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Semi-Automated Angular Corner Joint MIG Welding

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Abstract — The Automation play an important role now-a-days in industry for growing their productivity. Automation has numerous advantages such as time reduction, more productivity, better consumption of materials, reduction in scraps and waste etc. We have visited "NEUMET ENGINEERS INDIA PVT LTD" industry, we have seen that they are doing welding process manually on the sheet metals due to which there are some drawbacks arises. The aim of our project is to develop the semi-automated MIG welding machine for industry. The machine will run on VFD (Variable Frequency Drive) and pneumatic actuation arrangements with six degree of freedom of welding torch which will facilitate to weld corner joint of sheet metals by way of linear motion at different angles with governable feed. So, from this we can obtain a quality welding technique by means of accurate surface finishing with less welding defects. So, aimed at we have to prepare structure design, manufacturing and assembly then after get end result of it.

Keywords- MIG Welding, Semi-Automated, Angular Welding, Corner Joint, Variable Frequency Drive (VFD).

I. INTRODUCTION

Welding is a fabrication process used to join materials, usually metals or thermoplastics together. During welding, the pieces to be joined (the workpieces) are melted at the joining interface and usually a filler material is added to form a pool of molten material (the weld pool) that solidifies to become a strong joint.

There is a lots of less advancement in machineries in our countries, like other developed countries. Traditional methods for production is been utilized instead of automated machine. Automation in machine helps lots in the production line. Automation can provide many advantages in the production line such as reducing the time for production, wastage of materials can be easily controls, etc. Besides that automation also provides quality, accuracy, less manpower, etc. Using the traditional methods which is somewhat benefits to the small scale industries, small scale industries do not refers the automation machine or special purpose machine for their required works.

1.1 MIG Welding (Metal Inert Gas welding):

MIG welding, also known as Gas Metal Arc Welding (GMAW) is a process that utilizes a continuously fed solid electrode, shielding gas from an externally supplied source, and electrical power to melt the electrode and deposit this molten material in the weld joint. The equipment used automatically regulates the electrical characteristics of the arc. The only manual controls required of the welder for semi-automatic operation are travel speed, travel direction and gun (torch) positioning. Given proper equipment settings, the power supply will provide the necessary amperage to melt the electrode at the rate required to maintain the pre-selected arc length (voltage). For example, an increased stick-out, produced by drawing the torch back from the work piece, results in a reduction in current from the power supply. This maintains the same heating of the electrode and returns the arc length to its present condition. Filler metal selection should be closely matched to the base material being welded. In MIG Welding, the filler metal not only conducts current to the arc zone (resulting in melting the base metal and electrode), but adds reinforcement to the completed weld joint. MIG Welding can be used on a wide variety of metals and in a number of different base metal thicknesses.

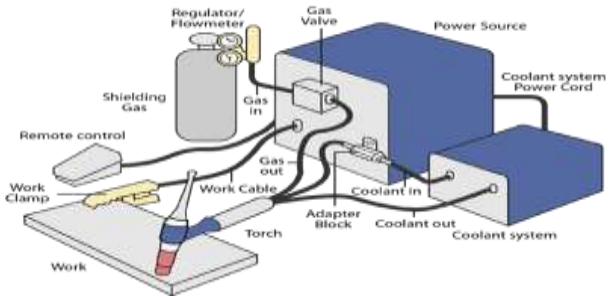

Figure 1. Metal inert gas arc welding

The angle at which holding the electrode is done, greatly affects the shape of the weld which is important in fillet and deep groove welding. Angular welding is generally done by making proper angle of the welding torch to the weld surface for the accurate welding process. According to the requirements that angle can be changed for proper feeding. A corner weld is a type of joint that is between two metal parts and is located at the right angles to one another. As the name indicates, it is used to connect two pieces together, forming a corner. It is generally done at outer edge of workpiece.

