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Wheel with rim having seats inclined towards the outside

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(56) Related Art
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AU 56534/94
US 3977727

ABSTRACT OF THE DISCLOSURE

A wheel, formed of a rim (1) having a first rim seat (13') and a second rim seat (13"), at least the first rim seat (13') having a generatrix which is applied towards the outside and extended axially towards the inside by a bearing surface (11) intended to receive a tread support ring, and of a wheel disk (2), said rim bearing surface (11) being provided, radially to the outside, with elements in relief (31) separated by recesses or hollows (30). On the major part of the entire surface of the radially inner wall of the wheel rim (1), each point of a generatrix (10) of said wall, included between the point of tangency A of said generatrix with the corresponding axially inner generatrix (20) of the disk and the end B axially located on the side of the second wheel seat (13") is on a circle of diameter D_P which is at least equal to the diameter D_A of the circle on which said point of tangency A is located and at most equal to the diameter D_B of the circle on which said end B is located.

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ORIGINAL
COMPLETE SPECIFICATION
STANDARD PATENT

Application Number:

Lodged:

Invention Title: WHEEL WITH RIM HAVING SEATS INCLINED TOWARDS THE OUTSIDE

The following statement is a full description of this invention, including the best method of performing it known to us :-

BACKGROUND OF THE INVENTION

The present invention relates to a wheel which is formed of a wheel disk and of a monobloc mounting rim for a tire, preferably a tire which has a radial carcass reinforcement and is capable of possibly forming, with a tread supporting ring in said tire, a rolling assembly which may be useful in the event of travel when the inflation pressure drops abnormally as compared with the normal pressure of use, known as the nominal service pressure, which pressure may even be zero.

The main difficulties encountered in the case of traveling on a flat tire or a tire with low pressure concern the risk of separation of the bead of the tire and, in

particular, separation of the bead located on the outer side of the tire mounted on the outer side of the vehicle. The well-known techniques proposed for avoiding such separations, and in particular the one consisting of arranging a protrusion or hump of small height axially to the interior of the rim outer seat, do not appear to give full satisfaction and tend to increase the difficulties in the mounting and dismounting of the tires.

French Application No. 2 699 121 describes, by way of example, a monobloc wheel rim 1 shown in Fig. 1 for the effective solution of the above problem. Said rim 1 is limited axially by two rim edges spaced axially apart by the width S of the rim. Said rim 1 comprises, as viewed in meridian section:

- a first rim seat 13' having a generatrix the axially outer end of which is on a circle of a diameter less than the diameter of the circle on which the axially inner end is located (the seat is then said to be inclined towards the outside) and limited axially to the outside by a protrusion or hump 15' of slight height;

- a second rim seat 13" having a generatrix the axially inner end of which is, on the one hand, on a circle of a diameter at least equal to the diameter of the circle on which the axially inner end of the generatrix of the first rim seat is located (and in the case shown in Fig. 1 of said application, on a circle of a diameter equal to that on which the axially inner end is located) and, on the other hand, on a circle of a diameter greater than the diameter of the circle on which its axially outer end is located, said second generatrix being extended axially to the outside by a hump 15" and axially to the inside by a rim flange 14.

In accordance with the respective differences in diameter of the circles on which the axially inner ends of the two rim seats are located, said rim may or may not be provided with a mounting groove 12, preferably located axially close to the second rim seat 13".

Said rim 1 is intended to be used advantageously with a tread support (not shown), a resilient support which can be removed and placed on a rim bearing surface 11, the generatrix of which may be linear or not and, if linear, parallel or not to the axis of rotation, a positioning stop 16 located between said bearing surface 11 and the mounting groove 12 permitting the axial positioning of the support in collaboration with one of the beads of the tire.

The depth of the mounting groove as well as the operating constraints which are not to be exceeded make necessary, in case the wheel is made of steel and the desired radially outer profile being given, axially variable thicknesses of metal and thus a radially inner meridian profile such as that shown in Fig. 1. It follows from an examination of said figure, and this in practically all possible mountings of tires on rims of this type, that the space radially available below the mounting groove 12 is greatly reduced as compared with the space radially below the bearing surface 11.

The fact that the mounting groove is situated axially closer to one edge of the rim than to the middle of the surface entails the risk of leading to the accumulation, below the corresponding portion of the bearing surface, of all sorts of materials, such as mud mixed to a greater or lesser extent with particles, such as snow or ice under winter conditions, which materials are difficult to remove. Furthermore, the constant desire for

less weight of the rim leads to the use of a material of low density for its manufacture. This use permits production in the form of a wheel, rim 1 and disk being then molded together at the same time but, on the other hand, results in serious modifications of the radially inner and outer meridian profiles, respectively, so as to correctly stabilize said wheel, in view of the severe conditions imposed by travel under zero or low pressure.

