



(51) International Patent Classification:

*B60C 15/04* (2006.01)    *B60C 5/08* (2006.01)  
*B60C 15/06* (2006.01)    *B60C 9/18* (2006.01)

(21) International Application Number:

PCT/US2014/015087

(22) International Filing Date:

6 February 2014 (06.02.2014)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

13/832,501    15 March 2013 (15.03.2013)    US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- with amended claims (Art. 19(1))

(54) Title: TIRE HAVING A SPLIT BODY PLY CONSTRUCTION

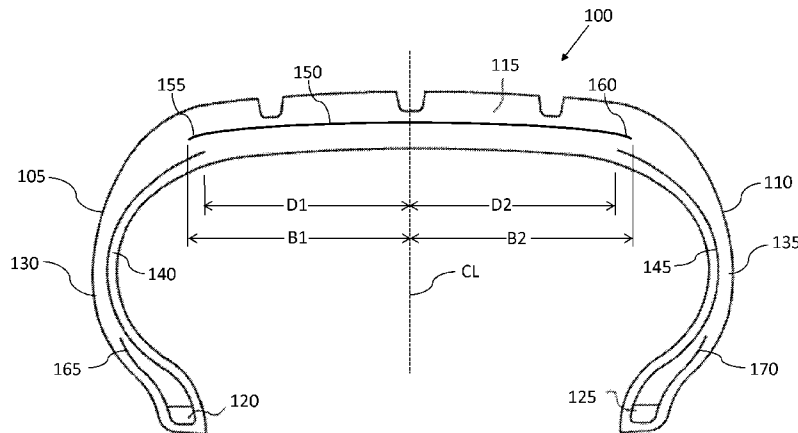


Figure 1

(57) Abstract: Various embodiments of a tire having a split body ply construction are disclosed.

WO 2014/149214 A1

**TIRE HAVING A SPLIT BODY PLY CONSTRUCTION**

## BACKGROUND

[0001] In the construction of a tire, one of the many key elements is the body ply. The body ply, which typically comprises reinforcement cord and rubber skim, wraps around the bead wire bundle (creating a “turnup” portion), passes radially across the tire, and wraps around the bead bundle on the opposite side (creating another “turnup” portion). The body ply provides strength to contain the air pressure within the tire and provides for sidewall impact resistance.

[0002] A prevalent consideration in the tire industry is the increasing of fuel efficiency through tire design. One strategy for increasing fuel efficiency through tire design is reducing the weight of the tire. Likewise, reduction of the materials used in tire construction would conserve natural resources.

[0003] What is needed is a reduced-weight tire and a method for making the same.

## SUMMARY

[0004] In one embodiment, a pneumatic tire is provided, the pneumatic tire comprising: at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge; a first bead portion; a second bead portion; a first sidewall; a second sidewall; a first fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge; a second fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge; and a cut-out zone in the crown portion of the tire, with the caveat that no fiber-reinforced material extends through the cut-out zone.

**[0005]** In another embodiment, a pneumatic tire is provided, the pneumatic tire comprising: at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge; a first bead portion; a second bead portion; a first sidewall; a second sidewall; a first fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge; a second fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge; a third fiber-reinforced half body ply extending from above the first bead portion, along the first sidewall, and terminating inside of the first belt edge; and a fourth fiber-reinforced half body ply extending from above the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

**[0006]** In another embodiment, a pneumatic tire is provided, the pneumatic tire comprising: at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge; a first bead portion; a second bead portion; a first sidewall; a second sidewall; a first fiber-reinforced half body ply extending from inside of the first belt edge, along the first sidewall, about the first bead portion, along the first sidewall, and terminating inside of the first belt edge; a second fiber-reinforced half body ply extending from inside of the second belt edge, along the second sidewall, about the second bead portion, along the second sidewall, and terminating inside of the second belt edge; and a cut-out zone in the crown portion of the tire, with the caveat that no fiber-reinforced material extends through the cut-out zone.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0007]** The accompanying figures, which are incorporated in and constitute a part of the specification, illustrate various example apparatuses and systems, and are used merely to

illustrate various example embodiments. In the figures, like elements bear like reference numerals.

[0008] **Figure 1** illustrates a cross-sectional view of an example arrangement of a tire having a split body ply construction.

[0009] **Figure 2** illustrates a cross-sectional view of an example arrangement of a tire having a split body ply construction.

[0010] **Figure 3** illustrates a cross-sectional view of an example arrangement of a tire having a split body ply construction.

[0011] **Figure 4** illustrates a cross-sectional view of a prior art tire construction.

#### DETAILED DESCRIPTION

[0012] The body ply of a tire radially inwardly of the belt in the crown portion carries relatively little to no force from the inflation pressure of the tire. As a result, any reinforcement provided by the body ply in this region is effectively unnecessary to the function of the tire. A tire void of body ply reinforcement in the crown portion would have less weight, and require less body ply material, than prior art tire constructions.

[0013] **Figure 1** illustrates a cross-sectional view of an example arrangement of a tire **100** having a split body ply construction. Tire **100** may comprise a first sidewall **105**, a second sidewall **110**, a crown portion **115**, a first bead portion **120**, and a second bead portion **125**. Tire **100** may additionally comprise a first side **130** and a second side **135**.

[0014] Tire **100** may comprise a pneumatic tire. In one embodiment, tire **100** is a pneumatic tire designed for application to a vehicle. In another embodiment, tire **100** is a pneumatic tire designed for application to a road vehicle. In one embodiment, tire **100** is a non-directional tire,

wherein tire **100** is configured to be mounted on a vehicle without a specified forward rolling direction. In another embodiment, tire **100** is a uni-directional tire, wherein tire **100** is configured to be mounted on a vehicle with a specified forward rolling direction.