1.2 Problem Definition And Solution

The problems occurs during manual welding are Welding defects(like Undercut, Lack of fusion, Inadequate penetration, Cracks, Improper Surface finishing, Not getting equal feed that's why the other surface defects occurs), use of filler materials is improper, Time consuming, High concentration required for welding, Well trained and high skilled worker required, Less flexibility of the machine, etc.

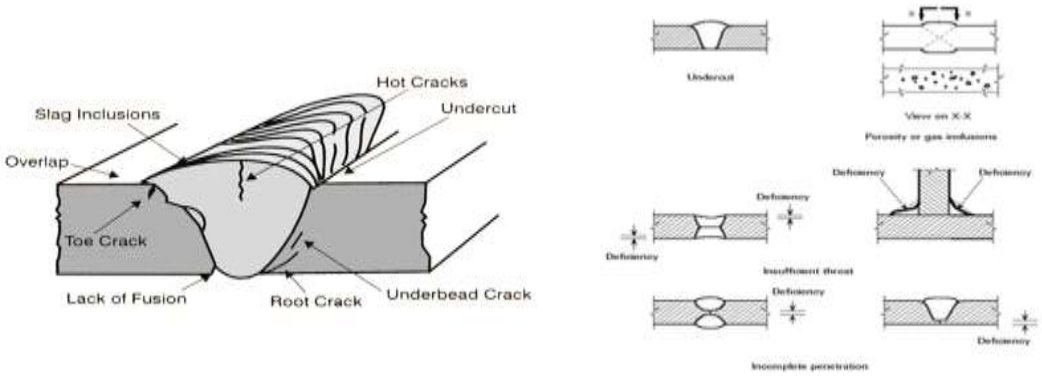

Fig. 2 Welding defects

Due to Automation above welding defects can be reduced with high accuracy and quality of welding surface. Wastage can be minimized with less time consumption and less man power requirement. So, implementing the proper designed machinery with automation can improved the Welding performance. Thus we have designed the machined mechanism with semi- automation with the help of VFD (Variable frequency Drive) controller, Pneumatic system, etc. The machine also contains 6 degree of freedom with corner joint welding and Angular welding.

II. DESCRIPTION OF MACHINE

The semi-automated Welding machine includes 6 degree of freedom such as two linear motion – Horizontal and Vertical linear motion. The Horizontal linear motion is for welding motion which used for travelling the torch on the corner edges of workpiece and the vertical linear motion is used for adjustment of the welding torch. The Welding torch height can also be adjusted with suitable rotary motion as per required workpiece height. For different thickness of the metal sheets particular weld angle of torch is required which is also included in machined. Adjustment for welding torch is also needed during the operation as torch get contact during the welding process with the workpieces, The welding process will be carried out by controlling through the VFD controller, Pneumatic system, Motor, and so on. The machine structure is prepared from the Mild steel 2062 with different parts assembly.

Fig. 3 Design welding machine

2.1 Working principles

The Welding torch of the MIG welding machine which will be connecting to the Semi-automated welding machine. The torch will be connected to the torch handler. The Welding torch height and rotary motion will be set accordingly to the workpiece with certain vertical linear motion. According to the workpiece thickness particular weld angle is provided to the welding torch. The power is supplied from the main line of the power source which is connected to the VFD controller. The VFD runs the motor with controllable speed and direction. Motors will give the horizontal linear motion to the machine which helps the welding torch to travel.

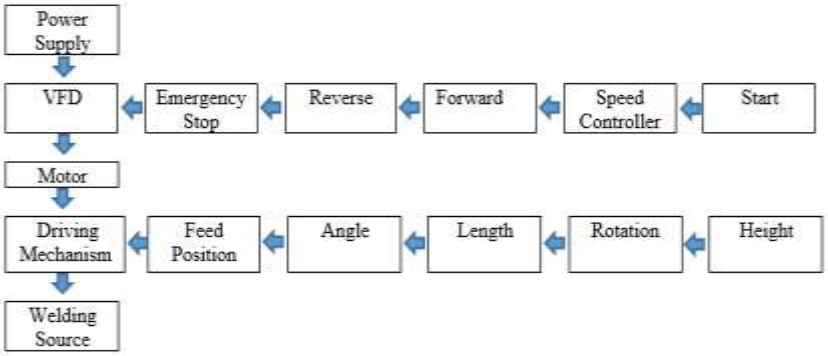

Fig. 4 Block diagram of working process

2.2 Mechanical parts

The mechanical parts of a semi-automated welding system includes driving mechanism and welding carriers.

