

# STUDY OF DESIGN AND MANUFACTURING OF AUTOMATED TORCH ROTARY WELDING MACHINE

Virendrakumar Mahajan<sup>1</sup>, Shubham Gove<sup>2</sup>, Sagaravhad<sup>3</sup>,  
Smiteshdhangar<sup>4</sup>, Prof. V.S.Gavali<sup>5</sup>

<sup>1,2,3,4</sup>BVCOE & RI Nashik B.E. Mechanical (Pune University) (India)

<sup>5</sup>Assistant Professor Mechanical Dept. BVCOE & RI Nashik (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 of "AUTOMATED TORCH ROTARY WELDING MACHINE", Gas Metal Arc Welding (80% argon and 20% CO<sub>2</sub> as inert gas) is used. The main role 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 process used to join materials, usually metals or thermoplastics, by causing combination. This process is carried by melting the work-piece and adding a filler material to form a pool of molten material (the

weld pool) that cools to form a strong joint, with pressure which is used in conjunction with heat, or by itself, to produce the weld.

This process is opposite to that of 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. The welding can be done in different manner, such as: Gas Tungsten Arc Welding,Shielded Metal Arc Welding,Tungsten Inert Gas and Metallic Inert Gas. MIG (Metallic Inert Gas) includes a wire fed "gun" that feeds wire at an adjustable speed and sprays a shield gas (generally pure Argon or a mix of Argon and CO<sub>2</sub>) upon 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 the 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 , reducing the amount of layers necessary to fill a weld, or to increase the travel speed.

In design of “AUTOMATED TORCH ROTARY WELDING MACHINE”, we have used Gas Metal Arc Welding (80% argon and 20% CO<sub>2</sub> as inert gas). 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.Circular welding is one of the most critical welding processes carried out manually, so we have used automated torch rotary welding process.

### **1.1 Objectives**

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. 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.

### **1.2 Problem Statement:**

Now, we have two alternatives to manufacture the SPM.

SPM1: Rotate work-piece around the welding torch.

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.

## II. LITERATURE REVIEW

**Fu-senRen Xiao-zehad** 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 Yang** has described effect of plasma torch scanning frequency on temp. Distribution at molten pool surface. In simulation plasma torch power is 750 kW, melting rate is 300kg/hr the torch scanning frequency changes from 0.0833 Hz to 0.5 Hz.

**ION Lucaciu** had worked on welding head enables vertical positioning of welding wire relative to electrode position, adjusting the lead angle when entering into metal bath or turning device for bringing the welding wire in front of or behind the torch according to direction of welding.

**R. Xiao** has worked on function of pressing wheels device is to provide the clamping force to sheet plates through a pressing wheels rolling on surface of sheet plates which is generated by compressed spring. The position sensors are used to indicate the position compressed spring. On other hand, they are necessary for connection and support for the components 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 skillful and stressful job profile. This kind of welding was done manually by highly skilled workers. The steps were as follows

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. 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. 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.

## 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".

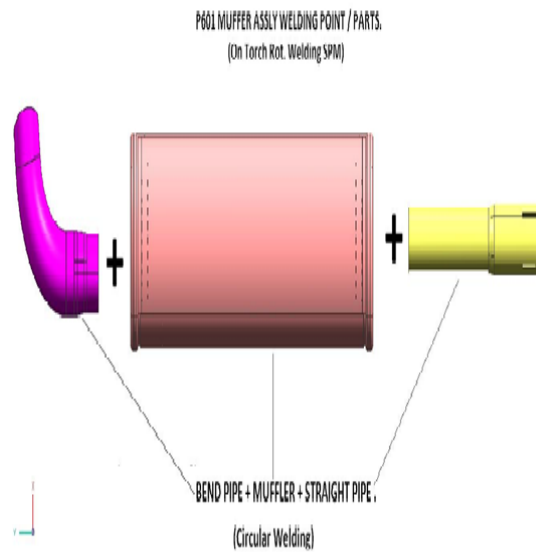
The muffler job assembly included the following parts:

1. Bend pipe
2. Muffler
3. Straight pipe

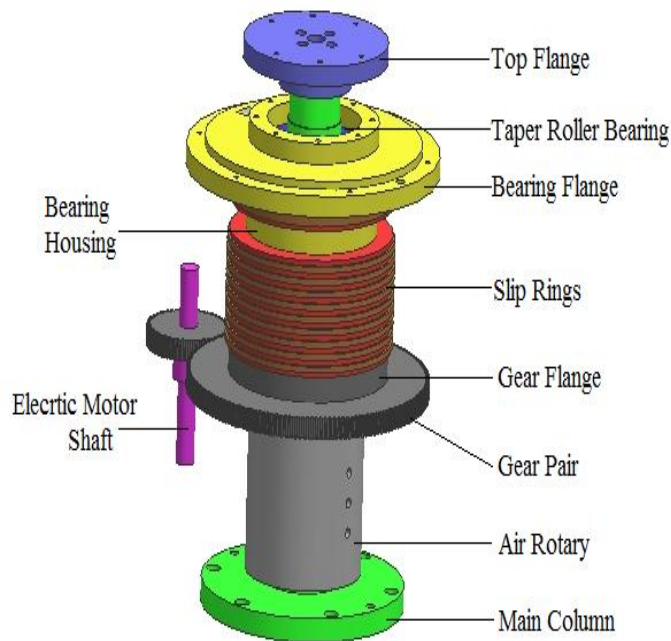
The plate on which the torch assembly is mounted is to be connected to the bearing flange. The reduction gear pair is designed according to the required speed of welding torch. The big gear is mounted on the gear flange which is mounted on the bearing housing. Two taper roller bearings are so selected 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.

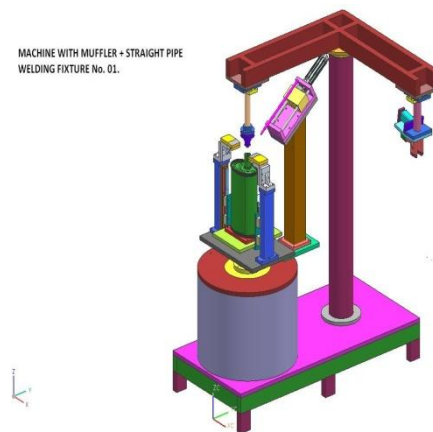
Finally all these components are mounted on the main column to form complete drive unit of the SPM.



**Fig 4.1.Muffer Assembly**



**Fig 4.2.Air Rotary Cylinder**



**Fig.4.3.Experimental set up**

## 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 economic 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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