Garage on Wheels

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Abstract- *Garage On Wheels is arising out of the concept of, if any vehicle have any problem or get damaged and there is no garage nearby then in that such situation many problems arises out. To overcome from such situations, Garage on Wheels will prove greatly useful. Sometimes mechanic who is coming to repair vehicle may forget some equipment at garage, if equipment is too large he can't carry it so far. In such situation mechanic too faces many problems for carrying equipment, to avoid this types of problem Garage on Wheels is useful and able to solving this problems. We did whole study of the situation that how to solve the problem. Our team decide to beat that problem and we got an idea of "GARAGE ON WHEELS" project. This project provide best service to customers. This project gives us time efficiency, enough space & convenient for today's generation.*

I. INTRODUCTION

"MAN" a most powerful and intelligent species of World, as the world is being modernized by Man, in this modern world Man is working toward Science, Engineering and other fields to reduce the effort of people living in this World from millions of years. Man has discovered various elements with help of this Nature, such as Metal, Non-metal, Ceramics and other components or elements present in Nature. During discoveries of this elements, due to working towards it and finding it out in a wide span of time, Man started performing the work in an accurate behavior, manner or skills. Man started to do work in Accuracy and Precision .Garage On Wheels is arising out of the concept of, if any vehicle have any problem or get damaged and there is no garage near by then in that such situation many problems arise out. To overcome from such situations Garage On Wheels will prove greatly useful. Sometimes mechanic who is coming to repair vehicle may forget some equipment at garage, if equipment is to large he can't carry it so far. In such situation mechanic too faces many problems for carrying equipment, to avoid this types of problem Garage On Wheels is useful and able to solving this problems.

II. PROBLEM STATEMENT

The Delivery of service with four-wheeler is not possible within 30 minutes as well as the vehicle is not able to overcome the traffic problem.

III. OBJECTIVE

The objective of the project is to provide service to the customers using two wheeler vehicle which will consist of all minor repairs in the vehicle.

The service objective is to offer

1. On Spot Minor Repair
2. Battery Jumpstart
3. Flat Tyre Fixing On Spot
4. Fuel Delivery
5. General Service
6. Towing (Flat Bed Towing, Uplift Towing)

A. System Description

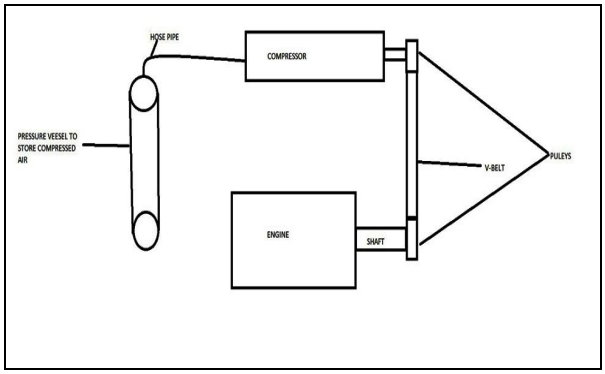

Fig 1 System Description

B. Actual Model

Fig 2 Actual Model

The above fig. shows actual model of project and block diagram of the whole system. The prime mover used to drive the whole system is the engine of Bajaj Chetak scooter. The engine shaft is extended to drive the compressor.The power is transmitted by using belt drive pulley mechanism.The power is transmitted over distance of 440 mm with the belt of thickness 17 mm.The driven pulley then drives the single acting reciprocating compressor which compresses the air and stores it in pressure veseel.The pressure vessel is mounted on left side of the scooter.This compressed air is used to remove tyre puntures.The battery jump start equipment and other tools are kept in tool container which is mounted by replacing back seat of the scooter.

III. DESIGN CALCULATIONS

1. Belt And Pulley

Given Parameters,

n_1(driver pulley)=1800rpm
n_2(driven pulley)=650rpm
v=24 m/s
t=5mm
f=0.35

$\rho = 0.959 m/cc$

Step 1=Diameter of Pulleys:

$$v = \frac{\pi d n}{60(1000)}$$

d=80mm and D=250mm

Step 2= Belt Length:

$$L = 2C + \frac{\pi(D+d)}{2} + \frac{(D-d)^2}{4C}$$

L=1414.5mm

Step 3= Belt Width and Belt Tensions:
Belt velocity is given by,

$$v = \frac{\pi d n}{60(1000)}$$

v =7.536m/s

Wrap Angle is given by,

$$\alpha = 180 - 2\sin^{-1}\left(\frac{D-d}{2C}\right)$$

α = 157.8° or 1.375rad

Volume = (Length)×(Width)×(Thickness)

m = $\rho \times volume$

m =(4.75×10^{-3})b kg/m

mv^2 = 0.2697 b
Also,
$e^{f\alpha}$ = 1.618

Belt Tension can be given as,

$$\frac{P_1 - mv^2}{P_2 - mv^2} = e^{f\alpha}$$

Maximum Stress in the belt is given as 2.25 N/mm^2

$$\sigma = \frac{P_1}{A}$$

Solving Simultaneously,

B = 475.52mm and P_1 =5349.6N , P_2 =3347.93N

2. Pressure Vessel

Given parameters,

L=58cm(length of the container)
P=5bar (Max. pressure)
F=52KN(force)

