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(54) **Light weight steel belted tire device**

Leichtgewichtige Stahlgürtelreifenvorrichtung

Dispositif de pneu ceinturé à acier léger

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(56) References cited:
**EP-A- 1 872 972**
**WO-A-2008/010379**
**FR-A- 2 910 379**



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## Description

I. Background of the Invention

A. Field of Invention

**[0001]** This invention generally relates to tires and in particular to light weight steel belted tires.

B. Description of the Related Art

**[0002]** It is well known that tire mass affects fuel efficiency as well as other operating characteristics of a vehicle. Furthermore, tire mass becomes more important as the size of the tires increase. For instance, tractor trailer tires can impact fuel efficiency more than that of a passenger car. Accordingly it is especially beneficial to use light weight tires for such vehicles. A number of attempts have been made to reduce the mass of such tires. For instance, some prior attempts include using non-steel reinforcing materials, such as aramids or fiberglass. However, such tires lack many of the benefits imparted by steel belts. Accordingly, there is a need in the art for a tire , particularly for a truck tire, that is light weight and includes steel belts.

II. Summary of the Invention

**[0003]** The invention relates to a tire according to claim 1.

**[0004]** Dependent claims refer to preferred embodiments of the invention.

**[0005]** In a preferred aspect of the present invention, the tire comprises a tread defining a footprint width, and the tread defining a center line, a first reinforcing layer disposed comprising a steel belt defining a width from 90% to 98% of the footprint width, a second reinforcing layer disposed above the first reinforcing layer and comprising a pair of steel belts preferably equally spaced apart from the center line and on opposing sides of the center line, and the space between the belts being substantially filled by a gum strip, a third reinforcing layer disposed above the second reinforcing layer and comprising a steel belt defining a width from 90% to 100% of the footprint width, a wedge layer disposed above the second reinforcing layer and under the third reinforcing layer, and a fourth reinforcing layer disposed under the tread and above the third reinforcing layer and comprising a steel or nylon belt, the belt defining a width from 60% to 88% of the footprint width.

**[0006]** In a preferred embodiment of the invention, the tire comprises a tread defining a footprint width, the tread defining a center line, a first reinforcing layer comprising a steel belt defining a width from 90% to 98% of the footprint width, wherein the steel belt of the first reinforcing layer defines a belt ply cord angle of 15 to 23 R, a second reinforcing layer disposed above the first reinforcing layer and comprising a pair of steel belts equally spaced apart from the center line and on opposing sides of the center line, and the space between the belts being substantially filled by a gum strip defining a width of 4,06 to 7,62 cm (1.6 to 3.0 inches) per half, wherein each of the steel belts of the second reinforcing layer define a belt ply cord angle of 2 R to L, a third reinforcing layer disposed above the second layer and comprising a steel belt defining a width from 90% to 100% of the footprint width, wherein the steel belt of the third reinforcing layer defines a belt ply cord angle of 15 to 23 L, a wedge layer disposed under the third reinforcing layer, wherein the wedge layer comprises a pair of wedges spaced apart laterally by equal distances from the tread center line, and on opposite sides of the tread center line, and wherein each wedge defines a wedge center line, and the wedge center line of each wedge aligns with an edge of the steel belt of the third reinforcing layer, and a fourth reinforcing layer disposed under the tread above the third reinforcing layer and comprising a steel or nylon belt, the belt defining a width from 60% to 88% of the footprint width, wherein the belt of the first reinforcing layer defines a belt ply cord angle of 15 to 23 L or a belt ply cord angle of 15 to 23 R.

**[0007]** One advantage of the present invention is the possibility to reduce the tire weight.

**[0008]** Another advantage of the present invention is that the plysteer can be increased and the crown durability, cornering force, and high speed can be improved.

**[0009]** Other benefits and advantages will become apparent to those skilled in the art to which it pertains upon reading and understanding of the following detailed specification.