SUMMARY OF THE INVENTION

In order to make it possible to obtain optimal lightness and at least partly remedy the above drawbacks, the invention provides a wheel including a rim and a wheel disk, said rim having a first rim seat and a second rim seat on axially opposing sides of the rim, at least the first rim seat having a generatrix an axially outer end of which is on a circle of a diameter less than the diameter of a circle on which an axially inner end is located, said first rim seat being extended outwardly in an axial direction by a hump of small height and inwardly in an axial direction by a bearing surface adapted to receive a tread support ring, said wheel disk being connected on the same side of the rim as the first rim seat to a radially inner wall of the rim, said wheel characterized in that the bearing surface includes, facing radially outward, elements in relief which are separated by hollows.

A definition of the word "generatrix" as used in this specification, including the appended claims, is given later in this specification.

Preferably, the wheel is further characterized in that a major part of the radially inner wall of the rim lies axially on the same side of the wheel disk as the second rim seat, in that a generatrix of said major part has ends A and B of which A is a point of tangency of that generatrix with a generatrix of an axially inner wall of the wheel disk, and in that each point on said generatrix of said major part between A and B is on a circle of diameter D_P at least equal to the diameter D_A of a circle on which the point A is located and at most equal to the

AUSTRALIAN PATENT OFFICE

diameter D_B of a circle on which the end B is located.

Preferably, the said major part of the radially inner wall of the rim has an area in the range 70% to 100% of the area of the entire surface of said radially inner wall.

The diameter D_P may increase continuously with increasing axial distance between the points A and B over the axial distance between A and B.

Advantageously, the wheel may be made of one or more materials of low density, such as the metals aluminium and magnesium alloys of said metals or such as thermoplastic or thermosetting materials, filled or unfilled.

By "hump of small height" above, there is to be understood a hump the height of which is preferably at most equal to 2.5% of the nominal diameter of the mounting rim, which is the diameter of the circle on which the axially inner end of the first rim seat is located.

If one calls the recessed ratio of the bearing surface, which is preferably cylindrical, the ratio of the surface occupied by the recesses or hollows to the total surface area of the radially outer face of the bearing surface, the said recessed ratio is preferably between 0.4 and 0.9.

The said elements in relief may include at least two circumferential ribs and transverse or quasi-transverse ribs attached to the circumferential ribs and defining said hollows between said transverse or quasi-transverse and circumferential ribs. The hollows so defined may be of various shapes and may be of unequal sizes.

The transverse ribs may be pierced by holes, thereby to equalize pressure amongst said hollows.

AUSTRALIAN PATENT OFFICE

The transverse ribs may be continuous or discontinuous, having branches separated by one or more openings in said transverse ribs, thereby to equalize pressure amongst said hollows.

The transverse ribs, continuous or discontinuous, may in particular have, on the radially outer face of the bearing surface, surfaces of different shape, defined by transverse sides of different configurations – linear, curved, broken line, parallel or not, etc. For simplicity in the manufacture of the wheel, the said sides will preferably be linear so as to confer on the hollows a quadrilateral shape which may be rectangular, square, trapezoidal, lozenge-shaped or the like. Preferably, the linear sides of said transverse ribs form an angle of at least 45° with a circumferential direction, whatever the geometrical shape of the hollows.

The hollows delimited by the circumferential ribs and the transverse ribs advantageously may be of unequal volume. In particular, the transverse or quasi-transverse ribs can be arranged circumferentially in accordance with variable pitches.

In an alternative arrangement within the scope of the invention, the said elements in relief include at least two circumferential ribs located axially at the sides of the bearing surface and blocks of rigid material. Such blocks may be non-equidistant from each other. The said blocks may be of frusto-conical form, which may be of different sizes, with radially outer faces of said blocks forming part of an outer face of the bearing surface.

The wheel in accordance with the invention preferably includes, as described in French application 2 699 121, a mounting groove located on the rim axially towards the second rim seat. The said mounting groove is preferably connected to a said hollow by a channel, thus permitting free passage of the inflation gas and the easier dismounting of the assembly consisting of the tyre

AUSTRALIAN PATENT OFFICE

and the wheel support ring. The said hollow connected to the mounting groove may be in communication with a passage orifice of an inflation valve, for example if the passage orifice is connected to the same hollow as the mounting groove.

The wheel may be characterized in that the second rim seat has a generatrix an axially inner end of which is on a circle whose diameter firstly is equal to the diameter of the circle on which the axially inner end of the generatrix of the first rim seat is located and secondly is greater than the diameter of a circle on which an axially outer end of said second rim seat is located, said second rim seat being extended outwardly in an axial direction by a hump and inwardly in an axial direction by a rim flange.

However, the wheel may be characterized in that the second rim seat has a generatrix an axially inner end of which is on a circle whose diameter firstly is greater than the diameter of the circle on which the axially inner end of the generatrix of the first rim seat is located and secondly is greater than the diameter of a circle on which an axially outer end of said second rim seat is located, said second rim seat being extended outwardly in an axial direction by a hump and inwardly in an axial direction by a frustoconical surface connecting the second rim seat and the bearing surface, and characterized in that the radially inner wall of the rim has a frustoconical surface between axial positions corresponding to said points A and B.

