Title: DOUBLE-RING SUPPORT FOR RUN-FLAT TIRE

Abstract: To provide an installable support ring inside nearly the whole cavity of the tire (20) without various complications in parts and procedures, a double-support ring (24) is designed by dividing it into two different annular pieces, one is installed inside the tire's cavity, the other is installed around the wheel rim. The tire's internal support ring (25), will set and fit around the rim's support ring (28). The rim's semi-flexible annular support (28) is having a geometrical holes (32) for solving and supporting physical requirements, the tire's inner support ring (25) is made of two annular flexible elastic sheets (26), with a curvature parallel to the tire's crown, and reaching the middle height of the tire, these sheets include an array of reinforced polyurethane pads (27). The design further supports the whole flat tire's side walls from a noticeable collapse to let it be driveable safely for longer distances and higher speeds than conventional types.

FIG. 1
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Double-Ring Support for Run-Flat Tire

Description of the Invention

Technical Field of Invention

This invention relates to a run-flat tire with a double support rings used as a light-weight fully supporting construction, for keeping smooth and comfortable vehicle handling for longer distances and higher speeds after the tire gets any of the multi-types punctures.

Background Art

Drivers have been waiting for the puncture-proof tire ever since Andre Michelin developed the first pneumatic (air-filled) automobile tire more than 100 years ago.

When a conventional tire is mounted on a wheel and inflated, the bead, which runs around the inner edge of the tire, presses against the edge of the wheel rim, providing an airtight seal and securing the tire to the wheel. The pressure of the air inside all four tires supports the vehicle's weight, drivability and braking. When a conventional tire is punctured, the sidewalls collapse, rendering the tire undrivable.

Tubed tires would leak the air directly when getting punctured, and the vehicle will be hard to drive or steer, the (tubeless) type will get the air leaked gradually, and so the vehicle will get gradually undriveable and hard to steer. Examples of tubed or tubeless tires are disclosed in G. C. Arey; F. O. Church; S. Khalil; D. M. Coddington et al.; and J. Kosanke, in U.S. Pat Nos. 2,334,893; 2,554,815; 2,680,463; 3,724,521; and 3,945,419 respectively.

But the problem in these constructions is that as the air leaks more, the safety decreases, and the probability of accident increases, in addition to getting the wheel rim damaged when the leakage gets high, these results are expensive in regard of human safety, and material and money loss, in addition to getting idle under the rain, or at night, or far away from urban areas.
As a solution, Tires and automobiles manufacturers put the ideas for designing a run-flat tires, which solved the upper problems, but created another problems.
The benefits of run-flat tires are: Increasing safety and convenience; can be temporarily driven; increase cargo space because they eliminate the need for a spare tire, jack, and tools; and they use conventional mounting procedures.
Run-flat tires are filled with air, but when punctured they depend on other means to support the vehicle. There are basically two types of run-flat tires:

1- Self-supporting run-flats. Most run-flat tires have specially reinforced sidewalls that support the weight of the vehicle when the tire deflates. Examples are disclosed in patents No.s US 7,448,422 and US 6,422,279 B1. This tire design can be used with conventional wheels and rims. Bridgestone, Dunlop, Goodyear, Pirelli, Yokohama, and other tire manufacturers make self-supporting run-flat tires.

2- Run-flat tires with support rings. In this type of run-flat, a support ring encircles the interior of the wheel and prevents the tire from collapsing on the wheel when it loses air. The only example currently in production is Michelin's PAX system, which employs a special alloy wheel, a rubber and polyurethane support ring, and a tire that are designed to work together, but such tires are expected to be potentially more expensive, and may require special mounting equipment. Further Examples of patented designs are disclosed in Patents No.s: US 4,773,461; US 4,324,279; US 4,293,017; 4,216,809.

Typically, run-flat tires can be driven with no air pressure for 50-125 miles at 50-55 mph. But run-flat tires of the self-supporting (reinforced) type suffer from steering slight pulling and vibration at normal driving speeds, because they depend on sidewall's stiffness to support a vehicle when a tire goes flat, they typically provide a harsher, noisier ride and poor handling than conventional tires.

