

Hydraulic Jack Cum Pipe Bending Machine

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Abstract – Final year project based on dual purpose utilization.

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I. INTRODUCTION

The project is to design and construct a hydraulic jack cum bending machine. This machine can be used to bend steel pipe into curve or other curvature shape. The size of machine is convenient for portable work. It is fully made with steel, moreover it is easy to be carried and used at any time for dual purpose.

In various fabrication works as well as in architectural work pipes are used in artistic ways. Also in automotive sector useful for lifting vehicle up to two tonnes. Using machine for two different purposes is developed under single frame.

II. WHAT IS HYDRAULIC JACK

A jack is a device that uses force to lift heavy loads. The primary mechanism with which force is applied varies, depending on the specific type of jack, but is typically a screw thread or a hydraulic cylinder. Jacks can be categorized based on the type of force they employ: mechanical or hydraulic. Mechanical jacks, such as car jacks and house jacks, lift heavy equipment and are rated based on lifting capacity (for example, the number of tons they can lift). Hydraulic jack tend to be stronger and can lift heavier loads higher, and include bottle jacks and floor jacks. HYDRAULIC JACKS depend on force generated by pressure. Essentially, if two cylinders (a large and a small one) are connected and force is applied to one cylinder, equal pressure is generated in both cylinders. However, because one cylinder has a larger area, the force the larger cylinder produces will be higher, although the pressure in the two cylinders will remain the same. Hydraulic jacks depend on this basic principle to lift heavy loads: they use pump plungers to move oil through two cylinders. The plunger is first drawn back, which opens the suction valve ball within and draws oil into the pump chamber. As the plunger is pushed forward, the oil moves through an external discharge check valve into the cylinder chamber, and the suction valve closes, which results in pressure building within the cylinder.

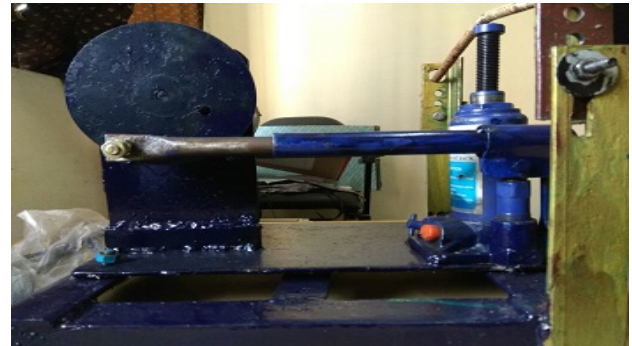
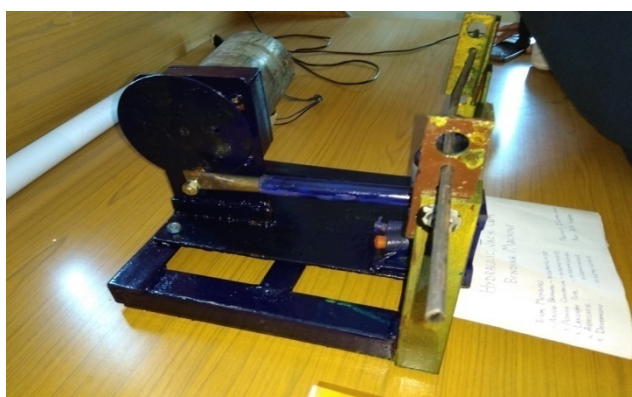


Fig. 2.1 Machine Layout



III. WHAT IS BENDING?



- Bending implies the deformation of a work piece produced by loads perpendicular to its axis as well as force couple acting in a plane passing through the axis of the bar. —Bending is only occurred when load is acting perpendicular to the neutral axes of pipe.

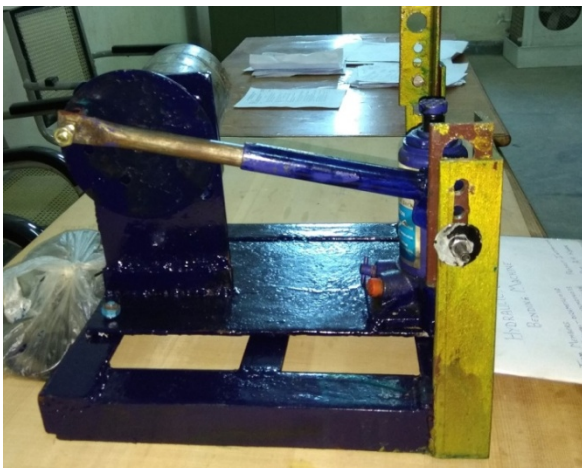
- ▣ Classification of Pipe Bending
- ▣ • Press Bending
- ▣ • Rotary Draw Bending
- ▣ • Mandrel bending
- ▣ • 3 Roll Bending
- ▣ • Bending springs
- ▣ • Heat induction bending
- ▣ • Sand packing/hot-slab bending

IV. SPECIFICATIONS OF HYDRAULIC JACK

- Rated capacity in tone • Jack dimensions • Lifting range in - cm
- Oil capacity in - cc • Net weight in – kg.

