Design and Fabrication of Pneumatic Controlled Clamping and Bending Device

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ABSTRACT

The main aim for us to select this project work is to acquire practical knowledge in the field of automation using Pneumatic system. The clamping and bending is done by the double acting cylinders which are actuated through the 5/2 way lever operated directional control valves.

There are two cylinders are used to clamp and bend the job. One cylinder is used for clamping and another cylinder is used for bending operation. When the lever is turned, the clamping cylinder clamps the job by air pressure through the 5/2 way lever operated directional control valve and the second valve is turned the bending cylinder bends the job. Both the lever valves are turned to original position hence the both the cylinders are return to original position.

Keywords: Bending device, Clamp, Cylinders, Fabrication, Pneumatic control

1. CONSTRUCTION MECHANISM:

This project consist of

1. M.S. Fabricated stand (For mounting the cylinder)
2. Lever operated directional control valve
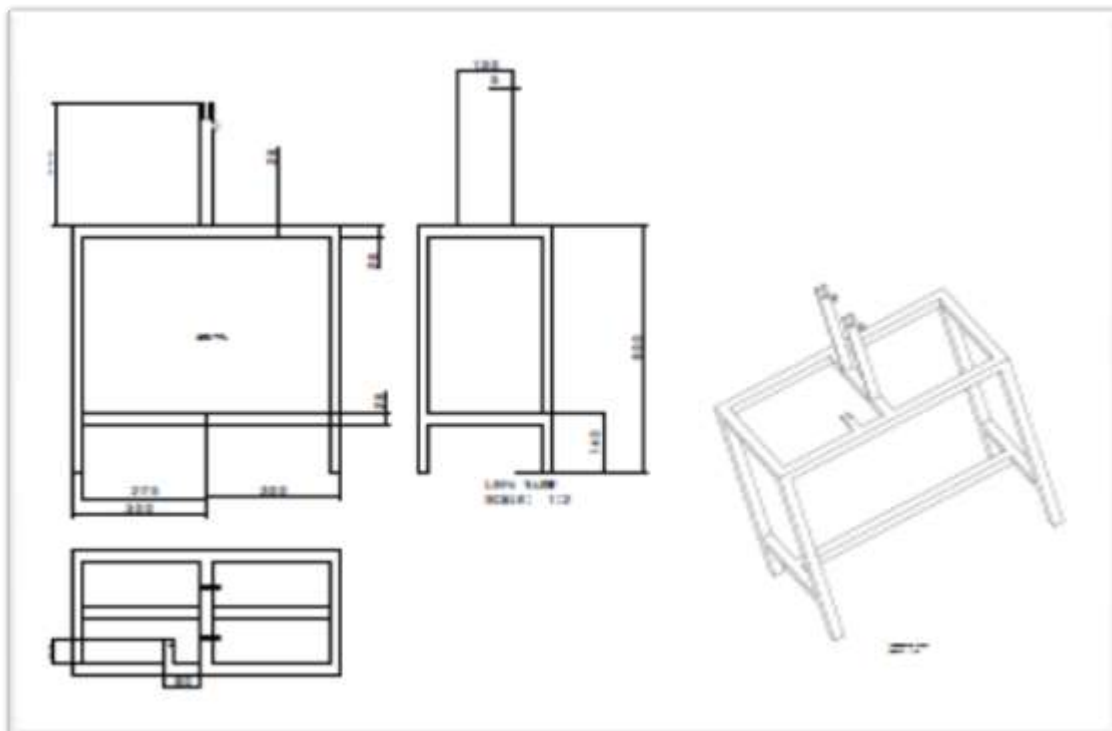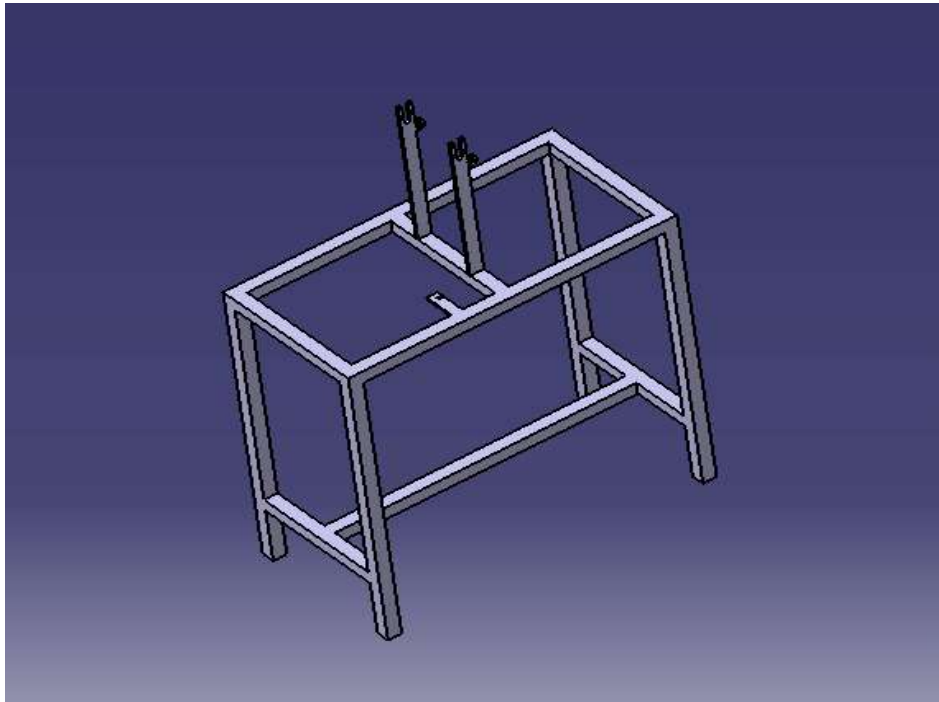3. Clamping cylinder unit
4. Bending cylinder unit