Also the run-flat tires with support rings, suffer from a relative collapse of the tire towards the support ring, due to the installation procedure of the ring insert which requires an unavoidable space that need to be left in-between the support ring and the inner surface of the tire tread when the tire is fully flat, this causes
at puncture cases a harsher / noisier ride. Solutions were put to install a ring
covering all the tire cavity, but that would not work without extra laborious and
material complications which requires dividing the ring to hinged pieces, to
allow installing and removing the support-ring construction inside the tire's
cavity. Other solutions were offered by easily inserting a multi-tube inside the
tire cavity, but without contacting the tire's surface, then blowing the tubes, but
this type will lead to the failure of all tubes when the tire collapse towards the
tubes having inside its crown a vertical sharp metal.
For both types there is another disadvantage, both utilize air pressure at normal
driving conditions, but when they get punctured, they will be driven on a
substantially less air than their normal-rated-free inflation pressure. As a result,
when such tires are punctured and run flat in a wider, deformed condition, the
loads thereon are not properly balanced and pneumatically supported. The
components of such tires, such as the sidewalls and tread, are therefore
subjected to extreme stress and wear, and expected to get un-repairable, or
expected to be punctured once again.
In total, the support ring tires can be a major competent promising solution for
supporting the whole pneumatic tire if and only there is a design that can be
easily inserted fully to inside mostly the whole cavity of the tire, without the use
of complicated, laborious, heavy structures that need to be disassembled and
assembled before installation and after punctures, and without the use of
multiple tubes that will fail when a sharp edge penetrate the tire tread vertically..
The design in this invention, is based on this idea which may lead to a
reasonable change in the line of run-flat tires manufacturing industry, where
here such a design that fill most of the cavity of the tire, will allow the vehicle to
be driven for a further distance and at a higher speeds, with an improved
driveability, steering, braking, tire's durability, and easy removal and
installation.
Disclosure of Invention

Brief Description

As it is not easy to install and remove a ring support structure inside nearly the whole cavity of the tire without various complications, and as it is not easy to install such a design with saving the elasticity and flexibility, a double support ring is provided here, wherein the first is to be installed inside the tire's cavity, while the other is installed around the wheel rim.

When installing the tire around the wheel rim, the tire's internal ring support, will set and fit at the same time around the rim's ring support. While the rim's semi-flexible annular support is having a geometrical openings for solving and supporting all support ring issues and requirements, the tire's inner support ring is made of two annular flexible elastic sheets, with a curvature parallel to that of the tire's crown and reaching the middle height of the tire, these sheets include in-between them an array of separate reinforced polyurethane pads with a height a little less than 1/2 of the tire's height.

Both of the support rings will achieve the targets of easy installation and removal, supporting the whole tire's crown and side walls from a noticeable collapse to let it be driveable safely for longer distances and higher speeds.

Brief Description of Drawings:

FIG. 1: Illustrates a three dimensional view of the inner parts of a double-ring support run-flat tire.

FIG. 2: Illustrates a two-dimensional side cross-section of the geometry of the double-ring support.

FIG. 3: Illustrates a two-dimensional side cross-section of the engagement in-between the double-ring support.

FIG. 4: Illustrates a side cross-section view of the inner parts of a double-ring support run-flat tire.

FIG. 5: Illustrates a side cross-section view of another embodiment of the inner parts for the tire's cavity support ring.
FIG. 6: Illustrates a two dimensional view of the double-ring support for run-flat tire puncture handling case compared to another conventional tire reinforced side wall or support ring types.

FIG. 7: Illustrates a rough three dimensional view the for tire's cavity side support ring installation.

Best Mode for Carrying Out the Invention

In order to make it easy to carry out the invention, a detailed description of the parts of the invention supported with figures is provided here, where the figures of the main parts are arranged sequentially, each part has many features, we made it easy to read, by referring to each feature with a number included in the parts description text and in the parts numbering list, the numbering of parts features is indicated here by starting it sequentially from number 20, whenever a part feature appears in the text, it will be directly assigned its required serial number. As example in FIG. 1, the parts features are arranged sequentially from number 20 to 21, 22, 23...

As a modified run-flat tire (20) need to run for a longer distance at higher speeds with comfortable handling, at the same time it did not lose much of its air pressure at once, and to avoid a partial collapse towards a conventional supporting ring directly even after any minor penetration of the tire tread (carcass) (21), or being only supported at a reinforced tire with stiffener side walls (22), or tubed, or having a heavy construction... inside the conventional tire, where all of these are making the tire to be a temporarily semi-run-flat tire, and are solving part of the problem and creating others, a modified design filling the whole tire's cavity (23) for a durable lightweight, low price, nearly fully supported run-flat tire (20) is afforded here.

