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(54) **Title**: TIRE HAVING AN ELECTRONIC DEVICE IN A LOWER SIDEWALL

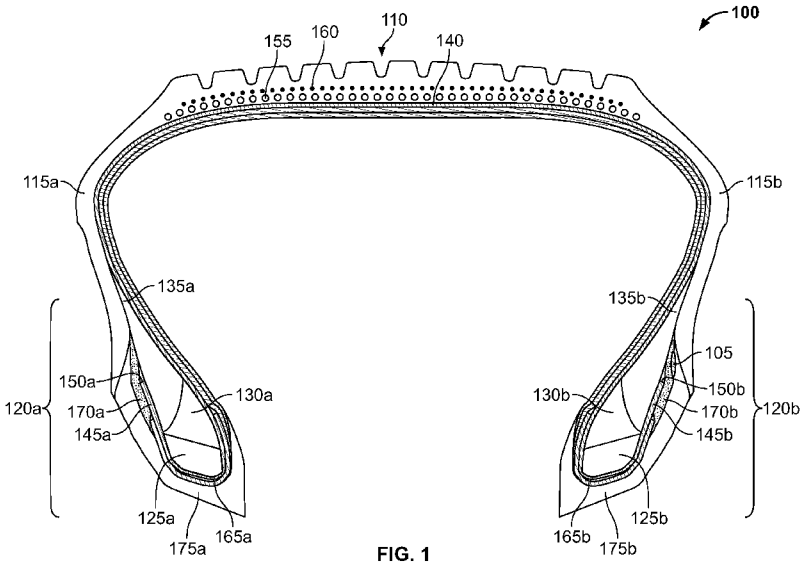


FIG. 1

(57) **Abstract**: A tire includes a pair of bead portions having a bead and a bead filler. A pair of reinforcement fillers has an inner surface with an upper portion contacting an outer surface of a respective bead filler, a middle portion contacting an outer surface of a respective turn up portion of a body ply, and a lower portion contacting an outer surface of a wire reinforcement. An electronic device is disposed radially below an apex of the bead filler of one of the bead portions and axially outside the bead filler. The electronic device is axially spaced from the bead filler such that the electronic device does not contact the bead filler.

WO 2015/088890 A1

TIRE HAVING AN ELECTRONIC DEVICE IN A LOWER SIDEWALL

FIELD OF INVENTION

[0001] The present disclosure relates to the field of incorporating an electronic device in a tire. More specifically, the present disclosure relates to the field of embedding a radio frequency identification ("RFID") tag in a tire.

BACKGROUND

[0002] Incorporation of an electronic device, such as an RFID tag, into a tire can occur during tire construction and before vulcanization or in a post-cure procedure. Such electronic devices have utility in transmitting data, such as tire-specific identification data, to an external reader. Ultra-high frequency ("UHF") tags are typically small and utilize flexible antennas for the transmission of data. When embedded into a tire, such as during tire construction, the electronic device represents a foreign object that can affect the structural integrity of the tire. Many locations within a tire are not suitable for placing an RFID tag because of cyclical flexural bending in service or because the location does not permit suitable radio frequency compatibility for reading applications.

SUMMARY OF THE INVENTION

[0003] In one embodiment, a tire includes a circumferential tread, a pair of sidewalls, and a pair of bead portions, with each bead portion having a bead and a bead filler with an apex. At least one body ply extends from bead to bead, and includes a pair of turn up portions. Each turn up portion has a turn up end axially outside of a respective bead and radially below the apex of a respective bead filler. The tire further includes a pair of wire reinforcements, with each wire reinforcement wrapping around one of the pair of bead portions such that each wire reinforcement has an inner portion axially inside the body ply and an outer portion axially outside a respective turn up portion of the body ply. The inner portion of each wire reinforcement has an inner end disposed radially above a respective bead and radially below the apex of a respective bead filler. The outer portion

of each wire reinforcement has an outer end radially above a respective bead and radially below the turn up end of a respective turn up portion of the body ply. The tire further includes a pair of reinforcement fillers. Each reinforcement filler has an inner surface with an upper portion contacting an outer surface of a respective bead filler, a middle portion contacting an outer surface of a respective turn up portion of the body ply, and a lower portion contacting an outer surface of a respective wire reinforcement. The reinforcement filler has a top end disposed below the apex of the respective bead filler. The tire further includes an electronic device disposed radially below the apex of the bead filler of one of the bead portions and axially outside the bead filler. The electronic device is axially spaced from the bead filler such that the electronic device does not contact the bead filler.

[0004] In another embodiment, a tire includes a circumferential tread, a pair of sidewalls, a pair of bead portions, and at least one body ply extending from bead portion to bead portion. The body ply includes a pair of turn up portions radially outside of a respective bead portion. Each bead portion includes a bead, a bead filler having an apex, and a wire reinforcement wrapping around the bead portion and at least a portion of the body ply. Each bead portion further includes a reinforcement filler having an inner surface. At least a portion of the inner surface is in contact with an outer surface of the bead filler. Each bead portion also includes a first chafer at least partially wrapping around the bead portion. At least one of the bead portions also includes an electronic device disposed radially below the apex of the bead filler. At least a portion of the electronic device is sandwiched between the first chafer and one of the pair of sidewalls, such that the electronic device is in contact with the first chafer and the sidewall.

[0005] In yet another embodiment, a tire includes a circumferential tread, a pair of sidewalls, a pair of bead portions, and at least one body ply extending from bead portion to bead portion. The body ply includes a pair of turn up portions radially outside of a respective bead portion. Each bead portion includes a bead, a bead filler having an apex, and a reinforcement filler having an inner surface. At least a portion of the inner surface is in contact with an outer surface of the bead filler. Each bead portion further includes an abrasion portion at least partially wrapping around the bead portion. An electronic device is disposed radially below the apex of the bead filler of one of the bead portions.

At least a portion of the electronic device is sandwiched between the reinforcement filler and the abrasion portion, such that the electronic device is in contact with the reinforcement filler and the abrasion portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] In the accompanying drawings, structures are illustrated that, together with the detailed description provided below, describe exemplary embodiments of the claimed invention. Like elements are identified with the same reference numerals. It should be understood that elements shown as a single component may be replaced with multiple components, and elements shown as multiple components may be replaced with a single component. The drawings are not to scale and the proportion of certain elements may be exaggerated for the purpose of illustration.

