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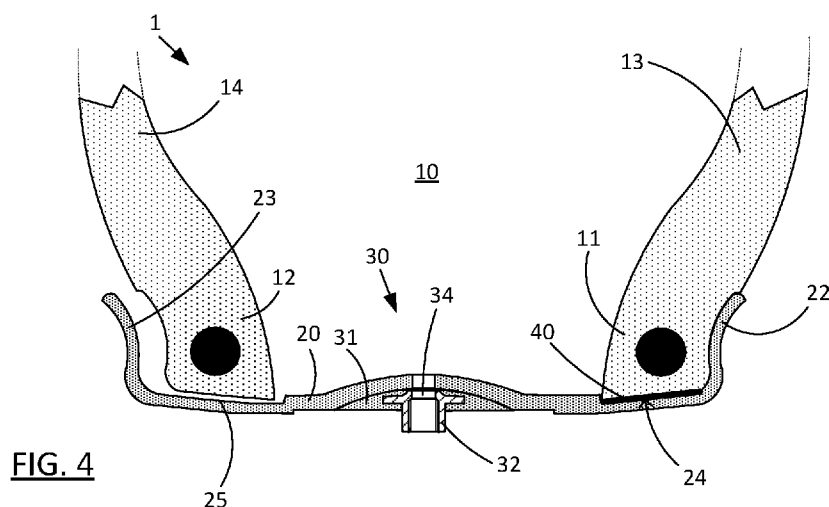
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(54) Title: PNEUMATIC TUBELESS TIRE



(57) Abstract: The invention provides for a pneumatic tire comprising: a crown portion; a pair of bead portions (11, 12); a pair of sidewalls (13, 14), each sidewall extending radially outward from a respective bead portion to the crown portion; an annular sealing piece (20) configured to extend from one bead portion to the other bead portion to provide an air-tight inflation chamber (10) when said tire is mounted and inflated on a wheel; wherein the annular sealing piece is non-permanently bonded (40) to at least one of the bead portions (11).



PNEUMATIC TUBELESS TIRE

FIELD OF THE INVENTION

[0001] This invention relates generally to tires. The present invention is directed to tubeless pneumatic tires having an annular sealing piece extending from bead portion to bead portion for sealing an internal inflation chamber.

BACKGROUND

[0002] Pneumatic tires may be mounted on a variety of different wheels. Wheels generally include a central barrel and a pair of rim flanges spaced axially along the central barrel and between which a tire is installed. Certain wheels, such as multi-piece wheels, are easily disassembled by removing a rim flange, which may form a single component or multiple components. Upon disassembling, a tire may be easily mounted on the wheel, after which the rim flange is reinstalled for use.

[0003] Because most multi-piece wheels are not airtight, it is common practice to use an inner tube to hold the tire pressure.

[0004] In order to use tubeless tires with multi-piece wheels, it has been proposed to have an annular sealing piece to form a seal between the tire and the wheel, thereby sealing the internal pressurization chamber formed between the tire and the wheel without using an inner tube.

[0005] Such annular sealing pieces may be attached to both bead portions as disclosed in European Patent EP1345783 or attached to only one bead portion as disclosed in international application WO2016/039777.

[0006] When making repairs to tubeless tires featuring such an annular sealing piece, the annular sealing piece is hindering full access to the inside of the tire. There is also the risk that the annular sealing piece may become damaged while making tire repairs or otherwise.

[0007] Accordingly, there is a need to provide a way to easily access the inside of such tubeless tires and protect its annular sealing piece from becoming damaged.

SUMMARY OF THE INVENTION

[0008] The present invention provides for a pneumatic tire comprising:

- a crown portion;
- a pair of bead portions;
- a pair of sidewalls, each sidewall extending radially outward from a respective bead portion to the crown portion;
- an annular sealing piece configured to extend from one bead portion to the other bead portion to provide an air-tight inflation chamber when said tire is mounted and inflated on a wheel;

wherein the annular sealing piece is non-permanently bonded to at least one of the bead portions.

[0009] In an embodiment, the annular sealing piece is bonded to the at least one of the bead portions using an adhesive.

[0010] In an embodiment, the annular sealing piece is bonded to the at least one of the bead portions using a non-permanent adhesive.

[0011] In an embodiment, said non-permanent adhesive has a peel strength between 10 and 65 pounds/inch.

[0012] In an embodiment, said non-permanent adhesive has a peel strength between 20 and 40 pounds/inch.

[0013] In an embodiment, said non-permanent adhesive is a silicone base adhesive.

[0014] In an embodiment, the annular sealing piece comprises an inflation valve base adapted for receiving a removable valve stem.

[0015] In an embodiment, the inflation valve base has an orifice inner diameter greater than 8mm.

[0016] In an embodiment, the annular sealing piece is bonded to both bead portions of the tire.

[0017] In an embodiment, the annular sealing piece is bonded to only one bead portion of the tire.

