Design & Manufacturing Of Rotary Job Welding SPM

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***Abstract*— Main role Automation is cost saving and to maximize productivity of system. Basic requirement of any manufacturing company is having effective work output. Circular welding is one of the most critical welding processes which is carried out manually, to fulfill that requirement we have used automated job rotary welding process. In my project I have to weld two circular welding points in automobile component. The finish component is air brake pedal assembly. Special purpose machine (Job Rotary Machine) is used for the welding for the air brake pedal using GMAW process with the help of torch this machine tools are designed and manufactured for specific jobs and such never produced in bulk, such machines are finding increasing use in industries and techniques for designing such machine would obviously be quite different from those used for mass produced machine. A very keen judgment is essential for success of such machines, Paper and Project aims at automation of circular welding which will successfully achieved in form of "Job Rotary Machine" with all desirable features a SPM carries.**

Keywords—component GMAW-Gas Metal Arc Welding, SPM-Special Purpose, rotary job, air brake pedal.

I. INTRODUCTION

Welding is a fabrication and sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is also done by melting the work-pieces and adding the filler material to form a pool of the molten material (the weld pool) which cools to become a strong joint, with pressure also 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 CO2) 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.

On the other hand, due to the complexity of the process availability of skilled worker is difficult. Moreover, due to monotonous and high concentration job schedule, worker fatigue becomes high and hence it forces the tendency of

 DOI : 10.18231/2454-9150.2019.0233

worker to have high wages. To avoid these undesirable circumstances, the application demands import of automation for this circular welding process. Welding automation worldwide utilizes different pneumatic and hydro- pneumatic instrumentation .Advancement in pneumatic as well as in hydro- pneumatic instrumentation has been a keen part of concern. It has become one of vital aspect in the field of research and development due to its effective output and range of accuracy. Newer and newer effective methods have been carried out to improve the automation and to make it inexpensive. This report illustrates role of automation. Based on our project, Automation is much helpful in cost saving and to increase the productivity of the system. Basic requirement for any manufacturing company is to have effective work output. In the world with ever growing technologies, system becomes obsolete very early. Thus, it is very necessary to implement a proper work system to reduce production time and to avoid high cost of not automating. The automation of manufacturing facilities and manufacturing support system increases the shop efficiency. It reduces the scrap and rework, thereby reducing the material and manufacturing cost. There is always a need of firm and realistic pattern of work output, for which automation is much reliable.

Automation can be defined as the technology involved in automated handling between machines and continuous processing at the machines. Automation is not a new technology and has been utilized in the industry since quite some time. In current times, automation has widely exploited the advantages of the electronic and robot technology for achieving efficient and complete control over production. We have chosen MIG welding because MIG is the most effective welding process with respect to other processes for its much greater penetration power and the automated electrode wire feed mechanism.

The paper aims at developing a much cheaper but effective and advanced gas metal arc welding with automated kit for automating the whole welding process. Metal Inert Gas welding is one of the most widely used processes in industry. The input parameters play a very significant role in determining the quality of a welded joint. In fact, weld geometry directly affects the complexity of weld schedules and thereby the construction and manufacturing costs of steel structures and mechanical devices. Therefore, these parameters affecting the arc and welding should be estimated and their changing conditions during process must be known before in order to obtain optimum results

These are combined in two groups as first order adjustable and second order adjustable parameters defined before welding process. Former are welding current, arc voltage and welding speed. These parameters will affect the weld characteristics to a considered great extent. Because these factors can be varied over a large range, they are considered the primary adjustments in any welding operation. Their values should be recorded for the observation.

II. PROBLEM STATEMENT

I had visited in Spectra Tech Industries Ltd. which is situated in bhosari, MIDC who are the manufacturers of welding fixtures and brake pedals. They are using the raw material as the cast iron or mild steel for the manufacturing of brake pedal. In our project given by “Spectra Tech”, we have to weld two circular welding points in brake pedal.

