# AUTOMATED PORTABLE HAMMERING MACHINE

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***Abstract:****Hammering is the most widely used industrial as well as construction activity. Hammering of metal sheets, fit parts requires a lot of time and effort. So here we proposed an automated portable hammering machine. This allows for accurate, fast and automated hammering wherever and whenever needed using a 12V battery. The person just needs to work piece and start the hammering machine. We here use a dc motor in order to move the hammer. The DC motor of a pulley attached to it which is connected to a larger pulley for an efficient power transfer and to increase torque. This large pulley is connected to a shaft that has a connecting rod through a mid-swinging arrangement in order to achieve it. This rod is to achieve lateral motion from the spinning shaft desired hammer motion with enough used torque.*

**Key words: dc motor, 12v battery, belt, pulley, hammer, paper cutting machine, manufacturing**

## 1.1 INTRODUCTION

Very often a hammer is a tool or device described that as delivery a blow such as sudden impact for an object. Generally, hammers are hand tools to drives nails, forging metal purposes, to fit part objects etc.

Automated portable hammering machine is one of the new techniques we proposed in order to achieve instant hammering, accurate repetition and impacting, fast hammering process. In the past, a labour used hammer for to drive nails, to fit parts, to break parts and more. It would be manually less effective and usage of man power in break parts and more. It would be manually less effective and usage of man power in process.

But, now - a – days it is possible to make the process easy by automatic hammering machine. There are very clear benefits for industrial and construction activity while using automated systems. Automated portable hammering machine can be considered as the back bone of any hammering operations in mass productions. Hammering machine is utilized as a part of material extending from instruments, moulding of metals and so fourth. The present development is identified with metal squeezing and forming machines including outstanding records of drive nails, forge metals etc. Hammering is the most utilized in mechanical operations and also development action.

This machine will perform accurate, fast and automated hammering whenever and wherever needed using a 12V battery. The person just needs to insert workpiece and start the hammering machine. The machine can be used for automatic hammering work as and when needed. Here you will use a dc motor in order to move the hammer. The DC motor consists of a pulley attached to it which is connected to a larger pulley for efficient power transfer to increase torque. This large pulley is connected to a shaft that has a connecting rod attached to it. This rod is used to achieve lateral motion from the spinning shaft. We now connect the other end of a hammer to this connecting rod through a mid-swinging arrangement in order to achieve desired hammer motion with enough torque. We now use a suitable bed where workpiece can be placed. The material you should used to build the frame of the machine is Mild steel. This is because it is the greatest material mankind has for construction. It is cheap, strong, readily available, easily cut, joined, and formed.

## 1.1 PROJECT DESCRIPTION

**1.1.1 DC motor** : A DC motor is one type of electric motor which converts direct current to electrical energy. Generally , it produces a higher RPM. We used a 100 RPM 12V DC motor to give motion to the hammer.

**Fig no 1.2.1 DC motor**

**1.2.2. Chain and sprocket :** The dc motor we used will produce higher rpm. But for hammering purpose we require high torque. To achieve this, we used chain an sprocket arrangement. A 14 tooth sprockets are used along with chain belt.

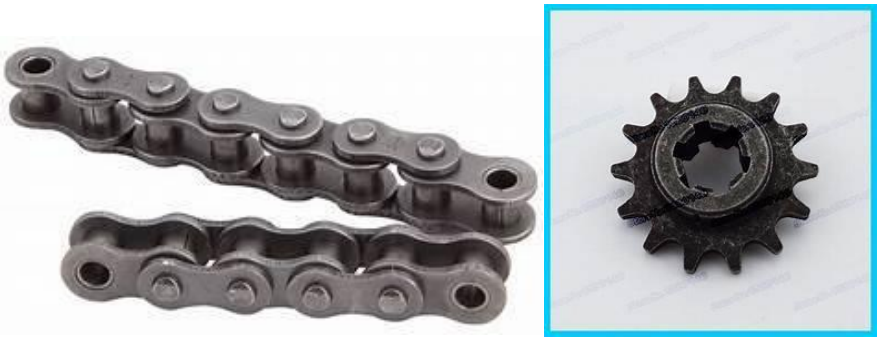


**Fig no 1.2.2 Chain and Sprocket**

**1.2.3. Cast Iron Rods :** We used cast iron rod for making the structure/frame of the machine. It gives support for entire parts involved and helps in arranging mountings and fixtures. It also observes the vibrations produced while hammering

