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Design and Manufacturing of Job Rotary Welding (SPM)

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Abstract – Welding is a joining process in which localized permanent joint can be produced with or without application of heat, pressure and filler material. Automation can be defined as use or application of integrated mechanical, electronic and computer based system in the operation and control of production system. Rotary welding is a advanced welding process in which either job or welding torch is rotated in order to do circular welding. In rotary welding machines system is designed to weld circular components with high through put. Now a days for circular welding of machine components many industries using single torch or multiple torches to weld both small and large surface areas called circular welding. In this project we are developing much cheaper but effective and advanced gas metal arc welding with automated kit for automating the whole welding process. Automation of brake pedel component i.e circular welding is successfully achieved in the form of Job Rotary Welding Machine.

***Key Words*: Job Rotary Welding1, SPM2, GMAW3, Brake pedal component4**

1. INTRODUCTION

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work-pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the work- pieces to form a bond between them, without melting the work pieces. Arc welding is one of several fusion processes for joining metals. By applying intense heat, metal at the joint between two parts is melted and caused to intermix - directly, or more commonly, with an intermediate molten filler metal. Upon cooling and solidification, a metallurgical bond is created. Since the joining is an intermixture of metals, the final weld element potentially has the same strength properties as the metal of the parts. This is in sharp contrast to non-fusion processes of joining (i.e. soldering, brazing etc.) in which the mechanical and physical properties of the base materials cannot be duplicated at the joint.

In arc welding, the intense heat needed to melt metal is produced by an electric arc. The arc is formed between the actual work and an electrode (stick or wire) that is manually or mechanically guided along the joint. The electrode can either be a rod with the purpose of simply carrying the current between the tip and the work. Or, it may be a specially prepared rod or wire that not only conducts the current but also melts and supplies filler metal to the joint. Most welding in the manufacture of steel products uses the second type of electrode.

There are several different ways to weld, such as: Shielded Metal Arc Welding, Gas Tungsten Arc Welding, Tungsten Inert Gas and Metallic Inert Gas. MIG (Metallic Inert Gas) involves a wire fed "gun" that feeds wire at an adjustable speed and sprays a shielding gas (generally pure Argon or a mix of Argon and CO_2) over the weld puddle to protect it from the outside world. With GMAW (Gas Metal Arc Welding) becoming more widely used in the industry worldwide and increasing demands towards higher productivity the demand for higher deposition rates arose. Generally speaking, the deposition rate depends on the wire feed speed and the wire diameter. A higher deposition rate can be used either to weld larger sections per weld run, thus reducing the amount of layers necessary to fill a weld, or to increase the travel speed. MIG and TIG both are argon welding as both the processes uses argon for shielding as it is an inert gas. But practically company is using 80% argon and 20% CO2 as inert gas (Inert gas - Used to shield the electric arc from outside contaminants and gases which may react with the weld.

Circular welding is one of the most critical welding process carried out manually, especially when accuracy and uniformity is of high concern.

2. Literature Review

1. Ho Thi My Nu et al [2019] published a research paper on " A Study on Rotary Friction Welding of Titanium Alloy(Ti6Al4V)". Investigation is done by numerical analysis and experiments. They have found that titanium alloy Ti6Al4V similar metal joints were successfully welded by the rotary friction welding process. The titanium rotary friction welding achieve a tensile strength that is higher than that of the base material. An increase in the forging pressure produces an increased upset. Therefore a small forging pressure is preferred in the friction welding process. Upset threshold were determined between 5mm and 7mm for small size specimen of Ti6Al4V. Below 5mm, insufficient bonding was observed, whereas the welding process became unstable above 7mm. During the initial friction stage, the temperature at the friction interface rapidly increases, while the temperature becomes uniform and almost constant during the steady friction stage. The microstructure of HAZ is similar to that of the BM with an increase in the fraction of β. The study proves the viability of rotary friction welding as a possible means of joining Ti6Al4V. Therefore, a small forging pressure is preferred in the friction welding process.