As to the radially inner face of the rim, it is preferably uniform, but it may also, for example, have transverse ribs and grooves. The greatest part of said face will preferably be uniform, the balance being formed of at least one transverse rib the generatrix of which radially furthest to the inside possibly having points located on circles of diameters greater than the diameter of the circle on which the point of tangency of the generatrix with the generatrix of the disk is located. If there are several transverse ribs having bases anchored in the radially inner face of the rim, the base should occupy an area at most equal to

AUSTRALIAN PATENT OFFICE

30% of the total surface of the radially inner wall, and said ribs are circumferentially uniformly spaced apart and used as reinforcement ribs in order to avoid defects produced by possible concentration of stress produced by the shapes of certain rims.

The following is a definition of the word "generatrix" as used in this specification including the claims. A generatrix of a surface or revolution having an axis of symmetry is a line or curve lying in a plane containing the axis, which, when said plane is rotated about the said axis, sweeps out the said surface. Accordingly, a part of a boundary of a body of revolution, seen in a meridional cross section of the body, is a generatrix of a corresponding part of the body's surface. Everywhere the word "generatrix" is used in this specification, the relevant axis of symmetry is the axis of revolution of the wheel.

The invention will be better understood from the drawings and accompanying the description which follows, illustrating non-limitative embodiments of a wheel intended for the mounting of a 185/60-14 tire.

DESCRIPTION OF THE DRAWINGS

Fig.1 is a diagrammatic meridian view of a wheel, such as described in said French application;

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Fig. 2 is a diagrammatic meridian view of a wheel in accordance with the invention;

Fig. 3 is a top view of the rim of Fig. 2;

Fig. 4 is a variant, seen from above, of the rim in accordance with the invention;

Fig. 5 is another variant wheel, seen in meridian section;

Fig. 6 shows, in meridian section, the wheel of Fig. 5, the radially inner face of which has four transverse ribs.

DESCRIPTION OF PREFERRED EMBODIMENTS

The wheel rim 1 shown in Fig. 2 has, to a large part, the characteristics of the rim 1 shown in Fig. 1, that is to say a rim with two rim seats 13' and 13" of equal diameter, the generatrices of which are inclined towards the outside, said rim seats being extended axially to the outside by humps 15' and 15" of a height of 6 mm, which represents about 0.017 times the nominal diameter D_J of the rim 1, which is the common diameter of the axially inner ends of the two rim seats 13' and 13". The first rim seat 13' is extended axially towards the inside by a bearing surface 11, itself provided at its other end with a positioning stop 16 for the support ring intended to be mounted on said bearing surface 11. The second rim seat 13" is extended axially towards the inside by a rim flange 14 which, together with the positioning stop 16, defines a mounting groove 12.

In accordance with the invention, the bearing surface 11 is provided with recesses 30 of triangular shape (Fig. 3), said recesses being defined axially by

circumferential ribs 32 of the bearing surface 11 and circumferentially by the transverse ribs 31, having, on the radially outer face of the bearing surface 11, linear sides 310 which are parallel to each other and which form an angle α of 45° with the circumferential direction. If we call S_E the surface occupied by the recesses and S_T the total cylindrical surface of the bearing surface 11, S_T being equal to πDL, D and L being the diameter and axial width respectively of said radially outer face of the bearing surface 11, then the recessed ratio, defined as the ratio S_E/S_T, is equal to 0.6. The width l, common in the example described to all the transverse ribs 31 and measured perpendicular to the common direction of the two sides 310 of the surface occupied by a rib 31, is between 3 mm and 7 mm. All the edges defining the elements in relief on the radially upper face of the bearing surface are advantageously beveled so as to facilitate the mounting of the support ring for the tread of the tire intended to be mounted on the rim.

As shown in Fig. 2, the valve passage 34 extends into one of the recesses 30 of the bearing surface 11, said recess being connected to the mounting groove 12 by a channel 33 of small dimensions permitting the passage of the inflation gas. This connection 33 between recess 30 and groove 12 facilitates the removal of the mounted assembly; in fact, without said connection, the vacuum produced by the deflation creates a close contact between the support ring and the ribs defining the recesses, resulting in difficulties in dismounting the rim and the assembly.

As to the generatrix 10 of the radially inner wall of the rim 1, it is tangent at A to the axially and radially inner wall of the wheel disk 2. In accordance with the

AUSTRALIAN PATENT OFFICE

invention, each point of said generatrix 10, like each point of every generatrix of said wall, integrally uniform in the case shown, located between the point A of tangency and its end B on the side of the second rim seat 13", is on a circle of diameter D_P at least equal to the diameter D_A of the circle on which the point of tangency A is located and at most equal to the diameter D_B of the circle on which the end B is located, the passage from the diameter D_A to the diameter D_B, greater than D_A, of the circle on which there is located the point B, taking place continuously over the greater part of the axial distance between the point of tangency A and the end B, as shown in Fig. 2. This avoids the mass buildup of foreign substances on the wheel and makes the removal of said bodies towards the outside possible. The complete removal of such material is all the easier due to the fact that the diameter of the radially inner wall 10 increases continuously, proceeding axially from the circle on which the point A is located to the circle comprising the point B, as shown in Fig. 5.

