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Automation of Overlay Process

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Abstract

The rolling industries use rollers to roll ingots to sheets of desired thickness. However after some time the surface of rollers gets worn out. Our project will be of help to industries as it mainly concerns with the restoration of the surface of rollers so that it can be used for prolonged period at the same time producing the desired result which is of utmost importance. Using Submerged Arc Welding process to overlay we tend to achieve a low cost automation machine to achieve the above process.

Keywords: Rolling process; overlay process;

1. Introduction

In many industries like automobile, turbine blades manufacturing thin sheets of metal are prepared from big ingots prepared from casting. These ingots undergo a process called rolling in which they are converted into thin metal sheets. Due high pressure and temperature generated in the process the surface of the rollers are worn out. To restore the original surface finish of the rollers a process known as overlay process is done. This project is about automation of this process using a boom and column assembly. A PLC and Variable Frequency Drive will be the main control components. An encoder and a proximity sensor will be used.

2. Components to be Used

2.1 Boom & Column assembly

This is one of the two basic component which will be used in the automation of the overlay process. The SAW welding equipment will be attached at the end of the horizontal arm i.e. the boom. The boom is able to travel along its length with the help

of a rack and pinion arrangement. The column is able to move up and down to facilitate accommodation of jobs of different diameters. The up and down motion is again made possible with help of a rack and pinion arrangement. Fig 1.1 shows a column & boom assembly.

Fig. 1: The picture depicts a column and boom assembly which will house the SAW equipment.

2.2 Rotator Assembly

The second important component used in the overlay process is the rotator. The job on which overlaying is done is mounted on the rotators. The distance between the roller wheels of rotators is adjustable again to accommodate jobs of different diameters. The distance between roller wheels is made adjustable with the help of left hand and right hand screw threads.

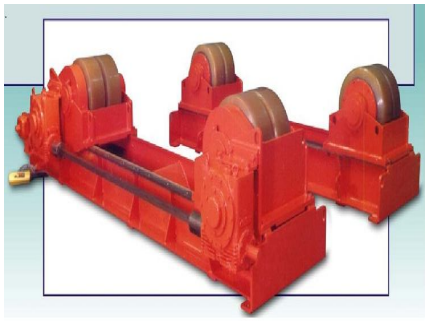

Fig. 2: This is the Rotator assembly. The work piece will be rolled by this assembly.

3. Concept of Automation

Generally Column-boom & rotator are use separatly. But when synchronized both assembly with each other, they can work as special purpose machine. Here as shown in Fig. we have to adjust the cylindrical workpiece on the rotator that will rotate the work piece with constant speed.

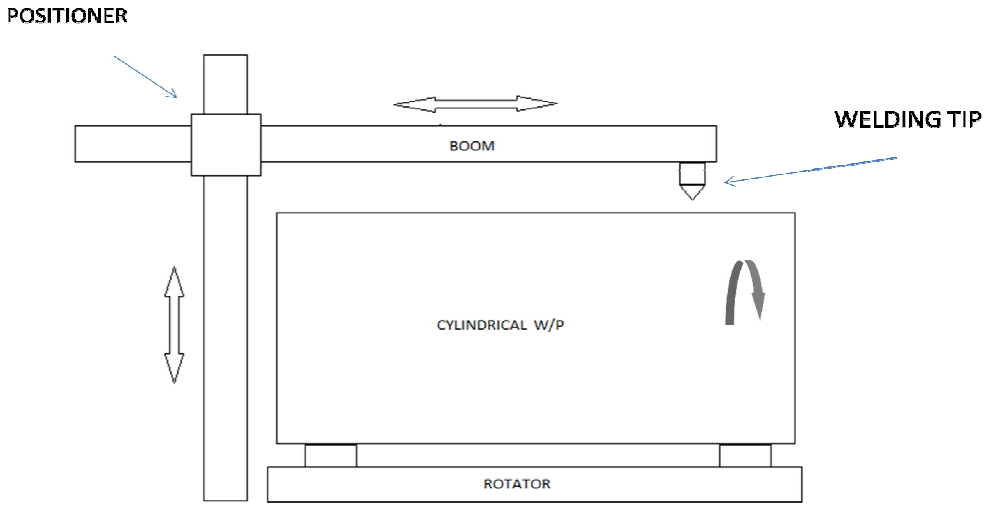

Fig. 3: Schematic Diagram Of Overlay Process.