While all the major accepted and used designs in the prior inventions for run-flat tires (20) surrendered to the fact that these designs are limited by the speed, distance, type of repair, and poor handling issues, which will lead to loading the vehicle in a semi-curled (half flat) tire; the design of the double-ring support (24) run-flat tire (20) here is done to overcome the problems of prior art.
But as a design that collects between achieving these points and being capable to be inserted inside the tire's whole cavity (23) by passing the side walls (22) of the tire (20) that restrict the insertion of a rigid or semi-rigid support ring as one piece to inside the tire's cavity (23), and as this is impossible without dividing such design into a complicated hinged pieces and segments, the best design is to divide the ring support into two annular modified double-ring supports (24), and to insert the first flexible annular shaped piece (25), that could be tilted, bent and curled to allow its insertion towards the tire's carcass (21) inner surface inside the tire's (20) cavity (23), this can only be achieved through designing it basically from two elastic rubber sheets (26) enclosing in-between them an array of separate support pads (27) made of polyurethane to give it the elasticity simulating the air cushion compressibility inside a conventional pneumatic tire, but as these pads (27) height increases, they will be exposed to deformation, twisting, cracks, shifting sideways, and as a result of this limitation, the height of it should be a little less than 1/2 of the tire's (20) height.

The remaining annular piece (28) height should be specified carefully, knowing that the normal tire height in tubeless tires from the ground side when loaded decreases to roughly 85-90 % of the tire's normal height, this means to allow the tire to operate under normal operating conditions without being in touch with the double-ring supports (24), these supports (25, 28) heights should be considered to equal 80 % of the tire height, which is a little bit lower than the loaded tire height by 5 %. Now it is easily clear that if the tire's cavity (23) support ring (25) height is specified to be 40 % of the tire's (20) height, this will achieve the requirement that is reached at the end of the last paragraph.

Furthermore, the remaining 40 % of the tire's (20) height will be fairly enough to be considered also as the height of the second part of the support ring (28) that need to be installed around the wheel rim (29), such a height with little modifications on the geometry of the rim's (29) support ring (28), will allow the tire (20) to be installed easily around the wheel rim (29) using the repair shop normal tools, while at the same time the tire's support ring (25) will set and fit around its mating rim's (29) support ring (28), to be united as one support ring (24).
Such a design proves that the prior art tire's full cavity support ring limitations, restrictions and complications should not lead to abandon such promising basic ideas, but to develop it more, as it is already shown here and in the following texts.

To clarify the design in more detailed manner, it is started here by explaining the related geometry specifications for the rim's (29) support ring (28), wherein to facilitate inserting this support ring (28) around the wheel rim (29), this ring (28) should have the following specifications: a- To be rigid annularly and flexible radially, b- having a thickness of 40 % of the height of the tire (20), c- having its outer sides curved, d- having its base width (rim's (29) side) less than the width of the tire (20) enclosed in-between the beads (30) setting on the rim (29); that is to make it easy for the tire (20) to be installed on the wheel rim (29), without getting the support ring (28) blocking it from any side, such a design will provide a one part of the double-ring support (24) for a run-flat tire (20).

The results of the combination of both of the semi-flexible or semi-rigid double-ring supports (24), is divided into four:

a- Providing a design that would not let the tire's (20) crown (31) and side wall (22) to collapse a noticeable distance after any kind of puncture, b- Providing a lightweight practical one piece annular combination, and easy installable design that solves the complications related to installing a supporting design which need not to be divided into pieces radialy, while at the same time such one piece design is capable of approaching to near the tire's (20) carcass (21) inner surface,
c- starting the modified supports (24) here with what the other designs ended, and only used, but here with a design that will elongate the life of the tire (20) and smoothen the driveability of the vehicle as much as possible, by depending on an annularly rigid, radialy flexible design of the double-ring support (24).
e- giving the tire (20) the capability to stand more for higher speeds and longer distances, and keeping the chances for repairing the tire easily and fast and cheap in any new or old type puncture workshop.
This general figure will be more clear through the following detailed description of the figures, then the method of operation which follows, will describe how the mentioned design will work, when it is assembled.

Parts drawings description:

1- FIG. 1 illustrates a three dimensional view of the inner parts of a double-ring support (24) run-flat tire (20), wherein a cut is made in the tire (20) showing the arrangement of the supports (24) from the wheel rim (29) side towards the tire's (20) crown (31), first the support ring (25) appears consisting from two elastic rubber sheets (26) enclosing in-between them an array of separate support pads (27), this arrangement is curved from the tire's tread (21) and side walls (22) sides around the support ring (28) which has a height equals 40 % of the height of the tire (20), appears installed on the wheel rim (29) annularly and surrounding it, the tire's (20) cavity (23), which is here further includes the tire's inner support ring (25), wherein this support ring (25) sidewall and base is not in touch with the tire (20) side walls (22) and crown (31) inner surface, that is to prevent heat built-up in-between them under normal non-flat tire conditions.

