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FABRICATION OF HYDRAULIC SHEET METAL BENDING MACHINE

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ABSTRACT

In this modern world the way of living was changing with the change in existing features. From this, bending operations takes a prominent role. These bending operations are usually done by Heavy machines like Hydraulic power leaf bending machine and sheet metal bending machine. But these machines are not suitable for small bending operations like door handles, welding plates etc. To overcome this problem, we designed "HYDRAULIC SHEET METAL BENDING MACHINE" Especially discussion made the productivity analysis of manually or power operated sheet bending machine. Considering manual operation is replaced by power operated devices. It also gives information about limitation of manually operated sheet bending machine and power operated sheet bending machine.

Keywords: Hydraulic cylinder, welding plates, Sheet metal bending, Motor, Hydraulic pipes

INTRODUCTION

Pneumatic systems are power systems using compressed air as a working medium for the power transmission. Their principle of operation is similar to that of the hydraulic power systems. An air compressor converts the mechanical energy of the prime mover into, mainly, pressure energy of the compressed air. This transformation facilitates the transmission, storage, and control of energy. After compression, the compressed air should be prepared for desired work. This project is about the design and fabrication of pneumatic punching tool which shows capability to design more than one concept and fabricate the machine using a variety of machine. Other than that, it is important for studies on pneumatic for punching tool and design of punching tool which are the main topic for this project. This project is provided for familiarize about the technology on sheet metal forming which is used pneumatic concept yet has rapidly grown especially in the automotive and electrical industry. Furthermore, the strong concern is to obtain better product quality with lower cost. Using pneumatic system is economical and environmentally friendly, as air is inexpensive, plentiful and easily compressed and stored in tanks.
Pneumatic devices get all their power from the energy in the compressed air they use, so you can probably see straight away that they need at least two key components: something to compress the air (the compressor) and something that uses compressed air to lift, move, or hold an object (the actuator). We also need a pipe or network of pipes (the circuit) to get air from the compressor to the actuator. Something to switch the air on or off (a valve) and maybe reverse its direction would also be handy (so we can make our machine lower things as well as lift them).

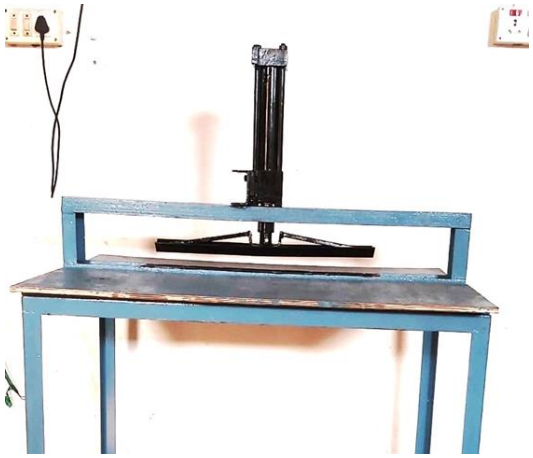

Fig -1.1: Hydraulic sheet metal bending machine

Components of Machine:

1. Motor 1½ hp
2. Hydraulic cylinder
3. Stainless steel bars
4. Metal cube
5. L - angle
6. Bolts
7. Nut bolts
8. C-angle

DETAILS OF DESIGN (Working Principle, Calculations)

2.1 Working:-

The compressed air from the compressor at the pressure of 8 to 10 bar is passed through a pipe connected to the hand lever operated valve with one input. The hand lever operated valve has two outputs pressure below the piston is more than the pressure above the piston. So, these move 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 two outputs. When the hand lever 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 hand lever operated valve is releasing 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.

2.2 Design:-

General Requirement of Machine Design:-
1. Easy to operate
2. Less time consuming
3. High productivity
4. Simplicity of design
5. Safety and convenience of control
6. Low Cost
7. Good Appearance.

2.3 Calculations :-

Force calculation for existing punch design
Terms and formulae used:

- Cutting force: - The force which has to act on the stock material in order to cut the blank or slug.
- Stripping force: - The force developed due to the spring back (or resiliency) of the punched material that grips the punch.
- Cutting force = L x t x Tmax
- Stripping force =10% -20% of cutting force
- L= Length of periphery to be cut in mm
- t= Sheet thickness in mm
- Tmax= Shear strength in N/mm2
- The formula to calculate the press force is as follows

Press force = cutting force + stripping force
Sample Calculation for Aluminium Sheet
Here is a sample calculation to calculate the punching force required for different thickness of aluminium sheet.

- Total length of cut, L =50 mm.
- If Sheet thickness, t = 1mm.
- Maximum tensile strength of aluminium, Tmax = 180 N/mm2
- Total cutting force = L x t x Tmax
- Total cutting force = 50 × 1 × 180
- Total cutting force = 9000 N

- Stripping force = 15% of the cutting force= 1350 N
- Press force = Cutting force + Stripping force= 9000 N + 1350 N= 10350 N

Sample Calculation for Plastic Sheet

Here is a sample calculation to calculate the punching force required for different thickness of plastic sheet.

- Total length of cut L = 50 mm.
- If Sheet thickness, t = 1mm.
- Maximum tensile strength of plastic, Tmax = 90 N/mm2
- Total cutting force= 4500 N
- Stripping force = 675 N
- Press force = Cutting force + Stripping force= 4500 + 675 N= 5175 N

COST

3.1 Cost estimation:

Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involved in a design & manufacturing with all related service facilities such as pattern making, tool, making as well as a portion of the General Administrative & selling costs.

Sr. NO.	Particulars	Cost in Rs.
1	Double acting cylinder	3000
2	4/3 way hand lever valve	800
3	Square Tubes	800
4	Rollers	250
5	Chain	300
6	Sprocket	300
7	Pneumatic fittings	250
8	Nut bolts	250
9	Punch	250
	Total Price	6200

Table 3.1: Cost estimation of materials

ADVENTAGES, DISADVANTAGES, APPLICATIONS, FUTURE SCOPE

4.1 Advantages

- It reduces the manual work
- It reduces the production time
- It occupies less floor space
- Less skilled operator is sufficient
- It's construction is simple and requires less maintenance.
- Low cost.
- Easy and fast operation
- High degree of accuracy
- High efficiency
- Automation/ New technology adoption.
- Less maintaining cost.

4.2 Disdvantages

- Cylinder stroke length is constant
- Need a separate compressor.

4.3 Applications

- Pressing Operation in all industries
- Paper punching industries
- Leather washer operation in all industries
- Punching operation also done.

4.4 Future scope

In this machine, compressed air is used to move the punch tool for carrying out punching operation. After the completion of the cycle the air moves out through the out port of Solenoid valve. This air is released to the atmosphere. In future the mechanism can be developed to use this air again for the working of cylinder.

Future Extension:

We contemplate the following future features which can be incorporated into this project:-

1) Automation of pneumatic punching machine
2) Accident avoiding systems by adding LDR sensors
3) Improvements in pneumatic machine by adding components like timers, silencers, etc

CONCLUSIONS

Pneumatically operated punching machine is suitable for small scale and medium size industries. Based on the shear provided on the punch face the punching force reduction of 25% to 60% thereby increasing tool life and reducing tool machining cost. Therefore with this force reduction we are able to easily punch sheets. Circularity of various material sheets punched is proportional to the blanking pressure and further investigation revealed that the circularity embed on a plastic sheet material is more favourable than Aluminium and Galvanized Iron as the ability to resist same pressure is less in plastic material comparable to Aluminium and Galvanized Iron .

Photos :

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