The wheel rim shown in Fig. 4 differs from the rim of Figs. 2 and 3 mainly by the fact that the transverse ribs are replaced by blocks 31 of aluminum or other rigid material in the form of conical frustrums. In the example shown, the said conical frustrums 31 are of the same volume, but they may be of different volumes, due to the fact that the surfaces of their bases may be of different dimensions, the only constraint to which the blocks 31 are subject residing in the fact that all the radially upper bases of said blocks are merged with the radially upper face of the bearing surface 11.

The wheel rim shown in Fig. 5 differs from the rim of Fig. 2 mainly by the fact that the second rim seat 13" has a diameter greater than the diameter of the first

bearing surface 13', the diameter of a rim seat being by definition the diameter of the axially inner end of this generatrix, which makes it possible to eliminate the mounting groove 12 and replace it by a frustoconical connecting surface 36 between the second rim seat 13" and the bearing surface 11. The generatrix 10 of the radially inner wall of the rim 1 is thus imparted a uniform frustoconical meridian profile from the point of tangency A between said profile and the inner wall of the disk 2 to its end B, the diameter of the wall 10 increasing continuously in monotonic fashion from A to B. Each transverse rib 31 is provided at its center with a groove 311 which permits the flow of inflation gas between hollows.

Fig. 6 shows, seen in meridian section, a variant wheel rim such as shown in Fig. 5, but having, on its radially inner face 10, four ribs 35 which are circumferentially equidistant from each other and have on their axially outside edges bulges 350, such that a radially inner generatrix 351 of a rib 35 has, on the edge of the rib, points spaced from the axis of rotation of the rolling assembly by an amount less than the distance separating said axis from the point A of tangency with the generatrix 20 of the axially and radially inner wall of the disk 2.

The wheel, shown in one of Figs. 2 to 6, makes it possible furthermore, for the same size of tire, to increase the volume of inflation gas, which has the advantage of decreasing the speed with which the tire, mounted on such a wheel, loses its pressure by diffusion.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A wheel including a rim and a wheel disk, said rim having a first rim seat and a second rim seat on axially opposing sides of the rim, at least the first rim seat having a generatrix an axially outer end of which is on a circle of a diameter less than the diameter of a circle on which an axially inner end is located, said first rim seat being extended outwardly in an axial direction by a hump of small height and inwardly in an axial direction by a bearing surface adapted to receive a tread support ring, said wheel disk being connected on the same side of the rim as the first rim seat to a radially inner wall of the rim, said wheel characterized in that the bearing surface includes, facing radially outward, elements in relief which are separated by hollows.

2. A wheel according to claim 1 characterized in that a major part of the radially inner wall of the rim lies axially on the same side of the wheel disk as the second rim seat, in that a generatrix of said major part has ends A and B of which A is a point of tangency of that generatrix with a generatrix of an axially inner wall of the wheel disk, and in that each point on said generatrix of said major part between A and B is on a circle of diameter D_P at least equal to the diameter D_A of a circle on which the point A is located and at most equal to the diameter D_B of a circle on which the end B is located.

3. A wheel according to claim 2 characterized in that said major part of the radially inner wall of the rim has an area in the range 70% to 100% of the area of the entire surface of said radially inner wall.

4. A wheel according to claim 2 or 3 characterized in that the diameter D_P increases continuously with increasing axial distance between the points A and B over the axial distance between A and B.

AUSTRALIAN PATENT OFFICE

5. A wheel according to any one of claims 1 to 4 characterized in that the wheel is made of one or more materials of low density, such as the metals aluminium and magnesium alloys of said metals or such as thermoplastic or thermosetting materials, filled or unfilled.

6. A wheel according to any one of claims 1 to 5 characterized in that the recessed ratio of said bearing surface, defined as the ratio of the surface area S_E occupied by said hollows to the total area S_T of the bearing surface, is between 0.4 and 0.9.

7. A wheel according to any one of claims 1 to 6 characterized in that said elements in relief include circumferential ribs and transverse ribs attached to the circumferential ribs and defining said hollows between said transverse and circumferential ribs.

8. A wheel according to claim 7 characterized in that a said hollow is of unequal size to another of said hollows.

9. A wheel according to claim 7 or 8 characterized in that said transverse ribs are discontinuous, having branches separated by one or more openings in said transverse ribs, thereby to equalize pressure amongst said hollows.

10. A wheel according to claim 7 or 8 characterized in that said transverse ribs are pierced by holes, thereby to equalize pressure amongst said hollows.

11. A wheel according to any one of claims 7 to 10 characterized in that radially outer surfaces of said transverse ribs are on a radially outer face of the bearing surface, and in that said radially outer surfaces are defined by linear sides of said transverse ribs forming an angle of at least 45° with a circumferential direction.

AUSTRALIAN PATENT OFFICE

12. A wheel according to any one of claims 1 to 6 characterized in that said elements in relief include at least two circumferential ribs located axially at the sides of the bearing surface and blocks of rigid material.

