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DESIGN AND FABRICATION OF AUTOMATIC WELDING TABLE

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ABSTRACT

In the fabrication industry, welding is the most common process. To perform this task efficiently, two or more employees are typically required. One or two employees to maintain the work piece while the other performs welding on it. In the case of cylindrical structures, it may be necessary to turn the work continuously and then use welding to seal the containers. To make this task easier, we created an automatic welding table with chuck arrangement which allows for fixed welding operations. To rotate the chuck here on table top welding turntable, a geared motor arrangement with a firm design has been used. This automated chuck is placed horizontally moveable system that keeps work in a good position.

The machine can be battery powered that allows for simple operation and chuck rotation speed control. The speed of the chuck, the opening and sealing of the chuck, and the number of turns to be performed on the work material to weld all are controlled by a PLC board. A weld positioner's working concept is the same for all work pieces, major or minor. They form a rotation plane which is perpendicular to the floor. These positioners can hold vast quantities of tooling.

***Key terms**: Fabrication industry, automatic welding machine, chuck operations, welding and cutting are some of key terms..*

1. INTRODUCTION

Welding equipment that carry out specific movements on a weld joint that is highly repeatable in shapes such as circle, arc, and longitudinal seams is known as fixed automation welding. Welding machine systems is versatile and that can be used for a lot of welding automation projects. Welding equipment operations are usually fixed in order to perform a basic geometric welding application. The backbone of fixed welding automation consists of welding position equipment and machine systems, which usually includes welding lathes, turn tables positioners, circle welders, and longitudinal seam metalworkers. We designed and developed a prototype welding fixture with increased flexibility to tackle this problem. All elements, large and small, maintain the same positioning standards. Many organizations concentrate in the design and production of sheet metal welding components, assembly fittings, checking fittings, and inspection fittings, and could provide it from a single fixture to a perfect solution.

Because of multifield (thermal, mechanical, metallurgy, etc.) interactions and intricate geometries in real-world applications, identifying weld induced errors has found to be a hard and computationally intensive task. However, with the availability of 64-bit computers and refined FE tools, welding engineers around the world are progressively inclined toward computer simulations of complex welding concepts rather than the conventional trial-and-error approach on the shop floor, it is the most standard procedure nowadays.

To make things simple, we designed an automatic welding table with chuck arrangement which permits for mono welding operations. To rotate the chuck on the table top welding turntable, a geared motor arrangement with a firm structure is being used. This automated chuck is positioned on a horizontally adjustable system and keep work in a better position for cutting and welding operations. The machine can be powered by batteries that permits for simple operation and chuck rotation speed control. Welding equipment that performs specific movements on a weld joint that is highly repetitive in shapes like circular, arches, and longitudinal seams is termed as fixed automation welding. Moreover, the chuck has been automated to open and closed in relation to the size of the work piece, significantly reducing time in opening and closing the chuck physically. The speed of the chuck, the number of revolutions to be implemented on the workpiece material to weld all are governed by a PLC board.

1.1 PROBLEM STATEMENT

To perform the welding operation efficiently, two or more employees are generally required. One person should hold the work whereas the other performs welding on the piece. In the case of cylindrical structures, it may be necessary to turn the work constantly and to use welding to seal the containers. Because of the multi-field (thermal, mechanical, metallurgy, etc.) interactions and intricate geometries in real-world applications, estimating weld induced errors has proved to be a tough and computationally costly task.

1.2 OBJECTIVES

To design and fabricate an automatic rotatory welding table with an automated three-jaw chuck to permit the welder to weld with ease and in highly repeatable shapes such as circles, curves, and longitudinal seams, as well as to increase production rate and reduce welding time by speeding up the welding process in a more efficient and ergonomically friendly way..

1.3 ADVANTAGES

By responding to the welder's comfortable ergonomic positions, the machine would reduce welder fatigue. This machine would drastically enhance welder safety by providing comfortable working positions. The steady rotation provided by the automated chuck leads to constant perfection in the welding operation, which might enhance weld quality. The automated chuck would significantly increase productivity over manually positioning parts and opening and closing the jaw. Welders can use this device to help customers operate and weld huge elements and parts. With revolving the chuck at constant preset rates, it ensures smooth welding. Faster welding speeds were accomplished, that is helpful for producing X-ray quality welds. The number of people involved in the welding process is reduced to one. This machine is extremely user-friendly, therefore no specialist operator is required to operate this. We can easily design the speed and diameter of the work piece depending on the type of job. This machine can be easily maintained and serviced without trouble.

