IMPROVE PRODUCT QUALITY OF AUTOMOTIVE VALVE AND PRODUCTIVITY OF SEMI-AUTOMATIC VALVE BENDING MACHINE

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Abstract: The bending machine is one of the most important machine tool in sheet metal work shop. It is primarily designed for bending. The bend has been made with the help of punch which exerts large force on the work clamped on the die. The bending machine is designed in such a way that, it works automatically. The automation strategy, when implemented is believed to result in reduced cycle time, costs and improved product quality. Other possible advantages are repeatability, increased productivity, reduced labour and integration of business systems. Automation is achieved with the help of Electro pneumatic system. Pneumatic devices are used in many industrial applications. Generally appropriate for applications involving less force than hydraulic applications, and typically less expensive than electric applications, most pneumatic devices are designed to use clean dry air as an energy source. The actuator then converts that compressed air into mechanical motion. Pneumatic cylinders are generally less expensive than hydraulic cylinders of similar size and capacity.

Index Terms **- Automotive Valve, Product Quality, Pneumatic cylinder, Bending Machine**

I. INTRODUCTION

In industries the automatic valve bending is widely used. Earlier the process was carried out manually. The manual process was time consuming as well as the output of machine was very less. The main aim of the project is to improve the efficiency of the required output and to increase the production with quality output. Now the technique of bending operation of the component is changed. This arrangement is made in order to avoid injuries to operators. The main aim of this project is to have the complete know how of pneumatic devices, sensors etc. by which the manually operated press or any machine can be converted into a semi or fully automatic unit. In this project the bending machine is a semi-automatic bending machine, in which the loading and unloading of the component is done manually and the bending of the plate is done automatically

Pneumatic devices are used in many industrial applications. Generally appropriate for applications involving less force than hydraulic applications, and typically less expensive than electric applications, most pneumatic devices are designed to use clean dry air as an energy source. The actuator then converts that compressed air into mechanical motion. Pneumatic cylinders are generally less expensive than hydraulic cylinders of similar size and capacity. L shape valves are used to fill air in the tyres in moped vehicles. They are generally bent through 90 ◦ angle for convenient air filling, such valves are produced using manually operated bending machine. But manually operated bending machine faces problems of scratches and notches on the surface of the valve, also incorrect bending angle and curvature. To minimize these problems we invented a fixture called valve bending machine, which is manufactured on VMC machine.EN8 material is use for fixture of VEM. Straight valve is mounted on fixture having fillet of radius 2mm and to reduce the scratches we use cushioning of nylon material .Forward stroke of piston cylinder strike on the valve and bend it at 90 ◦ angle, by using fillet on fixture it will bend at 90 ◦ angle properly. Due to friction between valve and fixture material, scratches are obtain on the surface of brass valve, because brass is softer material than EN8 material .To minimize such losses different cushioning can be used on fixture. For e.g. nylon cushioning of 0.5 mm is use here to eliminate the scratches.

II. LITERATURE REVIEW

Michele Monnoa et al In this paper a methodology for performing an energy assessment of two different tube-bending machines is proposed. The methodology is based on the experimental approach suggested by the ISO 14955 but also propose modelling strategy that allows extending the energy assessment comparison for the whole working range of the machines. The analysis shows that full electric bending machine allows saving a relevant quantity of energy. This advantage decreases as the production rate increases(2017).

Pankaj Yadav et al we know that Pneumatic Shearing machine is very cheap as compared to hydraulic shearing machine. The range of the cutting thickness can be increased by arranging a high pressure compressor and this machine is advantageous to small sheet metal cutting industries as they do not have rely on the expensive hydraulic shearing machine(2015).

Thorave Rohit . V et al this paper presents the design and fabrication of combined pipe bending and rolling machine we have selected this project to design and fabricate combined bending and rolling of pipe using single power source. The defects occur during bending are too much tedious to eliminate. While designing the machine we tried to minimize defects and minimize the initial cost of the machine. Using this machine both bending and rolling of pipe of outer diameter 19 mm and thickness 1-2 mm is possible with single power source only(2017).

Kothwal Satish et al. The main objective of our paper is to implement the pneumatic rod bending machine in the construction sites with less cost compared to the existing bending machines and increasing the productivity of the stirrups. Pneumatic rod bending

machine consist of Pneumatic cylinder, Compressor, Hoses, Pulley, Cutting blades, Fixture, Electronic circuits, Switches and wiring. The rod is bent by the Pneumatic cylinder piston with holding the rod in the fixture. The main advantage of our paper is the square shape of the Stirrups is bent continuously without repositioning the rod in the machine. (2017).

