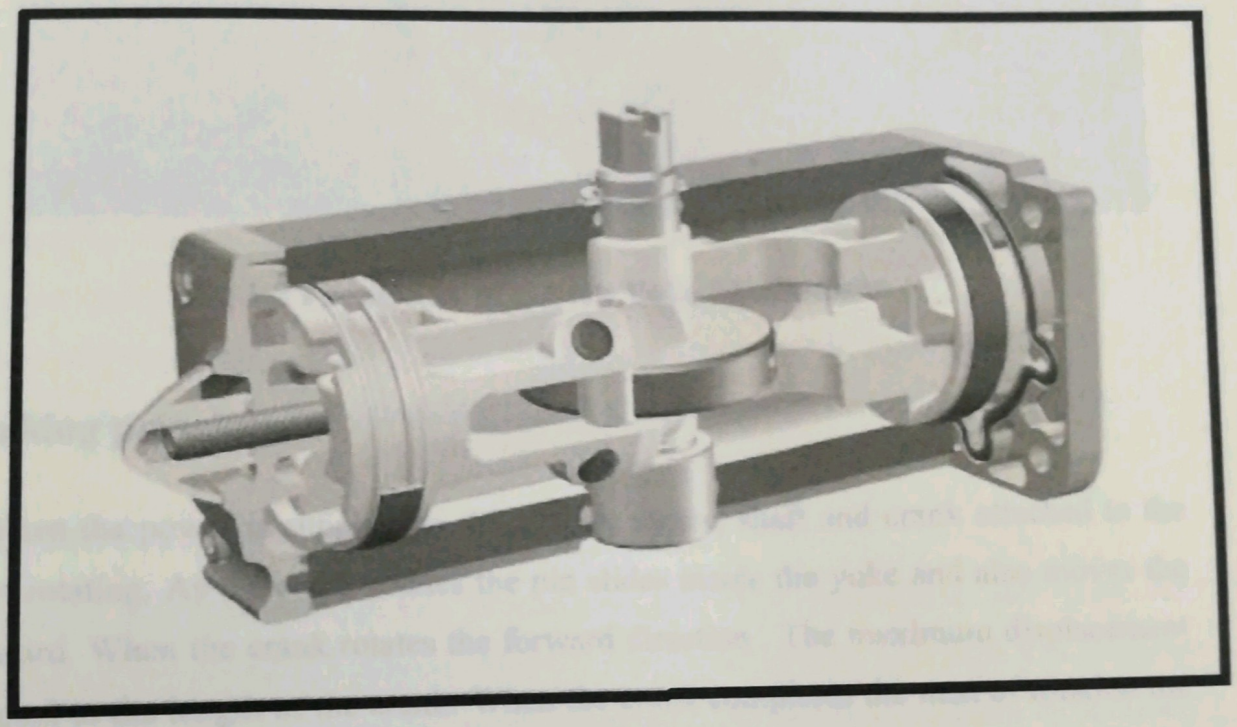


Fig1.1 Sectional view of Scotch yoke mechanism

1.3 Construction

The scotch yoke mechanism is constructed with iron bars. Here the crank is made in some length and the yoke is also made using the same material. It is noted that the minimum length of the yoke should be double the length of the crank. The crank and yoke is connected with a pin. Iron bars are welded to both sides of the yoke to get the reciprocating motion.

The yoke with the iron bars is fixed on the display board with the help of c clamp. Now the crank is welded to the end of the shaft of the motor. Now the pin on the crank is connected to the yoke. The pin used to connect yoke and crank is a bolt.

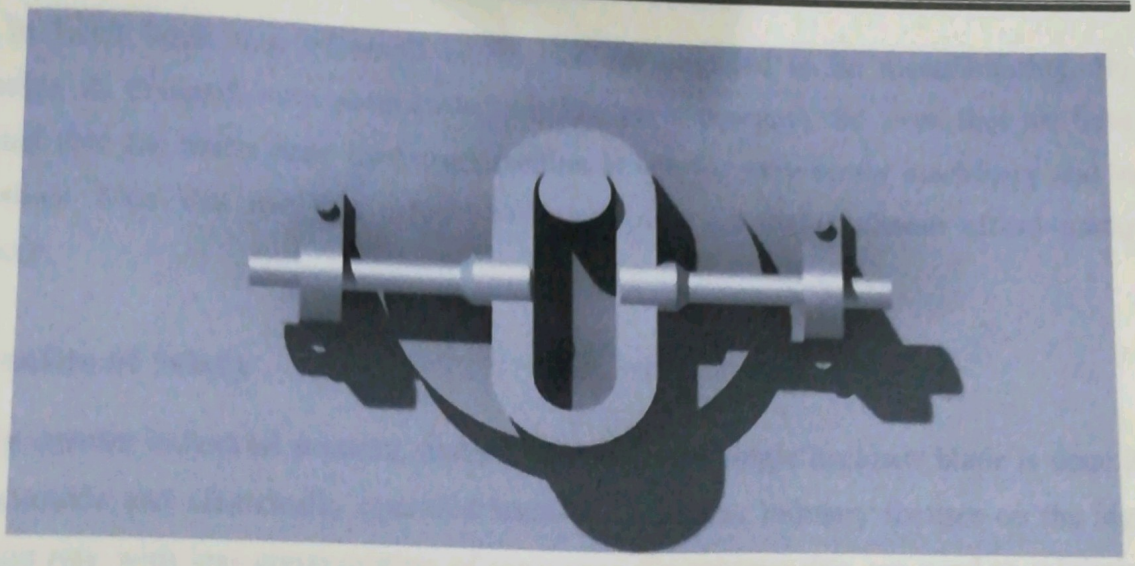


Fig 1.2 Front view of Scotch Yoke Mechanism

1.4 Working principle

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 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.

1.5 Motivation

When we search for our project in market we show the demand of hacksaw blade is considerably increasing day by day with the growth of industrialization, engineering sector, real estate, automobile sector etc.It is used in almost every sector for cutting of materials like angle, channel, flat plates, rods and such other things. It is also required in auto repairing shops, general repairing workshops, fitting shops, welding shops and technical institutes. Govt. department like Railway, Defense, PWD, Postal & Telegraph and others are one of the main users of it.

In India large nos. of small enterprises are engaged in its manufacturing. By considering its demand, new production unit has great prospect. So from that we have concluded that the future base hacksaw machine is use for very costly machinery and in locomotives. User can use this project in small industry, which cannot afford costly machinery.

1.6 Benefits of Study

In current industrial process, material cutting with single hacksaw blade is done in both pneumatic and electrically operated hacksaw machine. Industry focuses on the high production rate with less consumption of resources. To achieve this, we need to minimize idle time per unit. This four-way hacksaw machine those factor by reducing time per unit to increase the production. This work is design to overcome the stress attached to hand cutting of engineering material by turning it into less effort to produce uniform cutting.

1.7 Problem Statement

Present scenario of industry focuses on the high production rate with less consumption of resources. To achieve this, we need to minimize idle time and machine time per unit. The four-way hacksaw blade machine improves those factors by reducing time per unit to increase the production. In present situation, electrical as well as hydraulic operated machines are used but the output from them is not satisfactory as it has low cutting rate.

1.8 Aim and Objective of Model

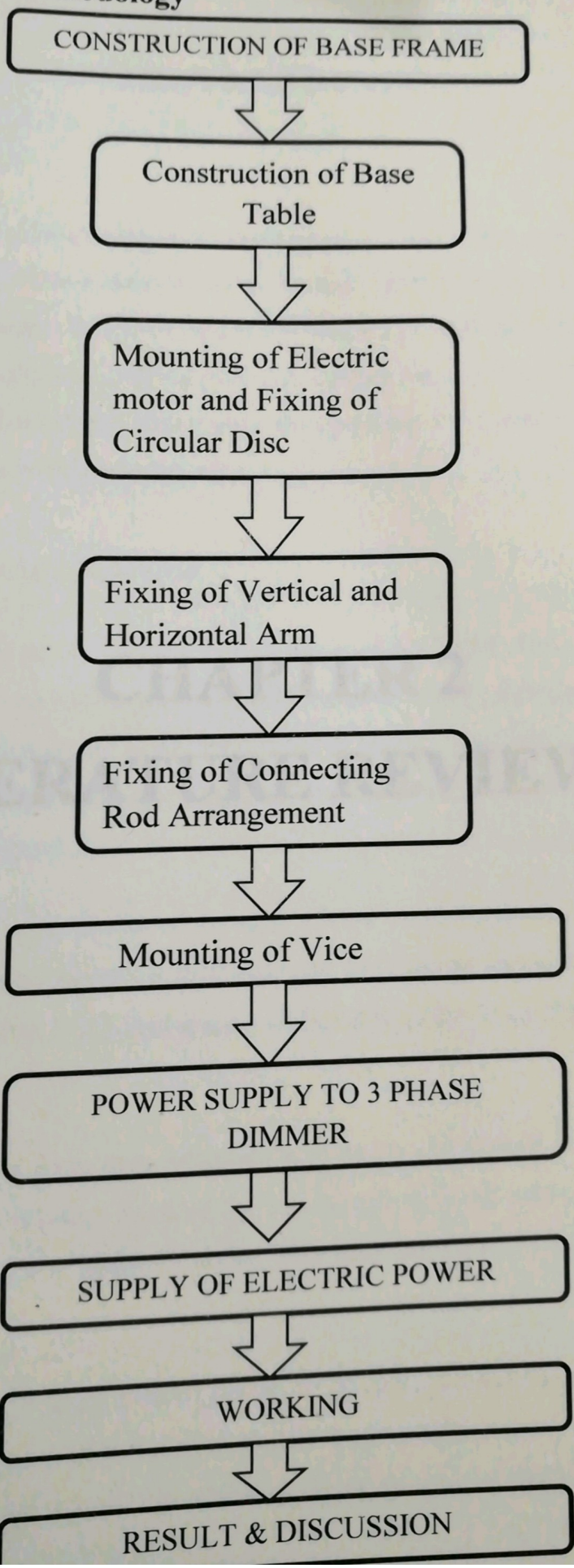
(1) .The main objective of this project is to reduce the human effort for machining various materials.