2- FIG. 2: Illustrates a two-dimensional side cross-section of the geometry of the double-ring supports (24), with holes (32) made along the width of the rim (29) support ring (28), here the cross section of the rim's (29) side support ring (28) after making the holes (32) is divided into four, where each one is resembling part of a complete geometrical design of a suggested support ring (28) to be selected separately for use, these geometrical designs of holes which are oval (33), enclosed in-between elongated crossing waves (34), elongated curved rectangles (35), or elongated hexagons (36) are suggested and selected to achieve the followings:

a- A geometrical design of elongated curved shape that goes in parallel with the curvature of the support ring (28) annular curvature, to achieve an optimum load distribution and smooth rolling of the support ring (28), which will be reflected on the whole wheel improved performance at punctures cases.
b - The holes (32) are made in a solid rubber support ring (28), the holes (32) are having linings made from polyurethane material to achieve reinforcing the support ring (28) in the empty spaces, while at the same time its semi-flexibility will let the support ring (28) performance simulate the conventional pneumatic tire properties, at the same time the holes (32) will achieve savings on the material, and to save an empty space inside the support ring (28), to achieve a flexible calculated compression and expansion of the support ring (28) along its height.

c - To achieve a three dimensional symmetry of the material and load distribution along the support ring (28).

d - In another embodiment to provide a smooth curved space without sharp edges inside the holes (32) for an easy installation of reinforced semi-compressible rubber or metal curved sheets to support the support ring (28) tension and compression, in another way to support its rigidity and flexibility at the same time, which will help in handling and resembling the conventional tire performance and tasks.

e - To provide a wide expanded area, where the load distribution of the vehicle through the support ring (28) will translate to a minimized pressure.

f - A small minor holes (37) of a selected suitable geometrical shapes can also be done through the support ring (28) remaining solid matter to provide a further means of achieving the prior mentioned points, but in a less range.

Furthermore, the outer body of the rim's (29) support ring (28) is designed to achieve the followings: An inner base with the side edges curved not sharp, to help in sliding the support ring (28) over the rim (29) edges in order to let it set firmly around the rim (29), at the same time this will help in pressing and sliding out the support ring (28) from around the rim (29), even though it is designed for a permanent installment, since its material, design, and geometry, will help in using it after many and various run-flat incidents.

While the surface of the rim's (29) support ring (28) is curved to help in installing the tire (20) with its inner support ring (25) inside it, all around
the wheel rim (29) and the ring support (28), that can be achieved by starting pressing and sliding the tire (20) around the support ring (28).

3- FIG. 3: Illustrates a two-dimensional side cross-section of the engagement in-between the double-ring supports (24). To prevent sliding of the tire's (20) side support ring (25) on the rim's (29) support ring (28), an engagement in-between the two support rings (24) is provided, wherein a protrusion (38) extending from along a width of the inner surface of the tire's (20) support ring (25) towards the rim's (29) support ring (28) groove (39) at four places which run along the width of the support rings (25, 28).

4- FIG. 4: Illustrates a side cross-section view of the inner parts of a double-ring support (24) run-flat tire (20) inside the whole tire's cavity (23). The tire's support ring (25) even having a semi rigid pads (27) made of polyurethane, the base and top of the pads (27) which are enclosing them are a thin sheet (26) of elastic rubber bonded to the whole support pads (27) array surfaces, the sheets (26) which are flexible and can be curled, bent, and elongated to allow the space of the elastic sheets (26) in-between the pads lead the pads to tilt with it, these pads (27) are kept separate from each other through a calculated space distance, which will allow their tilting and curling with the rubber sheets (26) while removing or installing it inside the cavity (23), while at the same time they stay rigid and supporting the tire (20) at run-flat cases. Through this support ring (28) the air valve (40) appears penetrating in one way to inside the tire's (20) cavity (23).

5- FIG. 5: Illustrates a side cross-section view of another embodiment of the inner parts for the tire's (20) cavity side support ring (25), wherein oval spaces are made in-between the pads (27) radially. The geometrical shape of the pads (27) should not limited to the one in figures (1, 5), it also can be hollow, or having a metallic support embedded inside it with a flat wide ends and relatively thin from the middle. Furthermore, it need to be noted that such a design is curved from the external side in parallel with the tire (20) crown (31) inner surface, while it is curved from inside in parallel with the rim's (29)
support ring (28) external surface, these will provide a firm setting in-
between the double-ring supports (24).

