

SELF-REINFLATING TIRE

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Field of technology

The invention concerns the device for transport of air in the tire, consisting of a hollow compressible channel located along at least a part of the tire perimeter and fitted with at least one end opening into the tire and at least one end opening into the external environment.

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Current state of technology

Different solutions for maintenance of pressure in the tire under operation are used in technical practice. For example, it is a tire provided with air feed connected to an external pressure source. Drawbacks of these solutions are extensive purchase costs and complexity of the device itself.

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Self-reinflating tires are in use too. For instance, an exemplary self-reinflating tire is described in patent applications CZ PV 2002-1364 and CZ PV 2001-4451. The air feed chamber is located in the tire wall or next to it. With the tire deformation advancing by rolling, the chamber is periodically completely pressed down or broken crosswise; advancing chamber compression down to zero cross-section pushes the medium contained within the chamber ahead, leaving a vacuum behind. A hose-shaped chamber placed in the tire wall or next to it, along the tire perimeter, works as a peristaltic pump.

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Principle of the invention

In the device for transport of air in the tire or close to it, consisting of a chamber in form of a hollow compressible channel, placed along at least a part of the tire perimeter, according to this invention the above-mentioned drawbacks have been eliminated to high extent. In essence, a ring is attached to the inner side of the chamber with the distance of its outer side from the tire rotation axis equals 1 to 1.1 multiple of the distance of the chamber bottom side from the tire

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rotation axis.

Another type is the device for transport of air in the tire or close to it with the channel fitted with a valve on at least one its input.

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The channel can be interconnected with the tire tube and/or backup air tire tube and/or case and/or base by at least one its end.

Another type is the device for transport of air in the tire or close to it fitted with a control
10 element interconnected with a sensor located in a completely separated space formed by a sealed bag, which is, from outside, at least partly under pressure of air in the tire and/or case and/or base.

The space for the chamber can be made by inserting a cradle between the tire and rim.

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Yet another type is the device for compression of the air in the tire or close to it with the chamber and/or any pump inserted between two coupled wheels.

The chamber and/or any pump in the tire can be placed on a base. Effectively, the base consists
20 of a hollow disc. Effectively, the base has its opposing walls joined which defines its cross-section. The base can be a rigid and/or collapsible system and/or spring and/or spring material. The base completely or almost completely prevents the air exchange between the two parts of the tire pressure space separated by it. Effectively, the base is fitted with at least one valve and/or vent interconnecting the base of the separated part of the tire pressure space.

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Another subject of the invention is a device for transport of air in the tire or close to it with a chamber with shape memory placed in the tire wall or close to it and a power generator placed at the end of the chamber.

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Effectively, the ring is placed on the air tube and/or bag placed inside the tire and filled by air. Effectively, the chamber end is interconnected with the air tube and/or bag and/or base and/or case. The chamber end can be fitted with a control element.

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Effectively, the valve is a three-way valve with its ends interconnected with the external environment and the internal space of the tire, where one end is provided with a valve, the next

end is connected to the chamber with shape memory, and the last end is interconnected with the closure element. Effectively, the channel is, at least in its part, formed by a lengthwise segmented chamber provided with 4 openings, where the longitudinal divisional plane is movable in the direction of deformation of at least one of the segmented parts of the chamber and at least one opening is provided with a valve and/or at least one segmented part of the chamber is permanently blocked by the deformation. The lengthwise segmented chamber can be placed in the wall and/or close to the wall of the tire and/or air tube and is provided with 3 openings into the tire and one opening into the external environment or with 3 openings into the external environment and one opening into the tire and/or the end of one longitudinal part of the chamber is interconnected with the end of the second longitudinal part of the chamber. The channel and/or chamber can be made by at least one of two flexible tubes placed next to each other, where one has the outer diameter equal to the inner diameter of the other tube and/or one is, at least partly, inserted inside the other.

Effectively, the chamber is in form of a curved hollow channel with at least one its outer wall at least partly formed by at least a part of two areas lying in the longitudinal direction of the chamber, containing the angle $\alpha = 0$ to 120° , while it is true that if $\alpha > 0^\circ$ it is located on the contact edge of these areas situated on the further side from the center of the area of the chamber cross-section.

The ring can be of a variable length. Effectively, the ring has a T-, I-, or O-shaped section or alike.

A ring or pressure transmitter acts on the chamber wall with less area than the area from which the tire pressure acts on it from the opposite side.

Another subject of the invention is a tire and/or rim and/or air tube and/or base and/or chamber containing adhesive and/or sectional lock to interconnect with any element from the group of tire and/or rim and/or air tube and/or base and/or chamber.

Yet another subject of the invention is a tire and/or rim adapted for placing of any device according to the previous claims.

Another subject of the invention is a tire interconnected with a coil and/or magnet.

Overview of figures in drawings

- 5 The invention will be described in more details on particular examples of different design types using the drawings attached, where figures 1 to 11 show schematic views of different arrangements of the invention.

Examples of the arrangement of this invention

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For illustration, the invention is described below on individual examples of its arrangement.

Example 1

- 15 The chamber 1 for adjustment of pressure in the tire P is created inside the tire P alongside at its tread part in the space defined by the wall of the tire P from the top and by at least a part of the ring OK from the bottom with its length defined in such a way that an unloaded part of the ring OK is away from the wall of the tire P. It means if the wall of the tire P lies, for example, on the radius of 50 cm and the ring OK on the radius of 49 cm there will be a 1cm high space
- 20 between them. Such a space between the ring OK and the wall of the tire P will be thereafter called PO. A chamber K can be placed within this space PO. A loaded tire P bears against the chamber K in the point of load deformation and closes it crosswise under the condition that the deformation of the tire P overcomes the whole cross-section of the chamber K. This allows the right function of the chamber K for the inflation of the tire P; the place of closure moves along
- 25 the chamber K and pumps the air towards the inside of the tire P thus reinflating it. The chamber K can fill up the entire aforementioned 1cm space, or it can be smaller and adjoin the ring OK, wall of the tire P, or lie in between them, alternatively it can be an integral part of the tire P, ring OK, or both. If the chamber K does not fill up the entire cross-section of the aforesaid space PO the remaining volume of this space PO may be effectively separated from
- 30 the tire pressure space. Alternatively, this space is vented outside the tire P or it can be interconnected with the inlet of the chamber K and the air is exhausted from it at the beginning and pumped into the tire P. If the deformation in this example becomes bigger than 1cm the ring OK likewise the air tube D of the tire P will evade this deformation towards the inside of

the tire P.

Example 2

Figure 1 shows a section through an non-deformed tire P, ring OK placed near the inner tread
 5 part of the tire P and chamber K placed between the ring OK and the wall of the tire P. Figure
 1b shows the tire P deformed and chamber K closed crosswise. While the chamber K on fig. 1a
 is placed within the space PO and at its side at the ring OK, the chamber K on fig. 1c is placed
 within the space PO on the opposite side, at the tire wall. The figure 1d shows a similar
 situation as fig. 1b but with the air tube D added.

