Automated Portable Hammering Machine

Prof. Randive Sonali Achyut,
Lecturer, Mechanical Engineering Department, Brahmdevdada Mane Polytechnic, Solapur, India.

Jadhav Mayur, Jadhav Samarth, Shaikh Aayan, Kore Sidharth
Students of, Mechanical Engineering Department, Brahmdevdada Mane Polytechnic, Solapur, India.

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 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 12V battery. 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 workpiece. Solidworks is used for designing the machine.

The main objective of the project is to develop an automated hammering machine with the help of a pulley, shaft, connecting rod, hammer, and 12V battery to provide ease for the hammering operations. Future work may involve the development of a body case for the machine.

Acknowledgments

I am extremely fortunate to be involved in an exciting and interesting project: portable hammering machine. It has enriched my knowledge. This project increased my thinking and understanding capability.

I express my greatest gratitude and respect to my guide Prof. D.S. Patil, HOD Prof. S.S. Phulari, and Principal Dr. S.B. Joshi for their excellent guidance, valuable suggestions, and endless support. I consider myself extremely lucky to be able to work under guidance of such a dynamic personality.

I would like to express my thanks to all my staff, faculty members of the mechanical engineering department, and classmates for guiding and supporting me time to time.

I would like to thank all whose direct and indirect support helped me completing my project.

List of Acronyms (Symbols) used in the report:

Symbol	Definition
V	Volt
Kg	Kilogram
Mm	Millimeter
M	Meter
RPM	Revolutions per Minute
A	Ampere
W	Watt
T	Torque
P	Power
Nm	Newton-meter
N	Newton, Number of Cycles
FBD	Free Body Diagram
Sec	Second
D	Diameter
J	Polar Moment of Inertia, Joules

Chapter 1: Introduction

Project Definition

This project is intended to design and manufacture a simple rotor test rig, where rotor faults can be inserted and tested. The test rig is to be fitted with vibration sensors to enable collecting data and use it to monitor the health of machines. The project is very important to the industry as through understanding the characteristics of failure, time and money will be saved. This is also very important from the safety perspective as this will lead to a safe operating environment for rotary machines.

Project Objectives

The main objectives of this project are:

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

Project Specification

The most reliable design of an automatic hammering machine is 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 the automatic hammering machine project. Following are 13 designs for initial data collection: These data are based on engineering standards.

Parameter	Value
Total weight	10 kg
Hammer weight	2 kg
Hammer length	790 mm
Hammer stroke height	350 mm
Width	300 mm
Length	600 mm
Height	700 mm
Battery	12V
Motor	0–450 RPM, I=1.5 A, V=12 V Max, P=24 W, T=7.6 Nm
Diameter of big pulley	200 mm

Parameter	Value
Diameter of small pulley	100 mm
Diameter of bearing	16 mm
Length of link rod	490 mm

Table 1: The system measurements

Marketing features

Locally:

- Increase profits
- Increase production
- Reduce cost
- Increase safety
- Realise manpower

Globally and internationally:

- Raise the economy
- Accuracy in international manufacturing
- Increase in the international industrialization
- Fast completion in global manufacturing

Engineering standards:

ASTM A36 Welding Standards:

- If the metal is thicker than 1/4-6 mm, preheat to 150°F.
- E7018 stick electrode, an 0.035 or 0.045 E70S-3-6 MIG wire, or for all position welds an E71T-1 electrode wire.
- Ensure mill scale in weld area is removed and the plate is always at a temperature >60°F.
- Keep single pass fillet welds <1/4-<6 mm.

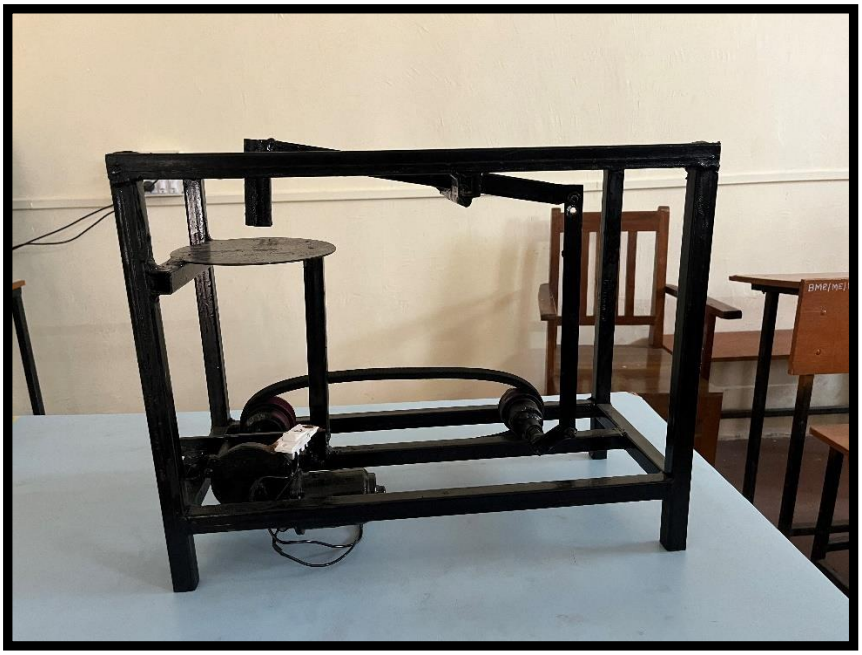
- For multi-pass welds, use inter-pass temp control.
- Hardness and grain size checked.