13. A wheel according to claim 12 characterized in that said blocks are of frusto-conical form and in that radially outer faces of said blocks define a radially outer face of the bearing surface.

14. A wheel according to claim 12 or 13 characterized in that a said block is of different volume from another said block.

15. A wheel according to any one of claims 1 to 14 including a mounting groove located on the rim axially towards the second rim seat, said mounting groove being connected to a said hollow by a channel.

16. A wheel according to claim 15 characterized in that the said hollow connected to the mounting groove is in communication with a passage orifice of an inflation valve.

17. A wheel according to any one of claims 1 to 16 characterized in that the second rim seat has a generatrix an axially inner end of which is on a circle whose diameter firstly is equal to the diameter of the circle on which the axially inner end of the generatrix of the first rim seat is located and secondly is greater than the diameter of a circle on which an axially outer end of said second rim seat is located, said second rim seat being extended outwardly in an axial direction by a hump and inwardly in an axial direction by a rim flange.

18. A wheel according to claim 2 characterized in that the second rim seat has a generatrix an axially inner end of which is on a circle whose diameter firstly is greater than the diameter of the circle on which the axially inner end of the generatrix of the first rim seat is located and secondly is greater than the diameter of a circle on which an axially outer end of said second rim seat is

AUSTRALIAN PATENT OFFICE

located, said second rim seat being extended outwardly in an axial direction by a hump and inwardly in an axial direction by a frustoconical surface connecting the second rim seat and the bearing surface, and characterized in that the radially inner wall of the rim has a frustoconical surface between axial positions corresponding to said points A and B.

19. A wheel according to claim 2 including on the radially inner wall of the rim four ribs which are circumferentially equidistant from each other, and which on their axially outer ends have bulges directed radially inward, so that points on radially inner edges of said bulges are at radii from an axis of rotation of the wheel which are less than the radius of the said point A.