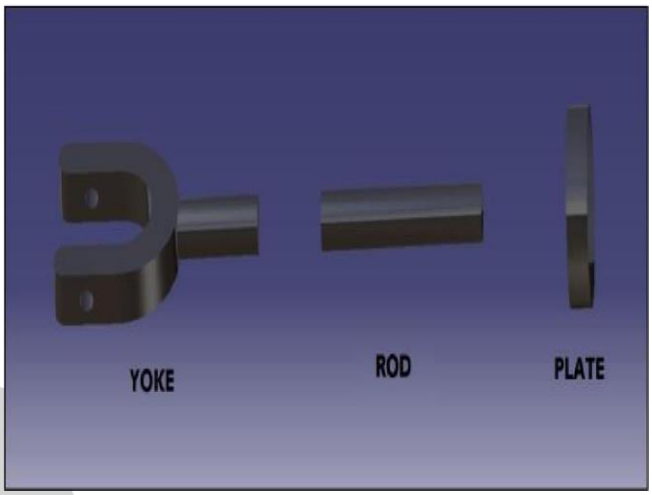

Fig.no 1: Components to be weld

As shown in the brake pedal is an assembly of rod, plate and yoke. It has two points on two faces of the rod. These two points are located at two different points in vertical plane. Onto these two points it has the plate and yoke. To weld these components onto their respective locations, we have to design a SPM which must carry an automated drive for uniform and precise welding.

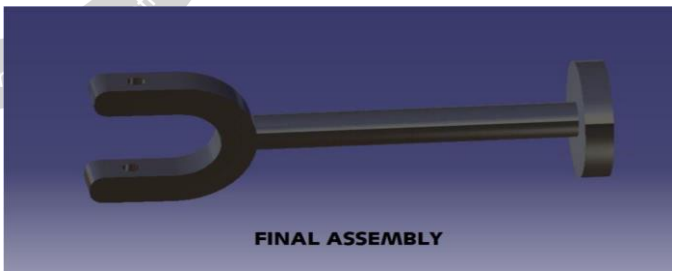

Fig.no 2: Final assembly after welding

III. OBJECTIVES

In project given by “Spectra Tech Industries”, I have to weld two circular welding points in the air brake pedal component. The component is a yoke, rod and plate assembly. It has two points on two faces of the rod. These two points are located at two different points in vertical plane. Onto these two points it has the yoke and plate. To weld these two parts onto their respective locations, we have to design a SPM which must carry an automate drive for uniform and precise welding.

Following are the main objectives of SPM to be designed.

1. Reduced errors.

 DOI : 10.18231/2454-9150.2019.0233

2. Cost savings.
3. Increased productivity.
4. Uniform and precise welding.
5. Reduced labour requirement.
6. Increased machine utilization.

Those are the key objectives of the SPM to be designed. They are to be considered while designing the SPM.

IV. LITERATURE REVIEW

[1]Tomokazu Sacagawea, Shin-ichi Nakashiba, iroyoshi Hiejima:

Although CO2 welding has been successfully used to join various materials, it is still at an early stage. So far, the development of the CO2 welding process for each new application has remained largely empirical. The numerical and experimental studies are significant help in understanding the CO2 welding process. In this paper, the research activities and progress to date in the development of CO2 welding are reviewed. In the present review, emphasis has been given, especially on the welding numerical and analytical modeling, soft computing approaches and welding characterization of the present technique. There are several gaps remaining in the experiment and numerical analysis of CO2 welding. Accurate and reliable experimental and numerical analysis of the CO2 welding is still a very difficult. The main objective of the paper is to review recent progress in CO2 welding and to provide a foundation for further research.

[2]Ai-min Li, Hai-lin Li, Sheng-weiYe:

The related approaches include design of Job Rotary Welding SPM based on PLC. This method presents an automatic welding machine used for the carbon dioxide gas welding, with the mechanical structure designed, and the working process of the automatic welding machine analyzed. Experimental operation results show that PLC controlled automatic welding machine can improve welding quality and efficiency, reduce labor intensity and bring huge economic benefits. Other methods include forward and reverse modeling in MIG Welding process using fuzzy logic based approaches. This is an era of automation where automation is broadly defined as replacement of manual effort by mechanical power. Automatic welding system can be classified into two categories namely: stem based on contact sensors. m based on noncontact sensors.
This paper focuses on the latter. There are three categories of non-contact sensors:

- Sy
- Syste
- Systems based on voltage through the arc welding.
- Systems based on ultrasonic sensors.