[0015] In one embodiment, tire **100** comprises at least one body ply. In another embodiment, tire **100** comprises at least one fiber-reinforced body ply. In another embodiment, tire **100** comprises at least one fiber-reinforced half body ply. In one embodiment, tire **100** comprises a first fiber-reinforced half body ply **140** and a second fiber-reinforced half body ply **145**. First fiber-reinforced half body ply **140** and second fiber-reinforced half body ply **145** may comprise a reinforcement cord and rubber skim. In one embodiment, the reinforcement cord is a fiber reinforcement cord. In another embodiment, the reinforcement cord can be any of a variety of materials, including for example, polyester, rayon, nylon, aramid, and polyethylene naphthalate (PEN). In one embodiment, the rubber skim is any of a variety of rubber materials, having any of a variety of common formulations, densities, and other properties for use in tires.

[0016] In one embodiment, tire **100** comprises a belt **150**. In another embodiment, tire **100** comprises a plurality of belts **150**. Belt **150** may be oriented in crown portion **115** of tire **100**. Crown portion **115** may be defined as the radially outermost portion of tire **100**, extending generally between first sidewall **105** and second sidewall **110**. Belt **150** may comprise any of a variety of materials, including a metal. In one embodiment, belt **150** comprises a first belt edge **155** and a second belt edge **160**.

[0017] In one embodiment, first fiber-reinforced half body ply **140** extends about first bead portion **120**, along first sidewall **105** and terminating inside (“inside” being toward the centerline **CL** of tire **100**) of first belt edge **155**. In another embodiment, first fiber-reinforced half body ply **140** extends from a point in first bead portion **120**. In another embodiment, first fiber-

reinforced half body ply **140** extends from a point in first sidewall **105**. In another embodiment, first fiber-reinforced half body ply **140** extends from a point in the shoulder region of first side **130** of tire **100**. In another embodiment, first fiber-reinforced half body ply **140** extends from inside first belt edge **155** of tire **100**.

[0018] In one embodiment, second fiber-reinforced half body ply **145** extends about second bead portion **125**, along second sidewall **110** and terminating inside (“inside” being toward the centerline **CL** of tire **100**) of second belt edge **160**. In another embodiment, second fiber-reinforced half body ply **145** extends from a point in second bead portion **125**. In another embodiment, second fiber-reinforced half body ply **145** extends from a point in second sidewall **110**. In another embodiment, second fiber-reinforced half body ply **145** extends from a point in the shoulder region of second side **135** of tire **100**. In another embodiment, second fiber-reinforced half body ply **145** extends from inside second belt edge **160** of tire **100**.

[0019] In one embodiment, first fiber-reinforced half body ply **140** comprises a first turnup portion **165** defined by the portion of first fiber-reinforced half body ply **140** extending about first bead portion **120**. In another embodiment, second fiber-reinforced half body ply **145** comprises a second turnup portion **170** defined by the portion of second fiber-reinforced half body ply **145** extending about second bead portion **125**.

[0020] In one embodiment, tire **100** comprises a centerline **CL** oriented at the laterally central point within tire **100**. Centerline **CL** may correspond with the centerline of a rim.

[0021] In one embodiment, first fiber-reinforced half body ply **140** terminates at a point that is a distance **D1** from centerline **CL**. In another embodiment, second fiber-reinforced half body ply **145** terminates at a point that is a distance **D2** from centerline **CL**.

[0022] In one embodiment, tire **100** comprises a cut-out zone in crown portion **115**. In one embodiment, no fiber-reinforced material extends through the cut-out zone, including any body ply or reinforcing ply. In another embodiment, no reinforcement material extends through the cut-out zone. The phrase “cut-out zone” is used herein to mean the zone in crown portion **115** between the end points of first fiber-reinforced half body ply **140** and second fiber-reinforced half body ply **145**. The cut-out zone may have a width comprising the sum of distance **D1** and distance **D2**.

[0023] In one embodiment, first belt edge **155** extends to a distance **B1** from centerline **CL**. In another embodiment, second belt edge **160** extends to a distance **B2** from centerline **CL**.

[0024] At least one of first fiber-reinforced half body ply **140** and second fiber-reinforced half body ply **145** may underlap belt **150**. In one embodiment, distance **B1** is greater than the distance **D1**. In another embodiment, distance **B2** is greater than the distance **D2**. In one embodiment, distance **B1** and distance **B2** are between about 0.0 in. and about 3.0 in. greater than distance **D1** and distance **D2**, respectively. In another embodiment, distance **B1** and distance **B2** are between about 0.2 in. and about 2.0 in. greater than distance **D1** and distance **D2**, respectively. In another embodiment, distance **B1** and distance **B2** are between about 0.3 in. and about 1.0 in. greater than distance **D1** and distance **D2**, respectively.

[0025] In one embodiment, at least one of first fiber-reinforced half body ply **140** and second fiber-reinforced half body ply **145** is oriented radially inwardly of belt **150**. In another embodiment, both of first fiber-reinforced half body ply **140** and second fiber-reinforced half body ply **145** are oriented radially inwardly of belt **150**. In another embodiment, at least one of first fiber-reinforced half body ply **140** and second fiber-reinforced half body ply **145** is oriented radially outwardly of belt **150**.

[0026] In one embodiment, tire **100** comprises a third fiber-reinforced half body ply (not shown) extending about first bead portion **120**, along first sidewall **105**, and terminating inside first belt edge **155**. In another embodiment, tire **100** comprises a fourth fiber-reinforced half body ply (not shown) extending about second bead portion **120**, along second sidewall **110**, and terminating inside second belt edge **160**. In another embodiment, tire **100** comprises fiber-reinforced half body plies in addition to the third and fourth fiber-reinforced half body plies.

[0027] In one embodiment, tire **100** comprises at least one body ply beginning in first side **130**, extending across crown portion **115**, and terminating in second side **135**. The at least one body ply may extend about one or both of first bead portion **120** and second bead portion **125**.

[0028] **Figure 2** illustrates a cross-sectional view of an example arrangement of a tire **200** having a split body ply construction. Tire **200** may comprise a first sidewall **205**, a second sidewall **210**, a crown portion **215**, a first bead portion **220**, and a second bead portion **225**. Tire **200** may additionally comprise a first side **230** and a second side **235**.

[0029] In one embodiment, tire **200** comprises at least one body ply. In another embodiment, tire **200** comprises at least one fiber-reinforced body ply. In another embodiment, tire **200** comprises at least one fiber-reinforced half body ply. In one embodiment, tire **200** comprises a first fiber-reinforced half body ply **240** and a second fiber-reinforced half body ply **245**. First fiber-reinforced half body ply **240** and second fiber-reinforced half body ply **245** may comprise a reinforcement cord and rubber skim.

