

PATENT SPECIFICATION

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(54) WHEEL RIM

(71) We, AVON RUBBER COMPANY LIMITED, a British Company, of Melksham, Wiltshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to wheel rims and to wheels incorporating them.

We are concerned to provide a wheel rim which has a well all of which is available for use in fitting a pneumatic tyre onto the rim, or taking it off, but wherein an obstructor can be removably secured in at least the mouth of the well so as to deny the whole of the well to the tyre beads. Then if the tyre accidentally deflates its beads cannot enter into the well and the tyre cannot escape from the rim. The problem, and an earlier proposal for dealing with it, are discussed and disclosed in our earlier application No. 20397/72 (Serial No. 1,420,622).

We find that problems arise in accurately and firmly seating the well obstructor, particularly in the axial direction, if the obstructor is the split cylindrical ring which is shown as preferred in that application and if the wheel rim is steel. It has been found not possible in practice to machine an adequate seat for the edges of the plane cylindrical ring at the mouth of a well of a steel rim.

In the present invention we provide a wheel rim having a base, a tyre bead retaining flange at each axial side of the base, a seat for a respective bead of a tyre on the base adjacent each flange, a well in the base axially between the bead seats and projecting radially inwardly of the bead seats, the well having side walls and a well base and being circumferentially continuous around the rim; the rim having also a removable well obstructor positionable so that it occupies the well with a band-like portion of the obstructor at the mouth of the well to deny the tyre beads

access to any substantial circumferential length of the well, retaining means to act between a pair of ends of the band-like portion of the obstructor to positively restrain the obstructor, in use, against radial or circumferential expansion, the obstructor having also at positions circumferentially distributed around the obstructor lugs projecting inwardly to enter into the well when the band-like portion of the obstructor is at the mouth of the well, the lugs being (a) to define a position of the obstructor axially in the rim by abutment against at least one radially inward portion of the well by virtue of the retention of the obstructor in the rim by the retaining means, and/or (b) to assure concentricity of the band-like portion of the obstructor in the rim.

When the band-like portion is arranged at the mouth of the well in the circular disposition in which it will be used, the lugs project generally radially inwardly. The lugs or some of them may extend inwardly to the full extent of the well. They may define an axial position of the obstructor (either a limiting or a unique axial position) by abutting against one (or both) of the side walls of the well. They thereby determine at least an axial relationship between the obstructor and the well, and may also by abutting on the base of the well assure concentricity of the band-like portion of the obstructor in the rim.

The lugs may be positioned at each axial edge of the band-like portion of the obstructor, each extending along the said edge at which it is positioned and being at an angle to the band-like portion so as to project into the well, whereby the lugs on the two edges abut against both side walls of the well, but a wider range of applicability to different rims (of the same diameter) is available if the lugs extend in an axial direction. These or some of them may be punched out of the material of the band-like portion at an

axially intermediate part thereof and inturned. Inturned tabs, bent over at adjacent ends of the band-like portion, may act as the said lugs (or as some of them) and additionally engage with the retainer means holding or drawing together adjacent said ends so as to hold the band-like portion against circumferential expansion.

In a general statement of the invention when the lugs extend axially, we provide a wheel rim having a continuous well in its base and tyre bead seats at each side of the well adjacent respective bead-retaining flanges, and also having a well obstructor with a band-like portion at the mouth of the well to prevent ingress of a tyre bead into any part of the circumferential length of the well, the band-like portion being made up of two semi-circular segments pivotally attached together at one pair of adjacent ends and releasably held together at their other pair of adjacent ends by retaining means exerting tension on the band-like portion to hold it in the rim, and a plurality of lugs on the band-like portion spaced around the well and projecting into the well from the band-like portion, the lugs being in pairs punched out of the material of the band-like portion and intermediate of the ends and the width of the segments and inturned, the lugs being for defining by interaction with at least one of the side walls and/or with the base of the well an axial position and/or the concentricity of the band-like portion of the obstructor in relation to the rim as a whole.

The obstructor may be unitary, with only two ends, or may be in a plurality of elongate arcuate segments, preferably no more than two. It is an important though subsidiary aspect of this invention that when the obstructor is in a plurality of parts, an assembly method is available which includes offering up the plurality of elongate segments of the band-like portion of the obstructor radially to the rim from respectively different directions, urging them into their respective intended positions, holding them there, inserting by a radial movement a retaining means between each adjacent pair of ends of the segments and tightening at least one of those means to hold the obstructor in position in the rim.

