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Design and fabrication of manually operated tyre pressing machine for reducing human efforts in removing tyres of heavy vehicles

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Abstract – *In present scenario in case of tyre worn out or air leakage in tyre of heavy vehicles like tractors, transport vehicles. The conventional method used to remove the tyre consumes a lot of efforts of the labour.the conventional method uses the different source of energy like mechanical and pneumatic. By using conventional method which involves hammers and rods for removing the tyre from heavy wheels leads to the chances of serious injuries .This paper deals with design and fabrication of manually operated tyre pressing machine for reducing human efforts in removing tyres of heavy vehicles .*

The newly developed method combines the advantages of both conventional as well as pneumatic method and also it is time and cost effective.

Key Words: **Tyre Pressing Machine , Heavy Vehicles Tyres, Bead Breaker, Tyre Removing Methods ,Press Tyre.**

1. INTRODUCTION

The traditional tire changing process by using manually operated tire changer may involve high force to remove tire from heavy wheels .The process of removing tire from heavy wheels involves bending, hard pressing and twisting. This can cause injuries to shoulder, wrist and knees, lower back. Injuries can occur suddenly over time. Some other major factors that are taken into consideration while doing this machine are as follows

1. Cost of power operated 'tire removing machine' is much higher as compared to traditional manual tire removing and fitting process.
2. Removing or fitting of tire on rim of wheel by conventional manual technique is very effortful and time consuming process.
3. Sometimes, hand tool, which is used for removing the tire from rim of wheel will damage the tube and tire of wheel due to it is not properly handle, or due to human handling error.
4. For conventional skilled and experienced operator is required.
5. Pneumatic method uses air pressure for dismantling or separating the tire from the disc. This method is very quick and effective but the only limitation for this method is that it is very costly so small scale service center of owners cannot afford this.

Manually operated tire pressing machine that we have fabricated is the efficient way for removing the heavy tire from the wheels. In this project we are going to combine the advantages of both conventional as well as pneumatic methods. This machine is quick in operation like the pneumatic method but also very economical as the conventional method.

Manually operated tire pressing machine [motpm] reduces most of the cost required in the pneumatic method and reduces the effort of the worker considerably.

2. LITERATURE REVIEW

Demounting and mounting procedure for tube type truck and bus tires manual [3] in this manual information about the use of proper tools to demount or mount tires and rims and use of lubricant on the beads and rim surfaces to make tire demounting and mounting easier is mentioned .

Tom duke contributing editor tire mounting and demounting manual [4]- in this manual mentioned that there are two basic types of tire changers: the tabletop or rim clamp style, and the center post style.

Atlas tc-733 automatic car tire changer maintenance manual [5] - technical specifications of tc-733 also assembly of different parts and operation of machine has been discussed. They have also discussed procedure of removing the tire from the wheels with safety instructions

Pornima T. Godbole et.al [6] reviewed "*machines for tire removing and fitting on rim of wheel*". In this paper various manuals related to demounting and mounting procedures of tire changer machine is discussed, it gives the basic idea about the effort required for pressing the tire by manual operations .also it gives idea about the construction for the model, various machine parts and new mechanism can be studied by these research paper

Hai-jun su et.al,[7] presented paper on, "*screw theory approach for the conceptual design of flexible joint for compliant mechanisms*" .in this paper a screw theory based approach for the analysis of flexible joints using wire and

sheet flexure has been discussed, the focus is on designing flexure system that have a simple geometry.

3. METHODOLOGY

This papers aims to design and fabrication of manually operated tire pressing machine for reducing human efforts of removing the tire from heavy vehicles. For fabrication of tyre pressing machine the tyre dimensions and force required has been determined .Then design and cad model has been prepared in software i.e. (Solid Works, Catia, Autodesk Inventor etc) and analysis has been done on Ansys. computed result of analytical calculations, design modification by reference of analytical value which has compared with design calculations.

