

Hydraulic Pipe Bending Machine

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Abstract: The hydraulic bending press is one of the most flexible machines on the market, allowing the fabricator or iron worker to shear, punch, bend, scroll, and press thousands of different parts. When considering industrial machinery, the hydraulic bending press is the perfect machine shop tool for the metal fabricator. The hydraulic pipe bending press fits any small to medium-sized industry when machinery for large-scale production must necessarily make way for machinery with distinctly lower production costs. The movement of lever is supplying pressurized oil to the hydraulic cylinder. The hydraulic cylinder consists of piston and piston rod. The ram is fixed at the end of the hydraulic cylinder. The pressurized oil pushes the hydraulic cylinder piston upward due to oil pressure. Already the pipe is fixed at the die holder. The ram is striking the pipe forcefully, due to the movement of the hydraulic piston. The valve is activated.

Keywords: Hydraulic Jack, Metallic Frame, Pressure Die, Pipe Bending and Roller Die

I. INTRODUCTION

Metal fabrication is the creation of metal structures by cutting, bending and assembling processes. It is a value-added process involving the creation of machines, parts, and structures from various raw materials. Pipe bending is any metal forming processes used to permanently form pipes or tubing. Tube bending may be form-bound or use freeform-bending procedures, and it may use heat supported or cold forming procedures. Bending is done by hydraulic pressing, hammering or via press brakes, tube benders and similar tools. Modern metal fabricators use press brakes to coin or air-bend metal sheet into form. CNC-controlled back gauges use hard stops to position cut parts to place bend lines in specific positions.

At present the development of science and technology are quick, in industrial machinery bender type also have a variety of bending machine into the remedial alternative industrial processing equipment, and bending performance of the pipe with the needs of industry will continue to improve. Pipe bender electric and manual form, CNC bending machine, hydraulic bending machine, on the market mainly by CNC bending machine led, but different bending machine can meet the market demand and different manufacturing process. The advantages of reasonable structure, the operation is convenient, affordable, and easy to installation and disassembles, but also can used for other operations, and many other advantages, is widely in the domestic application of hydraulic pipe bending machine. Automatic pipe bending machine is generally composed of the motor, the whole frame, the gear, reducer, electrical control equipment, and so on. The main realization is the steel pipe bending, shaping and other functions. Bending is the uniform straining of material, usually flat sheet or strip metal, around a straight axis which lies in the neutral plane and normal to the lengthwise direction of the sheet or strip metal flow takes place within the plastic range of the metal, so that the bend retains a permanent set after removal of the applied stress. The inner surface of a bend is in compression; the outer surface is in tension. A pure bending action does not reproduce the exact shape of the punch and die in the metal; such are production is one of forming. The neutral axis is the plane area in bent metal where all strains are zero.

II. LITERATURE SURVEY

V. Senthil Raja et al. [1], designed and fabricated a mobile hydraulic pipe bending machine. They proposed that the hydraulic bender has higher productivity. Sometimes heat treatment is used during bending the pipe but the technique is unsafe because it causes many problems in the produced pipes namely wrinkles, curve formation, reduced thickness, hole forming, reduction in strength, makes it break easily. The hydraulic pipe bending machine based on press bending has superior characteristics as compared to one based on heat treatment methods. This type of bender is suitable for application in both industrial and domestic purposes.

Olafimihan.E. O [2], developed a bending machine based on hydraulic operation. He found the range of the levels up to which pipes were found to be oval to be in between 3% to 5%. The process of bending is economic when used for low & medium quantities due to less amount of tooling required. Portable bending

machines make it convenient to perform multiple works on work pieces in the constructional areas. The workforce involved in this field is not equipped with proper machine so as to provide uniformity in work piece instead they are using the tools which are harming as they are not able to provide the proper stress on the work piece.

Ankit Vyas et al. [3], designed and fabricated a hydraulic pipe bending machine. They proposed in order to achieve high quality bends pipe can be heated, sand packed and also use of pipes of larger thickness can be important factors. More accurate and acceptable bends are obtained using the proposed machines as compared to bending operation performed manually. Considering higher factor of safety and provision for automation makes the design highly safe.