[0030] In one embodiment, tire **200** comprises a belt **250**. In another embodiment, tire **200** comprises a plurality of belts **250**. Belt **250** may be oriented in crown portion **215** of tire **200**. In one embodiment, belt **250** comprises a first belt edge **255** and a second belt edge **260**.

[0031] In one embodiment, first fiber-reinforced half body ply **240** extends from inside of first belt edge **255**, along first sidewall **205**, about first bead portion **220**, along first sidewall **205**, and terminating inside of first belt edge **255**. In another embodiment, second fiber-reinforced half body ply **245** extends from inside of second belt edge **260**, along second sidewall **210**, about second bead portion **225**, along second sidewall **210**, and terminating inside of second belt edge **260**. In one embodiment, a third fiber-reinforced half body ply (not shown) extends from inside of first belt edge **255**, along first sidewall **205**, about first bead portion **220**, along first sidewall **205**, and terminating inside of first belt edge **255**. In another embodiment, a fourth fiber-reinforced half body ply (not shown) extends from inside of second belt edge **260**, along second sidewall **210**, about second bead portion **225**, along second sidewall **210**, and terminating inside of second belt edge **260**.

[0032] In one embodiment, tire **200** comprises at least one body ply beginning in first side **230**, extending across crown portion **215**, and terminating in second side **235**. The at least one body ply may extend about one or both of first bead portion **220** and second bead portion **225**. In one embodiment, tire **200** comprises a third fiber-reinforced half body ply (not shown) extending about first bead portion **220**, along first sidewall **205**, and terminating inside of first belt edge **255**. In another embodiment, tire **200** comprises a fourth fiber-reinforced half body ply (not shown) extending about second bead portion **220**, along first sidewall **205**, and terminating inside of first belt edge **255**.

[0033] In one embodiment, first fiber-reinforced half body ply **240** comprises a first turnup portion **265** defined by the portion of first fiber-reinforced half body ply **240** extending about first bead portion **220**. In another embodiment, second fiber-reinforced half body ply **245**

comprises a second turnup portion **270** defined by the portion of second fiber-reinforced half body ply **245** extending about second bead portion **225**.

[0034] In one embodiment, tire **200** comprises a centerline **CL** oriented at the laterally central point within tire **200**. Centerline **CL** may correspond with the centerline of a rim.

[0035] In one embodiment, first fiber-reinforced half body ply **240** at least one of begins and terminates at a point that is a distance **D1** from centerline **CL**. In another embodiment, second fiber-reinforced half body ply **245** at least one of begins and terminates at a point that is a distance **D2** from centerline **CL**. In one embodiment, first belt edge **255** extends to a distance **B1** from centerline **CL**. In another embodiment, second belt edge **260** extends to a distance **B2** from centerline **CL**. In one embodiment, distance **B1** and distance **B2** are greater than distance **D1** and distance **D2**.

[0036] In one embodiment, first fiber-reinforced half body ply **240** is oriented radially inwardly of belt **250**. In one embodiment, second fiber-reinforced half body ply **245** is oriented radially inwardly of belt **250**.

[0037] In one embodiment, tire **200** comprises a cut-out zone in crown portion **215**. In one embodiment, no fiber-reinforced material extends through the cut-out zone, including any body ply or reinforcing ply. In another embodiment, no reinforcement material extends through the cut-out zone.

[0038] **Figure 3** illustrates a cross-sectional view of an example arrangement of a tire **300** having a split body ply construction. Tire **300** may comprise a first sidewall **305**, a second sidewall **310**, a crown portion **315**, a first bead portion **320**, and a second bead portion **325**. Tire **300** may additionally comprise a first side **330** and a second side **335**.

[0039] In one embodiment, tire **300** comprises at least one body ply. In another embodiment, tire **300** comprises at least one fiber-reinforced body ply. In another embodiment, tire **300** comprises at least one fiber-reinforced half body ply. In one embodiment, tire **300** comprises a first fiber-reinforced half body ply **340** and a second fiber-reinforced half body ply **345**. First fiber-reinforced half body ply **340** and second fiber-reinforced half body ply **345** may comprise a reinforcement cord and rubber skim.

[0040] In one embodiment, tire **300** comprises a belt **350**. In another embodiment, tire **300** comprises a plurality of belts **350**. Belt **350** may be oriented in crown portion **315** of tire **300**. In one embodiment, belt **350** comprises a first belt edge **355** and a second belt edge **360**.

[0041] In one embodiment, first fiber-reinforced half body ply **340** extends about first bead portion **320**, along first sidewall **305**, and terminates inside of first belt edge **355**. In another embodiment, second fiber-reinforced half body ply **345** extends about second bead portion **325**, along second sidewall **310**, and terminates inside of second belt edge **360**.

[0042] In one embodiment, first fiber-reinforced half body ply **340** comprises a first turnup portion **365** defined by the portion of first fiber-reinforced half body ply **340** extending about first bead portion **320**. In another embodiment, second fiber-reinforced half body ply **345** comprises a second turnup portion **370** defined by the portion of second fiber-reinforced half body ply **345** extending about second bead portion **325**.

[0043] In one embodiment, a third fiber-reinforced half body ply **375** extends from above bead portion **320**, along first sidewall **305**, and terminates inside of first belt edge **355**. In another embodiment, a fourth fiber-reinforced half body ply **380** extends from above bead portion **325**, along second sidewall **310**, and terminates inside of second belt edge **360**. In one

embodiment, at least one of third fiber-reinforced half body ply **375** and fourth fiber-reinforced half body ply **380** extends from below bead portions **320** and **325**. In one embodiment, at least one of third fiber-reinforced half body ply **375** and fourth fiber-reinforced half body ply **380** are oriented radially outwardly of first fiber-reinforced half body ply **340** and second fiber-reinforced half body ply **345**. In one embodiment, first fiber-reinforced half body ply **340**, second fiber-reinforced half body ply **345**, third fiber-reinforced half body ply **375**, and fourth fiber-reinforced half body ply **380** are oriented radially inwardly of belt **350**.

