International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 03 | Mar -2017 www.irjet.net p-ISSN: 2395-0072

DESIGN AND FABRICATION OF PNEUMATIC BAR BENDING MACHINE

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Abstract - *Now a days the world is focusing into automation. Each and every work of human is reduced by a machine, but few areas like construction the usage of machines for bending rods for stirrups which are used to withstand loads in beams and columns are not done by machine because the cost of machine is high and need skilled labours to operate it. In this paper is aimed to do bending operation for stirrups using pneumatic and named as pneumatic rod bending machine. The main objective of our paper is to implement the pneumatic rod bending machine in the construction sites with less cost compared to the existing bending machines, and increasing the productivity of the stirrups. Pneumatic rod bending machine consist of Pneumatic cylinder, Compressor, Hoses, Pulley, Cutting blades, Fixture, Electronic circuits, Switches and wiring .The rod is bent by the Pneumatic cylinder piston with holding the rod in the fixture. The main advantage of our paper is the square shape of the Stirrups is bent continuously without repositioning the rod in the machine.*

Keywords: bending operation, pneumatic system, Stirrup, manual stirrup making, fixture.

1.INTRODUCTION

Since long time ago the labour work has essential role in constructions including mixing coarse aggregate-sand-water- cement, ramming sand, land levelling, and digging the foundation for base of structure, cutting rod in required length, rod bending and pouring the mixture of concrete in columns and beams. Now days, due to development in technology it is required to reduce the labour work and time since there are lot of available resources. As population increasing very rapidly, demand of the construction to build the buildings for industries, overhead bridges, human livings and population is continuously increases. Several problems come in to the picture when we consider human work with respect to automation. By using conventional method it is not possible to reduce construction time and building it as early as possible. So, Automation in construction system is requires.[4]

The paper is designed based on the principles of pneumatics and the system is automatic type. By using automation the productivity of the product can be increase.

2.LITERATURE SURVEY

1.I Muhammed, S.Ravivishwnath, P Sureshkumar , N. Sarvanan Design and fabrication of hydraulic rod bending machine, April 2014. Worked on design and fabrication of rod bending machine and they concluded that Each and every work of human is reduced by a machine, but few areas like construction the usage of machines for bending rods for stirrups which are used to withstand loads in beams and columns are not done by machine because the cost of

machine is high and need skilled labours to operate it. So this project is aimed to do bending operation for stirrups using hydraulics and named as hydraulic rod bending machine. The main objective of our project is to implement the hydraulic rod bending machine in the construction sites with less cost compared to the existing bending machines, and increasing the productivity of the stirrups.

2.Vilas Shinde, Darshan Adhav, Suraj Jadhav, Afsar Attar, Sandip Gorde. Design and fabrication of hydraulic stirrup making machine, May 2016.They worked on Design and Fabrication of Hydraulic Stirrups Making Machine and they concluded that Since testing the stirrup making machine it is observed that how much time is required to make single piece of stirrup by effective working. The detail description is given as below: Loading and unloading combining clamping the bar to fixture it almost takes only 5 to 6 seconds. Time required to forward and backward stroke is about 10 to 11 seconds during which stirrup is made. Considering machine ergonomics that is interaction of human operator with machine, it is very easy to operate it because operating switch is provided at suitable place of machine. Again loading and unloading is not complicated since not very specialized tooling is used it is very simple structure.

3.CONSTRUCTION & WORKING

In this paper the rod is bend with the help of pneumatic force .The rod is feed automatically with the help of motor

and pulley arrangement. In this paper our aim to bend 8mm diameter of bar. We can make the stirrup of required dimension by using limit switch arrangement. In this ,when the rod is touches to the limit switch that time limit switch gives signal to the control unit, then control unit stop the motor and feeding of rod is stop automatically. After this, signal is given to the first cylinder by control unit and Cylinder bend the rod within a 3-4 stroke and we make complete stirrup. Cylinder second is only used for holding purpose.

