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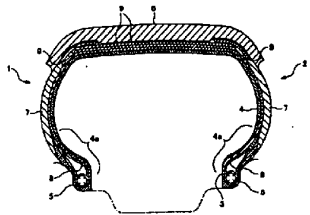
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(54) Title: TUBELESS TIRE

(54) 発明の名称: チュープレスタイヤ



(57) Abstract: A tubeless tire (1), comprising a pair of bead parts (5) for allowing the tire to be engaged with a wheel, an outer layer part (2) having a tread part (6) in contact with the ground, and an inner liner layer (3) formed of rubber stuck on the entire inner surface of the outer layer part (2), wherein an innermost layer (4) is provided on the inner surface of the inner liner layer (3), and the innermost layer (4) holds the air-tightness of the tubeless tire, comprises a stick part (4a) stuck on the inner liner layer (3) and a nonstick part (4b) not stuck on the inner liner layer (3), and can be deformed independently of the outer layer (2) and inner liner layer (3) at the nonstick part (4b).

(57) 要約:

ホイールに噛ませるための一対のビード部 (5) と、地面に接するトレッド部 (6) を有する外層部 (2) と、外層部 (2) の内面に全面接着されたゴムからなるインナーライナ層 (3) とを含むチュープレスタイヤ (1) において、インナーライナ層 (3) の内面には最内層 (4) を有し、最内層 (4) は、チュープレスタイヤの気密を保持するとともに、インナーライナ層 (3) に接着している接着部 (4 a) と、インナーライナ層 (3) に接着していない非接着部 (4 b) とを有し、非接着部 (4 b) において最外層 (2) およびインナーライナ層 (3) に対して独立に変形可能であるチュープレスタイヤ (1)。

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## TUBELESS TIRE

### BACKGROUND OF THE INVENTION

#### Field of the invention

The present invention relates to a structure of a tubeless tire, which can prevent the air inside the tire from leaking out, even if suffering from external injuries by harmful material such as a nail or the like during running of a vehicle.

#### Prior art

Today, as for a tire of vehicle, there is a tubeless tire widely used currently, for which there is not a tube utilized. The tubeless tire keeps airtight of a tire by making a rubber layer inside of the tire, so called an inner-liner layer.

When a foreign matter such as a long nail or the like stuck in this tubeless tire during running of a vehicle and penetrated the inner-liner layer, air in the tubeless tire has leaked through this penetration part, there might have been a event that running of a vehicle has become inability

For such an air leak, it is coped with by that seal materials included a tackiness rubber are put on the inside of the inner liner layer beforehand or that a rubber having viscoelasticity is stuck on the entire surface thereof. For example, when the seal materials are put on the inside of the inner liner layer in advance, the penetration portion will be filled up by self sealing action of seal materials and it can prevent a pneumatic large effluence in a tubeless tire.

However, in order to get the self sealing action of seal materials, it is necessary for seal materials to be put on the inside of the inner liner layer

thick so that a weight of the tubeless tire increases. And due to a load transformation of a tire in running, a temperature of the seal materials itself rises, so that there may be a trouble that the seal materials have fluidity. When the seal materials have fluidity, the seal materials come to change their shape in the tubeless tire by rotational oscillation  
 5 and a weight balance of the tubeless tire collapses, so that vibration of a vehicle is coming brought out.

The present invention has been made the forgoing problems to be solved. It is the primary object of the present invention to provide a tubeless tire, which can prevent abrupt air leak from the same, even if suffering from external injuries by  
 10 harmful material such as a nail or the like during running of a vehicle.

#### SUMMARY OF THE INVENTION

According to an aspect of the present invention there is provided a tubeless tire having:

- 15 a tread portion for contacting the ground,  
 a pair of beads for engaging the tire with the rims of a wheel, and  
 a pair of side walls each disposed between the tread portion and one of the beads,  
 the tread region and the two side walls having an outer layer, an intermediate  
 20 layer continuously adhered to the outer layer, and an innermost layer which is continuously adhered to the intermediate layer along at least a portion of each of the side walls and which is discretely adhered to the intermediate layer along the tread portion by way of adhesion lines or dots,



wherein, at the tread portion, the innermost layer can be deformed independently of the outer layer and intermediate layer.

