(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 274 190 B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
05.05.2021 Bulletin 2021/18

(21) Application number: **16769556.8**

(22) Date of filing: **22.03.2016**

(51) Int Cl.:
***B60C 11/11** (2006.01)* ***B60C 11/00** (2006.01)*
***B60C 11/13** (2006.01)* ***B60C 11/04** (2006.01)*

(86) International application number:
PCT/US2016/023621

(87) International publication number:
WO 2016/154221 (29.09.2016 Gazette 2016/39)

(54) **DUAL DOME CONVEX TIRE TREAD BLOCK OR TREAD RIB**

DOPPELKUPPEL-KONVEXREIFENLAUFFLÄCHENBLOCK ODER -LAUFFLÄCHENRIPPE

BLOC DE BANDE DE ROULEMENT OU NERVURE DE BANDE DE ROULEMENT DE PNEU CONVEXE À DEUX DÔMES

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **23.03.2015 US 201562137019 P**

(43) Date of publication of application:
31.01.2018 Bulletin 2018/05

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(56) References cited:
WO-A1-2014/148260
JP-A- 2004 058 810
KR-A- 20120 007 259
US-A- 5 322 107
US-A1- 2002 007 889
US-A1- 2003 136 487
US-A1- 2004 231 775
US-A1- 2005 167 021
US-A1- 2006 108 039

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Description

Background

[0001] The present disclosure relates to tires, and more specifically to controlling normal stress distribution in tread blocks or ribs of tires.

[0002] By reducing normal stresses in certain areas, such as the tread rib/block edges, irregular wear can be reduced.

[0003] There have been previous designs for a dome-shaped tread block, or tread rib. These designs have met with some success.

[0004] US 2003/0136487, on which the preamble of claim 1 is based, discloses a tread block used in a tire tread of a tire wherein two different sized domes are provided on a road engaging surface of the tread block. One sized dome is adjacent one lateral face of the tread block and the other sized dome is adjacent an opposite lateral face of the tread block.

[0005] A need exists, however, for further improvements relating to controlling stresses, particularly in certain areas such as tread rib or tread blocks.

Summary

[0006] According to the present invention there is provided a tire comprising: a tread block or rib used in a tire tread of the tire; and different sized first and second domes provided on a road engaging first surface of the tread block or rib wherein the first dome is disposed on the first surface and protrudes outwardly from the first surface, and each of the first and second domes has a convex profile, characterized in that the second dome is located on top of the first dome so that the second dome protrudes outwardly from the first dome, the first dome forming a first spheroid-shaped surface defined by a single first radius of curvature and the second dome forming a second spheroid-shaped surface defined by a single second radius of curvature wherein the first radius of curvature is different from the second radius of curvature.

[0007] The centers of the first and second domes are either concentric or offset.

[0008] The dome shapes can be elliptical with the major axes of the ellipses oriented such that the major axes are optimized for a specific tread block or rib geometry.

[0009] The major axes of the ellipses may be oriented parallel to or perpendicular to an axis of stiffness of the tread block or rib, for example.

[0010] Radii of the first and second domes are angled relative to one another.

[0011] A radius of the first dome may be greater than one-half a lateral width of the rib or tread block.

[0012] A radius of at least one of the first and second domes may be greater than one-half a circumferential length of the tread block.

[0013] At least the first dome may have a substantially elliptical configuration, and a major radius of at least the first dome may be greater than either one-half a circumferential length of the tread block or one-half a width of the tread block, and a minor radius of at least the first dome may be greater than the other of either one-half a circumferential length of the tread block or one-half a width of the tread block.

[0014] A primary benefit of this disclosure is the ability to control stress distribution across the tread block or rib.

[0015] Another advantage resides in reducing stress at the edges of the tread blocks or ribs, and reducing the potential for irregular wear.

[0016] By controlling where the second dome begins and ends, as well as by having different combinations of the two radii associated with the first and second domes, the dual dome structure allows greater control of the stress distribution.

[0017] Increased control of stress distribution can also be achieved by having different combinations of two radii.

[0018] The dual-dome configuration allows for an asymmetric distribution where one side of the tread block or rib could has a different pressure distribution than the other side, simply by locating the second dome off-centerfrom the first dome.

[0019] Benefits and advantages of the present disclosure will become more apparent from reading and understanding the following detailed description.

Brief Description of the Drawings

[0020]

Figure 1 is a cross-sectional view of a dual dome rib or tread block.

Figure 2 is a table of definitions of reference characters used in Figure 1.

Figure 3 is a perspective view of a tread/rib using a dual dome feature.

Figure 4 is a top view of a tread block using a dual dome feature with non-concentric domes.

Figure 5 is a perspective view of a tread block using a dual dome feature included for background information.

Figure 6 is a top view of a tread block using a dual dome feature with an elliptical dome shape included for background information.

Figure 7 is a top view of a tread block using a dual dome feature with off-angle ellipses included for background information.

Figure 8 is a table of representative dimensions and relative sizes of the various features of the dual domes.