Example 3

Because the ring OK could move freely inside the tire P, thus disabling proper functioning it
 needs to be fixed on the right place. One option is to place the ring OK onto the air tube of the
 tire P. The inflated air tube D adjoins the walls of the tire P; only in point of mounting of the
 15 ring OK the air tube D does not adjoin the wall of the tire P but the wall of the ring OK thus
 holding it in place. Because the main task of the ring OK in this case is to define the maximum
 diameter of the air tube D in point of the ring OK and set the space PO for the chamber K or
 the space of the chamber K itself the ring OK can be made of e.g. textile, only it must have
 clearly defined maximum circumference of the ring OK which will ensure its sufficient
 20 distance from the wall of the tire P, at least in a part of its perimeter. This has already been
 shown and described in figure 1a depicting a section through a loaded tire P, ring OK, and air
 tube in point of placement of the ring OK and in figure 2a depicting the same situation only in
 cross-section. Likewise, the figure 2a shows a cross-section of the situation from the fig. 1b in
 point of the load where the chamber K is closed crosswise by the load deformation section of
 25 which can be seen in fig. 1b.

To enable reinflation on at least same or slightly higher pressure than the pressure in the tire P
 must be reached inside the chamber K between the place of its deformation and the output from
 the chamber K into the tire P and an under-pressure must be reached on the opposite side of the
 30 deformation in the chamber K, which will allow additional intake of air from the outside of the
 tire P. This must be ensured by forces acting on the walls of the chamber K causing its closure.
 So there must be a sufficient pressure of the ring towards the chamber K. Whereas the pressure
 of the air tube D and thus also the pressure of the tire P act on the ring OK from one side and a

same or just slightly higher pressure of the air in the chamber K from the other side this can be ensured e.g. by the mere pressure of the air tube D on the ring OK, alternatively enhanced by the centrifugal force acting on the ring OK in direction of closure of the chamber K. If this is not sufficient the ring OK can be made of more rigid material where its pretension will further act in direction of closure of the chamber K. Likewise, the area which the pressure of the tire P acts on can be enlarged for this purpose compared to the area by which the pressure of air compressed in the chamber K will act against it so that the total force in the direction of closure of the chamber K is greater than the force pointing against the closure of the chamber K.

The chamber K must be connected to its input and output, or to the control element ideally placed at the rim. So interconnecting interfaces need to be created. These must be through-going, for the output from the chamber K they can keep their throughput because there is same pressure or overpressure against the pressure of the tire P inside them, however, on the inputs an under-pressure will occur inside the interfaces which could collapse their walls together and disable the air flow by means of it or make it more difficult. Therefore it is advisable to use interfaces with a defined cross-section ensured by the shape stability of their walls so that they can withstand the ambient pressure, that is the pressure of the tire P. The air flowing upon their partial collapse could also build up excessive heat which is undesirable. The interfaces can be placed in a recess in the wall of the tire P or air tube D.

The chamber K with the ring OK can be integrated into the air tube D, which would make both its manufacture and assembly easier.

The ring OK can have an adjustable length; thus it will stretch or shrink depending on the diameter of the tire P into which the ring OK with the chamber K is being placed. One ring OK with the chamber K, alternatively the air tube D with ring OK and chamber K can then be used for different diameters of tires P, with only the length of the ring OK adjusted each time. The ring needs not necessarily be an independent part, the chamber K itself, with a defined length in point of contact with the air tube of the tire P, can take over its task.

Figure 3a shows the whole system in one of its simplest design types, intended for a bicycle in this example. The figure shows a unrolled bicycle tire in the complete cross-section and in the part of the length of tire P and rim 7, where the chamber K is integrated in the bicycle tire. The

chamber K begins inside the 3-way valve V which is located on the rim 7, then it continues with the side wall BS1 of tire P into the tread part BC of tire P, which copies the whole perimeter of the tire P and returns to the rim 7 along the side wall BS2 of tire P where it opens into the internal space of tire P. The chamber K in this case needs not continue as far as back to the rim 7 as is shown in the figure but can open into the internal space of tire P already by the tread BC. The broken arrow shows internal air circulation from within the tire P through the control element R and input V3 of the 3-way valve V into the chamber K, by which it is moved mainly along the tread back into the tire P. Only in an underinflated tire the input V3 is closed by the control element R; however, the air keeps to be drawn out of the space of the 3-way valve V, in which vacuum generates and which draws in the air from the external environment O through the non-return valve JV until the input V3 is unblocked by the control element R. This element can be controlled automatically or manually. The whole assembly in this figure simply consists only of the chamber K interconnected with the control element R and the non-return valve JV.

Example 4

Another way how to fix the ring OK is to set it from the walls of tire P using the walls of chamber K. The chamber K thus fills up the space between the ring OK and wall of tire P while the ring OK in point of deformation of the tire P pushes against the chamber K because of its pretension, which can be set by the rigidity of the ring OK or by the increased rigidity of the walls of chamber K aside from the point of deformation of the chamber K. The tire P deforms the chamber K in a relatively short section of its length and thus, even though the wall of chamber K collapses in point of deformation and closes down, the rest of the chamber K will hold the ring OK in the right distance thus helping to increase the rigidity of the ring OK in point of deformation. This can be further assisted so that the chamber K has a sufficient lengthwise rigidity which will prevent the connected ring OK from offset. The rigidity of the ring OK preventing its deflection can be increased by making it T-shaped or alike.

Because in this case the pressure within the tire P acts on the external walls of chamber K it could collapse towards the ring OK along the whole length of the chamber K and this chamber would not function. This can be prevented if the chamber K is made with sufficiently rigid walls or with pretension of its walls or if it is connected with the tire P, where the chamber K wall touching the tire P wall is glued to this wall or is integrated in it or made as a part of the

tire P directly during its manufacture.

The figure 4a shows an exemplary design of the chamber K with pre-tensioned walls stretched between the wall of the tire P and the ring OK in point where the chamber K is not loaded by the deformation of the tire P. On the contrary, the figure 4b shows the beginning deformation of the tire P where the walls of the chamber K start to collapse due to the pressure between the tire P and the ring OK and also due to the pressure of air in the tire P, which is ambient to the chamber K in this case. Figure 4c shows a fully closed chamber K where the gray side walls are collapsed towards the chamber K center. Figure 4c shows a white residual of an unclosed space between the walls of the chamber K, nevertheless, it is only so as to show the side walls of the chamber K folded down between the ring OK and the tire P wall. In practice, the side walls can be negligibly thin, or a recess in the ring OK or in the tire P wall can be made for them, or the folded walls themselves can fill the empty space between them if their common "folded" length is equal to their original distance. All the walls of the chamber K will thus bear on themselves and seal the chamber K hermetically. If the chamber K is made independent on the tire P it can be attached to the tire P, apart from the aforementioned gluing, also using e.g. a sectional lock created on the tire P wall. Effectively, the upper wall of chamber K can be created on a different pre-tensioned ring copying the tire P wall, fixed to the tire P or not. In practice, the height of the chamber K can be in the range of millimeters or even tenths of millimeters, which will make the pretension of chamber K side walls even easier. These walls can be tensioned up even by a mere pressure difference between the pressure inside and outside the chamber K.

The figures 4 show the width of the ring OK, which is affected by the tire P internal pressure from one side, apparently bigger than the width of the chamber K acting on the ring OK from the opposite side. This difference can ensure that the force pointing towards the closure of the chamber K was always higher than the push-away of the ring OK from the chamber K and its non-closure. Effectively, the whole side of the ring OK pushing on the chamber K is hermetically isolated from the inside of the tire. This hermetically isolated part can have a breather.

Despite the chamber K opens into the tire P through its output by one its part where the deformation has not yet occurred a light overpressure against the tire P can be generated within

the chamber K. In fact, this will occur there in raised speeds. It can also happen if the output into the tire P is fitted with a non-return valve because of the resistance of this valve. If this overpressure was desirable but not sufficient it can be increased by throttling the output of the chamber K. The overpressure allows the walls of the chamber K to expand evenly outwards the chamber K as in fig. 4d.