Thus, by being continuously adhered to the intermediate layer along at least a portion of each of the side walls, the innermost layer does not slip on the intermediate layer. If a nail, or similar object, pierces the tubeless tire and penetrates the outer layer portion and the intermediate layer, the stress that the innermost layer receives from the nail is absorbed by deformation of the innermost layer, thus preventing the nail from penetrating the innermost layer. Accordingly, air is prevented from leaking from within the tubeless tire.

Preferably, the innermost layer has a plurality of folds. Accordingly, it can undergo greater deformation, and absorb higher stresses.

Preferably, the tubeless tire has an air gap formed between the innermost layer and the intermediate layer, in the portions in-between the adhesion lines or dots.

#### 15 BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a cross sectional view of a tubeless tire of this invention.

Fig.2 is a cross sectional view showing the state that a nail has stuck in a tubeless tire of this invention.

Fig.3 (a) and (b) is respectively one part of enlarged view showing the adhesion part of the most inner layer.

Fig.4 (a) is a cross sectional view of the tubeless tire which made a pleat or a fold for the most inner layer.

Fig.4 (b) is one part of enlarged view of folds.

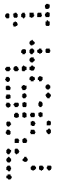


Fig.5 is a cross sectional view of a tubeless tire having a pneumatic layer between the most inner layer and the inner liner layer.

Fig.6 (a) is one part of enlarged view which shows the most inner layer that openings are formed.

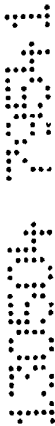
5 Fig.6 (b) is the cross sectional view showing the state that a nail has stuck in the tubeless tire used the most inner layer shown in Fig. 6 (a).

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

This invention will be described in further detail with reference to the accompanying drawings. Fig.1 is one part of a cross sectional view of a tubeless tire  
10 according to the present invention.

The tubeless tire 1 comprises: an outer layer portion 2; and an inner liner layer 3 (that is, an intermediate layer) including rubber or the like, which is stuck on the whole inside of the outer layer portion 2. Furthermore, there is a most inner liner layer 4 (that is, an innermost layer) provided in an inside of the inner liner layer 3.

15 The outer layer portion 2 comprises: a bead portion 5, which lets a wheel (as shown with broken line) engage it; a tread portion 6 to be grounding; and a sidewall portion 7, which is a region between the bead portion 5 and the tread portion 6. More further, there is provide a carcass 8 made from fibrous materials in each inside of the bead portion 5, the sidewall portion 7 and the tread portion 6 in order to maintain a form  
20 of the tubeless tire. Besides, there are a plurality of belts 9 inserted between the tread portion 6 and the carcass 8 in order to fix a stiffness of the tread portion 6. Still more, there is each of components of the outer layer portion 2 formed in one united body with glued all together by glue or vulcanization mold treatment.



The inner liner layer 3 is made from rubber, which has a role to prevent the tubeless tire 1 from leaking air injected inside thereof out and is stuck on the whole inside of the outer layer portion 2.

The most inner layer 4 is made from rubber and the like, and in each of parts 4a, 4a of the side walls (as shown in Fig. 1), there is a continuous adhesion part provided, through which the most inner layer 4 is glued on the inner liner layer 3 (as made in a body) by glue or vulcanization mold treatment. At this point, (in Fig. 1), there is non-adhesion part spread in region except for the adhesion part 4a. Therefore, the non-adhesion part of the most inner layer 4 can be transformed independently for the inner liner layer 3 and the outer layer 2.

The most inner layer 4 has a thickness of 0.3mm ~ 5mm prepared, and it is made from butyl type rubber, butyl type rubber combined with latex type rubber, styrene-butadiene rubber or natural rubber. In addition, as for a span or a width of the adhesion 4a of the tubeless tire 1, it is desirable for it to be around 10mm ~ 50mm from a bead portion 5.