Detailed Description

[0021] This disclosure relates to tires, and more particularly to tire treads, and that portion of the tire tread that forms a road engaging surface. Unless noted otherwise, typical terminology associated with tires and tire treads is used herein with its common meaning or understanding, such as "axial" or "lateral" is defined as a direction aligned with or parallel to the rotational axis of the tire, and "circumferential" is defined as the curvilinear direction of the outer surface (tread) of the tire that engages the ground or road surface. For purposes of this disclosure, the term "dome" as used herein is intended to describe and encompass partial, generally curvilinear or spheroid-shaped surfaces formed by one or more radii, e.g., circular or spherical-shaped domes formed by a radius, elliptical domes formed by major and minor axes with different radial dimensions, or combinations thereof. In this disclosure, the domes are convex shaped, smoothly contoured surfaces that extend outwardly from a remainder of the ground engaging surface of the tire tread, specifically extending outwardly from a circumferentially extending rib of the tread pattern or extending outwardly from a tread block.

[0022] Turning initially to Figures 1 - 4, there is shown a portion of a tire 100, namely a portion of a tire tread 102 that forms at least a portion of the ground or road engaging surface of the tire. The tire tread 102 extends over the road engaging surface between the shoulders of the tire 100, and includes ribs 110 and grooves 112 (circumferential), 114 (lateral) that may vary from one tread pattern to another tread pattern of a tire. The particular tread 102 is irrelevant to the present disclosure; however, the disclosure is used in connection with the individual ribs 110 that extend circumferentially around the tire 100 where the ribs are separated by circumferential grooves 112. Likewise, the present disclosure is applicable to individual tread blocks 116 that are defined both circumferentially (in a repeating pattern along the circumference) and laterally along the tread 102.

[0023] For ease of understanding, the following reference characters identified in Figure 2 and as used in various ones of the other figures are repeated below for ease of reference:

A = Distance From Edge Of Dome 1 To Location Where Dome 2 Begins
B = Distance From Opposite Edge Of Dome 1 to Location Where Dome 2 Ends
E = Distance From Edge Of Tread Block To Location Where Dome 1 Begins
F = Distance From Opposite Edge Of Tread Block To Location Where Dome 1 Ends
D1 = Width Of Dome 1
D2 = Width Of Dome 2
C1 = Distance From Edge Of Tread Block To Center Of Dome 1
C2 = Distance From Edge Of Tread Block To Center Of Dome 2
H1 = Height Of Dome 1 Above The Nominal Profile Surface
H2 = Height Of Dome 2 Above The Nominal Profile Surface
R1 = Radius Of Dome 1
R2 = Radius Of Dome 2
W = Width Of Tread Block Or Rib In Lateral Direction

[0024] The same is true of the following reference characters associated with Figure 4, or the later described Figure 7:

X1 = Circumferential Distance To Centerpoint Of Dome 1
C1 = Lateral Distance To Centerpoint Of Dome 1
X2 = Circumferential Distance To Centerpoint Of Dome 2
C2 = Lateral Distance To Centerpoint Of Dome 2
U = Angle Of Major Axis For Dome 1 Relative To Circumferential Direction
V = Angle Of Major Axis For Dome 2 Relative To Circumferential Direction
L = Length Of Tread Block In The Circumferential Direction

[0025] The tire tread 102 includes ribs 110 that extend in a circumferential direction and are divided in a lateral direction by grooves 112. A rib 110 may be circumferentially continuous or comprised of individual tread blocks 116 that are separated by generally laterally extending grooves 114 and together form the rib. As briefly noted in the Background, prior designs have employed a dome-shape on the road engaging surface of the tread block 116 or tread rib 110. The present disclosure is an improvement on such a design by employing a dual dome assembly or feature again on the road engaging surface of the tread rib 110 or tread block(s) 116.

[0026] More specifically, a first dome 130 is provided on the road engaging surface of the rib/tread block 110/116. The first dome 130 has a convex profile, i.e., the first dome protrudes outwardly from the road engaging surface of the rib/tread block 110/116. As shown, for example, in Figure 4, the first dome 130 has a generally circular periphery, i.e., has a constant radius R1, and is shown in Figures 1 and 4 as extending over substantially the entire road engaging surface of the rib/tread block 110/116. The smoothly contoured surface configuration of the first dome 130 is desirable to reduce stress concentrations that would develop in the rib/tread block 110/116 as the tire 100 rotates and the rib/tread block engages the road surface (not shown). It is contemplated that the entire perimeter or outer edge of the first dome 130 may be contained within the perimeter of the rib/tread block 110/116 (e.g., Figure 1), or alternately, the radius R1 may be greater than the distance C1 measured from the edge of a rib/tread block to a center of the first dome (e.g., Figure 4) such that the smooth, spherical contour of the first dome extends to the perimeter edge of the rib/tread block. The broken line showing in Figure 4 represents the hypothetical trace of the outer perimeter of the first dome 130 as measured from the center. As is evident, the dimension C1 is less than that of the radius R1 of the first dome 130 along substantial portions of those edges of the rib/tread block 110/116 shown in Figure 4 that extend in the circumferential direction along the sidewalls of the circumferential grooves 112, and along reduced portions of those edges of the ribs/tread block that extend in the lateral direction along the sidewalls of the lateral grooves 114. Again, however, the specific dimensions of these portions of the edges of the ribs/tread block 110/116 may be reversed, the same, or greater or lesser dimensions without departing from the scope of the claimed invention.