III. Brief Description of the Drawing

**[0010]** The invention may take physical form in certain parts and arrangement of parts, embodiments of which will be described in detail in this specification and illustrated in the accompanying drawing which form a part hereof and wherein:

FIG. 1 is a cross sectional drawing of an embodiment showing the relative positions of the various layers.

IV. Detailed Description of the Invention

**[0011]** The present embodiment relates to a preferably light weight steel belted tire. The embodiment shows a light weight tire comprising a plurality of reinforcing layers comprising steel belts. Each of the steel belts defines a width that is a predetermined fraction of the tire tread width. Furthermore, the steel belts comprise ply cords oriented at an angle relative to a centerline of the tire tread. For instance, ply cord angles include angles in a range of from 15 to 23 degrees (which includes 15, 16, 17, 18, 19, 20, 21, 22, and 23 degrees), wherein the angle slopes to the left. This angle range can be equivalently represented as 15 to 23 L. Other acceptable ranges can include 15 to 23 R (which includes 15, 16, 17, 18, 19, 20,

21, 22, and 23 degrees), wherein the angle slopes to the right. Still other acceptable ply cord angles can include approximately zero degrees, which means the ply cords are approximately parallel to the tread center line.

**[0012]** As used herein the term "footprint" includes the surface of a tire that contacts the ground when the tire is in a non-loaded state. Accordingly, the footprint width is the lateral width of the footprint when the tire is in contact with the ground but unloaded.

**[0013]** The first reinforcing layer comprises a steel belt defining a width. The second reinforcing layer is disposed above the first reinforcing layer and comprises a pair of steel belts preferably defining equal widths and spaced laterally apart from each other by preferably equal distances from the tread center line. According to a preferred embodiment, the space between the pair of steel belts of the second reinforcing layer is substantially occupied by a gum strip. The tire includes a pair of wedge strips preferably disposed above the second reinforcing layer. The wedge strips preferably each define equal widths and are preferably spaced laterally apart from each other by equal distances from the tread center line. Each wedge strip defines a wedge center line. The wedge center line of each wedge is preferably aligned with an opposing edge of the steel belt of a third reinforcing layer. The tire further comprises a third reinforcing layer disposed above the pair of wedge strips and a fourth reinforcing layer disposed above the third reinforcing layer, which can comprise a steel belt defining a width.

**[0014]** The tread can define any of a wide variety of footprint widths. Some acceptable footprint widths include 20 to 43,18 cm (7.80 to 17 inches). Other acceptable widths include 20,30 to 25,4 cm (8 to 10 inches), 25,4 to 30,48 cm (10 to 12 inches), 30,48 to 35,56 cm (12 to 14 inches, 35,56 to 40,64 cm (14 to 16 inches), and 40,64 to 43,18 cm (16 to 17 inches). Here, as elsewhere in the specification and claims, ranges may be combined. Generally, larger tires garner a greater benefit from the weight reducing effect of the present invention. Accordingly, some embodiments have a footprint widths in excess of 43,18 cm (17 inches).

**[0015]** The steel belt of the fourth reinforcing layer defines a width that can differ from that of other reinforcing layers. Furthermore, the steel or nylon belt can equal any of a range of predetermined fractions of the footprint width. For example some fractions of the footprint width include 60 to 88% (which includes 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72 ,73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, and 88). Preferably, the footprint width is in a range of from 70% to 88% or 82% to 88%. In one embodiment, the fourth reinforcing layer has a width that is 86% of the footprint width. Furthermore, the steel belt of the fourth reinforcing layer can comprise a plurality of belt ply cords oriented at an angle relative to the tread center line. Suitable angles include 15 to 23 degrees (which includes 15, 16, 17, 18, 19, 20, 21, 22, and 23 degrees) sloping either to the right or to the left relative to the tread center line.