20. A wheel substantially as herein described with reference to Figures 2 and 3.

21. A wheel substantially as herein described with reference to Figure 4.

22. A wheel substantially as herein described with reference to Figure 5.

23. A wheel substantially as herein described with reference to Figure 6.

DATED this 28th day of January, 2000

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SKP:DHS:MXM P3089AU00

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13 05 97 20801

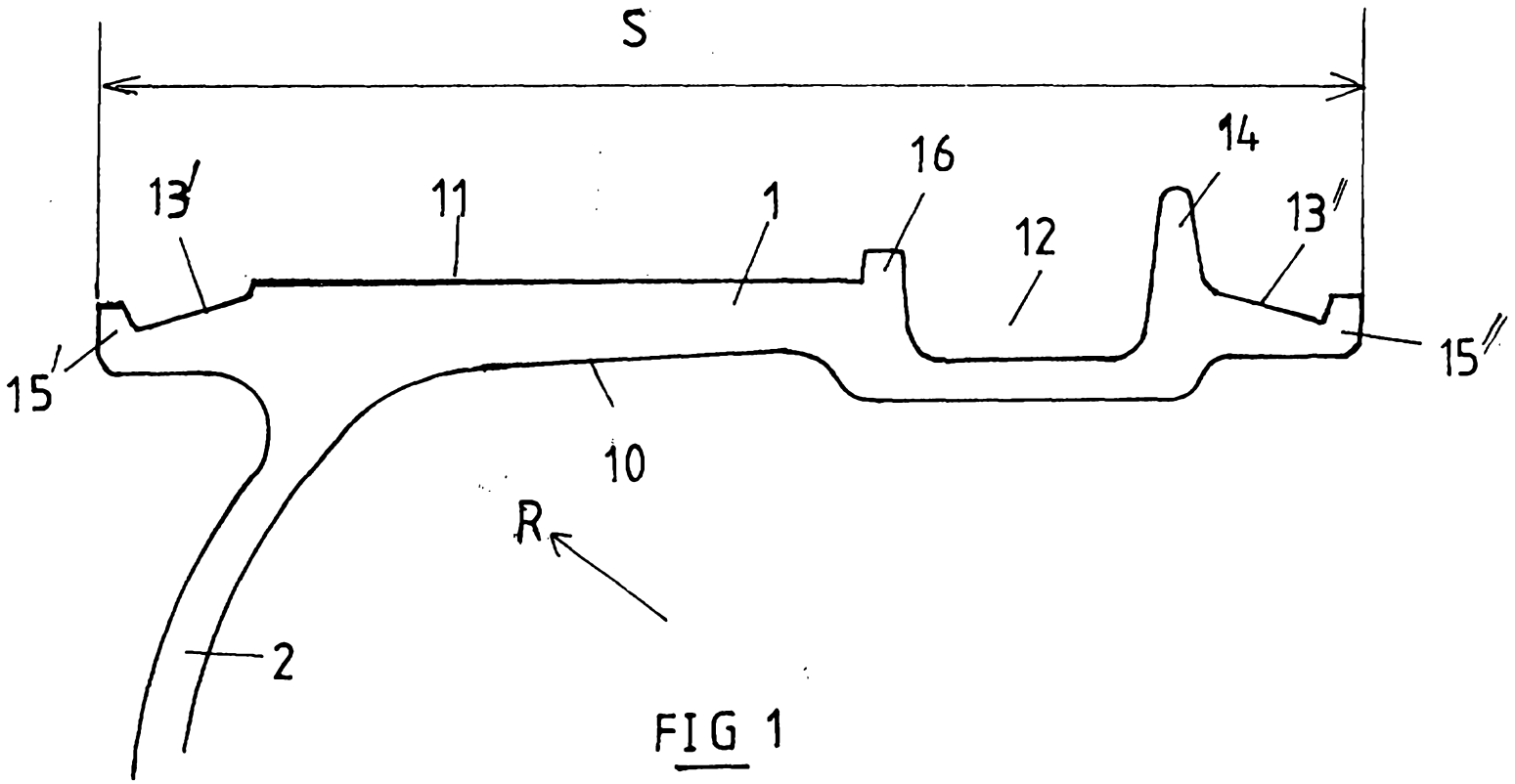


FIG 1

13 05 97 20801

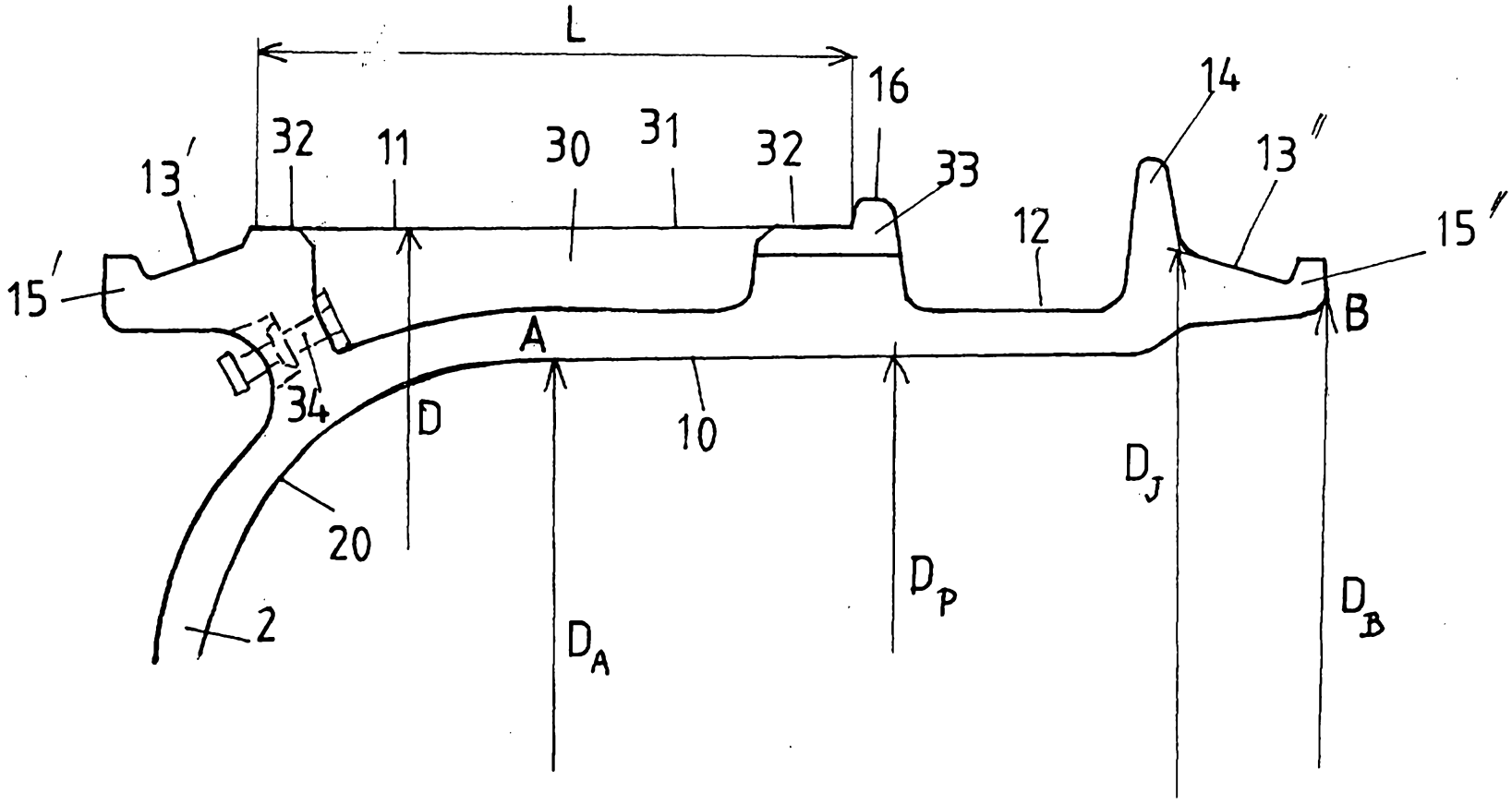


FIG 2

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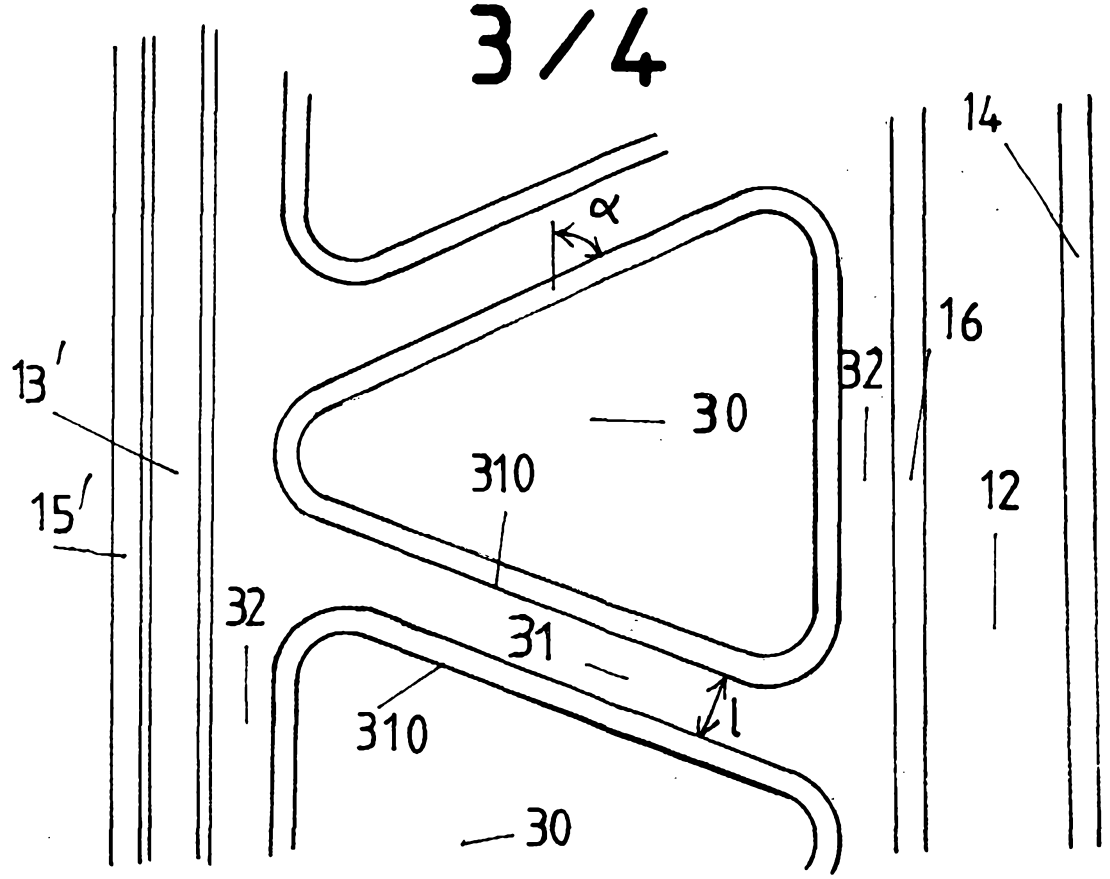


