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DEVELOPMENT AND ASSEMBLY OF AUTOMATIC PORTABLE HAMMERING MANCHINE

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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 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. Solid works 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.

1. Introduction

1.1 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.

1.2 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 process
4. To increase the efficiency and accuracy of the hammering operations.

1.3 Project Specifications :

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	12 V
Motor	0 – 450 RPM, I = 1,5 A, V= 12 V Max, P = 18 W, T= 7.6 NM
Diameter of big pulley	200 mm
Diameter of small pulley	100 mm
Diameter of bearing	16 mm
Length of link rod	490 mm

2. Literature Review

2.1 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 that 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.

2.2 Previous work

First of all, I would like to discuss the work of Julen Agirre. 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.

This 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.

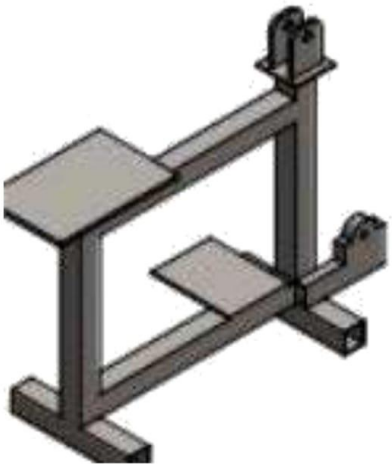
3. Selection of Components and assembly of project

Selection of components

Components of the system are the following:

Supporting Frame:

Here is the basic structure of the supporting frame for the Installation of the Motor, Pully, Shaf, and Arm of the hammer. The material used for the manufacturing of the frame is I section Cast Iron Rod because it is strong, cheap easily cut, readily available, and easy to form



Pulley one:

Pulley is used to transfer energy and motion, the pulley used in the project was selected according to the size ratio of the motor. Its function is to transfer motion and energy to the 2 nd pulley from the Dc motor. Material is Cast iron.

Shaft:

The shaft is used to connect the 1st pulley with 2nd pulley. Its material is Mild Steel.

2nd Pulley:

Here we have the 2nd pulley which takes input from the 1st pullet with the help of the shaft and is attached with the slider crank. It is mounted on the lower rare side of the main structure and is parallel to the main structure on its left side. Material is Cast Iron

Arm:

Here we have the arm of the system, its orientation is perpendicular to the axis of rotation of the shaft. Its material is mild steel

Dc Motor:

16v DC motor is being used in this project which is input power for the pulley

16 v Battery:

For input power, to the Motor, we use the 16 v Battery.

Assembly :

1) The first step was the Cad Model.
2) Make a structural analysis of the Design.
3) After analysis, go to the workshop and start working on the fabrication of the Model.
4) Mount the Motor 1st and 2nd PULLEY on the frame of the Hammering Machine.
5) Make them connected, i.e make a connection between 1st pulley and Dc Motor with the help of a belt.

6) Now connect the 1st pulley with 2nd pulley with the help of the Shaft.
7) Now attach the Slider Crank Mechanism.
8) Connect the arm with the handle of the hammer.
9) Now attach the input battery power to the motor
10) The motor will get the input (electric) and then convert it to the rotary motion, then the energy in the form of rotary motion will transfer to the slider motion. finally, the automated to and from motion of the hammer.

Thus, we have an Electrical Automated Hammering Machine.

4. Advantages and disadvantages and applications

A. Advantages

- Available in wide variety of sizes.
- Maintain good control and required force.
- Low cost.
- Save man power.
- Saves time.
- Time delay can be achieved easily.
- Mass production.

B. Disadvantages

- This mechanism is only suitable for few operations.
- As torque force required is more there is difficult to find the motor to achieve the required torque.

C. Applications

In manufacturing industries to perform different operations as follows,

- To perform smithy operation i.e. upset forging
- To perform the punching operation.
- To perform filleting operation as torque force produce is sufficient for the operation.
- To perform riveting operation etc.

5. Conclusions

In this project, an automatic hammering machine is designed and manufactured. All the components of the machine were designed on SolidWorks and a prototype was manufactured. The materials were selected for each component on the basis of the engineering standards. This machine is a unique machine 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 strokes. 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.

6. Future scope

The automatic hammering machine designed in this project can be improved from many perspectives. The first perspective is the design of the stroke of the hammer. It can be further improved and made lightweight. The

strength of the hammer should be improved so that it can be used for proper hammering operations in the industry. Moreover, the time lag between two strokes of the hammer can be reduced so that time can be saved during hammering operations. Adding more to it, the aesthetics of the machine can be enhanced.

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