A. Driving mechanism

For linear motion, driving mechanism contain Screw-ball bearing assembly and Double V guide channels. Screw ball Bearing assembly is used for travelling welding torch. It help of convert the rotatory motion of the motor to the linear motion. Guide channel is used for balancing the linear motion and giving it smooth runs.

B. Welding carrier

For welding carrier, Dumbler table handler is used for holding the workpiece for the welding operation. As Workpiece can easily setup for Corner joint and angular welding. Workpiece can be holds in any position on it with suitable handling.

2.3 Control parts

The control parts contain VFD (Variable frequency Drive) Controller and pneumatic system.

A. VFD

Drive is a system for controlling the rotational speed of a motor by controlling the frequency of the electrical power supplied to the motor. Variable frequency drive is a main component used for control the output of motor.

B. Pneumatic controller

Pneumatic Controller contain Two Valve as the direction Control valve and Rotary spool valve. Directional control valve are used in the pneumatics to serve the function for controlling direction motion. . Rotary spool valve is used to control the pressure of the pneumatic system which is directly affected to the speed.

Fig. 5 Photograph of actual working model

III. WELDING PARAMETER

3.1 Distance v/s rpm with Expected and Actual result

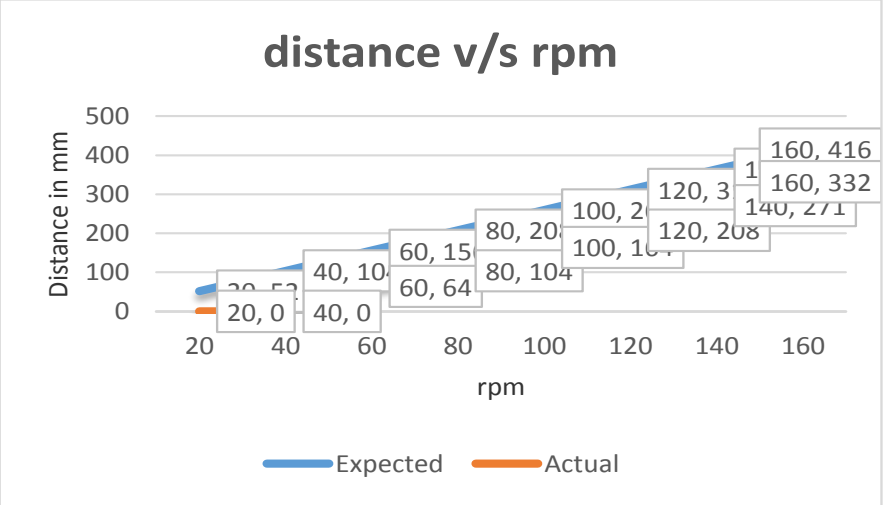

Fig.6 Distance v/s rpm

3.2 Thickness v/s rpm

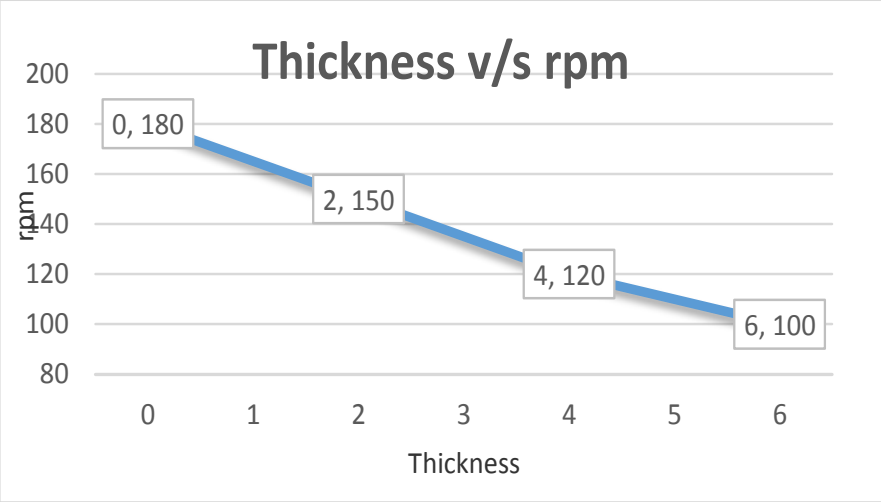

Fig.7 Thickness v/s rpm

3.3 Thickness v/s angle

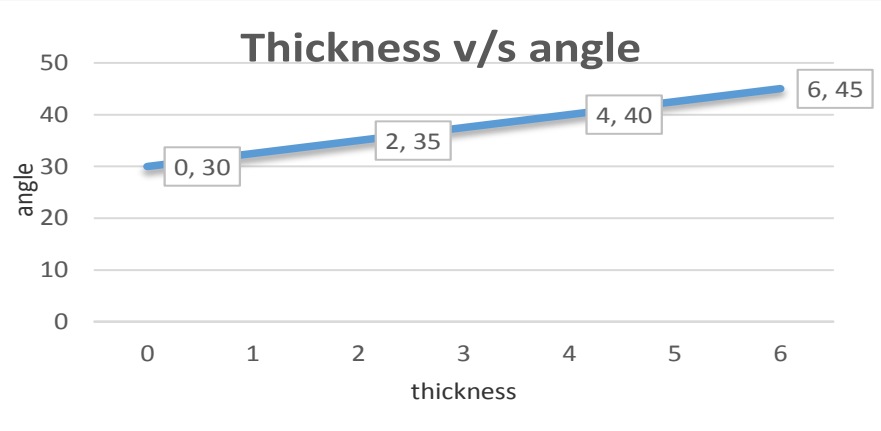

Fig.8 Thickness v/s angle

IV. TEST RESULT

