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Design & Analysis of Welding Fixture for the Angle Bracket

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Abstract - The design and development of a welding fixture specifically suited for the effective assembly of angle brackets in industrial applications is the main goal of this project. The necessity for dependable fixtures that guarantee accuracy and stability throughout the welding process has grown significantly, as the demand for premium-welded components rises. This study describes a methodical way to create a welding fixture that maximises the welding process while supporting angle brackets of different sizes and designs. The design process began with a complete examination of the specifications and needs for the angle brackets, including material qualities, dimensional tolerances, and manufacturing volumes. The choice of materials and design elements to reduce problems like distortion and thermal expansion was informed by a deep understanding of the welding techniques used, such as MIG and TIG welding. Using cutting-edge CAD software, preliminary conceptual drawings were created, enabling the visualisation of crucial parts including clamps, locators, and supports. To guarantee that the angle brackets were positioned securely during the welding process, the fixture's stability and adjustability were given first priority.

***Key Words*:** Fixture design, Angle Bracket, Solid works, drafting of fixture, manufacturing tool, CAD, Tool Design, CAE.

1.INTRODUCTION

Precision-engineered components are becoming more and more necessary in today's fast-paced industrial environment. Among these parts, angle brackets are essential for offering structural support in a variety of settings, such as equipment, automotive assembly, and construction. Angle bracket welding must meet strict quality criteria in addition to guaranteeing strength and stability. A dependable and effective welding fixture is necessary to do this.

In order to minimize movement and guarantee precise alignment, welding fixtures are specialized instruments made to hold work parts in place when welding. Fixtures that can support different geometries and sizes while providing easy access for welding equipment are frequently necessary due to the complexity of modern manufacturing. This requirement emphasizes how crucial a well-designed fixture is to increasing output and the calibre of the finished product.

Designing and creating a welding device especially for angle brackets used in industrial settings is the goal of this project. The fixture will address common welding process issues such operator safety, heat distortion, and inaccurate alignment. This project aims to develop a fixture that not only satisfies the technical requirements necessary for efficient welding but also improves the general workflow in a manufacturing setting by utilizing cutting-edge design approaches and prototype techniques.

Significant advantages are anticipated from the introduction of this welding setup, such as increased operator ergonomics, decreased cycle times, and greater welding precision. The project aims to provide a solid solution that complies with modern industrial standards and procedures by using a methodical design approach that incorporates thorough testing and iterative improvements. This introduction lays the groundwork for a thorough examination of the welding fixture's design procedure, testing procedures, and expected effects on angle bracket production. High levels of efficiency and precision are becoming more and more necessary in the field of modern manufacturing, especially in assembly processes where structural integrity is crucial. One the angle bracket is one of the most often used parts in many different sectors. These adaptable supports, which strengthen connections and provide stability in structural frames, are crucial in applications such as furniture, automobiles, and construction.

These angle brackets are frequently assembled using the welding technique, but this method has some drawbacks that may affect the product's quality. To achieve robust, dependable joints, proper alignment, stability during welding and distortion prevention are essential. Fabricators struggle to maintain accurate placement without a specialized welding fixture, which can result in misaligned components, uneven weld quality, and higher production costs because of rework and material waste.

2. Objective

- Achieving High Precision
- Reducing Setup Time
- Enhancing Stability
- Ensuring Versatility
- Improving Safety
- Minimizing Waste
- Incorporating Modern Technologies

3. Methodology

- CAD MODELLING

CAD is defined as Computer Aided Design. It is used to design Product as well as tool to get the manufacturing done in a very easy manner. CAD tools enable precise design, visualization, analysis, and modification of both the angle bracket and the welding fixture prior to physical fabrication.

- PRODUCT CAD MODEL

Modified angle plate fixture is a product used in industry for the fixturing for industrial racks. The product is made using the software tool that is solidworks. In which the sketching, and part design module is used.and drafting module is used for creating manufacturing drawing.