It is also particularly important from the point of view of assembly-line working, that the retaining means may be inserted by movement in a radially inward direction. The retaining means may include a shank with two enlargements, there being a radially directed and radially outwardly open slot in each said end of the band-like portion, the slot being of a width to allow passage of the shank but not of the

enlargement, and an abutment for the enlargement adjacent the slot. Alternatively an enlargement at at least one of the ends of the shank may be formed when the retainer means is already in position, for example by upsetting one end of the shank of a headed rivet; alternatively the retainer means may be a turnbuckle with a head already at each end and able to be screwthreadedly drawn together, both these being examples of retaining means acting to place the band-like portion under tension in the rim.

The invention includes also a wheel with such a rim, and an assembly of such a wheel and a tubeless tyre mounted on it, with its beads engaging permanent bead seats of the rim, one each lateral side of the well.

Particular embodiments of the invention will now be described with reference to the accompanying drawings wherein:—

Figure 1 is a perspective view, partly cut away, of a wheel incorporating a rim and with a tubeless tyre mounted on it;

Figure 2 is a section on one radius of the outer portion of a road wheel of a vehicle which has a pressed steel rim and which has a tyre and an obstructor mounted on it;

Figure 3 is a perspective view of the obstructor;

Figures 4 and 5 are sections on the lines A—A, B—B respectively in Figure 3;

Figure 6 is a perspective view of a second obstructor;

Figure 7 is a perspective view of one part of a third obstructor;

Figure 8 is a schematic drawing showing the part obstructor of Figure 7 assembled with another such part;

Figure 9 is a perspective view of a fourth obstructor;

Figure 10 is a schematic view of the fourth obstructor partly dis-assembled;

Figure 11 is a plan view of an alternative retainer means for the fourth obstructor;

Figure 12 is a representative radial sectional view through part of a rim with any of the second, third or fourth obstructors in position.

In Figures 1 and 2 a wheel disc 1 has attached to its outer periphery a pressed steel rim 2. The rim has bead-seat portions 3, 4 of its base which are respectively adjacent bead retaining flanges 5, 6 which respectively have axially out-turned flange edges 7, 8. Between the bead-seat portions 3, 4 is a cylindrical portion of the base 9 of the rim, to one side of which is situated a continuous annular well 10. Between the well 10 and bead-seat portion 4 leading to the nearer flange (6) there is a ridge 11 at the transition between one of its walls 12 and the bead-seat portion 4. The opposite wall 13 of the well extends from the

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cylindrical portion 9 of the rim to a base 14 of the well. The walls 12, 13 are frusto-conical annuli and having an angle of inclination α , in this case of 15° to a plane normal to the central axis of rotation of the rim when on a wheel. Of course other angles of inclination are possible and they will usually be steeper i.e. the angle α would be less than 15° .

In use, tyre beads 20, 21 of a tubeless tyre are fitted successively over the rim by occupying any part of the uninterrupted well 10 successively, in conventional manner. The ridge 11 helps prevent accidental dislodgement back into the well of bead 21. Since the present embodiment is intended for use with tubeless tyres, the rim has only one aperture through it suitably in a side wall of the well and this is occupied by the inflation valve.

Upon accidental loss of air one of the beads might escape into the well with consequent complete or partial loss of the tyre and with it, serious loss of control. To prevent this the well obstructor is provided which has a band-like portion 22 with radially inturned lugs 23 distributed regularly and on each lateral side, around its circumference. This is because with the material of this particular rim it is not practical to provide seating in the base of the rim at the mouth of the well. In the portions where there are no lugs (Figure 5) the band-like portion is planar in cross section. The band-like portion of this obstructor is held against radial expansion by a tangentially extending screw 24 engaging between inturned end tabs 25, 26, the head of the screw being accessible for engagement by a screwdriver directed generally tangentially through an elongate slot 27 in the band-like portion so that the latter can be tightened circumferentially onto the mouth of the well 10 with the lugs 23 wedging against its side walls 12, 13 to position the obstructor both radially and laterally. Some of the lugs may be different heights from others—e.g. they may be the full heights of the well (dotted line 28, Figure 2).