Besides, in order to increase an anti-air permeability of the most inner layer 4, the resin having a elasticity such as Velaren (a registered trademark of The Yokohama Rubber Co., Ltd.) or the like may be mixed said the inner-most layer 4 with, or also the fiber such as polyester, polyamide, aramid and the like may be mixed with.

Still more, it is possible that the rubber layer may be laminated with a reinforcement layer made from a combination of said resin and/or said fiber. In addition, as for the direction where the fiber or the fiber layer is displayed, any of direction such as radial direction, lap direction or cross direction will do, and there may be a plurality of fiber layers provided, which are laminated one after another.

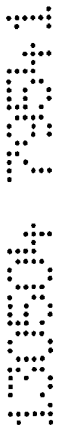
Subsequently, as for the condition when a foreign matter such as a nail or the like sticks in a tread portion 6 of the tubeless tire 1 and penetrates both the outer layer portion 2 and the inner liner layer 3 thereof, it will be described referring to Fig. 2.

As shown Fig. 2, a nail 10 penetrates both the outer layer portion 2 and the inner liner layer 3 but the nail 10 does not penetrate the innermost layer 4, because there is provided a non-adhesion part 4b (containing discrete adhesions; see figures 3(a) and (b)) of the most inner layer 4 is transformed (that is, it is deformed) not only independently of the outer layer portion 2 and the inner liner layer 3, but also such that the stress received from the nail 10 is absorbed. Therefore, air inside the tubeless tire 1 does not leak out.

The most inner layer 4 is also adhered to the inner liner layer 3 discretely along the tread portion 6. As shown in Fig. 3 (a) and (b), the discrete adhesion may be either liner adhesion parts 11 (lines) or dot like adhesion part 12 (dots). Consequently, as for such an adhesion part 11 or 12, either dot like or liner adhesion thereof does not prevent the most inner layer 4 from transforming and prevent the same from slipping out of predetermined position of the inner liner layer 3 as well.

Besides, a region except for the adhesion parts 11 and 12, which is shown in Fig. 3 (a) and (b), is all non-adhesion part.

Further, as for each line or each point of those adhesion parts 11 or 12, it is desirable for the interval thereof to be 10mm ~ 150mm because in case that the interval is smaller than 10mm, the most inner layer 4 cannot be transformed fully enough to absorb stress to be received from the nail. Where the intervals are bigger than 150mm, the discrete adhesion parts 11 and 12 are too far apart to be advantageous.



Furthermore, to show in Fig. 4 (a) and (b), there can be formed a plurality of folds 15 in the most inner layer 14. In addition to the expansion of the most inner layer 14 itself, by the transform of the folds 15, it becomes possible for bigger stress to be absorbed.

5 Moreover, in Fig. 4 (a) and (b), as for a part except the folds 15 of the most inner layer 14, it is possible for it to be glued to the inner liner layer 3 through the adhesion part 4a (shown in Fig.1), the liner adhesion part 11 (shown in Fig. 3 (a)) or the dot or point like adhesion part 12 (shown in Fig. 3 (b)).

Besides, there may be the folds 15 formed, each wave of which is  
 10 formed or established at equal spaces as shown in Fig.4 (b) and it may be established in succession not to open an interval. And as for height of the fold 15, it is desirable for it to be 5mm ~ 50mm. When it is lower than 5mm, effect of transformation of a fold is not provided, and when it is higher than 50mm, it causes the tubeless tire 1 to vibrate or oscillate and leads to vibration of a vehicle.

15 Furthermore, as for a direction of the folds 15, according to the present invention, it is established in the perpendicular direction to rotatory direction of the tubeless tire 1 as shown in Fig. 4 (a), but it can be arranged in arbitrary direction, i.e., parallel or the like to the rotatory direction.

And, in Fig. 4 (a), the fold 15 is made for inside of the most inner layer  
 20 14; however, it may be established in outside of the most inner layer 14. In this case, it is desirable that there is a part provided, at which a pointed head of the fold 15 is contacted to the inner liner layer 3, and in which, the fold 15 and the inner liner layer 3 are glued together through the liner adhesion part 11 or the dot like adhesion part 12 formed there.



