HYDRAULIC BAR BENDING

A Report of

Project Work (ME 322)

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1. Details of existing product or idea in market.

Rebar Bending Machine

- Rebar bending machines are used for of bending bars generally.
- These machines are used at large level construction areas where bending operations are frequently used.
- Bar bending machine is consist of electric motor, coupling, circular plate, worm gear drive, extended shaft.
- Electric motor transmits power which is used to bend bar with the help of circular plate.

2. Issue with the existing product.

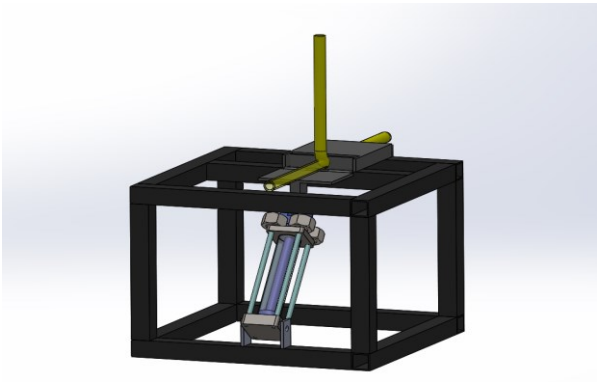
For Rebar bending machine

- The major issue with the already existing machine is so costly.
- Also it is so hard to carry from one place to another due to its large dimension and weight.

3. Brief description about basic dimensions of the product and material.

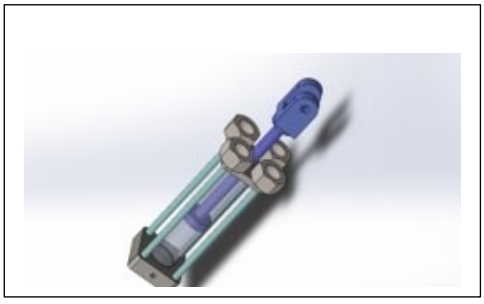
- Most of the rod bending machines are hydraulic based that require a lot of space and difficult to move from one place to other.
- So here we propose a compact and hydraulic based rod bending machine that bends the rods.
- We use hydraulic cylinder actuator attached to a movable bed that is attached to the supporting frame using hinges for vertical movement.

- This bed is used to support the materials to be bent and provide required bend as our requirement for the operation.



Components of Hydraulic Bar Bending Machine:

- Hydraulic Cylinder
- Control Valve
- Hydraulic Pump
- Supporting frame
- Tubes, pipes and hoses



4. Problem formulation(At least three points to be addressed)

The goal is to develop a bending machine which have following properties

- Cheaper compare with the existing bending machine available in the market.
- The machine available in the market have very high cost so it not economical to install for small construction work. Our product should cost efficient for small construction work also.
- It should be semi-automatic.
- Semi-automatic is in the sense that the loading and unloading is manual and the bending is done by the machine. It will enhance the productivity.
- Small in size and weight, so it can be easily transported to construction site as per requirement.
- Easy to operate.
- Simple design make sure that not much technical skill is required to operate.
- We can save the time.

5.Innovative idea to solve the issue

The main objective of this 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 and easy access to all areas.

- As model will be semi-automated. The automation strategy, which will be implemented is believed to result in reduced cycle time, costs and improved product quality.
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- Other advantages: repeatability, increased productivity, reduced labor ,Simple design, Less power, Easy maintenance and repair.

6. Design Calculation

a) Force Analysis to bend the Bar[1]

Parameters: -

- Diameter of bar (d = 8mm)
- Point of application of force (L = 20mm)
- Material: - Mild Steel
- Allowable bending stress σb = 300N/mm2