Now when work piece complete the one revolution proximity sensor sense it & give signal to boom motor & it will travel the thickness of the welding bead. Continuously it is occurred up till whole length will cover. So such way will obtain the layer of the filler metal on the given work piece.

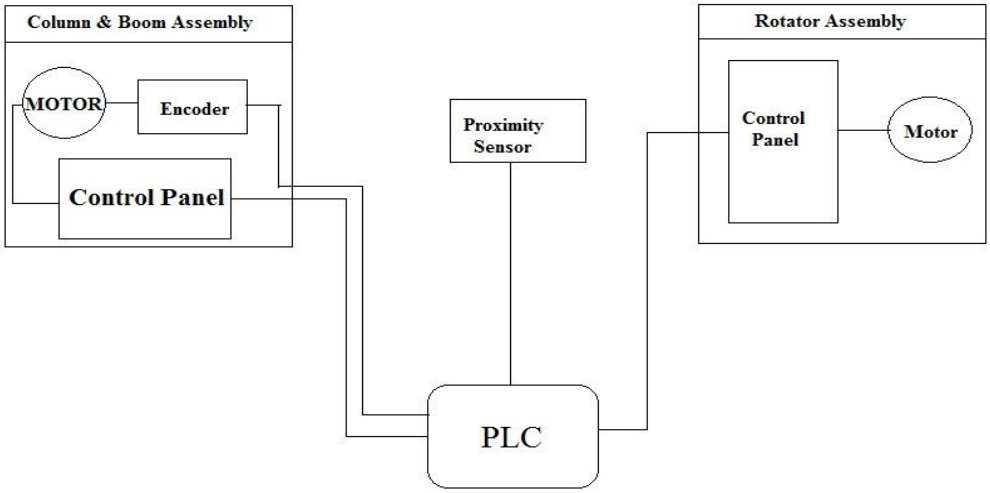

Fig. 3: Block Diagram of interfacing of various modules.

4. Methodology

4.1 Speed Synchronization & It's Calculation

Our main output is obtaining a uniform quality of weld throughout the surface of the workpiece. For achieving this the speed at which the welding is done which is the speed at which the boom moves forward with the welding equipment at the end has to be kept constant.