[0044] In one embodiment, tire **300** comprises a centerline **CL** oriented at the laterally central point within tire **300**. Centerline **CL** may correspond with the centerline of a rim.

[0045] In one embodiment, first fiber-reinforced half body ply **340** terminates at a point that is a distance **D1** from centerline **CL**. In another embodiment, second fiber-reinforced half body ply **345** terminates at a point that is a distance **D2** from centerline **CL**. In another embodiment, third fiber-reinforced half body ply **375** terminates at a point that is a distance **D1** from centerline **CL**. In another embodiment, fourth fiber-reinforced half body ply **380** terminates at a point that is a distance **D2** from centerline **CL**.

[0046] In one embodiment, first belt edge **355** extends to a distance **B1** from centerline **CL**. In another embodiment, second belt edge **360** extends to a distance **B2** from centerline **CL**. In one embodiment, distance **B1** and distance **B2** are greater than distance **D1** and distance **D2**.

[0047] In one embodiment, tire **300** comprises a cut-out zone in crown portion **315**. In one embodiment, no fiber-reinforced material extends through the cut-out zone, including any body ply or reinforcing ply. In another embodiment, no reinforcement material extends through the cut-out zone.

[0048] **Figure 4** illustrates a cross-sectional view of a tire **400** having a prior art construction. Tire **400** consists essentially of a first sidewall **405**, a second sidewall **410**, a crown portion **415**, a first side **430**, a second side **435**, a first bead portion **420**, and a second bead portion **425**.

[0049] As shown, tire **400** has a body ply **440**. Body ply **440** extends about first bead portion **455**, along sidewall **405** in first side **430**, across crown portion **415**, along sidewall **410** in second side **435**, and about second bead portion **425**. As shown, body ply **440** has a first turnup portion **445** defined by the portion of body ply **440** extending about first bead portion **420**. Body ply **440** also has a second turnup portion **447** defined by the portion of body ply **440** extending about second bead portion **425**. As shown, tire **400** has at least one belt **450**.

[0050] As illustrated in **Figure 4**, body ply **440** extends across the width of tire **400** without a cut-out zone.

[0051] To the extent that the term “includes” or “including” is used in the specification or the claims, it is intended to be inclusive in a manner similar to the term “comprising” as that term is interpreted when employed as a transitional word in a claim. Furthermore, to the extent that the term “or” is employed (e.g., A or B) it is intended to mean “A or B or both.” When the applicants intend to indicate “only A or B but not both” then the term “only A or B but not both” will be employed. Thus, use of the term “or” herein is the inclusive, and not the exclusive use. See Bryan A. Garner, *A Dictionary of Modern Legal Usage* 624 (2d. Ed. 1995). Also, to the extent that the terms “in” or “into” are used in the specification or the claims, it is intended to additionally mean “on” or “onto.” To the extent that the term “selectively” is used in the specification or the claims, it is intended to refer to a condition of a component wherein a user of the apparatus may activate or deactivate the feature or function of the component as is necessary

or desired in use of the apparatus. To the extent that the term “operatively connected” is used in the specification or the claims, it is intended to mean that the identified components are connected in a way to perform a designated function. As used in the specification and the claims, the singular forms “a,” “an,” and “the” include the plural. Finally, where the term “about” is used in conjunction with a number, it is intended to include  $\pm 10\%$  of the number. In other words, “about 10” may mean from 9 to 11.

**[0052]** As stated above, while the present application has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art, having the benefit of the present application. Therefore, the application, in its broader aspects, is not limited to the specific details, illustrative examples shown, or any apparatus referred to. Departures may be made from such details, examples, and apparatuses without departing from the spirit or scope of the general inventive concept.

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## CLAIMS

1. A pneumatic tire, comprising:
  - at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge;
  - a first bead portion;
  - a second bead portion;
  - a first sidewall;
  - a second sidewall;
  - a first fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge;
  - a second fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge; and
  - a cut-out zone in the crown portion of the tire,
    - with the caveat that no fiber-reinforced material extends through the cut-out zone.
2. The pneumatic tire of claim 1, wherein the tire comprises a centerline CL;
  - and wherein the first fiber-reinforced half body ply terminates at a point that is a distance D1 from centerline CL;
  - and wherein the second fiber-reinforced half body ply terminates at a point that is a distance D2 from centerline CL;
  - and wherein the first belt edge extends to a distance B1 from centerline CL;

and wherein the second belt edge extends to a distance B2 from centerline CL;

and

and wherein the distance B1 is greater than the distance D1 and the distance B2 is greater than the distance D2.

3. The pneumatic tire of claim 2, wherein distance B1 and distance B2 are up to about 3.0 in. greater than distance D1 and distance D2.

4. The pneumatic tire of claim 1, further comprising a third fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge.

5. The pneumatic tire of claim 1, further comprising a fourth fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

6. The pneumatic tire of claim 1, further comprising a third fiber-reinforced half body ply extending from above the first bead portion, along the first sidewall, and terminating inside of the first belt edge.

7. The pneumatic tire of claim 1, further comprising a fourth fiber-reinforced half body ply extending from above the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

8. The pneumatic tire of claim 1, wherein the first fiber-reinforced half body ply and the second fiber-reinforced half body ply are oriented radially inwardly of the belt.

9. A pneumatic tire, comprising:

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at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge;

a first bead portion;

a second bead portion;

a first sidewall;

a second sidewall;

a first fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge;

a second fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge;

a third fiber-reinforced half body ply extending from above the first bead portion, along the first sidewall, and terminating inside of the first belt edge; and

a fourth fiber-reinforced half body ply extending from above the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

10. The pneumatic tire of claim 9, further comprising a cut-out zone in the crown portion of the tire, with the caveat that no fiber-reinforced material extends through the cut-out zone.

11. The pneumatic tire of claim 9, wherein the third fiber-reinforced half body ply is oriented radially outwardly of the first fiber-reinforced half body ply.

12. The pneumatic tire of claim 9, wherein the fourth fiber-reinforced half body ply is oriented radially outwardly of the second fiber-reinforced half body ply.

