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"Design and Development of Pneumatic Sheet Metal Cutting Machine"

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ABSTRACT

We are using cutters for simple sheet metal cutting. This is a manual method by which sheet metal can sometimes be lost due to errors such as incorrect dimensions, etc., and even simple cutting can take a long time. Hydraulic machines for sheet metal cutting are also available. But this method is only used for heavy metal cutting and its cost is very high. For sheet metal cutting we are using simple pneumatic system. These two routes are operated by the pneumatic hand lever of the control valve. The control valve is operated by a compressor.

The sheet metal cutting process is a major part of all industries. Generally sheet metal cutting machine is operated by hand for medium and small scale industries. Our project includes "Pneumatic Sheet Metal Cutting Machine". Automation is inevitable in the modern world. Any automatic machine intended for the economical use of man, machine and materials. The sheet metal cutting machine operates with the help of a pneumatic double acting cylinder. The piston is attached to a rotating cutting tool. It is issued for cutting small sizes of metal (maximum 3 mm). The machine is portable in size, so easy to transport.

Keywords: Mild steel bars, Pneumatic double acting cylinder, 35C8 material for shearing blade.

INTRODUCTION

A pneumatic sheet cutter is a tool that uses a pneumatic cylinder. It uses the pneumatic equivalent of a mechanical lever to generate compressive strength. The pneumatic sheet cutter generates compressive strength with the help of compressed air. Shearing machines and bending machines are the most important in the sheet metal industry. This machine should be used for straight cutting machine with wide application. But some industries use handsheet cutters and hand benders. It requires human effort to operate the machine. The machine should be easy to operate and easy to maintain, so we tried to develop pneumatic shearing and bending machine. In the shearing operation, when the punch descends on the metal, the pressure exerted by the punch first causes the formation of metal plastic.

Because the clearance between the punch and the dye is very small, deformation of the plastic occurs in the localized area and in the metal adjacent to the cutting edge. In the bending operation, the bending is made with the help of a punch which exerts a great deal of force on the diver clamped work. The bending machine is designed in such a way that it works automatically. The machine is designed by monitoring components to improve efficiency and reduce cycle time by producing qualityoutput. Automation of the machine is achieved with the help of pneumatic system. This includes the design of efficient systems that reduce human effort and help increase productivity. It also includes pneumatic systems, pneumatic components and shearing dyes and bending dyes.

1.1 Literature Review

Vallance and Matlock (1992) studied the friction behaviour of zinc- based coated sheet steel sand laboratory scale friction analysis techniques that involve sheet sliding over cylindrical dies. Wenzloff et al (1992) introduced a new test procedure for the bending under tension friction test. Mai Huang and Gardeen (1994) presented a literature review of the spring back of doubly curved developable sheet metal surfaces and provided by biography on spring back in sheet metal forming. Reviewing the literature, it is found that researchers have been studying the phenomenon of spring back for nearly six decades.

There have been diverse efforts to evaluate and/or decrease spring back in the sheet metal forming industry for along time. Perduijn and Hoogenboom (1995) derived a simple explicit bending couple curvature relation for small and larger curvatures and they verified the model with experimental results. A simple approach for calculating bendability and spring back in bending based on the normal anisotropic value, strain hardening exponent and sheet thickness has been presented as described elsewhere by DawKweiLeu(1997).

You-Min Hang and Daw-Kweileu (1998) described the effects of process variables like punch radius, die radius, punch speed, friction coefficient, strain hardening exponent, normal anisotropy on V-die bending process of steel sheet. Sanchez (1999) focused on a systematic analysis of testing equipment as a measurement system of the friction phenomena on sheet metal under plane strain.

It provides experimental references in order to optimize the usage of lubricants and sheet metal. Weilong Hu (2000) proposed anisotropy hardening models with simple loading conditions that include exponential hardening model, linear hardening model and multi linear hardening model. Samuel (2000) analyzed the spring back in axis symmetric U-bending processes with a finite element program and discussed the effect of tool geometry and blank holder force on the final shape after spring

1.2 Objective

1. The developments of processes and procedures.
2. The developments of factory, shop and workplace. Layout and design of plat and equipment.
3. Reduced in human efforts.
4. Enhancements in use of materials, machines and man power.
5. The development of well physical working environment.

