ISSN No:-2456-2165

"Spare Me" Design And Development Of Mechanisam When Tire Runs Flat

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Abstract:- The reasons of flat tire were studied based on increasing incidents of tire puncture.We have proposed a device which can be used after the tire is puncture and breakdown. It is a device to resist the effects of deflation of tire when punctured, and to enable the vehicle to continue to be driven at reduced speeds (under 20 km/h), and for limited distances, depending on the type of tire. This device is entirely inspired and dedicated to women's as tire get puncture on a hot day, dark night or lone places, there is no need for an uncomfortable roadside tire change, they can easily mount the device and safely drive home or to nearest garage to get the tire changed. It also reduces the chance of tire blowout. Itcan be used in any type of vehicle as it is compact in size we can carried with the vehicle with this device we can eliminate the extra weight of screw jack and even spare tire. As the device is made of three rollers it can with stand the load of vehicle and can drive the vehicle for particular distance safely even on the bumpy roads. As flat tire somehow always happens at a time we could least afford so to overcome the situation this study is made.

Keywords:- Vehicles, Run-flat tire, Auxiliary wheels, Flat tire, Supporting tire.

I. INTRODUCTION

A flat tire is a deflated tire that can cause the rim to run against the tire tread, damaging the rim of the car, causing the rim to suddenly hit the ground, and eventually causing loss of control of the vehicle or irreparable damage to the rim. This accident costs the driver a lot of money to change the tires and replace them with new ones. Compared to non-pneumatic tires, an air-filled pneumatic tire offers several advantages in the most important driving characteristics of tires, such as ride comfort, handling and cornering, as well as falling over obstacles. However, it still suffers from the two main problems that an explosion can lead to total failure and blowing out at high speed can cause a dangerous car accident. In such situations, the only way to get back on the road is to replace the damaged tire with a spare tire in the trunk. As the term "run-flat" implies, it allows vehicles to drive on the road at normal speed for limited distances even after the puncture point. Tire manufacturers around the world have developed a number of run-flat tires since the concept was introduced, and examples include the strip tire introduced in 1976 and self-supporting tires with inner support rings or side-reinforced rubbers. The most common cause of a flat tire is a flat tire caused by a sharp object such as a nail, which causes the air to escape and the driver to lose control of the car. A tire can deflate slowly or quickly depending on the size of the puncture. So, as engineering students, we set out to create a mechanism that allows the tire to ride flat after flat so that the driver has just enough time to get to the nearest repair shop. Our goal is to create a mechanism to deflate the tire so that the tire does not have to be permanently changed in the event of a puncture. The goal of the project is to create a mechanism to deflate a tire by building a rolling mechanism inside the tire that supports vehicles after the tire is deflated and can also be installed on all types of tires and rims.

A. Problem definition

The sidewall of the tire becomes empty when a normal pneumatic tire is punctured, as the air inside quickly escapes at the given pressure level. As a result, the tire axle drops and the sidewall must be compressed between the aluminum rim and the ground. The idea of auxiliary wheels is to protect the sidewalls after leveling even if the internal pressure is zero.

II. LITERATURE REVIEW

A. Gap in literature

As number of punctures go up, the risk of tire bursting or getting a puncture again goes up. So, even though the tubeless tire could handle more than 5 punctures, but it's advisable to replace the tire after 3 to 4 punctures. Between 250 to 315 people die every day in road accidents across India. In recent survey conducted by APPOLO TIRES, 75% of deaths are due to tire bursts by incorrect tire pressure. 4% of Indian population i.e., 54,400,000 people face a problem of road side assist majorly by tire punctures and bursts. 4 to 5 deaths are caused by extortions & robbery in middle of nowhere. Women's safety is left at peak dangers in such situations in India. In Addition to this India is been in competition for tire production. In financial year 2019, the total tire production in India stood at around 192 million units. This was an increase of 8% over the preceding year.

