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Arduino Operated Portable Hammering Machine

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Mini Project Report

on

“ARDUINO OPERATED PORTABLE HAMMERING MACHINE”

In

Mechanical Engineering

BY

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Guide
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entitled as **ARDUINO OPERATED PORTABLE HAMMERING MACHINE** by the Third Year students of Bachelor of Engineering in Mechanical Engineering as a part of Mini project work prescribed by University of Mumbai.

(Prof. Henisha Raut)

Guide

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Abstract

This project aims at designing and fabricating an automated hammering machine that can perform hammering operations without the involvement of any human operator. This project is selected because no such machines with speed control using arduino are available in these industries. The introduction of an automated hammering machine in the industries will help the industries in prospering and it will make the operations safe and easy.

Moreover, the project will have a greater impact on the metal industries. The machine will be capable of performing fast and accurate hammering operations with the help of a 220V household supply. Mild steel is used for fabricating the machine. A large pulley and a shaft are connected with the help of a connecting rod. The spinning shaft will provide lateral motion to the rod. A mid-swinging arrangement is used for attaching the hammer and the connecting rod. A suitable bed will be developed for holding the work piece. Autodesk Inventor is used for designing the machine.

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Acronyms / Abbreviation

M.S : Mild Steel

FBD : Free Body Diagram

RPM : Revolutions Per Minutes

CAD : Computer Aided Drafting

Chapter 1

Introduction

This paper is basically worried about the upset outline process and assembling machine of programmed automatic hammering machine. Automatic portable hammering machine can be considered as the backbone of any hammering operation in mass production its principle function is to safely and preciously hammering work like to perform the punching operation, filleting operation, riveting operation and smithy operation i.e. upset forging etc for all designed operating conditions. This paper describes cad modeling, design and analysis of arduino Operated automatic portable hammering machine. A programmed hammering machine self-working machine going to assume an imperative part in the assembling procedure (hammering process). Hammering machine utilized as a part of the generation of material extending from instruments, to pivots, car frame forming, molding of metal and so forth.

1.1 Project Background

1.1.1 Hammer:

A **hammer** is basically a tool which is consisting of the weighted "head" which is fixed on a long handle that is swung to give the impact to a small area of the object.

It can be used to put the nail into the wood piece. It is also used to crush the rock as well as to sharp the metal.

Hammers have a wide range of driving and breaking applications.

In a modern hammer, their head is made of steel that has been treated by the heat for the purpose of a harness. The handles of the hammers are mostly made of wood and plastic.

Figure 1.1.1 Hammer

1.1.2 Electric Hammering Machine:

An automated hammering machine is a device, which works automatically with the help of an automated system, which drives by the motor, output rotary motion, which them transfer to the pulley, and then finally, automated the motion of the hammer. Input to the motor may be a battery source. But the limitation of this model is its lack of automation.

Figure 1.1.2 Simple Electric Hammering Machine

1.1.3 Slider-crank mechanism:

A slider-crank mechanism is used to convert the **rotary motion** into **linear motion**. For we need to connect a slider and crank with that of the rod.

Here we have the output of the DC motor in the form of rotary motion, and we use a connecting rod with a slider crank, which then convert the rotary motion of the motor from the gear train from the motion of the hammer.

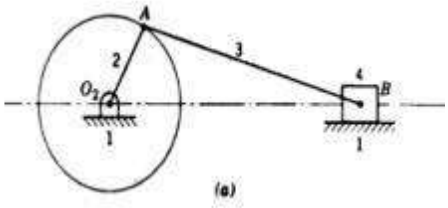

Figure 1.1.3 Slider Crank Mechanism

Chapter 2

Literature Review

2.1 Review

Julen Agirre,2020 [1]. He designed and fabricated a monitoring machine for the testing machine of hammer forging. It is quite relevant to our project. In this work, the authors have worked on developing an automated forging machine. Forging is a similar process to hammering and an almost similar machine was designed and fabricated in the work. The machine has a furnace for heating the metal, then cooling equipment for cooling the metal after the completion of the operations and a press that is used for hammering. From this literature, we have gained an idea about the required components for the automated hammering machine.