(2) The basic principles of power driven hacksaw or four-way hacksaw is Scotch Yoke Mechanism.

(3) The objective of this project is to save man power and time in cutting materials in order to achieve high productivity.

(4) By using scotch yoke Mechanism, we can operate four hacksaw at same time

1.9 Approach and Methodology



CHAPTER 2
LITERATURE REVIEW

CHAPTER 2

LITERATURE REVIEW

2.1 General

After the study of many literatures about design, construction and working of four-way hacksaw machine, some of them describe the methodology of four-way hacksaw. Lots of factor have been consider for the design, construction and working of four-way hacksaw machine such as cutting speed, cutting material, cutting time ,power ,efficiency etc. So, lots of literatures have been found which gives the relevance information and methodology of constructing a four-way hacksaw machine.

2.2 History of Hacksaw Machine

The saw was one of the first great innovations of the Metal Age. It was developed with smelted copper, from which a blade could be cast. Many of the early copper saws have the general appearance of large meat-carving knives. Egyptian illustrations from about 1500 BC onward show the saw being used to rip boards, the timber being lashed to a vertical post set into the ground.

Though there is no evidence of the type of saw used, Egyptians were able to saw hard stone. The blade, was probably toothless, and rode on an abrasive material such as moistened quartz sand. The 7 1/2-foot granite coffer still in the Great Pyramid carries saw marks.

During the Bronze Age, saws became much more widespread in woodworking. It was in this time that the modern form of the saw began to come into play. Some of the saws used resembled hacksaw blades of today. Iron saws started to be produces in the mid-7th century BC.

The Romans, added many improvements to simple says which made them easier to work with. For example, they added a rib to the back of saws to reduce the buckling of the thin blade. Hacksaws today use similar ribs to those on the ancient Roman saws.

While saws for cutting metal had been in used for many years, significant improvements in longevity and efficiency were made in the 1880s by George N. Clemson, a founder of Clemson Bros., Inc. of Middletown, New York, USA, Clemson conducted tests which involved changing the dimensions, shapes of teeth, styles of set, and variable heat treatments of blades.

Clemson claimed enormous improvements to the cutting ability of blades and built a major industrial operation manufacturing hacksaw blades sold under the trade name Star Hack Saw. In 1898, Clemson was granted US Patent 601947, which details various improvements in the hacksaw.

2.3 Theoretical Analysis of Multi-Way Hacksaw Machine

K. Prashant, et al. (2015) explained in their paper that, there are many electrically operated power hacksaw machines of different configurations and different manufacturers are available for the use in machine shop. These machines can cut rods of different material precisely at very fast rate but they can cut rods of one material at a time which means they can't able to cut dissimilar material at a same time. Now in industry, it is necessary to cut metal bars with very high rate to achieve mass production requirements. So, there is need to move for a new technology which gives us a mass production with less time and less energy input. It is impossible to depend upon conventional hacksaw machine.

This study gives guidelines about selection of material for our model in present situation the hydraulically and electrically operated hack saw machines are available but these are required more input as compared to output i.e. it does not give satisfactory output. Also, it can be able to cut only one component at a time a machine cuts four rods at a time gives improved productivity. As PDH uses a slider crank mechanism but we are going to use eccentric cam for obtain reciprocating motion.

2.4 Material selection and testing of hacksaw blade based on mechanical properties

Nitinchandra R. Patel, et al. (2013) explained in his research paper "Material selection and testing of hacksaw blade based on mechanical properties" stated that to obtain better operation, appropriate blade must be selected. To obtain fine cutting selection

of teeth per inches of blade is important. There are four types of blades in the market which are based on the material namely Alloy steel blade, high speed steel blade, high carbon steel blade and alloy steel blade. The best suitable blade out of these four is bimetallic blade on the basis of wear resistance cutting performance and properties of material.

2.5 Selection of Material for Hacksaw Blade using AHP-PROMETHEE Approach

- **H G Chothani**, et al. (2015) explained, in Mechanical Workshop/Technical institute, designer always faces the difficulties to select the perfect hack saw blade material for use of trainee as well as students to avoid accidents and reduce failure rates of blade.

There are number of methods are available for selection of best suited material for design. Out of two or more material on basis of selection parameters like speed, feed and work piece material.

Finally, paper stated that bimetallic material for blade is most suitable. In this paper, Preference Ranking Methods for Evaluations and analytic hierarchy process method are applied to rank out the material of hacksaw blade among of five materials.

2.6 Selection of cutting fluids in machining processes

- **O. Cakir**, et. al. (2007) explained in his research paper in a machining operation high temperature in a cutting tool results due to friction between work piece and cutting tool and cutting tool chip interface. There are some effects of this generated heat which are higher surface roughness, shorter tool life and lower the dimensional sensitiveness of the work material. This result is more important when there is need to machining harder material which are difficult to cut due to high heat production.

There are different methods of protecting cutting tool from heat generation during machining operation. One of the alternative is to select the coated which is expensive an only suitable for machining of material like heat resistance alloy, titanium alloy etc. apply the cutting fluid on tool and work piece while machining is another approach.

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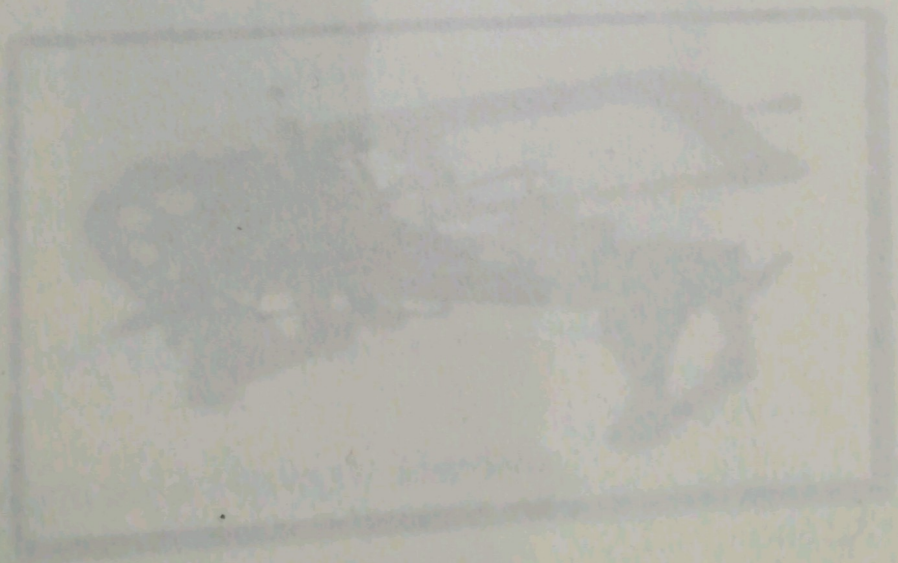
Which can provide cooling effects and lubrication between cutting tool and work piece and chip during machining operation .

Hence effect of generated heat on cutting tool and work piece can be eliminated fully or partially. Use of cutting fluid gives advantages like easy chip flow, longer tool life and highest machining quality in machining process.

It is required to select the cutting fluid by considering various parameters so that to get optimum result in machining process. The parameters to be considered are as cutting tool material, work piece material and method of machining process.

CHAPTER 3
HACKSAW MACHINE



CHAPTER 3

HACKSAW MACHINE

3.1 Types of Hacksaw Machine

(1) Light duty hacksaw machine.
(2) Hydraulic hacksaw machine.
(3) Power hacksaw machine.
(4) Circular band hacksaw machine.
(5) Horizontal swing type band saw machine.
(6) Band hacksaw machine.
(7) Jigsaw machine.
(8) Universal type circular hacksaw machine.
(9) Double column band saw machine.
(10) Chain saw circular machine.

3.1.1 Light duty hacksaw machine

Your quest for finest quality hydraulic hacksaw machine ends with us. We are recognized as one of the chief power hacksaw machine manufacturers of India. The hacksaw machine manufactured by us is used at length in number of industries.

Fig 3.1.1 Light duty hacksaw machine

Features of Light Duty Hacksaw Machine

(1) A quality 'Self-Centering Vice' with perfect grip.
(2) Gear and hydraulic are oil submerged.
(3) Full function coolant pump with fitting.
(4) Rigid and heavy M.S. fabricated body.

3.1.2 Hydraulic Hacksaw Machine

We supply a huge collection of precisely-engineered hydraulic hacksaw machine which is very effective in performing a series of cutting operations in workshops with its easy automation.

Acclaimed among the established hacksaw machine suppliers, we offer these machines in different cutting capacities, sizes, models etc. As per the needs and specifications of our end customers.

Fig 3.1.2 Hydraulic hacksaw machine

Features of Hydraulic Hacksaw Machine

(1) High productivity.

3.1.3 Power Hacksaw Machine

Power hacksaw machine fabricated by us is precision engineered so as to meet themodern demands of several industries. Due to their smooth & swift functioning ability they are able to operate in a spontaneous way which aids the worker in consistently carrying his work with ultimate efficiency.