From the above graphs, we found that Actual graph differs from the Expected graph. As expected at starting it would covered some distance as given rpm, but in actual it does not even move up to 80 rpm. It increases slowly as we increase the rpm. But we can't get the expected result due to load of the parts on the shafting. According to the thickness of the sheet metal, rpm are given to the motor through the VFD. As the thickness is smaller, more rpm is provided because at less rpm the plate may get affected due to over burning of welding torch. If thickness of Sheet metal is more than 4, than rpm given is less because the proper feeding can't be done at high rpm. So, according to the thickness of the sheet metal rpm is provided to the motor. Welding for sheet metal also depends on the angle of the welding torch. According to different thickness of the sheet metal angle is provided to the welding torch. Angle is necessary because it helps the welding torch for proper feeding of welds to the sheet metal. When thickness of the sheet metal is less than the angle provided is also less below 40 degree. As the thickness of the plate increase the angle of the welding torch also increase.

V. CONCLUSION

In the welding process the number of parameters affected the quality of weld. In case of linear and angular welding, angular welding is much more difficult than linear welding. In order to get the desire quality of weld one has to give accurate feed, which is one of the most important parameter. Due to the automation using VFD the weld accuracy and quality is increase with controllable linear motion of Welding torch with precise feed of work with less time utilization. By means of 6 degree of freedom the flexibility offers Ease of operation for moving the welding torch smoothly with appropriate adjustment of height, Angle, length etc. For Proper penetration of filler metal in different thickness of sheet metal parts with quality surface finished work is acquired by Angular welding. From this we obtained a quality welding technique by means of accurate surface finished worked with less welding defects is achieved.

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