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Design and Development of Portable Pneumatic Stirrup Making Machine

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Abstract: ***The main objective of this paper is the implementation of the pneumatic stirrup making machine on the construction site to bend the rod and to make in stirrup form. This machine is less costly compare to the existing machine. The productivity is also increased. When the labour makes a stirrup he has to generate a lot of force to bend the rod and make stirrup. He has to make number of stirrups in a day which can cause a severe pain and permanent damage. So our main objective is to make a bar bending machine. It is mainly designed for the rod bending and also used for bending sheet. The bend has been made with the help of the double acting cylinder force on the hinge. The machine works semi-automatically. In this implementation productivity is more than the other machine and the cost and labour work is also reduced.***

I. INTRODUCTION

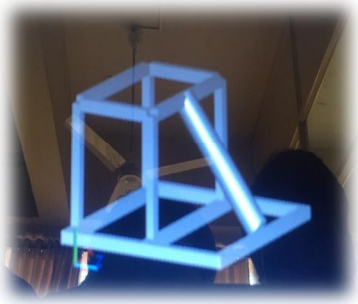
Now a days the construction side and industries are increasing so that to make the constructive the stirrup is required. For making the stirrup on the construction site the labour are given more force to bend the rod to make a stirrup by the hand. The main aim of this project is to known haow the pneumatic system works and to reduce the labour work. Our machine is semi-automatic. In which the loading and unloading of the rod is manually and the bending of the rod is manually and the bending of the rod is done with the pneumatically.

A. Components

1) *Pneumatic Cylinder:* The pneumatic cylinder is used for applying the force to bend the rod. This pneumatic cylinder is double acting. In double active cylinder air pressure is applied alternatively to the relative surface of the piston. Pneumatic cylinder is mainly made up with steel and working surface is polished and coating with chromium to reduce friction. Pneumatic cylinder is working quick then the hydraulic cylinder and does not required large space for the working fluid because the working fluid is air.
2) *Air Compressor:* An air compressor is a machine that used an electrical motor to power a device that suck in successive volume of air from the atmosphere. Compress each volume of air in a confined place to increase it pressure by making the volume smaller and supply to the tank after reading the upper limit of air compressor shuts off.
3) *Air Pipe:* Air pipe is a hollow cylinder. The mainly used of the air pipe is to supplier the compressed air from the compression to the pneumatic cylinder.
4) *Angular Indicator:* An angular indictor is used to measure the angle that the rod can bend by any angle.
5) *Pressure Regulating Component:* The pressure regulating component has formed by mainly 3 components.

a) *Filter:* the function of filter is used to remove impurity form the compressed air that is supply into pneumatic cylinder.
b) *Pressure Regulator Valve:* It is used to regulate the pressure which can be required for the banding the rod. It is attached with the pneumatic cylinder.
c) *Lubricator:* Lubricator is used for lubrication for pneumatic component.

6) *Rod:* Rod is used as a raw material for making a stirrup. Its material is mild steel. The ultimate strength of the rod is 600MPa


B. Component Specification

1) Pneumatic cylinder: - Double acting cylinder

Bore diameter = 63mm
Stock length = 150mm
Max. Supplying pr. = 7bar
Max. Spiriting pr. = 5-6 bar

2) TMT rod: - length of rod = 1000mm
Diameter of the rod = 4-8 mm
Ultimate strength = 600MP
Yield strength = 500MPa

3) Air pipe:- The inner diameter of the pipe is 8mm
Thickness:- _____mm

4) Pressure gauge: - Max. supply pr = 15 bar
Max operating pr = 9.5 bar
Regulating range = 0.5-0.8 bar
Ambient temp = 10-60 degree Celsius

II. CALCULATION

1) Cylinder Force Calculation: We are using 8mm diameter of Rod.

σ*y = 500Mpa
ı = (pie/64) d4
Y=d/2
M = F*(dist.) (where dist. = 50mm)
σ = MY/ı
500 = (F*(dist.)*(d/2)) / ((pie/64)*8^4)
Therefore, F = 502.65N
For bending of 8mm diameter rod 502.65N force is required.

2) Pressure Calculation: Cylinder inner diameter = 63mm
L = 150mm
F = P*A
P = F/A = 502.65 / ((pie/4)*63^2)
P = 0.161 N/mm^3
Therefore, P = 1.61 bar is required for bending rod.

III. DESIGN OF FRAME

Deflection of frame due to reaction force.
δ = FL^3/48EI = FL^3 / 48*E*(bd^3/12) = 0.08914mm
So, we can neglect this load deflection.