[0018] In an embodiment, the annular sealing piece is bonded to the at least one of the bead portions using cooperating shapes.

[0019] The foregoing and other objects, features, and advantages of the invention will be apparent from the following more detailed descriptions of particular embodiments of the invention, as illustrated in the accompanying drawings wherein like reference numbers represent like parts of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is a perspective section view showing a tire with an annular sealing piece according to the invention.

[0021] FIG. 2 is a perspective section view showing the annular sealing piece detached from the tire of FIG. 1.

[0022] FIG. 3 is a partial section view showing in more detail a tire according to the invention mounted onto a multi-piece wheel.

[0023] FIG. 4 is a partial section view showing in detail a tire according to the invention in un-mounted state.

[0024] FIG. 5 is a partial section view showing in detail a tire according to the invention using an inner tube.

[0025] FIG. 6 is a partial section view showing in detail another embodiment of the tire according to the invention.

[0026] FIG. 7 is a partial section view showing the principle of yet another embodiment of the tire according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0027] The present invention provides for a tire with an annular sealing piece where the annular sealing piece can be detached from the tire without damaging the tire or the sealing piece. The tire can then be readily repaired, flipped sides or otherwise worked on and the sealing piece can later be reattached to the tire before the tire is mounted onto a wheel.

[0028] The non-permanent bonding between the sealing piece and the tire can be realized by using any applicable non-permanent bonding means like for example non-permanent adhesives or cooperating shapes.

[0029] Certain exemplary embodiments of the preceding discussion will now be discussed in association with the figures provided herewith.

[0030] With reference to an exemplary embodiment shown in the section view of FIG. 1, a pneumatic tire **1** has a pair of bead portions **11** and **12**, a pair of sidewalls **13** and **14**, a crown portion **15** and an annular sealing piece **20**. The annular sealing piece has a generally tubular body **21** extending between the two tire bead portions. The annular sealing piece has a first end flange and a second end flanges designed to be wrapped around the bead portions. The first end flange **22** is attached to the first bead portion **11**. The second end flange **23** is not attached to the second bead portion **12**. The annular sealing piece is flexible enough to allow for limited access to the inner portion of the tire. The annular sealing piece has an inflation valve **30**.

[0031] When the tire is mounted onto a wheel and inflated, the annular sealing piece **20** provides its sealing function. The tire inner cavity **10** becomes airtight even when mounted onto a non-airtight wheel such as a conventional multi-piece wheel. Hence the tire can be mounted tubeless on a non-airtight wheel.

[0032] The annular sealing piece **20** is non-permanently bonded to the tire. Once the tire is separated from the wheel, the annular sealing piece can be detached from the rest of the tire without any permanent damage to either itself or the tire bead portions.

[0033] FIG. 2 shows in the same section view as in FIG. 1 the annular sealing piece **20** detached from the rest of the tire. The first edge flange **22** that was attached to the first bead portion of the tire is now detached from it. The separation of the non-permanent bond occurs with no damage and the annular sealing piece can be re-used if necessary.

[0034] FIG. 3 shows in more detail the cooperation of the tire **1** with a multi-piece wheel **50**. The radial plane of this section view goes through the center of the inflation valve **30**.

[0035] The multi-piece wheel of this example has a rim **51** welded onto a wheel disk **52**. A removable rim flange **53** in the form of an open ring is held in abutment against an annular stop **54** of the rim. The inflation pressure inside the tire cavity **10** is pushing the bead portions **11**, **12** away from each other. The bead portions are pressed against the rim flanges thereby forcing the bead portions **11**, **12** into an airtight contact with the annular sealing piece. The necessary sealing force is provided by the inflation tire pressure. Thus, the non-permanent bond **40** between the annular sealing piece and the first bead portion **11** is not required to be airtight itself. Bonding of the second bead portion to the annular sealing piece is also not necessary to create an airtight tire cavity.

[0036] As shown in detail here, an inflation valve **30** is provided to control the inflation pressure of the inner cavity **10** of the tire. A valve spud **31** attached to the annular sealing piece comprises a valve base **32** intended to be accessible through a valve slot **55** of the wheel. A removable elbows valve stem **35** allows access to the inflation valve from outside the wheel when the wheel is fitted to a vehicle. A valve slot covering plate **56** can be attached to the valve base by a valve nut **33**.

[0037] Depending on the tools available, mounting the tire onto a multi-piece wheel with the bonded bead portion (first bead portion **11**) on the side of the removable rim flange may be more convenient. Accordingly, when the tire needs to be flipped side on the wheel, the annular sealing piece **20** can be readily separated from the tire and re-attached to the other bead portion before the tire is mounted back onto a wheel with the bonded bead portion still on the side of the removable rim flange.

[0038] The annular sealing piece **20** can be made of rubber. The non-permanent bond **40** can use an adhesive that has sufficient bonding strength to resist the forces that affect the tire and the annular sealing piece during fitting and normal operation of the tire.

