DESIGN AND MANUFACTURING OF TORCH ROTARY WELDING SPM

[1]Chaitanya S. Gangurde, [2]Prof. G. E. Chavan, [3]Prof. N.L. Bhirud, [4]Prof. D. R. Satpute
[1]PG Scholar, [3]Head, Associate professor, [2,4] Assistant professor
[1,2,3,4] Department of Mechanical Engineering, Sandip University, Nashik, Maharashtra, India

Abstract : **Welding is a joining or fabrication or structural process that joins materials, usually metals or thermoplastics, by causing merging of base metal with filler material. In "Design, analysis & manufacturing of Torch Rotary Welding SPM", Gas Metal Arc Welding (80% argon and 20% CO2 as inert gas) is used. The main role of Automation is in cost saving and to maximize the productivity of the system. Basic requirement for any manufacturing company is to have effective work output. Circular welding is one of the most critical welding processes carried out manually, to fulfill that requirement we have used automated torch rotary welding process. In our project we have to weld two circular welding points in an automobile component. The finish component is muffler assembly. It has two points on two faces of the muffler. These two points are located at two different points in horizontal plane. Onto these two points it has the input and output pipes. To weld these two pipes with assembly we have to use fixture for avoiding the mistakes of misalignment of locations, we have design and manufacture a SPM which must carry an automate drive for uniform and precise welding. SPM1: Rotate work-piece around the welding torch. SPM2: Rotate welding torch around work- piece (muffler). Rotating the whole work-piece around the welding torch is not feasible due to the misaligned welding points along vertical axis on horizontal plane. Hence, it is not possible to construct the SPM1.Instead of SPM1, we can use SPM2 design which will allow us to manipulate the machine components as require with the (muffler). This Torch Rotary Machine is used for the welding of the muffler using the GMAW process with the help of torch. A fixture is provided on the machine for this operation. Welding torch rotates around the pipe and flange during welding. Necessary settings and adjustments are provided on this SPM to ensure smooth and safe operation of the system.**

Keywords: GMAW-Gas Metal Arc Welding, SPM- Special Purpose Machine, Muffler.

I. INTRODUCTION

Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is typically done by melting the work-pieces and adding a filler material to create a pool of liquid material (the weld pool) that cools to become a robust joint, with pressure typically utilized in conjunction with heat, or by itself, to produce the weld. This is in distinction with attachment 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. There ar many alternative 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 safeguard it from the skin 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 is used either to weld larger sections per weld run, thus
reducing the number of layers necessary to fill a weld, or to increase the travel speed. MIG.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. An inert chemical is one with a full outer shell of electrons that don't usually react with alternative substances. Inert gases include argon and helium. Some other non-inert gases ar used for fastening like dioxide.) MIG stands for Metal Inert Gas welding, many times called Wire-feed, Also referred as GMAW. The "Metal" refers to the wire that is employed to begin the arc. It is secure by argonon additionally the} feeding wire also acts because the filler rod. A semi-automatic method, it is fairly easy to learn and use. We can use argon as a shielding gas for either MIG or TIG welding. Argon is simply the gas utilized in the method. When victimization untainted wire in an exceedingly MIG fastening method you'll be able to use 100 percent Ar gas. TIG welding of aluminum uses 100% argon also. Most standard steel fastening with MIG wire uses seventy fifth Ar and twenty fifth dioxide. As a change of integrity methodology, welding has been around for centuries. Today around a hundred fastening strategies are utilized in totally different business sectors. In industry, there are different geometrical shapes to which an operator has to weld. Each and every shape carries its own operational constraints. Circular welding is one of the most critical welding process carried out manually, especially when accuracy and uniformity is of high concern. A manual mode of circular welding carries so many disadvantages like lower accuracy and precision, high wire, gas and electricity wastage and frequent micro cracks. This gives rise to need of automation for circular welding. The bulkiness and complexity of circular welding due to the presence of different holding arrangements and fixtures makes it expensive and highly time consuming process. 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 worker to have high wages. To avoid these undesirable circumstances, the application demands import of automation for this circular welding process. Welding automation world-wide 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.

1.1 PROBLEM STATEMENT

In our project given by "Samarth Industries", we have to weld two circular welding points in an automobile component. The component is a muffler assembly of Mahindra Scorpio. It has two points on two faces of the muffler. These two points are located at two different points in horizontal plane. Onto these two points it has the input and output pipes. To weld these two pipes onto their respective locations, we have to made a SPM which must carry an automate drive for uniform and precise welding.

Now, we have two alternatives to manufacture the SPM.

1. SPM1: Rotate work-piece around the welding torch.

2. SPM2: Rotate welding torch around work-piece (muffler).

Why to use SPM2?

Rotating the whole work-piece around the welding torch is not feasible due to the misaligned welding points along vertical axis on horizontal plane. Hence, it is not possible to construct the SPM1. Instead of SPM1, we can use SPM2 design which will allow us to manipulate the machine components as require with the work-piece (muffler). This special purpose machine (Torch Rotary Machine) is used for the welding of the muffler using the GMAW process with the help of torch. A fixture is provided on the machine for this operation. Welding torch rotates around the pipe and flange during welding. Necessary settings and adjustments are provided on this SPM to ensure smooth and safe operation of the system.

1.2 OBJECTIVE

1. Reduced errors.

2. Cost savings.

3. Greater productivity.

4. Simple and smooth process.

5. Uniform and precise welding.

6. Reduction in inventory.

7. Reduced labour requirement.

8. Increased machine utilization.

II. LITERATURE REVIEW

Fu-sen Ren Xiao-ze had developed a new type of special welding robot, which mixed design method of series and parallel and realized the integrated design of organization for robot and anchor. The robot kinematics is build and realized the real time control of welding torch position, orientation and welding speed during welding process. A. M. Vaidya and P. M. Padole had calculated the flexibility of the links and joint stiffness.