Fig 3.1.3 Power hacksaw machine

Features of Power Hacksaw Machine

(1) Fine cutting.
(2) Longer service life.
(3) Self lubrication.
(4) Infinitely variable feed rate.
(5) Cutting arm of high tension bearing capacity.

3.1.4 Circular Band Saw Hacksaw Machine

Supreme efficiency and long term durability are blended in Circular Band Saw Machine provided by us. Being durable and rendering unparalleled service, band saw machine manufactured by us is gaining lot of popularity in appreciation of customer's requirement. We offer circular band saw machines in varied sizes ranging from 10' to 14'.

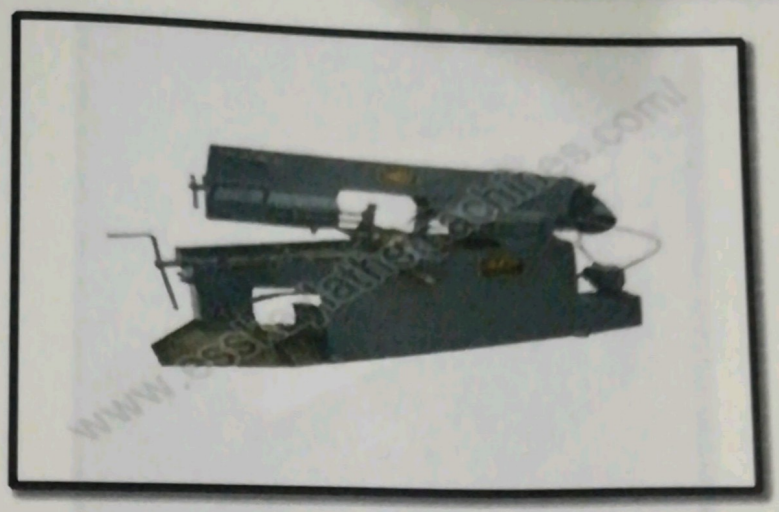


Fig 3.1.4 Circular band saw hacksaw machine

Types of Band Saw Machines

(1) Double column construction horizontal band saw machines.

(2) Vertical Band Saw Machines.

(3) Circular Sawing Machines.

Features of Circular Band Saw Hacksaw Machine

(1) LM Guide way 1000 meter length.

(2) Ball screw.

(3) Servo motor.

(4) S.S. Fabricator safety cover.

(5) Harden plate for griping the job.

3.1.5 Horizontal Swing Type Band saw Machine

Horizontal swing type band saw is manufactured by us in integral front and rear bed design. The entire assortment of these machines has large cross section of swing frame and ensures high speed productivity. All these horizontal swing type band saw machines are widely demanded in engineering industries for various cutting applications.

Fig 3.1.5 Horizontal sawing type band saw hacksaw machine

Features of Horizontal Swing Type Band saw Machine

(1) High speed.

(2) Heavy duty.

(3) High productivity.

(4) Integral front & rear bed design.

(5) Large cross section of swing frame.

3.1.6 Band Hacksaw Machine

A Band saw is a saw with a long, sharp blade consisting of continuous band of toothed metal stretched between two or more wheels to cut material. They are used principally in wood working, metal working and lumbering, but may cut a variety of materials.

Very useful for preparing specimen of big size in anatomy and meat departments. Fitted with large moving table and extension table operated on four ball-bearing rollers.

Used extensively in the meat packing, and wholesale fish industry, for handling swordfish and large halibuts etc.

Fig 3.1.6 Band hacksaw machine

Features of Band Hacksaw Machine

(1) Cast iron table with turn-on system.

(2) Tool holder for easy handling of tools.

(3) Enclosed cabinet support for storage of extra blades.

(4) Adjustable blade guide bearings.

(5) Heavy-duty fence with resaw bar and others.

3.1.7 Jigsaw Machine

The top maker of jig saws is Skill, A jig saw is both versatile and very safe to use. Ajigsaw combines the functions of band saw, a router, circular saw, and a scroll saw into one portable tool.

There are both corded jig saws and cordless jig saws - each offering its advantagesand disadvantages.

The corded jig saws are extremely convenient in remote areas and are best suited to cut wood and wood products. They are available from 12 to 18 volts and higher voltage equates to a battery that lasts longer.

Fig 3.1.7 Jigsaw machine

Features of Jigsaw Machine

(1) Sturdy model and Vibration free.

(2) Graded heavy duty casting body.

(3) Totally dust proof oil immersed.

(4) Gear box and main parts made of alloy steel.

(5) Easy & smooth trouble free operation.

3.1.8 Universal Type Circular Hacksaw Machine

Universal Type Circular Saw machines which are used for paneling, cutting or ripping lumber.

It is generally utilized in projects where fast straight cuts of respective precision are needed through heavier material.

This wonderful circular saw machine is available in two different ways which are automatic circular saw and semi-automatic circular saw.

Fig 3.1.8 Universal type circular hacksaw machine

Features of Universal Type Circular Hacksaw Machine

(1) Fast straight cuts of respective precision.

(2) It is also available in automatic circular saw and semi-automatic circular saw.

3.1.9 Double Column Band Saw Machine

Double Column Band Saw Machine is equipped with rigid chrome plated double column, separate electrical panel, infinitely variable feed with flow control valves and power driven wire brush. The range of band saw machine is hydraulically operated dual clamping system. Its application is used in engineering industry and construction industry.

Fig 3.1.9 Double column band saw machine

Features of Double Column Band Saw Machine

(1) Automatic height control.

(2) Power driven chip brush for chip removal.

(3) Manual band tension.

(4) Split front vice.

(5) Complete hydraulic.

(6) Length setting can be done.

(7) Complete electrical system integrated.

(8) Complete coolant system integrated.

3.1.10 Chain Saw Circular Machine

Available with us is an extensive range of Chain Saw Machines. Manufactured using high quality raw material, which facilitates fabrication of high quality products, our range is ideal for square whole operation.

Chain Saw Machines is specially designed for square hole in wood for doors and windows. This machine is used for mass production of square hole operation.

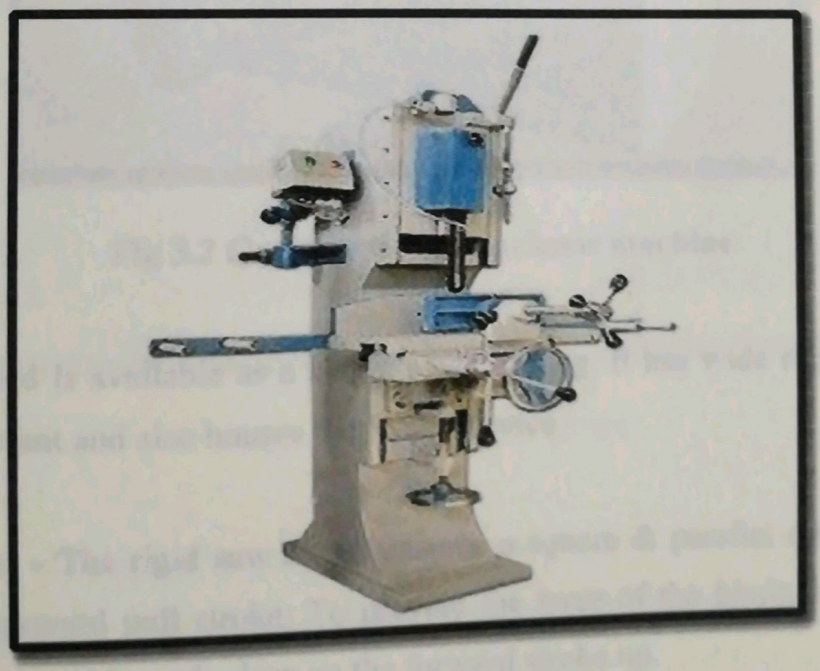


Fig 3.1.10 Chain saw circular machine

Features of Chain Saw Circular Machine

(1) Highly efficient.

(2) Easy to operate.

(3) Accurate dimension.

3.2 Construction of Hacksaw Machine

Hacksaw Machines offered by us are used for metal cutting ranging from transportable model to giant size machine. Owing to smooth & speedy functioning abilities, these hacksaw machines operations spontaneously for aiding the worker in consistently carrying his work with ultimate competence.

Fig 3.2 Construction of hacksaw machine

(a) Bed: -The bed is available as a single piece casting. It has wide rigid casting for the collection of coolant and also houses the V-belt device.

(b) Saw Frame: - The rigid saw frame ensures a square & parallel cut & the cut takes place on the backward pull stroke. To prevent the wear of the blade, it is hydraulically lifted out of contact with work place on the forward stroke up.

There are two type of saw frame:

- Solid frame
- Adjustable frame

(1) Solid Frame: - In this type, only one particular standard length of blade can be used with this frame.

