Title: TIRE WITH HIGH STRENGTH CORRUGATED SIDEWALLS

Abstract: A tire (1) having a pair of high strength sidewalls (7) lying opposite one another, wherein each sidewall has a plurality of plies (14) that are shaped during manufacture to have a series of pleats or corrugations (9) formed therein and stretching from the tire beads (24) radially outward along the side- walls (7). Each of the series of sidewall corrugations (9) includes a pattern of alternating inwardly extending depressions (10) and outwardly extending projections (12) that extend continuously around the tire (1). The corrugations (9) provide the sidewalls (7) with an integral structural reinforcement, whereby the tire (1) is advantageously capable of providing run flat support and avoiding damage to the rim (20) on which the tire is mounted. According to a preferred embodiment, the tire (1) herein disclosed is ideally suited for use on a motorcycle rim.
TIRE WITH HIGH STRENGTH CORRUGATED SIDEWALLS

BACKGROUND OF THE INVENTION

[0001] 1. Technical Field

This invention relates to a tire having high strength sidewalls wherein the sidewalls are manufactured with a pattern of alternating and radially aligned inwardly and outwardly extending pleats or corrugations. The tire herein disclosed has particular application to be installed on a motorcycle and offers the advantage of improved structural integrity for the sidewalls so as to avoid potential damage to the rim and provide run flat support.

[0002] 2. Background Art

Depending upon the vehicle and/or the terrain over which the vehicle will be driven, it is often necessary to have available a high strength tire that is suitable to withstand the forces to which the tire will be subjected during its use. A common practice to produce a high strength tire is to increase the thickness of the sidewall and/or add additional fibrous textile plies around the tire circumference. As a consequence of the aforementioned conventional manufacturing technique of adding more material to the tire to increase its strength, the weight of the tire is correspondingly increased. In this same regard, adding
weight to a tire is likely to adversely affect the vehicle's performance as well as the fuel costs of the vehicle on which a set of the heavy tires is installed.

[0003] Accordingly, what would be desirable is a tire that can be manufactured with sidewalls of increased strength, but without adding significant weight to the tire, negatively impacting the vehicle's performance, or increasing the cost of operating a vehicle on which a set of the tires is installed.

SUMMARY OF THE INVENTION

[0004] In general terms, a rubber tire is disclosed having high strength sidewalls and being ideally suited for use on a motorcycle rim. The high strength sidewalls of the tire are manufactured (e.g., molded) to include radially aligned pleats or corrugations that extend circumferentially therearound. In particular, the corrugations include a series of alternating inwardly extending depressions and outwardly extending projections that is formed in each of the sidewalls. That is, the fibrous plies in the sidewall casings are shaped to create the alternating depressions and projections so as to lie side-by-side one another and slope in alternating opposite directions. Each corrugation encompasses the reinforced bead that lays inside and against a lip of the rim and stretches from the bead radially along a sidewall below the crown of the tire. By virtue of the foregoing, the sidewalls of the tire are advantageously provided with structural reinforcement and rigidity or stiffening relative to conventional tires without having to add material or significantly increasing the weight of the tire. In addition, the corrugated sidewalls enable the tire to avoid damage to the rim and provide run flat support.
FIG. 1 shows a tire manufactured with its sidewalls having a series of corrugations formed therein in accordance with a preferred embodiment of this invention;

FIG. 2 is an enlarged detail taken from FIG. 1 showing the series of corrugations formed in one sidewall of the tire;

FIG. 3 is a cross-section taken along lines 3-3 of FIG. 2 showing outwardly extending projections from the series of corrugations formed in the sidewall of the tire;

FIG. 4 is a cross-section taken along lines 4-4 of FIG. 2 showing inwardly extending depressions from the series of corrugations formed in the sidewall of the tire; and

FIG. 5 is a cross-section taken along lines 5-5 of FIG. 2 showing the series of corrugations having alternating outwardly extending projections and inwardly extending depressions formed in the sidewalls of the tire.

Referring concurrently to FIGs. 1-5 of the drawings, there is shown a rubber tire 1 having a unique high strength sidewall configuration by which the sidewalls have a high strength characteristic that is especially adapted to provide the tire with run flat support. The tire 1 shown in the drawings is one that would be ideally used by a motorcycle. However, the
advantages of this invention are not limited to any particular vehicle on which the tire will be installed.

