ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 3, March 2018

A Paper on Run Flat Tires

[1] Vikas Kumar Choubey
[1] Department of Mechanical Engineering, Galgotias University, Yamuna Expressway Greater Noida, Uttar Pradesh
[1] Vikas.choubey@Galgotiasuniversity.edu.in

Abstract: Run flat or self-supporting tires are specifically designed to keep working even after a puncture for a short time. So if tire gets puncture on a hot day, dark night, they can safely drive home or to the nearest garage to get the tire fixed, there's no need for an inconvenient roadside tire change. Because of its special design, run flat tires often raising the risks of a potentially dangerous tire blow out. This can also remove the additional weight of the vehicle's spare tire, equipment for better balance, jack and tools in the vehicle for better balance, fuel efficiency and fluid handling.Self-supporting in the tire and helping the driver when the car suddenly breaks down, it can comfortably support the car's weight in the event of a puncture.The special materials on the running surfaces are tougher than on normal tires, helping the tire to bear the vehicle's weight and provide continuous driving to the nearest workshop or our house.These are pneumatic tires that are designed to withstand deflation when punctured and that will allow vehicles to drive for limited distances. Run flat tires have an additional internal structure providing support in deflation situations.The popularity of run flat tires is expected to grow as customers continue to rate high on the list of features they are looking for in a car.Two run-flat systems are described i.e.Overwork NLR and Michelin ACM insert rings.

Keywords: ACM, Deflation,NLR, Puncture, Vehicles,Tire.

INTRODUCTION

A flat tire is a deflated pneumatic tire, which can cause the wheel's rim to ride on the tire tread, damage the car's rim, sudden smash the rims to the ground and possibly lead to loss of vehicle control or irreparable damage to the rim.This crash costs a lot of money for the driver to repair the tyre and change the rim into a new one[1]. A flat tire's most common cause is a sharp object puncturing the tire, such as a nail causing air to escape and the driver lost control of the car.The tire can deflate slowly or swiftly, depending on the size of the puncture. So create a system that will allow the tyre to run after punctured and the driver has enough time to go to the nearby workshop.Create a flat tyre-running mechanism to avoid a permanently deformed tyre, when punctured. Besides that, the suspension tension will increase when the tyre flat due to road condition.to construct a system for running a flat tyre, by creating a support ring inside the tyre, which will support the vehicles after the tyre run flat and can also be fitted to all forms of tyre and wheel size[2].

Approximately 35% of the battlefield's damage to wheeled vehicles includes punctured tires.Research is being done on battlefield damage assessment and repair (BDAR) of flat tires and rapid wheel replacement, but the best solution at the moment appears to be a run-flat tire that allows the vehicle to continue to operate, even if the tire has been severely punctured.Two such systems, Michelin ACM insert rings and Vorwerk NLR have been tested[3].

RUN-FLAT TIRE DESCRIPTION

1. *NLR System:*

NLR system is a homogenous solid rubber balanced insert ring that is placed in a standard tubeless radial tire and fixed on a standard flatbed rim.The design does not affect the driving characteristics of normal roads or cross-countries[4]. If a tyre gets punctured in a combat zone in any way, the vehicle can continue its journey without stopping.When one or more tires are completely flat, the vehicle can be pushed for 1 to 4 km at top speed, escaping the danger zone and then continuing at a more moderate speed to fulfil its task or until it reaches a repair point[5]. Figure 1 shows the NLR run flat.

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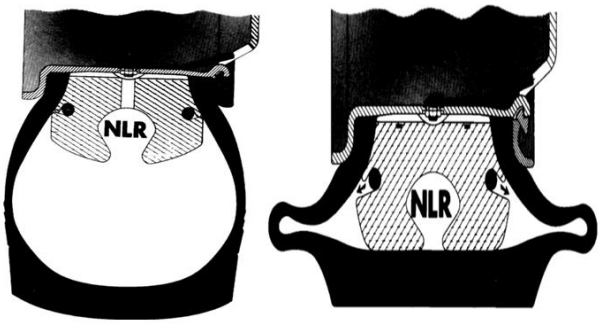

Fig.1: NLR Run Flat

2. Installation:

The radial tire is mounted on a tire spreader, to install the NLR insert ring. A hydraulic spreader consisting of a modified jack holds the NLR insert ring in an oval shape, and is brushed with a mounting paste.The oval insert is then put as deeply into the tire as possible. This eliminates the hydraulic spreader and the NLR ring springs back into its original round form and slides into the rubber. The tire/NLR assembly can now be mounted, following normal procedures, on a standard rim.The installation will take about twenty minutes at an organizational motor pool, using the normally available tire mounting equipment[6].

