Design & Manufacturing of Torch Rotary Welding Machine For Muffler Assembly

Kadu Swapnil Vishnu[1], Prof. P. J. Ambhore[2]

[1]*Student, M.tech. Computer Aided Design & Manufacturing Engineering, G. H. Raiosni College of Engineering & Managment, Wagholi, Pune, India.*
[2]*Professor, Department Mechanical Engineering, G.H. Raisoni College of Engineering & Managment, Wagholi, Pune, 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 " TORCH ROTARY WELDING MACHINE" , Gas Metal Arc Welding 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. Welding torch rotates around the pipe and flange during welding.

Key Words: *Gas Metal Arc Welding, SPM- Special Purpose Machine, Muffler.*

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.

As a joining method, welding has been around for centuries. Today around 100 welding methods are used in different industry sectors. 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.

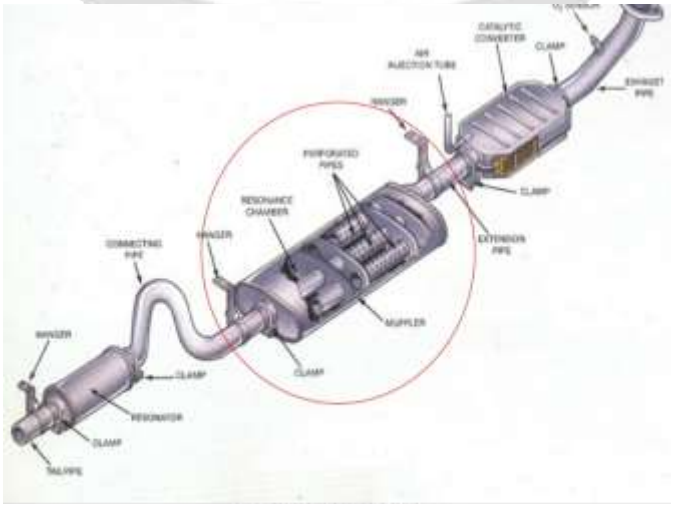


Fig.-1 : Muffler Assembly

2. LITRATURE REVIEW

(1)Virendrakumar Mahajan, Haiyong Jiong, et. al. 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. 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. 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.

(2)Shrinivas D, Yogesh R, et. al. Using robots in industrial welding operations is common but far from being a streamlined technological process. The problems are with the robots, still in their early design stages and difficult to use and program by regular operators; the welding process, which is complex and not really well known and the human-machine interfaces, which are unnatural and not really working. In this article, these problems are discussed, and a system designed with the double objective of serving R&D efforts on welding applications and to assist industrial partners working with welding setups is presented. The use of object-oriented and distributed software to assist industrial robotic welding applications is discussed. This Article gives complete idea of design of a mechanism to automate TIG Welding of circular pipes and tubes.

(3)Prof. Shendge Yogesh, R. Xiao et. al. The paper deals with the designing of mechanism, which can weld the circular as well as line component with accuracy, a linear motion with an improved degree of fineness and are relatively less cumbersome than traditional welding process. The technical constraint that has to be considered while designing and develop in the mechanical is was to achieve the stability, linear and uniform speed of welding torch and uniform weld thickness for quality product. The details of testing on various silencer shell give in paper. In near futur variable frequency drive (VFD) can be installed for its full atomization. Now a days welding finds wide spread applications in almost all branches of engineering industry. It is extensively employed in the fabrication and erection of steel structure in industries and construction. It is also used in various industries like aircraft frame works, railway wagons, furniture, automobile bodies, ship buildings, nuclear industries etc. depending on the application.

(4) Jiangtao Liu, Prof. V.S. Gavali, et al. For the continuous welding problem of multi-T-tube radiators' intersecting line, a new type of two-welding torch automatic welding machine is designed. The design scheme of the welding machine is described, and its main mechanisms are designed. Using three-dimensional software, its model is built. Motion simulation and interference checking are carried out based on interpolation. The fact welding test shows: the intersecting line is accurately welded and the production efficiency and welding quality is enhanced. The two-welding torch is driven to make lateral and up-and-down movement by the Y-axis synchronous drive mechanism and the Z-axis synchronous drive mechanism. Each welding torch welds half of the seam. Meanwhile, in the welding process, welding torches swing to the best posture to ensure the welding quality according to changes in the location of the welding joints.