R.D.Makwana et al. A fixture is designed and built to hold, support and locate every component to ensure that each is drilled or machined with accuracy and manufactured individually. The fixture designing and manufacturing is considered as complex process that requires the knowledge of different areas, such as geometry, dimensions, tolerances, procedures and manufacturing processes. This paper will give brief overview about the 3-2-1 locating principle to design the fixture for complex parts and other clamping principles. This paper also gives the idea and procedure for fixture design (2014).

2.1 PROBLEM STATEMENT

1.To remove scratches and notch introduced during bending operation on semi-automatic valve bending machine.
2.To reduce net reduction rate of valve due to scratches and reduce play during bending operations.

III. METHODOLOGY

To reduce experimentation cost we have decided software based simulation work. Before making the model we created basic 2D design of working model in CAD software. With the help of design data book we selected material for the fixture as well as we derive the equation for curvature of bending to get 90 degree angle. After that we generated codes in MASTERCAM software. To analysis of various stresses, stress concentration, deformation, nodal solution in ANSYS software. We get results via these software's then we conclude that our design and operation are safe to take in actual practice. From design data book and software result we select EN8 material for fixture. To avoid friction during operation we provide nylon material as a liner. To reduce impact force of piston we provide rubber cushioning. For assembly purpose we use M8 bolt for rigidly holding the fixture.

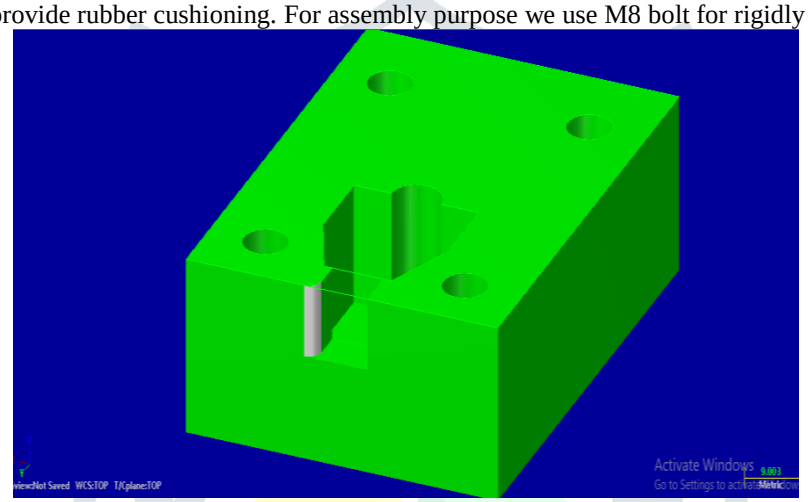

Figure3.1:Isometric view of Old Fixture

Design 2:- As the first design is failed so we designed a new concept. The enclosed cylinder which has diameter equivalent to diameter of valve. We used NX CAD software for designing of this fixture. We create 3D model of this fixture on software and then analyze it.