R. Mannens, 2018 [2]. His study states that, Industrial standard for introducing compressive residual stresses and improving the fatigue life of compressor blades in pumps, martensitic chromium-nickel stainless steel X3CrNiMo13-4 is surface treated by means of shot peening. Due to the process principle, the kinetic impact energy of the shot peening medium is lower and the resulting surface roughness is higher when compared with another mechanical surface

treatment technology machine hammer peening. Machine hammer peening is an incremental, high-frequency surface treatment process that offers advantages over shot peening due to its deterministic process kinematics.

A.A.Dyakonov,2017 [3]. In this work, the author has worked on developing an automated processing machine for testing the vibrations of the components. It is a mega form of our project. This project also involves an automated hammering machine but a separate automated hammering machine is not developed yet. In this work, the authors have also developed a software module for controlling the vibrational press. This software module is a new innovation and it will be very helpful if we integrate a software module in our project for the calculated hammering strokes per minute. Moreover, the authors have used Mat lab for analysing the results.

Ingalkar,2017 [4]. This paper discuss about cad modeling, design and analysis of automatic hammering machine. Our goal for this paper is to design and Fabricate an automatic hammering machine. And for this, we have calculated the maximum torque, impact velocity for hammering, torque force and also shear failure in bolt joint. In our project we are using torque force to perform various manufacturing operation in industries like riveting, upset forging, punching etc. Also time required for operation is less so it is useful in mass production.

Chapter 3

Problem Definition

3.1 Problem Statement

Hammering is the most widely used industrial as well as construction activity. Hammering of screws, metal sheets, parts etc. requires a lot of time and effort. So here we propose an automated hammering system that allows for fully automatic hammering process. This allows accurate, fast and automated hammering wherever and whenever needed. In hammering there is a high risk of getting injured so for eliminating that risk we propose an automated hammering system.

3.2 Objectives:

The main objectives of this project are:

- To design an automated hammering machine that can give automated blows.
- To replace the use of manual hammering for heavy-duty operations.
- To fabricate an automated hammering machine that can help workers in hammering processes.
- To increase the efficiency and accuracy of the hammering operations.

Chapter 4

Proposed Methodology

In this project we proposed to make a working model of a aurdino operated portable hammering machine which will be installed in small scale industries. A main frame and work surface can be fabricated by welding I beams/ C channels with each other. Stepper motor and pulley mounting can be welded to the main frame. Then arduino can be codded and connected to the motor to control its speed. According to the diagram connecting link can be used to attach and transmit circular motion of the pulley to the oscillating motion of the hammer head. Rotation of the pulley will cause the movement of the hammer head. This can be used to perform hammering task on any object placed on the working surface. By providing electric power to the stepper motor we receive the circular motion for the pulley. Arduino chip is used to control the speed of the stepper motor. The attached links will cause the hammer head to oscillate creating the hammering effect over the work surface. Object that needed to be worked on, can be placed on the surface. The work will be performed on the object by the hammer head, without any physical efforts from the workman.