[0007] **Figure 1** is a cross section of one embodiment of a tire **100** having an electronic device embedded therein;

[0008] **Figure 2** is a schematic drawing of one embodiment of an electronic device;

[0009] **Figure 3** is a cross section of the bead region of the tire **100**;

[0010] **Figure 4** is a cross section of an alternative embodiment of a bead region of a tire; and

[0011] **Figure 5** is a cross section of another alternative embodiment of a bead region of a tire.

DETAILED DESCRIPTION

[0012] The following includes definitions of selected terms employed herein. The definitions include various examples or forms of components that fall within the scope of a term and that may be used for implementation. The examples are not intended to be limiting. Both singular and plural forms of terms may be within the definitions.

[0013] "Axial" or "axially" refer to a direction that is parallel to the axis of rotation of a tire.

[0014] "Bead" refers to the part of the tire that contacts the wheel and defines a boundary of the sidewall.

[0015] "Circumferential" and "circumferentially" refer to a direction extending along the perimeter of the surface of the tread perpendicular to the axial direction.

[0016] "Equatorial plane" refers to the plane that is perpendicular to the tire's axis of rotation and passes through the center of the tire's tread.

[0017] "Radial" and "radially" refer to a direction perpendicular to the axis of rotation of a tire.

[0018] "Sidewall" refers to that portion of the tire between the tread and the bead.

[0019] "Tread" refers to that portion of the tire that comes into contact with the road under normal inflation and load.

[0020] Directions are stated herein with reference to the axis of rotation of the tire. The terms "upward" and "upwardly" refer to a general direction towards the tread of the tire, whereas "downward" and "downwardly" refer to the general direction towards the axis of rotation of the tire. Thus, when relative directional terms such as "upper" and "lower" or "top" and "bottom" are used in connection with an element, the "upper" or "top" element is spaced closer to the tread than the "lower" or "bottom" element. Additionally, when relative directional terms such as "above" or "below" are used in connection with an element, an element that is "above" another element is closer to the tread than the other element.

[0021] The terms "inward" and "inwardly" refer to a general direction towards the equatorial plane of the tire, whereas "outward" and "outwardly" refer to a general direction away from the equatorial plane of the tire and towards the sidewall of the tire. Thus, when relative directional terms such as "inner" and "outer" are used in connection with an element, the "inner" element is spaced closer to the equatorial plane of the tire than the "outer" element.

[0022] **Figure 1** illustrates a cross section of one embodiment of a tire **100** having an electronic device **105** embedded therein. In the illustrated embodiment, the tire **100** includes a circumferential tread **110** and a pair of sidewalls **115** including a first sidewall **115a** and a second sidewall **115b**. The first sidewall **115a** extends from a first bead region **120a** to the circumferential tread **110**. The second sidewall **115b** likewise extends from a second bead region **120b** to the circumferential tread **110**. Each bead region includes a bead **125a**,**b** and a bead filler **130a**,**b** having an apex **135a**,**b**.

[0023] The tire **100** further includes a body ply **140** extending from the first bead region **120a** to the second bead region **120b**. While only a single body ply **140** is shown in the illustrated embodiment, it should be understood that two or more body plies may be employed.

[0024] The body ply **140** wraps around each of the beads **125a,b**, thereby forming a first turn up portion **145a** and a second turn up portion **145b**. The first turn up portion **145a** terminates at a first turn up end **150a** located axially outside of the first bead filler **130a** and radially below the apex **135a** of the first bead filler **130a**. Likewise, the second turn up portion **145b** terminates at a second turn up end **150b** located axially outside of the second bead filler **130b** and radially below the apex **135b** of the second bead filler **130a**.

[0025] In the illustrated embodiment, the tire **100** further includes a belt **155** and a cap ply **160**. In an alternative embodiment (not shown), the tire may include two or more belts. In another alternative embodiment (not shown), the tire may include two or more cap plies. In yet another alternative embodiment (not shown), the cap ply may be omitted.

[0026] With continued reference to **Figure 1**, the tire **100** further includes a first wire reinforcement **165a** in the first bead region **120a** and a second wire reinforcement **165b** in the second bead region **120b**. Each wire reinforcement **165a,b** wraps around the respective bead **125a,b** and part of the respective bead filler **130a,b** and body ply **140**. The wire reinforcements **165a,b** may provide a structural reinforcement to the tire **100**, or it may protect the body ply **140** from abrasion. However, it should be understood that the wire reinforcements **165a,b** need not serve such functions. In an alternative embodiment (not shown), the wire reinforcement may be omitted.

[0027] The tire **100** also includes a pair of reinforcement fillers **170**, including a first reinforcement filler **170a** located axially outside of the first bead filler **130a** and a second reinforcement filler **170b** located axially outside of the second bead filler **130b**. Each reinforcement filler **170a,b** has a top end disposed below the apex **135a,b** of the respective bead filler **130a,b** and radially above the turn up end **150a,b** of the respective turn up portion **145a,b** of the body ply **140**.

[0028] The tire **100** further includes a pair of abrasion portions **175**, including a first abrasion portion **175a** and a second abrasion portion **175b**. Each abrasion portion **175** at least partially wraps around a bead **125** and bead filler **130** such that each abrasion portion includes a first portion disposed axially outside a respective bead filler **130**, reinforcement filler **170**, and turn up portion **145** of the body ply **140**. Each abrasion portion **175** further includes a second portion disposed below a respective bead **125**.

[0029] The electronic device **105** is disposed in one of the bead regions **120** at a location radially below the apex **135** of the respective bead filler **130** and axially outside the bead filler **130.** The electronic device **105** is axially spaced from the bead filler **130** such that the electronic device **105** does not contact the bead filler **130**. While the illustrated embodiment shows the electronic device **105** disposed on the right side of the tire **100**, it should be understood that the electronic device may be disposed on either side of the tire. It should be further understood that a tire could have multiple electronic devices, as one device disposed on each side of the tire.