In the embodiment shown in Fig. 5, there is the most inner layer 4 of the tubeless tire 1 provided, which non-adhesion part 4c thereof is left only a being fixed distance from the inner liner layer 3 and there is a pneumatic layer 16 (that is, an air gap) between formed. Hereupon, the pneumatic layer 16 has a role to prevent a tensile stress from concentrating on the same part of non-adhesion part 4c to be transformed by nails stuck in the tubeless tire as the non-adhesion part 4b shown in Fig. 2.

As for the non-adhesion part 4b shown in Fig. 2, by difference in pressure between an inside of the tubeless tire 1 and a space formed between the inner liner layer 3 and the non-adhesion part 4b of the most



inner layer 4, there is the stress loaded with, which is going to make the space small. Particularly, the tensile stress has concentrated on the point part of the non-adhesion part 4b transformed by the nail 10.

Accordingly, if there is a pneumatic layer 16 as shown in Fig. 5 provided, an inner pressure of which is substantially equal to the inner pressure of the tubeless tire, it is easy to come to prevent a nail from penetrating in the most inner layer 4 more because a stress that is loaded the most inner layer 4c with can be reduced.

Such pneumatic layer 16 is formed as follows.

First, the non-adhesion part 4c of the most inner layer 4 corresponding to the tread portion 6 is let be separated only fixed distance from the inner liner layer 3.

Subsequently, there is glued the adhesion part 4a on the inner liner layer 3 by vulcanization mold treatment, while air is introduced into the space that appears by the separating.

Further, the most inner layer 4 could hold a change by a heat of the most inner layer 4 in check, when aramid fiber to have a little transformation by a heat is glued thereto. Because the most inner layer 4 glued aramid fiber on has scarcely any transformation by a heat, in comparison that the outer layer portion 2 and inner liner layer 3 are transformed as expanding out by a heat at the time of vulcanization mold treatment, there can be the pneumatic layer 16 provided at the time of vulcanization mold treatment. At this point, it is preferable for aramid fiber to be glued in outside of the most inner layer 4 but it may be glued in inside thereof.

Moreover, there may be formed a plurality of project portions in

the pneumatic layer 16 side of the most inner layer 4, which are stuck on the inner liner layer 3, so that the gap with the most inner layer 4 and the inner liner layer 3 can be prevented from occurring.

As shown in Fig. 6 (a) and (b), as for the tubeless tire of this  
 5 embodiment, there are formed a plurality of openings 25 stood in line at regular interval in the most inner layer 24 thereof.

When a nail 10 is stuck in the tubeless tire 1, a non-adhesion part 24b of  
 a most inner layer 24 is transformed, and there is a space 26 produced, since air in  
 tubeless tire 1 flows in the space 26 through the opening 25, difference in pressure  
 10 between the space 26 and an inside of the tubeless tire 1 becomes smaller, so that  
 tensile stress loaded the non-adhesion part 24b with can be reduced. Accordingly, the  
 nail 10 can be prevented from penetrating the most inner layer 24.

Hereupon, as for the openings 25, it is desirable for a diameter of a hole  
 thereof to be around 1mm ~ 2mm and for each distance of regular interval thereof to be  
 15 10mm ~ 50mm in order to prevent the nails that stick in the tubeless tire and penetrate  
 the inner liner layer 3 from meeting with the position where the hole of the openings 25  
 is formed.

In addition, it may be possible that a part of the most inner layer 24  
 where the openings 25 are not formed is glued on the inner liner layer 3 with the liner or  
 20 the dot like adhesion to show in Fig. 3. Moreover, the fold



(as shown in Fig.4) can be provided on the most inner layer 24.

This invention is not limited to each of embodiments and can be changed and applied in many ways.

For example, it is established so that the most inner layer 14 to have the fold 15 may form the pneumatic layer and it is possible that above each form is combined each other and adopted.