ISSN No:-2456-2165

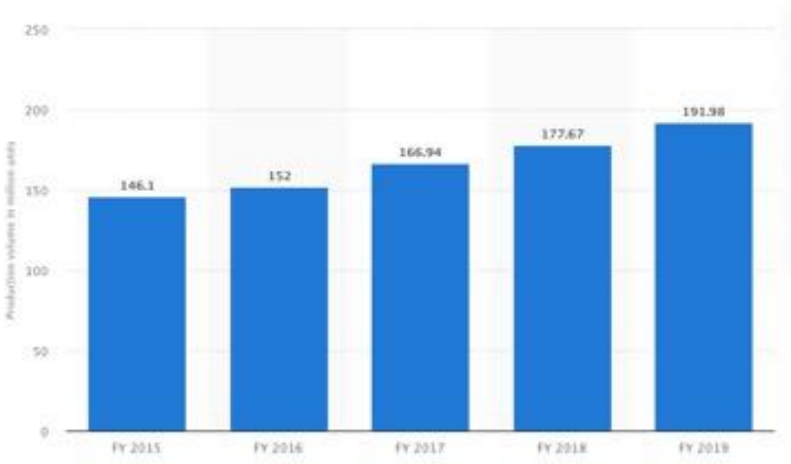

Fig. 1: PRODUCTION VOLUME OF TIRES IN INDIA (2015 TO 2019)

India's waste tire accounts for about 6-7% of the total. With the local tire industry growing at 12% per annum, waste volume is rising. India has been recycling and reusing waste tire for four decades, although it is estimated that 60% are disposed of through illegal dumping.

B. Objective

- Quick assist in situations of tire breakdown.
- Handles tubeless tire in breakdown as well as during a puncture.
- Envisions functionally for upcoming tire generation such as airless and spherical tires.
- Added technical enhancements such as a thermal sensors to know the heat generated in the device thus making it smart.

III. MATHEMATICAL MODELLING

Life of roller

$$L^{10} = \frac{\left(\frac{C}{P}\right)^{e} \times 10^{6}}{60 \times N}$$

L^{10} = 8896387.188 min
L^{10} = 16.92 year ≈ 17 years

Load /Resistance on roller

$$W = m \times g \times \left[\left(2 \times \frac{f}{D} + \mu \times \frac{d}{D}\right)\right] + m_v \times g \times \frac{\mu \times d}{D}$$

W = 94.91N

Total load

$$W_t = W \times 12$$

W_t = 1132.92 N

Rubber tearing is known to start from an inherent defect in the rubber. When rubber is stretched, the local tension in the vicinity of the defect increases. When the local stress reaches a critical limit, the rubber breaks with a crack (defect). It has been widely reported that the crack growth rate in rubber is determined by the specific energy generated per unit area of the fracture surface. This is a definite equation.

$$T = -\frac{1}{h}\left(\frac{\delta W}{\delta c}\right)$$

	Normal Tire	Flat Tire
Velocity (m/s^2)	V=50km/h =50km/h×(1000m/1km) × (1h/3600s) =13.89/35s =0.3969m/s^2	V=50km/h =50km/h×(1000m/1km) × (1h/3600s) =13.89/40s =0.3473m/s^2
Force(N)	F=m×a =670kg× 0.3969m/s^2 =265.92N =265.92/4 =66.48N	F=m×a =678kg×0.3473 =235.4N =235.47N/4 =58.87N
Torque(N.m)	T=rF =(0.24m)(66.48N) =15.96N.m	T=rF =(0.20m)(58.87N) =11.77N.m
Horse Power	HP=(T×RPM)/7120.89 =(15.96)(2000)/7120.89 =4.48HP	HP=T×RPM/7120.89 =(11.77)(2000)/7120.89 =3.31HP
Powerweight ratio	Powertoweightratio=4.48HP/670kg =0.006687	Powertoweightratio=3.31HP/678kg =0.00488

Table 1: Power to weight ratio calculation

ISSN No:-2456-2165

Economical Calculation (Tentative)
The ideal economy of vehicle is 50 to 60 kmpl which costs approx. for 1 liter is 105rs . But by using this device the economy gets decrease by 2% which can cost extra 5rs per liter which is ideal to customer rather then towing the vehicle or dragging the vehicle to nearest garage.