As in the case of many conventional tires, the tire 1 shown in FIGs. 1-5 has a knobby tread 3 extending outwardly from and running circumferentially around the crown 4 thereof. The size, shape and presence of the tread 3 that is molded into the rubber tire should likewise not be considered a limitation of this invention. By way of example only, the tread 3 carried by the tire 1 and shown in the drawings is especially suited for riding over dirt roads and off-road terrain.

In accordance with a preferred embodiment of this invention, the high strength characteristic of the tire 1 is achieved by manufacturing (e.g., molding) the sidewalls 5 and 7 with a series of radial pleats or corrugations 9 that are aligned side-by-side one another and extend continuously and circumferentially around each sidewall. More particularly, each of the series of corrugations 9 at each sidewall includes a pattern of alternating inwardly extending depressions 10 and outwardly extending projections 12. During manufacture of the tire 1, either one or a plurality of fibrous textile plies 14 that are usually bonded one above the other to form the casing for the sidewalls 5 and 7 are manipulated and shaped (e.g., molded) to create the pattern of alternating depressions 10 and projections 12 by which to establish the corrugations 9 in the sidewalls.

Depending upon the application of the tire 1 and the vehicle on which the tire will be mounted, the number, spacing and depth (or height) of the sidewall corrugations 9 can vary from one tire to another. However, by virtue of the corrugations 9 being formed in the sidewalls 5 and 7 by shaping the fibrous textile plies 14 thereof, the sidewalls of the tire 1 are
advantageously provided with an improved structural reinforcement and rigidity or stiffening relative to conventional tires without having to thicken the sidewalls and/or add additional plies. It may therefore be appreciated that the tire 1 herein disclosed avoids the common practice of adding additional rubber and fibrous material to the sidewalls in order to improve strength which is known to undesirably add weight and increase the cost to manufacture the tire. Also being advantageously avoided is the corresponding negative impact on the vehicle's performance and the fuel consumption of the vehicle on which a set of the improved tires is installed.

[0014] Referring particularly to FIGs. 3 and 4, the improved tire 1 is shown relative to a rim 20 of the vehicle on which the tire is mounted. The tire 1 is located on the rim 20 so that the innermost end of each corrugation from each of the series of corrugations 9 formed in the sidewalls 5 and 7 lay over and are supported by the lips 22 of rim 20. In this same regard, the radially innermost ends of the sidewall corrugations 9 encompass the usual reinforced tire beads 24.

[0015] More particularly, FIGs. 3 and 4 illustrate the opposing high strength sidewalls 5 and 7 which lie below the crown 4 of the tire 1. In a preferred embodiment of this invention, the corrugations 9 that are formed in and extend circumferentially around the tire 1 stretch from the reinforced beads 24 and radially outward therefrom along the sidewalls 5 and 7 below the crown 4.

[0016] By virtue of the corrugations 9 stretching radially outward from the beads 24 which lie inside of the lips 22 of the rim 20, the sidewalls 5 and 7 of the tire 1 are advantageously stiffened and stabilized adjacent the lips 22. That is, the corrugations 9
provide the plies 14 of the sidewalls 5 and 7 of the tire 1 with a trussed support and structural reinforcement that extend in both radial and lateral directions. Such a trussed support offers greater rim protection during road impacts and better sidewall stability when the tire 1 is subjected to side loads during cornering. In this same regard, the corrugations 9 running radially along the sidewalls 5 and 7 from the beads 24 absorb impact forces and thereby reduce potential damage to the rim 20. Accordingly, and as explained above, a relatively lightweight and cost efficient tire having high strength sidewalls can be manufactured having particular application for providing a tire with run flat support.
CLAIMS

1. A tire (1) comprising a crown (4) running circumferential around the tire and a pair of sidewalls (7) lying opposite one another and joined at first ends thereof to the crown, said tire also comprising a series of corrugations (9) formed in at least one of said pair of sidewalls.

2. The tire (1) recited in Claim 1, wherein each of the pair of sidewalls (7) has a series of corrugations (9) formed therein.

3. The tire (1) recited in Claim 2, wherein the series of corrugations (9) that is formed in each of said pair of sidewalls (7) includes alternating inwardly extending depressions (10) and outwardly extending projections (12) that are aligned side-by-side one another and extend around each of said sidewalls.

4. The tire (!) recited in Claim 3, wherein each of said alternating inwardly extending depressions (10) and outwardly extending projections (12) of each of the series of corrugations (9) runs radially along each of said pair of sidewalls (7).

5. The tire (1) recited in Claim 3, wherein each of the pair of sidewalls (7) has a fiber reinforced bead (24) running therearound, and each of said alternating inwardly extending depressions (10) and outwardly extending projections (12) of each of said series of corrugations (9) being formed in each of said pair of sidewalls so as to encompass respective ones of the
beads of said pair of sidewalls and extend from said beads radially along respective ones of said pair of sidewalls.

6. The tire (1) recited in Claim 3, wherein said alternating inwardly extending depressions (10) and outwardly extending projections (12) that are aligned side-by-side one another slope in different directions relative to one another.

7. A combination, comprising:

a rim (20); and

a tire (1) mounted on said rim (20), said tire having a crown (4) extending circumferentially around said tire, a pair of sidewalls (7) located below the crown and lying opposite one another to surround said rim, and a series of corrugations (9) formed in each of said pair of sidewalls, wherein each corrugation of the series of corrugations formed in each of said pair of sidewalls has alternating inwardly extending depressions (10) and outwardly extending projections (12) that run radially along said pair of sidewalls, and each of said series of corrugations extends around a respective one of said pair of sidewalls.

8. The combination recited in Claim 7, wherein said alternating inwardly extending depressions (10) and outwardly extending projections (12) from each of the series of corrugations (9) formed in respective ones of said pair of sidewalls (7) lie side-by-side and slope in different directions relative to one another.
9. The combination recited in Claim 7, wherein said rim (20) has a pair of lips (22) that are spaced from one another and each of the pair of sidewalls (7) of said tire has a fiber reinforced bead (24) extending therearound which is covered by and lies adjacent one of said pair of lips such that each fiber reinforced bead (24) of each sidewall (7) lies between the pair of lips (22) of said rim (20), and each corrugation (9) of each of said series of corrugations formed in said pair of sidewalls encompassing one of the fiber reinforced beads of said pair of sidewalls and stretching from said one bead radially along a respective one of said pair of sidewalls.

10. A method for making a tire (1) comprising the steps of:

   molding a pair of sidewalls (7) that lie opposite one another by bonding a plurality of fibrous plies (14) together one on top of the other;

   molding a crown (4) extending circumferentially around said tire and located radially outward from said pair of sidewalls (7);

   forming a fiber reinforced bead (24) in each of said pair of sidewalls (7) such that said beads extend around said sidewalls opposite said crown, and

   shaping the plurality of fibrous plies (14) of each of said pair of sidewalls (7) so that each sidewall has a series of corrugations (9) extending continuously therearound, and each series of corrugations has alternating inwardly extending depressions (10) and outwardly extending projections (12) that extend side-by-side one another between the crown (4) of said tire (1) and the bead (24) of a respective one of said pair of sidewalls.
11. The method recited in Claim 10, comprising the additional step of forming each
corrugation (9) from each of said series of corrugations so as to encompass respective ones of the
fiber reinforced beads (24) of said pair of sidewalls (7) and extend from said beads radially along
respective ones of said pair of sidewalls.
# INTERNATIONAL SEARCH REPORT

## A. CLASSIFICATION OF SUBJECT MATTER

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<th>IPC</th>
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<td>B29D 30/08; B60C 13/02, 13/00</td>
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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) |
| See Search History document |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched |
| See Search History document |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) |
| See Search History document |

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>US20100043934 &quot;A&quot; HEARLY, &quot;DELWYN LOVELL&quot; February 25, 2010; Figure 1, Paragraph 1, 4, 6-8</td>
<td>1-4, 6-8</td>
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<td>5-9</td>
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<td>X</td>
<td>US 6,955,782 B1 (RATLIFF JR BILLY JOE) October 18, 2005; Figure 1; column 2, lines 15-29</td>
<td>10, 11</td>
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<tr>
<td>Y</td>
<td>US 7,320,350 B2 (WRIGHT RICHARD J) January 22, 2008; Figure 1; Column 1, lines 12-14; column 6, lines 5-9</td>
<td>5, 9</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

- **A** Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent but published on or after the international filing date
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  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

### Date of the actual completion of the international search
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