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A Novel Approach for Disc Shaped Sheet Metal Cutting by Semi Automated Rig

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Abstract : Now a day's cutting of circular profile shape is done by many methods like gas circular profile cutting, plasma arc circular profile cutting, CNC type circular profile cutting and is done by both manual and automatic process. In our project, circular profile cutting machine setup was fabricated for small scale industries like duct fabrication in which angle grinding wheel (cut off wheel) is used to cut the circular shape on the sheet metal and also it is semi automatic process. When compared too many automatic and conventional types, Semi Automatic operation leads to reduce fatigue of human operator, lead time reduction and also getting proper profile geometry like circularity with less investment. This satisfies both operators and fabricators inside and outside of the workshop. Setup has simple mechanism of bevel gear arrangement with cut off wheel which is used to cut the circular profile shape with high accuracy on the sheet metal.

Keywords : Circular Profile, Cut off Wheel, Circularity, Bevel gear Arrangement.

Introduction

The circular or disc shaped cutting are done by manually in small scale industries. This manually operation is defenseless to the employee and it doesn't have precision, due to wrong alignment. For the batch production in SSI the tool and die making, installation of CNC machines extremely high.

Sheet Metal Cutting is an imperative process in many Industry divisions. Rapid growing industries segments like automotive have urge the growth opportunities of sheet metalworking. Sheet metal can be cut and bend into a variety of shapes finding numerous applications in car panels, wings of airplane, medical tables, roofs for buildings and many other things. The Disc shaped products are done with the help of disc cutting method which are done by manually with less precision and high rate of material wastage. Due to manual operation, time consumption is more and skilled workers are required. In this paper, the layout of sheet metal Cutter Panel shows the concept of 1. Disc Cutting tool, this explains the tool for cutting the round shaped component. 2. Motor (AC), this explains the power and torque consumed by the process. For the quick cutting process, installation of semi automatic sheet metal cutter panel is effective.

Literature Survey

The Disc and Round shaped component cutting cnc machine is designed and assembled in solid works¹. The design and fabrication of model of gas profile cutting machine and studying cutting speed and time for desired profile². A work they target the problem of small industries which use plasma arc cutting for the machining process and for them it has long been recognized that it is extremely difficult even for a skilled operator to accurately cut an accurate shape of sheet work pieces by simply free hand movement of the cutting tip relative to the work piece³. An Automatic metal sheet cutting machine in which the machine undergoes the

operation and constructions are the X-Y horizontal table is made up of 3 LM guides with LM guide blocks sliding smoothly over them⁴. The Design of profile Gas cutting Machine. In which The Portable Multipurpose electromagnetic profile machine is one of the essential machine tool in the workshop. The motors along with the reduction gear using the lead screw shaft, which is used to provide the cross way motion to the lower header using the guide nut arrangement⁵. A review of Profile cutting is a process that is used to cut steel and other metals of different thicknesses using a torch using PLC⁶. Earlier Literature Survey denotes that sheet metal fabrication has done through various sophisticated techniques for profile cutting .

In this study; we proposed the novel approach for cutting of circular shape on sheet metal for mounting air ventilator setup on the roof. Comparison made between manually operated and proposed setup like cycle time reduction , kerf width and geometry profile like circularity.

The objectives of the proposed work, therefore , are to ;

- To reduce the human fatigue.
- Reduce material wastage.
- Reduce the process time.
- Improve the cutting finishing.
- Obtain good geometrical accuracy.

Methodology

Design

Length and Height of the experimental setup is 610 mm x 480 mm. Design includes Column frame , Motor , Bevel Gears and Base Frame as shown in Figure 1.