1.4 SCOPE

This invention will make welding much more uncomplicated and convenient. This invention is designed to make the welder's working table much more ergonomically comfortable. This invention will increase production rate by controlling chuck rotation, opening, and closing, hence reducing manufacturing time and concentrating on uniform finish. The equipment is simple to operate, maintain, and rebuild.

2. REVIEW OF LITERATURE

2.1 INTRODUCTION

A review of literature is an evaluative report of information found in the literature that is related to our project's specified area of research. This literature should be reviewed, summarised, evaluated, and explained in the review. It will provide a theoretical basis for the research.

The microprocessor control of a brushless motor without a shaft position sensor is researched by Iizuka et al., (1985). The starting method, which utilizes the motor as a synchronous motor at standstill, and an ability to determine the permanent magnet rotor position using the back electromotive force (EMF) induced in the stator windings are described. Commutator transistors slice the motor voltage to change the motor speed. A 4-b single-chip microcomputer and two quad-comparators make up the control system.

R Ippolito and associates (1985) For industrial applications with high speed turning, a reliable gripping action is necessary. Extremely fast Production machining requires burst-proofing and sufficient gripping across the operating range. The existing work is divided into two halves. The first describes numerical stress analysis of main components utilizing FEM under both static and dynamic loads, as well as spin tests up to rupture speed for design optimization. The second stage involves an in-process gripping force measuring device that is specifically designed for use in a closed-loop regulation system. This work by Zhenhai Chen et al. (1998) proposes a novel proximity sensor based on micro electromechanical systems (MEMS) technology. The proximity sensor works on the fringe capacitance principle. The target object does not have to be a component of the measuring system and can be a conductor or a non-conductor. A closed-form analytical solution for a ring-shaped sensing pattern is obtained by modelling the proximity sensor. MEMS technology can be used to batch fabricate proximity sensors, and the technique is relatively simple. The prototype sensors' analyses revealed promising results. The proximity sensor's size can vary from a few hundred micrometres to the substrate's size.

3. MATERIALS AND METHODS

This project's ultimate purpose is to create an automatic rotary welding table. Materials are the most important element of each and every product. The required materials are selected and filtered. This chapter includes conceptual and design elements, as well as line drawings.

3.1 CONCEPTUAL DESIGN

The 3D modeling software has been used to develop the conceptual design and isometric view of an automatic welding machine, that was then assessed and the conceptual design shown. The parts are presented from the conceptual design. The developed automated rotary welding machine is in isometric view**.** is shown in fig 3.1

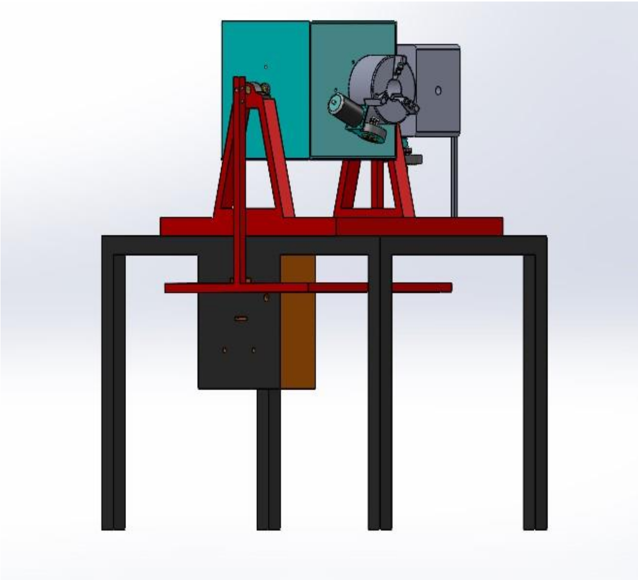

Fig 3.1 Automatic rotary welding machine

3.2 Exploded view

The exploded view of the automatic rotary welding machine is shown in fig 3.2

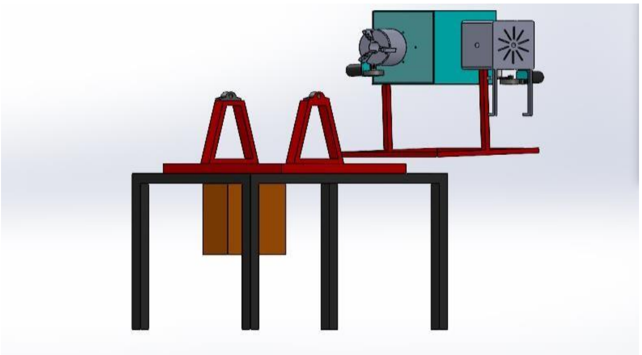

Fig 3.2 Exploded view

3.3 Components description

The automatic rotary welding machine consists of the following components to full fill the requirements of complete operations of the machine.