**[0016]** The steel belt of the third reinforcing layer defines a width that can differ from that of other reinforcing layers. Furthermore, the steel belt can equal any of a range of predetermined fractions of the footprint width. For example some fractions of the footprint width include 90 to % (which includes 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, and 100). More specifically, acceptable ranges include 91% to 96%. In one embodiment, the third reinforcing layer has a width that is 93% of the footprint width. Furthermore, the steel belt of the third reinforcing layer comprises a plurality of belt ply cords oriented at an angle relative to the tread center line. Suitable angles include 15 to 23 degrees (which includes 15, 16, 17, 18, 19, 20, 21, 22, and 23 degrees) sloping preferably to the left relative to the tread center line.

**[0017]** The wedge strips comprise any of a variety of widths provided the wedge center line of each wedge is aligned with opposing edges of the third reinforcing layer. However, the upper limit is set by the width of the third reinforcing layer relative to that of the footprint width. Specifically, in order to prevent the wedges from extending beyond the edge of the footprint, the width of each wedge strip can be no larger than $[w_{fp}\ (1\text{-}p)]/2$, where p is the ratio of the width of the third reinforcing layer divided by the footprint width, and $w_{fp}$ is the footprint width. Notably, in some alternative embodiments the wedge center lines of each wedge strip do not need to be aligned with opposing edges of the third reinforcing layer. In such embodiments, the width of each wedge strip is not limited by the foregoing equation.

**[0018]** The pair of steel belts comprising the second reinforcing layer can define widths that differ from that of other reinforcing layers. Furthermore, the second reinforcing layer can equal any of a range of predetermined fractions of the footprint width. Suitable fractions of the footprint width include 70 to 84 % (which includes 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, and 84). More specifically, acceptable ranges include 74% to 80%. In one embodiment, the second reinforcing layer has a width that is 82% of the footprint width. Furthermore, the steel belts of the second reinforcing layer comprises a plurality of belt ply cords preferably oriented at approximately zero degrees relative to the tread center line, or parallel to the tread center line.

**[0019]** The steel belt of the first reinforcing layer defines a width that can differ from that of other reinforcing layers. Furthermore, the steel belt can equal any of a range of predetermined fractions of the footprint width. Suitable fractions of the footprint includes 90 to 98 % (which includes 90, 91, 92, 93, 94, 95, 96, 97, and 98). More specifically, acceptable ranges include 94% to 98%. In one embodiment, the first reinforcing layer has a width that is 97% of the footprint width. Furthermore, the steel belt of the first reinforcing layer comprises a plurality of belt ply cords oriented at an angle relative to the tread center line. Suitable angles include 15 to 23 degrees (which includes 15, 16, 17, 18, 19, 20, 21, 22, and 23 degrees) sloping preferably to the right relative

to the tread center line.

**[0020]** FIGURE 1 is a schematic drawing showing relative sizes of the belts of an embodiment, assuming a footprint width of 37,59 cm (14.8 inches). According to FIGURE 1, a fourth reinforcing layer 110 comprises a steel or nylon belt having belt ply cords oriented at 18 L to 19 L. In this particular embodiment, the width of the belt is 12.8 inches, which is 86% of the footprint width. A third reinforcing layer 200 is disposed under the fourth reinforcing layer and also comprises a steel belt and defines a width of 35,05 cm (13.8 inches), which is 93% of the footprint width. The steel belt of this layer includes belt ply cords oriented at an angle of 18 L to 19 L.