[0027] In addition, a second dome 140 is provided and located on top of the first dome 130. That is, the second dome 140 also has a convex profile, i.e., the second dome protrudes outwardly from the first dome 130 of the rib/tread block 110/116 and thus defines a height H2 greater than height H1 of the first dome (Figure 1). As shown, for example, in Figure 4, the second dome 140 has a generally circular periphery, i.e., has a constant radius R2. The centers of the first and second domes 130, 140 may be concentric or maybe circumferentially and/or laterally offset from one another (i.e., non-concentric). It is contemplated that the second dome 140 will likely have an outer perimeter substantially less than that of the first dome 130, although under certain circumstances, the outer perimeter of the second dome may be only slightly less than the outer perimeter of the first dome.

[0028] In an alternate arrangement included for background information, one or both of the first and second domes 130, 140 may have different or varying radii so that either or both of the first and second domes may be non-spherical domes that nonetheless retain the desired feature of a smoothly contoured, generally curvilinear or spheroid surface that addresses the stress distribution issues associated with a rib/tread block 110/116. By way of example, Figures 5 and 6 illustrate first and second domes 230, 240 that both have a generally elliptical conformation. Other previously described features use reference numerals in the "200" series, e.g., lateral groove 114 in Figure 1 is now identified as lateral groove 214 in Figures 5 and 6. As illustrated, the major axes of each of the elliptically-shaped domes 230, 240 extend in the circumferential direction while the minor axes of each of these domes 230, 240 extend in the lateral direction. The dimensions of the major and minor axes of the first dome 230 are greater than the circumferential and lateral dimensions of the tread block 216 so that substantially the entirety of the road engaging surface area of the tread block has a smoothly contoured, generally curvilinear or spheroid conformation. The dimensions of the major and minor axes of the second dome 240 are both less than the circumferential and lateral dimensions of the tread block 216, although it is also understood that at least one of the axes may have a dimension greater than the underlying dimension of the first dome 230 or tread block. Further, the major and minor axes of the first and second domes 230, 240 are aligned with one another in the illustrated arrangement of Figures 5 and 6.

[0029] In Figure 7, first and second domes 330, 340 are elliptically shaped but the major and minor axes of the first dome is disposed at an angle (greater than 0 and less than 90 degrees) relative to the circumferential and lateral directions of the tread block, and likewise at different angles than the major and minor axes the other second dome 340. Thus, angle U represents the angle of the major axis for the first dome 330 relative to the circumferential direction of the tire 300 while angle V represents the angle of the major axis for the second dome 340 relative to the circumferential direction of the tire. Of course the angles U or V could be the same or different. Other previously described features use reference numerals in the "300" series, e.g., lateral groove 114 in Figure 1 is now identified as lateral groove 314 in Figure 7.

[0030] Figure 8 is a table that identifies preferred minimum and maximum dimensions in a relative parameters of the width W of the rib/tread block 110/116, the widths 01, 02 of the respective first and second domes, respectively, the heights H1, H2 of the respective first and second domes, the distances C1, C2 from the edge of the tread block to the center of the respective first and second domes, the circumferential distances from the edge of the tread block to the center of the respective first and second domes, and the potential range of angles U, V of the major axes of the elliptically shaped first and second domes.

[0031] It will also be understood that the dual dome feature of the present disclosure is shown on only a selected rib or tread block in the accompanying figures for ease of illustration and description, but one skilled in the art will appreciate that the dual dome feature may be used on some or all ribs/tread blocks of a tire.

[0032] In summary, the disclosure shows and describes circular/elliptical first domes covering a rib/tread block with both centered and offset circular/elliptical second domes spanning only a portion of the first domes. The dual domes control stress distribution across the block. As a result, tread block edges and ribs have reduced wear. By effectively positioning the second dome off-center/angled or by positioning the axes of an elliptical dome, pressure distribution can be designed to reduce wear. It is also understood that the rib/tread block configurations can be interchanged into any tread pattern type, including a smooth tire tread that has no pattern at all. It is possible for the dome features themselves to act as the traction mechanism by creating variation in the stress distribution. In the case of a spherical dome, the center locations of the first and second domes can be independent of each other, and in a somewhat analogous manner, the primary axes of the ellipses can be angle relative to the tread geometry and to each other. It is also possible to have a combination of a spherical dome (either the first or second dome) and an elliptical dome (either the second or first dome, respectively). Through selective design of the first and second domes, the normal stress distribution in the ribs/tread blocks of the tire can be controlled. By reducing normal stresses in certain areas, such as the edges of the tread rib/block, irregular wear can be reduced. The dual-dome feature allows greater control of the stress distribution by controlling where the second or upper dome begins and ends, as well as by having different combinations of the radii. Use of the dual dome feature also advantageously allows for an asymmetric distribution where one side of the rib/tread block could have a different pressure distribution from the other side of the rib/tread block simply by placing the second dome off-center from the first dome. Likewise, manipulating the orientation of the major axes of elliptically -shaped domes allows for optimization relative to specific tread block geometry, e.g., the major axes of the ellipses may be oriented parallel to or perpendicular to the axis of stiffness of the tread block.

[0033] This written description uses examples to describe the disclosure, including the best mode, and also to enable any person skilled in the art to make and use the disclosure. The patentable scope of the disclosure is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims.

Claims

1. A tire (100) comprising:

a tread block (116) or rib (110) used in a tire tread (102) of the tire (100); and

different sized first and second domes (130, 140) provided on a road engaging first surface of the tread block (116) or rib (110) wherein the first dome (130) is disposed on the first surface and protrudes outwardly from the first surface, and each of the first and second domes (130, 140) has a convex profile,

characterized in that

the second dome (140) is located on top of the first dome (130) so that the second dome (140) protrudes outwardly from the first dome (130), the first dome (130) forming a first spheroid-shaped surface defined by a single first radius (R1) of curvature and the second dome (140) forming a second spheroid-shaped surface defined by a single second radius (R2) of curvature wherein the first radius (R1) of curvature is different from the second radius (R2) of curvature.

