

Metal Pipe Bending Machine by Using Toggle Jack

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ABSTRACT

Bending machine is used to bend metal sheets, plate and pipes. Our aim of this project is portable bending machine. This machine is used to bend sheet into curve and the other curvature shapes. The size of the machine is very small as compare to other machines. And it is convenient for portable work. Bending machine is the common machine in the machine shop our main consultant on fabrication of this metal bending is to reduce human effort and for any bending operation less skilled operator required for this machine. The bending machine is manually operated therefore. Our objective is to increase accuracy at low price without affecting the pipe bending productivity.

Keywords: *Pipes, Plates, Bending, rolling, shaping*

INTRODUCTION:

Due to increase in the globalization, it is very much essential for the manufacturer to produce goods having highest reliability. Metal bending and rolling is generally used in fabrication as an and alternative method for casting or forging operations since it is related to human being hence it is necessary to design the joint with prior attention to safety of the user. Generally bending is the process that produces U-shape, V-shape, or channel shapes in ductile materials.as we have studied that bending is also called as flexure which characterizes the behaviour of the structural element which is subjected when subjected to external load applied perpendicularly to longitudinal axis of the element beam is an element whose length thickness and width is smaller than the length. A shell is a geometric structure in which width and length are of same magnitude and the thickness of this geometric structures smaller. There are two different machines available in market for bending of sheet and bending of pipe. There is no single machine available which bends sheet as well as pipe in a single unit. Roller bending process can be used to deform a sheet or plate. Cylindrical shells are the basic components used for the various engineering applications like boiler chambers, cylindrical tanks, heat exchanger shells, pressure vessels, etc. The process can be performed using many materials such as carbon and alloy steels, aluminium alloys and titanium alloys. Rolling machines with both three rollers are used to produce of cylinders with various curvatures. The rolling process is generally performed by a three roll. The bending machine is very useful in manufacturing floor, it's not production machine it's a tool work machine.

A bending is a process of bending a metal. The metal can be a sheet metal, tubes, square hollow, rod, and iron angle. This type of metal has its own thickness. In bending machine designing several considerations is taken into including type of metal, type of the roller bender, power driven or manual and the size of the bending machine. Usually, the difference of these types of bending machine is only on the capacity of the bending machine that can bend a sheet metal or tubes. Today, the bending machine that available in the market is for the sheet metal and tube bending machine. Many machine makers vary their product based on the capacity of the bending machine and power driven or manual. Moreover, most of the machine uses roll bending type. This type of machine has 3 rolls which is 1 roll is fixed and the other 2 are adjustable. The sheet metal need to put in the roller and then rolls around it until the desire shape is acquired. The product that can be produced with this machine are coil, truncated cone, etc.

As we know bent pipes have numerous applications in industry. They are mainly used for transportation of fluids. In some cases it is also used for supporting purpose (frame). Previously bending operation was done manually which requires lots of human efforts and accuracy was very low. The other drawbacks of manual bending machine include injuries to workers, low productivity, more time consumption etc. The main purpose of this invention is to cover the drawbacks of manual bending machine. In some applications very high accuracy in bending angle is needed. This is not possible with the help of manual machine. The machine works with the help of stepper motor. The main components of machine are stepper motor, reduction

gearbox, PLC (programmable logic controller) and fixture. Stepper 3 PH induction motor provides input energy for operation. Reduction gearbox is useful for the reduction of motor speed up to required speed. PLC ensures the cycle time of operation and also governs human machine interaction. Fixture plays important role in bending operation. It provides path for bending pipe and also acts as a support structure for pipe.

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Pipe Bending Machine:

A roll bending machine uses roller to bend a metal. The roller of bending machine can be two rollers, three rollers, or four rollers. The common product of roll bending machine are tube bending, plate bending and a coil. All modern roll bending machine is power driven and some of the bending machine equip with electronic control for more. During the roll bending process the pipe extrusion, or solid is passed through a series of roller(typically 3) that apply pressure to the pipe gradually changing the bend radius in the pipe. The pyramided style roll benders have one moving roll, usually the top roll. Double pinch type roll benders have to adjustable rolls, usually the bottom rolls, and a fixed top roll this method of bending causes very little deformation in the cross section of the pipe. This process is suited to producing pipe which is in require shape as well as long gentle bends like those used in making structure of pipe.

