

# PNEUMATIC ROD BENDING MACHINE

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## ABSTRACT

*In today's society, the use of bending machines is on the rise. In the manufacturing industry, bending is used for a variety of purposes, including blanking and pressing. There are numerous options available. Different sorts of bending Pneumatic bending is the most prevalent as well as hydraulic bending However, pneumatic bending is more efficient. Hydraulic bending is preferable. The most significant benefit .Their speed is a feature of pneumatic bending. Bending with a pneumatic cylinder is referred to as pneumatic bending. They are 10 times faster than hydraulic bending and can execute a variety of tasks. Many jobs may be completed faster and more efficiently. Bending with a pneumatic cylinder is referred to as pneumatic bending. They are so adaptable that they can be used in a factory. Any required position, including upside down, is acceptable. The purpose of Design and Fabrication of Pneumatic Components is the focus of our project. Bending capability of and ability to make a 6mm thick bent Rod made of TMT. The primary goal of the goal of this initiative is to the use of a pneumatic rod bending machine in the development sites that are less expensive than the existing ones boosting the productivity of the bending machines stirrups. One of the most significant machines is the bending machine. In a sheet metal shop, a machine tool is used. It's largely about intended for bending the curve was created using the use of a punch that applies a lot of force to the work clamped against the die. The bending machine is made of stainless steel. In such a way that it works on its own.*

**Key Words:** (Size 10 & Bold) Key word1, Key word2, Key word3, etc (Minimum 5 to 8 key words)...

## INTRODUCTION:

Labour activity has played an important part in building for a long time, including combining coarse aggregate sand water, cement, pounding sand, land levelling and digging the foundation for the structure's base, cutting rode, and so on. Because there are so many resources, it is now necessary to cut labour work and time due to technological advancements. When we contemplate human labour in relation to automation, we encounter a number of issues. It is not possible to shorten construction time and build it as soon as possible using standard procedures. As a result, construction system automation is required. Now-a-days Automatic plate bending machines are widely employed in sectors, particularly in the car and other industries. Previously, bending machines were operated by hand. As a result, the machine's production was quite low. The bending operation of the component is now done in a different way. Once the plate has been loaded, the operator should not only use one push button to start the machine, but two, so that both hands are engaged. This arrangement was designed in order to keep operators safe. The major goal of this project is to gain a thorough understanding of pneumatic devices, sensors, and other mechanisms that can be used to transform a manually driven press or other equipment into a semi- or completely automatic unit. The bending machine used in this project is a semi- automatic bending machine, in which the component is loaded and unloaded manually and the rod is bent pneumatically.

### 1.1 OBJECT OF THE PROJECT:

- To build a bending machine capable of bending a metal bars up to 20mm in diameter.
- Design of a pneumatic TMT rod bending machine using analytical methods.
- Pneumatic TMT rod bending machine modelling and simulation.
- Preparation of a pneumatic TMT rod bending machine prototype sample.
- A pneumatic TMT rod bending machine was used in an experiment.

- Study of the pneumatic TMT rod bending machine's comparative results.

## 2. AIM OF PROJECT:

The user's manual efforts will be reduced by using a pneumatic TMT rod bending machine. The customer will benefit from the usage of a pneumatic TMT rod bending machine to control and generate; At the time of bending, precise data for TMT rod were obtained. When compared to completing it manually, it will save time.

- **Components:**
- Pneumatic Cylinder
- Solenoid Valve
- Air Com pressure
- Air Pipe
- Rods
- Pressure Gauge
- TMT R OD

### PNEUMATIC CYLINDER:

Pneumatic cylinders (also known as air cylinders) are mechanical devices that produce a force in a reciprocating linear motion using the power of compressed gas. Something compels a piston to move in the desired direction, similar to hydraulic cylinders. The piston is a disc or cylinder, and the piston rod transmits the force developed by the piston to the object that has to be pushed.



**Fig-1**

Pneumatics are sometimes preferred by engineers because they are quieter, cleaner, and do not require a great quantity of fluid storage space. Because the operating fluid in a pneumatic cylinder is a gas, leakage from the cylinder will not drip out and contaminate the environment, making pneumatics more desirable where contamination is a concern.

### SOLENOID VALVE:

A solenoid valve is a valve that is controlled by electricity. An electric current is used to control the valve through a solenoid. The flow is switched on or off in a two-port valve, and the outflow is switched between the two outlet ports in a three-port valve. On a manifold, multiple solenoid valves can be grouped together. In fluidics, solenoid

valves are the most commonly utilised control elements. Their res possibilities include turning off, releasing, dosing, distributing, and mixing fluids. They can be found in a wide range of applications. Solenoids provide quick and safe switching, as well as high reliability, long service life, good medium compatibility of the materials utilised, minimal control power, and a compact design.