[0039] This adhesive must allow separation of the annular sealing piece from the tire bead portions without significant damage to the tire or to the annular sealing piece in order to allow reusing them.

[0040] Especially suitable adhesives are so-called “non-permanent” adhesives, that is to say adhesives that bond without causing a permanent change to the attaching surfaces. Therefore, the

attached parts can be separated later without damage to said surfaces. The remains of the adhesive can be removed by peeling off or cleaned with a suitable cleaner. Since the surfaces are undamaged, they can be glued together again with fresh adhesive.

[0041] It has been found that adhesives that provide an adhesive strength peel test value of 10 to 60 pounds per inch and preferably 20 to 30 pounds per inch (in accordance with T-Peel Test ASTM D1876) are the most suitable adhesives.

[0042] Below is a list of commercially available adhesives and their respective peel test values when used to attach rubber to rubber :

Adhesive type/commercial name	T-Peel Test value (ASTM D1876) lb/inch
Cyanoacrylate (LOCTITE 4902)	12.5
ELMER'S Rubber Cement	22.8
Polyurethane (GORILLA GLUE)	28.5
Flexible epoxy (MASTER BOND EP21TDC-7)	25-35
Modified Ethyl Cyanoacrylate (CHEMTOOLS 8414)	40
GE Silicone RTV 120 series	40
Rubber modified epoxy / 3M Scotch Weld EC9323	40
GE Silicone sealant SCS1200	61

[0043] Among those adhesives, silicon base adhesives are preferred because of their flexibility.

[0044] FIG. 4 is a view similar to FIG. 3 but showing the tire separated from the wheel, thus not inflated. As described earlier, first bead portion **11** is attached to the annular sealing piece by a non-permanently bond **40** while second bead portion **12** is not attached. It is clear from looking at this view that once the annular sealing piece **20** is peeled from the first tire bead portion **11**, the tire can be flipped sides relative to the annular sealing piece. Then the second bead portion **12** can readily be bonded with new adhesive onto the same bonding surface **24**.

[0045] When a tubeless tire is damaged, if repairable, a patch may be used in certain instances to make the repair. This repair, however, may require special equipment and expertise

not present when and where the tire becomes damaged, which is often remote to a tire repair location. Due to the limited availability of spare wheels or the time and equipment required to tow a vehicle in for repair of the tire, it is desirable to avoid the reliance on these solutions when a vehicle having a damaged tire is too remote from a tire service location. Accordingly, there could be a need to provide temporary use of the damaged tire until it can be repaired.

[0046] FIG. 5 in combination with FIG. 4 discloses a preferred feature of the inflation valve base to address this potential need. To this end, the size of the orifice 34 of the valve base 32 is preferably such that a valve stem of an inner tube can be inserted through it after the elbowed valve stem 35 has been removed from the valve base.

[0047] FIG. 5 shows the inner tube 60 installed inside the tire 1 and providing for an airtight inflation chamber 610. The inner tube valve 62 has a stem 63 that goes through the orifice 34 of the valve base 32. An orifice diameter of at least 8 mm allows for use of most conventional inner tubes having standard metallic valve stems. A valve stem extension 70 can be attached to the tip 65 valve stem 63 of the inner tube.

[0048] This allows for using an inner tube as a roadside temporary repair when the tubeless tire of the invention has been punctured remote from a suitable tire service shop. FIG. 5 illustrates the tire-wheel assembly in an inflated state after application of the temporary inner tube solution and clearly shows that said tire-wheel assembly is functionally very similar to the tubeless configuration of FIG. 3.

[0049] FIG. 6 shows another embodiment of the tire 101 where the non-permanent bond between bead portions 111, 112 and the annular sealing piece 120 is using cooperating shapes, for instance compatible dovetail profiles. Male dovetail profiles 1201 on the bonding surface 124 of the annular sealing piece 120 can be held in female dovetail profiles 1111 of the first bead portion 111. The same male profiles 1201 can also cooperate with female dovetail profiles 1121 of the second bead portion 112 after flipping the tire.

[0050] FIG. 7 shows another embodiment where both bead regions are non-permanently bonded (see bonds 40, 41) to the annular sealing piece. An advantage of this configuration is that the tire is even more easily mounted or flipped side on its wheel. It can also remain uncontaminated by water or foreign matters during shipping or storing. If access to the inside of

the tire is needed for a small repair, one of the beads can be detached from its bonding surface on the annular sealing piece and may later be bonded again as described earlier or simply left unattached.

[0051] The terms “comprising,” “including,” and “having,” as used in the claims and specification herein, shall be considered as indicating an open group that may include other elements not specified. The terms “a,” “an,” and the singular forms of words shall be taken to include the plural form of the same words, such that the terms mean that one or more of something is provided. The terms “at least one” and “one or more” are used interchangeably. The term “single” shall be used to indicate that one and only one of something is intended. Similarly, other specific integer values, such as “two,” are used when a specific number of things is intended. The terms “preferably,” “preferred,” “prefer,” “optionally,” “may,” and similar terms are used to indicate that an item, condition or step being referred to is an optional (i.e., not required) feature of the invention. Ranges that are described as being “between a and b” are inclusive of the values for “a” and “b” unless otherwise specified.