1- FIG. 6: Illustrates a two dimensional view of the double-ring support (24)
run-flat tire (20) puncture handling case compared to another
conventional reinforced side support (41) or conventional support ring
(42) types, here it is clear that as the air of the tire (20) is leaked, for the
three types, the tire (20) crown (31) will collapse to inside, but it will be
directly supported by the nearby double-ring support (24) in the design
provided in this invention, this design offers support for the tire (20) even
when it releases air through its bead (30) side or valve side (40). These
two cases as shown in FIG. 6 (A, B) will not be handled by the
conventional support ring (42) designs and other side wall reinforcement
(41) designs, where in these designs a collapse of the tire crown (31) will
be noticeable, the tire (20) height will decrease to more than 1/2 of it,
making the tire (20) a semi-run-flat tire (20) not a run-flat tire (20) as it is
repeatedly called, such a case will loosen the beads (30) fitness from the
wheel rim (29), this will lead to slippage of the tire (20), deformation,
curling... all of these will lead to a limitation on the driving speed and
distance with poor driveability, and finally a damaged tire (20), the result
which is mostly avoided in when the design suggested in this invention is
used in handling the same case, so it is clear that the design in this
invention will not let the tire (20) carcass (21) collapses to the same
height which the other conventional designs fail to it directly, the
puncture situation with this invention will be the same as a tire (20) that
lost around 1 bar of its air pressure, tires that lose such amount of air,
which are handled daily, did not have a considerable effects on the
vehicle ride handling, at either normal or higher speeds for long distance,
from experience, the effects of such a loss of the tire's (20) pressure
appears after a month or more, so there is no noticeable tire's (20) crown
(31) and sidewalls (22) collapse, this will provide an opportunity for
driving at a moderate higher speed for longer distances with a
comfortable driving. Hence the age of the tire (20) will be increased, the
chances for repairing it become higher, the driveability is improved, the
driving speed and distance crossed are increased, and the vibrations are
decreased, which lead to more safety, while the wheel rim (29) is perfectly
protected from dents that result from a sudden partial collapse of the tire,
or a semi-run-flat tire hitting road humps or going in potholes as in the
case with conventional support rings.
Furthermore, it need to be noted that this invention offers a design that
can handle multi-punctures at the same time, with different bore sizes or
depths, while the prior mentioned designs, or even the multi-tube
designs, multi-air balls designs, tire's crown lubricants and sealants,
cannot offer such benefits and advantages.

Method of installation and removal;
The installation depends mainly on a double-ring support divided annularly
into two pieces to make it easy for installing it in the whole tire's cavity (23)
in comparison with the other support rings, the procedure will be as the
following:
Step 1: roughly as in FIG. 7 this step starts with inserting part of the tire's
(20) side support ring (25) (with pads (26)) from its edge to inside the tire
cavity (23), while the other remaining outer part is easily bent and tilted
inwards, and then pushed down then to inside the tire's (20) cavity (23).
Step 2: The other part of the double-ring support (24) that need to be fixed
from the wheel rim (29) side, is tilted little to let the edge of the rim (29) goes
to inside its bore, then the support ring (28) is tilted back towards the rim
(29), where it is pushed and slid down around the rim (29), furthermore, the
support ring has a chamfer (43) (Fig. 4) at its inner edge going annularly to
help in slising and fitting it to the rim (29).
The tire (20) with its support ring (25) is then fitted to the rim (29) with its
support ring (28) following the conventional procedures, considering mating
and engaging the four protrusions (38) and grooves (39).
Disassembling the upper mentioned two pieces is easily carried out
by reversing the mentioned steps using the normal tire (20) repair
workshop's tools.
Industrial Applicability

In addition to all mentioned reasons before about the important needs for a double-ring support for run-flat tires and the modes for carrying out it, the subject invention has the following benefits:

1- Easily produced using simply designed manufactured molds where the elastic rubber, polyurethane are injected in to form the annular sheets and the (pads, rim's support ring) respectively.

2- Easy usage: using simple parts, it minimizes the time for installing and removing them.

3- Workable: using the right places for installing them.

4- Compact, lightweight, built-in, safe, and attractive design.

5- Improves run-flat tire comfortable drivability, handling, safety, and keep it repairable, without the need of replacing the double-ring support.