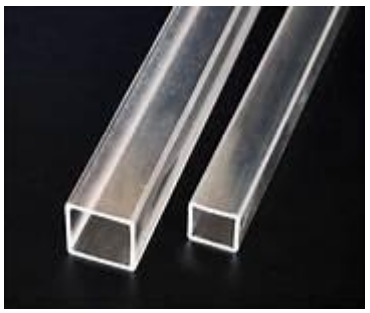


**Fig no 1.2.3 Cast Iron Rods**

**1.2.4. Cast Iron Plate:** We need a cast iron plate to use it as a pad for placing objects.

**Fig no 1.2.4 Cast Iron Plate**

**1.2.5. Coupling:** It is used to connect or to hold two identical shafts of same size. Here we used this coupling to connect motor shaft to extended shaft, to transmit the power evenly.

**Fig no 1.2.5 Coupling**

**1.2.6. Motor driven shaft:** A driven shaft is a mechanical part to transmit torque and revolution, typically used to associate different segments of a drive prepares that can be associated different straightforwardly as a result a separation or the need to take in to account relative development between them. The shaft is connected to eccentric disc and is transfers rotational motion from motor to hammer rod.

**Fig no 1.2.6 Motor Driven Shaft**

**1.2.7. Hammer:** In this project we have used hammer weight of 1kg for various operations such as punching, riveting, upset forging etc. these types of manufacturing operations in manufacturing industries.

**Fig no 1.2.7 Hammer**

## 1.2 OBJECTIVES OF PROJECT

Determination of impact velocity and torque force of hammer
To determine the time required for the various operations
Prepare the modelling of project on CATIA V5R20
Automation with minimum man power
Low initial and operating cost
As the time required in less useful in mass production

# MODELLING AND FABRICATION

## 2.1 INTRODUCTION TO CAD MODELLING

CAD modelling is used by many designers to create elaborate computerized model of objects. CAD is computer aided design. Engineers, architects, and even standard artists utilize computers to assist their design projects. Computers allow them to in visualize their designs and confront problems before they have expanded any of the resources necessary to put them in to physical from CAD modelling takes many different forms depending on the type of project. Some models are simple two dimensional representations of various views of an object. It is an important industrial art involved in automotive, aerospace, prosthetic and artistic designs. CAD modelling has a profound effect on the process's development. First a general idea must be made to solve a specific problem. Next, CAD modelling is used to work out the specifics of the models design.

## 2.2 TYPES OF CAD MODELLING

### 2.2.1 WIREFRAME MODELS

Wireframe systems were developed in the early 1960's to automate design drafting of the early 3D CAD systems wireframe models. The very first system were only 2D and the user had to construct a model point by point and line by line. A wireframe model is represented by tables defining edges and points. The coordinates of the each point are stored in the point table. This representation is natural for a designer who is familiar with 3D drawing since is the lines and curves in a drawing which define 3D shape a wireframe in it simply in a computer as a data structure .

### 2.2.2 SURAFCE MODELS

Surface models are represented by tables of edges and points, as is a wireframe model, but additional to wireframe. A surface model is represented by table of faces. The face table stores information on which edges are attached to each face, in most conventional CAD system for free form surfaces, surface models have been used as internal representations. Surface models play an important role in industry, because they give an accurate description of the surface of an object. An example of very simple surface models shown in figures.

### 2.2.3 SOLID MODELS

Because there is no ambiguity in using a solid 3D object, the importance of using solid modelling has been widely recognized. Solid models can support a wide range of activities, like interference check computation of volumes and surface area, finite element analysis etc. In general, most solid modelling systems have adopted either consecutive solid geometry or boundary representation as representation of solids.