**Fig-2**

### **AIR COMPRESSOR:**

An air compressor is a machine that transfers power (from an electric motor, a diesel or gasoline engine, or other sources) into potential energy stored in pressured air (i.e., compressed air). An air compressor increases the pressure of a storage tank by forcing more and more air into it using one of several methods. The air compressor turns off when the tank pressure reaches its maximum level. The compressed air is then stored in the tank until it is needed. An air compressor is a device that transfers power (from an electric motor, a diesel or gasoline engine, or other sources) into potential energy stored in pressured air (i.e., compressed air)



**Fig-3**

The compressed air's energy can be used for a variety of purposes, harnessing the kinetic energy of the air as it is. The tank depressurizes when the pressure is discharged. When the tank pressure drops below a certain level, the air compressor kicks in and re-pressurizes the tank. Electric and gas/diesel compressors are the most prevalent types of air compressors. A compressor's power is measured in HP (horsepower) and CFM (cubic feet per minute) (cubic feet of air per minute). The tank's gallon capacity indicates how much compressed air is available in reserve.

### **AIR PIPE:**

A pipe is a tubular section or hollow cylinder with a circular cross section that is primarily used to transport substances such as liquids and gases (fluids), slurries, powders, and masses of tiny solids. Hollow pipe is significantly stiffer per unit weight than solid components; therefore it can be employed for structural applications as well AS

**Fig-4****TMT ROD:**

Thermo-mechanical processing (TMT) is a metallurgical process that combines forging, rolling, and/or work hardening with heat treatment into a single step.

**Fig-5****PRESSURE GAUGE:**

In compressed-air systems, pressure regulators, also known as pressure-reducing valves, maintain a constant output pressure regardless of variations in input pressure or output flow. Regulators are a type of valve that has loading, sensing, actuating, and control components all in one package. They are categorised as general purpose, special purpose, or precision and come in a variety of combinations.

**Fig-6****P NEUMATIV FITTING:**

Fittings are the vital link between the many components of a pneumatic system. Pneumadynes' large selection of micro pneumatic fittings meets a wide range of connection and tube required.



**Fig-7**

### **CYLINDER:**

Linear actuators, such as cylinders, convert fluid power into mechanical power. JACKS or RAMS are other names for them. Hydraulic cylinders are used to generate huge forces and precise movement at high pressures. As a result, they are made of strong materials like steel and are built to endure large forces. Because gas is a non-expansive chemical, using pneumatic cylinder at high pressures is risky hence they are limited to roughly 10 Bar. As a result, they are made of lighter materials like aluminium and brass. The velocity of a pneumatic cylinder is difficult to control precisely because gas is a compressible substance. Aside from that, the underlying philosophy for hydraulic and pneumatic cylinders is the same.

### **BATTERY:**

This project presents the design and construction of a battery charger. A battery charger is an electrical/electronic device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The system consists of a step down transformer, an AC to DC converter and a DC voltage regulator. The circuits are designed using copper wire, rectifier diodes, and electrolytic capacitors, resistors with other passive and active component of electronics. A battery charger is an indispensable device for battery users because battery is an essential element that powers any electronic products like UPS inverters system, photographic equipments, hand-held lamps (flashlight or torch), computer- memory standby, toys, novelties and automobiles, etc. These products will become useless if there is no charger to refill their battery when it runs down. In this project, a sophisticated class of battery charger is designed not just to refill rechargeable batteries but to conserve the battery life because wrong handling and charging of a battery can permanently damage the battery even if is brand new. With this



**Fig-8**

### **WORKING PRINCIPLE:**

The bending machine is powered by a single-acting pneumatic cylinder. The piston was detached from the bending tool that was moving. It's utilised to bend the TMT Rod's small size. The machine is small and portable, making it easy to travel. The force medium for this process was compressed air from the compressor. There are pneumatic systems. The timer unit is utilised in conjunction with single acting cylinders solenoid valves, flow control valves, and single acting cylinders solenoid valves. The compressor's arm is inserted into the flow control valve. The solenoid valve receives the controlled air from the flow control valve. All of the air in the precise time interval is controlled via solenoid valves. The solenoid valve 3/2 is employed. Air enters the cylinder and pushes the piston in

one position as a result of which the bending stroke is obtained. In the next position, air enters the cylinder from the opposite side and pushes the piston back, resulting in the releasing stroke. The timer control unit circuit controls the speed of the bending and releasing strokes.

#### **COST ANALYSIS:**

S.NO.	COMPONENT NAME	QUANTIT Y	PRICE
1	PNEUMATIC CYLINDER	1	1200
2	AIR PIPE	2	60
3	PNEUMATIC FITTING	4	200
4	SOLENOID VALVE	1	700
5	PRESSURE GUAGE	1	200
6	TMT ROD	3	40
7	AIR COMPRESSOR	1	1400
8	BATTERY	1	900
9	IRON	10KG	720
		TOTAL COST=	5420

#### **STRUCTURE ANALYSIS:**

Width-36cm

Length-61.5cm

Height-23cm

#### **IRON SHEET MEASSUREMENT:**

Width-33cm

Length-51.5cm

Thickness-0.01cm

#### **PNEUMATIC SHEET ATTACHES:**

Width-2.5cm

Length-9cm

Thickness-0.05cm

**ROD SUPPORTER:**

Stick-8

Length-6cm

**DESIGN CALCULATION:**

Battery V=12 Volt

Current I=7.5 Amp.