And the most inner layer 4, 14, 24 are shown to cover the all inside of the inner liner layer 3, but may be formed only to cover a part corresponded to the tread portion 6.

#### Availability of application of industrial field

According to the present invention, there is the most inner layer formed in inside of the inner liner layer provided, which maintains the airtight of the tubeless tire and is constructed that in the non-adhesion part thereof, it is possible to transform its shape independently for the outer layer portion and the inner liner layer, so that the stress loaded the most inner layer with by the nails can be absorbed in the non-adhesion part of the most inner layer. Therefore, the nails can be prevented from penetrating the most inner layer, and air in the tubeless tire can be prevented from leaking out.

Further, as to the gap of the most inner layer and the inner liner layer, it can be prevented from occurring in running of the tubeless tire, owing to the adhesion part provided, in which the most inner layer is stuck on the inner liner layer. Accordingly, unnecessary vibration dose not occur with the tubeless tire.

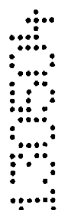
Furthermore, even if the big stress is added to the most inner layer, it can be absorbed in a fold established in the most inner layer.

Therefore, the nails can be prevented from penetrating the most inner layer.

Still more, due to the pneumatic layer formed between the non-adhesion part of the most inner layer and the inner liner layer, and the openings formed at regular interval in the non-adhesion part of the most inner layer, it is possible that the all stress loaded the most inner layer with reduced at the time when the most inner layer is transformed. Accordingly, the nails are prevented from penetrating the most inner layer.

## THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A tubeless tire having:
- a tread portion for contacting the ground,
- 5 a pair of beads for engaging the tire with the rims of a wheel, and
- a pair of side walls each disposed between the tread portion and one of the beads,
- the tread region and the two side walls having an outer layer, an intermediate layer continuously adhered to the outer layer, and an innermost layer which is
- 10 continuously adhered to the intermediate layer along at least a portion of each of the side walls and which is discretely adhered to the intermediate layer along the tread portion by way of adhesion lines or dots,
- wherein, at the tread portion, the innermost layer can be deformed independently of the outer layer and intermediate layer.
- 15
2. A tubeless tire as claimed in claim 1, wherein the discrete adhesion of the innermost layer to the intermediate layer is in the form of at least one circumferential line of adhesion.
- 20 3. A tubeless tire as claimed in claim 1, wherein the discrete adhesion of the innermost layer to the intermediate layer is in the form of a plurality of spaced adhesion dots.



4. A tubeless tire as claimed in any one of the preceding claims, wherein the innermost layer has a plurality of folds.

5. A tubeless tire as claimed in any one of the preceding claims, wherein at least one air gap is formed between the intermediate layer and the innermost layer in the portions in-between the adhesion lines or dots.

6. A tubeless tire as claimed in any one of claims 1 to 4, wherein the innermost layer has a plurality of openings along the tread portion.

10

7. A tubeless tire substantially as herein described with reference to the accompanying drawings.

Dated this 12th day of May 2004

15 Honda Giken Kogyo Kabushiki

By their Patent Attorneys

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Fellows Institute of Patent and