3. Run-flat Operation:

The NLR insert cross-section is designed to deliver specific operating characteristics. There is a tube filled with lubricant in the peripheral groove around both sides of the rim contain a tube filled with lubricant.When the tire is flat, the sides of the tube compartments are squashed allowing the tubes to burst and release the lubricant that is attracted to the contact surface between the insert and the flat tire by centrifugal forces.The lubricant reduces the friction between the two surfaces and makes the flat tire more durable[7].The flat tire's practical cross section is still capable of carrying a full charge. If the tire walls crack and the carcass completely breaks up, the vehicle may still drive on the insert ring.The NLR insert has the advantages of low weight, a balanced ring and easy installation. The lubricant increases flat tire lifespan.Under normal operation the vehicle performance characteristics are not affected at all, and the inserts allow the use of low tire pressure for cross country travel.A radial tire's weight is lower than that of a military tire which it replaces, providing the NLR insert ring with a weight allowance.The shape of the ring cross section allows for continued vehicle operation with an acceptable degree of comfort when a tire puncture occurs.The braking system's efficacy isn't affected[8].

4. ACM System:

The ACM system uses an insert that can be used with radial tires. The insert consists of a three-piece bolted aluminium ring mounted on a bead lock with rubber foundation. The rubber is mounted over the insert of rigid aluminium. Installation takes about an hour at an industrial motor pool.Driving characteristics with a tire in good condition and a normal tire pressure are almost similar to those with the NLR insert and driving characteristics do not change noticeably.The ACM cross section is higher than the NLR cross section, and not as much air can be released from the tire for cross country service. The vehicle cannot drive on the aluminium ACM ring alone if the tire wall is completely ruptured and the rubber broken down and lost[9]. Figure 2 shows the ACM run flat.

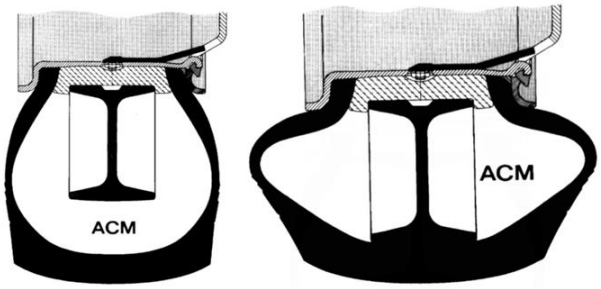

Fig.2: ACM Run-Flat

5. Components of tyre:

There are several pieces to a tire carcass: cap, sidewall, rim, rubber and ply.

a. Tread:

The tread is the part of the tire which comes into contact with the surface of the road. At a given moment in time, the section in contact with the road is the contact area.The tread is a thick rubber, or rubber / composite

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blend designed to provide an appropriate traction level that doesn't wear away too quickly. The tread pattern is distinguished by grooves, lugs, voids and sips in the geometrical shape.Grooves run around the tire circumferentially, and are needed to channel the water away. Lugs are that portion of the tread design that comes into contact with the road surface. Spaces between lugs are called voids that allow the lugs to flex and evacuate water.Tread patterns feature circumferentially non-symmetrical (or non-uniform) lug sizes to reduce the noise at distinct frequencies.Sips are valleys cut across the tire, typically perpendicular to the grooves, allowing the water from the grooves to escape to the sides in an effort to prevent hydroplaning.Treads are often designed to satisfy specific marketing positions for the product. The tire have high performance when small void ratios to provide more rubber for higher traction in contact with the road, but may be compounded with softer rubber which provides better traction but wears fast.Mud and snow (M&S) tires are designed with higher vacuum ratios to channel rain and mud away, while delivering better grip performance[10].

b. Tread lug:

Tread lugs provide the required contact surface for the traction. This is compressed as the tread lug reaches the road contact area, or footprint. As it rotates by the hand it is circumferentially deformed.As it exits the footprint it gets back to its original form. The tire exerts variable forces into the vehicle during the deformation and recuperation cycle. These forces are described as Variation of Force.

c. Tread void:

Rubber voids provide stability and deformation for the lug as it enters and exits the footprint. Voids also provide pathways to be channelled away from the mud, rainwater, dirt, and snow. The void ratio is the tire's void zone separated by the whole field of the rubber.Low void areas have a high area of contact and thus higher traction on clean, dry pavement.

d. Rain groove:

The rain groove is a tread pattern design element explicitly designed for channelling water away from footprint. In most truck tires, the Rain grooves are circumferential. Most high-performance passenger tires feature rain grooves angled to the tire's sides from the bottom.Some tire manufacturers claim their tread pattern is designed by the action of tread flexing to actively pump water out of under the tire. This results in a smoother ride at various weather types.

e. Wear bar:

Wear bars or wear indicators are elevated features at the bottom of the tread grooves which indicate that the tire has reached its wear limit.The tires are completely worn and should be taken out of service when the tread lugs are worn to the point where the wear bars attach across the luggage. Most wear bars indicate a residual tread depth of 1.6 millimetres (0.063 in) and at this point are deemed worn out.

f. Bead:

The bead is the part of the tire that touches the wheel's surface. Normally, the bead is filled with steel wire and coated with high strength rubber which is low flexibility. The bead seats tightly against the two wheel rims to make sure a tubeless tire holds air without leakage.The bead fit is secure to ensure no circumferential change of the tire as the wheel rotates. The rim width in comparison to the tire is a factor in an automobile's handling characteristics, because the rim supports the shape of the tire[11].

g. Sidewall:

Due to significant under inflation, irregular sidewall wear down to cloth plies the sidewall is that part of the tire that bridges between the rubber and the bead.The sidewall is largely rubber but reinforced with cords made of fabric or steel which provide tensile strength and flexibility.The sidewall absorbs air pressure and transmits the torque applied by the drive axle to the tires in order to create friction but supports little of the vehicle's weight as is clear from the tire's total collapse when punctured.The sidewalls are moulded with manufacturer-specific details; government-mandated

warning labels and other consumer information, and sometimes decorative ornamentation, such as whitewalls.

h. Rim:

The tire's beads are placed on a wheel's bottom or outside edge. These outer edges are formed to get a proper shape on each side, with an inner inclined radially cylindrical wall on which the tire can be mounted.The rim of the wheel must be of the correct design and type to hold the bead of the tire of appropriate size. Tires are mounted onto the wheel by pressing their beads into the channel created by the inner and outer rims of the wheel[12].

CONCLUSION

Run-flat tires can be used to minimize the high rate of damage to tires on wheeled vehicles.The damaged vehicle in most cases continue to move without stopping for emergency repair, and can likely complete its mission before returning to a maintenance point for repair under its own control.Run-flat tires can be used to minimize the high rate of damage to tires on wheeled vehicles.The damaged vehicle in most cases continue to move without stopping for emergency repair, and can likely complete its mission before returning to a maintenance point for repair under its own control.Run-flat tires can be used to minimize the high rate of damage to tires on wheeled vehicles.The NLR and ACM insert rings that allow the punctured tires to run flat can be mounted at the operational level in a reasonable time and allow regular radial tires to be used, replacing the much smaller, less usable and more expensive "battle tires" with thicker sidewalls and treads also known as fighting tires.Normal tyre designs have stronger properties than flat tyre designs.The higher power to weight ratio for a given horsepower rating, the less the car weighs the more / better it uses fuel-the less inertia a car carries, the easier it is to accelerate and change its direction.

REFERENCES

[1] J. Ejsmont, J. Jackowski, W. Luty, G. Motrycz, P. Stryjek, and B. Ś. Zurek, “Analysis of rolling resistance of tires with run flat insert,” *Key Eng. Mater.*, 2014, doi: 10.4028/www.scientific.net/KEM.597.165.

[2] W. S. Khan and F. A. Dar, “Ride comfort evaluation of bias ply and radial run-flat tire in high mobility vehicle,” in *SAE Technical Papers*, 2013, doi: 10.4271/2013-26-0143.

[3] X. Jin, C. Hou, X. Fan, Y. Sun, J. Lv, and C. Lu, “Investigation on the static and dynamic behaviors of non-pneumatic tires with honeycomb spokes,” *Compos. Struct.*, 2018, doi: 10.1016/j.compstruct.2017.12.044.