13. The pneumatic tire of claim 9, wherein the tire comprises a centerline CL;  
and wherein the first fiber-reinforced half body ply terminates at a point that is a distance D1 from centerline CL;  
and wherein the second fiber-reinforced half body ply terminates at a point that is a distance D2 from centerline CL;  
and wherein the first belt edge extends to a distance B1 from centerline CL;  
and wherein the second belt edge extends to a distance B2 from centerline CL;  
and  
and wherein the distance B1 is greater than the distance D1 and the distance B2 is greater than the distance D2.
14. The pneumatic tire of claim 13, wherein distance B1 and distance B2 are up to about 3.0 in. greater than distance D1 and distance D2.
15. The pneumatic tire of claim 9, wherein the first fiber-reinforced half body ply, the second fiber-reinforced half body ply, the third fiber-reinforced half body ply, and the fourth fiber-reinforced half body ply are oriented radially inwardly of the belt.
16. A pneumatic tire, comprising:  
at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge;  
a first bead portion;  
a second bead portion;  
a first sidewall;

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a second sidewall;

a first fiber-reinforced half body ply extending from inside of the first belt edge, along the first sidewall, about the first bead portion, along the first sidewall, and terminating inside of the first belt edge;

a second fiber-reinforced half body ply extending from inside of the second belt edge, along the second sidewall, about the second bead portion, along the second sidewall, and terminating inside of the second belt edge; and

a cut-out zone in the crown portion of the tire,

with the caveat that no fiber-reinforced material extends through the cut-out zone.

17. The pneumatic tire of claim 16, wherein the tire comprises a centerline CL;

wherein the first fiber-reinforced half body ply begins or terminates at a point that is a distance D1 from centerline CL;

wherein the second fiber-reinforced half body ply begins or terminates at a point that is a distance D2 from centerline CL;

wherein the first belt edge extends to a distance B1 from centerline CL;

wherein the second belt edge extends to a distance B2 from centerline CL; and

wherein the distance B1 is greater than the distance D1 and the distance B2 is greater than the distance D2.

18. The pneumatic tire of claim 17, wherein distance B1 and distance B2 are up to about 3.0 in. greater than distance D1 and distance D2.

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19. The pneumatic tire of claim 16, wherein the first fiber-reinforced half body ply and the second fiber-reinforced half body ply are oriented radially inwardly of the belt.

20. The pneumatic tire of claim 16, further comprising a third fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge and a fourth fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

**AMENDED CLAIMS**  
received by the International Bureau on 23 July 2014 (23.07.2014)

What is claimed is:

1. A pneumatic tire, comprising:

at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge;

a first bead portion;

a second bead portion;

a first sidewall;

a second sidewall;

a first fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge;

a second fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge; and

a cut-out zone in the crown portion of the tire,

with the caveat that neither a fiber-reinforced material, nor a reinforcement material, extends through the cut-out zone.

2. The pneumatic tire of claim 1, wherein the tire comprises a centerline CL;

and wherein the first fiber-reinforced half body ply terminates at a point that is a distance D1 from centerline CL;

and wherein the second fiber-reinforced half body ply terminates at a point that is a distance D2 from centerline CL;

and wherein the first belt edge extends to a distance B1 from centerline CL;

and wherein the second belt edge extends to a distance B2 from centerline CL;

and

wherein the distance B1 is greater than the distance D1 and the distance B2 is greater than the distance D2.

3. The pneumatic tire of claim 2, wherein distance B1 and distance B2 are up to about 3.0 in. greater than distance D1 and distance D2.

4. The pneumatic tire of claim 1, further comprising a third fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge.

5. The pneumatic tire of claim 1, further comprising a fourth fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

6. The pneumatic tire of claim 1, further comprising a third fiber-reinforced half body ply extending from above the first bead portion, along the first sidewall, and terminating inside of the first belt edge.

7. The pneumatic tire of claim 1, further comprising a fourth fiber-reinforced half body ply extending from above the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

8. The pneumatic tire of claim 1, wherein the first fiber-reinforced half body ply and the second fiber-reinforced half body ply are oriented radially inwardly of the belt,

9. A pneumatic tire, comprising:

at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge;

a first bead portion;

a second bead portion;

a first sidewall;

a second sidewall;

a first fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge;

a second fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge;

a third fiber-reinforced half body ply extending from above the first bead portion, along the first sidewall, and terminating inside of the first belt edge; and

a fourth fiber-reinforced half body ply extending from above the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

10. The pneumatic tire of claim 9, further comprising a cut-out zone in the crown portion of the tire, with the caveat that no fiber-reinforced material extends through the cut-out zone.

11. The pneumatic tire of claim 9, wherein the third fiber-reinforced half body ply is oriented radially outwardly of the first fiber-reinforced half body ply.

12. The pneumatic tire of claim 9, wherein the fourth fiber-reinforced half body ply is oriented radially outwardly of the second fiber-reinforced half body ply.

13. The pneumatic tire of claim 9, wherein the tire comprises a centerline CL;

and wherein the first fiber-reinforced half body ply terminates at a point that is a distance D1 from centerline CL;

and wherein the second fiber-reinforced half body ply terminates at a point that is a distance D2 from centerline CL;

and wherein the first belt edge extends to a distance B1 from centerline CL;

and wherein the second belt edge extends to a distance B2 from centerline CL;

and

wherein the distance B1 is greater than the distance D1 and the distance B2 is greater than the distance D2.

14. The pneumatic tire of claim 13, wherein distance B1 and distance B2 are up to about 3.0 in. greater than distance D1 and distance D2.

15. The pneumatic tire of claim 9, wherein the first fiber-reinforced half body ply, the second fiber-reinforced half body ply, the third fiber-reinforced half

body ply, and the fourth fiber-reinforced half body ply are oriented radially inwardly of the belt.

