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CAM OPERATED HAMMER MACHINE

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Abstract:
A cam-operated hammer machine is a mechanical device that converts rotary motion into reciprocating hammering action using a cam and follower mechanism. It is widely used in industries such as metalworking, forging, and shaping applications. The system consists of a motor, a camshaft, a follower, a hammer, and a frame.As the cam rotates, it pushes the follower upward, lifting the hammer. When the cam lobe moves away, the follower drops, allowing the hammer to strike with force. The design ensures continuous and automated hammering with high precision, reducing manual labor and increasing efficiency. Different cam profiles can be used to achieve varied hammering speeds and forces, making the machine adaptable to specific industrial needs.This machine is cost-effective, easy to operate, and requires minimal maintenance. It is ideal for small-scale industries where automation of hammering processes is necessary. The study of cam profiles, material selection, and impact force analysis is crucial for optimizing performance.

Introduction

A cam-operated hammer machine is a mechanical system designed to automate hammering operations by converting rotary motion into reciprocating motion using a cam and follower mechanism. This machine is widely used in industries such as metalworking, forging, and sheet metal processing for shaping, embossing, and bending materials with high precision and efficiency. The primary components of this machine include a cam, follower, hammer, frame, motor (or crank), and anvil. The cam, driven by a motor or manual crank, rotates continuously, causing the follower to move up and down. This movement lifts and then releases the hammer, which strikes the workpiece placed on the anvil. The cyclic nature of the mechanism ensures repeated hammering with consistent force, making it highly suitable for mass production and reducing manual labour. One of the key advantages of a cam-operated hammer machine is its ability to provide controlled and uniform hammering, ensuring precision in shaping materials. It eliminates the inconsistencies associated with manual hammering and enhances productivity by allowing continuous operation. The machine's design can be customized based on the required impact force, making it adaptable to different industrial applications. Additionally, it reduces physical strain on workers, making it a safer alternative in manufacturing environments. Cam-operated hammer machines are used in various fields, including blacksmithing, sheet metal industries, jewellery

making, and mechanical workshops. They play a crucial role in manufacturing processes that require repetitive hammering with accuracy and speed. Their efficiency, ease of operation, and cost-effectiveness make them an essential tool in modern workshops. As technology advances, these machines continue to be refined for greater precision and automation, further enhancing their utility in industrial applications.

Figure1: Cam Operated Hammer machine

PROBLEM STATEMENT

Forging process is very rigorous and tiring process, though there are machines for carrying out Forging operations but they are only suited for big size components and large-scale production Used by big industries. Mechanization of any process is beneficial for the user yet no such Solution exists for small blacksmiths. Many blacksmiths have comparatively high scale of Production requirement but they cannot afford such machines. Also, these machines not only consume much space but also are expensive for these blacksmiths. The prices of maintenance And electricity require running these machines add to the burden of blacksmiths rather than Aiding them.

PROBLEM IDENTIFICATION

- Needs more human power.
- Takes more time.
- No safety.

Aim

The primary aim of a cam-operated hammer machine is to automate and improve the Efficiency of hammering operations by converting rotary motion into reciprocating motion using a cam and follower mechanism. This machine is designed to reduce manual labor, Increase productivity, and ensure precision in applications such as forging, metal shaping, And sheet metal processing..

Objectives

To automate the hammering action in the forging process and thereby reduce the human effort in Blacksmith forging.

Need Analysis:

Any invention should be having a need. The need analysis is an important part of Value analysis. It emphasizes on finding on the purpose which the new machine ought to serve.

Current scenario on forging workshop have to face many problem such as Needs more human mm Power, Takes more time, no safety. In order to reduce it automatic hammer striker is used.

To do this, it's very essential to wonder three questions:

- To whom (or what) this product will be useful?
- On who (or what) it acts?
- For what purpose will we design it?

Construction Working And Assembly

A cam-operated hammer machine consists of several key mechanical components that work Together to convert rotary motion into reciprocating hammering action. The main parts of the Machine include:

1. **Cam** – The heart of the mechanism, which rotates to lift and drop the hammer. The shape of The cam determines the movement of the follower and the hammer's striking force.
2. **Follower** – A component that moves according to the cam profile, transmitting motion to the Hammer. It ensures smooth lifting and dropping of the hammer.
3. **Hammer** – The striking tool that applies force to the workpiece. It is attached to the Follower and moves up and down.
4. **Anvil/Base** – A fixed surface where the workpiece is placed for hammering operations.
5. **Frame** – The rigid structure that supports all the machine components and ensures stability During operation.
6. **Motor or Crank Handle** – Provides the rotary motion needed to drive the cam. It can be Powered electrically or manually, depending on the design of the machine.
7. **Spring (Optional)** – In some designs, a spring is used to assist the hammer's return motion, Improving efficiency.