4. DESIGN AND FABRICATION DETAILS

4.1 BASIC CONSIDERATIONS

The machine designed and fabricated should be simple, detachable, efficient and affordable. While designing this machine following points need to be considered`

A] Reduction in human efforts-

As compared to conventional method this machine should reduce the human efforts and also increase the efficiency of work

B] Compact structure and easy handling -

the existing machines available in the market are comparatively longer in size .due to their size it is quite difficult for the operator to carry out the procedure it takes lot of physical strength that risk the health of the operator it also takes quite a bit of time to carry out the procedure so to make it easy for the separator the machine should be light in weight and compact in size this will ensure faster operation and well being of the operator.

C] Portable machine -

Existing machine not portable and cannot be dismantled easily. So mostly it confined to a particular place. So the machine should facilitate easily dismantling and assembly to be portable .it should also be movable to perform tasks at various locations.

D] To analyses failure in design-

it is necessary to analyses various parts to ensure it does not fail during the operation .even if it fails it should be fail safe .to protect operator .

E] cost-

The machine should be cost effective to make it affordable for small shops .it will also reduce the operational cost.

4.2 FABRICATION DETAILS

The various considerations made during the design procedure are reduced efforts of the operator ergonomic design easy handling and low cost. The machines consist of important parts.

A] SCREW-

The screw is used for pressing purpose; they are made out of high plain carbon steel. Which an available in the form of shaft in the market. It is attached to the nut of c-clamp which process the bead breaker, there is an arrangement to mount the lever.

Fig -1: Screw

B] NUT-

The material recommended of nut is bronze because it's high resistance to wear and tear. But it is costly. To reduce cost of the nut the width of the nut .is reduced and its surface is coated by cast iron. This reduced the cost and increased the strength.

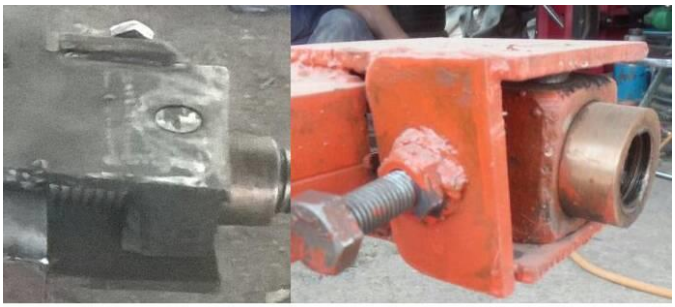

Fig -2: Nut

C] SUPPORT BED-

The function of support bed to support the whole structure. It is made of mild steel. It is easily available in the market In the form of c-beam or d-beam.

Fig -3: Support Bed

D]C-CLAMP-

It is made of mild steel. Its consists of two side arms and nut which is movable

Fig -4.1: C-Clamp

Fig -4.2.

E] BEAD BREAKER-

It is a part which presses the tyre which are shown in figure. It consists of a hole to mount the screw and thick plate in mounted at the back side of the hole.

Fig -5: Bead Breaker

F] LEVER-

An Ellen key can be curved as lever. A hollow pipe can be used to increase the leverage. A pneumatic gun can be used to replace the lever.

G] WHEEL-

Hard plastic is used to make wheel .this facilitate easy movement. They are attached at the board with the help of nut.

Fig -6: Wheel

5. EXPRIMENTAL SETUP

The base of tyre pressing machine is made of mild steel. which absorbs the vibrations and with stand the forces acting on it .c clamp is mounted on the top of the base .which consist of two sides arms. Each side arms is provided with nut. Throw which the screw is passed. at one end of screw bead breaker is attached. And at the other end lever is employed. To reduce the further effort the machine is made movable by attaching wheels to the base.

6.WORKING

Tyre pressing machine involves the rotary motion of the lever which causes the bead breaker to press the tyre .it has two side arm to which the nuts are attached and

through which screw passes and to that screw bead breaker is attached. As the lever is rotated it also rotates the screw to which bead breaker is mounted and it press the bead of the tyre .instead of lever pneumatic gun can also be used to rotate the screw.

7. CONCLUSIONS

This machine reduces the total efforts of the operator. And it also reduces total cost of product and process.

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