Reason to Design a Pipe Bending:

Machine The reason to design a bending machine for pipe bending is because there is no proper bending machine to bend a metal pipe for small scale. The bending machines found in the market come from variety of types. There are bending machine such as press brake bending machine, roll bending machine and a folding machine. Moreover, the design for the bending machine for pipe bending is to bend a metal pipe. It produces sheet metal bending with desire degree of bending except 90°. Other reason regarding to the bending machine design, the bending machine in the market come with big size and the bending machine is expensive. The existing bending machine in the market is created for huge capacity for bending a metal pipe. With the capacity of bending machine that exists in the market, the existing bending machine is not fulfilling the requirement of the usage. The requirement of operation of bending machine is simple. Thus it is not suitable to purchase existing bending machine to be used for simple bending machine operation. Moreover, the machine is heavy and use up a lot of space. In addition, the problem will arise when to move and put the bending machine due to heavy and space.

Need For Pipe Bending Machine:

As we know that pipe bends are used in various household things therefore it is necessary to build an economical pipe bending machine. It is used in designing of various machine components, without this bending device a machine can't work properly. As far as industrial application is concerned it is used for piping purpose. The reason to design a bending machine is because there is no proper bending machine to bend a solid or hollow pipe for small scale. There are bending machine such as press brake bending machine. Roll bending machine and a folding machine.

Bending machine often called as pyramid type, because of these types of arrangement of the three rollers. The process mainly consist 3 steps:

- 1) Positioning of the sheet or pipe.
- 2) Lowering of central roller.
- 3) Repeating feed of sheet or pipe.

In first step, a flat blank sheet, fed into the machine by two rotating side rollers until the sheet is properly positioned. In the 2nd step, centre roller displaced downward causes bending of the sheet, in the final step, two side roller rotate again, so that the sheet is bending continuously. The rolling process always starts with the crucial operation of pre-bending both ends of the sheet. The success of 3 roller bending process is depends on the experience and skill of the operator.



Fig Bending Machine

BASIC WORKING PRINCIPLES:

When any metal is made to roll under symmetric roller having equal or different diameter with the gradual pressure on it by means of any external element and feed is given to metal the metal will bend into a curvature shape this is due to the stress generated in metal is goes beyond the yield stress.

The upper roller of the coiling machine acts on the piston in the symmetrical position of the two lower rollers by the hydraulic oil in the hydraulic cylinder to perform vertical lifting movement. The gears of the lower gears driven by the final gear of the main reducer engage the cooperative rotary motion of the two lower roller gears to provide torque for rolling the plate. The flat metal plate of the coiling machine passes through the three work rolls (two lower rolls and one upper roll) of the coiling machine, and the metal plate passes through multiple passes by means of the lower roll of the upper roll and the rotation of the lower roll. Continuous bending, producing permanent plastic deformation, rolling into the desired cylinder, cone or part thereof. The disadvantage of the hydraulic three-roller coiler is that the end of the sheet needs to be pre-bent by means of other equipment. The coiling machine is suitable for large coiling machines with a coil thickness of more than 50mm. A fixed row of idler rollers is added at the lower part of the two lower rollers to shorten the span of the two rollers, thereby improving the accuracy of the rolled workpiece and the overall performance of the machine.