2. The tire of claim 1, wherein centers of the first and second domes (130, 140) are concentric.

3. The tire of claim 1, wherein centers of the first and second domes (130, 140) are offset relative to one another.

4. The tire of any preceding claim, wherein at least one of the first and second domes (230, 240) has a substantially elliptical configuration.

5. The tire of any preceding claim, wherein radii (R1, R2) of the first and second domes (130, 140) are angled relative to one another.

6. The tire of any preceding claim, wherein at least one of the radii (R1, R2) is at an angle greater than zero and less than ninety degrees relative to a circumferential direction of the tire (100).

7. The tire of any preceding claim, wherein a radius of the first dome (130) is greater than one-half a lateral width (W) of the rib (110) or tread block (116).

8. The tire of any preceding claim, wherein a radius (R1, R2) of at least one of the first and second domes (130, 140) is greater than one-half a circumferential length of the tread block (116).

9. The tire of any preceding claim, wherein at least the first dome (230) has a substantially elliptical configuration, and a major radius of at least the first dome (230) is greater than either one-half a circumferential length of the tread block (216) or one-half a width of the tread block (216), and a minor radius of at least the first dome (230) is greater than the other of either one-half a circumferential length of the tread block (216) or one-half a width of the tread block (216).

10. The tire of any preceding claim, wherein a height (H1) of the first dome (130) above a nominal profile of the first surface ranges from 0.051 mm (0.002") to 0.203 mm (0.008").

11. The tire of any preceding claim, wherein a height (H2) of the second dome (140) above a nominal profile of the first surface ranges from 0.102 mm (0.004") to 0.381 mm (0.015").

12. The tire of any preceding claim, wherein a width dimension (D1) of the first dome (130) ranges from 50% to 500% of a width (W) of the rib (110) or tread block (116).

13. The tire of any preceding claim, wherein a width dimension (D2) of the second dome (140) ranges from 10% to 95% of a width dimension (D1) of the first dome (130).

14. The tire of any preceding claim, wherein the radius (R1) of the first dome (130) is greater than both a width dimension (W) and a circumferential dimension of the tread block (116).

15. The tire of any preceding claim, wherein the radius

(R2) of the second dome (140) is less than both the width dimension (W) and the circumferential dimension of the tread block (116).

Patentansprüche

1. Reifen (100), umfassend:

einen Profilblock (116) oder eine Rippe (110), der bzw. die in einem Reifenprofil (102) des Reifens (100) verwendet wird; und
eine erste und eine zweite Kuppel (130, 140) unterschiedlicher Größe, die auf einer die Straße kontaktierenden ersten Oberfläche des Profilblocks (116) oder der Rippe (110) vorgesehen sind, wobei die erste Kuppel (130) auf der ersten Oberfläche vorgesehen ist und von der ersten Oberfläche aus nach außen vorsteht, und die erste und die zweite Kuppel (130, 140) jeweils ein konvexes Profil haben,
dadurch gekennzeichnet, dass
die zweite Kuppel (140) oben auf der ersten Kuppel (130) angeordnet ist, sodass die zweite Kuppel (140) von der ersten Kuppel (130) aus nach außen vorsteht, wobei die erste Kuppel (130) eine erste sphärisch geformte Oberfläche ausbildet, die durch einen einzigen ersten Krümmungsradius (R1) definiert ist, und die zweite Kuppel (140) ein zweite sphärisch geformte Oberfläche ausbildet, die durch einen einzigen zweiten Krümmungsradius (R2) definiert ist, wobei der erste Krümmungsradius (R1) sich von dem zweiten Krümmungsradius (R2) unterscheidet.

2. Reifen gemäß Anspruch 1, wobei Mittelpunkte der ersten und der zweiten Kuppel (130, 140) konzentrisch sind.

3. Reifen gemäß Anspruch 1, wobei Mittelpunkte der ersten und der zweiten Kuppel (130, 140) zueinander versetzt sind.

4. Reifen gemäß einem der vorhergehenden Ansprüche, wobei mindestens eine aus der ersten und der zweiten Kuppel (230, 240) eine im Wesentlichen elliptische Konfiguration hat.

5. Reifen gemäß einem der vorhergehenden Ansprüche, wobei Radien (R1, R2) der ersten und der zweiten Kuppel (130, 140) relativ zueinander in einem Winkel stehen.

6. Reifen gemäß einem der vorhergehenden Ansprüche, wobei mindestens einer der Radien (R1, R2) in einem Winkel größer null und kleiner als neunzig Grad relativ zu einer Umfangsrichtung des Reifens (100) steht.

7. Reifen gemäß einem der vorhergehenden Ansprüche, wobei ein Radius der ersten Kuppel (130) größer als eine Hälfte einer Breite (W) der Rippe (110) oder des Profilblocks (116) in Querrichtung ist.

8. Reifen gemäß einem der vorhergehenden Ansprüche, wobei ein Radius (R1, R2) mindestens einer aus der ersten und der zweiten Kuppel (130, 140) größer als eine Hälfte einer Länge des Profilblocks (116) in Umfangsrichtung ist.

