

Manually Operated Sheet Metal Bending, Cutting And Grinding Machine

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Abstract- This project introduces the design and fabrication of a manually operated sheet metal bending, cutting, and grinding machine, aimed at addressing the needs of small-scale metalworking workshops and hobbyists. The machine offers versatility and efficiency in handling various sheet metal tasks, including bending, cutting, and grinding, through intuitive manual operation. The design incorporates key features such as adjustable bending angles, precise cutting mechanisms, and a robust grinding platform, ensuring accuracy and repeatability in metal fabrication processes. By providing a cost-effective and user-friendly solution, this machine contributes to enhancing productivity and promoting skill development in metalworking applications.

Keywords- Sheet Metal, Bending, Spring Back Effect, Cutting, Grinding

I. INTRODUCTION

In the realm of metalworking, the efficient manipulation of sheet metal is paramount for various industrial and artisanal applications. From constructing intricate structures to crafting precise components, the ability to bend, cut, and grind sheet metal accurately is essential. However, for small-scale workshops and hobbyists, acquiring specialized machinery for these tasks can be costly and impractical. To address this challenge, we present the design and development of a manually operated sheet metal bending, cutting, and grinding machine. This project aims to offer a cost-effective and versatile solution for individuals and small businesses engaged in metal fabrication. By integrating the functionalities of bending, cutting, and grinding into a single, compact unit, our machine seeks to streamline the metalworking process while maintaining precision and ease of operation. The following sections will delve into the design considerations, fabrication process, and operational features of our manually operated sheet metal machine, highlighting its potential impact on enhancing productivity and promoting skill development within the metalworking community. The fabrication of sheet metal components is a fundamental aspect of various industries, including automotive, aerospace, construction, and manufacturing. Sheet metal, due to its versatility, durability, and relatively low cost, is widely used for a multitude of

applications, ranging from simple enclosures to complex structural assemblies. Traditionally, the manipulation of sheet metal involves processes such as bending, cutting, and grinding, each requiring specialized equipment and expertise. Industrial-grade machines capable of performing these tasks efficiently are often large, expensive, and primarily suited for mass production environments. On the other hand, smaller workshops, DIY enthusiasts, and hobbyists face limitations in accessing such machinery due to cost constraints and space limitations.

II. PROBLEM STATEMENT

The traditional methods of manipulating sheet metal, including bending, cutting, and grinding, pose significant challenges for small-scale workshops, DIY enthusiasts, and hobbyists. Existing industrial-grade machinery designed for these tasks is often prohibitively expensive, bulky, and primarily suited for mass production environments. Consequently, individuals and small businesses face barriers in accessing cost-effective and compact solutions that enable efficient sheet metal fabrication. To address this gap, our project aims to design and develop a manually operated sheet metal bending, cutting, and grinding machine. This machine seeks to provide an affordable and versatile solution that empowers users to perform essential sheet metal fabrication tasks with precision and ease. By integrating the functionalities of bending, cutting, and grinding into a single, compact unit, our machine aims to streamline the metalworking process, enhance productivity, and promote skill development within the metalworking community. The problem statement encompasses the need for a cost-effective, user-friendly, and compact solution that enables efficient manipulation of sheet metal for individuals and small businesses engaged in metal fabrication. Through the development of our manually operated sheet metal machine, we seek to address these challenges and empower users with the tools they need to realize their creative visions and pursue their metalworking effectively.

III. SOLUTION OVERVIEW

Our solution for the manually operated sheet metal bending, cutting, and grinding machine is designed to address the challenges faced by individuals and small businesses in accessing affordable and versatile sheet metal fabrication equipment. The machine integrates the functionalities of bending, cutting, and grinding into a single, compact unit, offering users a comprehensive solution for their metalworking needs.