[0030] **Figure 2** is a schematic drawing of one embodiment of an electronic device **105**. In the illustrated embodiment, the electronic device **105** is an RFID tag having a passive RFID transponder **180** and a pair of antennae **185a**,**b** forming a dipole. The RFID tag may be embedded in a material, such as rubber or another polymeric material. Alternatively, a bare RFID tag may be employed. It should be understood, however, that the illustrated embodiment is merely exemplary, and any electronic device may be employed.

[0031] In one embodiment, the electronic device **105** is oriented in a substantially circumferential direction.

[0032] **Figure 3** illustrates a cross section of one of the bead regions **120** of the tire **100**. As can be seen in this illustration, the wire reinforcement **165** wraps around the bead **125** and partially wraps around the bead filler **130** such that the wire reinforcement **165** has an inner portion axially inside the body ply **140** and an outer portion axially outside the turn up portion **145** of the body ply **140**. The inner portion of the wire reinforcement **165** has an inner end terminating radially above the bead **125** and radially below the apex **135** of the bead filler **130**. The outer portion of the wire reinforcement **165** has an outer end radially above the bead **125** and radially below the turn up end **150**

of the turn up portion **145** of the body ply **140**. However, it should be understood that the illustrated wire reinforcement is merely exemplary, and that the inner and outer ends may be disposed at any location. In an alternative embodiment (not shown), the wire reinforcement may be omitted.

[0033] With continued reference to **Figure 3**, the reinforcement filler **170** has an inner surface with an upper portion contacting an outer surface of the bead filler **130**, a middle portion contacting an outer surface of the turn up portion **145** of the body ply **140**, and a lower portion contacting an outer surface of the wire reinforcement **165**. The electronic device **105** is sandwiched between the reinforcement filler **170** and the abrasion portion **175**, such that the electronic device **105** contacts both the reinforcement filler **170** and the abrasion portion **175**. The electronic device **105** is disposed radially above the turn up end **150** of the turn up portion **145** of the body ply **140**. In an alternative embodiment (not shown), at least a portion of the electronic device **105** is radially below the turn up end of the turn up portion of the body ply. In another alternative embodiment (not shown), the electronic device may be spaced from one or both of the reinforcement filler and the abrasion portion. In yet another alternative embodiment (not shown), a lower portion of the electronic device is sandwiched between the reinforcement filler and the abrasion portion while an upper portion of the electronic device is sandwiched between the sidewall and the bead filler.

[0034] In the illustrated embodiment, the upper end of the abrasion portion **175** is sandwiched between the reinforcement filler **170** and a lower end of the sidewall **115**. In an alternative embodiment (not shown), the lower end of the sidewall may instead be sandwiched between the reinforcement filler and the upper end of the abrasion portion. In such an embodiment, at least a portion of the electronic device may be sandwiched between the sidewall and the reinforcement filler.

[0035] In the illustrated embodiment, an upper portion of the abrasion portion **175** is disposed between the reinforcement filler **170** and the sidewall **115**, such that the abrasion portion **175** is in contact with the reinforcement filler **170** and the sidewall **115**. In an alternative embodiment (not shown), the abrasion portion may be spaced from one or both of the reinforcement filler and the sidewall.

[0036] With continued reference to **Figure 3**, a portion of the sidewall **115** includes a concave outer surface **190**. In an alternative embodiment (not shown), the sidewall does not include this concave section.

[0037] In the illustrated embodiment, the bead filler **130** includes a first portion $\mathbf{130_1}$ constructed of a first material and a second portion $\mathbf{130_2}$ constructed of a second material, the first material being harder than the second material. The first portion $\mathbf{130_1}$ is disposed between the bead **125** and the second portion $\mathbf{130_2}$. In an alternative embodiment, the bead filler may be constructed of a single material. In another alternative embodiment, the bead filler may have three or more portions constructed of different materials.

[0038] **Figure 4** illustrates a cross section of a portion of an alternative embodiment of a tire **200** having an electronic device **205**. As can be seen in this illustration, this portion of the tire **200** is substantially similar to the bead region **120** of the tire **100**, except the sidewall **215** does not include a concave portion.

[0039] A bead region **220** of the tire **200** is illustrated. The bead region **220** includes a bead **225** and a bead filler **230** having an apex **235**. The tire **200** further includes a body ply **240** having a turn up portion **245** and a turn up end **250**. A wire reinforcement **265** wraps around the bead **225** and partially wraps around the bead filler **230** such that the wire reinforcement **265** has an inner portion axially inside the body ply **240** and an outer portion axially outside the turn up portion **245** of the body ply **240**. The inner portion of the wire reinforcement **265** has an inner end terminating radially above the bead **225** and radially below the apex **235** of the bead filler **230**. The outer portion of the wire reinforcement **265** has an outer end radially above the bead **225** and radially below the turn up end **250** of the turn up portion **245** of the body ply **240**. However, it should be understood that the illustrated wire reinforcement is merely exemplary, and that the inner and outer ends may be disposed at any location. In an alternative embodiment (not shown), the wire reinforcement may be omitted.

[0040] With continued reference to **Figure 4**, a reinforcement filler **270** has an inner surface with an upper portion contacting an outer surface of the bead filler **230**, a middle portion contacting an outer surface of the turn up portion **245** of the body ply **240**, and a lower portion contacting an outer surface of the wire reinforcement **265**. The electronic device **205** is sandwiched between the reinforcement filler **270** and an abrasion portion

275, such that the electronic device **205** contacts both the reinforcement filler **270** and the abrasion portion **275**. The electronic device **205** is disposed radially above the turn up end **250** of the turn up portion **245** of the body ply **240**. In an alternative embodiment (not shown), at least a portion of the electronic device **205** is radially below the turn up end of the turn up portion of the body ply. In another alternative embodiment (not shown), the electronic device may be spaced from one or both of the reinforcement filler and the abrasion portion.

[0041] In the illustrated embodiment, an upper portion of the abrasion portion **275** is disposed between the reinforcement filler **270** and the sidewall **215**, such that the abrasion portion **275** is in contact with the reinforcement filler **270** and the sidewall **215**. In an alternative embodiment (not shown), the abrasion portion may be spaced from one or both of the reinforcement filler and the sidewall.