FIG 3

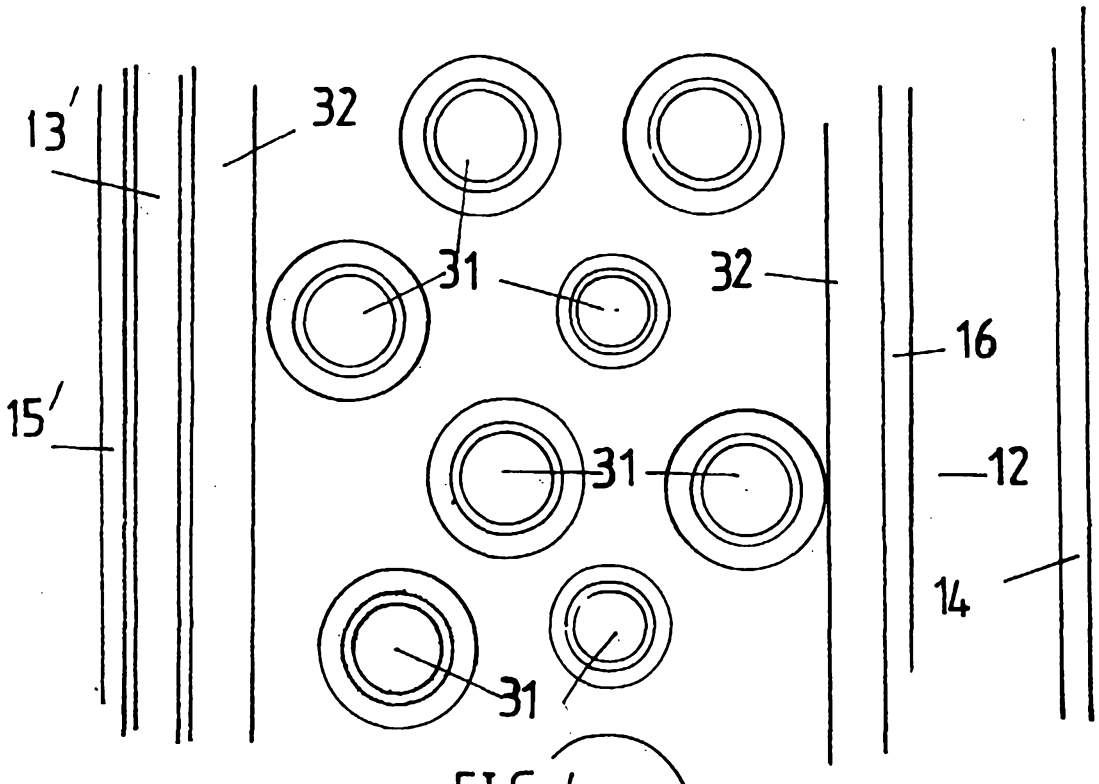


FIG 4

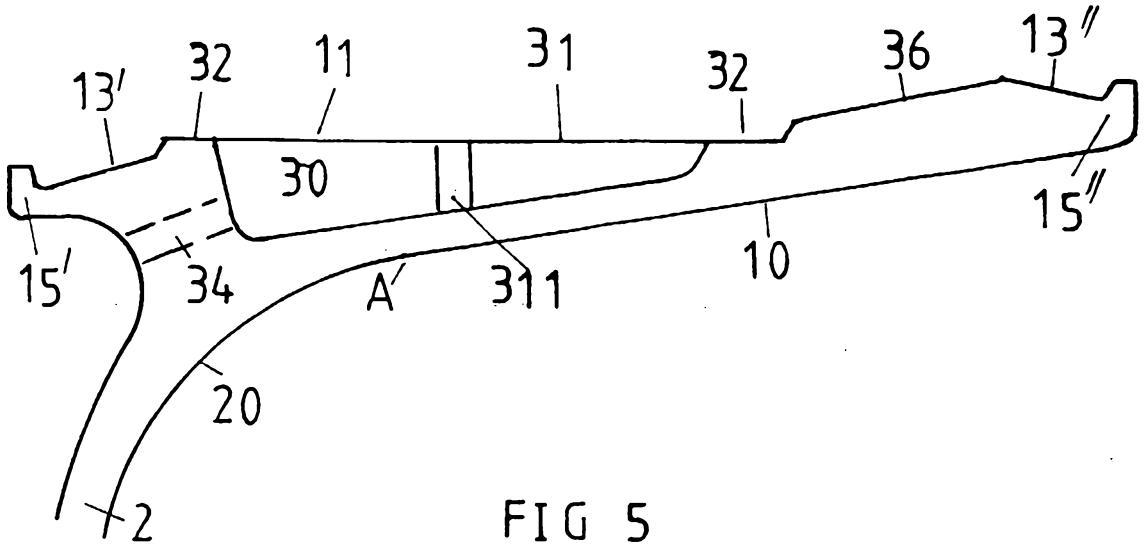


FIG 5

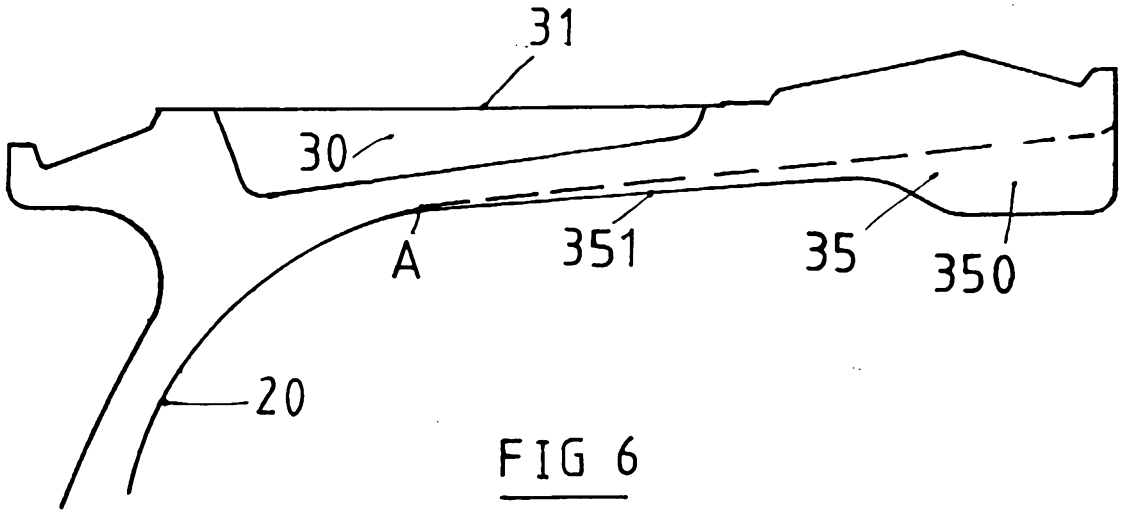


FIG 6