1.3 Design

1.Base Frame Quantity:

Height: 300mm
Length: 900mm
Width: 300mm
Weight: 5kg

2.Shearing Blade- Quantity

Length: 300mm
Height:60mm
Thickness:15mm
Weight:3.5kg

3.Base Plate- Quantity

Length:65mm
Width:65mm
Thickness:6mm

4.Fork End- Quantity

Length:75mm
Width:20mm
Thickness:5mm

5.Angle Section- Quantity:

Height:45mm
Length:300mm
Width:45mm
Thickness:7mm
Weight:0.5kg

6.Connection Link:

Length:360mm
Thickness:5mm
Height:25mm
Weight:0.3kg

7.Support Link-

Height: 90mm
Width:25
Thickness: 5

8.Blade Link:

Height:90mm
Width:20mm
Thickness:5mm
Welded Length:30mm

SPECIFICATION:

Pneumatic Cylinder- Quantity:
Total Length: 375mm
Bore: 40mm
Stroke: 200mm
Piston Rod Diameter: 20mm
Max Working Pressure: 8 bar
Weight: 3kg

DC Value**-** Quantity: 1
Operation: Manual Type: Hand Lever, Detent Type
Number of Ports: 5
Number of Positions: 3
Construction: Sliding spool type

Pneumatic Pipe- Quantity: 3000mm
Diameter:8mm

Thickness: 1mm

Fork End Nut- Quantity: 2

Length: 16mm, Size:M16

MATERIALS

Raw Material Used-

1. Mild Steel bars for baseframe.
2. 35C8 material for shearingblades.
3. Cylinder fittings like fork end, base plates, supportlinks.
4. Angle section for bladefitting.
5. Connecting link.

Ready Items Used-

1. Pneumatic double actingcylinder
2. Direction & flow controlvalves.
3. Pneumatic pipe & pipefittings
4. Bolts &nuts.
5. Antirust coat &paint.

Machine & Tools Used-

1. CuttingMachine.
2. Hacksaw CuttingMachine.
3. Sensitive DrillingMachine.
4. Horizontal MillingMachine.
5. Electric Arc WeldingMachine.
6. TableGrinder.
7. HandGrinder.
8. Surface GrindingMachine.
9. Tap & TapHolder.

WORKING

The pneumatic machine includes a table with support arms for holding the sheet, a stop or guide for securing the sheet, upper and lower straight-edge blades, a gauging device for correctpositioning of the sheet. The table also includes a two-way directional valve. The two way directional valve is connected to the compressor. The compressor has a piston for the movable member. The piston is connected to the crankshaft, which in turn is connected to the prime mover (electric motor, internal combustion engine). At the inlet and outlet ports, the valves allow air to enter and exit the chamber. When the compressor is turned on, compressed air enters the inlet of the pneumatic cylinder. The sheet is placed in the upper and lower blades. The lower blade remains stationary while the upper blade is turned downwards. The upper blade is slightly offset from the lower blade, approximately 5 - 10% of the sheet thickness.

Also, the upper blade is usually angled so that the cut goes from one end to the other, thus reducing the required force. When the pneumatic hand operated lever is moved backwards, the upper blade will return to its original position (i.e., the upper blade will move upwards). After cutting the material, adjust the pneumatic hand lever to the middle position (i.e., to the normal position).) And then the compressor is turned off.

CONCLUSION

NowweknowthatPneumaticShearingmachineisveryeconomicalascompared to hydraulic shearing machine. The range of the cutting thickness can be increased by ordering a high pressure compressor and installing more hardened blades. This machine is advantageous to small sheet metal cutting industries as they cannot afford the expensive hydraulic shearingmachine

FUTURE SCOPE OF PROJECT

From old age man is always trying to get more and more luxuries. Man is always trying to develop more and more improved techniques by enhancing

his aesthetic appearance and financial considerations. So there is always more scope. But being a diploma engineer and having the ability to think and plan. But due to some time constraints and lack of funding, we just thought and put in the next future improvement report.

1. It can be operated hydraulically on power by installing gear oil pump in place of arrangement of air compressor and pneumatic cylinder.
2. The rack and pinion can be operated or the spring and lever can be operated by replacing the pneumatic circuit rack and pinion arrangement by square negotiated screw and nut arrangement.
3. Where there is a shortage of electricity, the electric motor compressor I.C has been replaced. Engine compressor installed.

Thus there are many changes in the future, which we can do to survive in the huge world of competition.

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