[3]Beningo Maqueria:

He developed an ultrasonic based robot to track the seam. He used an ultrasonic sensor which is interfaced to a P-50 process robot in an effort to achieve on-line seam tracking of joints, without the use of geometrical models or subsequent

"Teaching" routines. Ai-min Li, et al (2011) designed an automatic welding machine based on PLC. He designed the machine to perform carbon dioxide gas welding.

[4]XiangdongGao, Dukun Ding:

Studied the MIG welding parameters are the most important factors affecting the quality, productivity and cost of welded joint, Weld bead size, shape and penetration depend on number of parameters. Lot of research work has been done regarding the effect of variables on the process. The quality of a welded joint is directly influenced by the welding input parameters.

[5]Pritschow. G.Muller. S, Horber:

Describe the welding Positioner with auto indexing which is very important for mass production industries related with circular welding, as it depends upon the skill of worker to move electrode along the welding line. This special device can rotate the job at fixed rate to assist the welding process for circular components and ensure good profile and homogenous welding. This model has applications in small cylinder welding, compressors, and bottle filling plants etc. Automated welding Positioner machine for circular weld is totally satisfying the requirements. For this system Worm and worm wheel, Commutation motor, Belt drive, Proximity sensor, Ball bearing, Electronic relay, Inching switch, and inputs are required. Other methods include forward and reverse modelling in MIG Welding process using fuzzy logic-based approaches. It is an attempt to carry out the forward and reverse modelling of the MIG welding process using fuzzy logic-based approaches.

V. DESIGN AND MANUFACTURING AND EXPERIMENTAL VALIDATION

Previously, circular welding was considered as the most skilful and stressful job profile. This kind of welding was done manually by highly skilled workers. The steps were as follows:-

A) Fixture and location:

First of all, the worker or his helper will put the rod on the disc onto the fixture and locate it using different locators. There are two different locators which were used for this plate and rod. After locating, using proper constraints, the worker fixes the rod upon the plate.

 DOI : 10.18231/2454-9150.2019.0233

B) Manual welding:

After fixture and location, the skilled worker starts welding the circular points with a welding torch. He has to do the welding very carefully which will result in uniform welding thickness. In this case, worker fatigue and personal temperaments affects the quality at that time. **C) Unclamping Rod & Plate:**

Loosening all fixture components were carried out for the smooth removal of Rod and Plate out of the fixture. This will take some considerable time and increases the lead time in same manner.

Effects of manual welding:

1. Time consumption (lead time).
2. Higher cost.
3. Increased worker fatigue.
4. Skilled worker required.
5. Lower welding strength.
6. Increased inventory due to slow and pending work.
7. Lack of customer satisfaction.
8. Lower production rate.
9. Due to lack of skilled worker, production reliability decreases.
10. Less accuracy and precision as there are so many factors affecting these parameters.

I have visited "Spectra Tech Industries" and I had found that the three parts that are welded by workers manually by using the above mentioned suitable methods. Due to this they were continuously facing tremendous problems like strength, accuracy, misalignment. The skilled worker starts welding the circular points with the welding torch. He has to do welding carefully which will result in uniform welding thickness. In this case, worker fatigue and personal temperaments affects the quality at that time. Then it affects on the production of that component or they give more time for that manual welding.

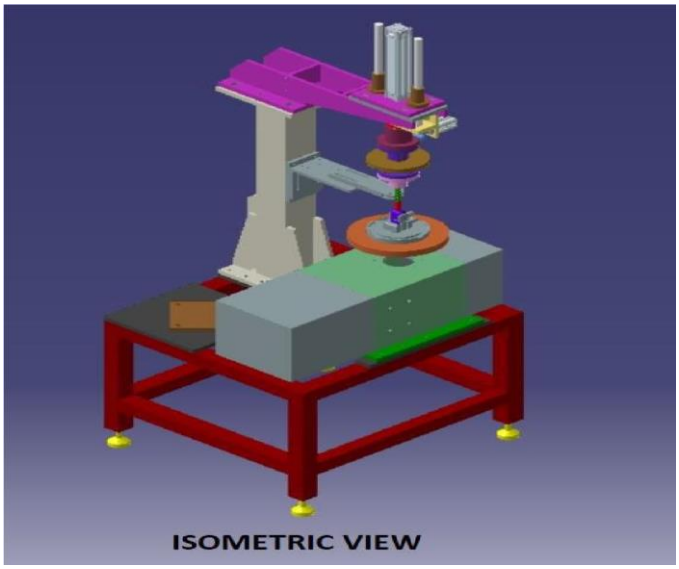

Fig.no 3: Job Rotary Welding SPM

5.1 Manual Mode:

5.1.1 Operator will select the fixture "Straight Pipe or Bend Pipe" through selector switch & set the pipe locator manually. 5.1.2 Operator will press the button of JOB CLAPM / JOB LIFT.