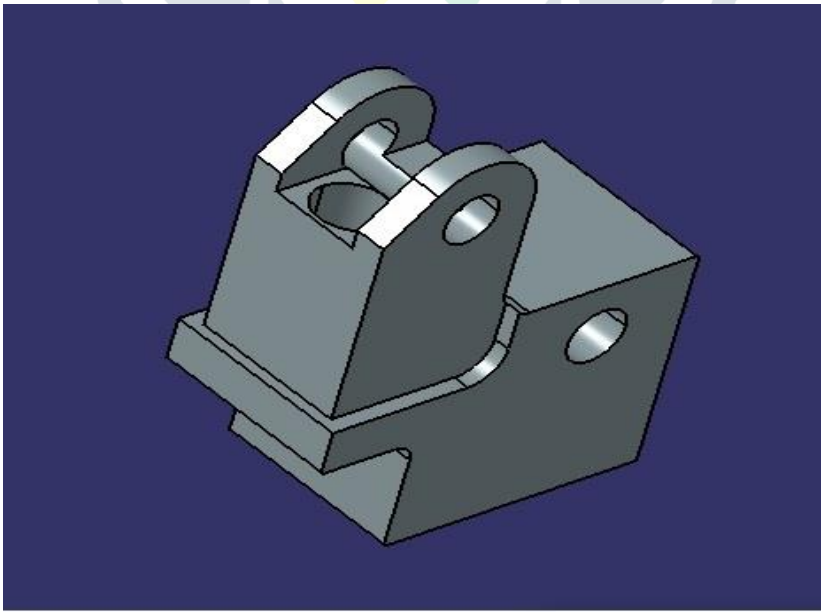

Figure3.2:CAD Drawing

After the creation and analysis we select OHNS material from Design Data Book which has suitable properties for required fixture. After selecting material we manufactured this fixture on Vertical Milling Machine. We decided that this fixture will undergo from heat treatment process. To gain hardness we place fixture in Muffle Furnace at 800°C for 1 hour. And then We place this fixture in free air till it get into normal temperature. Due to heat treatment we got required properties.

After heat treatment process we mount this fixture on setup. We start trials.

Figure3.3:Isometric View of actual fixture.

Figure3.4:Side view of actual fixture

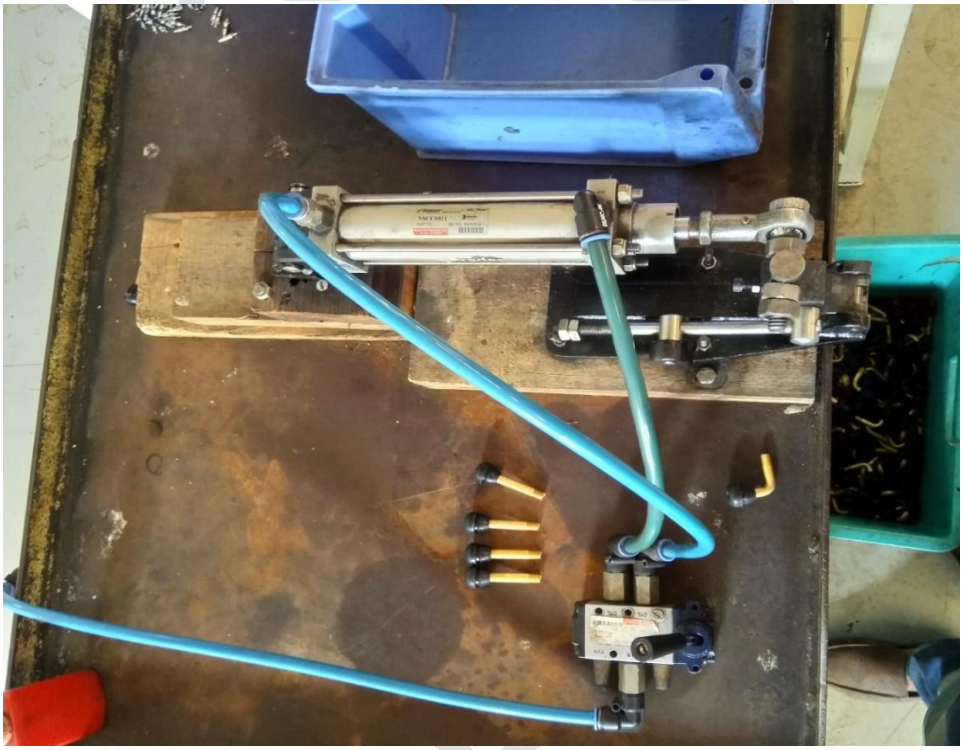

Figure3.5:Steup (Before Insertion of valve)

3.1 MATERIAL DATA

For Structural Steel

Table 3.1.1: Properties Structural Steel

Structural Steel	Constants
Density	7.85e-006 kg mm^-3
Coefficient of Thermal Expansion	1.2e-005 C^-1
Specific Heat	4.34e+005 mJ kg^-1 C^-1
Thermal Conductivity	6.05e-002 W mm^-1 C^-1
Resistivity	1.7e-004 ohm mm