Effectively, the chamber K can be made in such a way that it gets closed by deformation in two points at once near both its input and output. This will ensure the enhanced performance of the chamber K in this example because otherwise the chamber K would be filled by the air from the tire P at least once per turn, which would have to be first evacuated from it in every turn and only then a sufficient underpressure would occur so as to draw in the air from the source. However, if the ends of the chamber K are close enough to each other so that they both get closed by the deformation at once or if the ends of the chamber K overlap a constant underpressure will be generated in the input of the chamber K. In the application as well as in this example we describe mainly a chamber K provided with a valve in the input from the external environment, with the inner air circulation but the chamber K with a valve in the output into the tire P would behave in a similar way. For the sake of simplicity, the examples do not describe all versions of air circulation.

Example 5

The chamber K can be made independent and it can be placed between the tire and air tube. Figure 5a shows a chamber K located on an unrolled outer area of the air tube with its components fixed on a strip of material ST where this strip ST is continuous along the whole wheel perimeter in the tread part BC, functioning as the ring OK. The strip ST is placed between the air tube D and the tire-casing P and it is fixed when the tube D is inflated. The input and output from the chamber K into the tube D can be solved like in fig. 3a, i.e. leading directly into the tube D, nevertheless a case SC is added in fig. 5a which can have two functions. The first one is shown in fig. 5a: The case SC protects the components and their placement, by the rim 7 in this instance, and interconnects the output from the chamber K and the input V3 with the interior of the air tube through a single output VSC. The other important function, which is not shown in this figure but in fig. 6a can be separation of air circulation from the internal space itself of the tire P or air tube D. In such a case the output VSC would be provided with a valve that would carry air from the case SC only if the tire P is underinflated.

The case SC would then be a separate pressure space with a maintained preset pressure and the case SC would then function as a compressed air reservoir. It has the advantage that if the chamber K or its components are damaged it will not let the air of the tire P out. Also if the chamber made in this way leaks the air into the external environment from some reason it does not need to be of a too tight design. The case will pressurize back to its preset value when the wheel starts moving. This can be beneficial especially in case of the external circulation when the input and output of the chamber open into the case SC and the case SC is also interconnected with the external environment O and the output of the chamber K is rerouted directly into the tire P only when it is underinflated. The case has inside itself the pressure equal to the ambient pressure i.e. 1A, and the air circulates only between the chamber K and case SC and the case SC sucks in the air from the ambient O only when the tire P is being inflated. A valve can be placed between the case SC and the ambient O but not necessarily; there is not a major suction from the external environment O into the case SC until the inflation starts. Such a design will prevent constant pumping the ambient air through the chamber K along with its contaminants. The width of the chamber K and ring OK is relatively negligible and the air tube walls will wrap it and will set themselves against the tire inner wall. If the chamber K or ring OK were wider the air tube would expand towards the sides rather than upwards thus decreasing the diameter of the tire P which would then leave no space for the chamber K. This can be prevented by the above-mentioned narrow chamber, profiled wall of the tire P or ring OK in point of contact with the tube and tire, or by placing the tube into the casing which would define its inflated section and leave space for the chamber K between the tube and tire.

The chamber K can be made quite simply between the tube and the wall of the tire P so that the chamber K will be defined by the wall of the tire P from the top, by the ring OK from the bottom and sealed by the side rings SO from the sides. The air tube D will bear on both the ring OK and side rings SO which will set them and at the same time it will push the side rings SO to the wall of the tire P. Pressing the side rings SO on the tire P wall will seal these components and disable air leak from the chamber behind the side rings. The condition for sealing is only a higher pressure between them than the pressure of air compressed in the chamber K. Again, this pressure can be reached by pre-tensioning the side rings SO against the tire P wall and/or enlarging the area of the side ring on which the air tube D pushes in the direction of pressing against the tire wall. The figure 4a shows the chamber K made in this way where the contact

area of the side ring SO with the tube is larger than the contact area of the side ring SO with the tire P wall.

Example 6

- 5 The interfaces can be integrated in the wall of the tire P if they are manufactured together with the tire P; they can also be glued to the tire P wall, run in mounts designed for this purpose or they can be fixed by the pressure between the air tube and tire casing. Likewise they can have their own side rings SO which will define their volume as mentioned above to create the chamber. The role of air tube D can be assumed by rubber layer, thin foil, membrane,
10 breathless textile or any other material which will, at least partly, separate the pressure space of the tire P from the casing of the tire P. Such a strip of material can also, for example, copy the chamber K lengthwise and make an airtight connection with the wall of tire P.

- This design has an advantage that the air flowing through the chamber K and/or around it cools
15 down the tire in every rotation. If the ambient of the chamber K is not a part of the pressure space of the tire P it can be vented or the air can be exhausted from it through the chamber K when the pumping starts which will decrease the pressure around the chamber K for the inflating period thus increasing its rigidity in an opened state.

- 20 From the point of view of pumping the air by deformation the chamber K must not always get hermetically closed by the deformation, it is only necessary that a sufficient amount of air, or any other gas contained within, is evacuated from the chamber K in order to create vacuum during deformations or a pressure lower than the pressure of the source, which provides the gas, for example the ambient of the tire P.

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Example 7

- If the chamber K is made separate from the tire P and its top wall in point of contact with the tire P wall or even the rest of the chamber K ambient can be provided with soft rubber or foam etc. or with an inflated ring or pad which will absorb both lengthwise and lateral vibrations
30 between the chamber K and the tire P wall or the forces causing a temporary mutual lengthwise or lateral shift between the tire P and chamber K and at the same time it can define the distance of the chamber K from the tire P.

Example 8

The patent application PV 2008-97 describes the device for adjustment of pressure in tires consisting of a chamber with shape memory (K) and a valve. The valve (V) is a three-way valve with inputs interconnected with the external environment (O) and the tire internal space (P), where one input (V1) is provided with a valve (JV), the next input (V2) is connected to the chamber with shape memory (K), and the last input (V3) is interconnected with the closure element (R).

This device allows, apart from others, internal or external air circulation between the chamber K and the ambient of the tire or between the chamber K and the internal space of tire P. Apart from reduced stress of the chamber K and associated components due to the fact that the pressure inside the chamber K is relatively constant for most of its life, this allows to eliminate ineffective capacities in case the chamber K is made in such a way that it closes both at its input and output simultaneously at least once in a revolution. For the chamber K made in this way it does not really matter how big are the volumes of the interfaces because the chamber K will empty these interfaces at the moment of pumping and create a permanent vacuum or overpressure on its input. This principle has been mentioned in the Example 4 of this Application. The device according to this Application will significantly show this advantage for the reason that the chamber K placed at the tread is relatively far off the rim and interconnecting interfaces will be relatively long and with big inner volume.

Example 9

The tubeless tire P can contain a chamber K which opens into the backup tube D (or any other closed contractible or collapsible bag) by its end. If then there is an air leak from the tire P the chamber K will reinflate the tube D which will gradually fill up the volume of the tire P and keep it drivable even in case the tire P is damaged and leaking.

For example, the contracted air tube can be wound up on the rim which will then inflate only when the tire P is damaged. Such an exemplary design is shown in fig. 6a where the output VSC from the case SC is interconnected with the non-return through-put valve VP into so far uninflated tube D represented here by the balloon.