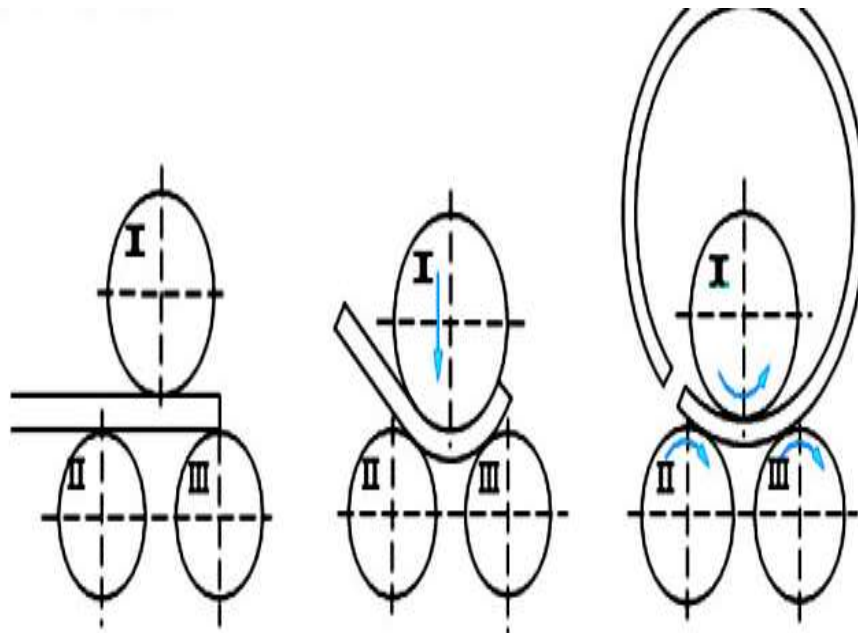


Fig. Basic Working Principle

The pipe bender is mainly composed of mechanical devices, hydraulic systems, etc. The mechanical device mainly consists of a clamping device, a trolley propulsion device, a guide wheel device and a rocker arm rotation device.

Its working principle is to advance the roller pipe machine at a constant speed, and make the steel pipe machine walk along a preset track to form a bend with a fixed radius of curvature and angle. First install the steel pipe in place, and adjust the bending radius through the lead screw nut transmission device on the rocker arm slewing device to obtain the required elbow pipe fittings. Features: The bent tube has small deformation, small wall thickness difference and no stress. The bending radius can be adjusted from 0 to 1800.

Crafting process of roller bending machine

The research work of this subject is mainly to analyse and mathematically model the control system of the pipe bender according to the process flow of the pipe bender, determine the control algorithm suitable for the system, and complete the combination of theory and practice.

Due to the different materials of the pipes, the large differences in pipe diameter, wall thickness, bending angle, etc., the relationship between the heating temperature of the intermediate frequency power supply and the advancing speed of the elbow is different, and the setting of various process parameters is also more complicated. Whether the parameter setting is appropriate or not will greatly affect the various mechanical properties of the elbow, so it should be based on the working conditions

The different parameters are selected to control the quality of the pipe bender. Secondly, on the basis of a good understanding of the pipe bending machine system and pipe bending process, according to the actual situation, complete the selection of hardware equipment.

OUTCOMES:

- Can be made portable.
- Simple in construction.
- Easily operated.
- Better productivity.
- Enhancing the availability of the machinery and making it cheap.

PROJECT PROBLEM:

By reviewing all the above paper brings further experimental study on 3-roller bar bending machine. This study shows the bending of bar into required radius of curvature having greater thickness with shorter width. Bending of this thick sheet executes higher load on centre roller of machine. As the thickness of the sheet increases the load acting on the top roller also increases, thus for rolling of thick material brings changes in design parameter (mainly on sheet thickness t). Hence, this problem can be related to bending of rectangular bar at the mid span and bending moment equation. Consider a bar having a depth & width of 207 respectively is to be bend in a circular curve by radius R .

- The main reason to choose this project is to simplify the operation of bending.
- The main problem is that machines already available are most costly.
- Our focus is just to make the machine cost efficient.

OBJECTIVES OF THE PROJECT:

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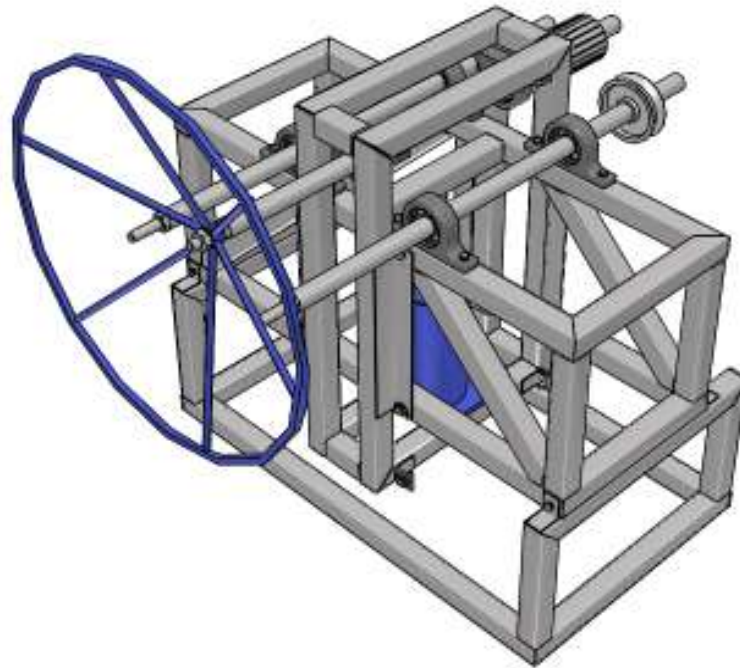