3.2 ANALYSIS OF BENDING PIN

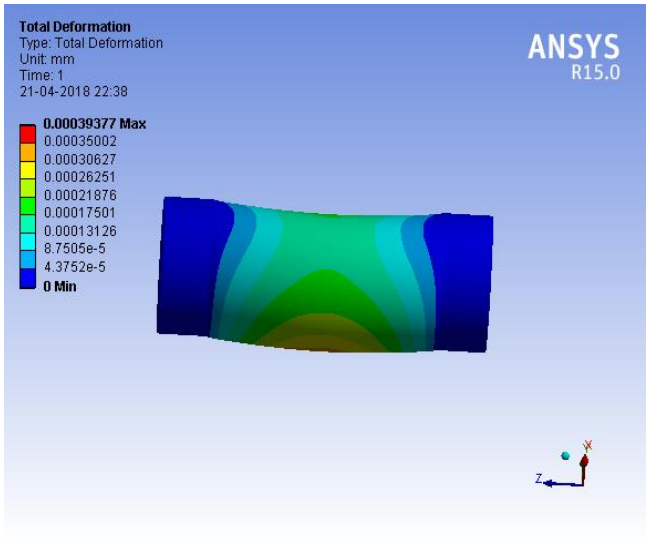

Figure3.2.1: Total Deformation.