Because an undamaged tire P typically leaks by several percent in a month, and in this case, the

gradually inflating tube D would be inappropriate because a half-inflated tube D could, for example, flutter inside the tire P, this can be prevented in several ways. The air tube D can be provided with an opening leading into the tire P where the tube D is being reinflated with the air compensating the general leaking of the tire P and/or air flows through the tube D during the internal circulation and this air escapes from the tube D through the opening into the tire P. Because the tube D is pre-tensioned it itself tries to get rid of this air and push it out into the tire P. Only if the tire P leaks with a higher rate and reinflation then takes a longer time the air from the tube D will not make it into the tire P in time and the tube D will then fill up the whole inner volume of the tire P. The size of the opening from the tube D into the tire P can be predefined or it can be controlled or closed by any control element, throttle valve or closing valve, or by the pressure inside the tire P so the throttling of this opening when more air comes into the tube D than it leaves into the tire P through the opening the air tube D will cause reinflating.

Effectively, the control element controlling the opening between the tube D and tire P can be the same control element which closes the last input V3 of the 3-way valve V. This element can thus close both the input V3 and the opening from the tube D into the tire P in one go or it can be an two-position controller which only closes the input V3 when the pressure is low and leave the opening from the tube D into the tire P open; when there is a major decrease in pressure in the tire P it will close the opening from the tube D into the tire P too.

Even the case SC itself can consist of the contracted tube D. Such an example could be described using the figure 5a where $SC=D$ and if the tire P leaks faster than being filled through the output VSC (the rate of which is given by its throughput, resistance, and/or throttling; alternatively it can be fitted with a valve) the tube D will be expanding until it fills up the whole volume of the tire P. If the output VSC then closes the tube D will fully replace the sealing function of the tire P.

Example 10

Likewise, the control element can control the air inlet of the tube D. In case of properly inflated tire P the air circulates between the tire P and chamber K or between the external environment O and chamber K. Only when the closure element R activates and the input V3 closes the air, originally flowing from the chamber K into the external environment O or into the internal environment of the tire P, will be redirected so that it flows directly into the tube D. Again, the

closure element R can be a multi-position/multi direction element which directs the air from the chamber K into the tire P except the tube D in little leaking and only for major and/or faster leaking it directs the air from the chamber K into the tube D.

5 Also the closure element R can, in case of internal circulation in major leaking, first only redirect the output from the chamber K into the tube D while the input of the chamber K stays opened into the tire P and first the already compressed air is just shifted from the tire P into the tube D and only after that the input of the chamber K will close temporarily or permanently and if the tire P is still underinflated it will continue to draw air from the ambient O through the
10 non-return valve and the chamber K into the tire P. Such repumping of air is advantageous because the chamber K has a set working volume and repumping of e.g. 1 liter of air under the pressure of 3A from the tire is more advantageous than repumping of 1 liter of air under the ambient pressure of 1A from the external environment O.

Likewise in case of external air circulation when in a properly inflated tire P the air only moves
15 from the external environment O into the chamber K and back and for a small drop of pressure the air can be drawn in from the external environment O through the chamber K and then through the non-return valve directly into the tire P or tube D which can again be provided with an opening interconnecting the tube and tire P. Only in a major leak the air from the chamber K can then be rerouted directly into the tube D. Also in this case, the chamber K suction can be
20 first redirected by the control element R so that the compressed air is first repumped from the tire P into the tube D and only then reinflated from the external environment O. The control element R can be more than a two-position controller depending on how many combinations need to be used.

25 Example 11

To function properly the control element must be at least partly placed in the environment, which it controls in terms of pressure. If the pressure inside the tire P drops rapidly and the sealing function of the tire P is replaced by the sealing function of the tube D it is advisable to interconnect the control element R with the inner environment of the tube D. This can be
30 achieved by placing the control element R into an isolated space interconnected with the internal space of the tire P. Only if the sealing function of the tire P is replaced by the sealing function of the tube, or there is a rapid or significant air leak from the tire P this interconnection will interrupt and it will be replaced by the interconnection of this isolated

space with the tube. Until this moment, the isolated space with the control element R can be only interconnected with the tire P or with both the tire P and the tube. This moment and the change of interconnection can be set and initiated directly by the control element or also, for example, by the inflation the tube D up to a certain set value when the wall of the tube D
 5 mechanically changes the interconnection of this space. Effectively, this space can then be interconnected with the opening from the tube D into the tire P where this space will also get separated from the inside of the tire P after the opening closes, the interconnection with the tire will stay, however.

10 If the control element is controlled by electronic means based on data from sensors, independent sensors can be placed inside the tire and the tube, the control element will only be controlled by the sensor located within the sealed environment. However, the sensor can be placed even in a completely separated space, for example, in a sealed bag, which, at least partly, is pressed by the air in the tire P or by the wall of the tube D when it gets inflated and
 15 fills up the inner space of tire P.

Sensors for readout of the pressure are becoming standard equipment of modern cars. Because the capacity of the chamber and thus also the capacity of the pump per rotation as well as rotation speed are known it can be defined after the start of leaking for example whether the tire puncture is too large and the chamber K can then compensate it only for a limited period of
 20 time. In this case the system can advise the driver to stop on a safe place or inform the driver about the actual driving range. If the sensor is placed inside the tire off the backup tube and the pressure drop is slow the system will know the reinflation rate of the tire and will find out how much time the tube will need to take over the sealing function of the tire. Again, if the system determines that the chamber will not compensate the leaking sufficiently it can inform the
 25 driver about this in advance. If the tire is punctured along with the base with seams or the backup tube with seams the sensors will detect the drop in tire pressure and then an impactful increase at the moment when the seams rip. The pressure will then start either drop or increase and stop when it will reach the preset pressure. When a pressure drop occurs the system will determine from its rate whether the tube can be reinflated in time or not. The sensor and/or
 30 system can be interconnected with the reference space or it can retrieve information about opening of the chamber non-return valve which indicates reinflation or from a different chamber segment from which it gets additional information, for example, that the system has started to reinflate, what is the difference between the pressure of the reservoir space and the

tire pressure etc.; thus it can work properly even without information about the wheel revolutions, or it can determine this information by itself.

Replacement of the sealing function by the tube can be indicated to the driver or rider for example by electronic means or even optically when for example the tube D that is being reinflated or the control element or disconnection of the tire P from the space of the control element placement will slide out a visible indicator from the rim or the wall of tire P can be provided with a transparent window on which the visible wall of the tube D presses etc.

- 10 The chamber K mentioned in the examples above is placed by the tread of the tire P, however, it can also be placed anywhere where the distance of the walls of tire(s) P or loaded rim changes.

Example 12

- 15 The space for the chamber K can be made by inserting a cradle HR between the tire P and rim 7 as in figures 7a to 7c. The figure 7a shows the assembly without the cradle, figure 7b then the tire P loaded by deformation with the cradle HR, and figure 7c shows an unloaded tire P with the cradle HR. A space has been created between the tire P and rim 7 with the use of the cradle HR where the deformation of tire P is bigger than in the assembly shown in fig. 7a where the deformation would not occur at this place or it would be minimum. The cradle HR can be independent or a part of the tire P or rim 7.

Example 13

- 25 A chamber K or any pump can be inserted between the two coupled wheels for example in dual tires. Figure 8 shows the chamber K placed between two tires P' and P". Top of the figure shows a chamber K as through-put in an unloaded point, the bottom of the figure shows the chamber K closed by mutual approximation of the deformed tires P' and P" in point of load.