Trade Mark Attorneys of Australia



FIG. 1

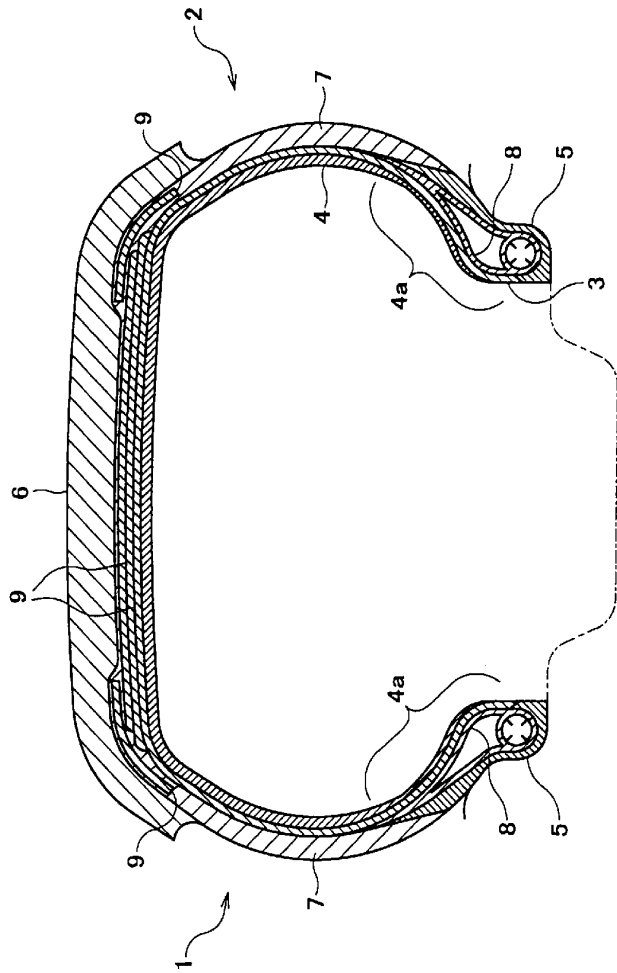


FIG.2

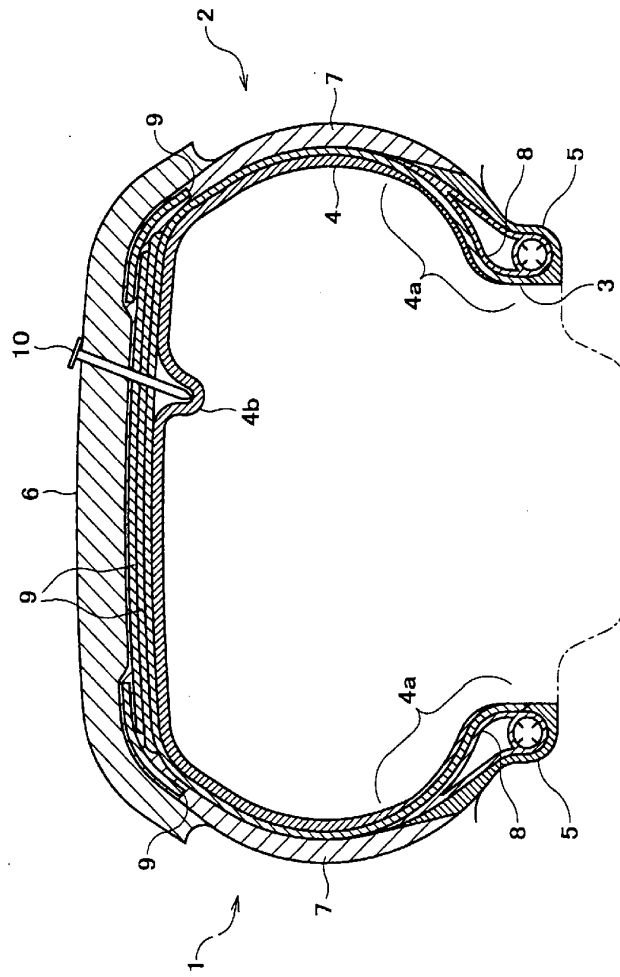
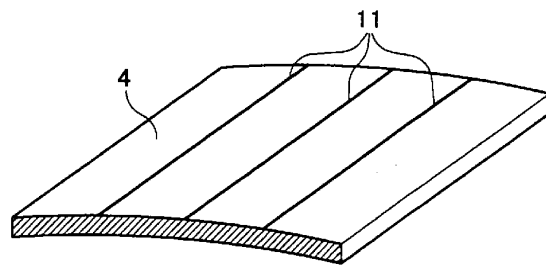


FIG. 3

(a)



(b)