[4] Y. Mohamadi, M. Mousavi, S. M. H. N. Moogahi, F. Abolhassani, S. Ijaz, and G. Hassanzadeh, “Effect of Wharton’s Jelly derived mesenchymal stem cells on the expression of NLRP3 receptor and neuroinflammation in experimental spinal cord injury,” *J. Clin. Diagnostic Res.*, 2018, doi: 10.7860/JCDR/2018/37321.12168.

[5] L. Lian, C. Ciraci, G. Chang, J. Hu, and S. J. Lamont, “NLRC5 knockdown in chicken macrophages alters response to LPS and poly (I:C) stimulation,” *BMC Vet. Res.*, 2012, doi: 10.1186/1746-6148-8-23.

[6] W. Zima and P. Dziewa, “Modelling of liquid flat-plate solar collector operation in transient states,” *Proc. Inst. Mech. Eng. Part A J. Power Energy*, 2011, doi: 10.1177/09576509JPE1044.

[7] E. M. Terveer *et al.*, “How to: Establish and run a stool bank,” *Clinical Microbiology and Infection*. 2017, doi: 10.1016/j.cmi.2017.05.015.

[8] L. Zang, Y. Zhao, B. Li, J. Wang, and X. Du, “Mechanical elastic wheel improving road holding and wear resistance of tire,” *Nongye Gongcheng Xuebao/Transactions Chinese Soc. Agric. Eng.*, 2014, doi: 10.3969/j.issn.1002-6819.2014.12.007.

[9] L. Wang, R. Nojima, and S. Moriai, “A secure automobile information sharing system,” in *IoTPTS 2015 - Proceedings of the 1st ACM Workshop on IoT Privacy, Trust, and Security, Part of ASIACCS 2015*, 2015, doi: 10.1145/2732209.2732214.

[10] Y. P. Wu, Y. Zhou, J. L. Li, H. D. Zhou, J. M. Chen, and H. C. Zhao, “A comparative study on

wear behavior and mechanism of styrene butadiene rubber under dry and wet conditions," *Wear*, 2016, doi: 10.1016/j.wear.2016.01.025.

[11] F. Farroni, M. Russo, R. Russo, and F. Timpone, "A physical-analytical model for a real-time local grip estimation of tyre rubber in sliding contact with road asperities," *Proc. Inst. Mech. Eng. Part D J. Automob. Eng.*, 2014, doi: 10.1177/0954407014521402.

[12] F. Cataldo, O. Ursini, and G. Angelini, "Biodiesel as a Plasticizer of a SBR-Based Tire Tread Formulation," *ISRN Polym. Sci.*, 2013, doi: 10.1155/2013/340426.

[13] Vishal Jain, Mahesh Kumar Madan, "Information Retrieval through Multi-Agent System with Data Mining in Cloud Computing", International Journal of Computer Technology and Applications (IJCTA) Volume 3 Issue 1, January-February 2012, page no. 62-66, having ISSN 2229-6093 .

[14] Vishal Jain, Mahesh Kumar Madan, "Multi Agent Driven Data Mining for Knowledge Discovery in Cloud Computing", International Journal of Computer Science & Information Technology Research Excellence Vol. 2, Issue 1, Jan-Feb 2012, page no. 65-69, having ISSN 2250-2734.

[15] Kavita Arora, Dr. Kavita, Dr. Vishal Jain. (2020). A Study On Attacks In Mobile Ad-Hoc Networks. International Journal of Advanced Science and Technology, 29(8s), 279 - 289. Retrieved from http://sersc.org/journals/index.php/IJAST/article/view/10502

[16] J Ganeshkumar, N Rajesh, J Elavarasan, M Sarmila, S Balamurugan, "A Survey on Decentralized Access Control Strategies for Data Stored in Clouds", International Journal of Innovative Research in Computer and Communication Engineering, 2015

[17] J Ganeshkumar, N Rajesh, J Elavarasan, M Sarmila, S Balamurugan, "Investigations on Decentralized Access Control Strategies for Anonymous Authentication of Data Stored In Clouds", International Journal of Innovative Research in Computer and Communication Engineering, 2015

[18] VM Prabhakaran, S Balamurugan, S Charanyaa, "Sequence Flow Modelling for Efficient Protection of Personal Health Records (PHRs) in Cloud", International Journal of Innovative Research in Computer and Communication Engineering, 2015