IV. RESULTS

During Max Load
(pressure below 20psi)

During Min Load
(pressure below 20psi)

Fig. 2: Prototype Testing

Fig. 3: Compact ability

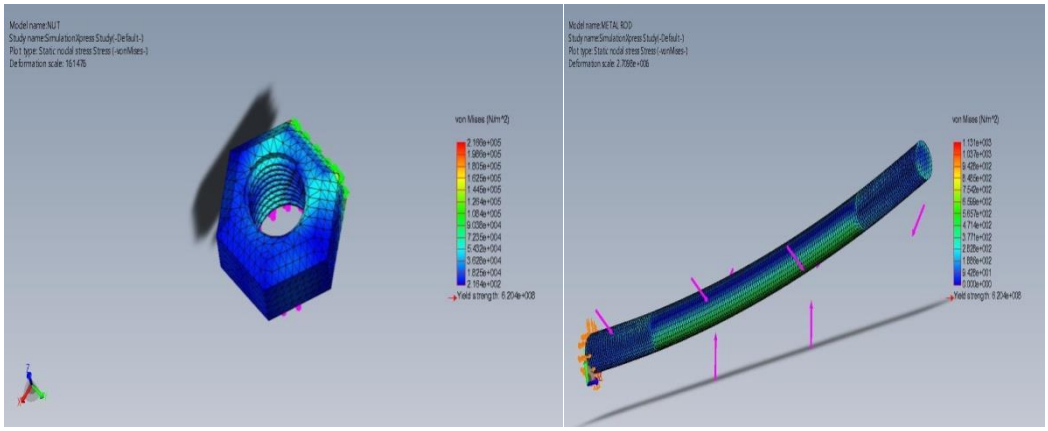

Fig. 4: Stress analysis on nut stress analysis on rod

ISSN No:-2456-2165

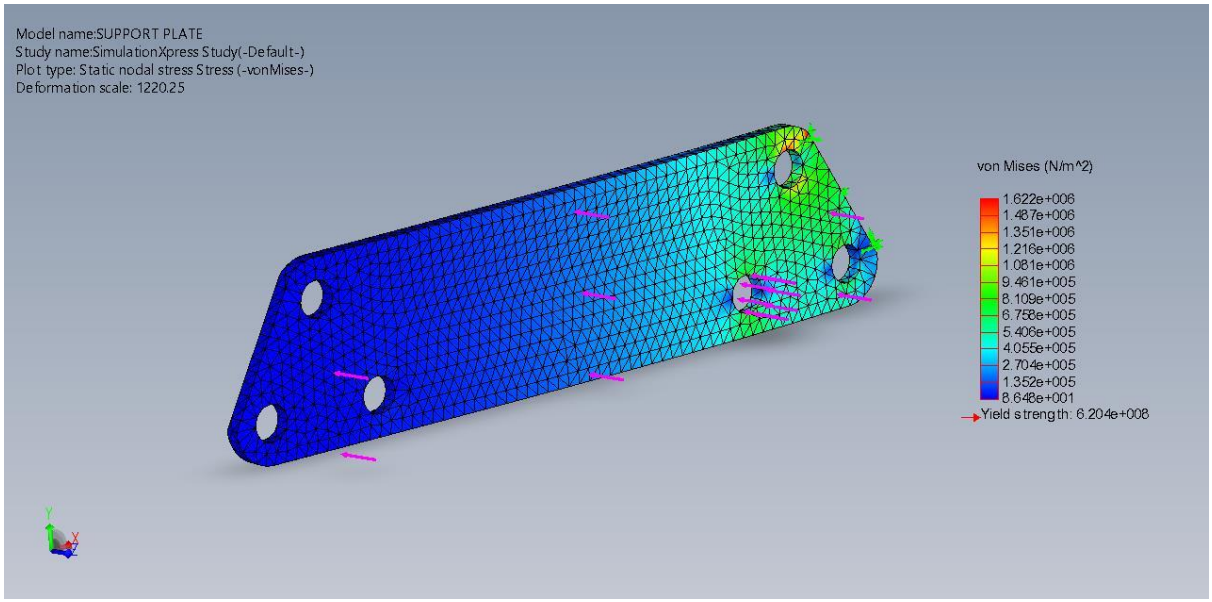

Fig. 5: Stress Analysis on side metal frame

V. CONCLUSION

Research has shown that a mechanism for a flat tire needs to be designed and developed. Safety tires are a very important safety component of any vehicle. They are important not only for driving and correct driving of the vehicle, but also for a quick and efficient response in emergency situations and to avoid accidents. Introduced as a new utility wheel to solve the problems of tire cracks and punctures. The auxiliary wheel mechanism remains under the tire when the tire is flat or punctured to cover a certain distance, thus providing a new research idea to improve tire safety and mobility. In addition, the obtained results show that the matter should be investigated further. , especially in the distribution of contact pressure between the auxiliary wheels and the road surface.

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