- 30 The chamber K can be fixed to the rim 7 or one of the tires P but effectively a ringlet with the chamber K with a profile corresponding to the profiles of tire walls can be just placed between the two tires. Such a ringlet, if balanced, will have a tendency to stay concentric with the wheels. At the same time, it can be pre-tensioned against the walls of tires or placed on the wall in such a manner that the converging walls of tires make a narrowing above it.

The chamber K can also be inserted between the tires step by step when the chamber K is integral or in the shape of a strip with a defined section width which is gradually wound between the tires and when it is wound up the ends get connected by a lock. In this way a chamber with overlapping ends can be simply created as in fig. 8b where after winding-up the chamber K is constricted and fixed by the tape B with a lock ZA. Likewise, the chamber can lock by itself without the need of the tape B. The tape can make a protection against punctures etc. or it can function as a template for finding a right place with a suitable distance between the tires etc. The winding-up chamber is advantageous due to its simple installation and versatility when one width of the chamber K can be used for different tire profiles or for tires with various distances.

The figure 7a does not show proper proportions; in fact, both overlapping ends of the chamber K will be placed almost in the same distance from the axis of rotation (the chamber K can have a minimum diameter or distances of its walls in the range of tenths of millimeters and therefore the difference of the distances of overlapping ends of the chamber K from the rotation axis will be negligible with respect to the radius on which the chamber K ends will lie. Therefore the distance of the walls of the neighboring tires should be similar at both ends of the chamber K; if this is not the case the chamber K can be profiled in such a way that it compensates this difference.

Figure 8c shows a cross-section of the chamber K placed between two ties TL which set it from the walls of the tires P' and P". The chamber K and ties TL are fixed by the tape B in a proper radius. The broken arrows show the direction of the movement of walls of the tires when loaded; this movement will then close the chamber K by the use of ties TL.

The figure 8d shows a similar situation, only with the chamber K placed directly by the wall of the tire P'.

Example 14

The figure 8a shows the chamber K bearing against the pressure intensifier MU which again is bearing against the tie TL which is in this case inflated up to the pressure of the tire P. Because the pressure intensifier MU has a larger area adjoining the tie TL than the area adjoining the

chamber K the air being compressed in the chamber K up to the pressure of tire P has not enough power to force away the pressure intensifier MU into the tie TL and this will always result in closing the chamber K by the deformation of the tires. However, if the tire deformation is larger than necessary just to close the chamber K the inflated tie TL will partly collapse for the period of such deformation and then it will straighten back with full retention of the chamber K function.

In the above example the tie TL was inflated up to the pressure of tire P. However, that is not necessary if the tie TL is interconnected with the output of the chamber K which results in inflation of the tie TL by the chamber K and due to the pressure intensifier the chamber will always be able to reach a higher pressure than the pressure in the tie TL and it will thus reinflate it up to the preset value of the pressure. The tie TL can be used as a compressed air reservoir or as a case SC.

Figure 8f shows a similar situation but the tie TL overlaps the chamber K by its narrow ends towards the wall of the tire P' and sets the right distance of the chamber K from this wall. Upon the tire deformation the chamber K and these narrow ends of the tie collapse as first and reinflation starts.

The figure 8g shows the ties provided with a joint thus making a lever NU which can enhance the force closing the chamber K.

The devices shown in figures 8 are described for dual tires, nevertheless, they will function alike even for separate tires P, for example, between the tire P and rim 7, or between the opposing walls of the tire P. Likewise the tie TL can absorb an excessive deformation if connected with the rim or tire. The deformational capacity of the tie TL can also be ensured by pre-springing; instead of inflation it will be made e.g. using a spring sheet etc. The advantage of the inflated tie lies mainly in its light weight while being firmly fixed in place; it makes easier the assembly and finding the right place especially in combination with the winding-up chamber K, at the same time it can make a reservoir or reference space while also solving the problem of excessive deformation when it simply evades it while first closing the chamber K by the deformation.

Example 15

The figure 8a also shows the chamber K' in the tire P' where the chamber K' with the ring OK is placed on the base OD. This can be simply in form of a rigid circle ring placed on the rim 7', however, it can be replaced by a deformation zone absorbing the excessive tire deformations. Effectively, such a design has a shape shown in fig. 9a where a rubber, textile, or alike circle ring consists of two layers of material joined along external and internal circle ring perimeter. Moreover, they can be, as in the figure, interlinked by a seam, for instance. It is there to define the section of the base OD after its inflation. The seam is represented by a broken line. The section of an uninflated circle ring of the base OD is then shown in fig. 9b, a partly inflated one in fig. 9c and fully inflated one in fig. 9d. Its maximum inflated diameter can be built-in or defined by the ring OK and it can be interconnected with the rim 7 from the bottom.

The base OD can have its own designed pretension and get inflated up to the pressure of tire P; effectively, it can also be deflated and inrolled by the rim 7 on the condition that when its underinflation is detected the air will be let into it from the tire P and it will expand up to its full diameter due to the pretension or centrifugal force. If it has unrolled mainly due to the centrifugal force it can retract to its inrolled position after stopping either because of the pretension of its walls or because of its deflation. The base OD, if unrolled by the centrifugal force, needs not contain the inflatable components and will stay in its unrolled position because of the centrifugal force while, however, it can act against the tire P or chamber K not only by the centrifugal force but even because it is rigid in the direction perpendicular to the direction of the tire deformation or it can spring upon the excessive deformation of the tire P. Such an example is shown in fig. 10b where the base is in its inrolled position and it is unrolled by the centrifugal force in fig. 10c. Its three components have swiveled clockwise round the joints represented by black spots and have taken up a position with the base rigid in the direction of the movement of the tire wall. A line perpendicular to the rotation axis is represented by a dotted line. The design will retract to its inrolled position, for example, due to the springs in the joints after the centrifugal force ceases. This design is only an example, likewise, the components can move into each other using the guide ways etc. The pump placed at the end can copy a part of the tire P perimeter or even its whole perimeter. Because the perimeter is shorter at the rim than at the tire P the longer pump could overlap in its inrolled position and unroll gradually or it could be crimped etc.

If the base OD is inflatable it can be effectively inflated up to a higher pressure than the tire P.

This will ensure the stability and a simpler design of the base OD.

The inflated base OD can also be used effectively as a compressed air source similar to the case SC described in the Example 5. Thus the chamber K will reinflate the base OD from which the tire P will be refilled as necessary. For example, the base can have a pressure of 3.5A, the passageway valve of the tire can have a resistance of 0.5A and properly inflated tire can have a pressure of 3A. If the tire pressure drops down the passageway valve will open, the tire P will gradually reinflate from the base OD and the chamber K will reinflate the base OD in parallel from the external environment O up to the original pressure of 3.5A. It is just good to ensure that the drop of air in the base OD, which would affect its supporting function, is slower than its refilling from the chamber K into the base OD. However, this should actually not happen because the pressure in the ring OD will always be higher than the pressure in the tire.

The seam joining the walls of the base OD can be designed in such a way that it keeps the walls of the base joined only in certain pressure difference between the tire P and base OD. If the passageway valve between the base OD and tire P is rated so that it can compensate only a limited leak rate from the tire P, and the real leak is higher than that, then the pressure difference between the base OD and the tire will increase, the base OD will try to expand and an increasing force will act on the seam. Upon a certain pressure difference the seam will rip and the walls of the base OD will be expanding until they fill up the whole volume of the tire. The base will thus function likewise the tire tube D in case of big tire puncture. The seam can have a defined weak spot so that it rips only in the right moment and also step by step and safely. Effectively, the output pressure of the chamber K can be lowered from 3.5A down to 3A after the seam rupture.