1) Static Calculation: Mass of cylinder = 1.7-2 kg
Mass of air = ρ*v
P = P/RT
Density of air at 6bar pressure and 30**°C** temperature is 6.895 Kg/m^3
V = (pie/4)*d^2*L
Mass of air = 0.00100 kg
Total mass = cylinder + air = 2.00105 kg
So, this much load can sustain the frame.

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IV. ADVANTAGES

A. Quick response is achieved
B. Simple in construction
C. Easy to maintain and repair
D. No fire hazard problem
E. Continuous operation is possible

V. LIMITATION

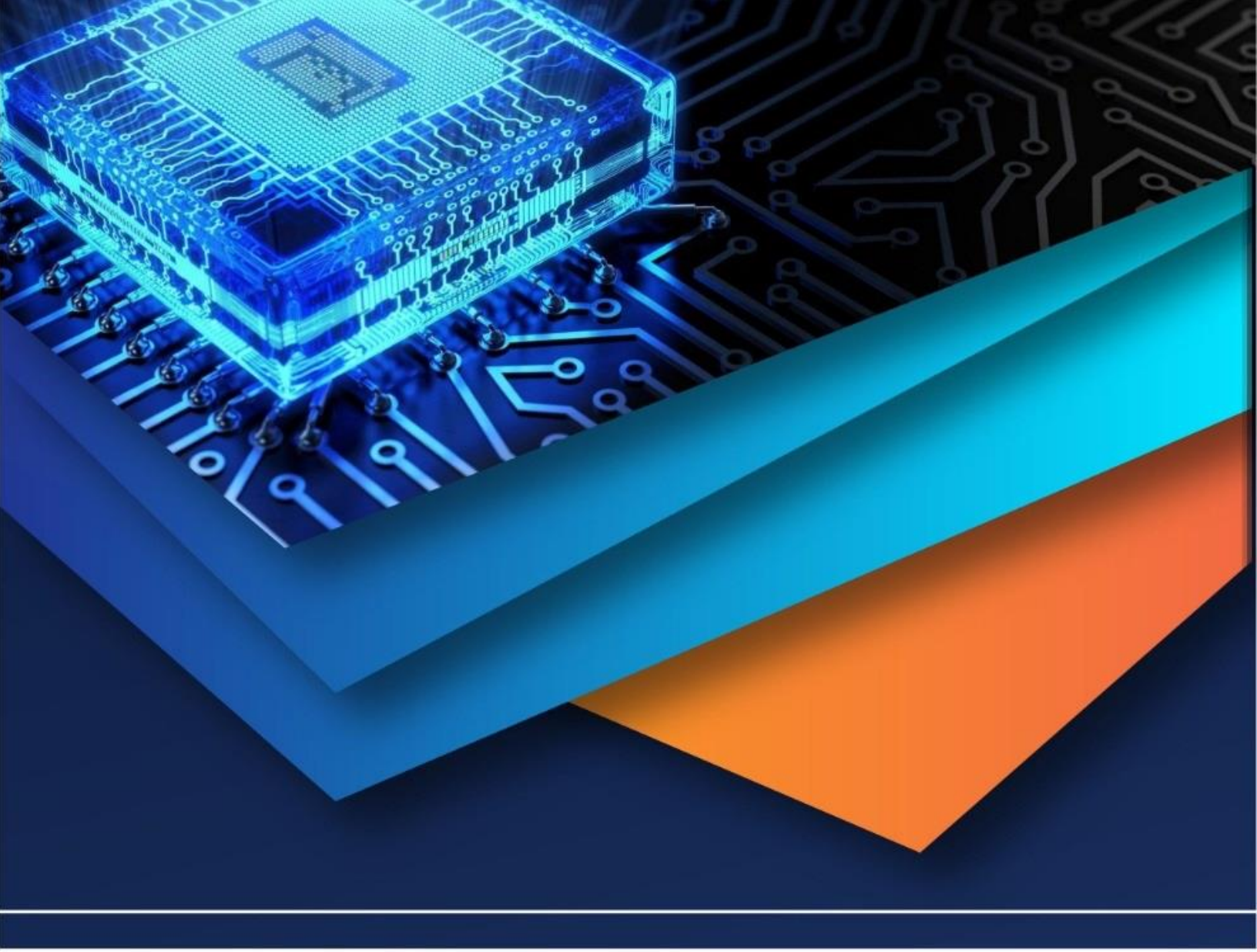
A. While working the compressor noise is produce.
B. Load carrying capacity of this machine is not very high.

VI. APPLICATION

A. Bar bending
B. Sheet metal bending
C. In production
D. Mini workshops

VII. CONCLUSION

In manually making stirrup can consume maximum time so that make a semi-automatic and automatic M/C for reducing time and also the labour effort. In semi-automatic M/C loading and unloading the rod by manually and bend the rod by pneumatically. It can also be converted into fully automatic by electric and electronic device.



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