Fig.-1: Isomteric View of Product

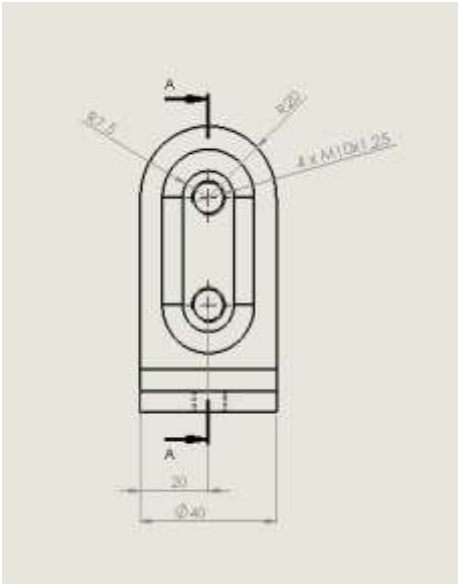

Fig. -2: Front View of Product

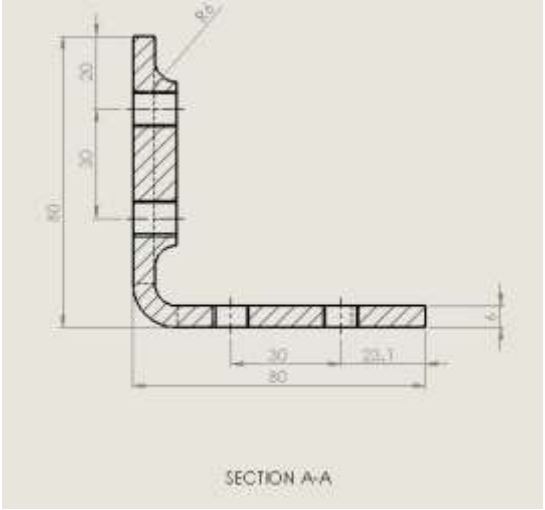

Fig. -3: Side Cut Section View of Product

- Tool CAD Model

Making items precisely, fast, and consistently with the same quality is crucial in production. The use of fixtures and jigs is one method for accomplishing this. During machining, these specialised tools are utilised to hold and guide the work piece and tools. They help save time, reduce human error, and increase precision in the production process.

A tiny metal component frequently found in mechanical assemblies or frames is the angle bracket. Its form might make it challenging to handle and manufacture with standard techniques. Errors, misalignment, or lengthier setup times may result from this.