2. C.Jia et al [2018] published a research paper on ''Rotating-Tungstun narrow-groove GTAW for thick plate''. They had worked on novel rotating tungsten narrow groove gas tungsten welding process was proposed based on a specially designed non axisymmetric and rotating tungsten electrode. They have found that noval technology of rotating tungsten narrow groove GTAW achieved good weld appearances and sufficient side wall penetration. Also the new welding torch can control the rotation of the arc in the narrow groove, and the advantages include perfect gas shielding , steady wire feeding, sufficient side wall fusion, concave and fish scale weld joint, as well as absence of oxidation. Stable rotating arc can periodically heat the sidewall and weld pool at the bottom. The current and arc voltage changed periodically because of the distance between the tungsten tip and the liquid metal surface. The weld power ensured the adequate heat input on the sidewall. The periodic arc rotation had a stirring effect on the weld pool, and the ideal heating effect on the sidewall guaranteed good sidewall fusion , smooth weld appearance and the absence of coarse garins caused by overheating in the weld joint.

3. Afnan Dadi et al[2018] has worked on optimizing the process parameters of SMAW process of mild steel by using taguchi method and annova analysis. To fulfill this objective, selecting important welding parameters like welding current, root gap and thickness of plate as per field experts suggestions and available literature. On the selected parameters trails have been conducted as per taguchi method at the welding current of 110amp the tensile strength was maximum for single v joint design in comparison with weld carried out of 90amp, 100amp and 120amp and also in comparison to other types of joint design, i.e. double v (uts 387.74mpa, ys 297.81mpa) and square butt joint (uts 394.16mpa, ys 284.93mpa) the ultimate tensile strength of single v joint design was maximum. With the increase in welding current which was taken as a variable parameter the ultimate tensile strength 435.59mpa, yield strength 340.23mpa and percentage elongation of 20.39 was recorded. Maximum/optimum value of tensile strength of single v joint design was obtained when welding speed was 157.80mm/min. the maximum uts was obtained when the heat input rate was 919.63 j/mm. Hence it can be concluded that the ultimate tensile strength in case of the single v joint was maximum as a result of correct fusion between weld metal and base metal, right joint design and edge preparation for this type of material thickness.

4. Virendrakumar Mahajan in [2016] has worked on automation of circular welding which is successfully achieved in the form of ''Torch Rotary Machine'' with all desirable features a SPM carries. In this project they have to join muffler assembly by circular welding. So for that they designed the torch rotary welding machine. In that machine the welding torch is rotating with respect to muffler assembly i.e job and circular weld points are correctly join by this type of welding. They have automated the whole welding process and achieved good results through this welding machine. Design and dimensions obtained in the design cycle came to their supposed results, which leads to error free welding cycle without susceptible failures. Quality improvement and decrease in time consumption followed the objectives. Productivity increases to a great extent through this project. For our project we have taken reference design by studying this research paper and designed our SPM by taking reference of this paper.

3. Problem Statement

Now a days in most of the industries circular welding for brake component is done by manually. Yogeshwar industries situated in MIDC Nashik are the manufactures of welding fixtures and brake pedals. They are using raw material as cast iron or mild steel for the manufacturing of the brake pedal. In our project we have to weld two circular welding points in brake pedal using automating the welding machine(SPM).

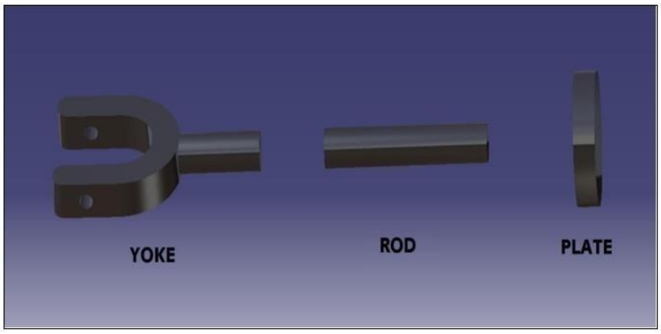

Figure 1 : Problem Statement

The component is yoke, rod and plate assembly. It has two points on the two faces of rod. These two points are located at two different points in vertical plane as shown in fig

4. Objectives

- Reduced errors.
- Cost saving.
- Increased productivity.
- Uniform and precise welding.
- Reduced labour requirement.
- Increased machine utilization.