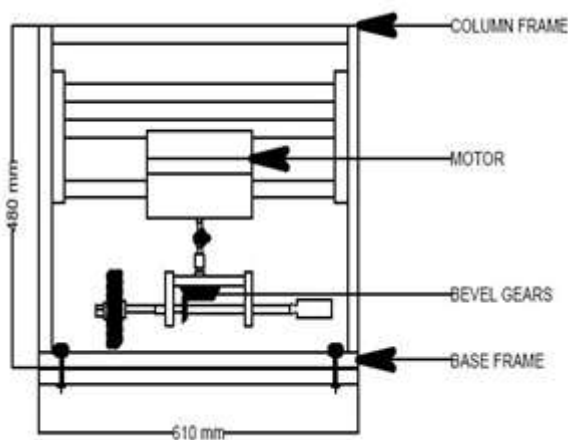


Figure.1. Design of Experimental Setup (Front View)

Experimental Setup

In this setup the simple mechanism is used to cut the circular profile shape in sheet metal. For that we used the components for various operations.

The operations carried out by the components are 1. Lead screw which is used to give depth of cut, 2. Bevel gear mechanism which gives horizontal rotational movement into vertical rotational movement and to increase the motor rpm, 3. Base and column pipe are used to hold the setup rigidly.

Table 1.Motor Specification

Type	Capacitor Start Capacitor run (CSR)
Rated voltage	230V
Rated current	1.5 Amps
Rated power	150 W
Rated speed	1300 RPM
Efficiency	50% nominal
Capacitor	8 MFD

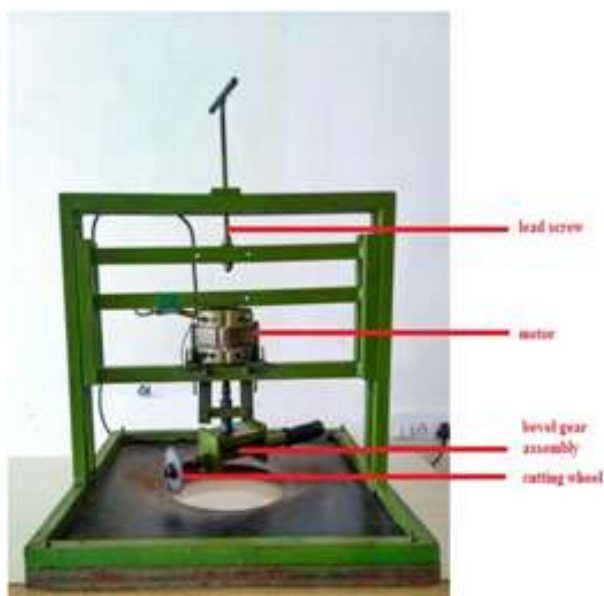
Table 2.Individual Components Specifications

Components	Dimensions
Base pipe	610×610×21 mm
Column pipe	480×610×21 mm
Cross row pipe	568×25 mm
Bolt for frame	6 mm
Bolt for lead screw	10 mm
Cut off wheel	Ø40 mm
Coupling 1	Ø16mm
Coupling 2	Ø23mm

Results and Discussions

With the experimental setup, Sheet metal cutting has to be made as semi automated process due to the installation of gear setup with cutting wheel instead of doing manually i.e., conventional manner, the overall cycle time, Kerf width has been reduced in proposed method than previous conventional method as well as accuracy is improved and it is determined by Circularity. Figure.3. illustrates that the cycle time has been reduced from 15.53 minutes to 9.27 minutes. Figure. 4. Illustrates that the Kerf width is reduced from 1.2 cm to 0.8 cm.

From Figure.5 and Figure. 6, Comparison made between previous and proposed method and reveals the circumference irregularities attained after cut.