(5)Fu-sen Ren Xiao-zehad, Maske Dikshant, et al**.** 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**.**

(6)N.R. Nagare, Anil Kumar, et. al. Advances in technologies are necessary for every industry to survive in competition. The main factors by improving which the industry can survive in the market are productivity, quality & customer delivery date. In this paper I am going to present the scope of improvement in the manual Gas Tungsten Arc Welding (TIG) by replacing it with automated Gas Tungsten Arc Welding. For increasing productivity of the TIG welding machine the important factors are Current, Voltage, Arc Length, Gas Flow & welding speed. Thus, by doing the trail on SS304l workpiece, optimum parameter to control the penetration within 1mm is found out. With the Automation the quality & the quantity of the production also increases. As the quality of the welding with the automation is much higher than the manual TIG so the scrap gets reduced & productivity improved.

3. PROBLEM DEFINATION

In our project given by " Yogeshwar 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.

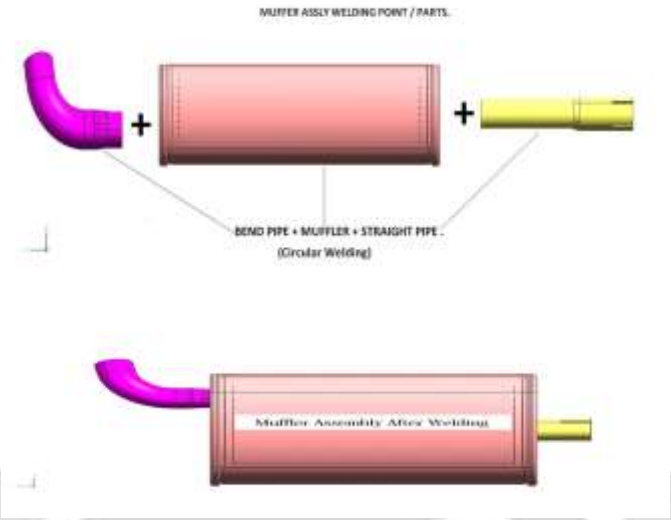


Fig.2- Muffler Assembly

4. BILL OF MATERIAL (MANUF. & STD. PARTS)

Sr.No.	Parts Name	Material	Quantity
1	Base Plate	M.S.	1
2	Main Column	EN8	1
3	Gear pair	C50	1
4	Gear flange	M.S.	1
5	Taper roller bearing	STD	2
6	Bearing housing	M.S.	1
7	Slip rings	-	10
8	Top flange	M.S.	1
9	Muffler resting plate	M.S.	1
10	Guiding rail	-	2
11	Guiding pillars	-	2
12	Resting angles	M.S.	2
13	Base rings	M.S.	1
14	Head column	M.S.	1
15	Working head	M.S.	2
16	Straight pipe locator	-	1
17	Bend pipe locator	-	1
18	Locking pins	-	2

5. IMPLEMENTATION OF TORCH ROTARY MACHINE

5.1 Manual Mode Operation Sequence

- Operator will select the fixture " Straight Pipe Or Bend Pipe" through selector switch & set the pipe locator manually.
- Operator will press the button of JOB CLAPM / JOB LIFT
- Operator will select machine mode TEST / WELD through selector switch
- Operator will press the button of Torch forward.
- Operator will select the machine rotation forward through selector switch.
- Welding will start (If machine is in weld mode)
- After completion of 01 rotation with overlap welding of torch machine & welding will stop on the spot.
- Operator will select the machine rotation reverse through selector switch; machine will go back at home position.
- Operator will press the button of torch reverse torch assembly will go back at home position.