**[0021]** The embodiment shown in FIGURE 1 also includes a pair of wedge strips 300, 310 each defining a wedge center line 302, 312 that are aligned with opposing edges of the third reinforcing layer 200. Accordingly, the maximum width of the wedge strips is governed by the equation $[w_{fp}(1\text{-}p)]/2$. The second reinforcing layer is disposed under the wedge strips 300, 310 and comprises a pair of steel belts 400, 440. In this embodiment the total width of the second reinforcing layer is 31 cm (12.2 inches). The steel belts 400, 440 comprise belt ply cords oriented at approximately zero degrees relative to the tread center line. Each steel belt 400, 440 has a width of 8,89 cm (3.5 inches), which is about 29% of the overall width of the second reinforcing layer. Each steel belt 400, 440 is also 6,6 cm (2.6 inches) from the tread center line 100. The gap between the steel belts 400, 440 is substantially occupied by a gum strip 420 having a width of 13,21 cm (5.2 inches), which is about 43% of the total width of the second reinforcing layer. Finally, the embodiment of FIGURE 1 includes a first reinforcing layer 500 comprising a steel belt having a width of 36,58 cm (14.4 inches), which is 97% of the footprint width. The steel belt of this layer comprises belt ply cords oriented at an angle of 18 to 19 R.

## Claims

1. A tire having a footprint width and a tread having a center line (100), the tire comprising a first reinforcing layer (500) comprising a steel belt having a width from 90% to 98% of the footprint width, a second reinforcing layer (400) disposed radially outwards of the first reinforcing layer (500) comprising a pair of steel belts (400, 440) preferably equally spaced apart from the center line (100) and on opposing sides of the center line (100), wherein the space between the pair of steel belts (400, 440) is at least substantially filled by a gum strip (420), a wedge layer (300, 310) disposed radially outwards of the second reinforcing layer (400), a third reinforcing layer (200) radially outwards of the wedge layer (310) comprising a steel belt having a width from 90% to 100% of the footprint width, and at least a fourth reinforcing layer (110) disposed radially outwards of the third reinforcing layer (200) and comprising a steel or nylon belt, the steel or nylon belt defining a width from 60% to 88% of the footprint width.

2. The tire of claim 1, wherein the belt of the fourth reinforcing layer (110) has a belt ply cord angle in a range of from of 15°L to 23°L or in a range of from 15°R to 23°R.

3. The tire of claim 2, wherein the belt of the fourth reinforcing layer (110) has a belt ply cord angle of in a range of from 18° to 19°L.

4. The tire of at least one of the previous claims, wherein the steel belt of the third reinforcing layer (200) has a belt ply cord angle in a range of from 15°L to 23°L.

5. The tire of claim 4, wherein the steel belt of the third reinforcing layer (200) defines a belt ply cord angle in a range of from 18° to 19°L.

6. The tire of at least one of the previous claims, wherein the wedge layer (310) comprises a pair of wedges spaced apart laterally by substantially equal distances from the center line (100), and on opposite sides of the center line (100).

7. The tire of claim 6, wherein each wedge defines a center line (302, 312), and the center line of each wedge at least substantially aligns with an edge of the steel belt of the third reinforcing layer (200).

8. The tire of at least one of the previous claims, wherein each of the steel belts of the second reinforcing layer (400) has a belt ply cord angle in a range of from 2°R to 2°L, alternatively 0° or about 0°.

9. The tire of at least one of the previous claims, wherein the steel belt of the first reinforcing layer (500) has a belt ply cord angle in a range of from 15°R to 23°R.

10. The tire of claim 9, wherein the steel belt of the first reinforcing layer (500) has a belt ply cord angle in a range of from 18°R to 19°R.

11. The tire of at least one of the previous claims, wherein the gum strip (420) has width in a range of from of 8,13 to 15,24 cm (3.2 to 6.0 inches), alternatively 11,43 to 13,92 cm (4.5 to 5.5 inches).

12. The tire of at least one of the previous claims, wherein the footprint width is in a range of from 19,81 to 43,18 cm (7.80 to 17 inches).

13. The tire of at least one of the previous claims wherein the width of the first reinforcing layer (500) is in a range of from 94% to 98% of the footprint width.

**14.** The tire of at least one of the previous claims wherein the width of the second reinforcing layer (400) is in a range of from 70% to 84%, alternatively 80% to 84% of the footprint width.

**15.** The tire of at least one of the previous claims wherein the width of the third reinforcing layer (200) is in a range of from 91 % to 96%, and/or wherein the width of the fourth reinforcing layer (110) is in a range of from 82% to 88% of the footprint width.