5. Methodology

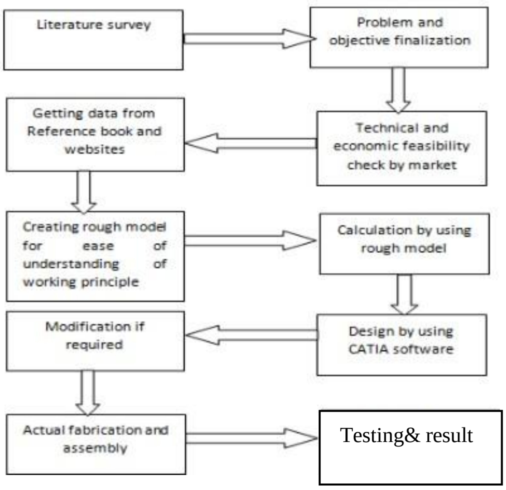

Chart 1 : Methodology

6. Design of the model

The various parts required for project is designed and assembly of the same is created in CATIA &AutoCAD. For knowing the working principle we have designed separate components in Catia V5 and then assembled in it. Fig 1 shows assembly is of drive unit and fig 2 shows the actual setup of machine.

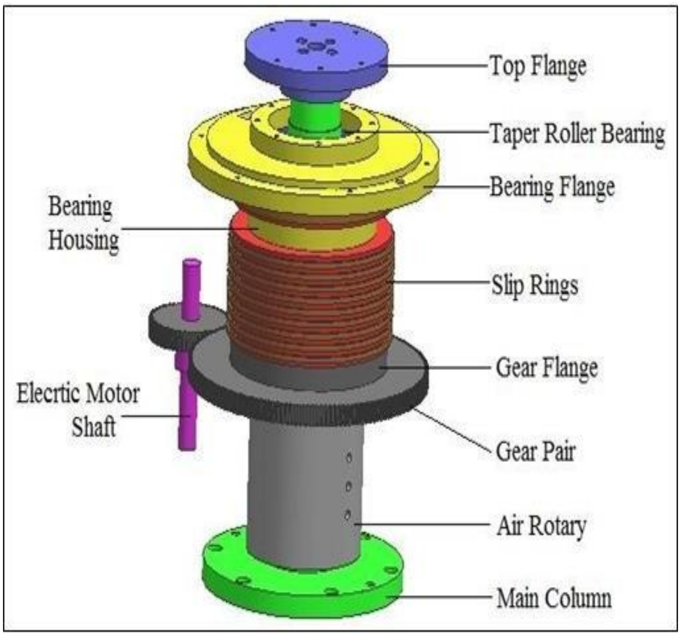

Figure 2: Drive unit assembly Catia V5

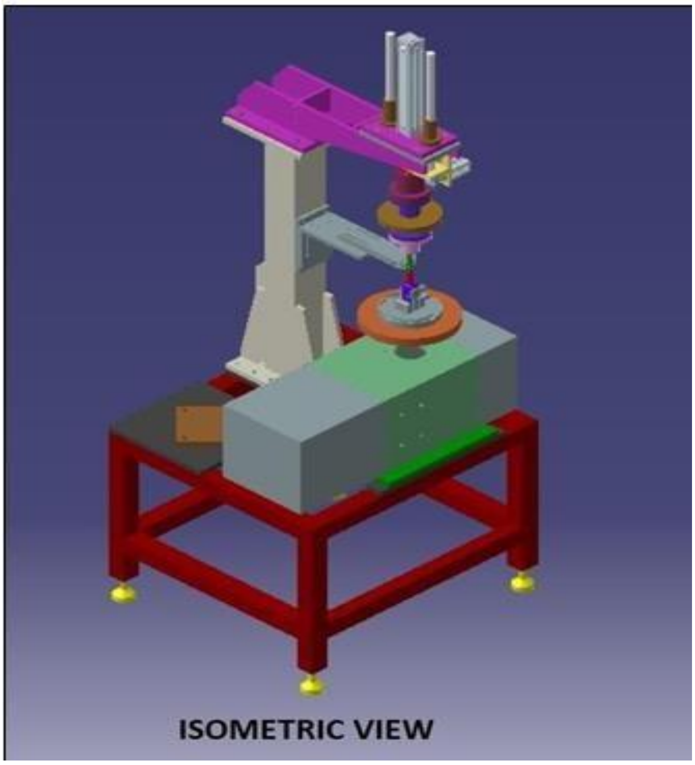

Figure 2: Actual setup in Catia V5

7. Material Specification

Sr. No	Part Name	Raw Material
1	Base Plate(Whole structure)	M.S.
2	Main Column	EN8
3	Main Column base	M.S.
4	Gear Pair	C50
5	Gear Flange	M.S.
6	Taper Roller Bearing	STD
7	Slip Rings	
8	Bearing Housing	M.S.
9	Bearing Flange	M.S.
10	Base Ring	M.S.
11	Head Column	M.S.
12	Working Heads	M.S.
13	Straight pipe locator	-
14	Bend pipe locator	-
15	Locking pins	-

Table 1: Material specification

8. Advantages and Limitations

Advantages

1. Circular welding which were done using manual welding it get done by automation. Thus automation welding operation.
2. As in torch rotary energy required is very high. So in job rotary there is energy saving compared to torch rotary.
3. Quality of weld joint get improve compared to manual welding.
4. Operator fatigue get reduced
5. Saves time and improve productivity of the industry

Disadvantages

1. The main disadvantages of the SPM is high initial cost.
2. Also maintenance of the machine is high.
3. High operating cost.
4. Design of the job rotary machine is complex.
5. The machine can be used only for circular welding of components and not for other type of component.

9. Conclusion