After the beads of the tyre have been fitted onto the rim base by using the well, both beads are pushed to one axial side (towards flange 5) so as to expose the well fully, the band-like portion 22 is placed round the mouth of the well, and the screw 24 engaged between its ends and then tightened so as to place the band-like portion under positive restraint against escape, or radial or circumferential expansion. One bead (21) is then pushed back over the well and the ridge 11 to seat on the bead-seat portion 4 of the base, and the tubeless tyre can then be inflated.

The obstructor may alternatively take one of the forms about to be described.

The second form has a band-like portion 110 continuous between two ends 111, 112 which are adjacent when the obstructor is positioned on a rim (portion 110 is shown in this conformation) and which can be held and tightened circumferentially together by nut and bolt 113 acting as retaining means and passing through holes in radially inturned end tabs 114, 115. Other retaining means and end arrangements will be described with reference to further embodiments.

At intervals along the circumferential length of the band-like portion 110 and in a laterally intermediate portion thereof are punched out pairs of lugs 116, four pairs in this embodiment. They are defined by cuts in the middle portion of the width of the band-like portion so as to leave continuous edge portions 117, and are inturned so as to form lugs which project radially inwardly, at an angle of, say, 70° to 90° to the tangent to the band-like portion at the root of the respective lug. The lateral edges of each lug taper together (not shown in Figure 6) so that those lateral edges conform generally to the taper of a well into which the lugs will project (see Figure 12).

The extent of inward projection of axially extending lugs may be such that the radially innermost ends abut the base of the well, to define the radial and axial position of the band-like portion relative to that base, or the positioning may be defined solely by abutment of the lateral edges of the lugs with the tapering side walls of the well. These cases may arise either when the lateral edges of the band-like portion are positioned between the side walls of the well at the mouth of the well, or as shown in Figure 12, when those edges overlap over adjacent edges of the base of the rim so as to bridge the well entirely, the lugs then providing stops only against lateral (axial) displacement of the band. Obviously, end tabs such as 114, 115 will be made an appropriate size.

The other forms of obstructor to be described are two-part. One pair of adjacent ends may be articulated together at a permanent circumferential spacing from each other while the other pair is provided with retaining means for releasably holding them together against circumferential expansion, or both pairs of ends may be provided with tension-applying retaining means.

In the form shown in Figures 7 and 8 for example, an obstructor is made up of two halves 120, 121 which are identical. Each has a pair of intermediate lugs 116 and inturned end tabs 122, all of which are shaped and dimensioned appropriately to act as

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positioning means for the band-like portion when placed in the well of a rim so that the tabs 122 act as positioning lugs. Each end tab 122 has a radially extending slot 123 of which the radially outer end is open, and joins into a circumferentially extending slot 124 in the band-like portion. Each slot 124 has an enlargement 125 at its end remote from the end tab 122. The form shown in Figures 9 and 10 is similar. Halves 126 are identical with each other and very like halves 120, 121 except that the lugs 116 are omitted. End tabs 122 have slots 123 and there are slots 124 and enlargements 125, as before; in Figures 9 and 10 end tabs 122 are the sole positioning lugs.

The slots 123, 124 are to allow the insertion from a radial direction of a retainer means such as a turnbuckle 127 (Figure 9) or rivet 128 (Figure 11). One or both of the enlargements 125 allows passage in that direction of the enlarged bead 129 at one end of the shank of the rivet 128 or of the enlarged heads 130 at each end of the shank 131 of the turnbuckle 127. The shank 131 of the turnbuckle is made up of a pair of screws threaded in opposite senses and engaged by an appropriately screwthreaded sleeve 132. Rotation of the sleeve 132 causes expansion or contraction of the shank, to move the heads 130 further apart from, or closer to, each other.

As illustrated in Figure 8 turnbuckles 127, 127' may be fitted between both of the pairs of ends of the halves 120, 121 alternatively the halves may be articulated together in place of the turnbuckle 127' preferably in such a way as to balance the mass of the turnbuckle 127. One suitable way of articulation is seen at 133, Figure 9, namely by use of a double headed rod. This may be positioned before the halves 120, 121 are brought near a rim so that the obstructor may be offered to the rim in the conformation seen in Figure 10 and then closed together.

Alternatively if the halves are not previously hinged together they may be offered up from opposite radial directions, held in engagement with the well, and retaining means inserted from opposite radial directions which are at 90° to the first-mentioned ones, at each pair of adjacent ends of halves.