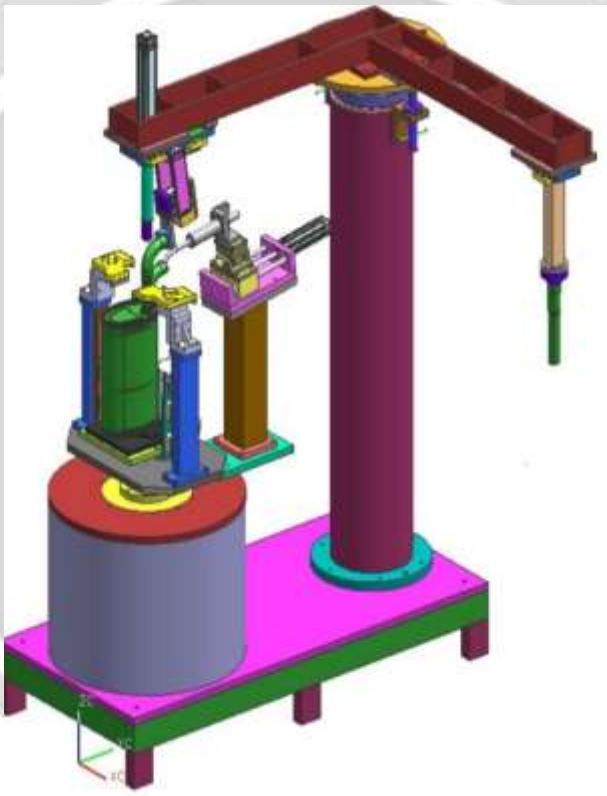


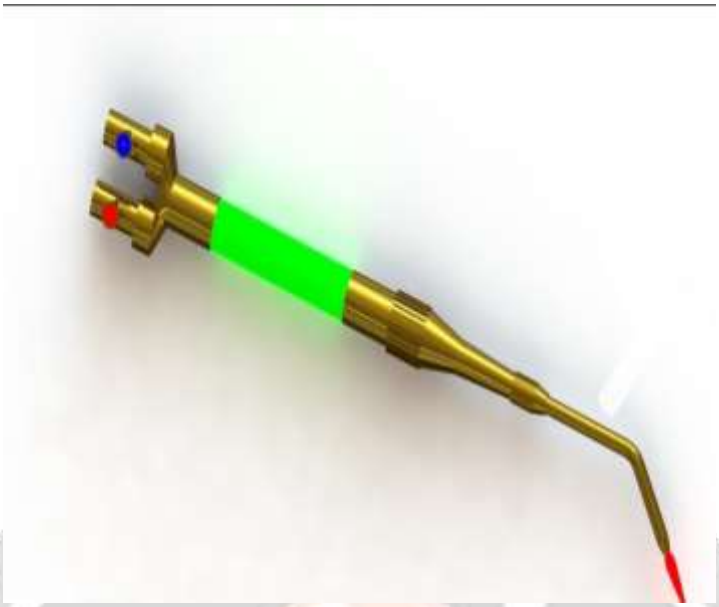
Fig.3- Torch Rotary Welding Machine

5.2 Auto Mode Operation Sequence

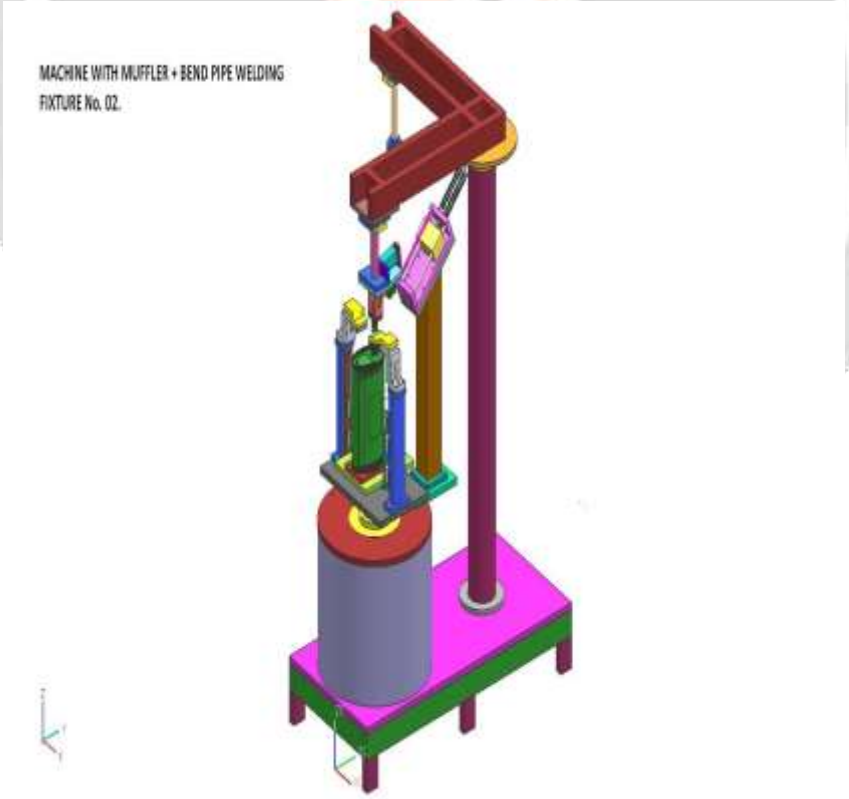
- Operator will select the fixture " Straight Pipe or Bend Pipe" through selector switch & set the pipe locator manually.
- Operator will press the button of JOB CLAPM / JOB LIFT.
- Operator will select machine mode TEST / WELD through selector switch.
- Operator will press the button of cycle start.
- Torch assembly will come forward; welding & torch rotation will start immediately. After completion of 1 rotation torch will rotate for 10 mm overlap welding, after completion of overlap welding torch will rotate to reverse for home position.
- If machine is in TEST mode welding will not done.
- After completion of Auto Cycle in WELD mode job counter will count the job automatically.