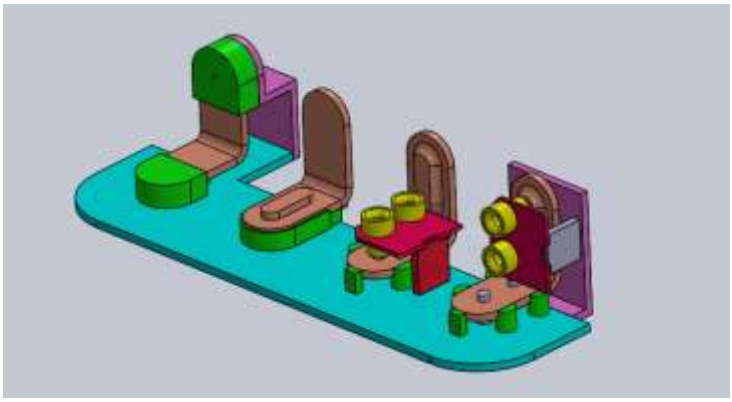

Fig. -4. Assembly of Jig and Fixture Tool

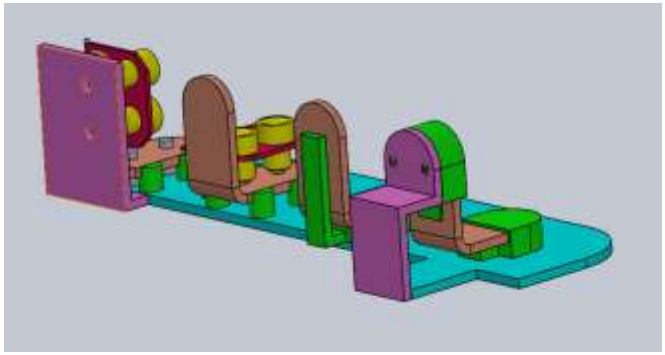

Fig. -5. Assembly Back Isometry View of Jig and Fixture Tool

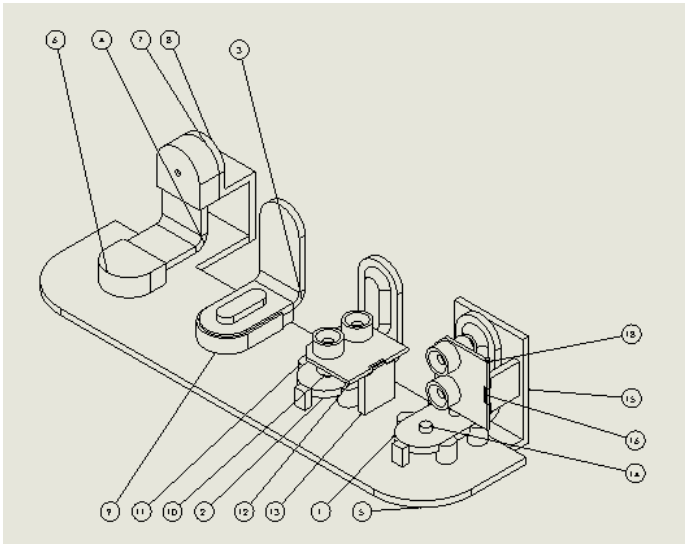

Fig. -6: Assembly with Part Ballooning

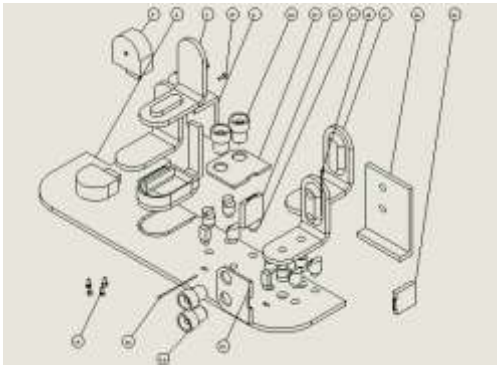

Fig.-7: Exploded View of Assembly with Part Ballooning

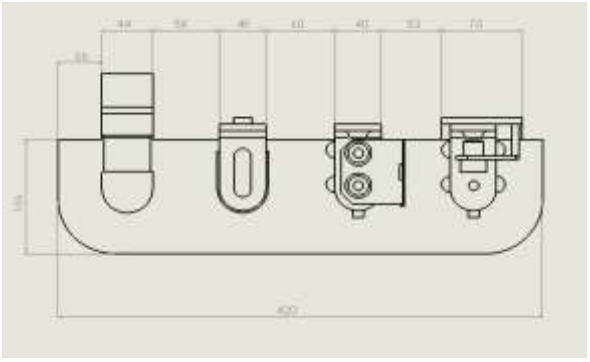

Fig. -8: Assembly Top View

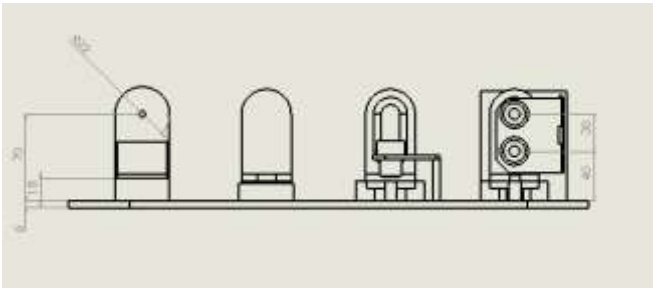

Fig. 9: Assembly Front View

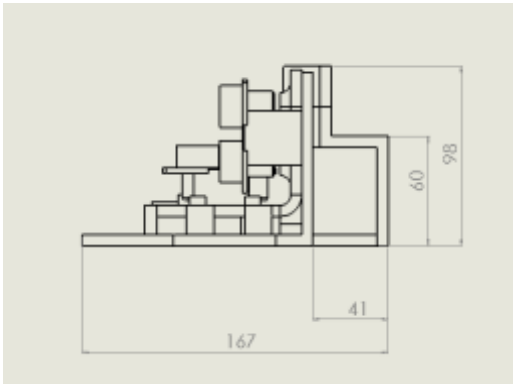

Fig. -10: Assembly Side View

- Tool Analysis

To ensure the longevity and optimal performance of jigs and fixtures, computer-aided engineering (CAE) analysis has emerged as a crucial method. In order to maximise the design for durability, performance, and cost-effectiveness, engineers can utilise CAE to model and analyse how jigs and fixtures will behave in realistic operational conditions prior to actual manufacturing. A more complex approach to jig and fixture design is made possible by the use of CAE, which removes the requirement for physical prototyping and reduces design flaws.

- Stages in Static Structural Analysis

  - Geometry Creation/Import
  - Material Assignment
  - Meshing
  - Applying Loads and Supports
  - Solving
  - Results and Interpretation

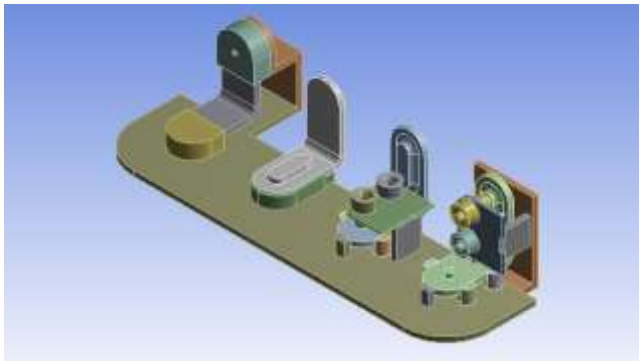

Fig -10: Model

Fig -11 : Mesh Model

Fig- 12: Boundary Condition

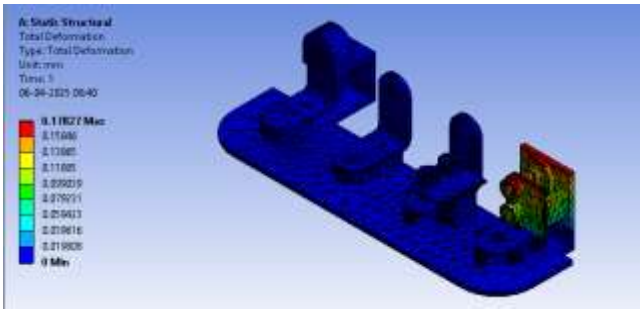

Fig -13 : Total Deformation

4. CONCLUSIONS

With an emphasis on enhancing welding accuracy, operational effectiveness, and repeatability in an industrial context, the design and development of a welding fixture for the angle bracket has been completed successfully. A fixture that guarantees correct alignment, secure holding, and unhindered access to weld joints has been developed through meticulous CAD modelling, careful selection of clamping and locating mechanisms, and ergonomic considerations.
Static structural analysis is done on the fixture tool for checking the stresses and deformation. By applying the above loading, the stresses and total deformation is found in limit. Therefore according to static structural study using ansys software our design is safe.

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