16. A pneumatic tire, comprising:

at least one belt oriented in a crown portion of the tire, the at least one belt comprising a first belt edge and a second belt edge;

a first bead portion;

a second bead portion;

a first sidewall;

a second sidewall;

a first fiber-reinforced half body ply extending from inside of the first belt edge, along the first sidewall, about the first bead portion, along the first sidewall, and terminating inside of the first belt edge;

a second fiber-reinforced half body ply extending from inside of the second belt edge, along the second sidewall, about the second bead portion, along the second sidewall, and terminating inside of the second belt edge; and

a cut-out zone in the crown portion of the tire,

with the caveat that neither a fiber-reinforced material, nor a reinforcement material, extends through the cut-out zone.

17. The pneumatic tire of claim 16, wherein the tire comprises a centerline CL;

wherein the first fiber-reinforced half body ply begins or terminates at a point that is a distance D1 from centerline CL;

wherein the second fiber-reinforced half body ply begins or terminates at a point that is a distance D2 from centerline CL;

wherein the first belt edge extends to a distance B1 from centerline CL;

wherein the second belt edge extends to a distance B2 from centerline CL; and

wherein the distance B1 is greater than the distance D1 and the distance B2 is greater than the distance D2.

18. The pneumatic tire of claim 17, wherein distance B1 and distance B2 are up to about 3.0 in. greater than distance D1 and distance D2.

19. The pneumatic tire of claim 16, wherein the first fiber-reinforced half body ply and the second fiber-reinforced half body ply are oriented radially inwardly of the belt.

20. The pneumatic tire of claim 16, further comprising a third fiber-reinforced half body ply extending about the first bead portion, along the first sidewall, and terminating inside of the first belt edge and a fourth fiber-reinforced half body ply extending about the second bead portion, along the second sidewall, and terminating inside of the second belt edge.