### 2.2.4 CAD DRAWINGS OF HAMMERING MACHINE

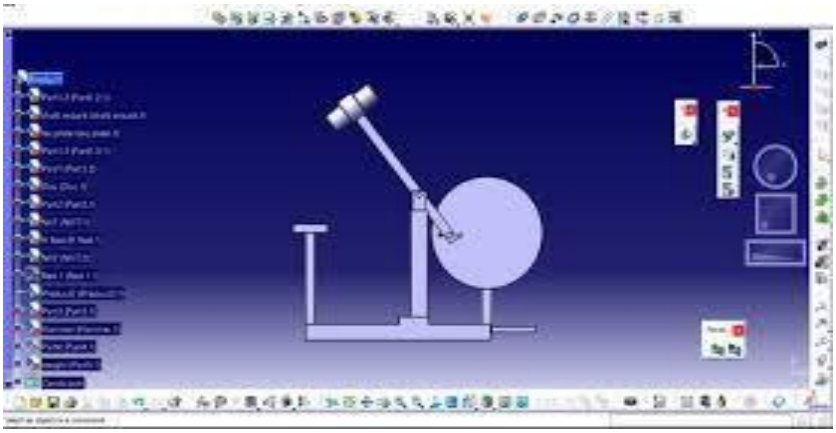


**Fig no 8. 3D View of automated hammering machine**

## 2.3 FABRICATION OF AUTOMATED HAMMERING MACHINE

### 2.3.1 INTRODUCTION TO FABRICATION :

Fabrication is the creation of metals structures by cutting, bending, and assembling process. It is a value added process involving the creation of machines, parts, and structures from various raw materials.

Typically a fabrication bids on a job, usually based on engineering drawings or CAD Drawings, and it involves a multitude of value added processes, including welding, cutting, forming and machining. Metal fabrication usually starts with drawings with precise dimensions and specification. Fabrication employs typical projects include loose parts, structural frames foe buildings and heavy equipment, and stairs and hand railings.

As with other manufacturing processes, both human labour and automation are commonly used. A fabricated product may be called a fabrication. The end products of other common types of metal working, such as machining, metal stamping, forging, and casting, may be similar in shape and function, but those processes are not classified as fabrication. Here is some of the process involved in fabrication.

**Cutting** is done by sawing , shearing , or chiselling torching with handled torches and via numerical control (CNC)cutters

**Bending** is done by hammering or via press brakes, tube benders and similar tools. Modern metal fabricators use press brakes to coin or air bend metal sheet into form. CNC controlled back gauges use hard stops to position cut parts to place bend lines in specific positions.

**Assembling** is done by welding, binding with adhesives, riveting, threaded fasteners, or further bending in the form of crimped seams. Structural steel and sheet metal are the usual materials for fabrication.

### 2.3.2 FABRICATION PROCESS INVOLVED IN THE PROJECT

As we discussed above, about the different process involved in fabrication to complete the project. Hence fabrication plays a vital role which is given a major side in making of automated portable hammering machine.

The different fabrication process involved are like cutting raw materials in to desired shapes, turning of shaft, cutting a flat plate into circular disc, grinding of the uneven surfaces and edges, bolting and riveting wherever required, finally welding of the parts in order to assemble them and to form supporting frames an structures. Some of the following pictures represent the fabrication process involved.

**Fig no 2.3.2 Fabrication images of hammering machine**

## MECHANISM INVOLVED

### 3.1 MECHANISM

In engineering, a mechanism is a device that transforms input forces and movement into a desired set of output forces and movements. Mechanisms generally consist of moving components that can include gears and gear trains, belt and chain drives, cam and followers etc.

The German scientist Reuleaux states that " a machine is a combination of resistant bodies so arranged that by their means the mechanical forces of nature can be compelled to do work accompanied by certain determinate motion.

A mechanism usually a piece of a larger process or mechanical systems. Sometimes an entire machine may be referred as to a mechanism. Examples are steering mechanism in car, or the winding mechanism of a wrist watches.

### 3.2 MECHANISM IN KINEMATICS OF MACHINES

Machines are devices used to accomplish work. A mechanism is the heart of a machine. It is the mechanical portion of a machine that has the function of transferring motion and forces from a power source to an output.

Mechanisms are assembling of rigid members connected together by joints. Links are the individual parts of the mechanism. They are considered rigid bodies and are connected with other links to transmit motion and force. Elastic parts such as springs, are not rigid and, therefore, are not considered links. They have no effect on the kinematics of mechanisms are usually ignored during kinematics analysis. They do supply forces and must be included during the dynamic force portion of analysis.

### 3.3 TYPES OF MECHANISMS

#### 3.3.1 The Double Crank Mechanism

The double rocker mechanism has the shortest link of the four bar mechanism configured as the frame. If one of the pivoted links is rotate continuously, the other pivoted link also rotate continuously. Thus, the two pivoted links are both able to rotate through a full revolution. The double crank mechanism also called a drag link mechanism.

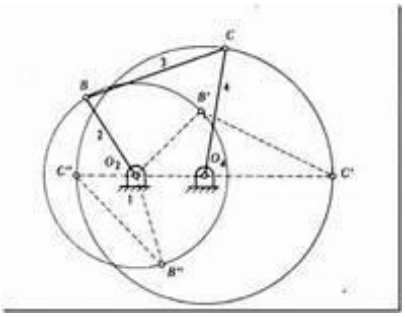


**Fig no 3.3.1 Double Crank Mechanism**

### 3.3.2 Crank Rocker Mechanism

Crank rocker mechanism has the shortest link of the four bar mechanism configured adjacent to the frame. If this shortest link is continuously rotated, the output link will oscillate between limits. Thus the shortest link is called the crank, and the output link is called the rocker. As the motor continuously rotates the input link, the output link oscillates, or "rocks". The wiper arm and blade are firmly attached to output link, oscillating the wiper across a wind shield.

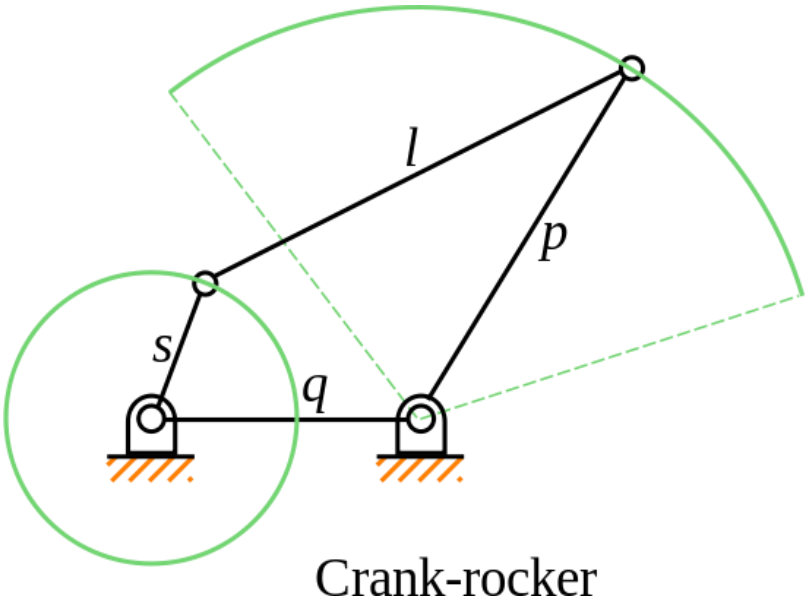



**Fig no 3.3.2 Crank Rocker Mechanism**

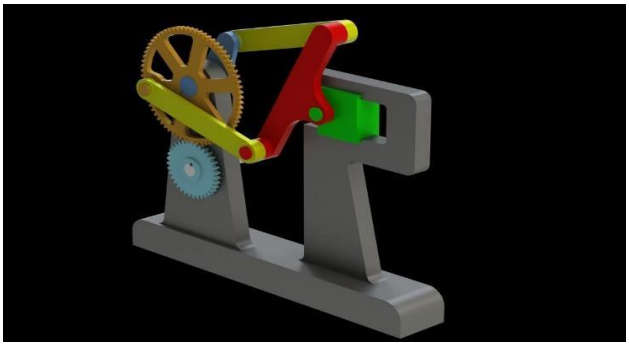


**Fig no 3.3.2(b) Real time application of Crank Rocker**

### 3.3.3 Double Rocker mechanism

Double rocker mechanism has the link opposite the shortest link of the four bar mechanism configured as the frame. In this configuration, neither link connected to the frame will be able to complete a full revolution. Thus, both input and output links are constrained to oscillate between limits, and are called rockers.

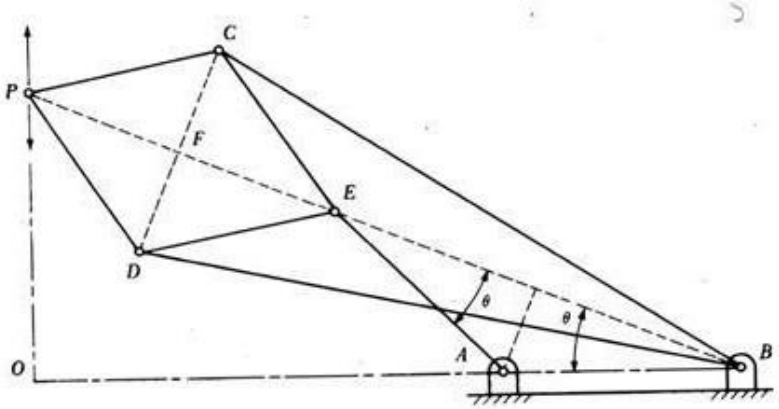
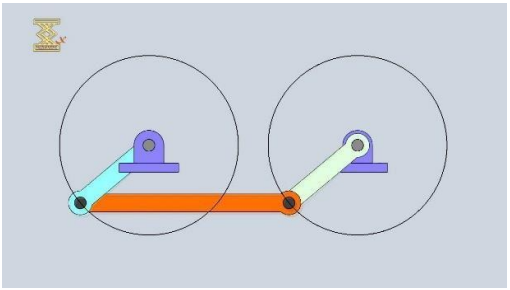