5.1.3 Operator will select machine mode TEST / WELD through selector switch.

5.1.4 Operator will press the button of Torch forward.

5.1.5 Operator will select the machine rotation forward through selector switch.

5.1.6 Welding will start (If machine is in weld mode) 5.1.7 After completion of 01 rotation with overlap welding of torch machine & welding will stop on the spot.

5.1.8 Operator will select the machine rotation reverse through selector switch; machine will go back at home position.

5.1.9 Operator will press the button of torch reverse torch assembly will go back at home position. 5.1.10 in manual mode job counter will not count the job.

5.2 Automation In Welding Steps:

That 's why we found automation. The automation technique the welding is that the base plate mounted on the fixture present on the foundation is clamp and fastened with the help of worker.

Then the rod is fixed in spindle which is located on the top vertical column of the machine.

The base is given the rotary motion using motor .Plate starts rotating about the axis of the rod. Then the rod is slowly placed over the base plate. And rod is also given the rotary motion.

Then we introduce the welding torch, But It is stationary.

Then we performed the welding using that welding torch. plate and rod welding component is done.

Then

Then the component will be inverted for next part to be welded to that component.

Next part is yoke which is loaded in the machine.

Component will be inverted and yoke is loaded in machine.

Then the circular welding yoke and rod will be carried out in the same manner.

 DOI : 10.18231/2454-9150.2019.0233

In this way the overall welding process is carried out.

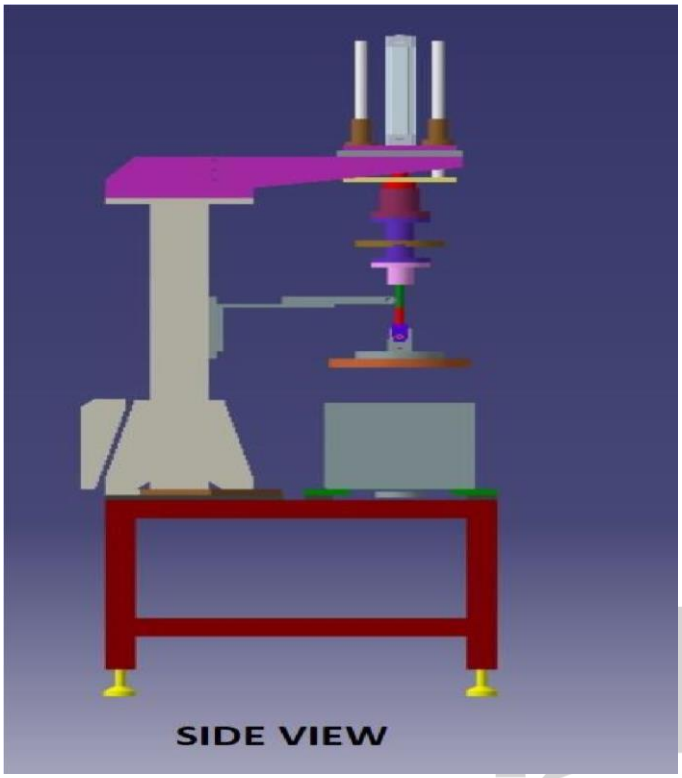

Fig.no 4: Job Rotary Welding SPM

VI. CONCLUSION

Paper and Dissertation aims at automation of circular welding which is successfully achieved in the form of "Job Rotary Machine" with all desirable features a SPM carries. Designs 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 increased to a great extent through this project. Company enjoys 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 (cost savings), quality benefits and status improvement among the competitors. We gained unique experience of integrating and evaluating theory and practical aspects of design and manufacturing. This helped us to extract valuable knowledge and data. We came to know the reality of ground level working on the workshop floor. We are sure that, this valuable experience will be useful in our future in all aspects of life.

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