9. Reifen gemäß einem der vorhergehenden Ansprüche, wobei mindestens die erste Kuppel (230) eine im Wesentlichen elliptische Konfiguration hat und eine große Halbachse mindestens der ersten Kuppel (230) größer als entweder eine Hälfte einer Länge des Profilblocks (216) in Umfangsrichtung oder eine Hälfte einer Breite des Profilblocks (216) ist und eine kleine Halbachse mindestens der ersten Kuppel (230) größer als die jeweils andere aus entweder der Hälfte einer Länge des Profilblocks (216) in Umfangsrichtung oder der Hälfte einer Breite des Profilblocks (216) ist.

10. Reifen gemäß einem der vorhergehenden Ansprüche, wobei eine Höhe (H1) der ersten Kuppel (130) über einem Nennprofil der ersten Oberfläche in einem Bereich von 0,051 mm (0,002 Zoll) bis 0,203 mm (0,008 Zoll) liegt.

11. Reifen gemäß einem der vorhergehenden Ansprüche, wobei eine Höhe (H2) der zweiten Kuppel (140) über einem Nennprofil der ersten Oberfläche in einem Bereich von 0,102 mm (0,004 Zoll) bis 0,381 mm (0,015 Zoll) liegt.

12. Reifen gemäß einem der vorhergehenden Ansprüche, wobei eine Breitenabmessung (D1) der ersten Kuppel (130) in einem Bereich von 50% bis 500% einer Breite (W) der Rippe (110) oder des Profilblocks (116) liegt.

13. Reifen gemäß einem der vorhergehenden Ansprüche, wobei eine Breitenabmessung (D2) der zweiten Kuppel (140) in einem Bereich von 10% bis 95% einer Breitenabmessung (D1) der ersten Kuppel (130) liegt.

14. Reifen gemäß einem der vorhergehenden Ansprüche, wobei der Radius (R1) der ersten Kuppel (130) größer als sowohl eine Breitenabmessung (W) als auch eine Abmessung des Profilblocks (116) in Umfangsrichtung ist.

15. Reifen gemäß einem der vorhergehenden Ansprüche, wobei der Radius (R2) der zweiten Kuppel (140) kleiner als sowohl die Breitenabmessung (W) als auch die Abmessung des Profilblocks (116) in Umfangsrichtung ist.

Revendications

1. Pneu (100) comprenant :

un bloc (116) ou une nervure (110) de bande de roulement utilisé(e) dans une bande de roulement de pneu (102) du pneu (100) ; et
des premier et second dômes (130, 140) de dimension différente, prévus sur une première surface de mise en prise de route du bloc (116) ou de la nervure (110) de bande de roulement, dans lequel le premier dôme (130) est disposé sur la première surface et fait saillie vers l'extérieur à partir de la première surface, et chacun des premier et second dômes (130, 140) a un profil convexe,
caractérisé en ce que :
le second dôme (140) est positionné sur le dessus du premier dôme (130) de sorte que le second dôme (140) fait saillie vers l'extérieur à partir du premier dôme (130), le premier dôme (130) formant une première surface sphéroïdale définie par un seul premier rayon (R1) de courbure et le second dôme (140) formant une seconde surface sphéroïdale définie par un seul second rayon (R2) de courbure, dans lequel le premier rayon (R1) de courbure est différent du second rayon (R2) de courbure.

2. Pneu selon la revendication 1, dans lequel les centres des premier et second dômes (130, 140) sont concentriques.

3. Pneu selon la revendication 1, dans lequel les centres des premier et second dômes (130, 140) sont décalés l'un par rapport à l'autre.

4. Pneu selon l'une quelconque des revendications précédentes, dans lequel au moins l'un des premier et second dômes (230, 240) a une configuration sensiblement elliptique.

5. Pneu selon l'une quelconque des revendications précédentes, dans lequel les rayons (R1, R2) des premier et second dômes (130, 140) sont coudés l'un par rapport à l'autre.

6. Pneu selon l'une quelconque des revendications précédentes, dans lequel au moins l'un des rayons (R1, R2) est à un angle supérieur à zéro et inférieur à quatre-vingt-dix degrés par rapport à une direction circonférentielle du pneu (100).

7. Pneu selon l'une quelconque des revendications précédentes, dans lequel un rayon de premier dôme (130) est supérieur à la moitié d'une largeur latérale (W) de la nervure (110) ou du bloc (116) de bande de roulement.

8. Pneu selon l'une quelconque des revendications précédentes, dans lequel un rayon (R1, R2) d'au moins l'un parmi les premier et second dômes (130, 140) est supérieur à une moitié d'une longueur circonférentielle du bloc de bande de roulement (116).

9. Pneu selon l'une quelconque des revendications précédentes, dans lequel au moins le premier dôme (230) a une configuration sensiblement elliptique, et un rayon majeur au moins du premier dôme (230) est supérieur à la moitié d'une longueur circonférentielle du bloc de bande de roulement (216) ou la moitié d'une largeur du bloc de bande de roulement (216), et un rayon mineur au moins du premier dôme (230) est supérieur à l'autre parmi la moitié d'une longueur circonférentielle du bloc de bande de roulement (216) ou la moitié d'une largeur du bloc de bande de roulement (216).