Design Constraints Engineering Standards:

- Quality features of hand hammers
- Characteristics and verification
- Applies to hammers used under normal working
- Best practices established by experts in the industry
- Comply with laws that specify design and testing criteria
- Reduce product liability risk
- Budget for certification testing

Applications

- Use in a production line
- Can be used indoors to drive nails, fit parts, forge metal, and break apart objects
- Use in workshops



Chapter 2: Literature Review

Project background

With the evolution of technology and the advancements made in the industry, automation has become an important resource for industrial operations. Hammering is a very common process in the industries of mechanical engineering. Most of the industries that involve the fabrication and machining of metal components use hammering. Moreover, hammering is extensively used in the wood industry. This project aims at designing and fabricating an automated hammering machine that can perform hammering operations efficiently. Moreover, the hammering operation is manually performed which results in different types of injuries to the operators. Adding more to it, the efficiency and accuracy required in hammering operations are not achieved through manual hammering operations. Therefore, this project is selected that aims at designing and fabricating an automated hammering machine. An image elaborating the automated hammering machine is given below:

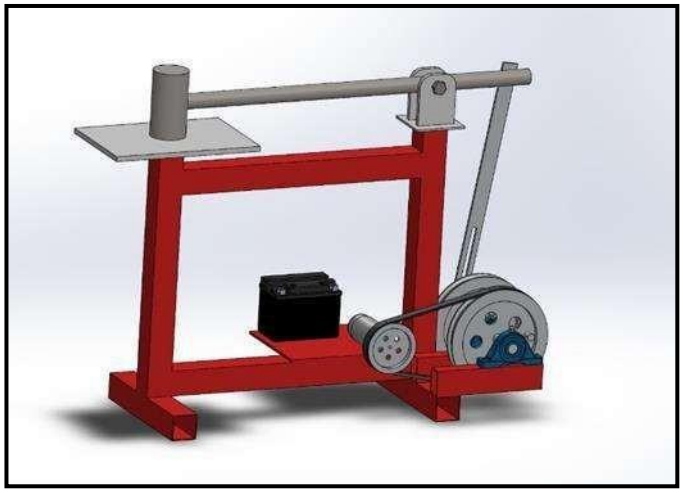


Figure 2: Automated Hammering Machine

It is a simple device, but it will be helpful in many operations. The industry now requires accuracy, and there are very small limitations of allowed tolerances. An important aspect of this project is the improvement of the operations and the safety of the operators. For instance, consider the hammering operation being done on a large metal piece. If this device will be used, there will be small risks of injuries for the operators, but manual operations can bring a lot of harm. Moreover, this device will help in gaining the required level of accuracy. If this automated hammering machine is developed on a commercial basis and it is provided to different industries, it can bring a lot of revolution in the industries.

References

[1] J. Agirre, "Monitoring of a Hammer Forging Testing Machine for High Speed Material Characterization," Procedia Manufacturing, 2020.
[2] A. Dyakonov, "Automated Processing of Vibration Test Results for Basic Metal-concrete Components of the Cutting Machines," 2017.
[3] 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.
[4] J.R. Honninge, "Improvement of Microstructure and Mechanical Properties in Wire + Arc Additively Manufactured Ti-6Al-4V with Machine Hammer Peening," 2017.
[5] R. Mannens, "Analysis of surface defects on industrial casting tools for automotive applications after machine hammer peening," 2017.
[6] T. Brüggemanna, D. Biermanna, A. Zabela, "Development of an automatic modal pendulum for the measurement of frequency responses for the calculation of stability charts," ScienceDirect, 2015: 587-592.

Project Team: