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(54) A pneumatic tyre and wheel rim assembly

(57) In a pneumatic tyre (1) and wheel rim (2) assembly the tyre beads (5) are engaged with bead seats (13) which are formed on the radially inner surface of the rim (2). Each bead seat (13) is formed by a groove (15) which provides an abutment (18) preventing movement of the bead (5) in an axially outwards direction and an abutment (17) preventing movement of the bead (5) in an axially inwards direction. Alternatively one or both of the abutments may be omitted. The tyre beads (5) may, as shown, be reinforced by substantially radially incompressible bead cores (6). The rim (2) may be formed by a plurality of arcuate components which abut end-to-end, to facilitate assembly with the tyre.

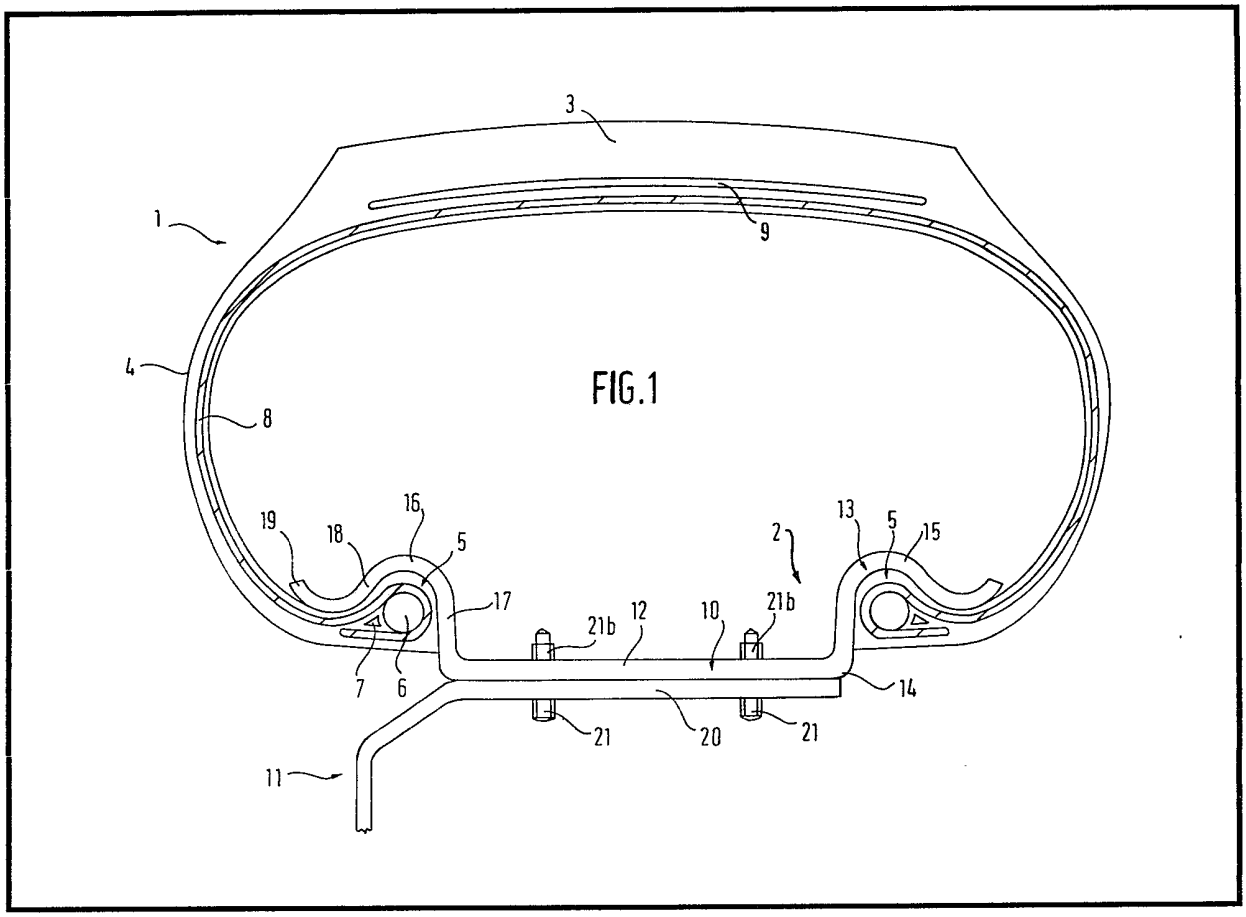

FIG.1

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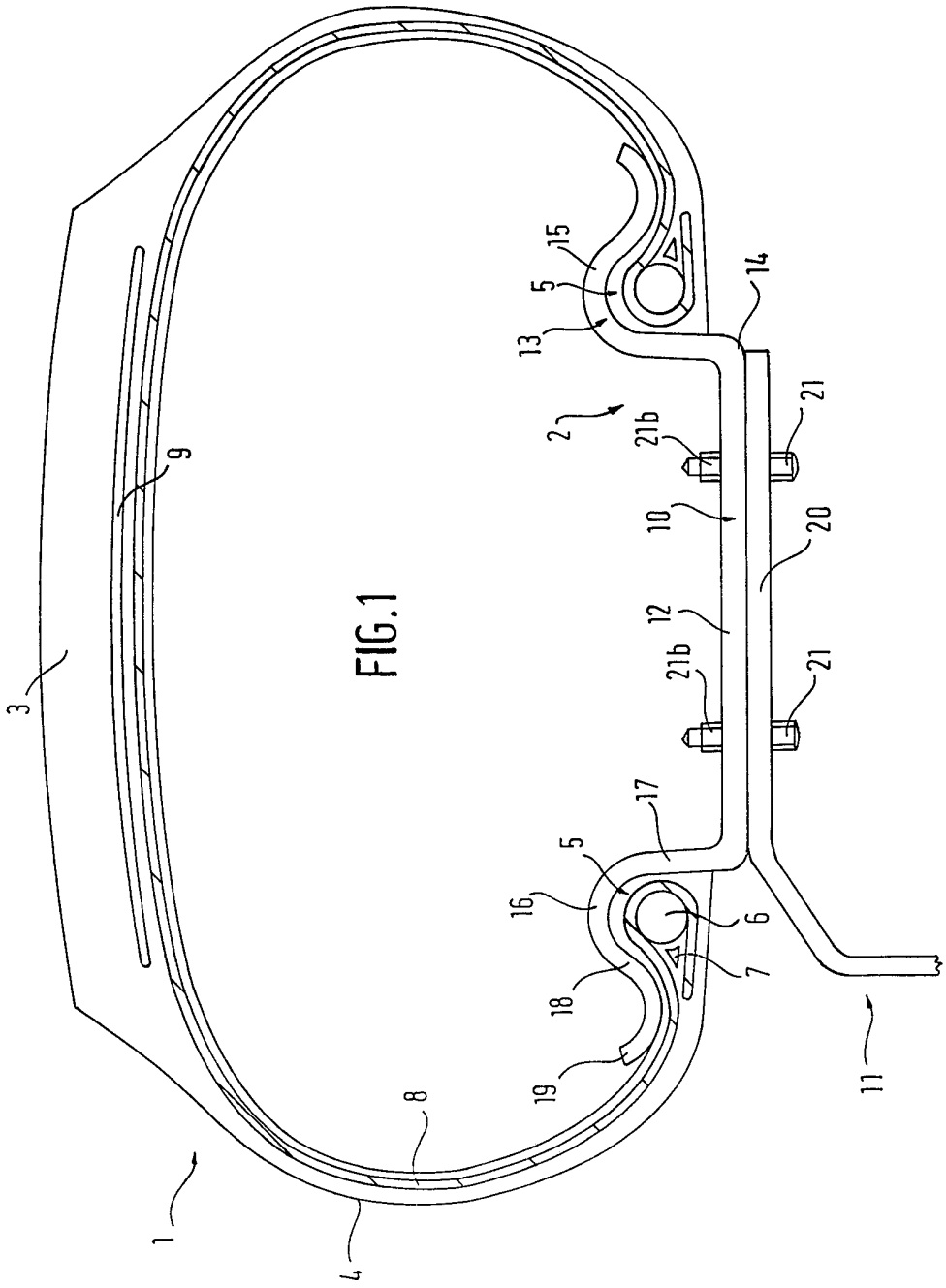

FIG.1

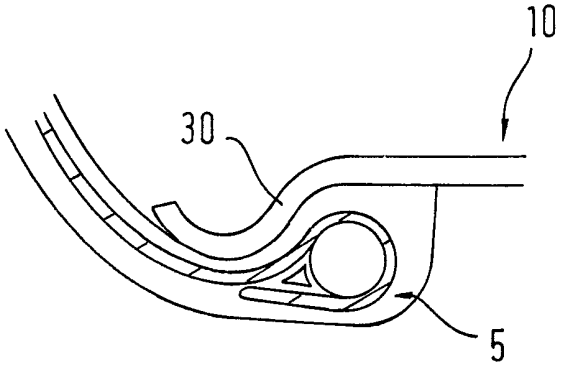

FIG. 2

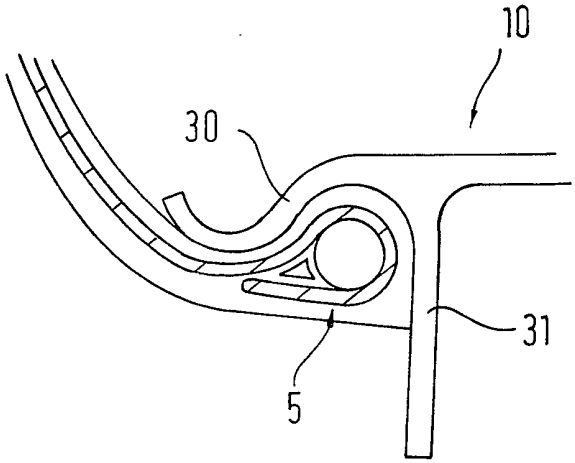

FIG. 3

SPECIFICATION

Improvements in or relating to a pneumatic tyre and wheel rim assembly

This invention concerns improvements in or relating to a pneumatic tyre and wheel rim assembly.

Pneumatic tyres are retained on their wheel rims by the engagement of beads, one at the radially inward edge of each sidewall, on bead seats. The bead seats are tapered so that inflation pressure forces the bead onto the taper to effect the engagement. The bead regions of tyres are accordingly designed to provide for the taper engagement as well as anchorage of the carcass reinforcement. This requires a comparatively rigid zone in the tyre bead which extends into the lower sidewall and in heavy duty tyres such as are used for trucks this rigid zone may extend for up to 20% of the section height of the tyre. Flexing of the sidewall is therefore transmitted to a rigid bead zone which is stiff and inefficient in absorbing deflection. As a result premature failure of the tyre is often caused by failure of the bead. In addition the provision of a relatively large bead zone reduces the length of the sidewall and consequently the sidewall is not able to be very efficient in absorbing deflection. Furthermore the complexities of providing the necessary bead zone stiffness incurs cost.

One object of the present invention is to provide an improved means of retaining a tyre on a wheel rim which obviates some of the above problems.

According to the present invention we provide a pneumatic tyre and wheel rim assembly comprising a tyre having a pair of sidewalls, a wheel rim constructed and arranged to define a pair of axially spaced bead seats on the radially inner surface of the wheel rim, the tyre having a pair of axially spaced reinforced tyre beads, each tyre bead having a radially outwardly directed surface in engagement with a respective one of the bead seats whereby the beads are located and retained by the associated bead seat.

Preferably each bead seat is annular. Preferably each bead seat has an abutment to prevent movement of the associated bead in an axially outward direction. Conveniently each abutment is formed by tapering the axially outer portions of the wheel rim in a radially inward direction to form an inclined bead seat.

Preferably the axially outer edge of each bead seat is profiled to form a radius to avoid chafing of the inside of the tyre bead region and/or lower tyre sidewall.

Each bead seat may have a second abutment to prevent movement of the associated bead in an axially inward direction. Each second abutment may be formed by the well of the wheel rim and comprise a radially directed flange.

In one preferred construction each bead seat comprises an annular groove of arcuate cross-section in which the side portions of each groove extend in a generally radially inwards direction from the base portion of the groove to provide said first and second abutments respectively.

Preferably the beads are reinforced by a bead core. Preferably the bead core is of annular cross-section and the tyre bead is seated in the associated bead seat. Preferably the core is substantially radially incompressible. The core may be substantially inextensible and may comprise a steel cable type.

Preferably the tyre is a low aspect tyre having an aspect ratio of 70% or less, preferably 60% or less and is preferably a radial tyre. Preferably the tyre tread is wider than the axial distance between the bead seats. Preferably the lower portion of the tyre sidewalls curve axially inwardly to meet the associated bead at a relatively small angle with respect to a line parallel to the rotational axis of the tyre.

The wheel rim comprises a rim member profiled to define the bead seats. The rim member is retained in position by the usual wheel disc. The rim member may be formed by one or more components. In one preferred construction the rim member is formed by three components to facilitate assembly.

According to a further aspect of the present invention we provide a pneumatic tyre for the assembly according to the present invention.

According to yet a further aspect of the present invention we provide a wheel rim for the assembly according to the present invention.

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings wherein:—

Figure 1 is a cross-sectional view of a pneumatic tyre and wheel rim assembly according to the present invention, and

Figures 2 and 3 show modifications to the assembly shown in Fig. 1.

The pneumatic tyre and wheel rim assembly shown in Fig. 1 of the accompanying drawings comprises a steel ply radial tyre 1 having an aspect ratio of 50% and a multi-component wheel rim 2.

The radial tyre 1 has a tread 3, a pair of sidewalls 4 and a pair of annular axially spaced beads 5. Each bead 5 comprises a bead core having a steel wire cable 6 of annular cross-section and a triangular bead apex 7. Each bead is radially incompressible. A single steel cord ply 8 extends circumferentially around the tyre from one bead to the other bead. The ends of the ply 8 are wrapped around the associated bead core. Tread reinforcements indicated generally by

the reference numeral 9 are provided radially outwards of the ply 8 and reinforce the crown of the tyre.

The wheel rim 2 comprises a rim member 10 having a cylindrical centre portion 12 and axially spaced end portions defining bead seats 13. The rim member 10 is formed by three similar elements 14 (one only shown) which may be formed by rolling, casting or other suitable methods.

Sealing means (not shown) is provided between the abutting ends of the elements 14.

Each bead seat 13 is similar and comprises an annular groove 15 having a base portion 16 and opposed side portions 17 and 18 respectively which extend radially inwards from the base portion 16. The side portion 17 leads radially inwards to the centre portion 12 and side portion 18 terminates in an axially outwardly directed radius 19. The tyre tread 3 is wider than the axial distance between the axially outer side portions of the grooves 15.

A wheel disc 11 comprising a cylindrical element 20 fits within the centre portion 12 of the assembled rim member 10 and is secured to each element 14 by bolts 21 which are rendered air-tight by means of O-rings (not shown). Alternatively a tube may be fitted.

Assembly of the tyre and rim is as follows, the elements 14 are inserted in turn into the interior of the tyre and the beads 5 located in the associated portion of the bead seats. With all three elements 14 in place the wheel disc 20 is fitted and secured to the elements 14 by engaging the bolts 21 in threaded nuts 21*b* welded to the elements 14. A valve (not shown) provided in the side portion 17 of one of the elements 14 allows the tyre to be inflated.

As will be apparent from the drawing the diameter of each bead is greater than the minimum diameter of the axially outer side portion 18 of the associated groove 15. The bead cables 6 are substantially incompressible in a radial direction and consequently when the tyre is inflated the beads 5 are retained in the associated grooves 15.

When the tyre is deflected the tyre inner liner moves away from the radius 19 and side portion 18 of the associated groove 15 and undesirable contact is avoided. As a result the beads 5 do not have to be reinforced by the provision of bead inserts, flippers, chafers etc. to the same extent as conventional tyres and the tyre sidewalls 4 may be longer than comparable aspect ratio tyres thus allowing for greater deflection and improved dynamic performance characteristics.

It will be apparent from the foregoing that by forming each bead seat as a groove the side portions of each groove form abutments to prevent movement of the associated bead in either an axially outward direction or an axially inward direction.

The above-described assembly may be modified in a number of ways, for example each bead seat may comprise the radially inner surface of an outwardly directed flange rather than a groove. As shown in Fig. 2 each flange 30 may be tapered in a radially inward direction to form an abutment to prevent movement of the associated bead 5 in an axially outward direction. Furthermore as shown in Fig. 3 each flange 30 may have a further radially inwardly directed flange 31 forming an abutment to prevent movement of the associated bead 5 in axially inward direction.

Furthermore the wheel rim may have a well as in the above-described embodiment or the well may be omitted, it being understood that a well is not required for fitting the tyres according to the present invention. If the well is omitted the wheel rim may be provided with further abutments to prevent movement on the beads in an axially inward direction.

Finally while it is preferred to have bead seats comprising grooves of arcuate cross-section and bead cores comprising cables of annular cross-section the bead cores may be of any type known to those skilled in the art while the groove may be of any suitable cross-section.

CLAIMS

1. A pneumatic tyre and wheel rim assembly comprising a tyre having a pair of sidewalls, a wheel rim constructed and arranged to define a pair of axially spaced bead seats on the radially inner surface of the wheel rim, the tyre having a pair of axially spaced reinforced tyre beads, each tyre bead having a radially outwardly directed surface in engagement with a respective one of the bead seats whereby the beads are located and retained by the associated bead seat.

2. An assembly according to claim 1 wherein each bead seat has a first abutment to prevent movement of the associated tyre bead in an axially outward direction.

3. An assembly according to claim 2 wherein the axially outer portions of the wheel rim are tapered in a radially inward direction to form inclined bead seats which define the first abutments.

4. An assembly according to claim 2 or claim 3 wherein each bead seat has a second abutment to prevent movement of the associated tyre bead in an axially inward direction.

5. An assembly according to claim 4 wherein each second abutment comprises a radially directed flange.

6. An assembly according to claim 4 wherein each bead seat comprises a groove having a base portion and a pair of opposed side portions which extend in a generally radially inward direction from the base portion to define the first and second abutments.

7. An assembly according to claim 6 wherein each groove is of arcuate cross-sec-

tion.

8. An assembly according to any one of the preceding claims wherein each tyre bead is reinforced by a bead core.

9. An assembly according to claim 8 wherein each bead core is substantially inextensible.

10. An assembly according to any one of the preceding claims wherein each tyre bead is substantially radially incompressible.

11. An assembly according to any one of the preceding claims wherein the bead reinforcement does not extend into the lower portion of the adjacent tyre sidewall to any appreciable extent.

12. An assembly according to any one of the preceding claims wherein the tyre is a radial tyre.

13. An assembly according to claim 12 wherein the tyre has an aspect ratio of 70% or less.

14. An assembly according to any one of the preceding claims wherein the axial width of the tyre tread exceeds the axial distance between the bead seats.

15. An assembly according to any one of the preceding claims wherein the lower portion of the tyre sidewalls curve axially inwardly to meet the associated bead at a relatively small angle with respect to a line parallel to the rotational axis of the tyre.

16. An assembly according to any one of the preceding claims wherein the wheel rim comprises a multi-component wheel rim member.

17. An assembly according to any one of the preceding claims wherein the axially outer edges of the wheel rim are profiled to form radii.

18. A pneumatic tyre and wheel rim assembly substantially as hereinbefore described with reference to the accompanying drawings.

19. The pneumatic tyre of the assembly according to any one of the preceding claims.

20. The wheel rim of the assembly according to any one of claims 1 to 18.

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