Vikash Patial et al. [4], designed and manufactured a pneumatic pipe bending machine. They proposed that the bend angle is dependent upon the displacement which the die horn travels. With increase in the angle of bending increase in spring back angle is also observed irrespective of what the material of pipe is. The same kind of change is observed for spring back angle in relation to brittleness of material.

S. A. Krishna Mohan [5], designed and fabricated a hydraulic pipe bending machine which is portable and compact. As proposed by him in such benders the pipe is placed between the rollers. Force is applied using hydraulic jack and the pipe is bent to the required value of angle depending upon the die used. Such is economic, portable and has higher flexibility. Hence, it is a better alternative in comparison to bending machines which are manual.

Girish Gharat et al. [6], designed and fabricated a pneumatic punching and bending machine. They developed automated pneumatic press by using a simple C-frame press due to its lesser space requirement & ease of operation. The machine finds its usefulness in washer production industry for producing washers having thickness less than 1mm.

III. OBJECTIVES AND METHODOLOGY

3.1 Objectives

The main objectives of this proposed work are as follows:

- This concept saves time & energy which leads to effective working of model.
- This process bends the tube without any buckling (collapsing underpressure), and with as little crimping and flattening as possible.
- This design of hydraulically operated pipe bending machine is fully portable type as it weighs less.
- The operating procedure of this system is very simple, so any person can operate.

3.2 Methodology

- Topic of hydraulic pipe bending machine.
- We started the work of our project with literature survey.
- We went through many research papers. We sorted out some papers that were relevant to our topic.
- We got different ideas from different research papers. Thus we decided rough idea of how we are going to make our project.
- With the help of information collected selection of material and construction process is done.
- Once the fabrication of the project is done testing takes place at desired conditions and the obtained result is recorded.
- Here we are constructing the prototype of the expected fabrication model.

IV. WORKING PRINCIPLE

As a process, tube bending starts with loading a tube into a pipe bender and clamping it into place between two support dies. The dies size is selected according to the size of the pipe/tube diameter. Similarly, the spacing between the support dies are selected as per the required curvature of the pipe/tube after bending. Pascal's Law states that pressure acting on a confined fluid is transmitted equally and undiminished in all directions. The principle is that the pressure in any portion of a hydraulic system is equal throughout that system. This statement is valid with the omission of the force of gravity, which would have to be added, according to the fluid level. A hydraulic jack is used to lift heavy loads by applying a force via a hydraulic cylinder as shown in Fig.1. The pressure dies work as tooling component as shown in Fig. 2. The shape of dies especially the radius of curvature is selected considering outer diameter of the work piece as shown in Fig. 3. The frame structure of a project as shown in Fig. 4. The completed fabricated model of the project work as shown in Fig. 5. The main components used in this project are listed below

- Hydraulic jack.
- Pressures die.
- Roller dies.
- Holding plates.
- Machine model frame.
- Bolts and nuts.

V. FIGURES



Fig. 1 Hydraulic Jack



Fig. 2 Pressure Die



Fig. 3 Roller Die



Fig. 4 Frame Structure



Fig.5 Completed Project Model

VI. CONCLUSION AND FUTURE SCOPE OF WORK

6.1 Conclusion

Hydraulic Pipe bending machines can be used for bending pipes without creating a thrust. These machines would be very effective. Among many industries (especially small-scale industries or places where bending is done rarely) such as plumbing, mechanical, and architecture, pipe bending machines remain a piece of consistent machinery for the curving of the pipes as per the use. The dies with various tube diameters can be used in the same machine by providing minor modifications and higher bend angle can also be achieved. The fabricated machine can be used for a wide range of bend angle; bend radius and can perform bending operation on the range of tubes thickness, which is key advantage in comparison to other machines options present in the market in the same price range. The fabricated bending machine has several advantages like low cost, less space requirement, portability and accuracy over the manual counterparts.

6.2 Future Scope of Work

After conducting the operations using this project, following things can be upgraded in the future.

- The bending capacity of the Machine can be upgraded by using high strength capacity Hydraulic Jack and more efficient metal frame.
- Modifying the machine from only bending pipes and tubes to other kinds of rods with various curvatures by increasing the options of changeability of roller guides and pressure dies.
- Semi automation or automation of the hydraulic bending machine by adding various accessories and components.

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