**Fig no 3.3.3 Double Rocker Mechanism**

### 3.3.4 Change Point Mechanism

In change point mechanism, the sum of two sides is the same as the sum of the other two. Having this equality, the change point mechanism can be positioned such that all links become collinear.



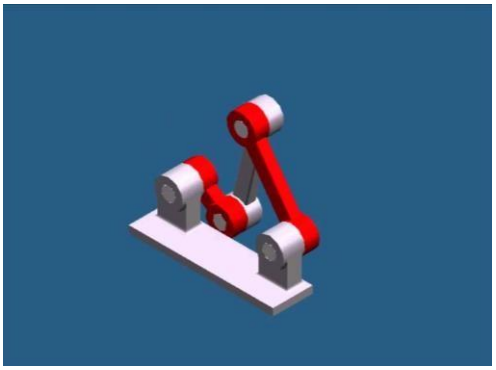


**Fig no 3.3.4 Change Point Mechanism**

### 3.3.5 Slider Crank mechanism

Slider crank mechanism consists of a combination of four links, with one being designated as the frame. The links are connected by three pin joints and one sliding joint. A mechanism that drives a manual water pump is an example.

### 3.3.5.1 Why we choose slider crank mechanism for the project?

In our project we used slider crank mechanism to convert rotary motion in to linear motion. A crank is an arm attached at a right angle to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. It is used to convert circular motion into reciprocating motion, or vice versa. The arm may be a bent portion of the shaft, or a separate arm or disc attached to it. Attached to the end of the crank by a pivot is a rod, usually called a connecting rod. The end of the rod attached to the crank moves in a circular motion, while the other end is usually constrained to move in a linear sliding motion. The term often refers to a human powered crank which is used to manually turn axel, as in a bicycle crank set or a brace and bit drill. There is usually a bar perpendicular to the other end of the arm, often with a freely rotatable handle or pedal attached. Many applications require a machine with a reciprocating, linear sliding motion of a component. Engines and compressors require a piston to move through a precise distance, called the stroke, as a crank continuously rotates. A form of the slider crank mechanism is used in virtually all these applications

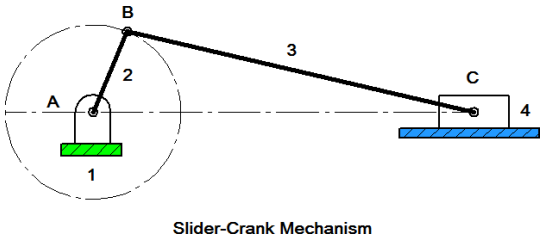



**Fig no 3.3.5(a) Block Diagram of Slider Crank Mechanism**

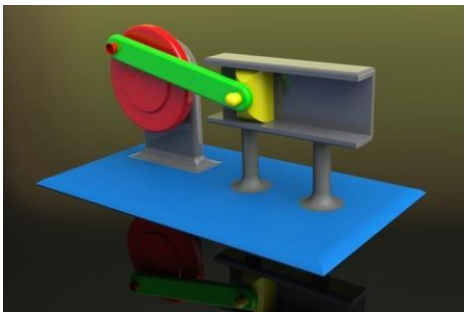


**Fig no 3.3.5 (b) Realtime Application of the Mechanism**

## APPLICATIONS AND FUTURE SCOPE

### 4.1 Applications of Automated Portable Hammering Machine

Automated portable hammering machine can be involved in wide range of applications accosting to the requirement and capability of the machine wherever needed. These following are some of the applications implemented in manufacturing industries.