The following figure shows the construction of this project

PNEUMATIC CLAMPING AND BENDING MACHINE
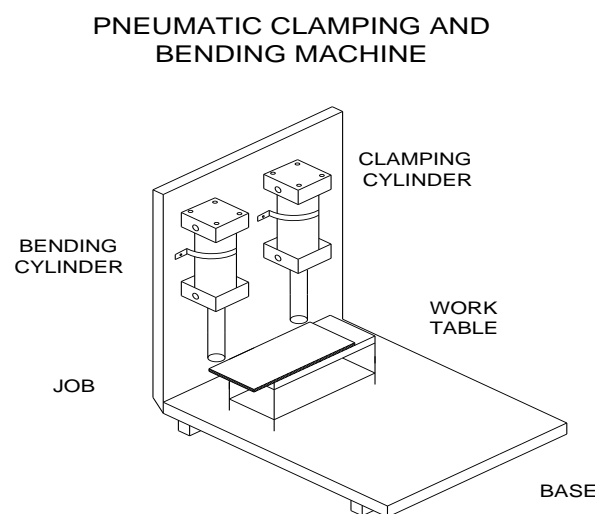
1.1 M.S Fabricated Stand:

A M.S L angle frame is fabricated to a size of 600mmx600mmx 300mm (Length x Height x breath) And it is used as a base plate for the this project work. These frames are made with 25 x 25 x 2.5mm square tube M.S material. This fabricated frame is shown below.

First of all the frame is designed and the base is constructed by using the welded joints and cut the material with the required size by using hacksaw machine. The stand frame material is used to mild steel at low cost is widely and is used overall.

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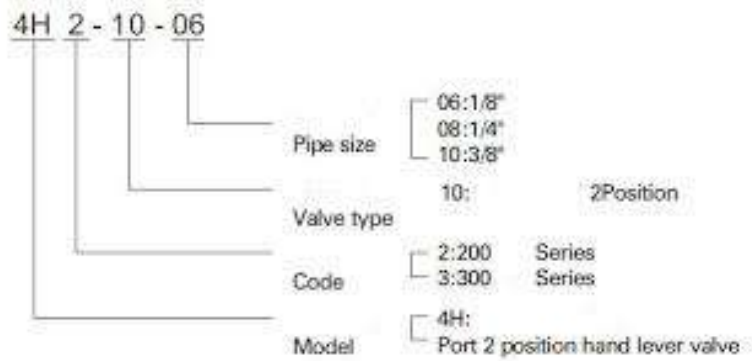**Volume 04 Issue 02**
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2. PNEUMATIC CONTROL SYSTEM:

In pneumatic system, the piston rod in cylinder is moved by the supply of compressed air which is supplied through the solenoid operated 5/2 way directional control valve. The cylinder A and B ports are connected to the 5/2 way solenoid D.C. Valve with 6/8mm PVC tube. The 6mm connector is used to connect this cylinder port and D.C valve. The minimum air pressure required is 5 to 6bar. The figure shows the cross section view of double acting cylinder.

When the valve is turned ON, the 5/2 way DC valve directs the air to the air cylinder and the piston pushes the clamping plate and thus clamp the object for further action. The piston rod is return to original position, when the valve is turned OFF.

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2.1 VALVE CONNECTORS:

The following figure shows the connector to connect the valve and cylinder through the polyurethane tube.

2.2 POLYURETHANE TUBE:

The following figure shows the polyurethane tube for connecting valve and cylinder and allowing the pressurized air through this pipe line.

3. WORKING PRINCIPLE

Before starting the machine set the pressure 6 Bar in the FRL unit and connect air supply to the 5/2 way lever operated directional control valve at the pressure port.

Now, Press the lever valve for clamping after placing the job in the worktable. The air supply goes to clamping cylinder, which clamp the job. After clamping, the second lever operated 5/2way directional valve is turned, the second cylinder moved to bend the job.. After the bending operation, the cylinder returns to the original position by reversing position of lever valve.

3.1 DESIGN AND CALCULATIONS

3.1.1 Pressure, radius, area and force relationships

Although the diameter of the piston and the force exerted by a cylinder are related, they are not directly proportional to one another. Additionally, the typical mathematical relationship between the two assumes that the air supply does not become saturated. Due to the effective cross sectional area reduced by the area of the piston rod, the in stroke force is less than the outstroke force when both are powered pneumatically and by same supply of compressed gas.

The relationship, between force on outstroke, pressure and radius, is as follows:

$$F = p(\pi r^2)$$

This is derived from the relationship, between force, pressure and **effective** *cross-sectional area*, which is: F = p A\,

With the same symbolic notation of variables as above, but also A represents the effective cross sectional area.

On in stroke, the same relationship between force exerted, pressure and *effective cross sectional area* applies as discussed above for outstroke. However, since the cross sectional area is less than the piston area the relationship between force, pressure and *radius* is different. The calculation isn't more complicated though, since the effective cross sectional area is merely that of the piston less that of the piston rod.

For in stroke, therefore, the relationship between force exerted, pressure, radius of the piston, and radius of the piston rod, is as follows:

$$F = p(\pi r_1^2 - \pi r_2^2) = p\pi(r_1^2 - r_2^2)$$

Where:

F represents the force exerted
r_1 represents the radius of the piston
r_2 represents the radius of the piston rod

π is pi, approximately equal to 3.14159.

4. CALCULATION;

CYLINDER DIA -------------------------------40 MM

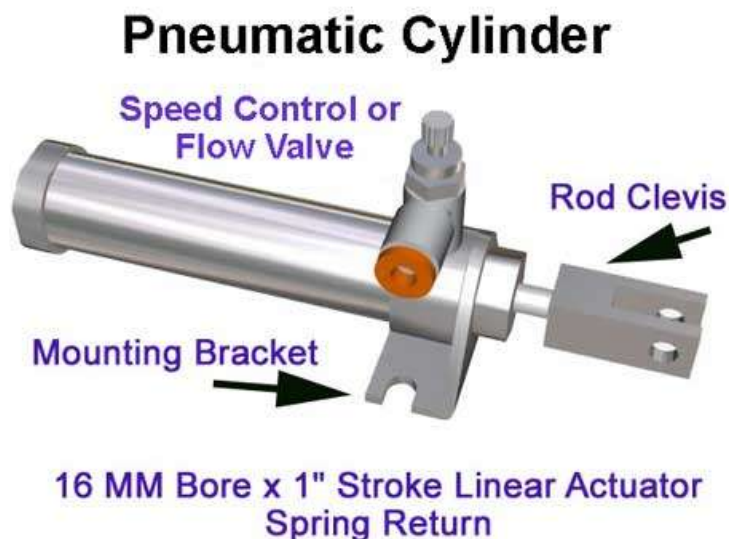**STROKE LENGTH** -------------------------70 MM