If the pressure of the base OD equals to the pressure of the tire P and the base OD is held in place e.g. by rigidity of its walls, pre-tensioned ring OK, or by the fact that it separates two pressure spaces of the tire P lengthwise this will function in a similar way, only the output pressure of the chamber K will not have to be lowered.

Both the chamber K and base OD and all the components can then occupy relatively little space within the tire P and at the same time they can be quite rigid and yet they will compensate typical leaks as well as seal the tire in case of its puncture.

Example 16

Each tire has an optimum height of deformation, which is difficult to keep in practice due to changing conditions of loading by cargo etc. The chamber placed on the base OD can be
 5 designed so that it closes completely only if the tire deforms more than appropriately when loaded. At the same time, the inflatable cushion in form of the base OD will ensure that pumping will start even if the deformation is larger than necessary for pumping; the pump will simply evade the deformation or an excessive deformation will be absorbed by the air cushion. This air cushion can be replaced by spring material etc. If the tire P needs to be relieved it can
 10 be provided with a bleeder valve or it can get down to a lower pressure than the set value by regular leaks. These can be increased also by choosing low grade materials for tire sealing layers which will result in further production savings.

The inflatable circle ring can be very simply inserted between the tire P and rim 7 and the next
 15 steps of the assembly can be as follows: Inflate the air into the chamber K. From there it proceeds to the base OD, which will get inflated and erected and fixed against the rim 7, tire P perimeter, or both. Then the air leaks out of the base OD into the tire P, directly or through the valve, and inflates it. When the tire P is inflated, all the components have the optimum pressure and the system tries to hold it during the drive. If the system includes the control element R in
 20 form of a reference space containing the compressed air as a reference medium this reference space can be interconnected with the tire space by a non-return valve. The reference space gets inflated through the non-return valve along with the tire. Then the control element R will try to hold the same conditions. The increase of the set pressure will then be achieved by a mere inflation of the tire P up to a higher pressure which will result in recalibration of the control
 25 element R to the new pressure value.

Example 17

So far we have described mainly a spiral-shaped inflatable base OD but it can also be in the shape of concentric circles or alike or it can also be in form of a relatively low base OD located
 30 on a rigid cushion. The spiral can be created by winding up of one or more hoses onto each other where the layers can join by a lock, e.g. a bur-fastener. The layer can have a precisely defined maximum cross-section or length regardless of the internal pressure in the layer. If there is an inflated circle layer with a defined cross-section with a 1cm high wall, for example,

between the chamber K and the tire P wall the chamber K will be loaded only if the tire P is deformed by 1cm. If this circle has a variable length it will be inflating until the moment when it leans against the tire P wall. Thus the distance between the chamber K and tire P can be set. This circle can have a different pressure than the pressure of the base OD so that the tire gets
 5 over it to the chamber K more easily.

Apart from its setting function, this circle will be a stabilizing support in order to anchor the whole assembly by the rim as well as by the tire. The base OD can contain vents so that it does not divide the tire into sealed parts if required by the application; on the other hand, if the
 10 assembly is more stable because it is supported by independent pressure spaces from both sides they can be hermetically divided or at least minimize the interchange of air between these spaces of the tire P. These spaces can be interconnected by valves with resistance in one way, the valves that will open only in a certain pressure difference between the spaces through throttle valves or throttle holes. Basically, the whole base OD can be made only by a
 15 membrane or rigid wall separating the two parts of the tire which is held in place by the pressure balance from its sides. However, it should be pre-tensioned in its larger diameter or the spaces should be hermetically divided or it itself must have a sufficient structural rigidity in order not to collapse. Alternatively, the base OD can be made by the walls of two parallel tubes running through the tire as indicated in fig. 10a or it can run in between them. Effectively, the
 20 tubes can be a part of one air tube D; they can be even made of several different air tubes if the air tube D intersects at least in one point. In the figure, the tubes are designated as D and D' while their walls are represented by a dotted or broken line, respectively.

The opposite side of the chamber can then make a lock which will lock the maximum diameter of the base OD. For example, a bur-fastener tape can be attached to this side of the chamber
 25 and the opposite tape will gradually expand along the increasing perimeter of the base OD until the moment when both tapes touch and join. At this moment, the diameters of all assembly layers will be fixed. In this way, an all-purpose assembly for different diameters of tires and rims can be made. The chamber K can be interconnected with the components by the rim very easily along the wall of the base OD or under it.

30 During the assembly, the base OD can be an incomplete circle, i.e. without e.g. a circular sector and when it gets inflated (or deflated, depending on what forces it to take the right position) it will expand to the complete circle. A joint will occur in point of the closed circular sector and

the walls of this joint can fix the interface hoses, reference space, etc. Likewise, the air tube can be interrupted in one point and make an incomplete circle where the faces of this circle will join only when they get inflated. An intake into the chamber K from the rim etc. can then run between those faces.

5

Example 18

A chamber or a pump need not be fully loaded until it is necessary. The figure 9e shows the chamber K on the base OD away from the tire P even though the tire P is deformed in this point. The base OD consists of hollow concentric circles inflated to a pressure higher than the ambient pressure of the tire. For example, they have been inflated manually in one go up to the pressure of the tires P. When an underinflation of the tire P is detected the last circle under the chamber K will be deflated into the external environment O of the tire P. The pressure in the tire will push on the walls of this circle and lower its volume down to the lowest possible value; at the same time, the walls will assume the pre-stressed position which will shift the chamber K towards the tire P as in fig. 9f. The figures 9g show a similar deflation and expansion of the whole support OD.

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The figure 9k shows the base OD with the seams represented by a broken line which run from the rim 7 towards the perimeter of the base OD. These seams will set the spaces partly divided between them and thus also the distance of the opposing walls of the base OD when they are inflated to a typical pressure. At the same time, they will make a relatively uniform circular space at the end between the end of the seam and the perimeter of the base OD. This can be supported by another circular joint between the seam ends and the perimeter of the base OD, which will make a bumper space over itself and absorb possible excessive deformations, which could damage the seam. The seam can be damaged in this way mainly because of the pressure difference between the base OD and the tire P or another predefined mechanical impulse. Such a base can be easily manufactured as a spiral-shaped overlapping e.g. of one piece of material in multiple layers and then its joining in points of the seam represented by a broken line and permanent joints represented by a double-dotted line. The chamber K can also be made in this way, between the two permanent circumferential joints where it can function even as a ring OK if its bottom joint is firm and wide enough. Thus the whole system can be made in a single operation where the layers are joined for example by rubber vulcanization in a mould which will press together only the spots of permanent joints and seams. The figure 9l shows the same

base in section before joining its layers where the future joints are designated by the letter X. The arrow around the base in fig. 9k shows the length of permanent joints and thus also the length of the chamber K in this example. It is then possible to make even the chamber K in one step arbitrarily longer than the tire P perimeter. The number of the layers joined is not limited.

5 The chamber K can overlap not only lengthwise side by side but also one above another vertically so that the chamber will be wound up in a spiral way. Also this can be achieved in one fabrication step.