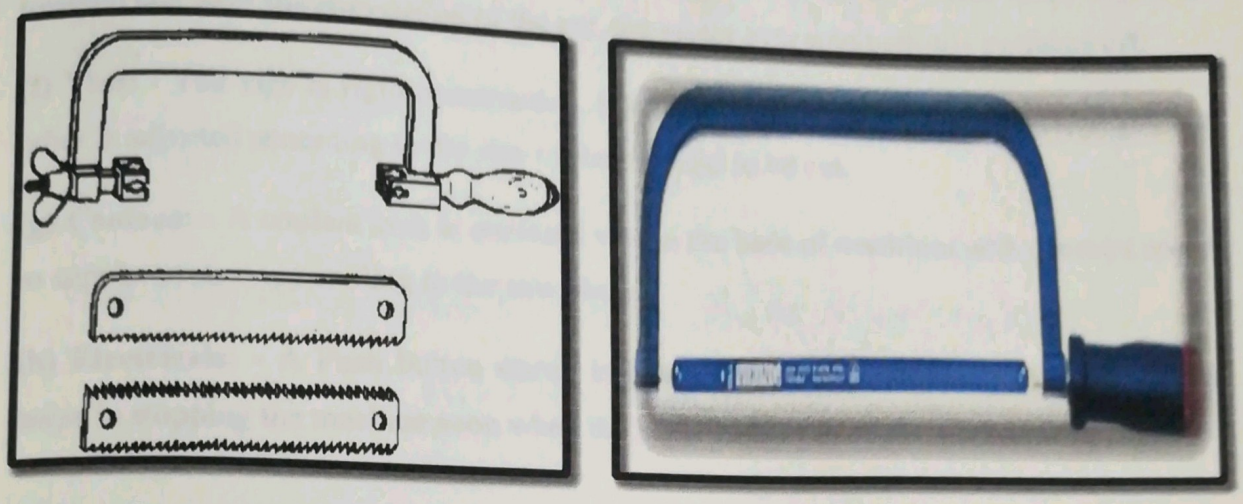


Fig 3.2.1 Solid frame

(2) Adjustable Frame: - In this type different standard lengths of blades can be fitted to this frame.

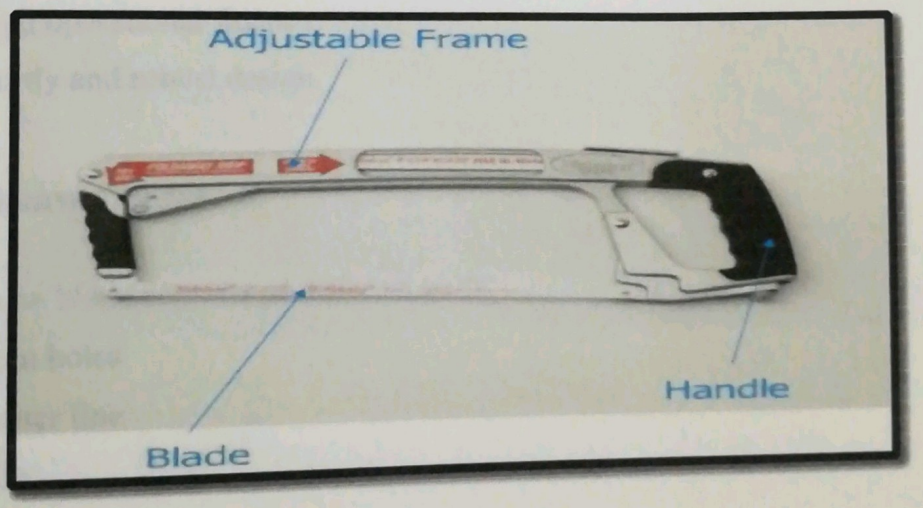


Fig 3.2.2 Adjustable frame

(c) The Drive: - The drive is attached through V-Pulleys with provision to adjust the complete tension of the V-Belts. The shafts are fitted with ball bearings and taper and ball bearings to eliminate friction.

(d) Speed: - Specific speeds have been provided for different kind of metals in order to make it suitable. high speed for metals like mild steel, brass, copper etc. and low speed for cast iron.

(e) Feed saw: - Two levers are provided to hydraulically control the Feed Saw at the dash-pot. One controls the rate of feed and the other enables the bow slide to be raised or lowered and after the completion of the cut, the motor gets automatically switched off.

(f) Vice: - The vice is rigid construction. It has two jaws, one jaw remains fixed and the other is adjusted according to the size of the material to be cut.

(g) Coolant: - A coolant tank is enclosed within the base of machines with constant speed to supply continuous cooling to the saw blade.

(h) Electricals: - A Push button starter is fitted with an adjustable trip mechanism that helps in stopping the machine soon when the blade is clear from the work at extra cost.

Features of Hacksaw Machine

- Power efficiency.
- High productivity.
- Superb performance.
- High operational fluency.
- Sturdy and robust design.

3.3 Hacksaw Blades

The hacksaw blade consists of different parts:

- 2 pin holes
- Center line
- Side
- Back edge

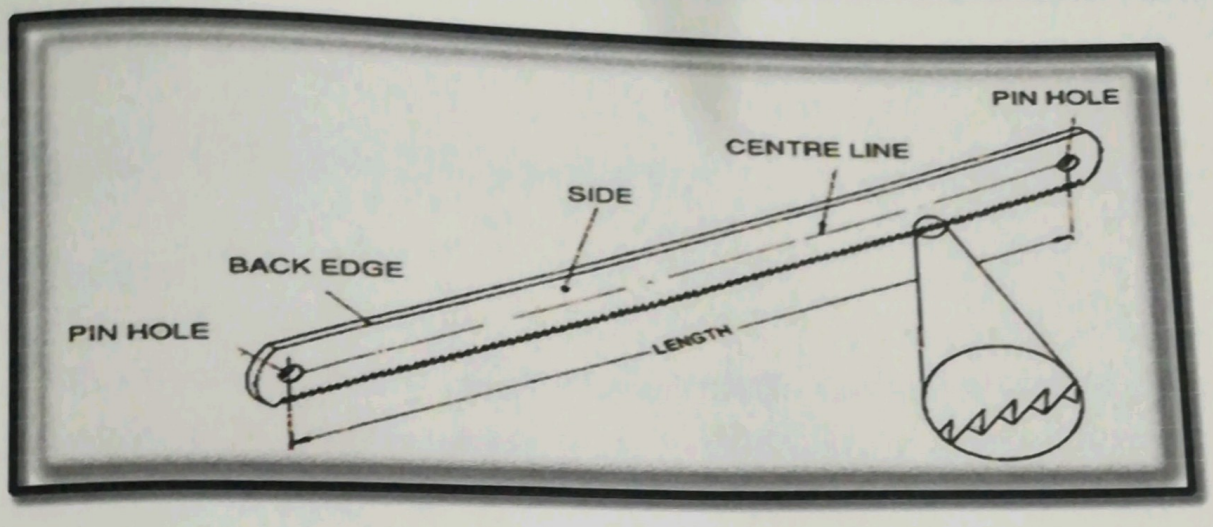


Fig 3.3 Hacksaw blade

3.3.1 Characteristics of Hacksaw Blade

The hacksaw blade has 2 main characteristics:

(1) Teeth pitch which is the number of teeth per 25 mm.

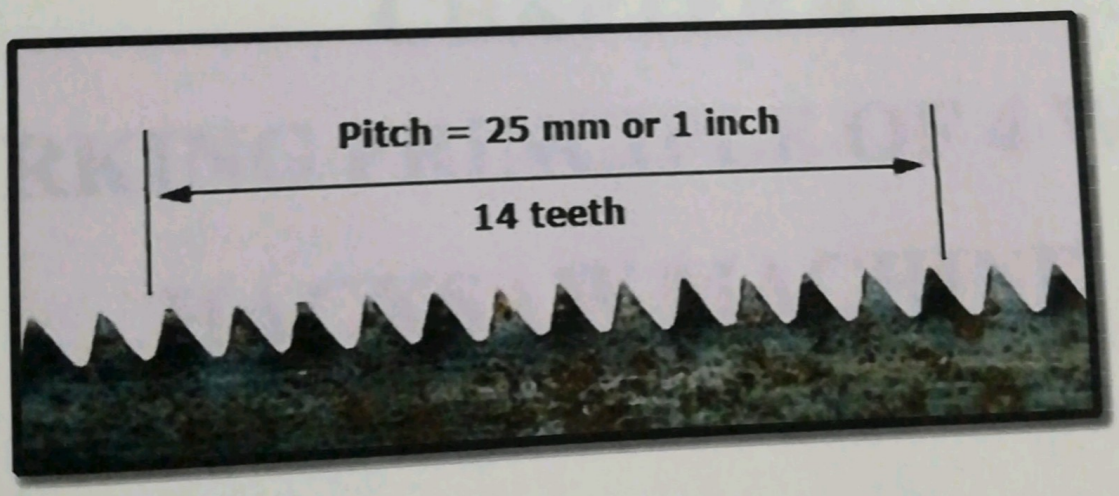
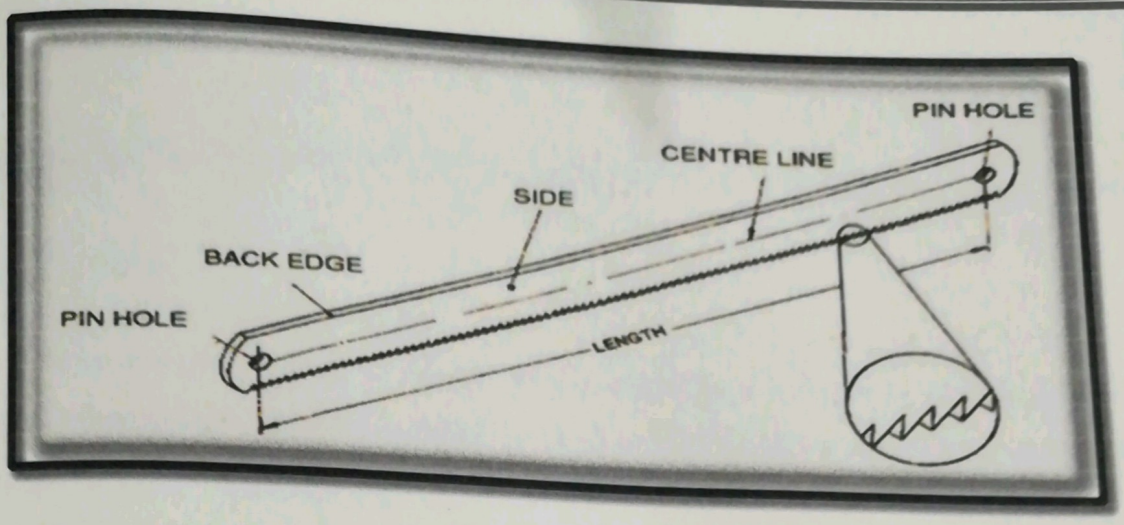


Fig 3.3.1 Teeth pitch

(2) Blade length which is the length between the centers of its pin holes.