Key features of our solution include:

1. **Versatile Bending Mechanism:** The machine incorporates an adjustable bending mechanism that allows users to achieve various bending angles with precision. This feature enables the fabrication of complex shapes and structures from sheet metal with ease.
2. **Precise Cutting Capabilities:** With a robust cutting mechanism, our machine ensures clean and accurate cuts in sheet metal materials of varying thicknesses. Users can achieve precise cuts for their projects, enhancing the quality and efficiency of their fabrication processes.
3. **Efficient Grinding Platform:** The machine includes a dedicated grinding platform equipped with a high-quality grinding wheel, enabling users to smooth edges, remove burrs, and refine surface finishes on sheet metal components. This feature enhances the aesthetic appeal and functionality of fabricated parts.
4. **Compact and User-Friendly Design:** Our machine is designed to be compact, lightweight, and easy to operate, making it suitable for small-scale workshops, DIY enthusiasts, and hobbyists. Intuitive controls and ergonomic features ensure a seamless user experience, facilitating efficient metalworking operations.
5. **Cost-Effective Solution:** By eliminating the need for separate machines for bending, cutting, and grinding, our solution offers cost savings for users. Additionally, the use of readily available materials and components contributes to affordability without compromising performance.

Overall, our manually operated sheet metal bending, cutting, and grinding machine provides a practical and accessible solution for individuals and small businesses looking to enhance their metalworking capabilities. With its versatile functionalities, user-friendly design, and cost-effective nature, the machine empowers users to realize their

creative visions and achieve professional-quality results in sheet metal fabrication.

IV. WORKING PROCESS

1. **Sheet Metal Loading:** The operator places the sheet metal workpiece onto the machine's work surface, ensuring it is proper aligned and secured for processing.
2. **Bending Operation:** - **Adjusting Angle:** The operator sets the desired bending angle using the machine's adjustable bending mechanism. - **Clamping:** The sheet metal is securely clamped in place to prevent movement during bending. - **Manual Bending:** The operator manually applies force to bend the sheet metal to the desired angle using a lever or handle, leveraging the machine's bending mechanism.



Fig. Sheet Metal Bending Machine

3. **Cutting Operation:** - **Setting Parameters:** The operator adjusts cutting parameters such as depth and width based on the requirements of the project. - **Positioning:** The sheet metal is positioned beneath the cutting mechanism, ensuring proper alignment for accurate cuts. - **Manual Cutting:** The operator manually activates the cutting mechanism, typically using a lever or pedal, to initiate the cutting process. The cutting blade or tool penetrates the sheet metal, producing clean and precise cuts.
4. **Grinding Operation:** - **Preparing Surface:** If necessary, the operator may prepare the surface of the sheet metal by removing burrs or imperfections using a deburring tool or file. - **Grinding Setup:** The operator selects the appropriate grinding wheel or abrasive tool based on the desired finish or surface treatment. - **Manual Grinding:** Using the machine's grinding platform, the operator manually grinds the surface of the sheet metal to achieve the desired finish, smoothness, or edge profile.

5. Finishing and Inspection: - Once all fabrication operations are complete, the operator inspects the fabricated components for quality and accuracy. - Any necessary finishing touches, such as deburring or polishing, may be applied manually to ensure the desired final appearance and functionality.

6. Unloading and Cleanup: - After fabrication is complete, the operator unloads the fabricated components from the machine's work surface. - Any debris or waste generated during the fabrication process is cleaned up and disposed of properly to maintain a safe and organized work environment.

V. CONCLUSION

In conclusion, the development of the manually operated sheet metal bending, cutting, and grinding machine represents a significant advancement in the field of metalworking. Through the integration of versatile functionalities, user-friendly design features, and cost-effective solutions, this machine addresses the challenges faced by individuals and small businesses in accessing efficient sheet metal fabrication equipment. The project's objectives were successfully achieved, with the machine offering a comprehensive solution for bending, cutting, and grinding sheet metal materials with precision and ease. By empowering users to perform essential fabrication tasks manually, the machine promotes skill development, creativity, and productivity within the metalworking community. Overall, the project demonstrates the power of innovation and collaboration in addressing real-world challenges, and the manually operated sheet metal machine stands as a testament to the ingenuity and dedication of those committed to advancing the field of metalworking. With its versatility, affordability, and accessibility, it paves the way for a new era of creativity and excellence in sheet metal fabrication.

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