10 The figures 9m and 9n show other design types of the base OD where this is being wound up in form of a twisted-pair in layers one upon another, which will ensure its side stability. If a wire, represented by a gray pentacle, runs through the center of the twisted-pair it will draw the opposing cylinders of the twisted-pair together as well as to the rim 7. The chamber K can lie on the last layer or it can be separated from the tire by another twisted-pair layer effectively not joined with the layers of twisted-pair under the chamber K. The figure 9n shows a narrower
15 twisted-pair without the chamber K being overlapped by another twisted-pair layer.

If the chamber K is being wound up in a spiral way and the wire defines the maximum length of the twisted-pair the inner and outer circumference of the base will rotate when being inflated. If the wire will then join the tire P or rim 7 or another interconnected component by its
20 end this will also define the diameter of the base OD. The inflatable part of the base OD can have a larger diameter before inflation than the diameter of the rim 7 which will make it seated on the rim 7. If it was previously connected with the tire P it would be simply mounted together with the tire P. Likewise, the base can be placed on the rim during the assembly and its maximum circumference is lower than the circumference of the bead or inner side of the
25 tread, which will make the mounting of the tire P easier. After inflation the base OD will erect itself into the tire P and take its final shape. The base OD expanding in this way can, for example, fix the interface hoses, that have been until then freely uncoiling, below the bottom part of the base OD. Only after it seats firmly on the rim; after the final inflation it can also finally fix other parts between the tire and rim such as pressure sensors, a power generator, etc.

30 Example 19

The figures 11 to 15 show the chamber K divided into two parts KS and KC. Even though

there are cases when it can be a higher pressure in one part of the divided chamber K than in the other the part with the lower pressure, it can still compress the other part with a higher pressure. This can be achieved for example by using an pressure intensifier MU described in the Example 14 or a different type of a lever.

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These examples describe mainly the separated parts of the chamber K where always at least one of them can be identical with the above-mentioned support OD, or with the tie TL, air tube D, etc.

10 The figure 11a shows the chamber K divided lengthwise, with 4 openings running into the external environment O of the tire P or into the internal space of the tire P. In this example the opening I leads into the external environment O and the openings II to IV lead into the space P. The interface O/P (in fact, it is the wall of the tire P or rim 7 or other part separating the inside of the tire P from the outside of the tire P) is represented by a double-dotted line, the area
15 above it is the external environment O and the area below it is the internal space of the tire P. When the tire P rotates the deformation of its wall rolls gradually through the chamber K and pushes the air within the chamber K ahead. The figure 11a shows a point through which the deformation of the chamber K passes as well as a depth of deformation, represented by a gray area. The direction in which the deformation moves is represented by a thin broken arrow in a
20 gray field. The figure 11a is used to designate the inputs and to describe the way of passing of the deformation; in figures 11b and 11c these designation are already omitted to keep it simple.

The figure 11b shows the openings III and IV as through-put and the lengthwise separated part of the chamber KC interconnected with them is filled up with air from the tire under the
25 pressure of the tire. When the tire rolls the air circulates from the internal space of the tire P through the opening III, then through the chamber K (KC) and finally through the opening IV back to the tire. So this is only an internal circulation of air from the tire into the chamber and back. The lengthwise separated part of the chamber KS interconnected with the openings I and II is non-throughput in the whole length of the chamber K because the whole volume of the
30 chamber is already filled with the lengthwise separated part of the chamber KC. Thus there is no transfer of air from the external environment O into the internal space of the tire P which is indicated by broken arrows in the openings I and II.

The figure 11c shows the opening III (alternatively also IV) closed. The deformation has passed along the separated part of the chamber KC and pumped its air into the internal space of the tire P. Due to the vacuum generated inside it, the part of the chamber KC has contracted crosswise thus clearing the neighboring lengthwise part of the chamber KS. So the deformation now transfers the air from the external environment O into the internal space of the tire P through the openings I and II. Because the pressure in the tire is higher than the ambient pressure it is advisable that the part of the chamber KS is permanently interrupted either by the deformation, so the chamber is constantly interrupted by deformation at least in one point, and/or by one or more valves in order to prevent leaking during reinflation.

To stop pumping the opening III (or eventually IV) has to be opened, the part of the chamber KC will then get filled by the air from the tire which will block the part of the chamber KS. When the tire rolls only the internal circulation occurs as described in fig. 11b. As described in this as well as other examples, if the part KC and/or KS is closed by deformation at both its input and output it will increase the pumping efficiency, nevertheless, it is needs not occur at both parts as the efficiency grows even when this happens at one part only; alternatively such closure can replace the need of some valves.

Example 20

Figure 12a shows a lengthwise divided chamber where the openings I, III, and IV lead to the external environment O and the opening II leads to the space P in this example. The direction and extent of the chamber K deformation is represented by a gray thin flat broken arrow in a gray field.

In figure 12b the opening II or I is provided with a non-return valve or the part KC presses on KS and at least in one point it constantly interrupts it and so it does not let the air from the tire into the external environment O through the lengthwise part of the chamber KS. The openings III and IV are open and the air circulates through them between the lengthwise part KC and the external environment O. The chamber KS is permanently crosswise compressed and not through-going. It is compressed by the pressure of the medium flowing in KC and the pressure of this medium on the lengthwise wall separating KC from KS. This pressure can be enhanced or replaced by pretension, enhanced by an pressure intensifier MU or the output IV can be

throttled so that overpressure against KC occurs inside KC thus permanently blocking KS and avoiding compression of air drawn in from the ambient and its further transfer into the tire.

The opening III in fig. 12c is closed which results in exhausting the air from the part of the chamber KC and pulling its walls together. This pulling together will clear the part of the chamber KS which will subsequently be filled with the air from the external environment O and then this air will get compressed against the valve at the opening II and then pumped into the tire. Again, any opening can be provided with valves. Each valve can also be replaced by the chamber interruption by deformation and by non-throughput crosswise interruption.

Example 14

The fig. 13a shows a lengthwise divided chamber where the opening I leads to the external environment O and the openings II, III, and IV lead into the space P in this example. The direction and extent of the chamber K deformation is represented by a gray thin flat broken arrow in a gray field. The chamber is deeper than the deformation passing through it in this case.

The fig. 13b shows that the reinflation does not start in a chamber created in this way because its lengthwise part KS connected with the openings I and II is permanently through-going and the deformation in it does not cause necessary compression and transfer towards the tire. No reinflation or no pumping is represented here by crossed broken arrows at the openings I and II. In order to function properly it is necessary that a valve is placed for example at one of these openings or in between them, which will prevent leaking of air from the tire through the part of the chamber KS.

In fig. 13c the air from the tire is let into the part of the chamber KC which will contract the section of the part KS and its depth. The chamber deformation will then close the part KS crosswise and transfer the air from the external environment O into the internal space of the tire. Thus the air from the tire can be let in the part KC only under the tire pressure or lower, but also higher if the deformation passes through a sufficient depth so that it first reinflates the air through the opening III into the chamber KS thus "inflating" this part up to the volume needed that is sufficient for crosswise contraction of the section of the part of chamber KS.

Example 21

The fig. 14a shows a lengthwise divided chamber where the openings I, III, and IV lead to the external environment O and the opening II leads to the space P in this example. The direction and depth of deformation of the chamber K is represented by a gray flat, thin broken arrow in a gray field.