[0042] In the illustrated embodiment, the bead filler **230** includes a first portion $\mathbf{230_1}$ constructed of a first material and a second portion $\mathbf{230_2}$ constructed of a second material, the first material being harder than the second material. The first portion $\mathbf{230_1}$ is disposed between the bead **225** and the second portion $\mathbf{230_2}$. In an alternative embodiment, the bead filler may be constructed of a single material. In another alternative embodiment, the bead filler may have three or more portions constructed of different materials.

[0043] **Figure 5** illustrates a cross section of a portion of another alternative embodiment of a tire **300** having an electronic device **305** spaced from a bead filler **310**. While only a bead region **315** of the tire **300** is shown, it should be understood that that the tire **300** may share the features of tire **100** illustrated in **Figure 1**, except for the differences described below.

[0044] The bead region **315** includes a bead **320** and the bead filler **310**. The bead filler **310** has an apex **325**. The bead filler **310** includes a first portion $\mathbf{310_1}$ constructed of a first material and a second portion $\mathbf{310_2}$ constructed of a second material, the first material being harder than the second material. The first portion $\mathbf{310_1}$ is disposed between the bead **320** and the second portion $\mathbf{310_2}$. In an alternative embodiment, the bead filler may be constructed of a single material. In another alternative embodiment, the bead filler may have three or more portions constructed of different materials.

[0045] A body ply **330** wraps around the bead **320** and a portion of the bead filler **310**, such that a turn up portion **335** terminates at a turn up end **340** axially outside of the bead **320** and radially below the apex **325** of the bead filler **310**.

[0046] A wire reinforcement **345** partially wraps around the bead **320** and the bead filler **310** such that the wire reinforcement **345** has an inner portion axially inside the body ply **330** and an outer portion axially outside the turn up portion **335** of the body ply **330**. The inner portion of the wire reinforcement **345** has an inner end disposed radially above the bead **320** and radially below the apex **325** of the bead filler **310**. The outer portion of the wire reinforcement **345** has an outer end radially above the bead **320** and radially below the turn up end **340** of the turn up portion **335** of the body ply **330**. However, it should be understood that the illustrated wire reinforcement is merely exemplary, and that the inner and outer ends may be disposed at any location. In an alternative embodiment (not shown), the wire reinforcement may be omitted.

[0047] The bead region **315** of the tire **300** further includes a reinforcement filler **350**. The reinforcement filler **350** has an inner surface with an upper portion contacting an outer surface of the bead filler **310**, a middle portion contacting an outer surface of the turn up portion **335** of the body ply **330**, and a lower portion contacting an outer surface of the wire reinforcement **345**. The reinforcement filler **350** has a top end disposed below the apex **325** of the bead filler **310**.

[0048] The bead region **315** further includes a pair of chafers **355**, including a first chafer **355a** and a second chafer **355b** disposed outside of the first chafer **355a**. The pair of chafers **355** at least partially wrap around the bead **320** and bead filler **310**, such that the pair of chafers **355** includes a first portion disposed axially outside the bead filler **310**, the reinforcement filler **350**, and the turn up portion **335** of the body ply **330**. The pair of chafers further includes a second portion disposed below the bead **320**.

[0049] While two chafers are shown in the illustrated embodiment, it should be understood that a single chafer may be employed in an alternative embodiment. In another alternative embodiment (not shown), three or more chafers may be employed.

[0050] In the illustrated embodiment, the first chafer **355a** has a first outer end and the second chafer **355b** has a second outer end located radially below the first outer end of the first chafer **355a**. In an alternative embodiment (not shown), the first chafer and

second chafer have outer ends that terminate at the same radial height. In another alternative embodiment (not shown), the first chafer has a first outer end located radially below the second outer end of the second chafer.

[0051] The first chafer **355a** is disposed between the electronic device **305** and the bead filler **310**, such that the electronic device **305** is sandwiched between the first portion of the first chafer **355a** and a sidewall **360**. The electronic device **305** is disposed at a location radially below the first outer end of the first chafer **355a** and radially above the second outer end of the second chafer **355b**. In an alternative embodiment (not shown), at least a portion of the electronic device is disposed below the second outer end of the second chafer **355b**.

[0052] In the illustrated embodiment, the first chafer **355a** contacts the electronic device **305** and the second chafer **355b** does not contact the electronic device **305**. In an alternative embodiment (not shown), both the first chafer and the second chafer contact the electronic device. In another alternative embodiment (not shown), the second chafer contacts the electronic device, but the first chafer does not. In yet another alternative embodiment (not shown), the electronic device is spaced from both the first and second chafers.

[0053] The bead region **315** further includes an abrasion portion **365** that at least partially wraps around the bead **320** and bead filler **310**. In the illustrated embodiment, the upper end of the abrasion portion **365** is sandwiched between the second chafer **355b** and a lower end of the sidewall **360**. In an alternative embodiment (not shown), the lower end of the sidewall may instead be sandwiched between the second chafer and the upper end of the abrasion portion. In another alternative embodiment (not shown), the abrasion portion may be omitted, and the sidewall rubber may extend around the bead region.

[0054] 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." Furthermore, to the extent the term "connect" is used in the specification or claims, it is intended to mean not only "directly connected to," but also "indirectly connected to" such as connected through another component or components.

[0055] 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. Therefore, the application, in its broader aspects, is not limited to the specific details, the representative apparatus and method, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the applicant's general inventive concept.

