Design and Fabrication of Pneumatic Punching and Bending Machine

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Abstract—The pneumatic system has gained a large amount of importance in last few decades. This importance is due to its accuracy and cost. This convenience in operating the pneumatic system has made us to design and fabricate this unit as our project. This unit, as we hope that it can be operated easily with semi-skilled operators. The pneumatic press tool has an advantage of working in low pressure, that is even a pressure of 6 bar is enough for operating the unit. The pressurized air passing through the tubes to the cylinder, forces the piston out whose power through the linkage is transmitted to the punch. The work piece thus got is for required dimensions and the piece can be collected through the land clearance provided in the die. The die used in this is fixed such that the die of required shape can be used according to the requirement. This enables us to use different type punch dies resulting in a wide range of products. Different types of punch as requirement can be thus got. According to the work material the operating pressure can be varied.

Key words: Double Acting Pneumatic Cylinder, Directional Control Foot Operated Valve

I. INTRODUCTION

The press is the punching and bending machine tool designed to punch metal plate by applying mechanical force or pressure. The metal is punched or bend to the desired requirement. The presses are exclusively intended for mass production and they represent the fastest and more efficient way to form a metal into a finished punched or bend product. Press tools are used to punch and bend thin metals. Press tools operation can be simplified to a few simple operations involving a punch and die. There are Nenmours types of presses in Engineering field, which are used to full fill the requirements. We are interested to introduce pneumatic system in presses. The main function of pneumatic press is to punch or bend thin sheet metals or non metals using pneumatic power. In this project we have used to punching process and bending process for simple application and we are using foot operated valve instead of hand operated lever so single man can performed the operation of machine like punching and bending easily.

II. COMPONENTS AND DESCRIPTION

A. Directional Control Foot Operated Valve:
The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV, this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts. This valve was selected for speedy operation and to reduce the manual effort by means of using a foot operated valve. A foot operated valve is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism.

B. Double Acting Pneumatic Cylinder:
An (pneumatic) air cylinder is an operative device in which the state input energy of compressed air; (i.e) pneumatic power is converted into mechanical output power, by reducing the pressure of the air to that of the atmosphere. The bore of the cylinder has very smooth finishing reduces friction and losses. There are two angle plates welded to the cylinder as fitting means. A double acting cylinder is employed in a control system with a full pneumatic cushioning and it is essential when the cylinders itself is required heavy masses. The normal escape of air is out by ‘cushioning piston’.

C. Punch and Die:
Die and punch are known as ‘press tools’. Die is the lower part of press tool. It is clamped on the bolster plate of the press. It remains stationary during the operation. The die has a cavity to receive the punch. The cavity may be with clearance or without clearance. Punch is the upper part of the press tool. It is attached to the lower end of the tool holder of the press. It sheds with the tool holder during the operation and is forced into the die cavity. Die and punch must be in prefect alignment for proper operation. Die and punches are always used together. Dies are classified according to either the type of construction or operation to be performed. High speed steel, satellite or cemented carbide, mild steel is the materials used for making dies and punches. The die materials selected depend on the type of production, operation, sheet metal thickness and accuracy.

D. Flow Control Valve:
The flow control valve is used to control the flow of air into the cylinder. In this project we are used flow control valve to control the forward and return stroke of cylinder.

E. Compressor:
The compressor forms the main part of the pneumatic system by producing the compressed air. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air intake conduction, namely at atmospheric pressure and normal ambient temperature. The clear conduction of the suction air one of the factors which decide the life of a compressor. Compressor is generally classified into two types, namely.

- Positive displacement compressor
- Turbo compressor

III. WORKING

The compressed air from the compressor at the pressure of 8 to 10 bar is passed through a pipe connected to the Foot Operated valve with one input. The Foot Operated valve has two outputs pressure below the piston is more than the
pressure above the piston. So these moves the piston rod from BDC to TDC. This force acting is passed on to punch which also moves downwards. The punch is guided by a punch guide who is fixed such that the punch is clearly guided to the die. The materials are in between the punch and die. So as the punch comes down the materials are sheared to the required profile and one input. The air entering into the input goes out through the two outputs . when the Foot Operated valve is pressed . Due to the high air pressure at the BDC of the piston, the air of the punch and the blank is moved downwards through the die clearance. When the piston is at the extreme point of the stroke length, the exhaust valve is opened and the air is exhausted through it and when Foot operated valve is release the pressurized air come in at the TDC of the piston and it pushes the piston from TDC to BDC. So the one side of the air is pulled downwards and the other side is lifted upwards. So the punch is therefore pulled upwards from the die. Now the piston reaches the BDC of the required stroke length. Now the material is fed and the next stroke of the piston is made ready. Similar operation is performed for bending by replacing punching tool by bending tool. Figure (A) shows the circuit diagram of pneumatic punching and bending machine. Figure (B) shows the Pneumatic Bending Machine and figure (C) shows the Pneumatic Punching Machine.

Fig. 1: (A) Circuit Diagram of Pneumatic Punching and Bending Machine
Fig. 1: (B) Pneumatic Bending Machine
Fig. 1: (C) Pneumatic Punching Machine.

IV. CONCLUSION
This project has met its objective to produce a C-Frame Pneumatic Press and its function is limited to V-Bending and Punching.

We designed a pneumatic press which costs less than that available in the market. We are very good at what we have done and had fun doing it. Our pneumatic press is useful to do metal forming operations and as it is a 2 tonne capacity press. We can do simple operations like bending, punching, which is very useful and helpful to do small works at our college. We chose a simple c-frame press which occupies less space which anyone can operate.

We tested our project by producing a V-bend and punching the sheet metal. As our project is based on manufacturing of pneumatic punching and V-bending, further modifications can be done and increase its applications.

V. FUTURE EXTENSION
We contemplate the following future features which can be incorporated into this project:-

1) A die to produce a washer of less than 1mm thickness.
2) Automation of pneumatic press.
3) Improvements in pneumatic press by adding components like timers, silencers etc.

REFERENCES