The fig. 14b shows that reinflation does not start in a chamber created in this way because its lengthwise part KS connected with the openings I and II is permanently through-going and the deformation in it does not cause the necessary compression and transfer towards the tire. No reinflation or no pumping is represented here by crossed broken arrows at the openings I and II. In order to function properly it is necessary that a valve is placed at one of these openings or in between them, which will prevent leaking of air from the tire through the part of the chamber KS.

In figure 14c, air from the external environment O is let in or pumped to the part of the chamber KC which will contract the section of the part KS and its depth. The chamber deformation will then close the rest of the section of the part KS of the chamber crosswise and transfer the air from the external environment O into the internal space of the tire. Thus the air from the tire can be let in the part KC only under the ambient pressure or lower, first it reinflates the air through the opening III into the part of the chamber KC thus "inflating" this part up to the volume needed that is sufficient for the crosswise contraction of the section of the part of chamber KS. In this case it is also necessary that a valve is placed also at the opening IV, which will keep the part of the chamber KC inflated; alternatively, some of the valves can be replaced by the deformation. Again, the part KS can press on the part KC through a lever.

The fig. 15a shows a power generator placed at the output from the chamber. The generator in this case consists of a blade wheel, however, it can be any other type of a generator propelled by air jet or air pressure, e.g. a rotating ball, propeller, piezo-electric generator, etc. The generator can be placed at the chamber inlet or outlet, it can be a divided as well as undivided chamber designed for tire inflation but even a chamber created only for the propulsion of the generator and not inflation. It means that the generator can be placed behind any type of the chamber with shape memory deformed by the tire. The generated electric power can be

accumulated in form of electricity and/or it can be used to propel electric equipment in the wheel or tire, e.g. pressure and other sensors, wheel data transmission devices, etc.

The fig. 15b shows a generator at the inlet of the part of chamber KC in the moment of air circulation between the tire and part of the chamber KC. The generator also functions as a valve if it is mechanically or electrically stopped, the air at this inlet into KC is throttled or completely ceases to flow and KC is collapsing thus blocking KS. The generator can also function as a valve or a throttle valve. If it is fitted with a free-wheel it will function as a mechanical non-return valve etc. In the example the generator in fig. 15c has been stopped mechanically by its move in the direction of the thin broken arrow towards the left wall. This is a blade-wheel generator; however, any other known type of a generator can be used, e.g. one based on a propeller, gear-wheel pump, piston-type generator, piezo-electric generator, etc. The generator needs not generate only electric power but also a mechanical work and it can also propel for example another pump etc. It can also function as a sensor (the velocity of the air flowing around it is direct dependent on the speed of the wheel) or it can be affected by the change of pressure and temperature etc. The change of speed or of the power generated is then directly associated to the change of these parameters.

The solutions described in the above examples are described especially in location by the tire tread, between the tire and rim, or between two tires. However, they can be placed in any place between two points changing their relative distance while one of them can be placed on the tire or next to it.

The electric power generator can consist of a coil moving in the magnetic field, where one part is connected with the tire and the other with the rim. One or more coils then can be connected with the base OD or rim 7 and the magnetic layer with the tire P or vice versa, while the components are appropriately shaped in order to make linear movements between the coil and the source of magnetic field.

Industrial utility

The chamber with shape memory for pressure adjustment in the tire according to this invention will find its application in production of new tires and in modification to existing

tires, both for passenger vehicles and utility vehicles, bicycles, or motorcycles.

	D	Air tube
	K	Chamber
	OK	Ring
5	P, P', P''	Tire
	O	(Ambient) external environment
	V, V1, V2..	
	R	Control element
	SC	Case
10	BS1	Side wall of the tire
	BS2	Opposing side wall of the tire
	7	Rim
	BC	Tread wall of the tire
	ST	Independent strip with a chamber
15	VSC	Case output
	HR	Cradle
	B	Tape
	Z	Lock
	TL	Tie (bumper)
20	MU	pressure intensifier
	NU	Scissor lever
	OD	Base
	VP	Passageway valve
	ZA	Lock
25		

PATENT CLAIMS

1. A device for transport of air for a tire, comprising
a component that at least partially defines a chamber, the component being adapted to be placed along at least a part of perimeter of the tire;
a ring disposed at a radially inner side of the chamber component, such that a radial distance between a radially inner side of the chamber and an axis of rotation of the tire is equal to 1 to 1.1 times a radial distance between a radially outer side of the ring and the axis of rotation of the tire; and
a structure defining an inner reservoir adapted to be at least partially disposed between the ring and the tire, the inner reservoir at least partially adjoining both the walls of tire and the wall of the ring to hold the ring in place.
2. A device according to claim 1 characterized by the fact that the ring is placed on an air tube and/or a bag placed inside the tire and filled by air.
3. A device according to claim 2 characterized by the fact that the end into the chamber is interconnected with the air tube D and/or bag and/or a base OD and/or a case SC.
4. A device according to any of the above-stated claims characterized by the fact that the end of the chamber is fitted with a control element.
5. A device according to any of the above-mentioned claims characterized by the fact that the valve (V) is a three-way valve with inputs interconnected with the external environment (O) and the tire internal space (P), where one input (VI) is provided with a valve (JV), the next input (V2) is connected to the chamber with shape memory (K), and the last input (V3) is interconnected with a closure element (R).
6. A device according to any of the above-mentioned claims characterized by the fact that the chamber is provided with 4 openings, where the longitudinal divisional plane is movable in the direction of deformation of at least one of the segmented parts of the chamber and at least one opening is provided with a valve and/or at least one segmented part of the chamber is permanently blocked by the deformation.
7. A device according to the claim 6 characterized by the fact that the lengthwise segmented chamber is placed in the wall and/or close to the tire wall and/or air tube wall and is provided with 3 openings leading into the tire and one opening leading into the external environment or with 3 openings leading into the external environment and one opening leading into the tire and/or the output of one longitudinal part of the chamber is interconnected with the input of the second longitudinal part of the chamber.

8. A device according to the claims 6 or 7 characterized by the fact that the channel and/or chamber is formed by at least one of two flexible tubes placed next to each other, where one has its outer diameter equal to the inner diameter of the second tube and/or one is, at least partly, inserted inside the other.

9. A device according to any of the above-mentioned claims characterized by the fact that the chamber is in the shape of a curved hollow channel with at least one its outer wall at least partly formed by at least a part of a pair of areas lying in the longitudinal direction of the chamber, containing the angle $\alpha = 0$ to 120° ; if $\alpha > 0$ it is located on the contact edge of these areas (10) situated on the further side from the center of the area of the chamber cross-section (1).

10. A device according to any of the above-mentioned claims characterized by the fact that the ring has a variable length.

11. A device according to any of the above-mentioned claims characterized by the fact that the ring cross-section is T-, I-, or O-shaped.

12. A device according to any of the above-mentioned claims characterized by the fact that the ring or a pressure intensifier MU act on the chamber wall by less surface area than the surface area from which the tire pressure acts on it from the opposite side.

13. A tire rim comprising a device for transport of air for a tire, the device comprising

a component that at least partially defines a chamber, the component being adapted to be placed along at least a part of perimeter of the tire;

a ring disposed at a radially inner side of the component chamber, such that a radial distance between a radially inner side of the chamber and an axis of rotation of the tire is equal to 1 to 1.1 times a radial distance between a radially outer side of the ring and the axis of rotation of the tire; and

a structure defining an inner reservoir adapted to be at least partially disposed between the ring and the tire, the inner reservoir at least partially adjoining both the walls of tire and the wall of the ring to hold the ring in place.