Fig. Layout of the Project Concept

LITERATURE SURVEY:

A Bending machine is widely use in automation industry. Unfortunately, there is no proper bending machine to bend a metal of less thickness. Moreover, the existing bending machine is big in size, consume a lot of space and it is use for big scale production. In this project, the literature review will discuss in detail in designing a bending machine, component features considered in designing a bending machine, etc. bending is a process by which a metal can be bend by plastically deforming the material and its shape. Material supposed to be stressed beyond the yield strength but below the ultimate tensile strength. Roll forming, [also known as roll bending], is a process for forming plates, sheets, bars, beams, angles or pipes into various shapes by passing the work piece between the properly spaced rolls. Sheet and plate are the mill products often formed by the three roll bending machine. The elastic part of the deformation is recovered up on removal of the load. This phenomenon is known as "spring back" or elastic recovery. Metal forming processes are classified into two categories: hot working and cold working process. Metal bending is a cold working process. Cold working process is the plastic deformation of metals below the recrystallization temperature. This process is mostly done in room temperature. Bending machines can be classified based on the number and arrangement of the rollers, also on the method of pinching the work piece.

Types of three roll bending machines are:

1. Single (initial) pinch 3-roll bending machine.
2. Double pinch 3-roll bending machine.
3. 4 roll bending machines.

- 4. 6 Roller Bending machine.
- 5. Multi Roller Bending machine.

Implementation of System by Us: (System Implementation)



Fig. Assembly of C-Channels and Toggle jack



Fig. Channel



Fig. Pedestal Bearings



Fig. Assembly of Bending Machine

ADVANTAGES OF THE SYSTEM:

1. Operation of this machine is very simple.
2. Unit is compact so less space is required.
3. The diameter can be easily operate this machine.
4. The total cost of the machine is less.
5. Maintenance of this machine is very easy.
6. Easy to handle.
7. Time consumption is less.
8. Less effort & productive.
9. Skilled workers are not required.
10. Convenient for mass production.
11. Less in weight.

LIMITATIONS OF THE SYSTEM:

1. Time consuming process.
2. Required neat use of Toggle jack.
3. The length of the metal to be bend must be more than the distance between lower rollers.
4. Operation of the jack lock become boring.

APPLICATIONS:

1. Outer cylindrical casing for motors employed in submersible pumps.
2. Air conditioning ducts.
3. Dairy equipment.

4. It is also used to make cylinders of different diameters.
5. It is also used in bicycles.
6. Round handles.
7. Used in automobile industries.

FUTURE SCOPE:

The scopes of the study are encompasses investigation of the difficulties in portable metal pipe bending machine. The investigation is starting with stating with the problem statements. The idea of designing a bending machine can be seen clearly through the problem statements, which is a solution of designing a bending machine can be generated to encounter those problems. From this investigation, a literature review can be conducted. In the literature review, it will discuss about the reason to design a bending machine for pipe bending, the comparison of existing bending machine, classification of bending machine, working principle of bending machine, etc.

CONCLUSIONS:

Design analysis of three roll type bending machine has been made considerint4 a steel plate of Design width 80mm and thickness 1 mm. and square pipe having 20turn sides for hollow and solid metal. Layout of the machine and the configuration is decided based on this analysis. Forces on various parts/components are estimated. Using the standard design procedure, various components of the machine is designed and the design details are shown in respective sections/chapters. Thus we have manufactured a bending machine.

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