Pneumatic Air Cylinder Pressure= 10 Bar

**FORCE:**

The Fluid Pushes Against. The Face Of The Piston And Produce A Force.

$$F = P/A \quad N/Mt^2$$

Compressor Maximum Pressure= 150 PSI

$$P = 150 \times 0.0689$$

$$P = 10.33 \text{ BAR}$$

d=diameter of air cylinder= 32mm

$$\text{Area of cylinder } a = \pi/4 \times d^2 = 8.04 \text{ mt}^2$$

Maximum operating pressure  $P_w = (5-8) \text{ bar}$

Pneumatic applied force on rod  $f = P_w \times A$

$$F = 5 \times 10^5 \times 8.04 \times 10^{-4}$$

$$F = 402.1 \text{ N}$$

**APPLIED FORCE ON ROD**

$$F = 402 \text{ N}$$

This applied force will work on rod. Then rod will bend.

$F_B = \text{BENDING FORCE} = F$

$M = \text{BENDING MOMENT}$

$M = \text{BENDING FORCE} \times \text{BENDING LENGTH}$

$$M = 402 \times 0.08$$

$$M = 32.16 \text{ NM}$$

**ADVANTAGE:**

- High levels of dependability and durability
- The design is straightforward.
- High resiliency in the face of adversity
- Pneumatic systems are less dangerous than electric systems.
- Friendly to the environment
- Low-cost and economical
- Fewer resources
- In the technical field, pneumatic is more efficient.
- It is possible to respond quickly.
- Construction is straightforward.
- Simple to maintain and repair
- The cost of the device is quite low.
- Over loading does not pose a fire threat.
- Without halting, continuous functioning is possible.
- Reduction in the number of people employed.
- Increased output
- Enhanced security
- Machine movement and handling are simple.
- All areas are easily accessible.
  
- **DISADVANTAGE:**
- While compressing the air, silence is required.
- It is impossible to obtain high torque.
- The load-carrying capacity is limited.

Pneumatic TMT Rod Bending Machine Applications:

Bending of an angle

- Bending metal
- In the construction industry
- In the works
- This equipment is ideal for small-scale businesses.
- Each and every industrial application

**CONCLUSION OF PROJECT REPORT:**



We may deduce from this project that a pneumatic bending machine is far less expensive than a hydraulic bending machine. By organising the high-pressure compressor, we may increase the bending thickness. This equipment can also be used in the event of a power outage. Compressed air is used in this sort of bending machine. As a result, if an electrical problem arises, we can switch to the IC- Engine fitted compressor. This type of bending equipment is really useful. Small-scale bending enterprises can benefit from this because they can't afford the more expensive hydraulic bending machines. Machine for bending. This mechanism converts a manually operated press into an automatic unit. As a result, we can save the most amount of time possible while increasing output as compared to manual. Humans are only required to load and unload the TMT in this project

#### **FUTURE SCOPE:**

Making rod bends is a time-consuming process that necessitates continual hand labour. This will reduce the operator's physical exertion by minimising human efforts. Repetitive work has a detrimental effect on human health. Reduce the amount of stirrup that is wasted, and the cost of stirrup production will be reduced. There is potential to build the stirrup with safety standards and ergonomic considerations in mind, reducing the number of events that occur when manually stirrup making. There is room for improvement. By using a human-powered flywheel motor to make stirrups, the efficiency and production capacity of stirrups can be increased. The machines that are currently available include motor power (electrical supply) operating machines and hydraulic type machines, both of which are incompatible with non-availability.. in terms of electricity This study proposes a new method for bending a rod with a diameter of 10, 12 mm using human force as an energy source. Man has been striving for more and more luxury since the dawn of time. Man is constantly attempting to build more and more modified techniques while keeping an eye on aesthetics and cost considerations. As a result, there is always more room for improvement. However, due to time constraints and a lack of funding, we were only able to consider and include the following prospective revisions in the report. 1. By replacing the pneumatic circuit with a rack and pinion arrangement and a square threaded screw and entrancement, it may be made rack and pinion or spring and lever driven. 2. In areas where electricity is scarce, the electric motor-driven compressor is replaced by a compressor powered by an internal combustion engine. 3. Compressed air is used in this machine. is used to move the cutting tool throughout the cutting process. The air exits the Solenoid valve through the out port after the cycle is completed. This air is allowed to escape into the atmosphere. In the future, a system could be created to repurpose e this air for cylinder operation. As a result, there are a plethora of changes that we can undertake in the future to ensure our survival in the vast global realm of competition.

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