4.1 CAD Model and block diagram:

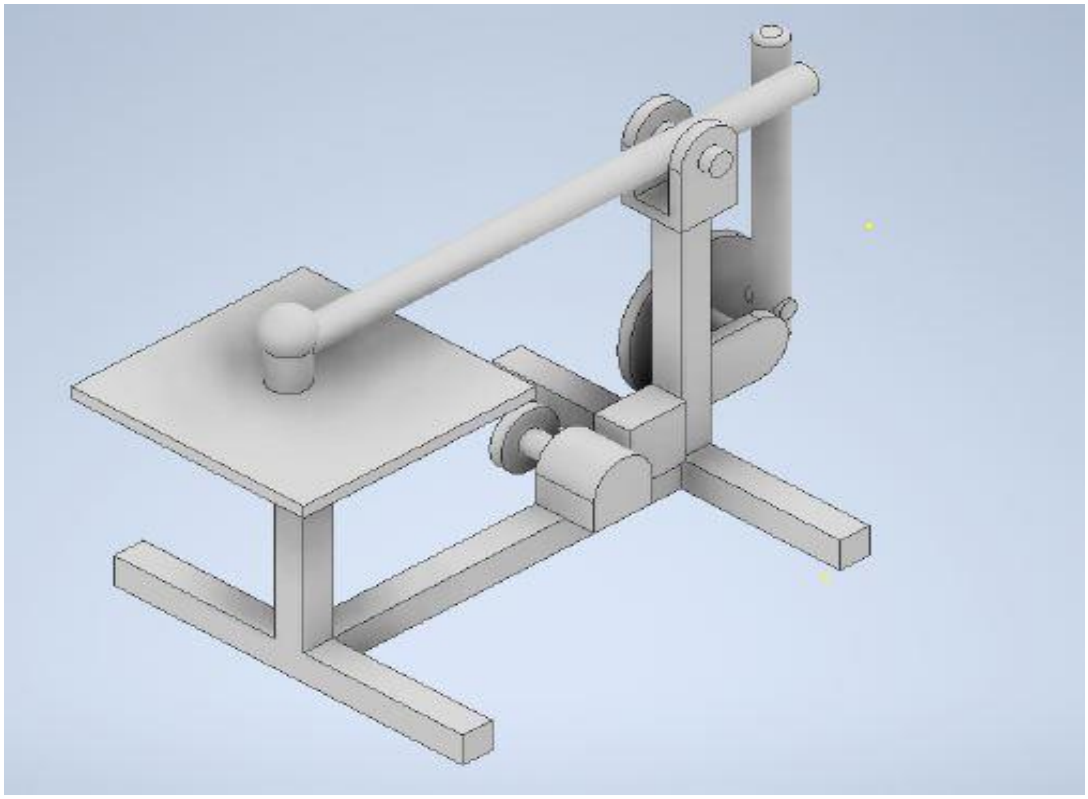

Fig no 4.1.1. CAD model

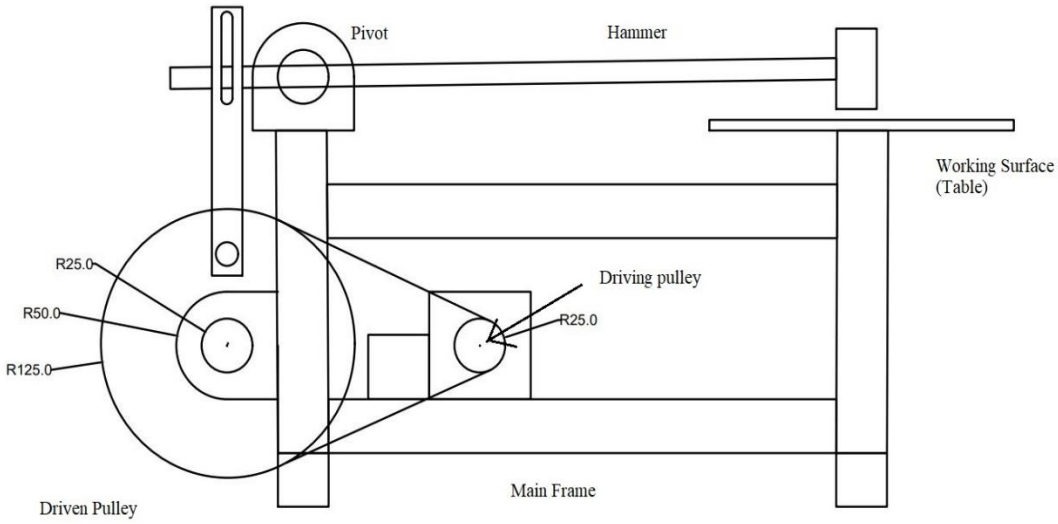

Fig no 4.1.2. Block Diagram

4.2 Component Selection

4.2.1 Main Frame

Main frame is the body made of mild steel on which all the assemblies and components are to be mounted. The setup on which all the hammering action to be done. It is assembled by welding 25mm X 25mm M.S tube of various length. It also consist of 50mm X 50mm X 10mm M.S sheet to form working surface.