3.1 SOLID CAD MODEL

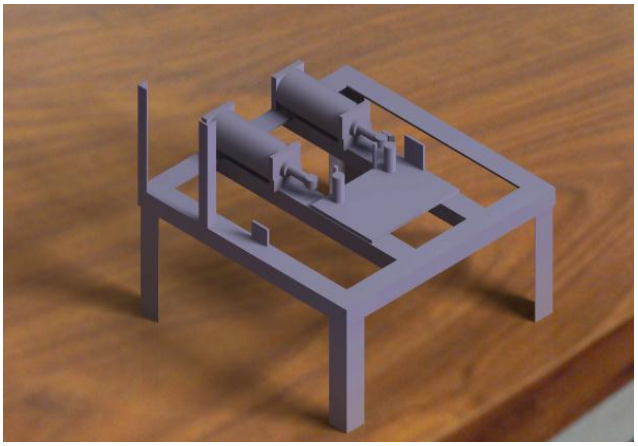

Fig 3.1 solid cad model

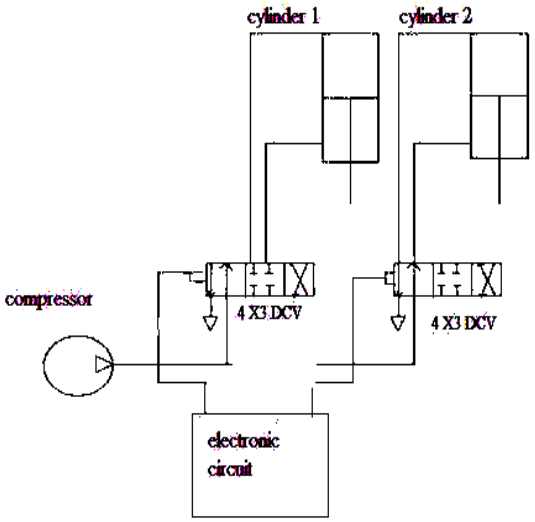

Fig 3.2 Pneumatic Circuit

4. DESIGN CALCULATIONS

Force :- Diameter of Rod = 8 mm

Material – Mild Steel

Allowable bending stress (σb) =300 N/mm^2

Force required to bend rod –

$\frac{M}{I} = \frac{\sigma_b}{y}$ We know that Bending moment is given by,

$M=F \times L$

$$F = \frac{([\sigma_b \times I])}{L \times y}$$

Where

$I=\frac{\pi}{64} D^4$ And D= 8 mm

$$F = \frac{([\sigma_b \times \frac{\pi}{64} D^4])}{L \times y}$$

$$F = \frac{([300 \times \frac{\pi}{64} s^4])}{10 \times 4}$$

F=1508 N This is the force at which rod is just start to bend So selected force = 1508N

Pneumatic cylinder design- We know pressure is given by

$$P = \frac{F}{A}$$

$A=\frac{\pi}{4} D^2$ So,

Assume pressure is constant at 5 bar

$$P = \frac{1508}{\frac{\pi}{4} D^2}$$

D = 0.06396 m

D = 63.96 mm

Select standard cylinder diameter as 80 mm

Stroke Length: Minimum Bending length of bar = 60 mm

Clearance between striker and

Rod dia=20mm

Cylinder Stroke length = bending length + clearance

= 60 mm + 20 mm = 80 mm

Select standard length is **100 mm**.

5.RESULTS&DISCUSSION

Since testing the stirrup making machine it is observed that how much time is required to make single piece of stirrup by effective working. The detail description is given as below:

Loading and unloading combining clamping the bar to fixture it almost takes only 4 to 5 seconds. Time required to forward stroke is about 6 to 7 seconds. The total time required to complete one stirrup is about 25 seconds. Considering machine ergonomics that is interaction of human operator with machine, it is very easy to operate it because the total system is automatically operated. Again loading and unloading is not complicated since not very specialized tooling is used it is very simple structure. Counting overall time let us assume that one stirrup takes approximate 25 seconds, so in one hour 140 stirrups can be made. Hence after effective working for 8 hours we can produce about 1200 stirrups.

Obtained Results-

NO	Parameter	Results
1	Loading and unloading time	3 seconds.
2	Operating and bending time	6 seconds.
3	Total lead time required for single piece	24 seconds.
4	Number of pieces in an hour	150 Pieces.
5	Effective working of 8 hours (production rate)	1150-1200 Pieces.

6.CONCLUSION

- In latest attempt a successful solution for the manual stirrup making is obtained.
- By using various fixtures in the table we can able achieve different shapes and sizes of the stirrups.
- The system can be handled by any operator very easily.
- Since it is cheap and simple design this machine can be sell to anywhere across the nation.
- Advance bar bending machine use for mass production. By using advance bar bending machine increases production rate and reduce labour cost.

7.FUTURE SCOPE

Operation for making stirrup is tedious and required continuous manual work to perform the bending operation. This will minimize human efforts for less physical exertion of the operator. Adverse effect of repetitive work on human health is minimising. Reduce the wastage of stirrup and this will reduce the cost of stirrup making activity. There is a scope to design the stirrup with safety standards and with ergonomic considerations which will help to avoid the incidents during manually stirrup making. There is a scope to improve the stirrup making efficiency and production capacity of stirrup by using human powered flywheel motor of stirrup making. The currently available machines are motor power (electrical supply) operation machines and hydraulic type machine which cannot work where non availability of electricity. This research presents a new urge as method to bend the given rod of 6,8 mm diameter with the help of human power as a energy source for performing the job. This area is having a large scope because of construction in MIHAN & CARGO project, at the same time fast development in rural area..

8.REFERENCES

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