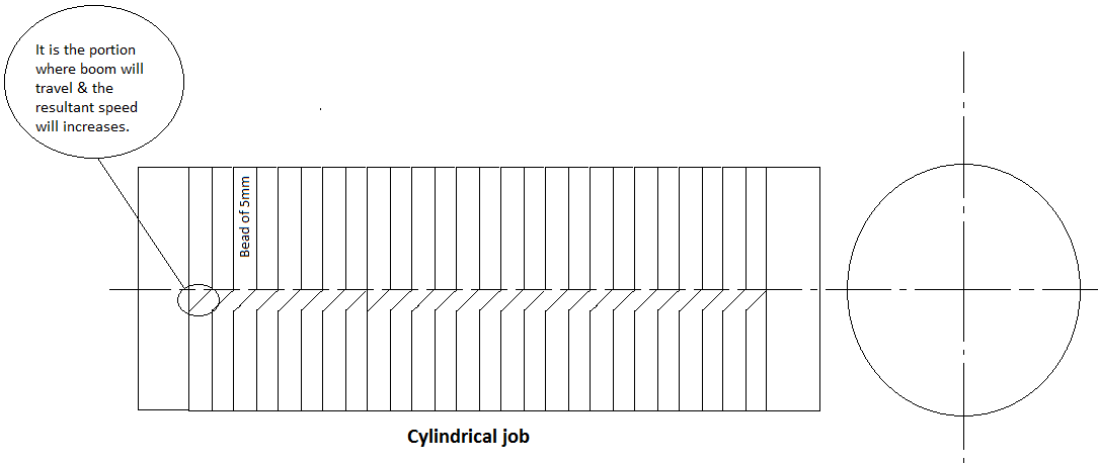

Fig. 4: Overlay done on w/p

Following are the constrain of the problem

1) Speed of the boom in between 100mm/min to 1500 mm/min so we cant reduced beyond that otherwise desired work will not obtain.
2) Speed of the rotator is also in between 100mm/min to 1500 mm/min.
3) Welding speed not increase beyond the 620 mm/min otherwise width of the bead will change or not desirable.

So there is generation of triangle when boom will move as rotator rotate continuously which is describe as below:

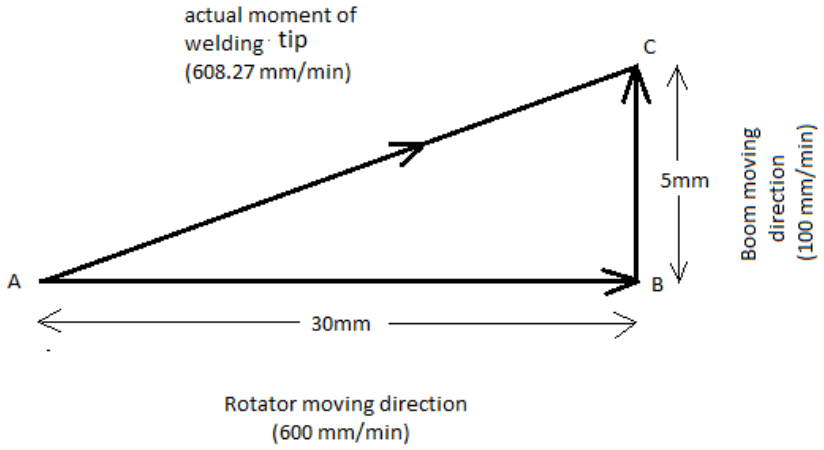

Fig. 5: Speed Vector Diagram.

Here the boom moving is fixed 5 mm we can't very as our bead is of 5mm thickness so BC should not changed & resultant speed should not increased beyond 620 mm/min & nearer to 600 mm/min is appreciable. AB should not greater than the 50mm. So by select rotator speed 600mm/min & boom speed 100mm/min we obtain the 608.27 mm/min which will satisfy all requirements its calculation is as:

- Vector AB=600 mm/min
- Vector BC=100mm/min

So by vector addition calculation,

- $AC=\sqrt{(AB^2+BC^2+2(AB)(BC)*\cos\beta)}$
  $AC=\sqrt{(600^2+100^2+2(600)(100)\cos 90)}$
  AC=600.8 mm/min

So by utilizing this parameter we can obtain the resultant speed that is under limit. Yet now we will work further with this calculation if we are not able to obtain desired accuracy practically then we will move toward changing of the gear ratio to obtain desired accuracy.

5. Conclusion

So by automizing this process the benefits which will be obtained:

1) The precision of the parameters involved in the overlay process.
2) Reduced labour demand as the process is made automatic.
3) Reduction in cost as compared to special purpose machine.

Since this process is to be done at frequent intervals depending on usage of rollers this automatic process will be of good use for industries

References

[1] Column- boom & rotator Assembly drawing from Amin Machianry
[2] Contol panel drawing of column-boom & rotator from Amin Machnary
[3] Regarding VFD Source from YASKAWA MANUAL A1000
[4] Regarding PLC Sourdce from fatek website www.fatek.com
[5] American Welding Society handbook.