[0052] While this invention has been described with reference to particular embodiments thereof, it shall be understood that such description is by way of illustration only and should not be construed as limiting the scope of the claimed invention. Accordingly, the scope and content of the invention are to be defined only by the terms of the following claims. Furthermore, it is understood that the features of any specific embodiment discussed herein may be combined with one or more features of any one or more embodiments otherwise discussed or contemplated herein unless otherwise stated.

[0053] It will be appreciated that many different multi-piece wheels are known, and as such, any other multi-piece wheel may be employed with the invention, including wheels where the removable rim flange comprises a plurality of ring components.

CLAIMS

What is claimed is:

1. A pneumatic tire comprising:
 - a crown portion (15);
 - a pair of bead portions (11, 12);
 - a pair of sidewalls (13, 14), each sidewall extending radially outward from a respective bead portion to the crown portion;
 - an annular sealing piece (20) configured to extend from one bead portion to the other bead portion to provide an air-tight inflation chamber (10) when said tire is mounted and inflated on a wheel;

wherein the annular sealing piece is non-permanently bonded (40) to at least one of the bead portions (11).
2. The pneumatic tire of claim 1, wherein the annular sealing piece is bonded to the at least one of the bead portions using an adhesive.
3. The pneumatic tire of claim 2, wherein the annular sealing piece is bonded to the at least one of the bead portions using a non-permanent adhesive.
4. The pneumatic tire of claim 3, wherein said non-permanent adhesive has a peel strength between 10 and 65 pounds/inch.
5. The pneumatic tire of claim 3, wherein said non-permanent adhesive has a peel strength between 20 and 40 pounds/inch.
6. The pneumatic tire of any one of claims 3 to 5, wherein said non-permanent adhesive is a silicone base adhesive.
7. The pneumatic tire of any of the preceding claims, where the annular sealing piece comprises an inflation valve base (32) adapted for receiving a removable valve stem (35).

8. The pneumatic tire of Claim 6, wherein the inflation valve base (32) has an orifice (34) inner diameter greater than 8mm.
9. The pneumatic tire of any of the preceding claims, wherein the annular sealing piece is bonded (40, 41) to both bead portions (11, 12) of the tire.
10. The pneumatic tire of any of claim 1 to 7, wherein the annular sealing piece is bonded (40) to only one bead portion (11) of the tire.
11. The pneumatic tire of claim 1, wherein the annular sealing piece is bonded to the at least one of the bead portions using cooperating shapes (1201, 1111, 1121).

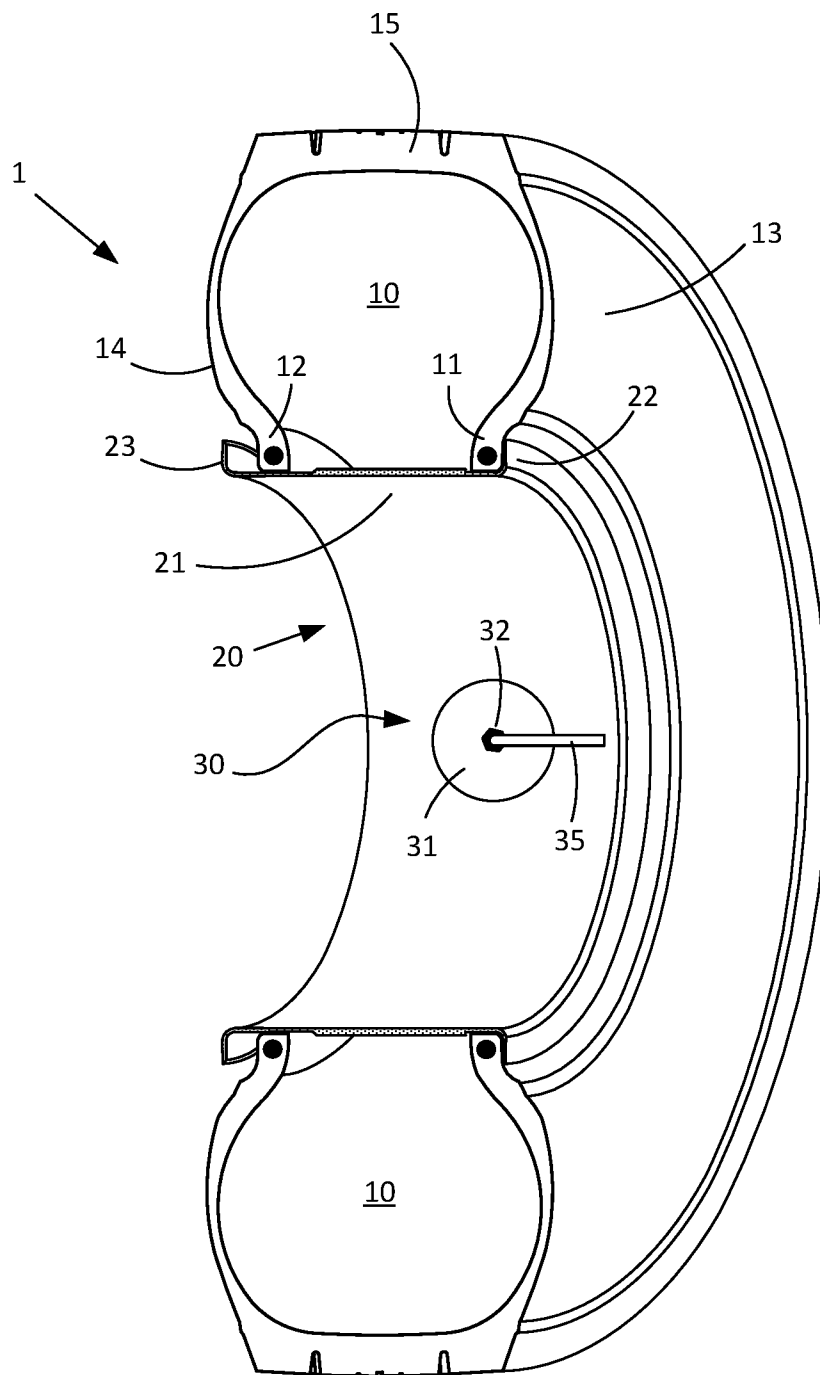
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FIG. 1

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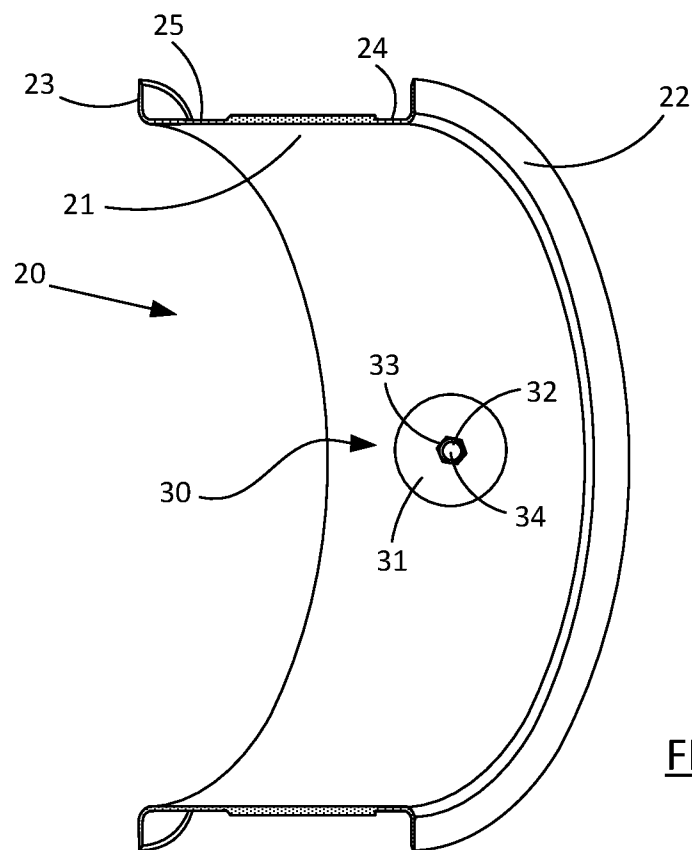


FIG. 2

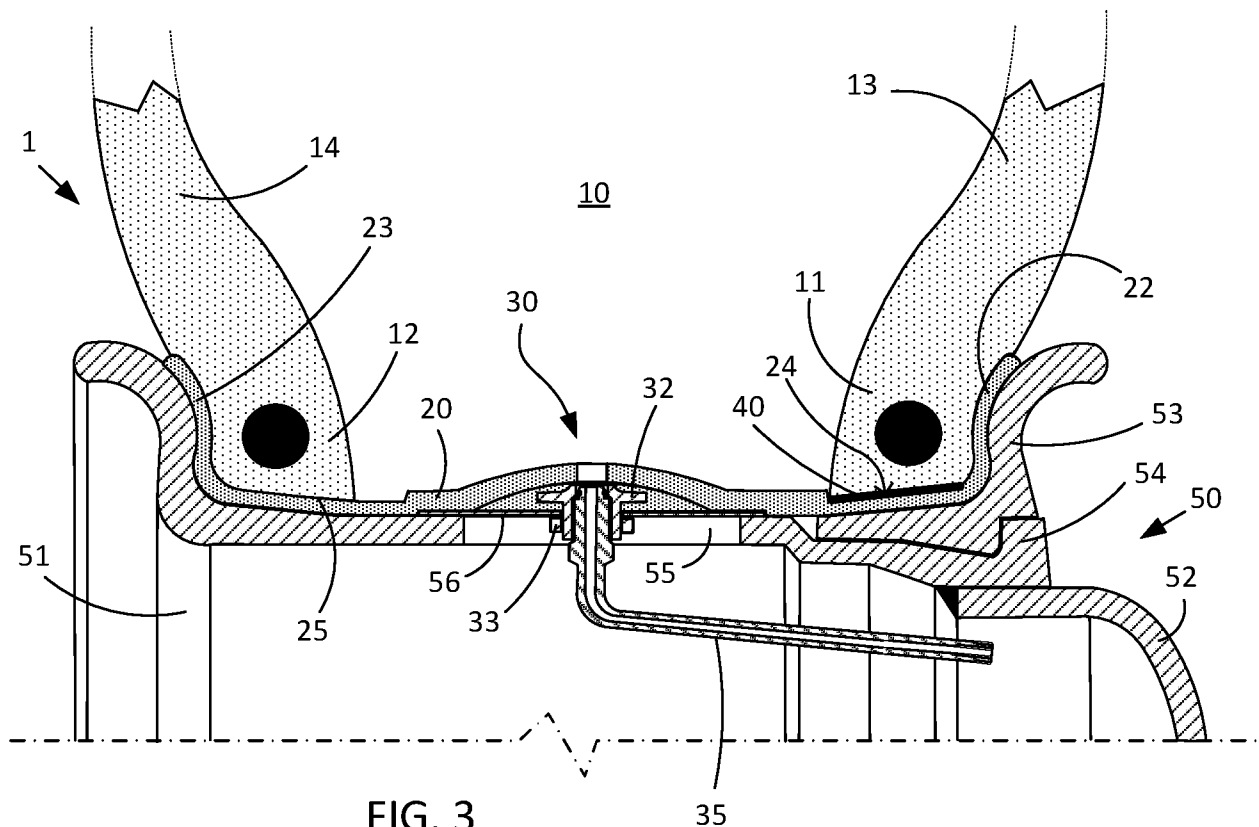
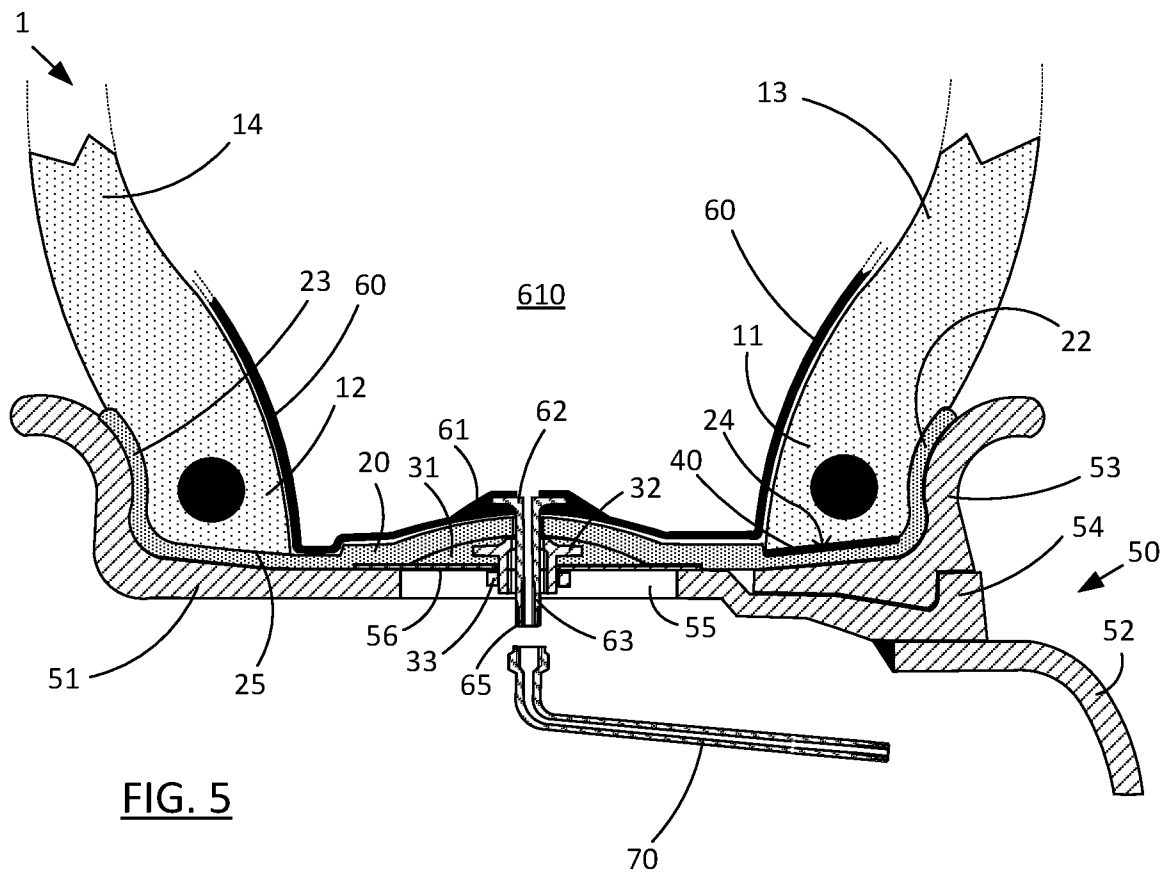
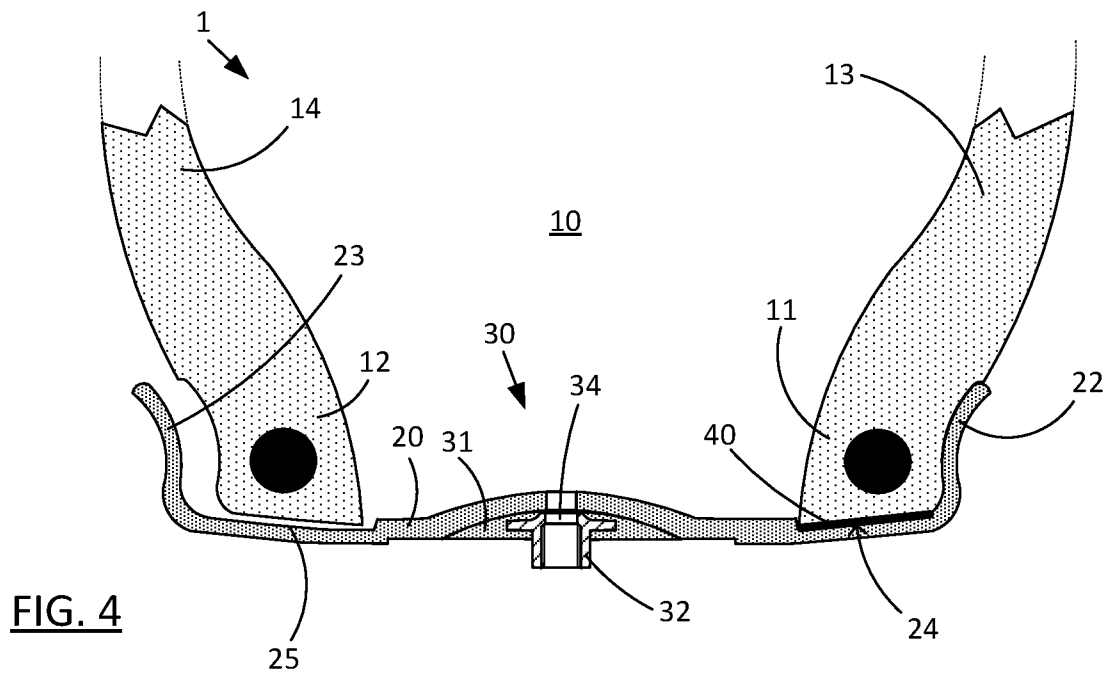


FIG. 3



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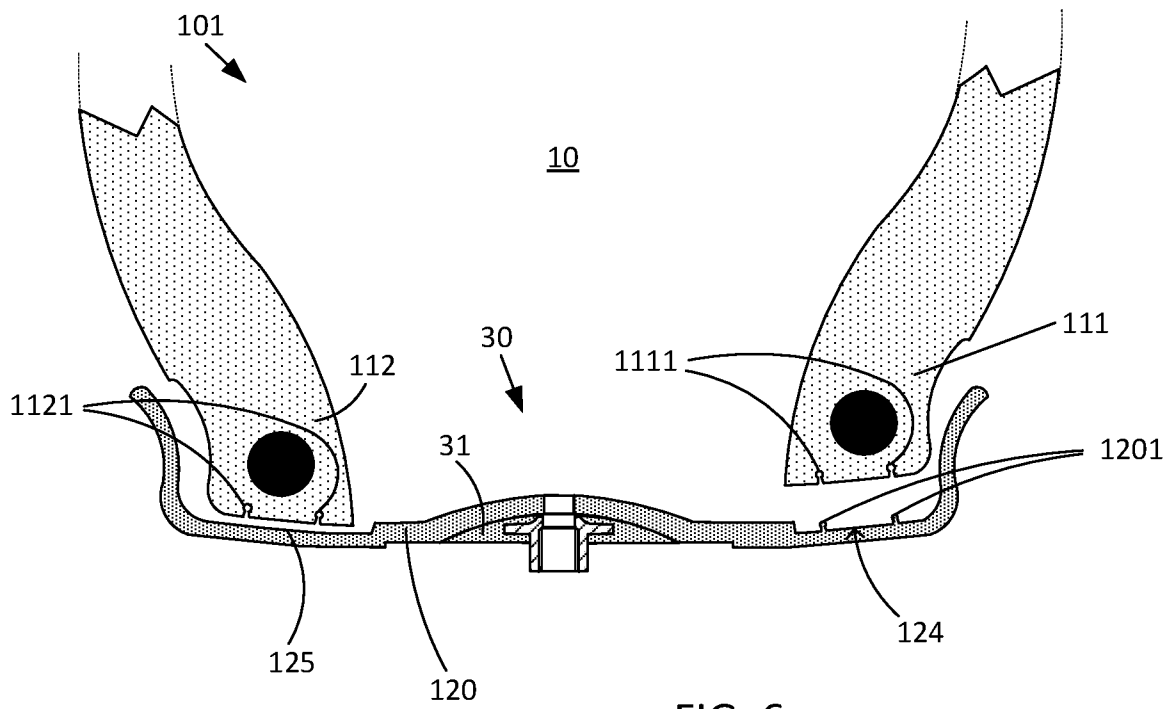