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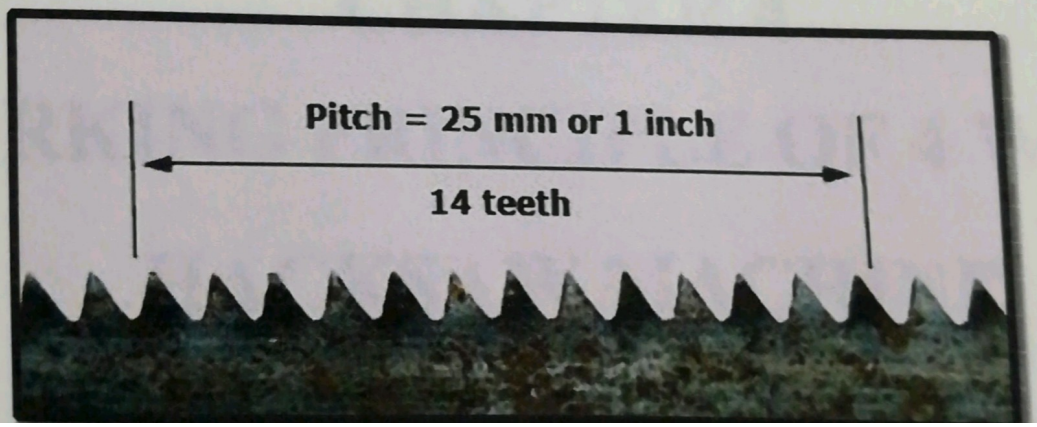


CHAPTER 4
WORKING PRINCIPLE OF 4 WAY HACKSAW MACHINE

CHAPTER 4

WORKING PRINCIPLE OF 4 WAY HACKSAW MACHINE

4.1 Working

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 center of the frame which is operated by a motor. The power to the motor is given with the help of transformer. 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 work pieces are cut simultaneously using the motor and the cam mechanism.

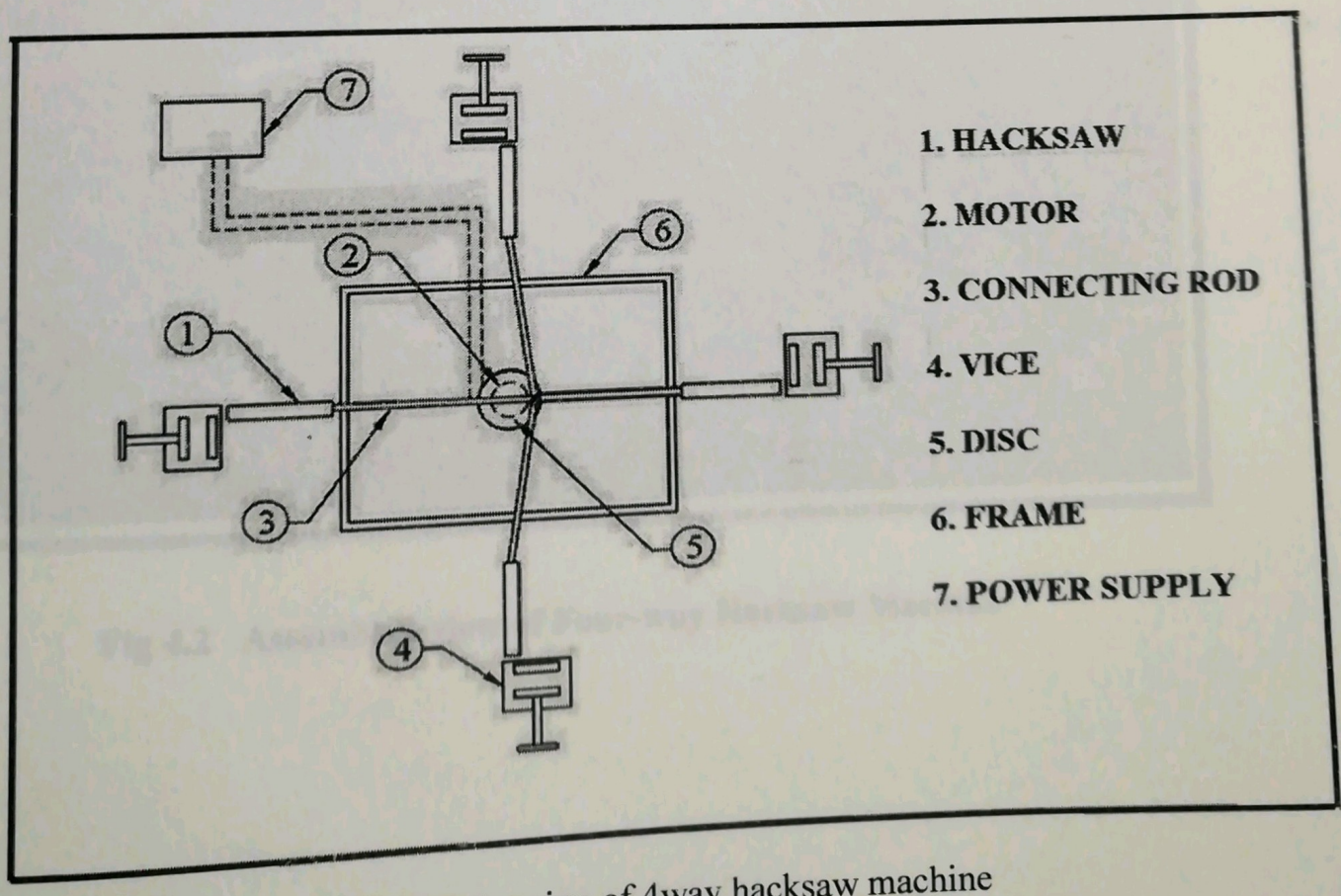


Fig-4.1- 2D drawing of 4way hacksaw machine

4.2 Assembly of 4 Way Hacksaw Machine

For assembly of 4 way hacksaw machine first of all on base plate electric motor is mount vertically, hollow disc having internal circle radius is same as the radius of shaft of motor is fit on shaft and also the disc have eccentric center, metal bar is weld at the eccentric center.The links one end is connect with the end of hacksaw frame and second end is connect with the metal bar of eccentric center.The buckle type elements are connect at the end of hacksaw frame and link is connect in this buckle, pipe provide support to the hacksaw frame, the pipe is connect to the base. Vice is also fit on pipe and which also connect with the base.

Fig 4.2 Assembled view of Four-way Hacksaw Machine

CHAPTER 5
COMPONENTS DETAILS

CHAPTER 5

COMPONENTS DETAILS

5.1 List of Components

No.	COMPONENTS	MATERIAL DETAILS	NOS
1	Hacksaw Blade	Bi-metallic	4
2	Hacksaw Frame	Mild Steel	4
3	Electric Motor	90 RPM	1
4	Connecting Rods	Mild Steel	4
5	Vice (Baby Vice)	Cast Iron	4
6	Disc	Mild Steel	1
7	Frame	Mild Sreel	1

5.2 Description of Components

(1) Hacksaw Frame

The main and very important of the project is hacksaw.A hacksaw is a fine-tooth saw with a blade under tension in a frame, used for cutting materials such as metal. Hand-held hacksaws consist of a metal frame with a handle, and pins for attaching a narrow disposable blade.

A screw or other mechanism is used to put the thin blade under tension. The blade is fit on hacksaw frame and this hacksaw is connect with the connecting rod (links) through a buckle type element. Hacksaw frame is adjustable type to fit the blade.

On Hacksaw, the blade can be mounted with the teeth facing towards or away from the handle resulting in cutting action on either the push or pull stroke.