6. 3D MODEL OF PART

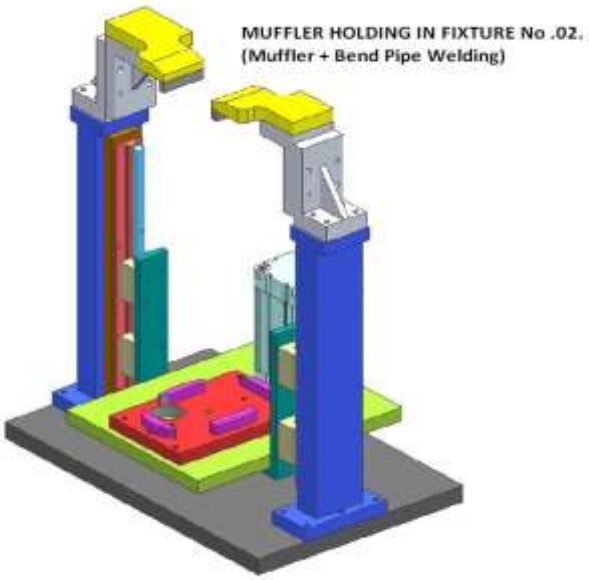
1. Welding Torch :



2. Welding Machine with Muffler + Bend Pipe :



3. Muffler Holding Fixture For Bend Pipe :



4. Bend Pipe Holding & Locating Fixture :

7. 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.

8. ACKNOWLEDGEMENT

In the due course of project with the valuable guidance of Guide Prof. P. J. Ambhore, the paper was completed as per schedule & desirable results were achieved.

9. REFERENCES

(1) Virendrakumar Mahajan, Haiyong Jiong- "STUDY OF DESIGN AND MANUFACTURING OF AUTOMATED TORCH ROTARY WELDING MACHINE." International conference on Emerging trends in engineering & Managment Research, Anjenari, 23 march 2016
(2) Shrinivas D**,** Yogesh R- "Dvelopment of automation for manual tungsten inert gas (TIG) welding" International Journal of Academic Research and Development, Volume 3; Issue 3; May 2018; Page No. 222-224
(3) Prof. Shendge Yogesh**,** R Xiao- "Special purpose machine for Linear Welding" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), e-ISSN: 2278-1684,p-ISSN: 2320-334X ,PP. 21-24
(4) Jiangtao Liu**,** Prof. V. S. Gavali- "Design of Two-welding Torch Automatic Welding Machine" Applied Mechanics and Materials Online: 2013-08-08 ISSN: 1662-7482, Vol. 345, pp 530-533 ,2013 Trans Tech Publications, Switzerland.
(5) Prof. M.R. Nagare "Research Paper on Automation of Gas Tungsten Arc Welding & Parameters of Auto-TIG" IJSTE - International Journal of Science Technology & Engineering, Volume 2, Issue 2 ,August 2015.
(6) " A textbook of Material science and metallurgy" ,O.P. Khanna, DhanpatRai and Sons.
(7) " A textbook of Welding Technology" , O.P. Khanna, Dhanpat Rai and Sons.