10. Pneu selon l'une quelconque des revendications précédentes, dans lequel une hauteur (H1) du premier dôme (130) au-dessus d'un profilé nominal de la première surface est de l'ordre de 0,051 mm (0,002") à 0,203 mm (0,008").

11. Pneu selon l'une quelconque des revendications précédentes, dans lequel une hauteur (H2) du second dôme (140) au-dessus d'un profilé nominal de la première de surface est de l'ordre de 0,102 mm (0,004") à 0,381 mm (0,015").

12. Pneu selon l'une quelconque des revendications précédentes, dans lequel une dimension de largeur (D1) du premier dôme (130) est de l'ordre de 50 % à 500 % d'une largeur (W) de la nervure (110) ou du bloc de bande de roulement (116).

13. Pneu selon l'une quelconque des revendications précédentes, dans lequel une dimension de largeur (D2) du second dôme (140) est de l'ordre de 10 % à 95 % d'une dimension de largeur (D1) du premier dôme (130).

14. Pneu selon l'une quelconque des revendications précédentes, dans lequel le rayon (R1) du premier dôme (130) est supérieur à la fois à une dimension de largeur (W) et à une dimension circonférentielle du bloc de bande de roulement (116).

15. Pneu selon l'une quelconque des revendications précédentes, dans lequel le rayon (R2) du second dôme (140) est inférieur à la fois à la dimension de largeur (W) et à la dimension circonférentielle du bloc de bande de roulement (116).

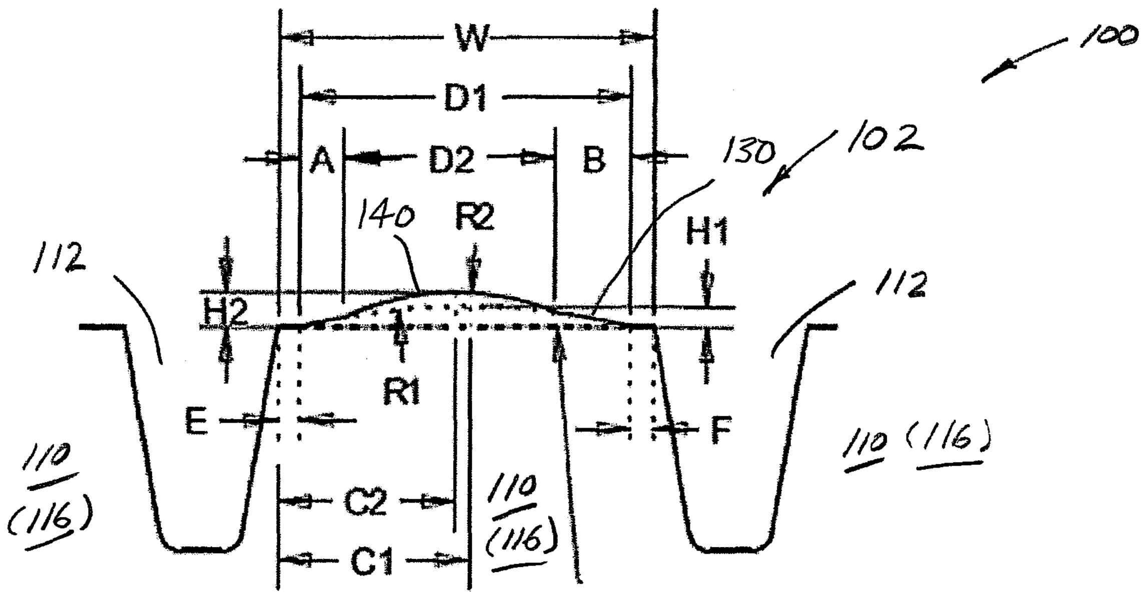

Figure 1

A = DISTANCE FROM EDGE OF DOME 1 TO LOCATION WHERE DOME 2 BEGINS
B = DISTANCE FROM OPPOSITE EDGE OF DOME 1 TO LOCATION WHERE DOME 2 ENDS
E = DISTANCE FROM EDGE OF TREAD BLOCK TO LOCATION WHERE DOME 1 BEGINS
F = DISTANCE FROM OPPOSITE EDGE OF TREAD BLOCK TO LOCATION WHERE DOME 1 ENDS
D1 = WIDTH OF DOME 1
D2 = WIDTH OF DOME 2
C1 = DISTANCE FROM EDGE OF TREAD BLOCK TO CENTER OF DOME 1
C2 = DISTANCE FROM EDGE OF TREAD BLOCK TO CENTER OF DOME 2
H1 = HEIGHT OF DOME 1 ABOVE THE NOMINAL PROFILE SURFACE
H2 = HEIGHT OF DOME 2 ABOVE THE NOMINAL PROFILE SURFACE
R1 = RADIUS OF DOME 1
R2 = RADIUS OF DOME 2
W = WIDTH OF TREAD BLOCK OR RIB IN LATERAL DIRECTION