FIG. 6

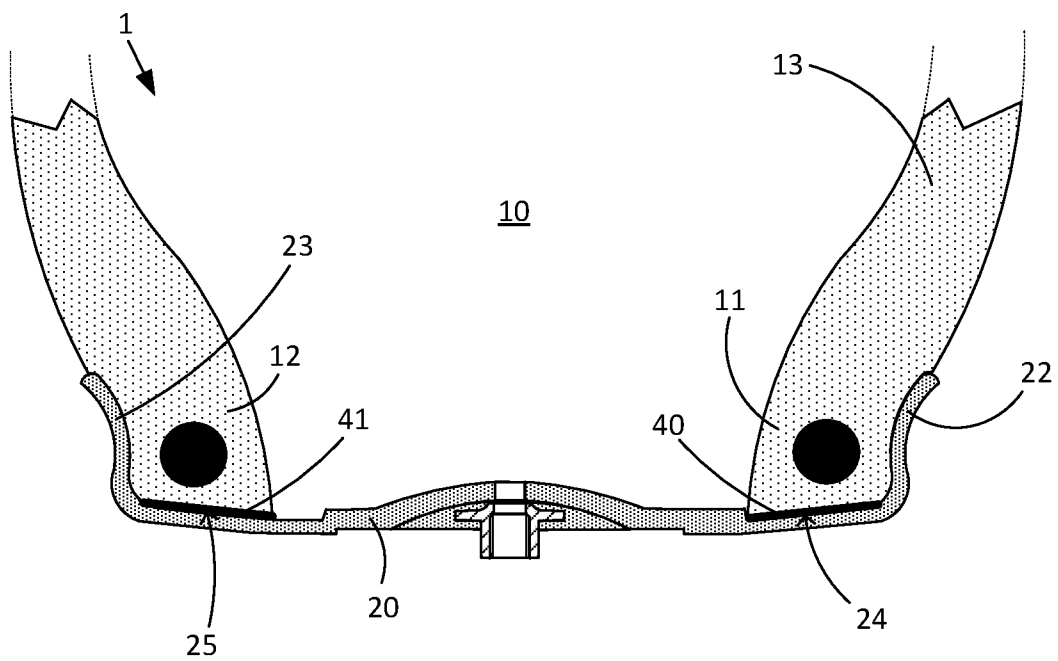


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2016/068699

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60C5/16 B60B21/12
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B60C B60B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 24 384 B (FRIEDRICH W HEUSINKVELD) 13 February 1958 (1958-02-13) column 2, line 23 - column 3, line 37 figures	1-11
X	----- WO 2016/039777 A1 (MICHELIN & CIE [FR]; MICHELIN RECH TECH [CH]; ZARAK CESAR ENRIQUE [US]) 17 March 2016 (2016-03-17) cited in the application	1-3,7-10
A	page 4, paragraph 2 - page 5, paragraph 2 page 5, paragraph 3 figures	4-6,11
X	----- DE 10 02 210 B (MANFRED JUENGLING) 7 February 1957 (1957-02-07)	1,7-9,11
Y	column 2, line 45 - column 4, line 12	7,8
A	figures 2-6, 10	2-6,10
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2016/068699

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 37 27 051 A1 (SUMITOMO RUBBER IND [JP])	1,9,11
Y	23 February 1989 (1989-02-23)	7,8
A	page 2, line 43 - page 3, line 6 figures	2-6,10

X	GB 787 784 A (DUNLOP RUBBER CO)	1,7-9,11
	18 December 1957 (1957-12-18)	
A	page 2, line 1 - line 39 figure	2-6,10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/068699

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 1024384	B	13-02-1958	NONE
WO 2016039777	A1	17-03-2016	CN 106794707 A 31-05-2017 WO 2016039777 A1 17-03-2016
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