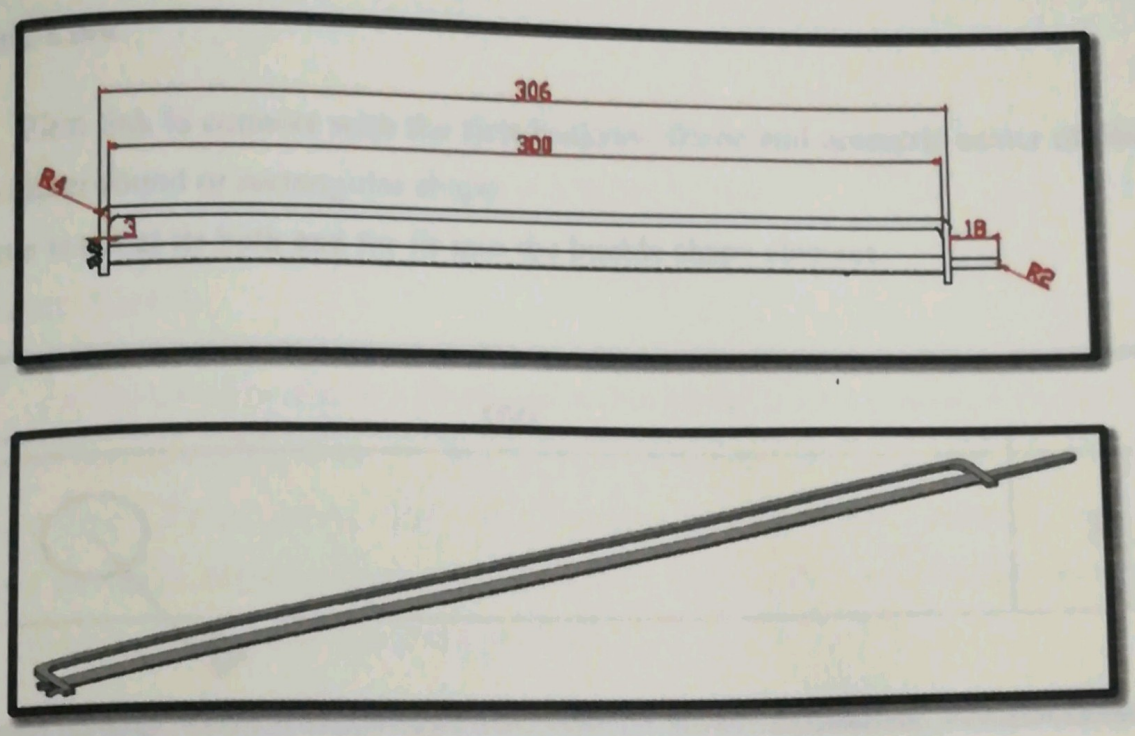


Fig 5.1 Hacksaw Frame

(2) Hacksaw Blade

Hacksaw blades (both hand & power hacksaw) are generally made up of carbon steel or high speed steel strip rolls. The blank of required size is obtained by fixing the strip rolls on the stand of semi-automatic strip cutting machine and punched a hole at their both ends. Then, teeth are being made on the blank by milling or hobbling process. Once teeth are being cut, the hacksaw blades are heat treated and tempered for the required hardness. The last step in the manufacturing process is surface cleaning, painting, printing and packing of the hacksaw blades for market supply.Blade is fit on frame the standard length of blade is 300 mm and its end radius is 3mm, its thickness is very small. One side of blade has cutting edge.

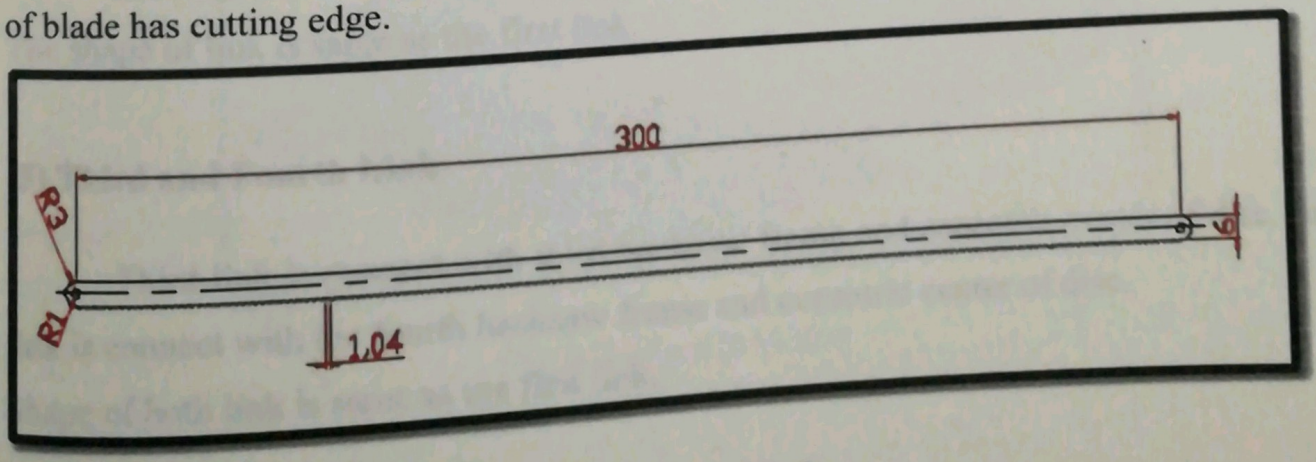


Fig 5.2 Hacksaw blade

(3) First Link

First link is connect with the first hacksaw frame and eccentric center of disc. The link is either round or rectangular shape.

The hole is cut at its both end for fit into the buckle shape element.

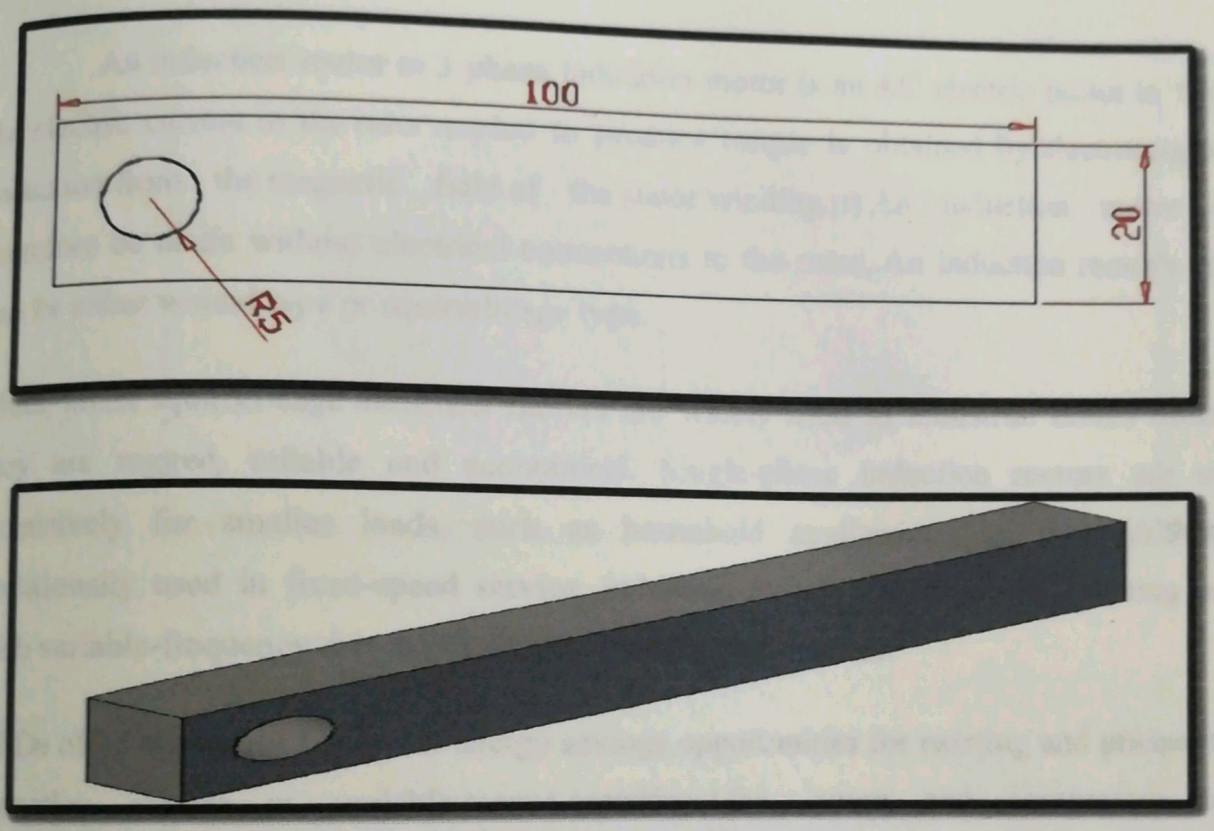


Fig 5.3 First, second, third, fourth and fifth link

(4) Second Link

Second link is connect with the second hacksaw frame and eccentric center of disc. The shape of link is same as the first link.

(5) Third and Fourth Link

Third link is connect with third hacksaw frame and eccentric center of disc, fourth link is connect with the fourth hacksaw frame and eccentric center of disc.

Shape of both link is same as the first link.

(6) Fifth Link

This is a fix link the eccentric center of disc is known as the fifth link, the shape of this link is cylinder type. It rotate with the rotation of disc.

(7) Electric Motor

An induction motor or 3 phase induction motor is an AC electric motor in which the electric current in the rotor needed to produce torque is obtained by electromagnetic induction from the magnetic field of the stator winding.[1] An induction motor can therefore be made without electrical connections to the rotor. An induction motor's rotor can be either wound type or squirrel-cage type.

Three-phase squirrel-cage induction motors are widely used in industrial drives because they are rugged, reliable and economical. Single-phase induction motors are used extensively for smaller loads, such as household appliances like fans. Although traditionally used in fixed-speed service, induction motors are increasingly being used with variable-frequency drives (VFDs) in variable-speed service.

VFDs offer especially important energy savings opportunities for existing and prospective induction motors in variable-torque centrifugal fan, pump and compressor load applications. Squirrel cage induction motors are very widely used in both fixed-speed and variable-frequency drive (VFD) applications

Fig 5.4 Electric motor

(8) Hollow Disc

Disc is fitted on the shaft of motor the internal diameter of disc is same as thediameter of shaft. The cylinder shape metal bar is fit on the eccentric center of disc this is known as the fifth and fix link.