Due to limitations of manual arc welding our project will leads to automation of circular welding, which can successfully achieved in the form of Job Rotary Machine with all desirable features. Also quality improvement and decrease in time consumption of welding process. Company will enjoy benefits of improved lead time, quality, customer satisfaction and increase in the number of orders. Further this SPM allots the benefits to the industry like economical benefits and status improvement among the competitors. We gained unique experience of integrating and evaluating theory and practical aspects of design. This helps us to extract valuable knowledge and data. We are sure that this valuable experience will be helpful in our future in all aspects.

10. References

1. Ho Thi My Nu, Truyen The Le,Luu Phuong Minh and Nguyen Huu Loc “ Study on Rotary friction welding of Titanium alloy “ [2019]

2. C. Jia, Q. Yan, B. Wei and C. Wu “ Rotating tungsten narrow groove GTAW for thick plate rotating non axisymmetric tungsten ensure sidewall penetration”[2018]

3. Afnan Dadi, Prof. Bhupesh Goyal & Mr. Hardik Patel “Optimization of shielded metal arc welding parameters for welding of mild steel plate using Taguchi approach” [2017]

4. Virendrakumar Mahajan, Shubham Gove, Sagar Avhad and Prof. V.S.Gavali “ Study of design and manufacturing of torch rotary welding SPM” [2016]

5. Swapnil Gundewar and Prof. M.R Nagare “Automation of Gas tungsten arc welding & parameters of Auto TIG “ [2015]

6. Prof Sanjeev Kumar, Prof D.P Singh & Ashwane Kumar “Robotic & Automated welding” [2015]

11. Book References

[1].A textbook of “Material science and metallurgy”, O.P Khanna, DhanpatRai.
[2]“Design Of Machine Element” by V.B Bhandari.
[3]PSG Design data book.
[4] “Industrial fluid power” by Andrew Person.
[5] “ A textbook of weldingtechnology” by O.P Khanna and Dhanpat Rai and sons.