CLAIMS

What is claimed is:

1. A tire comprising:

a circumferential tread;

a pair of sidewalls;

a pair of bead portions, each bead portion including a bead and a bead filler having an apex;

at least one body ply extending from bead to bead, including a pair of turn up portions, each turn up portion having a turn up end axially outside of a respective bead and radially below the apex of a respective bead filler;

a pair of wire reinforcements, each wire reinforcement wrapping around one of the pair of bead portions such that each wire reinforcement has an inner portion axially inside the body ply and an outer portion axially outside a respective turn up portion of the body ply,

wherein the inner portion of each wire reinforcement has an inner end disposed radially above a respective bead and radially below the apex of a respective bead filler, and

wherein the outer portion of each wire reinforcement has an outer end radially above a respective bead and radially below the turn up end of a respective turn up portion of the body ply;

a pair of reinforcement fillers, each reinforcement filler having an inner surface with an upper portion contacting an outer surface of a respective bead filler, a middle portion contacting an outer surface of a respective turn up portion of the body ply, and a lower portion contacting an outer surface of a respective wire reinforcement,

wherein the reinforcement filler has a top end disposed below the apex of the respective bead filler; and

an electronic device disposed radially below the apex of the bead filler of one of the bead portions and axially outside the bead filler, wherein the electronic

device is axially spaced from the bead filler such that the electronic device does not contact the bead filler.

2. The tire of claim 1, wherein the bead filler in each of the pair of bead portions is constructed of a first material and a second material, the first material being harder than the second material.

3. The tire of claim 2, wherein the first material of the bead filler is disposed between the bead and the second material of the respective bead portion.

4. The tire of claim 1, further comprising a pair of chafers, each chafer at least partially wrapping around one of the pair of bead portions such that each chafer includes:

a first portion disposed axially outside a respective bead filler, a respective reinforcement filler, and a respective turn up portion of the body ply, and

a second portion disposed below a respective bead.

5. The tire of claim 4, wherein the first portion of the chafer is disposed between the electronic device and the bead filler, such that the first portion of the chafer contacts the electronic device.

6. The tire of claim 1, further comprising a pair of abrasion portions, each abrasion portion at least partially wrapping around one of the pair of bead portions such that each abrasion portion includes:

a first portion disposed axially outside a respective bead filler, a respective reinforcement filler, and a respective turn up portion of the body ply, and

a second portion disposed below a respective bead.

7. The tire of claim 6, wherein the electronic device is sandwiched between one of the pair of reinforcement fillers and the sidewall.

8. A tire comprising:

a circumferential tread;

a pair of sidewalls;

a pair of bead portions;

at least one body ply extending from bead portion to bead portion, the body ply including a pair of turn up portions radially outside of a respective bead portion,

wherein each bead portion includes:

a bead,

a bead filler having an apex,

a wire reinforcement wrapping around the bead portion and at least a portion of the body ply,

a reinforcement filler having an inner surface, wherein at least a portion of the inner surface is in contact with an outer surface of the bead filler,

at least one chafer at least partially wrapping around the bead portion; and

an electronic device disposed radially below the apex of the bead filler of one of the bead portions, wherein at least a portion of the electronic device is sandwiched between the at least one chafer and one of the pair of sidewalls, such that the electronic device is in contact with the at least one chafer and the sidewall.

9. The tire of claim 8, wherein the at least one chafer includes a first chafer, and a second chafer at least partially wrapping around the first chafer.

10. The tire of claim 9, wherein the first chafer has a first outer end and the second chafer has a second outer end located radially below the first outer end, wherein the electronic device is sandwiched between the first chafer and one of the pair of sidewalls, and wherein the electronic device is disposed radially above the second outer end.

11. The tire of claim 9, wherein the electronic device is sandwiched between the second chafer and one of the pair of sidewalls.

12. The tire of claim 8, wherein the electronic device is a radio frequency identification tag.

13. The tire of claim 8, wherein each bead portion further includes an abrasion portion at least partially wrapping around the bead portion.

14. A tire comprising:

a circumferential tread;

a pair of sidewalls;

a pair of bead portions;

at least one body ply extending from bead portion to bead portion, the body ply including a pair of turn up portions radially outside of a respective bead portion,

wherein each bead portion includes:

a bead,

a bead filler having an apex,

a reinforcement filler having an inner surface, wherein at least a portion of the inner surface is in contact with an outer surface of the bead filler, and

an abrasion portion at least partially wrapping around the bead portion; and

an electronic device disposed radially below the apex of the bead filler of one of the bead portions, wherein at least a portion of the electronic device is sandwiched between the reinforcement filler and the abrasion portion, such that the electronic device is in contact with the reinforcement filler and the abrasion portion.

15. The tire of claim 14, wherein an upper portion of the abrasion portion is sandwiched between the reinforcement filler and one of the pair of sidewalls, such that the abrasion portion is in contact with the reinforcement filler and the sidewall.

16. The tire of claim 14, wherein each of the turn up portions of the body ply terminates at a turn up end disposed radially below a top end of a respective reinforcement filler.

17. The tire of claim 16, wherein the electronic device is disposed radially above the turn up end of the body ply, and wherein the electronic device is spaced axially outward from the turn up portion of the body ply.

18. The tire of claim 14, wherein inner surface of the reinforcement filler of each of the bead portions includes an upper portion contacting the outer surface of the bead filler, a middle portion contacting an outer surface of a respective turn up portion of the body ply, and a lower portion contacting an outer surface of the wire reinforcement.

19. The tire of claim 14, wherein the reinforcement filler of each of the bead portions has a top end located below the apex of the bead filler.

20. The tire of claim 14, wherein each of the pair of sidewalls includes a concave outer surface.

21. A tire comprising:

a circumferential tread;

a pair of sidewalls;

a pair of bead portions;

at least one body ply extending from bead portion to bead portion, the body ply including a pair of turn up portions radially outside of a respective bead portion,

wherein each bead portion includes:

a bead,

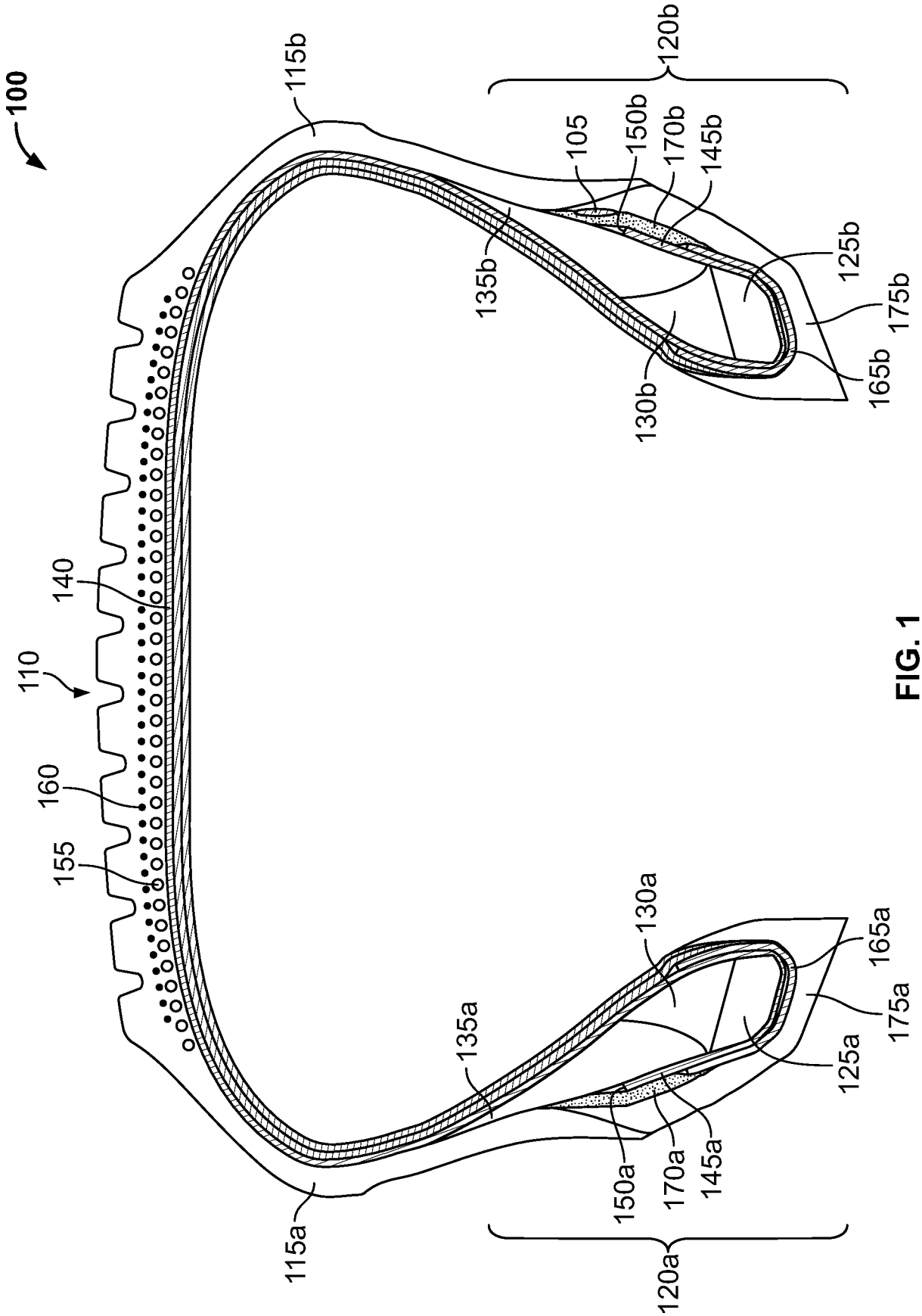
a bead filler having an apex,

a reinforcement filler having an inner surface, wherein at least a portion of the inner surface is in contact with an outer surface of the bead filler,

a first chafer at least partially wrapping around the bead portion;

a second chafer at least partially wrapping around the first chafer; and

an electronic device disposed radially below the apex of the bead filler of one of the bead portions, wherein at least a portion of the electronic device is sandwiched between the second chafer and one of the pair of sidewalls.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125a
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170a
145a
115a
120a