**Figure.2. Proposed Experimental Setup (Front View)**

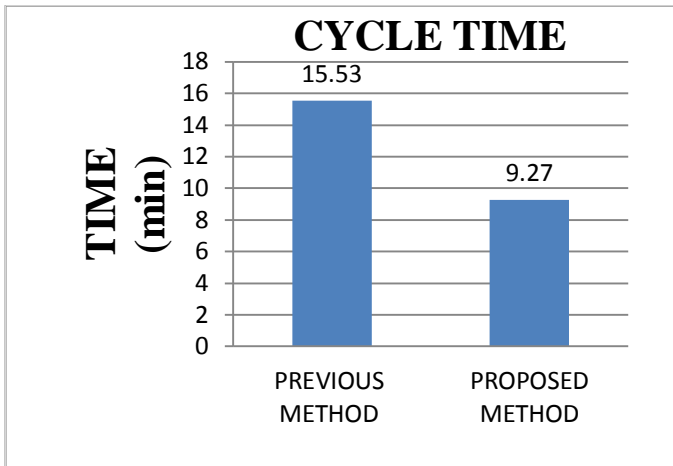


Figure. 3. Cycle time Reduction

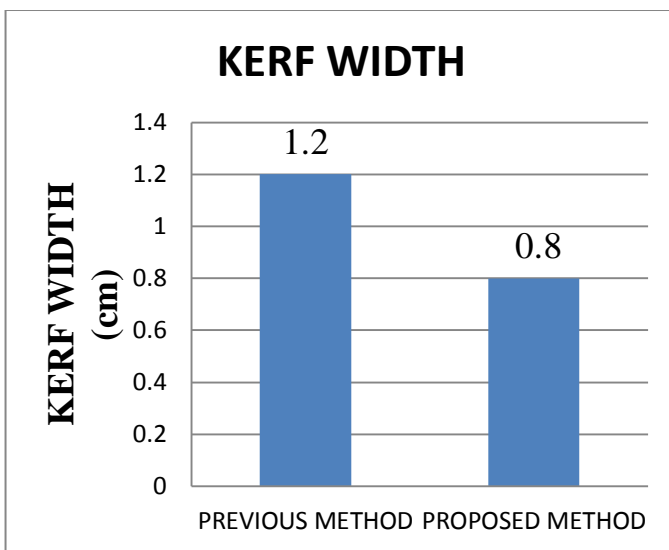


Figure. 4. Kerf Width

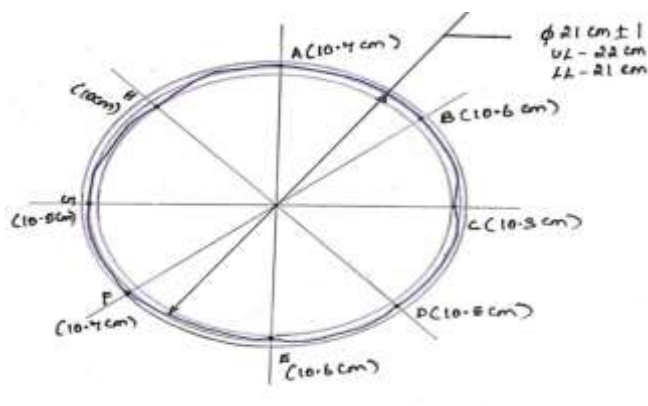


Figure. 5. Circularity Profile (Previous Method)

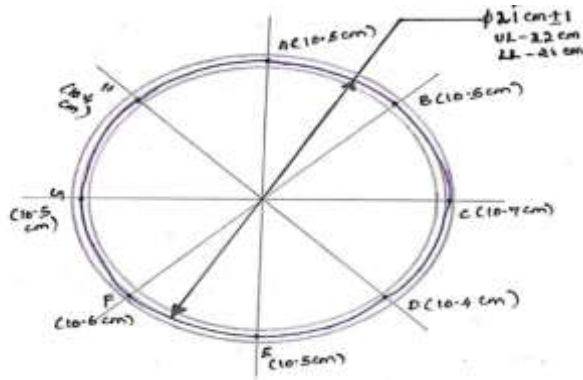


Figure. 6. Circularity Profile (Proposed Method)

Conclusion

The Proposed experimental setup is more beneficial to the small scale industries compared to conventional type of angle grinding machine. In this paper, we focused on the area of limitation like human fatigue; cycle time etc. on conventional type and their limitations were overcome by proposed setup.

Form the experiment results; cycle time is reduced from 15.53 min to 9.27 min. So the sheet cutting per shift is increased from 24 pieces to 48 pieces. In previous method, kerf width is 1.2cm but in proposed method it is reduced to 0.8cm and it indicates that reduction in material wastage.

Finally, Circularity was attained by proposed method is better than the conventional method because it has circumference irregularities hence it shows that accuracy of the cut by proposed method is good.

Thus we concluded that as an effective experimental setup was established to overcome the limitation of conventional type.

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