1) Motor
2) Spur Gear
3) Bearing
4) Control unit
5) Three jaw chuck

3.3.1 MOTOR

A operation of every electric motor is based on simple electromagnetism. When a current-carrying conductor is placed in an externally applied magnetic field, it will experience a force proportional to the current in the conductor and also the strength of the external magnetic field. As you may remember from our early experiences with magnets, opposite polarities (North and South) attract, however like polarities (North and North, South and South) resist. A DC motor's internal configuration is designed to generate rotational motion by harnessing the magnetic interaction between a current-carrying cable and an external magnetic field.

Let's start with a basic two-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).

An axle, rotor (armature), stator, commutator, field magnet(s), and brushes seem to be the six basic parts of a DC motor. High-strength permanent magnets can provide external magnetic field in most common DC motors. The stator is the motor's normalized pattern, that comprised of the motor casing and two or more permanent magnet pole pieces. The rotor rotates in respect to the stator, together with the axle and linked commutator. Windings (generally on a core) make up the rotor, which are electrically connected to the commutator.

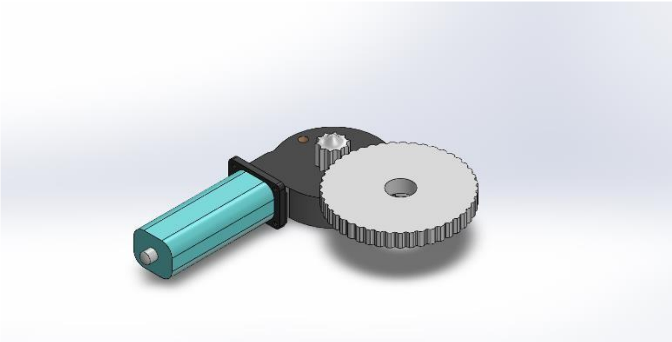

FIG 3.3 MOTOR

3.3.2 SPUR GEAR

Spur gears are the most basic and widely used type of gear. A cylinder or circle seems to be the most common configuration. The teeth project radially, and with these straight-cut gears, the leading edges of the teeth are aligned parallel to the axis of rotation. Only when such gears are installed on parallel axles can they mesh effectively. The torque ratio is computed by analyzing the force that one gear's tooth exerts on some other gear's tooth. Consider two teeth in contact at a point on the line that connects two gears' shaft axes. There'll be a radial and circumferential component to the force. Gears are a very useful and uncomplicated machine.

A gear is a component of a transmission network. Transfer rotary force to another device or gear. A gear is not same as a pulley as it is a round wheel. Allow force to be completely transferred without sliding by linking up with other gear teeth. Geared devices can transmit forces at various speeds, torques, or direction from the power source, depending on their design and arrangement. Gears are a very useful and uncomplicated machine

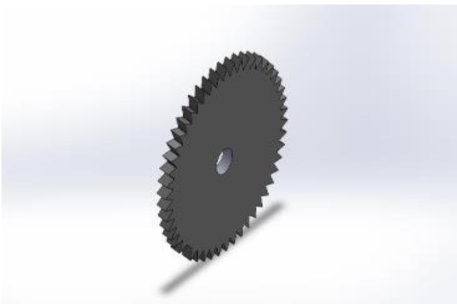

FIG 3.4 SPURS GEAR

3.3.3 BEARING

A bearing is a device that allows limited relative motion between two parts, either rotation or linear motion. Bearings are classified in general terms predicated on the motions they allow and the principles of functioning. Low friction bearings are often used to increase efficiency, reduce wear, and allow high speeds. A bearing can reduce friction by virtue of its shape, material, or the admission and retention of a fluid between two surfaces. Gains an opportunity with the use of spheres or rollers. By material, it takes full advantage of the bearing material's properties. Bushes, bushings, journal bearings, sleeve bearings, rifle bearings, & plain bearings are all types of sliding bearings. Bearings with rolling elements, such as ball and roller bearings.