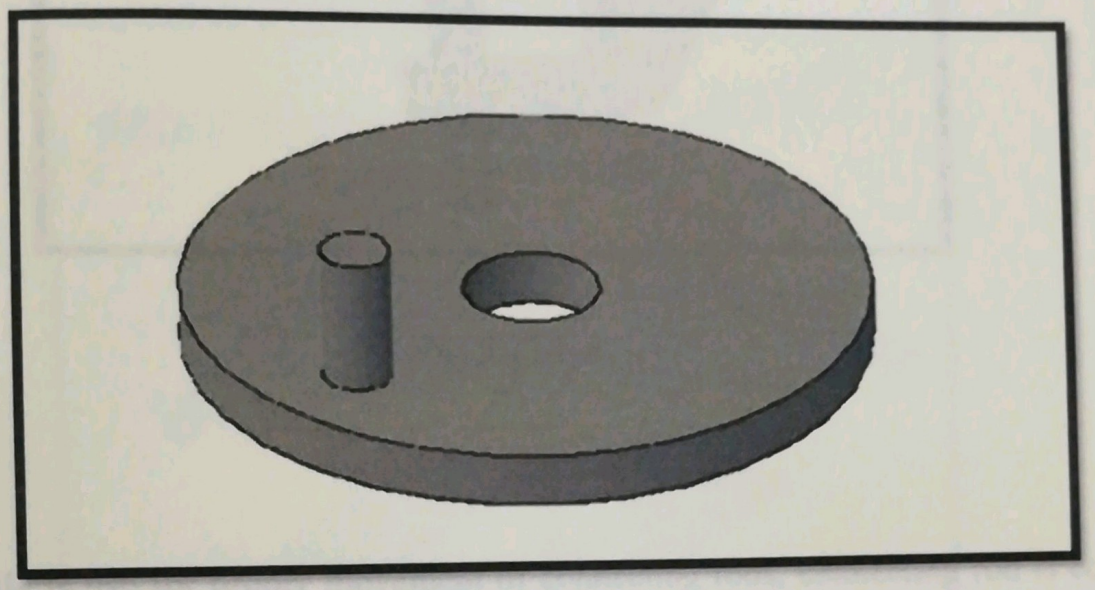


Fig 5.5 Hollow Disc

(9) Vice

Vice is a mechanical apparatus used to secure an object to allow work to be performed on it. Vices have two parallel jaws, one fixed and the other movable, threaded in and out by a screw and lever. Vices are of various types, we have used an engineer's vice, also known as a metalworking vice or fitter vice, is used to clamp metal. It is typically made of cast steel or malleable cast iron. Cheaper vices may be made of brittle cast iron.

The jaws are often separate and replaceable, usually engraved with serrated or diamond teeth. Soft jaw covers made of aluminium, lead, or plastic may be used to protect delicate work. An engineer's vice is bolted onto the top surface of a workbench, with the face of the fixed jaws just forward of its front edge. The vice may include other features such as a small anvil on the back of its body.

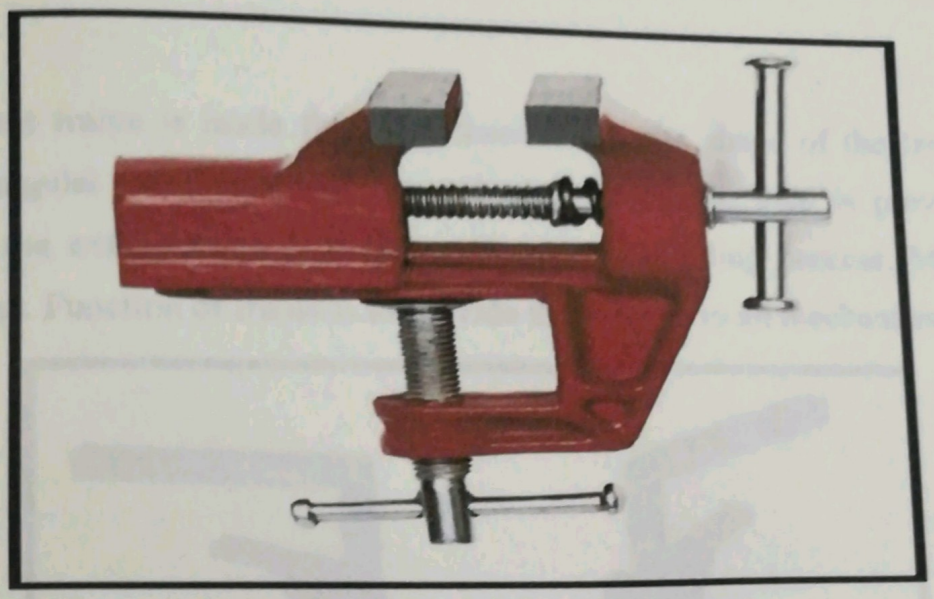


Fig 5.6 Vice

(10) Buckle

Buckle is use for proper movement of connecting rods, connecting rod is connect withhacksaw frame through this buckle.

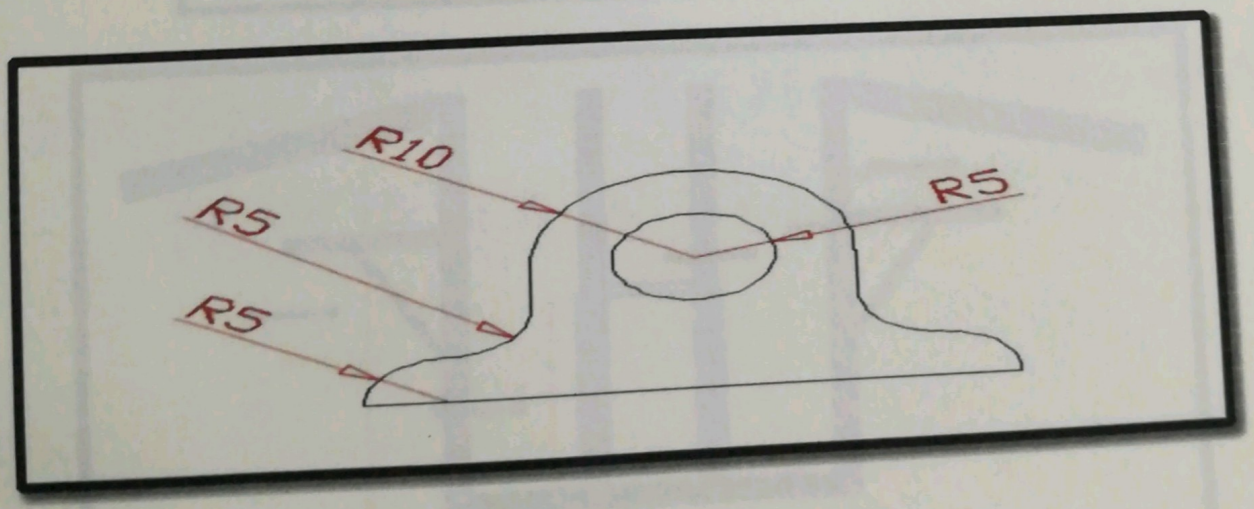
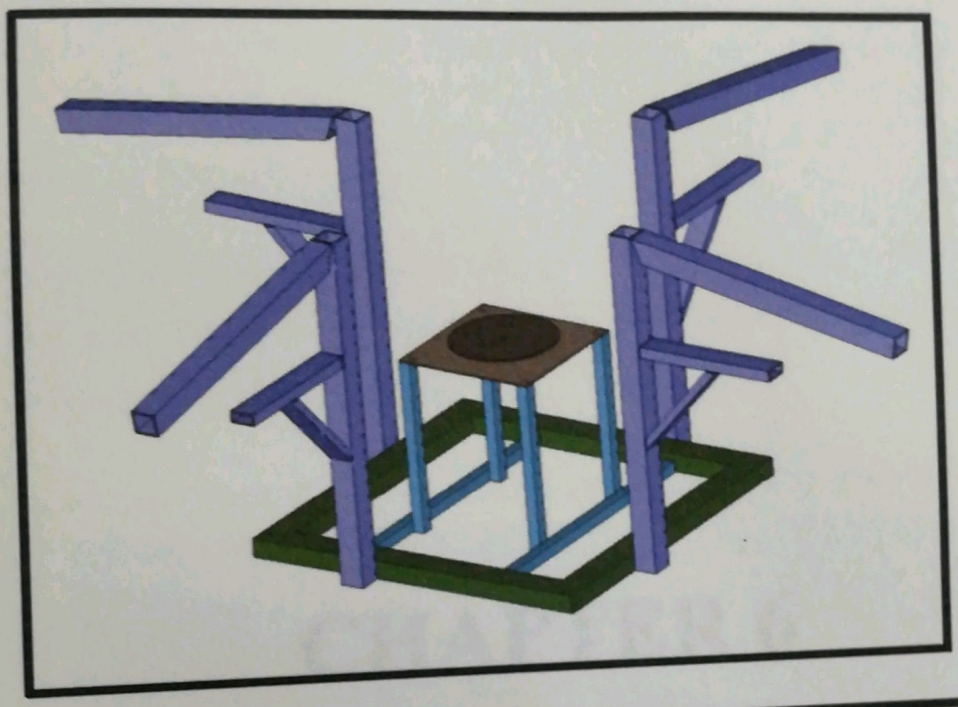


Fig 5.7 Buckle

(11) Frame

The base frame is made from the sheet metal, the shape of the frame is either squareor rectangular type, support pipe and pipe for fit the vice is provide the base framethrough the extension of pipe by application of welding process. Motor is fit at middle of frame. Function of frame is to provide the support to all mechanism.



