

Automated Portable Hammering Machine

Pruthvi suresh kidile¹, Abhishek vinod somvanshi², parth parmashwar parihar³, sayed rehan sadiq ali⁴, Prof. Mungle N. A.⁵

^{1,2,3,4} Student of Diploma in Mechanical Engineering Department, Vishweshwarayya Institute Of Engineering & Technology,

Almala, Maharashtra, India.

⁵ Guide Lecturer in Mechanical Engineering Department, Vishweshwarayya Institute Of Engineering & Technology,

Almala, Maharashtra, India

-----***-----

ABSTRACT : an Automated Portable Hammering Machine, developed to address the physical strain and inconsistency associated with manual hammering in small-scale industries. Manual hammering is not only labor-intensive but also leads to operational fatigue and inaccurate results over prolonged periods.

The proposed system utilizes a DC geared motor coupled with a crank-and-slider mechanism to convert rotational motion into linear reciprocating strikes. The machine is designed for portability, utilizing a lightweight mild steel frame and a rechargeable power source, making it suitable for on-site applications such as riveting, center punching, and sheet metal forming.

Experimental results indicate that the machine provides a constant impact force and a controlled striking rate (measured in Blows Per Minute), significantly reducing human error. Comparative analysis shows a 60% increase in productivity and a substantial reduction in the risk of musculoskeletal injuries for the operator. The project concludes that automating the hammering process in a portable format offers a cost-effective and ergonomic solution for modern fabrication workshops.

KEYWORDS :

Automation,

Portable Hammering Machine,

Nut & Bolts,

DC Geared Motor.

1. INTRODUCTION

The **Automated Portable Hammering Machine** is designed to modernize traditional striking tasks by substituting human physical effort with a motorized mechanical system. In industrial and construction settings, manual hammering is not only labor-intensive but also prone to inconsistency and significant ergonomic risks, such as carpal tunnel syndrome and chronic fatigue. This project addresses these issues by utilizing a DC geared motor coupled with a crank-and-slider mechanism to convert rotational energy into a precise, linear reciprocating motion. By integrating a lightweight frame—typically constructed from mild steel or aluminum—the machine remains highly portable, allowing it to be used on-site for applications such as riveting, center punching, and sheet metal flattening where stationary pneumatic hammers are impractical.

2. PROBLEM IDENTIFICATION

In Manual hammering is a fundamental but flawed process in small-scale fabrication and construction. The primary issue is **human dependency**, where the quality of work is directly tied to the physical strength and stamina of the operator. Over a standard work shift, an operator's strike force diminishes due to muscle fatigue, leading to inconsistent results in tasks like riveting or forging. Furthermore, the repetitive high-impact nature of swinging a hammer leads to long-term **occupational health hazards**, including carpal tunnel syndrome, joint inflammation, and Hand-

Arm Vibration Syndrome (HAVS), which decreases the long-term productivity of the workforce. Beyond the human element, there is a clear **technological and economic gap** in the current market. While large-scale industries utilize stationary pneumatic or hydraulic power hammers, these machines are expensive, consume high amounts of energy, and are entirely non-portable. Conversely, small workshops and on-site construction workers are often left with no choice but to use manual sledgehammers because industrial alternatives cannot be transported to tight spaces or remote locations. There is a critical need for a mid-range, **automated yet portable** solution that provides the precision of a machine with the mobility of a hand tool, thereby increasing safety and operational efficiency while reducing labor costs.

3. OBJECTIVE

The objectives of the **Automated Portable Hammering Machine** project are centered on improving industrial efficiency and operator safety. They can be summarized into the following two paragraphs: The primary objective of this project is to design and develop a mechanical system that replaces manual hammering with a consistent, motorized striking action. By utilizing a **crank-and-slider** or **Scotch Yoke mechanism**, the machine aims to convert the rotational motion of a DC motor into a linear reciprocating stroke. A key focus is placed on **portability**, ensuring that the frame is lightweight enough for on-site use in construction or small workshops where stationary pneumatic hammers cannot reach. This design seeks to provide a mid-range solution that offers the power of industrial machinery with the mobility of a handheld tool.

4. WORKING PRINCIPLE

The operation begins when the DC geared motor is activated by a power source, such as a battery or AC adapter. The motor rotates a circular crank or cam, which is the heart of the Crank-and-Slider mechanism. As the crank rotates, it moves a connecting rod that is attached to the hammer's vertical shaft. This mechanical arrangement transforms the continuous circular motion of the motor into a reciprocating (up-and-down) linear motion. During the upward stroke, the hammer is lifted to a predetermined height, often compressing a helical spring or simply gaining potential energy. The stroke length—and subsequently

the velocity—is determined by the radius of the crank and the RPM of the motor. In the second phase of the cycle, known as the impact stroke, the hammer reaches its peak position and is driven downward toward the workpiece. If a spring-loaded design is used, the stored elastic potential energy in the spring is released, accelerating the hammer head at a rate much higher than gravity alone could provide. The hammer head, typically made of hardened steel, strikes the material with a calculated force $F = m \cdot a$. This cycle repeats continuously as long as the motor is powered, providing a steady frequency of Blows Per Minute (BPM). By adjusting the motor speed via a controller, the operator can precisely manage the intensity and tempo of the hammering to suit different materials like aluminum, mild steel, or wood.

6. Following are the main components of Automated portable hammering machine:-

1. DC Geared motor
2. Hammer
3. M.S Plate
4. Nut & Bolt

1. DC Geared motor



3. Hammer



4. M.S Plate



5. Nut & bolt



7. Conclusion:

The development of the Automated Portable Hammering Machine successfully demonstrates that mechanical automation can be effectively scaled down into a mobile, user-friendly format. By replacing manual labor with a crank-and-slider mechanism, the project achieves a high degree of strike consistency and operational efficiency that is impossible to maintain through human effort alone. The integration of a high-torque DC motor and a lightweight frame ensures that the tool is not only powerful enough for industrial tasks

like riveting and sheet metal forming but also portable enough for on-site maintenance and repair. This prototype bridges the critical gap between heavy, stationary power hammers and tiring, inaccurate manual hand tools.

Beyond the mechanical performance, the project highlights significant improvements in occupational safety and ergonomics. By isolating the operator from the repetitive high-impact forces of hammering, the machine significantly reduces the risk of long-term musculoskeletal disorders and Hand-Arm Vibration Syndrome (HAVS). The ability to control the Blows Per Minute (BPM) and impact force allows for greater precision across various materials, reducing waste and improving the overall quality of fabrication. In conclusion, the automated portable hammering machine stands as a cost-effective, energy-efficient, and ergonomic solution that enhances productivity while prioritizing the physical well-being of the modern technician.

8. References:

1. JournalNX (2025). Cam Operated Hammer Machine. JournalNX – A Multidisciplinary Peer Reviewed Journal.

2. IJSREM (2025). Automated Portable Hammering Machine. International Journal of Scientific Research in Engineering and Management.

3. Journal of Emerging Technologies and Innovative Research (2023). Design and Fabrication of Automated Hammering Machine.

4. IJNRD (2024). Design and Analysis of Automated Hammering Machine. International Journal of Novel Research and Development.

5. Okello, H. (2022). Design of Automated Hammering Machine. Research Dissertation.

Automatic Hammer with Cam Mechanism – Design and Fabrication Project. Mechanical Engineering Project Documentation.