OPERATING PRESSURE ---------------- 5 BAR (5 KG/CM^2)

FORCE REQUIRED TO CUT THE MATERIAL 10 KG (ASSUME)

$$\text{PRSUURE} = \frac{\text{FORCE}}{\text{AREA}}$$

$$5 \text{ KG/CM}^2 = \frac{10 \text{ KG}}{\P D^2/4}$$

DIA METER= USE CALCULATOR TO FIND DIA

Pneumatic Cylinder

Speed Control or Flow Valve

Rod Clevis

Mounting Bracket

16 MM Bore x 1" Stroke Linear Actuator
Spring Return

5. ADVANTAGES

- The pneumatic is more efficient in
- Quick response is achieved the technical field.

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- Simple in construction
- Cost of unit is very less
- Easy maintenance and repair
- No fire hazard problem due to overloading
- Continuous operation is possible without stopping

6. DISADVANTAGES

- Silencer must be used while
- High torque cannot be obtained compressing the air
- Load carrying capacity is low

7. APPLICATIONS

- This machine is very useful for small
- These machines used to cut the roller scale industries
- All industrial application sheet metal

8. CONCLUSION

By doing this "FABRICATION OF PNEUMATIC CLAMPING AND BENDING MACHINE" I and my co-workers have gained the experience in fabrication and we have gathered practical experience by welding the structures.

By doing this project we gained the knowledge of pneumatic system and how automation can be effectively done with the help of pneumatic system.

It is concluded that any automation system can be done with the help of pneumatic system.

We have successfully completed the project work on using pneumatic control at our factory and institution.\

9. FUTURE ENHANCEMENTS:

The place where there is affectivity of the electricity the electric motor operate compressor can be replaced by any I.C. Engine installed compressor.

Thus in future there are so many modifications, which we can make to survive the huge global world of competition.

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REFERENCES

[1]   A.S. Aditya Polapragada & K. Sri Varsha , "Pneumatic Auto Feed Punching , cutting and Riveting Machine ", International Journal of Engineering Research & Technology , Vol. 1 Issue 7, September - 2012 ISSN: 2278-0181.

[2]   Bosch-Rexroth, Manuals of Pneumatics.

[3]   E. Paul. Degarmo, "Shearing in Metal Cutting", Pages 518-528, Materials and Processes in

Manufacturing, Eighth edition, 2003, Prentice Hall of India Pvt Ltd.

[4]   K. Mahadevan, Design Data Handbook, Third edition, Reprint 2002, CBS Publishers & distributors. P. Croser, F.Ebel, Pneumatics, Festo, 10, 2002

[5]   P.M.Pradhan, "Experimental Investigation and Fabrication of Pneumatic Cutting tool", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 6, June 2013.

[6]   Phillip F. Ostwald, Jairo Munoz, Manufacturing Processes and systems 9th Ed., Wiley-India, 2008

[7]   Pneumatic Systems (principles and maintenance) wriiten by S.R. Majumdar.Robotics and Automation by R.K Rajput

[8]   S. R. Majumdar, Pneumatic Systems, Tata McGraw-Hill , 1996

[9]   W. Bolton,Mechatronics, Pearson Prentice hall, 2008

[10]   www.answer.com,industrialautomation,scope

[11]   www.britannica.com,automation,advantages&dis advantages

[12]   www.en.wikipedia,relay

[13]   www.enwikipedia,ladderdiargam

[14]   www.jrank.org,pages,677,automation&applicati on

[15]   www.netviewforz,os,automation,guide,objective s

[16]   www.omega.com , air-preparation

[17]   www.wikipedia , chapter7, air compressor air filters-lubricator