**Patentansprüche**

**1.** Reifen, der eine Aufstandsflächenbreite und eine Lauffläche mit einer Mittellinie (100) aufweist, wobei der Reifen eine erste Verstärkungslage (500) umfasst, die einen Stahlgürtel mit einer Breite von 90% bis 98% der Aufstandsflächenbreite umfasst, eine radial auswärts von der ersten Verstärkungslage (500) angeordnete zweite Verstärkungslage (400), die ein Paar Stahlgürtel (400, 440) umfasst, die bevorzugt gleich beabstandet von der Mittellinie (100) und an entgegengesetzten Seiten der Mittellinie (100) sind, wobei der Raum zwischen dem Paar Stahlgürteln (400, 440) mindestens im Wesentlichen durch einen Gumstreifen (420) gefüllt ist, eine radial auswärts von der zweiten Verstärkungslage (400) angeordnete Keillage (300,310), eine dritte Verstärkungslage (200) radial auswärts von der Keillage (310), die einen Stahlgürtel umfasst, der eine Breite von 90% bis 100% der Aufstandsflächenbreite aufweist, und mindestens eine vierte Verstärkungslage (110), die radial auswärts von der dritten Verstärkungslage (200) angeordnet ist und einen Stahl- oder Nylongürtel umfasst, wobei der Stahl- oder Nylongürtel eine Breite von 60% bis 88% der Aufstandsflächenbreite definiert.

**2.** Reifen nach Anspruch 1, wobei der Gürtel der vierten Verstärkungslage (110) einen Gürtellagenkordwinkel in einem Bereich von 15°L bis 23°L oder in einem Bereich von 15 °R bis 23 °R aufweist.

**3.** Reifen nach Anspruch 2, wobei der Gürtel der vierten Verstärkungslage (110) einen Gürtellagenkordwinkel in einem Bereich von 18°bis 19°L aufweist.

**4.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei der Stahlgürtel der dritten Verstärkungslage (200) einen Gürtellagenkordwinkel in einem Bereich von 15 °L bis 23 °L aufweist.

**5.** Reifen nach Anspruch 4, wobei der Stahlgürtel der dritten Verstärkungslage (200) einen Gürtellagenkordwinkel in einem Bereich von 18° bis 19°L definiert.

**6.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei die Keillage (310) ein Paar Keile umfasst, die durch im Wesentlichen gleiche Abstände von der Mittellinie (100), und an entgegengesetzten Seiten der Mittellinie (100), seitlich voneinander beabstandet sind.

**7.** Reifen nach Anspruch 6, wobei jeder Keil eine Mittellinie (302, 312) definiert und die Mittellinie jedes Keils mindestens im Wesentlichen mit einem Rand des Stahlgürtels der dritten Verstärkungslage (200) auf einer Linie liegt.

**8.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei jeder der Stahlgürtel der zweiten Verstärkungslage (400) einen Gürtellagenkordwinkel in einem Bereich von 2 °R bis 2°L, alternativ 0 ° oder etwa 0 °, aufweist.

**9.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei der Stahlgürtel der ersten Verstärkungslage (500) einen Gürtellagenkordwinkel in einem Bereich von 15 °R bis 23 °R aufweist.

**10.** Reifen nach Anspruch 9, wobei der Stahlgürtel der ersten Verstärkungslage (500) einen Gürtellagenkordwinkel in einem Bereich von 18°R bis 19°R aufweist.

**11.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei der Gumstreifen (420) eine Breite in einem Bereich von 8,13 bis 15,24 cm (3,2 bis 6,0 Zoll), alternativ 11,43 bis 13,97 cm (4,5 bis 5,5 Zoll), aufweist.

**12.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei die Aufstandsflächenbreite in einem Bereich von 19,81 bis 43,18 cm (7,80 bis 17 Zoll) liegt.