Zhao principle has represented impact of plasma torch scanning frequency on worker. Distribution at molten pool surface. In simulation plasma torch power is 750 kilowatt, melting rate is 300kg/hr the torch scanning frequency changes from 0.0833 Hz to 0.5 Hz.

ION Lucaciu had worked on attachment head permits vertical positioning of attachment wire relative to conductor position, adjusting the lead angle when entering into metal bath or turning device for bringing the attachment wire ahead of or behind the torch in step with direction of attachment.

R. Xiao has worked on perform of pressing wheels device is to supply the clamping force to sheet plates through a pressing wheels rolling on surface of sheet plates that is generated by compressed spring. The position sensors ar wont to indicate the position compressed spring. On alternative hand, they're necessary for association and support for the elements of clamping devices. The region of compact force of spring device is designed from 50 N to 500N which can basically meet requirement in actual welding.

III. EXISTING METHOD

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:-

1. Fixture and location:

First of all, the worker or his helper will put the muffler in the work-piece onto the fixture and locate it using different locators. There are two different locators which were used for bend pipe and straight pipe. After locating, using proper constraints, the worker fixes the muffler between upper jaws and base fixture plate.

2. 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.

3. Unclamping muffler:

Loosening all fixture components were carried out for the smooth removal of muffler 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.

IV. EXPERIMENTAL VALIDATION

We have designed Torch Rotary Welding Machine, as the manual welding and others welding processes like job rotary machines facing problem for welding of circular jobs. Samarth Engineer"s customer facing problem in welding of muffler assembly. Sometimes there were problem related to rotation of job. So Samarth Engineers introduced the idea of "AUTOMATED TORCH ROTARY WELDING MACHINE ". The muffler job assembly included the following parts:

1. Bend pipe
2. Muffler
3. Straight pipe

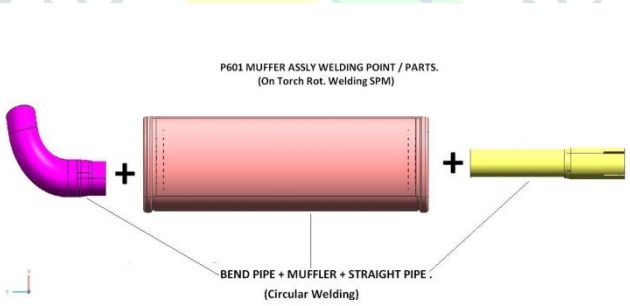

Fig 1.Muffler Assembly

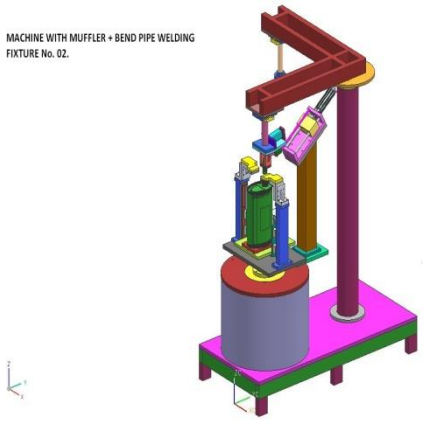

Fig 2.Machine with bend pipe

The plate on which the torch assembly is mounted is to be connected to the bearing flange. The reduction gear pair is designed according to the required speed of welding torch. The big gear is mounted on the gear flange which is mounted on the bearing housing. Two taper roller bearings are so selected to bear drive load and to reduce friction to a great extent while rotating

the torch. Air rotary is provided to supply continuous compressed air to the pneumatic circuits used in the SPM. Slip rings and earthing rings are provided for welding purpose. Finally all these components are mounted on the main column to form complete drive unit of the SPM.

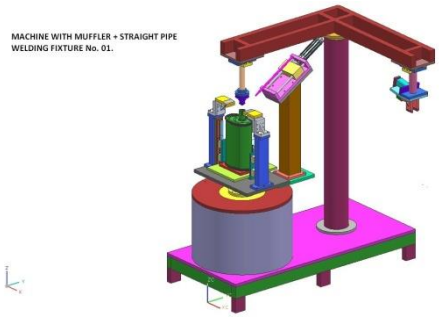

Fig 3.Machine with straight pipe

V. FUTURE SCOPE

1. This is automated machine so labour required is less. This will solve the problem of lack of manpower.

2. This is time saving machine hence it will increase the productivity.

3. Due to uniform circular speed of welding torch, welding is uniform with no micro cracks so quality is improved.

4. In manual welding, the efficiency of the operator decreases due to fatigue. This may result in a lower welding strength at the end of the shift, specifically for the elderly operators, causing lesser future orders.

5.As there is no scope for non-uniformity due to automation, the weld thickness is never increases hence saves energy which frequently takes place in manual welding due to human errors.

VI. CONCLUSION

Project aims at automation of circular welding which is successfully achieved in the form of 'Torch 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 increases 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.

REFERENCE

[1] "A textbook of Material science and metallurgy",O.P. Khanna, DhanpatRai and Sons.
[2] "Maintenance manual", Rextorth.
[3] "Maintenance Engineering Handbook", L. R. Higgins, Tata McGraw Hill.
[4] "Industrial fluid power", Andrew Pearson
[5] "A textbook of Welding Technology", O.P. Khanna, DhanpatRai and Sons.
[6] "Rational Welding Design", T G F Gray and J Spence, Butterworths and Company, Second Edition.