Step1 F=PDL

D=17.9≅ 18cm
Where,
D=inside diameter

Step2 Thickness of the shell (t)

$$t = \left(\frac{PR_{in}}{SE - 0.6P}\right)$$

R_{in}=inside radius
S=maximum allowable stress=2.6MPa
E=joint Efficiency=1
t=1.95cm≅ $2cm$
hoop stress(σ) = $(\frac{PD}{2t})$

$\sigma = 2.25MPa \leq 2.6\text{MPa}$ $\therefore$ *design is safe*

Step3 Inside diameter=outside diameter-(2*thickness)

∴Outside diameter=22cm

Step4 Thickness of hemispheral ends(t)

$t=\left(\frac{PR_{in}}{2SE-0.2P}\right)$

t=0.88 cm$\cong$ *1cm*

IV. ANALYSIS

The finite element analysis of pressure vessel is performed on the solidworks software. The input force is applied as the internal pressure generated during the storage of compressed air. The input pressure is 5 bar which is the maximum working pressure of the system according to requirements.

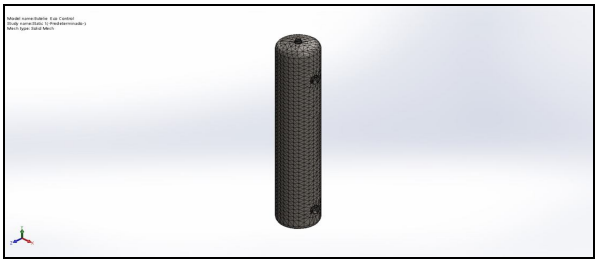

Fig 2 Quad Meshing

The above fig. shows the meshing of pressure vessel. The meshing is done by using quadratic element type with mesh count of 5.

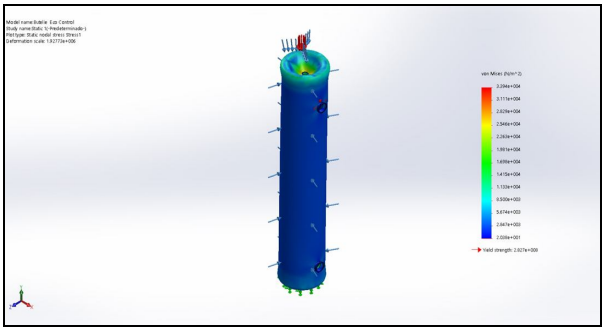

Fig 3 Stress Analysis

Later the stress analysis of pressure vessel is performed. The pressure vessel is fixed at only one end and internal pressure of 5 bar is applied. The maximum von-misses stress generated is $3.394*10^4$ Pa which is below the yield strength of material. Hence the design is safe in the stress consideration.

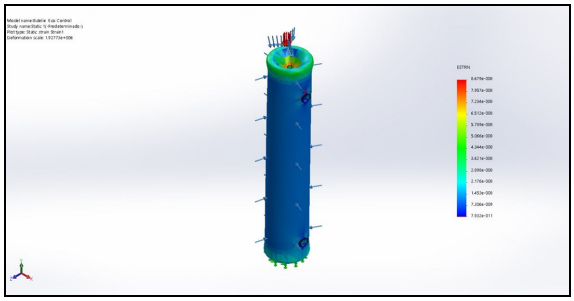

Fig 4 Strain Analysis

In the strain analysis, the maximum strain produced is 8.679 $*10^{-8}$ which is less than allowable strain. Hence the design is safe.

V. CONCLUSION

From testing results it is observed that the system design is safe and meeting all the company requirements within specified time. The selected model of scooter is cheap, provide enough space for mounting all equipment and gives time efficiency. Service plays an important role in achieving the customer satisfaction. The project will deliver the road side service which will reduce the customer efforts and the wastage of time of finding nearby garage as the service will come to the customer directly. Garage on wheels successively serves its purpose and provides efficiency and convenience.

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