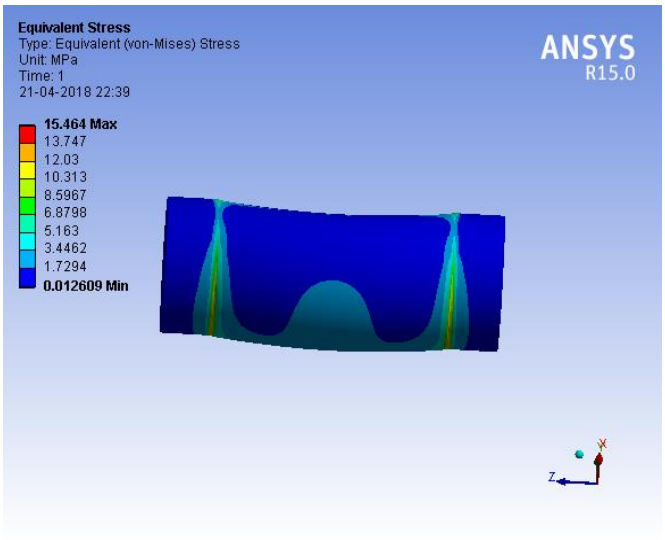

Figure3.2.2: Equivalent (Von - Mises) Stress

3.3 ANALYSIS OF FIXTURE

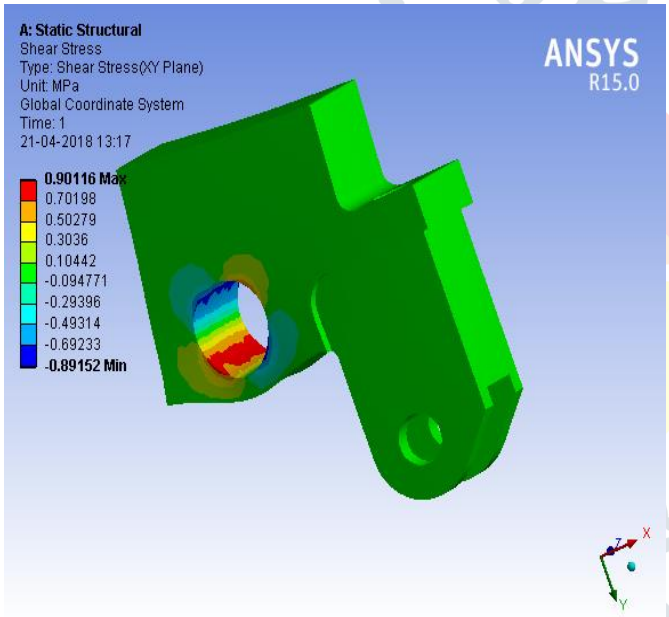

Figure 3.3.1: Static Structural

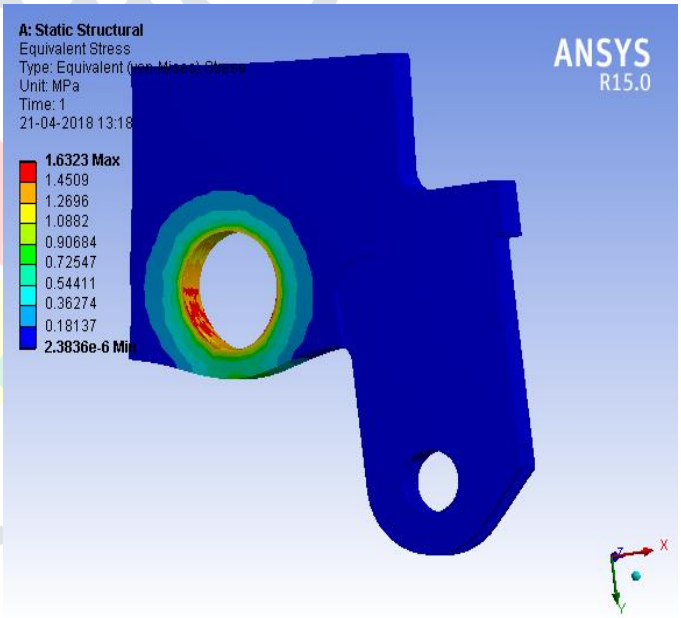

Figure 3.3.2: Static Structural Equivalent Stress

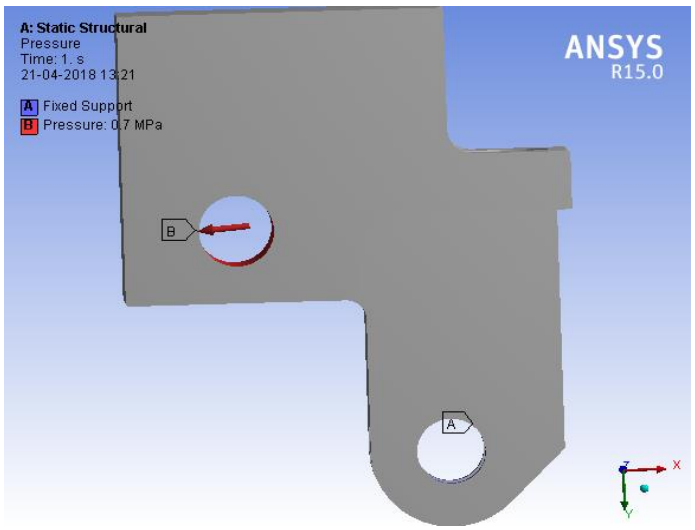

Figure 3.3.3: Static Structural Pressure

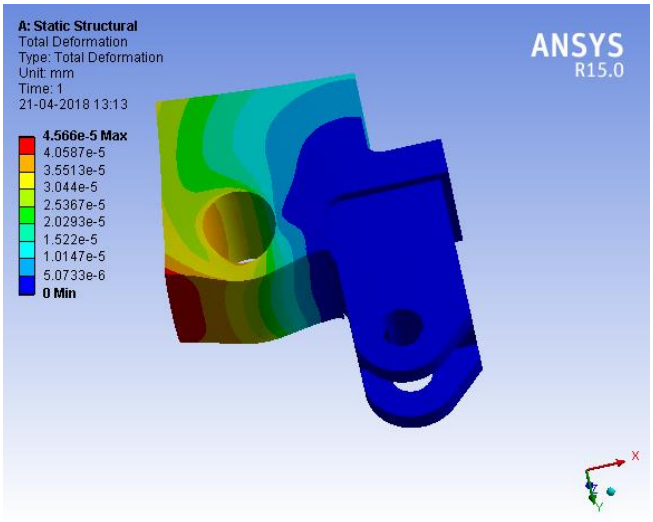

Figure 3.3.4: Total Deformatio

IV. RESULT

1. Accurate 90° angle obtained by valve bending machine.
2. The diameter is maintained throughout valve for proper pressure distribution.
3. Notches and scratches on surface of valve is eliminated.
4. Production rate increases and net rejection rate is decreases from 3-4% to 1-2%.
5. 10% increment in production rate.

Figure 4.1: Finished Valve.

V. CONCLUSION

The manual bending machine is converted into pneumatic bending machine by which maximum operating time will be saved. Thus the output will be more. In this project the human intervention is for loading and unloading the valve. It may be called as semiautomatic machine. This machine can be converted into a fully automatic machine where loading and unloading of the valve can be done automatically. To conclude, this project is made keeping in mind that any manually operated machine can be converted to automatic machines by using pneumatic, electrical and electronic devices. For these purpose one should have the full know how of the devices which are being used. By doing so the existing old machines can be modified and made automatic by which the initial cost, to procure new automatic machines may be minimized. Thus there is a lot of scope in this area (automation). Hence there is still wide scope in the automation is where lots of improvement can be made with the help of the latest technology.

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