4.2.2 Aurdino

Aurdino chip set is used with pre-coding to control the speed of the stepper motor

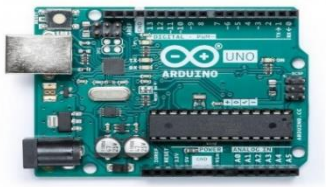

Fig no. 4.2.2 Aurdino chip

4.2.3 Stepper motor

Stepper motor is the source of mechanical power to run the model for hammering. It converts the electricity to circular motion which is transmitted to the p ulleys. Its speed is controlled by the Aurdino chip set

Fig no.4.2.3 Stepper motor

4.2.4 Belt and pulley assembly

Belt and Pulley assembly transmit the torque and mechanical power to the connected mechanical link. This assembly was chosen over gear and chain mechanism because of its low cost and low maintenance

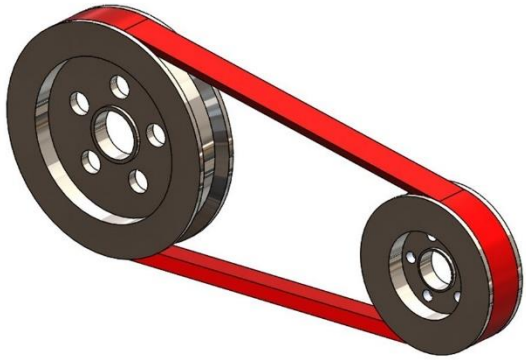

Fig no. 4.2.4 Belt and pulley Assembly

4.2.5 Hammer

It is one of the main component of the model as it does the hammering operation in this proposed model. Hammers are made of hardened steel.

Fig no. 4.2.5 Hammer

4.3 Cost Analysis

Table no.4.3.1. Cost analysis

ITEM	QUANTITY	UNIT PRICE	TOTAL PRICE
MS Square tube 50*50*2	2 Meters	Rs.200/m	Rs.400
Stepper Motor	1	Rs.550/unit	Rs.550
Belt	1	Rs.80/unit	Rs.80
Pulley	1	Rs.350/unit	Rs.350
Nut Bolts M10	10	Rs.10/unit	Rs.100
MS Sheet 10mm	300mm*300mm	Rs.165/m2	Rs.55
Hammer	1	Rs.500/unit	Rs.500
Arduino Chip	1	Rs.300/unit	Rs.300
Welding Charges	-	Rs.500	Rs.500
		Grand Total	Rs.3000 (Approx. Total Cost)

Chapter 5

Conclusion

In this project, an automatic hammering machine is to be designed and manufactured. All the components of the machine were designed on Autodesk Inventor and a prototype was manufactured. The materials were selected for each component on the basis of the engineering standards. Machine is a unique machine because of its arduino operation and no other automatic hammering machine of this design exists. This machine can be controlled and operated for the required number of strokes per minute. Previously designed automatic hammering machines did not involve variable speed or variable strokes. The project was full of challenges because of COVID-19 and the unavailability of the important components. The experience of designing an automatic hammering machine and then fabricating it was fascinating. From this project, we have learned the selection of materials for different components and we learned about different machining processes that can be used for manufacturing a specific component. The project taught us regarding economic constraints that how can we manage a project under a given budget. Moreover, if this product is manufactured on a commercial basis, it can be proved as a useful product for the industry.

References

Journal Paper

[1] J. Agirre, "Monitoring of a Hammer Forging Testing Machine for High Speed Material

[2] R. Mannens, "Influence of Impact Force, Impact Angle, and Stroke Length in Machine Hammer Peening on the Surface Integrity of the Stainless Steel X3CrNiMo13-4," 2018.

[3] Dyakonov, "Automated Processing of Vibration Test Results for Basic Metalconcrete Components of the Cutting Machines," 2017.

[4] Ingalkar, M V. "DESIGN, CAD MODELING & FABRICATION OF AUTOMATIC HAMMERING MACHINE." International Research Journal of Engineering and Technology [IRJET]" 2017