- ✓ To perform smithy operations that is upset forging
- ✓ To perform punching operations
- ✓ To perform filleting operations as torque force produce is sufficient for the operations
- ✓ To perform riveting operations etc
- ✓ Used to form desired shapes by hammering on heated metals
- ✓ In order to break hard substances like stones, hence it is used

### 4.2 Advantages of Hammering Machine

- ✓ Instant and fast hammering process
- ✓ Save man power and time
- ✓ Low initial and tooling cost
- ✓ Accurate repletion and impact
- ✓ Portable and user friendly
- ✓ Mass production
- ✓ Maintaining good control and required force while operation is going on

### 4.3 Disadvantages of hammering machine

This mechanism is suitable for few operations as the torque force required is more there is a difficult to find the motor to achieve the required torque having little wear while operation is going on

### 4.4 Future scope

The concept of an automated hammering machine in this presentation has been shown to have a place in the actual market to fill a need demanded by potential customers.

Help in production line where many workers are used for the material handling purpose it also reduce the cost and threshing time requirement of more number of worker will completely eliminated as only two works can carried out the completely eliminated as only two workers can carried out to be complete operation. The project objective originally is to reduce human efforts in manufacturing industries. The in the future the complete stress analysis of the project model can be done. This analysis could be done by us. Moreover, for the future automated hammering machine to achieve fully success in the future, many collateral improvement must be done in terms of systems and time delay management and some modification can will be done in this project.

## EXPERIMENTAL ANALYSIS

### 5.1 ANALYSIS OF THE DESIGN

The most reliable design of automated portable hammering machine are described below along with their specifications in order to show the different existing approaches to the small and portable automatic hammering concept. These data could be useful when performing the initial sizing in the design stage of automated hammering machine project following are 13 initial data collection.

Total weight = 6kg
Hammer weight = 1kg
Hammer stroke height = 186mm

Hammer length = 609.6
Width = 355mm
Height = 450mm
Length = 580mm
Disc thickness = 1mm
Battery (supply voltage) = 12v and 7 ampere
Motor = 100 rpm,12v dc motor
Diameter of sprocket = 42mm
Length of the link rod = 200mm

## 5.2 Calculations

**a) To calculate maximum torque by motor**

Motor rating Given data N= 100 RPM
I= 7 A V=12V
Power transmitted by motor P=V x I
P=12 x 7
= 84W
P= 2Πnt / 60 84= 2π30 x t /60 T=67.39 N-m

**B) To find torque force transmitted we have to cases**

**CASE 1 ; When hammer moves down wards**

Given
BC = H= 153mm =0.153mm
Maximum torque = 67.39N-m Length of the hammer rod = 609.6
= 0.60m
Torque force required = T max X length of the hammer rod T f = 67.39 x 0.60m/ 0.153
T f =104.27

**CASE 2: When hammer goes upward, torque will be decreased** T f = T max[length of the hammer] / 0.153 -weight of the hammer T f = T max [0.60] / 0.153 – 14.71

TF = 69.15 N-m

**c) To find impact velocity of the hammer**

given :
H= 153mm
T(Time) = 2 sec So,
V = H x T
V = 0.306 m/sec

**RESULT**

Thus for riveting of 2 mm rivet calculated the impact velocity in 0.306m/sec with a torque force of 104.27 N-m is sufficient and it is calculated successfully.

**D) To calculate shear stress in bolted joint**

We have bolted joints so there is a torsional shear stress in joints, We have,
T= 67.39 N-m

D= diameter of bolt 10mm J= Polar moment of inertia J= π / 64 x $(0.1)^4$
J= 4.90 x $10^{-6}$ $m^4$
T / J = τ / r
67.39 / 4.90 = τ / 0.05
τ = 275.061 x 103 N / $m^2$

**RESULT**

As the standard permissible value of shear stress for M10 bolt is 396 x $10^3$ N /mm2 and the calculated value of shear stress is less than permissible shear stress the design safe.

| **NEED TO BE FIND** | **RESULT** |
|---|---|
| Maximum torque by motor **T** | 67.39 N-m |
| Power transmitted by motor **P** | 84 W |
| Torque force transmitted down wards | 69.15 N-m |
| Impact velocity of the hammer | 0.306 m / sec |
| Shear stress in bolted joint | 275.061 x 103 N / $m^2$ |
| Polar moment of inertia | 4.90 x $10^{-6}$ $m^4$ |
| | |

**CONCLUSION**

We have successfully calculated the torque force of the motor. For the design the impact velocity and torque force for rivetin g 2mm rivet is calculated accurately. The entire modelling of the project is done with the help of CATIA V5R20 . In this addition to this. The project work has provided is an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding. Planning, perching, assembling, and machining while doing this feel that the project work is good solution to bridge the gates project work. We between institutions and industries. We are proud that we have completed the work with limited time successfully automated hammering machine is working with satisfactory condition. We have done to our ability and skills making machine work.

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