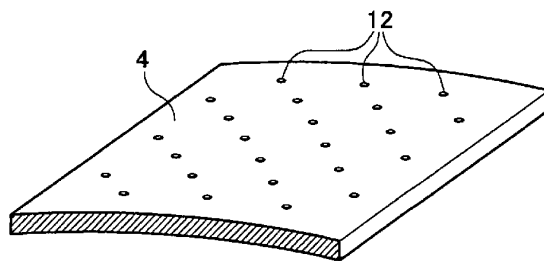


FIG. 4

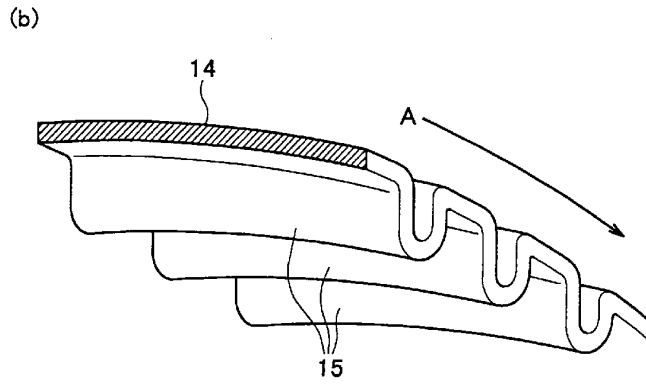
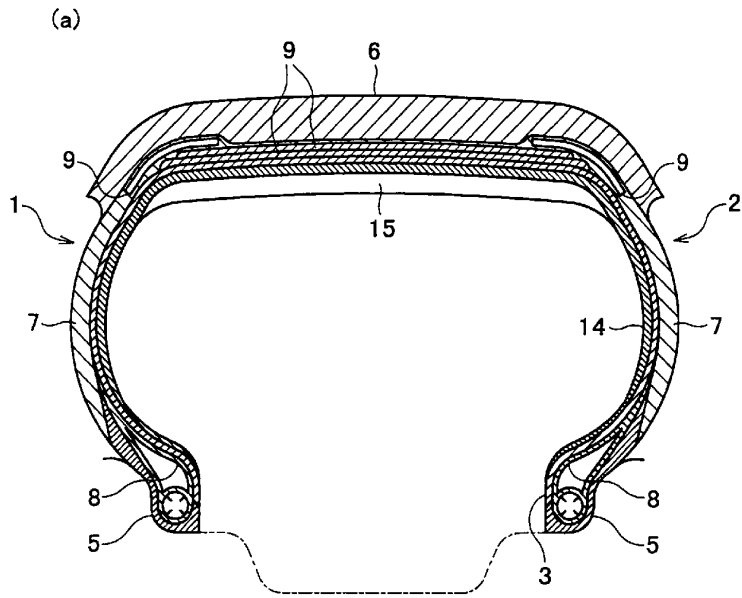


FIG.5

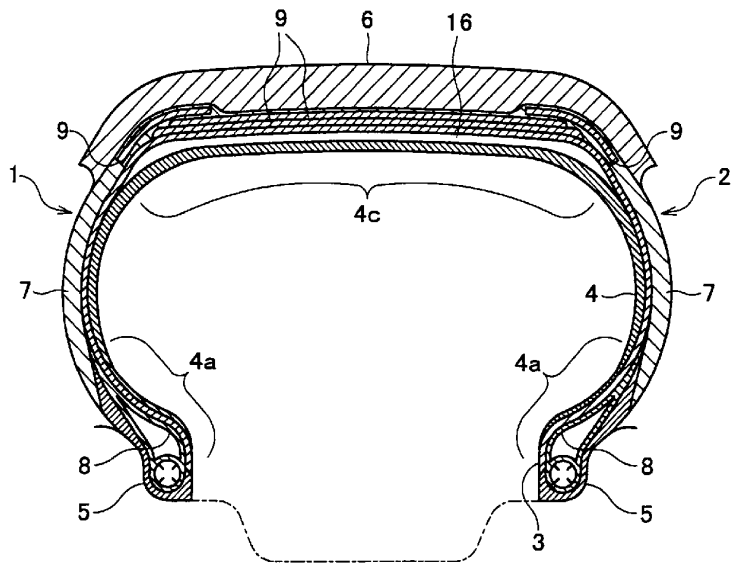


FIG. 6