Figure 2

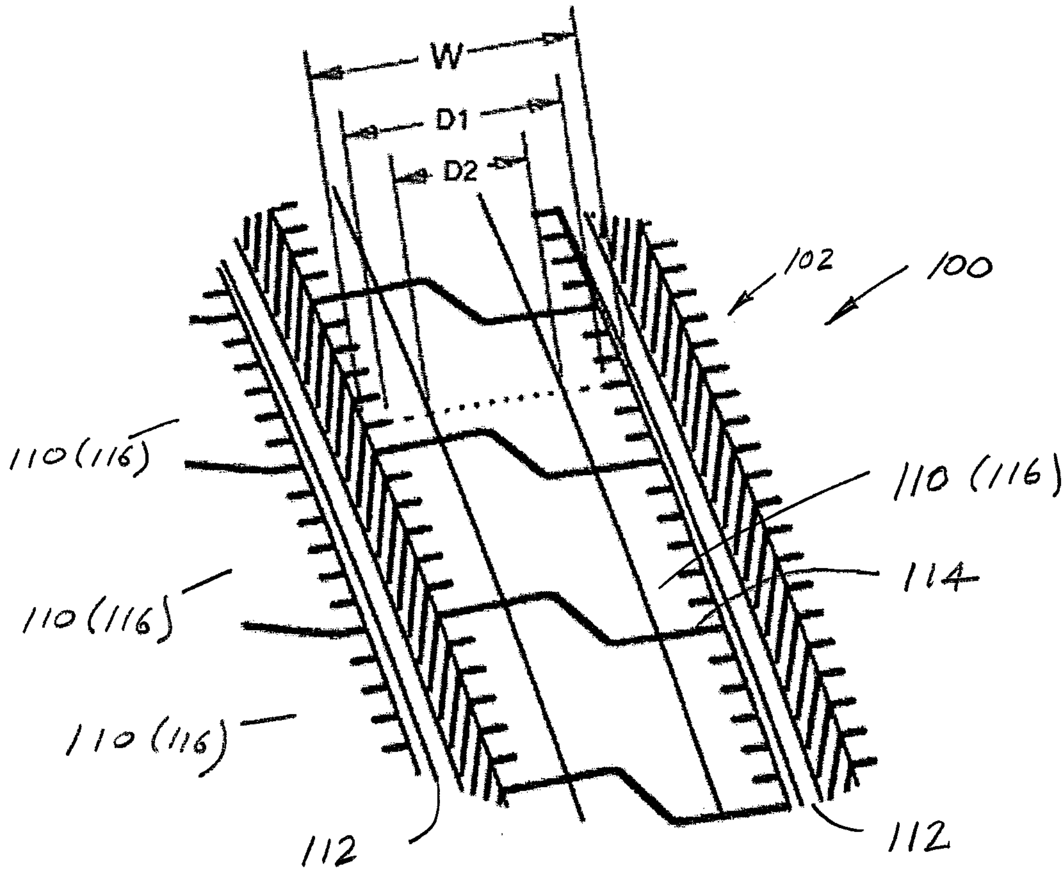

Figure 3

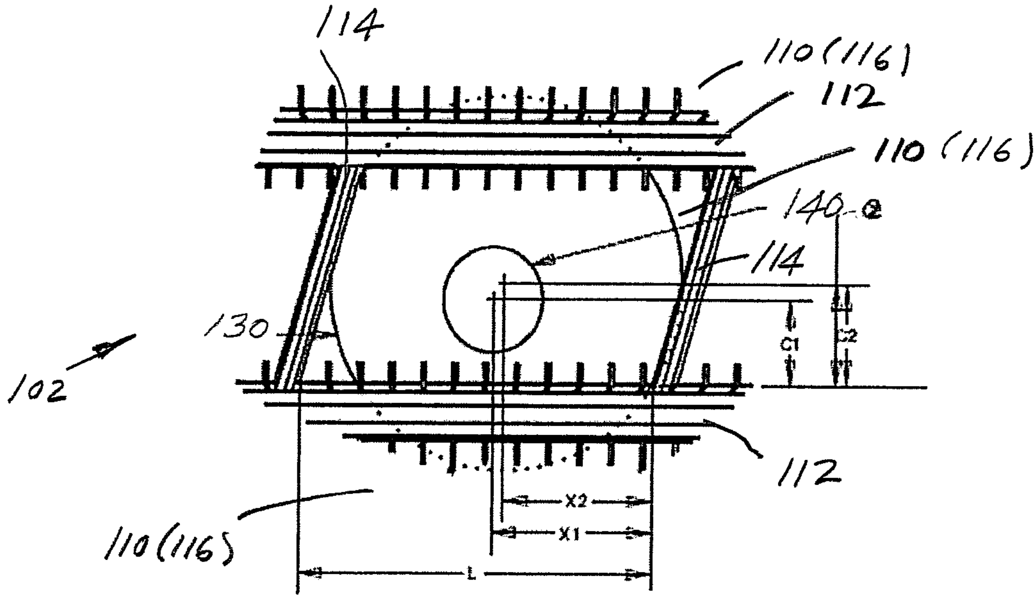

Figure 4

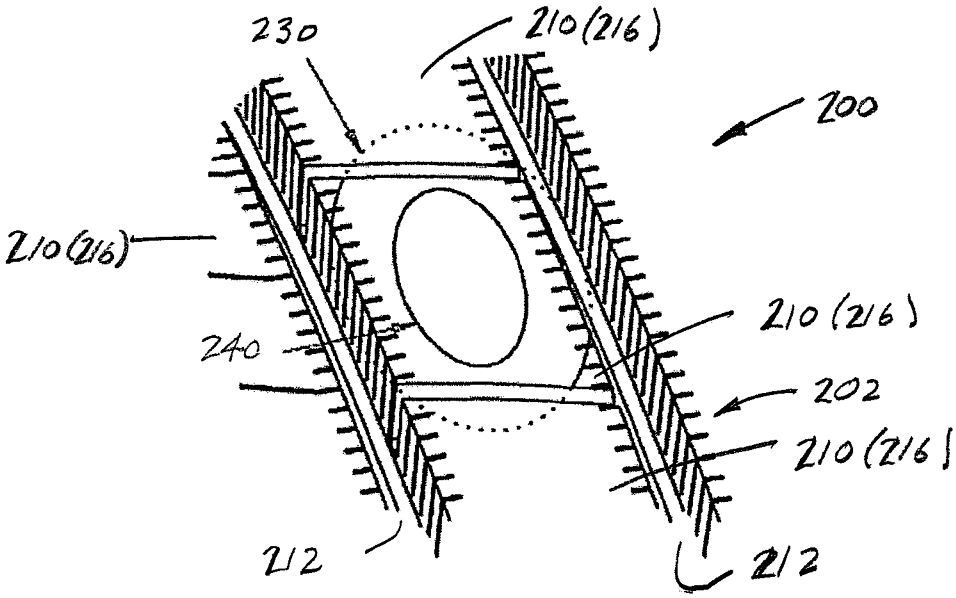

Figure 5

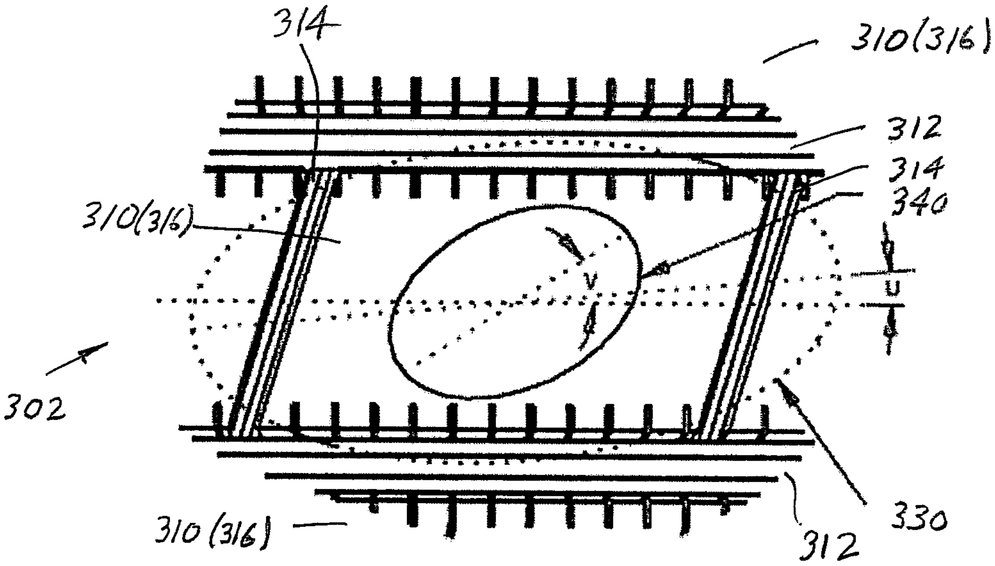

Figure 7

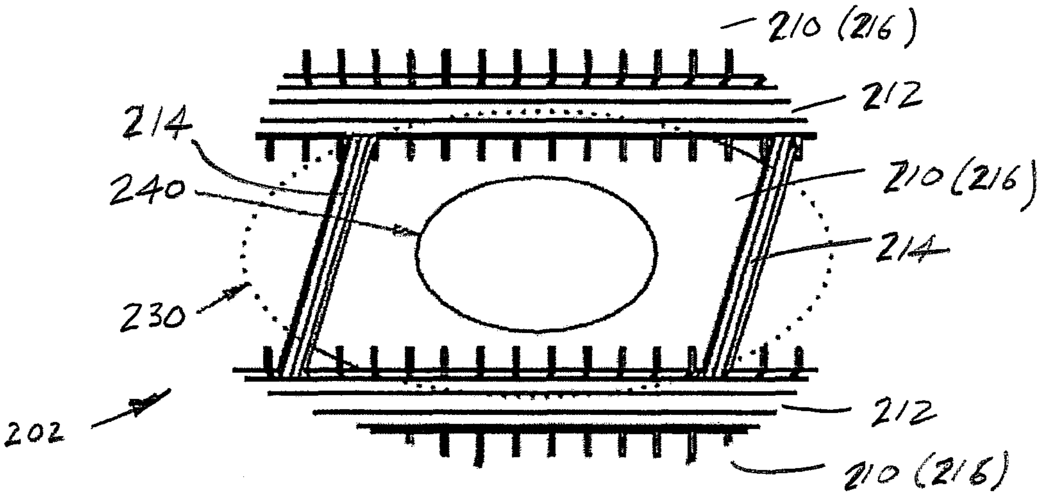

Figure 6

PARAMETER	MINIMUM	MAXIMUM	PREFERRED
W	0.150"	10.0"	1.0"-1.5"
D1	50% W	500% W	100% W
D2	10% D1	95% D1	75% D1
H1	0.002"	0.300"	0.008"
H2	0.004"	0.302"	0.015"
C1	0% W	100% W	50% W
C2	0% W	100% W	50% W
X1	0% L	100% L	50% L
X2	0% L	100% L	50% L
U	0°	90°	0°
V	0°	90°	0°

Figure 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 20030136487 A **[0004]**