Working Principe Of Cam Operated Fhammer Machine

The cam-operated hammer machine works by converting rotary motion into reciprocating Motion through the cam and follower mechanism. The working process is as follows:

1. **Rotation of the Cam –** The cam, which is driven by a motor or manual crank, begins to Rotate. The cam profile is designed to control the movement of the follower.
2. **Lifting the Hammer** – As the cam rotates, it pushes the follower upward. The follower is Connected to the hammer, so as the follower moves up, the hammer is lifted.
3. **Hammer Release and Impact –** Once the cam reaches its peak, the follower moves past the High point of the cam profile, allowing the hammer to drop freely due to gravity or assisted by a Spring. This results in a powerful striking force on the workpiece placed on the anvil.
4. **Continuous Hammering –** As the cam continues to rotate, this cycle repeats, allowing Continuous and automated hammering. The speed and force of hammering depend on the cam Design and rotational speed.

Advantages

- Simple Mechanism
- Precision Control.
- Consistent
- High Speed
- Customization.
- Energy Efficient.
- Less Skilled Labour Required

Dis- Advantages

- Limited Impact Force.
- Cam Wear and Tear.
- Complex Cam Design.
- Fixed Stroke Pattern.
- Noise and Vibration.
- .Limited Adaptability

Future Scope:

The sensor which has been provided on the anvil for ON and OFF if the work Piece is contact with anvil. Automatic hold of work piece instant of using iron tongs it will reduce the Accident in the process.

Octopus Diagram:

- Presentation
- The octopus diagram is a representative tool of the different service function of the product. It's an associative diagram. It shows the links (functions) between the product and the different elements of its environment.

Methodology

- The methodology to find the different function between different elements is very simple following some principles:
- Define borders for the study area
- Find all the external elements from the product which will be in contact with it
- Find the principal functions : each time that the product can make in relation to different elements, there is a principal function
- Find the constraint functions: each time that one external element act on the product, there is a constraint function. All the links (functions) can be drawn on a diagram named: Octopus diagram.

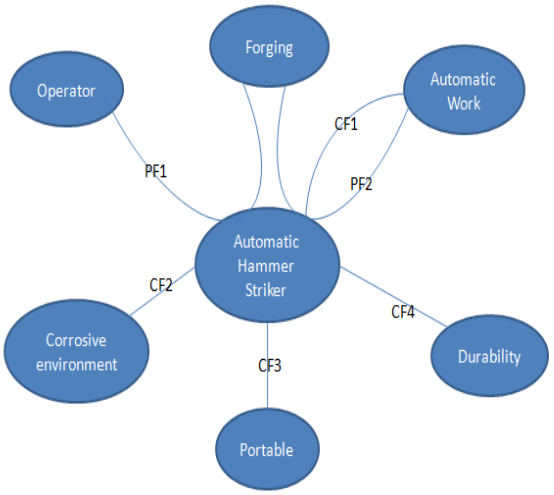

Figure2: Octopus Diagram

Brief Explanation Of The Octopus Diagram

- On the basis of the already framed need, we did a complete study on the principal functions that the machine would have to serve. We also enlisted the constraint functions .The crumbs of this study are as follows:
- The primary function is to reduce the user work by using automatic hammer striker.
- To produce uniform force of the hammer will be a constraint. For producing uniform force of the hammer the motor is used.
- The machine should be automated to reduce the work and safety of the labour.
- Durability of the crank shaft will be a constraint. The wear and tear is high due to impact load. So the material of the crank is should be durable.
- The machine should be portable to any place is the one of the constraint.
- The metallic paint is used to resist corrosion by the environment .so a layer to paint is given to the machine.

Bull Diagram

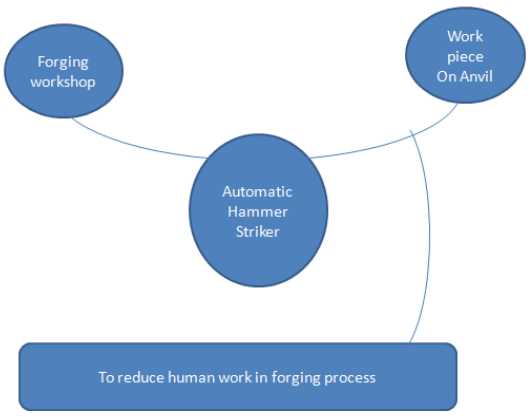

Fig:-Bull Diagram

Interpretation of Bull Diagram:

The bull diagram is an expression of the need. Our need is "to reduce human work in forging process".

- The hammer striker is used in forging workshop to forge the work piece.
- The hammer striker acts on the work piece on the anvil. Anvil acts as a medium.
- It is used to reduce human work in forging process.

Conclusion

Cam-operated hammer machines are efficient and reliable for applications requiring precise, high-speed, and repetitive hammering, such as forging, stamping, and metal shaping. Their simple design, energy efficiency, and consistent performance make them ideal for mass production. However, they have limitations in force adjustability, durability, and adaptability, as the cam mechanism wears out over time and requires maintenance. While they are cost-effective and easy to operate, they may not be suitable for heavy-duty tasks where higher impact force or variable stroke control is needed. Overall, cam-operated hammer machines are a great choice for industries that prioritize precision and automation over flexibility and extreme power

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