D	25mm	Bore diameter
Dsp	52mm	Outside diameter
B	34.1mm BEARING	Width
NG GREASE	16,700 1/min	Limiting speed for grease lubrication
Cr	14,000N	Basic dynamic load rating , radial
COr	7,800 N	Basic static load rating radial
Car	335N	Fatigue load limit , radial
~ m	200g	Weight

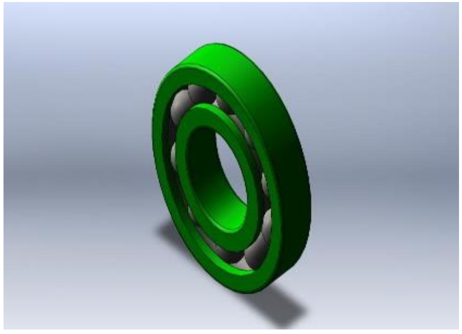

Fig3.5 BEARING

TABLE 3.2

SPECIFICATION OF BEARING

Fits bearings with OD of	52 mm
Bolt hole to bolt hole	4.13 inch
Overall length	5.5.1 inch
Shaft height	1.43 inch
Overall height	2.27 inch
Bolt hole	0.511 ch

3.3.4 CONTROL UNIT

Microcontroller is a computer on a chip. Micro suggests that the device is small, and controller tells you that the device' might be used to control objects, processes, or events. Another term to describe a microcontroller is embedded controller, because the microcontroller and its support circuits are often built into, or embedded in, the devices they control. It is temporary storage unit. A microcontroller is a complete microprocessor system built on a single IC.

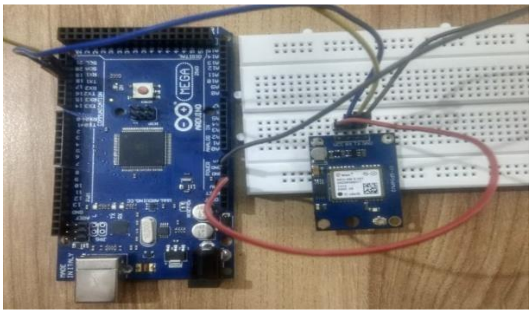

Fig 3.6 Aurdino Mega

Fig 3.7 Proximity Sensor

Fig 3.8 Relay

3.3.5 THREE-JAW CHUCK

Three-jaw chucks are designed to automatically center round or hexagonal parts or stock to within a few thousandths of an inch once all three jaws move together. These chucks simply hold work in the lathe rapidly and effortlessly. Turn the outer ring with one hand while gripping the knurled inner ring with the other to open or close the chuck. To apply additional leverage to tighten or loosen the chuck, insert the tommy bars in the holes provided in each ring.

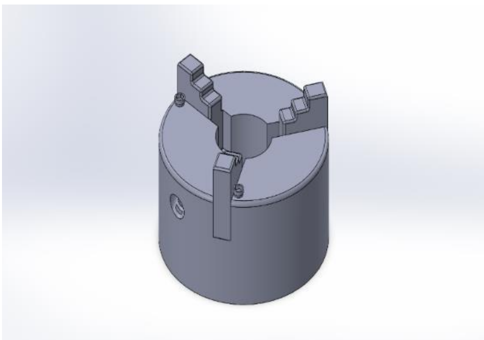

FIG 3.9 THREE JAW CHUCK

3.3.6 GEAR BOX

A gear box is used to increase the output torque of a motor or to vary the speed (RPM). The shaft of a motor is connected to one end of a gear box, it produces a given output torque and speed determined by the gear ratio through internal configuration of gear. The power is transmitted from one shaft to another using gear. The number of teeth and the size of the gears calculate the amount of torque transmitted through it.

4. SUMMARY AND CONCLUSION

4.1 SUMMARY

The fabrication industry's two most significant operations are welding and cutting. Both operations usually require two or more people to complete rapidly. One or two persons to hold the work while another person does welding or cutting. In the case of cylindrical strictures, it is sometimes necessary to switch the work continually in order to achieve container sealing via welding. To make this task easier, we designed a rotary welding turn table with chuck design that allow for mono welding and cutting. To rotate the chuck on the table top welding turntable, a geared motor arrangement with a firm design is used.

We calculated the chuck rotation speed for three different work pieces with different diameters during the construction of this project, ranging from 0.0904 for work piece 1, 0.0753 for work piece 2, and 0.05014 for work piece 3. These speed calculations are made with the help of a professional CSWIP 3.0 certified engineer and are dependent on the thickness of the welding pipe. Later, using Python programming, this speed is programmed into the PLC board. The "AUTOMATIC WELDING TABLE" project is well-planned and designed to reduce the ergonomic stress induced in a welder in mass production by including the tilting chuck feature.

4.2 CONCLUSION

This project was designed with the aim of offering flexibility in operation with the use of a "360° ROTARY CHUCK" in this equipment. The "AUTOMATIC WELDING TABLE" project was created with the intentions of being somewhat cost effective and useful to a variety of industries and workshops. This project taught us more about the steps required in completing the project. As a result, the project was successfully completed..