6- As it keeps the height of the tire nearly the same from the road surface, unlike other conventional run-flat tire designs, the height kept by the double-ring design here, will keep the rim far away from being exposed to deformation as the tire pass a hump or run in a road hole.

7- This design did not require any modifications on the prior wheel rims or tires.
Parts Drawings Index:

20 Tire.
21 Tread (Carcass).
22 Side wall.
23 Cavity.
24 Double ring support.
25 Tire side support ring.
26 Elastic rubber sheets.
27 Supporting pads.
28 Rim side support ring.
29 Rim.
30 Beads.
31 Crown.
32 Hole.
33 Oval hole.
34 Hole enclosed in elongated crossing waves.
35 Elongated curved rectangular holes.
36 Elongated hexagonal holes.
37 Minor holes.
38 Protrusions.
39 Grooves.
40 Air valve.
41 Reinforced side wall.
42 Conventional ring support.
43 Chamfer.
Claims

1. A double-ring support (24) for run-flat tire (20) compromising:
   two different pieces of annular support rings.
   a support ring (25) installable inside the tire's cavity (23).
   a support ring (28) installable around the wheel rim (29).
   a two annular flexible elastic rubber sheets (26), with a curvature parallel to the tire's crown (31), and reaching nearly the middle height of the tire (20), these sheets include an array of reinforced polyurethane pads (27).
   wheel rim's (29) semi-flexible annular support (28) having holes (32) along its width with elongated geometrical shapes.

2. The double-ring support (24) in claim 1, wherein the height of the tire's cavity (23) support ring (25) is 40 % of the tire's height.

3. The double-ring support (24) in claim 1, wherein the height of the rim's support ring (28) is 40 % of the tire's height.

4. The double-ring support (24) in claim 1, wherein the tire's cavity support ring (25) elastic rubber sheets (26) are having a noticeable flexible three dimensional movements in-between the support pads (27) to let the whole support ring (25) be flexible in tilting and bending.

5. The tire's cavity support ring (25) in claim 4, wherein its tilting and bending properties are helping in installing it inside the tire's cavity (23) far towards the carcass (21) and side walls (22) inner surfaces.

6. The double-ring support (24) in claim 1, wherein the tire's cavity support ring (25) pads (27) are either solid or reinforced from inside by metallic bars with wider ends than the middle.

7. The double-ring support (24) in claim 1, wherein the tire's cavity support ring (25) pads (27) geometry is cylindrical with wider ends than the middle for helping in force and load distribution.

8. The double-ring support (24) in claim 1, wherein the rim's support ring (28) holes (32) are extending from side to side and having a geometrical cross sectional shapes either oval (33), or enclosed in-between elongated crossing waves (34), or elongated curved rectangular (35) holes, or elongated hexagonal (36) holes.
9- The holes (32) geometrical cross sections in claim 8, wherein it is elongated and curved in parallel with the wheel rim (29) and tire (20) circular curvatures, to help in achieving an optimum load distribution, smooth rolling of the support ring (28) and the run-flat tire (20), a three dimensional symmetry of the material along the support ring (28), and to provide a wide expanded area, where the load distribution of the vehicle through the support ring (28) will translate to a minimized load.

10- The double-ring support (24) in claim 1, wherein the rim's support ring (28) holes (32) are reinforced by linings of polyurethane or compressible metallic sheets, to simulate the flexibility, elasticity and compressibility of a conventional pneumatic tire.

11- The double-ring support (24) in claim 1, wherein the tire's cavity (23) support ring (25) is having four protrusions from side to side (38) facing four grooves (39) in the rim's (29) support ring (28) for mating and engaging both support rings into one double-ring support (24).

12- The double-ring support (24) in claim 1, wherein it is divided into two annular pieces of support rings (25, 28), to help in installing it easily inside the tire's whole cavity (23) without various complications in parts and procedures as in conventional supports having similar target.

13- The double-ring support (24) in claim 1, wherein the rim's support ring (28) is having a chamfer along its inner annular edges for helping in installing and sliding the support ring (28) around the wheel rim (29), while it is curved from its outer surface edges to help in fitting and setting inside the tire (20) and the tire's cavity (23) support ring (25).

14- The double-ring support (24) in claim 1, wherein it will fill the whole tire's cavity (31) from ground side, handle multi-punctures of different sizes, and support the whole flat tire's side walls from a noticeable collapse to let it be driveable safely for longer distances and higher speeds than conventional support rings or reinforced side walls types.