FIG. 1

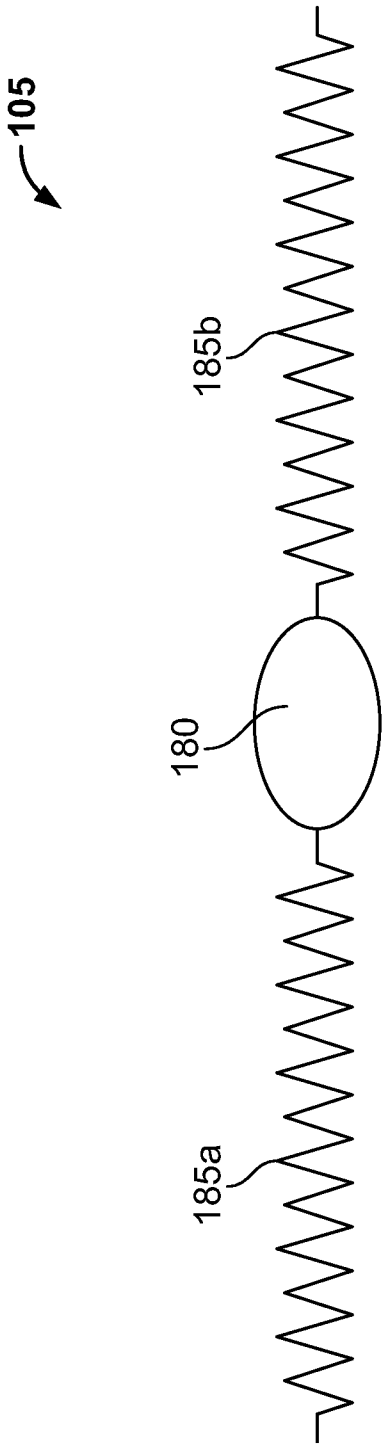


FIG. 2

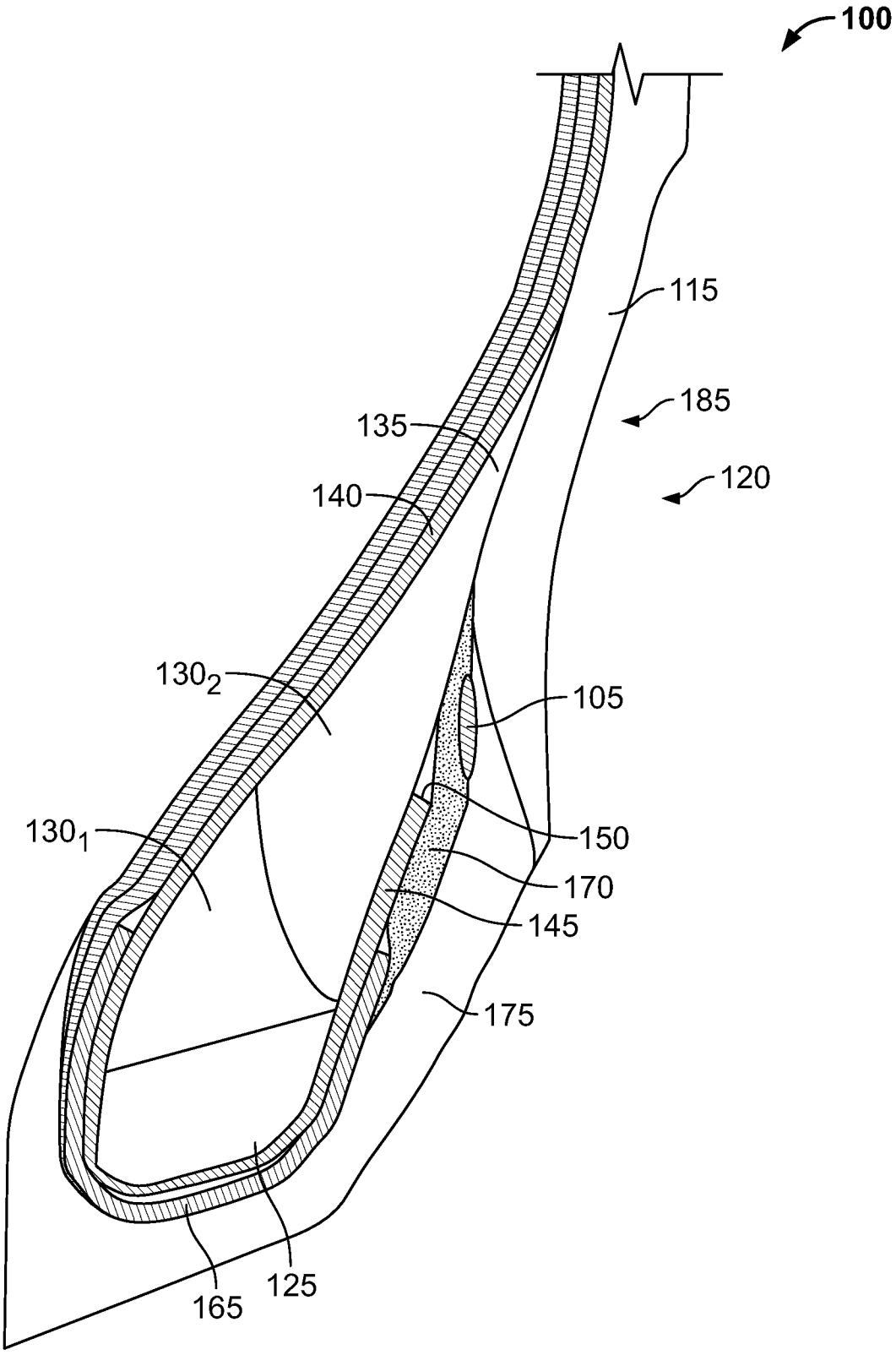


FIG. 3

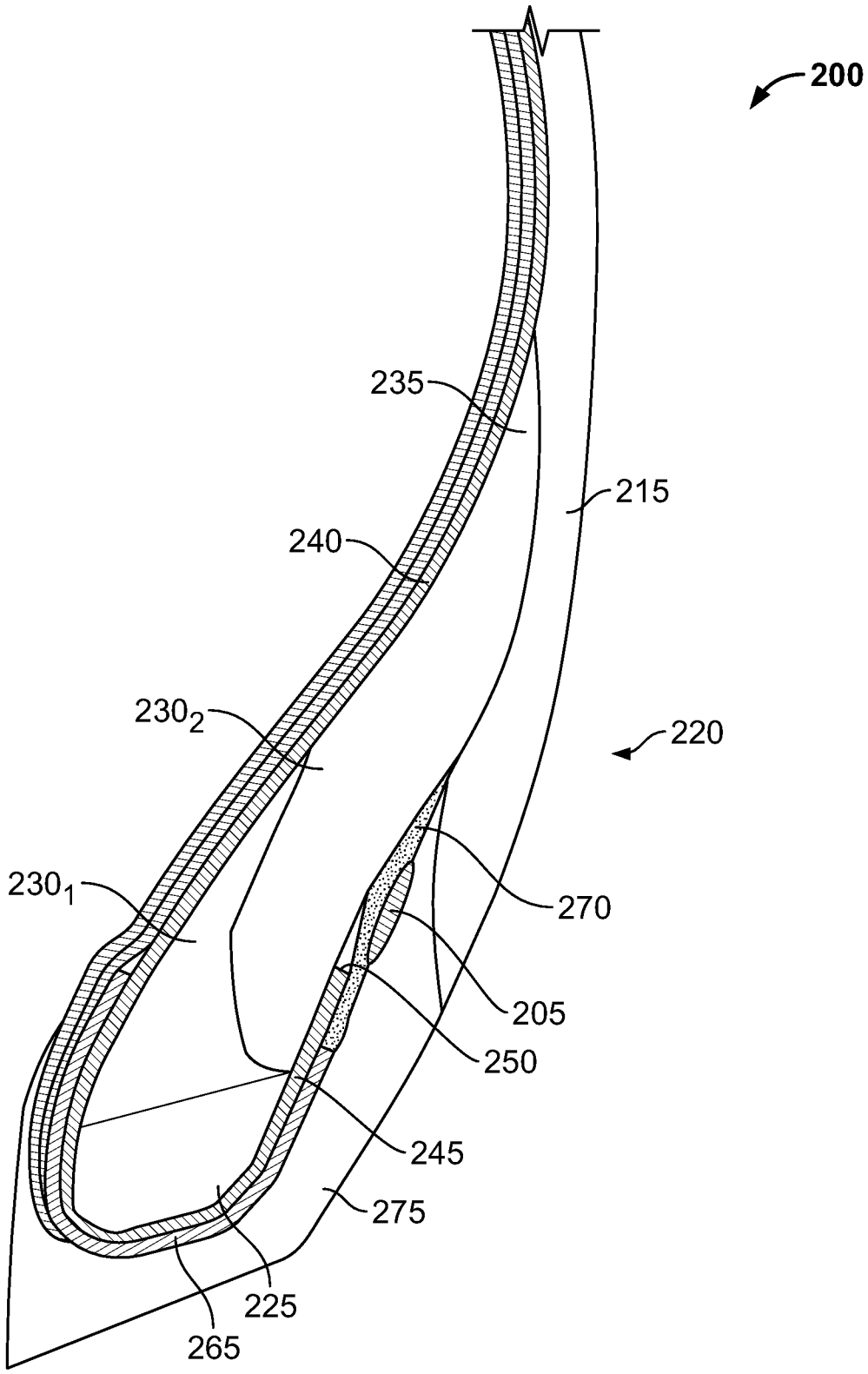
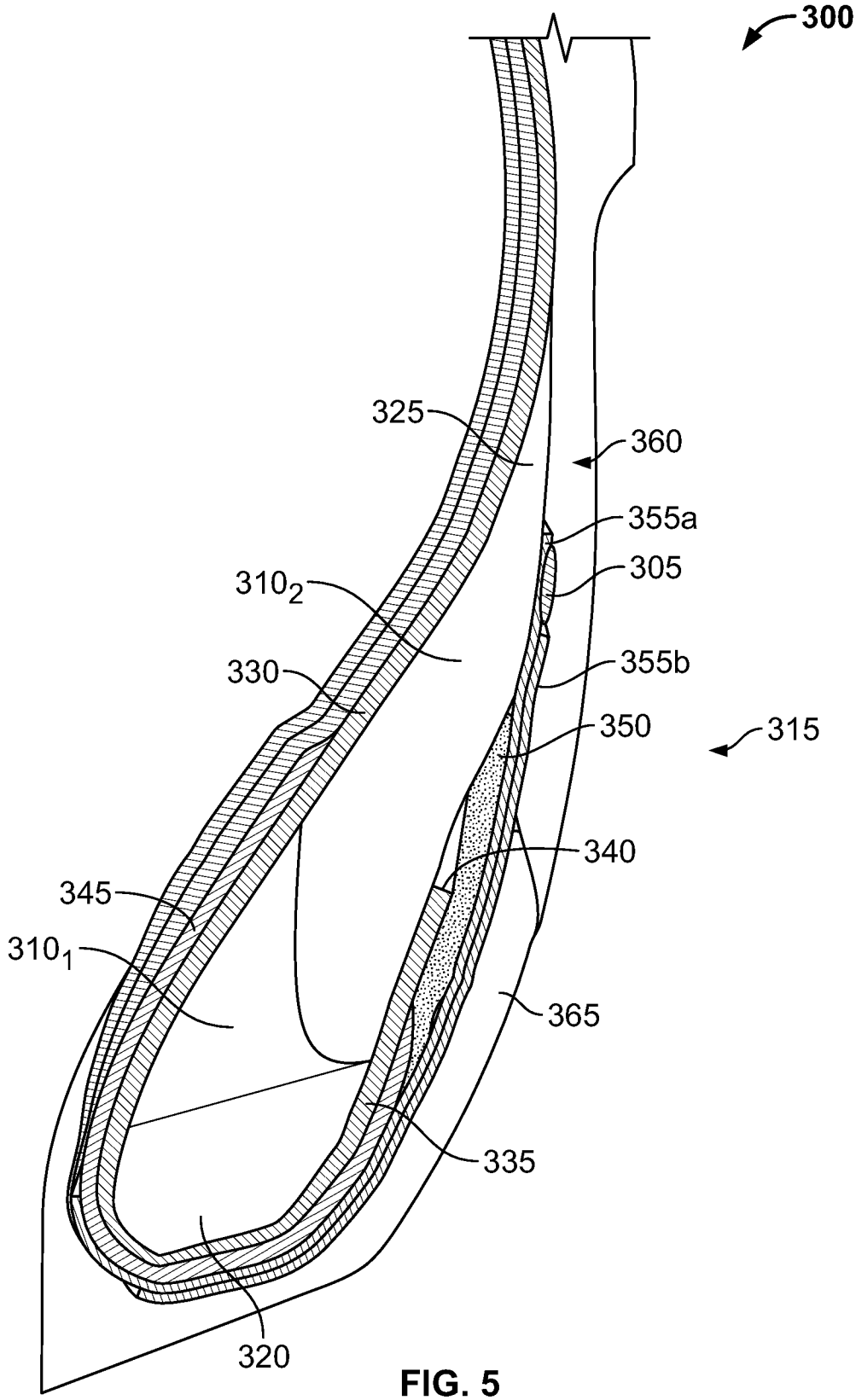


FIG. 4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310_1
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FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/068696

A. CLASSIFICATION OF SUBJECT MATTER

B60C 15/02(2006.01)i, B60C 15/04(2006.01)i, B60C 15/06(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 15/02; B60C 19/08; B60C 9/00; H04Q 1/48; B60C 9/02; B60C 9/18; B60C 15/00; B29D 30/08; B60C 19/00; B60C 15/04; B60C 15/06

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) & Keywords: tire, tread, bead, body ply, wire reinforcement, reinforcement filler, RFID, chafer, abrasion, turn up

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2008-0289736 A1 (ADAMSON et al.) 27 November 2008 See paragraphs [0051]-[0063] and figure 1.	1-21
A	US 4911217 A (DUNN et al.) 27 March 1990 See column 6, line 6-column 7, line 22 and figure 2.	1-21
A	US 2006-0102269 A1 (UCHIDA et al.) 18 May 2006 See paragraph [0026] and figure 1.	1-21
A	US 2010-0122757 A1 (LIONETTI et al.) 20 May 2010 See paragraphs [0039]-[0051] and figures 1-9B	1-21
A	US 2012-0291936 A1 (LIONETTI et al.) 22 November 2012 See paragraphs [0043]-[0063] and figures 1-10.	1-21

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 March 2015 (26.03.2015)	**27 March 2015 (27.03.2015)**

Name and mailing address of the ISA/KR
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2014/068696

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