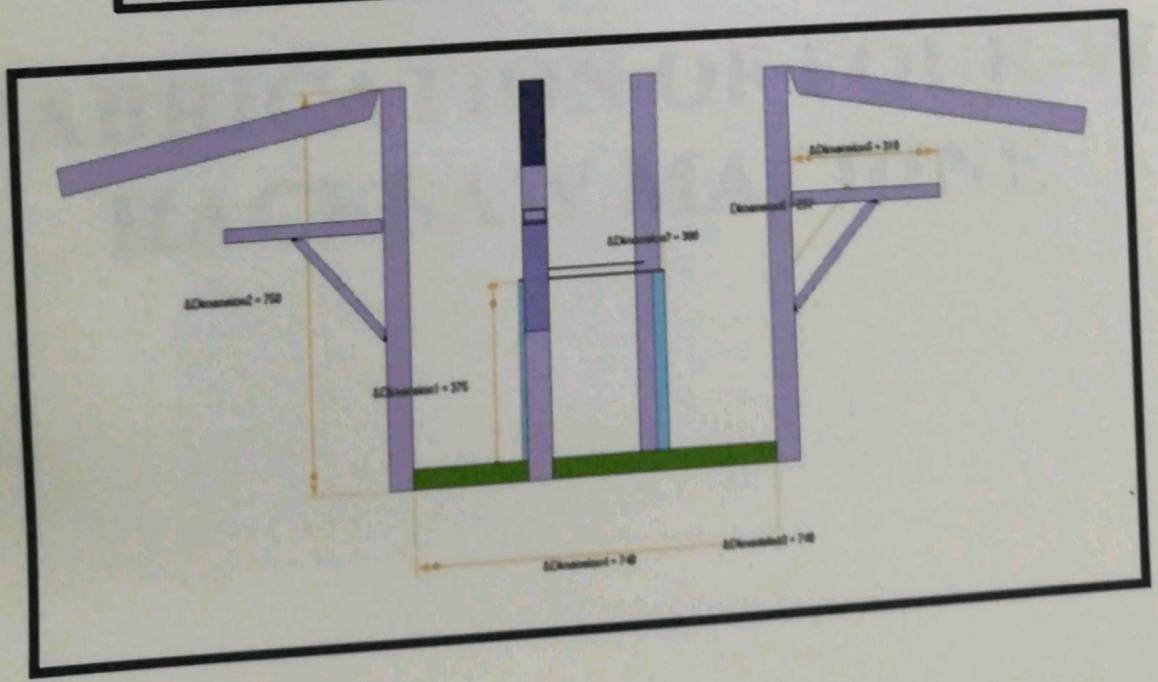


Fig 5.8 Frame and front view

CHAPTER 6

FABRICATION OF FOUR-WAY HACKSAW MACHINE

CHAPTER 6

FABRICATION OF FOUR-WAY HACKSAW MACHINE

Fabrication means providing a physical shape to the prepared model. Fabrication was mostly done using the metal parts. The base and the support structures were made using the parts made up of cast iron. The fabrication of each part are described as follows.

6.1 Construction of Base Frame

The base structure of machine is made up of mild steel. The structure is of square geometry and edge is of 740mm. The mild steel bars used here is hollow section, the cross section of this hollow bar is 60mm x 40mm.

Fig 6.1 Construction of Base Frame

6.2 Construction of Base Table

Material used for construction of base table is mild steel and has four longitudinal bars of square cross section, height of the table is 335mm from base frame and surface of table is square in shape with each side measuring 300mm. The table is welded to the two longitudinal bars at the center of the base frame using arc welding, hence this base frame with table gives the structural support to the motor and other parts of machine.

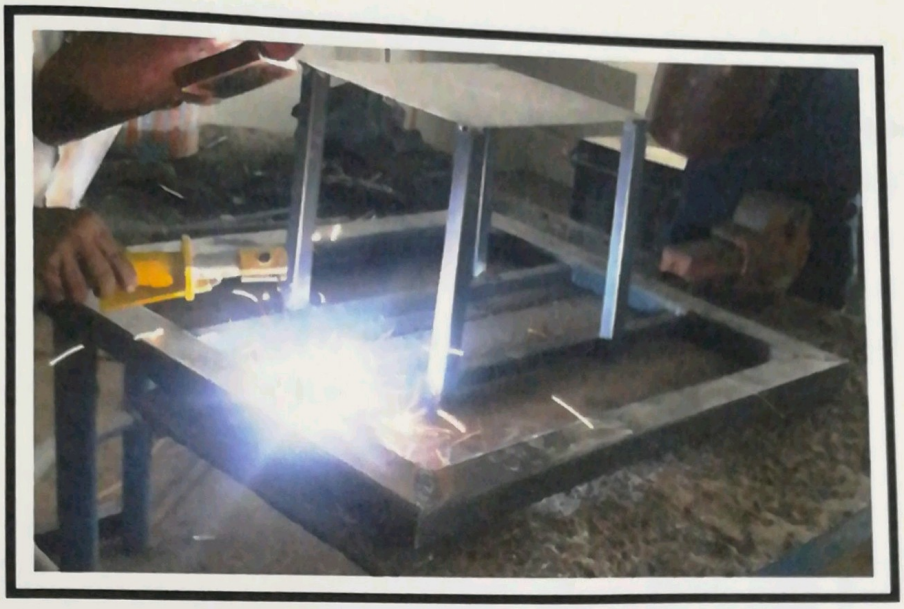


Fig 6.2 Construction of Base Table

6.3 Mounting of Electric motor and Fixing of Circular Disc

Circular hole **is** made at the center of the table surface, this hole is 3mm larger in diameter to shaft diameter of the motor, now the 3 phase Ac Induction motor of 1Hp which has 1430Rpm is Mounted beneath the base table, such that the shaft of the motor is exactly at the center of base table, and motor is held rigidly to the legs of the base table by nut and bolt arrangement. Circular disc of 230mm diameter is fixed at the center of the motor shaft above the base table, hole of 8mm is drilled at the circumference of the disc. From this hole nut and bolt is fixed which is used to connect hacksaw frame and connecting rod.

Fig.6.3 Mounting of Electric Motor

6.4 Fixing of Vertical and Horizontal Arm

Four Vertical arms are fixed by using metal arc welding at the four edges of the square base frame, these arms are of square cross section, and the length of each arm is of 750mm from the base. These vertical arms decides the total height of the machine and acts as a support to the vertical arm. Now the horizontal arm is attached to the Vertical arm by welding end surface Hinges to both the arms as shown in the figure and then the Hacksaw frame is attached to the horizontal arm as per the required dimensions.

Fig.6.4 Fixing of Horizontal Arm and Vertical Arm

6.5 Fixing of Connecting Rod Arrangement

Two holes of 8mm is drilled at the ends of four Connecting rods and corners are grinded. One end of the Connecting rod is fixed to the circumference of the disc by nut and bolt arrangement and hole at the other end of Connecting rod is attached to the Hacksaw frame with the Revit.

Fig.6.5 Fixing of Connecting rod

6.6 Mounting of Vice

Horizontal support is welded to the vertical arm at a height of 280mm from the base frame. Now the vice is mounted at the end of horizontal support and below to the hacksaw frame, hence this vice holds the work piece. The jaw opening of this vice is of 40mm and 70 in length.

Fig.6.6 Mounting of Bench Vice To The Base Table

CHAPTER 7
ADVANTAGES, DISADVANTAGES AND APPLICATIONS

CHAPTER 7

ADVANTAGES, DISADVANTAGES AND APPLICATIONS

7.1 ADVANTAGES

- The components used for the fabrication are easily available.
- Simple in construction.
- Easy to fabricate.
- Repairing and replacing is not a challenging task.
- Speed can be varied for cutting different materials.
- Machine is portable.
- Weight of machine is less.
- It reduces the work of labor.
- High production rate.
- Cost is less.

7.2 DISADVANTAGES

- Must be handled with care.
- The loading and unloading of the work pieces must be done manually.

7.3 APPLICATIONS

- Small scale industries.
- All manufacturing plants.
- Highly suitable for production industries and workshops.

CHAPTER 8
RESULT AND DISCUSSION

CHAPTER 8

RESULT AND DISCUSSION

Machine is driven by3 phase Ac Induction motor of 1Hp which has 1430Rpm. Test was carried out on machine using different metal. For the loaded test, a pipe of diameter 25 mm and length 12 inch and the material of the shaft was Polyvinyl Chloride (PVC) was clamped on the vice of the machine. It took the machine 8 seconds to cut the with a new hacksaw blade.

The cut was observed to be neat and straight. The total cost of producing the machine was estimated to be Rs16, 836. Suggestion have been made on overall machine performance optimization and further work on the machine

CHAPTER 9
CONCLUSION

CHAPTER 9

CONCLUSION

On the above discussion, we conclude that the purposed machine will aim in the limitations of single piece cutting of material at the instant of time by introducing four way cutting of material simultaneously. It is so compact that will be occupy less space, cost effective & usable in mini and large industries. As in cutting it take less time of cutting per unit of work piece, so machine idle time is also reduced which also encounters on improved efficiency. It also works on minimizing vibrations and jerks produced during cutting operation.

CHAPTER 10
FUTURE SCOPE

CHAPTER 10

FUTURE SCOPE

- By increasing the motor power and dimensions of eccentric cam the size of material to be cut can be increased.
- By using limit switches or sensors Automatic feeding mechanism for material can be introduced.
- Automatic lifting up mechanism for frame when cutting operation can be by using hydraulic piston and cylinder.

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