**13.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei die Breite der ersten Verstärkungslage (500) in einem Bereich von 94% bis 98% der Aufstandsflächenbreite liegt.

**14.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei die Breite der zweiten Verstärkungslage (400) in einem Bereich von 70% bis 84%, alternativ 80% bis 84%, der Aufstandsflächenbreite liegt.

**15.** Reifen nach mindestens einem der vorgenannten Ansprüche, wobei die Breite der dritten Verstärkungslage (200) in einem Bereich von 91 % bis 96% liegt, und/oder wobei die Breite der vierten Verstärkungslage (110) in einem Bereich von 82% bis 88% der Aufstandsflächenbreite liegt.

**Revendications**

1. Bandage pneumatique possédant une largeur de sculpture et une bande de roulement possédant une ligne médiane (100), le bandage pneumatique comprenant une première couche de renforcement (500) comprenant une ceinture d'acier dont la largeur représente de 90 % à 98 % de la largeur de la sculpture, une deuxième couche de renforcement (400) disposée en direction radiale à l'extérieur de la première couche de renforcement (500) comprenant une paire de ceintures d'acier (400, 440) de préférence espacées de manière équidistante par rapport à la ligne médiane (100) et sur les côtés opposés de la ligne médiane (100), l'espace ménagé entre la paire de ceintures d'acier (400, 440) étant rempli au moins de manière substantielle par une bande de gomme (420), une couche cunéiforme (300, 310) disposée en direction radiale à l'extérieur de la deuxième couche de renforcement (400), une troisième couche de renforcement (200) en direction radiale à l'extérieur de la couche cunéiforme (310), comprenant une ceinture d'acier dont la largeur représente de 90 % à 100 % de la largeur de la sculpture, et au moins une quatrième couche de renforcement (110) disposée en direction radiale à l'extérieur de la troisième couche de renforcement (200) et comprenant une ceinture d'acier ou de nylon, la ceinture d'acier ou de nylon définissant une largeur représentant de 60 % à 88 % de la largeur de la sculpture.

2. Bandage pneumatique selon la revendication 1, dans lequel la ceinture de la quatrième couche de renforcement (110) forme un angle de câblé de nappe de ceinture dans la plage de 15°L à 23°L ou dans la plage de 15°R à 23°R.

3. Bandage pneumatique selon la revendication 2, dans lequel la ceinture de la quatrième couche de renforcement (110) forme un angle de câblé de nappe de ceinture dans la plage de 18°L à 19°L.

4. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la ceinture en acier de la troisième couche de renforcement (200) forme un angle de câblé de nappe de ceinture dans la plage de 15°L à 23°L.

5. Bandage pneumatique selon la revendication 4, dans lequel la ceinture en acier de la troisième couche de renforcement (200) définit un angle de câblé de nappe de ceinture dans la plage de 18°L à 19°L.

6. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la couche cunéiforme (310) comprend une paire de coins séparés l'un de l'autre en direction latérale sur des distances essentiellement égales par rapport à la ligne médiane (100) et sur les côtés opposés de la ligne médiane (100).

7. Bandage pneumatique selon la revendication 6, dans lequel chaque coin définit une ligne médiane (302, 312) et la ligne médiane de chaque coin vient se disposer au moins de manière essentielle en alignement avec un coin de la ceinture d'acier de la troisième couche de renforcement (200).

8. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel chacune des ceintures en acier de la deuxième couche de renforcement (400) forme un angle de câblé de nappe de ceinture dans la plage de 2°R à 2°L, en variante de 0° ou d'environ 0°.

9. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la ceinture en acier de la première couche de renforcement (500) forme un angle de câblé de nappe de ceinture dans la plage de 15°R à 23°R.

10. Bandage pneumatique selon la revendication 9, dans lequel la ceinture en acier de la première couche de renforcement (500) forme un angle de câblé de nappe de ceinture dans la plage de 18°R à 19°R.

11. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la bande de gomme (420) possède une largeur dans la plage de 8,13 à 15,24 cm (3,2 à 6,0 pouces), en variante de 11,43 à 13,97 cm (4,5 à 5,5 pouces).

12. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la largeur de la sculpture se situe dans la plage de 19,81 à 43,18 cm (7,80 à 17 pouces).

13. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la largeur de la première couche de renforcement (500) représente de 94 % à 98 % de la largeur de la sculpture.

14. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la largeur de la deuxième couche de renforcement (400) représente de 70 % à 84 %, en variante de 80 % à 84 % de la largeur de la sculpture.

15. Bandage pneumatique selon au moins une des revendications précédentes, dans lequel la largeur de la troisième couche de renforcement (200) représente de 91 % à 96 %, et/ou dans lequel la largeur de la quatrième couche de renforcement (110) représente de 82 % à 88 % de la largeur de la sculpture.

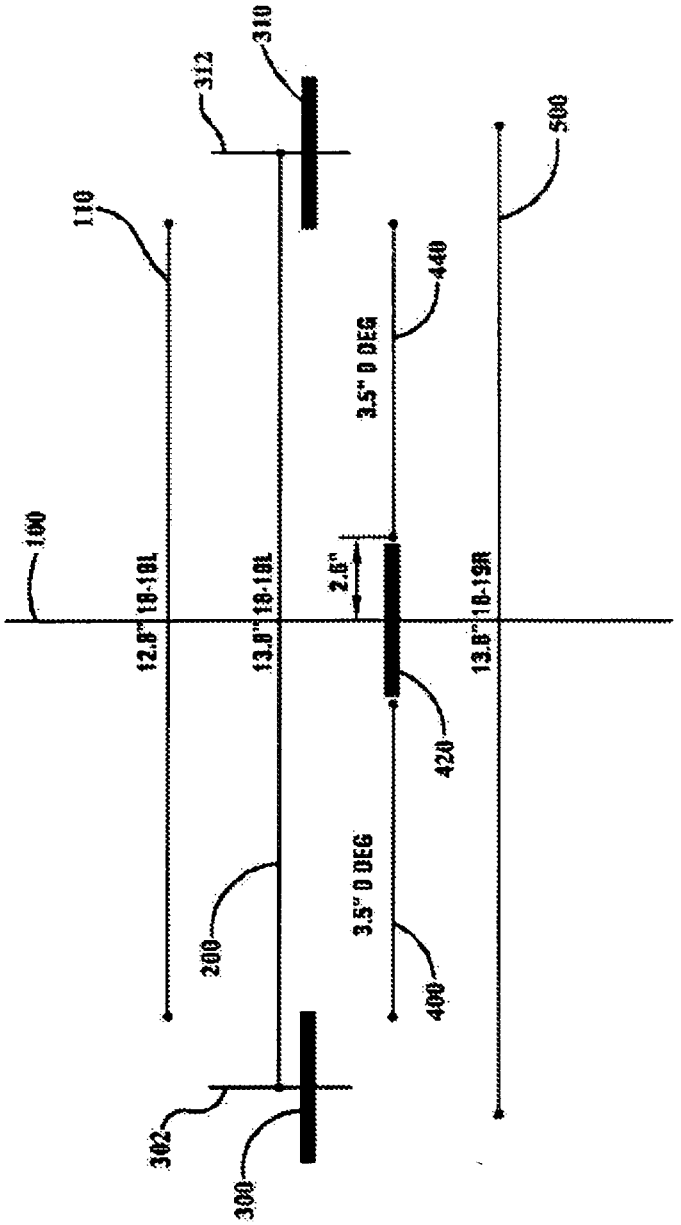
100
110
200
300
302
310
312
400
420
440
500
12.8"
13.8"
2.8"
13.8"
3.5" 0 DEG
3.5" 0 DEG
18-18L
18-18L
18-19R

FIG. 1