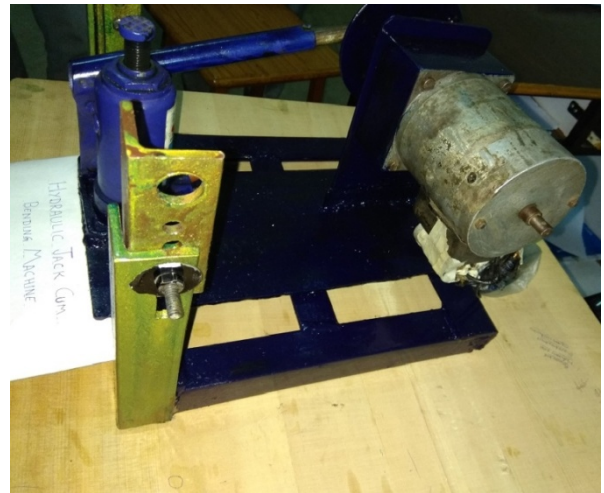
▣ CLASIFICATION OF HYDRAULIC JACK:

- ▣ • According to the source of power
- ▣ • Manually operated jacks (hand or pedal operated)
- ▣ • Power operated jacks (pump is used)
- ▣ • According to the lift of ram • High lift
- ▣ • Medium lift • Low lift
- ▣ • According to the arrangement of cylinder
- ▣ • Vertical • Horizontal
- ▣ • Inclined
- ▣ • According to the number of cylinders
- ▣ • Single cylinder
- ▣ • Multi cylinder
- ▣ • According to the construction
- ▣ • Floor mounted jack • Bottle jack
- ▣ • Trolley jack



V. DESIGN OF HYDRAULIC JACK DESIGN CONSIDERATIONS& METHODOLOGY:

- Load (W) = 2.5 ton(25kN)
- OPERATING PRESSURE (p) = 25 M Pa
- Lift range (L) = 20 cm
- Permissible tensile stress of mild steel (σ_t) = 120 N/mm²
- No. of strokes for lifting load (n) = 150
- Factor of safety = 5
- Permissible shear stress of mild steel (τ) = 20 N/mm²
- Permissible compressive stress of mild steel (σ_c) = 20 N/mm²
- Permissible compressive stress of cast iron (σ_{CI}) = 120 N/mm²
- Permissible shear stress of cast iron (τ_{CI}) = 35 N/mm²



COMMON PROBLEMS WITH THESE SYSTEMS

- Tremendous amount of human effort is necessary.
- Labour cost is more.
- Time consuming in terms of setting of operation setup.
- Defects in the form of angular deformation and wrinkles are seen and quality is not good.

SOLUTION OF HYDRAULIC PIPE BENDING MACHINE

- The bending force is generated is quite large with a minimum human effort.
- Loading is done by operating handle of the jack which carries the bending action resulting into a safe and damage free bending operation.

SYSTEM DESIGN

- System selection based on physical constraints.

- Arrangement of various component.
- Man machine interaction.
- Servicing facility.
- Height of machine.
- Weight of machine.

ADVANTAGES

- Hydraulic ram force reduces human effort in operation.
- Portable.
- Simple construction.
- Low cost.
- Less needs for maintenance.
- No extra skill is required for operating this system.

MECHANICAL DESIGN

- Fabricated parts.
- Parts to be purchased.

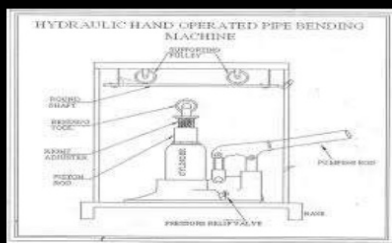
WORKING PRINCIPLE OF HYDRAULIC JACK

The hydraulic jack is a device used for lifting heavy loads by the application of much smaller force. It is based on the Pascal's law, which states that intensity of pressure is transmitted equally in all directions through a mass of fluid at rest.

The working principle of a hydraulic jack may be explained with the help of figure shown below. Consider a ram and plunger, operating in two cylinders of different diameters, which are interconnected at the bottom, through a chamber, which is filled with some liquid.

WORKING

The pipe is inserted between the pulleys and the Hydraulic jack pulley as shown in figure. The Bending Force is applied with hydraulic Jack when the handle is operated. Thus pipe is bent. For desired diameter of bending curve the pulleys are changed or altered.

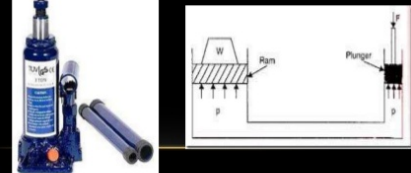


VI. CONCLUSION

WORKING PRINCIPLE

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FUTURE SCOPE

This machine can be applied in construction site and also for automobile jack which can be used for lifting of jack for old age people.

AUTHOR DETAILS

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