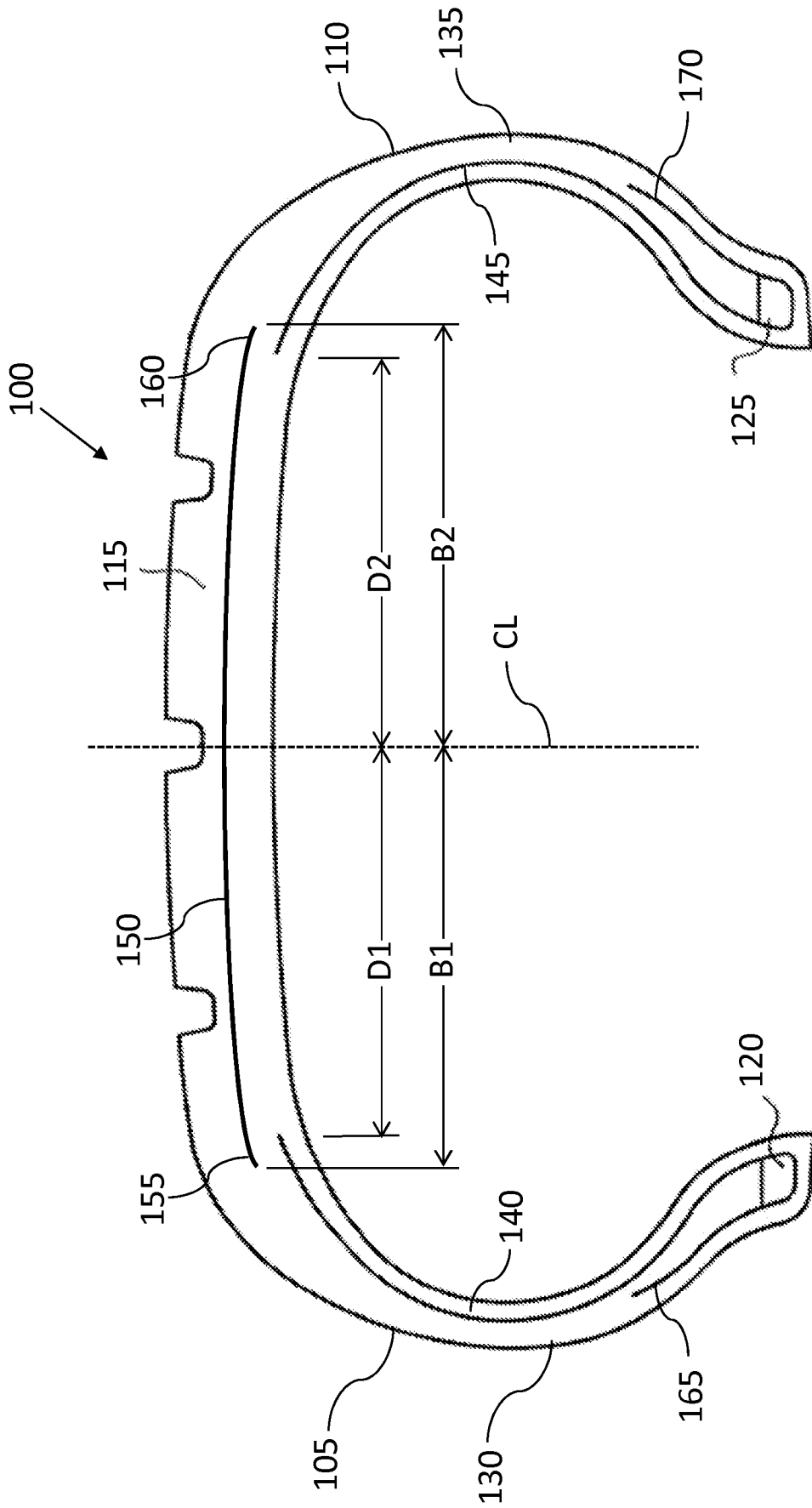


Figure 1

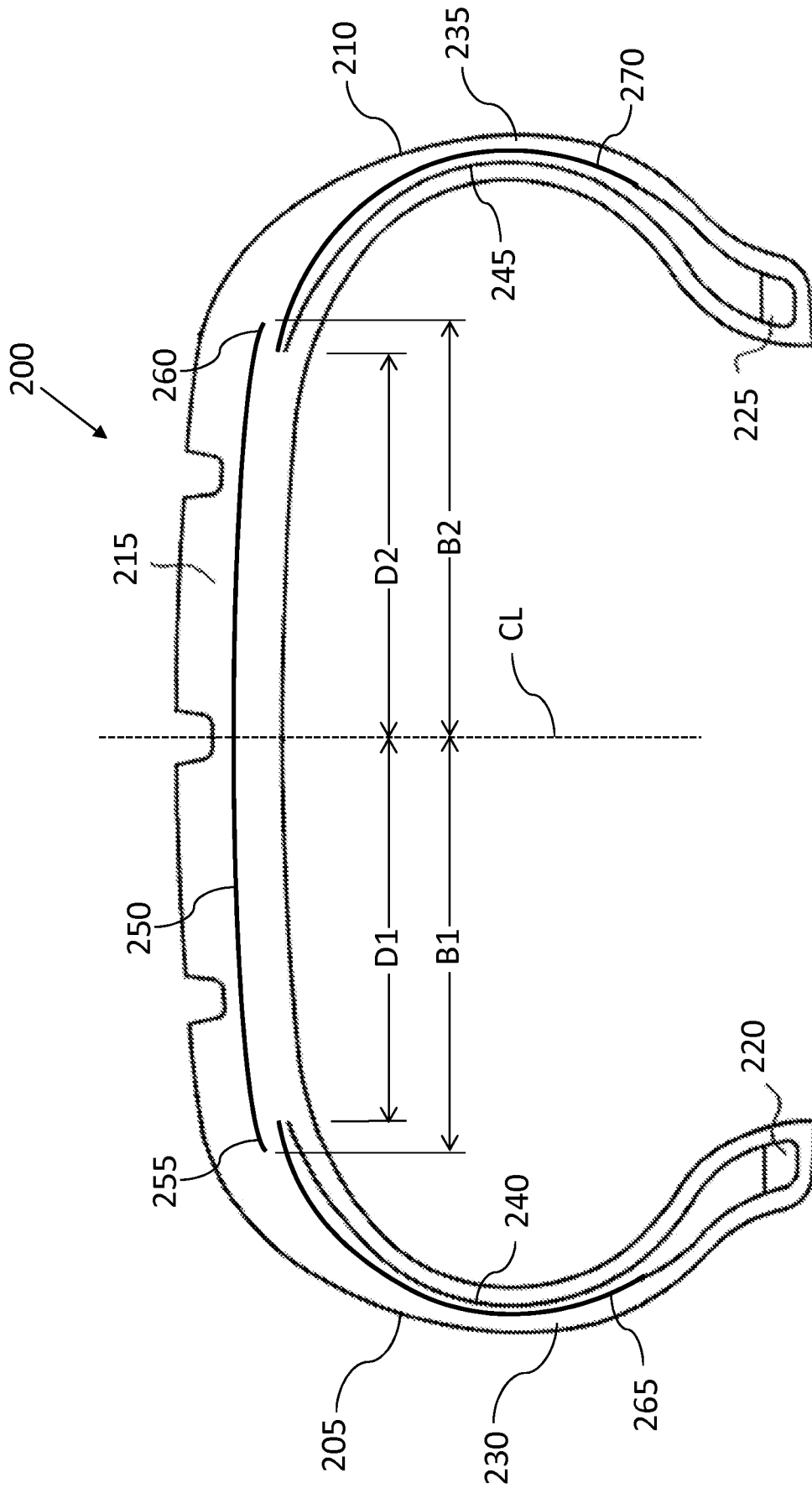


Figure 2

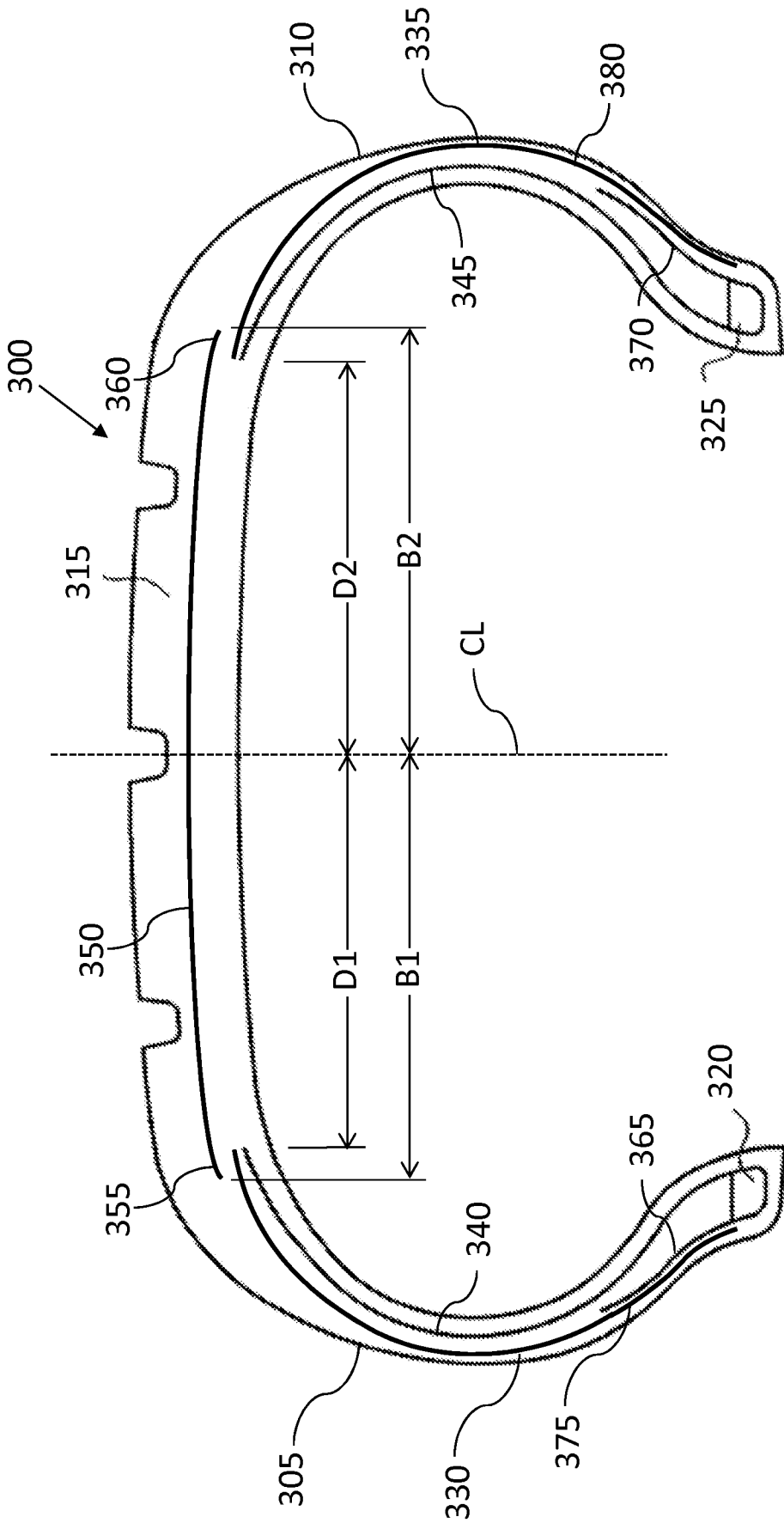
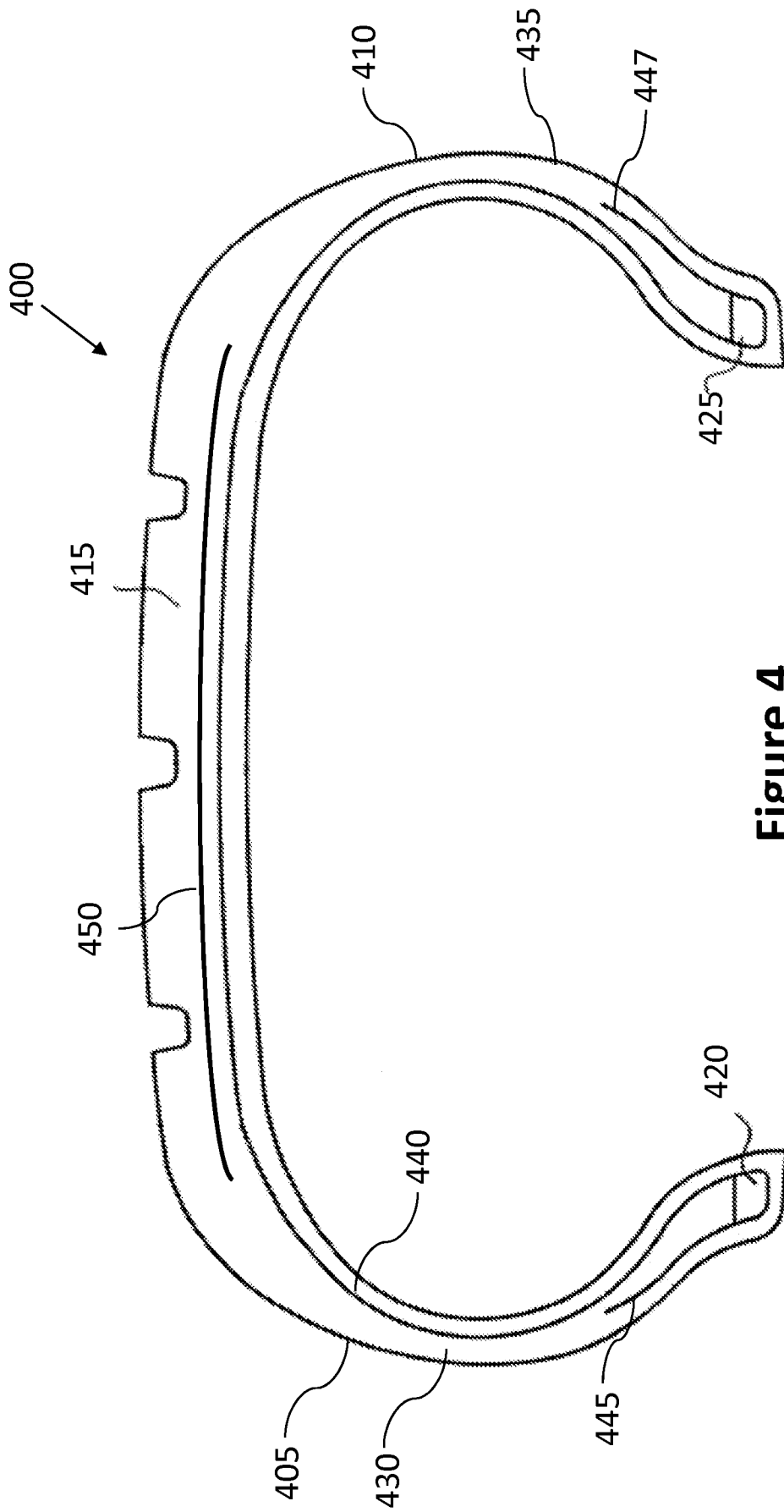


Figure 3



**Figure 4**  
PRIOR ART

**A. CLASSIFICATION OF SUBJECT MATTER****B60C 15/04(2006.01)i, B60C 15/06(2006.01)i, B60C 5/08(2006.01)i, B60C 9/18(2006.01)i**

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 15/04; B60C 9/00; B60C 9/02; B60C 9/08; B60C 13/00; B60C 15/06; B60C 5/08; B60C 9/18

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: tire, belt, crown, half body ply, and cut-out zone

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6305452 B1 (SATO, TAKAYUKI) 23 October 2001 See column 2, lines 21-45, column 4, lines 4-6; claim 1; and figures 1-3.	1-5,8
Y		6-7,9-20
Y	US 5273094 A (CHAVET, RUDOLF) 28 December 1993 See column 5, lines 62-65 and figure 2.	6-7,9-15
Y	US 6345658 B1 (SHIDA et al.) 12 February 2002 See column 3, lines 53-67 and figure 1.	16-20
A	US 2009-0101267 A1 (NEUBAUER et al.) 23 April 2009 See paragraphs [0060]-[0062] and figures 2-3.	1-20
A	US 2008-0093003 A1 (SANDSTROM et al.) 24 April 2008 See paragraphs [0050] and figure 1.	1-20

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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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

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

27 May 2014 (27.05.2014)

Date of mailing of the international search report

**28 May 2014 (28.05.2014)**

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2014/015087**

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