Using Bending moment and Bending stress relationship

$$\frac{M}{I} = \frac{\sigma b}{y}$$

M = Bending Moment

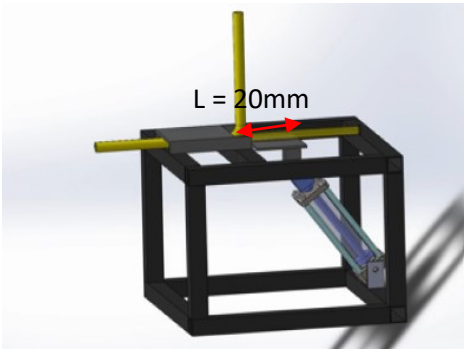
I = Second moment of Area

y = Distance to neutral axis = 4mm

Now bending moment

M = F x L

F = $\frac{I\,\sigma b}{y\,L}$, where I = $\frac{\pi D^4}{64}$



After Substituting I in the Force equation: -

F = $\frac{\pi D^4\,\sigma b}{y \times L \times 64}$

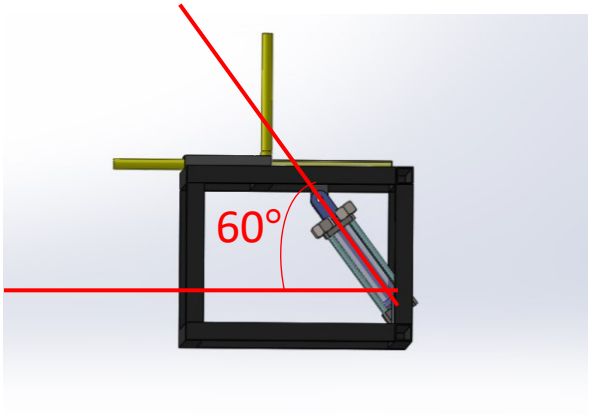
After the substituting the values of variable

F = 754.08 N

This is the force at which bar will just start to bend.

So required force from the hydraulic cylinder is F/sin(60).

Fnet = 754.08/sin(60) = 870.73 N



b) Hydraulic Cylinder Design

- Our aim is to design a suitable cylinder with a diameter of piston and stroke length.

We know pressure is given by ,

P = $\frac{F}{A}$ and $A = \frac{\pi D^2}{4}$ where D = diameter of piston of cylinder.

Assuming constant pressure at 5 bar

P = $\frac{870.73 \times 4}{\pi \times D^2}$

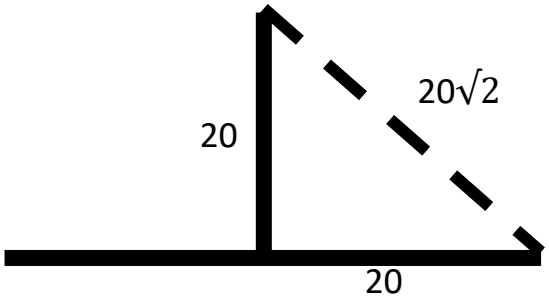
using P = 5 x 105 N/m2

D2 = $\frac{870.73 \times 4}{\pi \times 5 \times 10^5}$

D = 0.04708 m = 47.08 mm

- Selecting standard diameter of 50 mm.

Now calculation of stroke length



stroke length = $20\sqrt{2}$ =28.24 mm

+ clearance (~ 2-5 mm)

stroke length = 30 mm (standard)

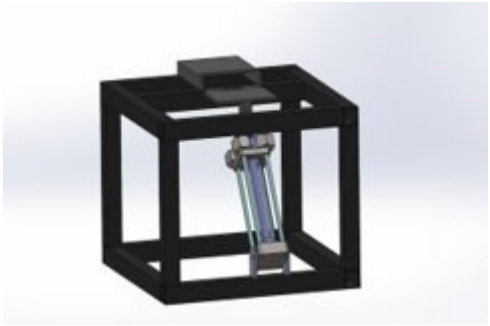
Hydraulic Cylinder has piston diameter of 50mm and stroke length of 30 mm.

8. Cost Analysis

- Hydraulic Cylinder :₹1800
- Control Valve: ₹2000
- Hydraulic Pump : ₹5000
- Supporting frame and Hinges : ₹ 1000
- Tubes, pipes and hoses: ₹ 250

Approximate total: ~ ₹10,000

9. Comparison



Existing Model **Our Model**

Parameter	**Existing Model**	**Our model**
Dimensions	900 mm*800 mm*850 mm	500 mm*300 mm*200 mm
Weight	320 Kg	8 Kg
Cost	~ ₹ 1,20,000	~ ₹ 10,000

References: -

1. Thokale Monoj, Kothwal Rahul, More Soyog and Pawase Mahesh, IRJET volume: 04, Ussue:3 Mar-2017, e-ISSN: 2395-0056