Then the shank of the turnbuckle 127 is shortened so that the heads 130 no longer register with the enlargement 125 (so that they can no longer escape radially outwardly) but come to bear on the mutually remote surfaces of the tabs 122 adjacent the slots 123. Thus they hold the tabs and hence the band-like portions

together under circumferential tension when it is placed on a rim.

If the retainer means such as a rivet 128 is used it may again be inserted from a radial direction and then an enlargement 134 be formed in the shank so as to hold the tabs 122 firmly together. The rivet may be a pop rivet with a hollow shank. Although the use of a rivet is advantageous under in-line conditions of assembly i.e. on a conveyor assembly line, the bands are only removable after destruction of the rivet.

The forms of construction described with reference to Figures 7 to 11 are able to be subjected to automatic or semi-automatic assembly steps in in-line fashion.

WHAT WE CLAIM IS:—

1. A wheel rim having a base, a tyre bead retaining flange at each axial side of the base, a seat for a respective bead of a tyre on the base adjacent each flange, a well in the base axially between the bead seats and projecting radially inwardly of the bead seats, the well having side walls and a well base and being circumferentially continuous around the rim; the rim having also a removable well obstructor positionable so that it occupies the well with a band-like portion of the obstructor at the mouth of the well to deny the tyre beads access to any substantial circumferential length of the well, retaining means to act between a pair of ends of the band-like portion of the obstructor to positively restrain the obstructor, in use, against radial or circumferential expansion, the obstructor having also at positions circumferentially distributed around the obstructor lugs projecting inwardly to enter into the well when the band-like portion of the obstructor is at the mouth of the well, the lugs being (a) to define a position of the obstructor axially in the rim by abutment against at least one radially inward portion of the well by virtue of the retention of the obstructor in the rim by the retaining means, and/or (b) to assure concentricity of the band-like portion of the obstructor in the rim.

2. A wheel rim according to Claim 1 wherein the lugs abut against at least one side wall of the well to define the axial position of the obstructor.

3. A wheel rim according to Claim 1 or Claim 2 wherein the lugs abut against the well base.

4. A wheel rim according to any one of the preceding claims wherein the lugs are positioned at each axial edge of the band-like portion of the obstructor, each extending along the said edge at which it is positioned and being at an angle to the band-like portion so as to project into the



positioning means for the band-like portion when placed in the well of a rim so that the tabs 122 act as positioning lugs. Each end tab 122 has a radially extending slot 123 of which the radially outer end is open, and joins into a circumferentially extending slot 124 in the band-like portion. Each slot 124 has an enlargement 125 at its end remote from the end tab 122. The form shown in Figures 9 and 10 is similar. Halves 126 are identical with each other and very like halves 120, 121 except that the lugs 116 are omitted. End tabs 122 have slots 123 and there are slots 124 and enlargements 125, as before; in Figures 9 and 10 end tabs 122 are the sole positioning lugs.

The slots 123, 124 are to allow the insertion from a radial direction of a retainer means such as a turnbuckle 127 (Figure 9) or rivet 128 (Figure 11). One or both of the enlargements 125 allows passage in that direction of the enlarged bead 129 at one end of the shank of the rivet 128 or of the enlarged heads 130 at each end of the shank 131 of the turnbuckle 127. The shank 131 of the turnbuckle is made up of a pair of screws threaded in opposite senses and engaged by an appropriately screwthreaded sleeve 132. Rotation of the sleeve 132 causes expansion or contraction of the shank, to move the heads 130 further apart from, or closer to, each other.

As illustrated in Figure 8 turnbuckles 127, 127' may be fitted between both of the pairs of ends of the halves 120, 121 alternatively the halves may be articulated together in place of the turnbuckle 127' preferably in such a way as to balance the mass of the turnbuckle 127. One suitable way of articulation is seen at 133, Figure 9, namely by use of a double headed rod. This may be positioned before the halves 120, 121 are brought near a rim so that the obstructor may be offered to the rim in the conformation seen in Figure 10 and then closed together.

Alternatively if the halves are not previously hinged together they may be offered up from opposite radial directions, held in engagement with the well, and retaining means inserted from opposite radial directions which are at 90° to the first-mentioned ones, at each pair of adjacent ends of halves.

Then the shank of the turnbuckle 127 is shortened so that the heads 130 no longer register with the enlargement 125 (so that they can no longer escape radially outwardly) but come to bear on the mutually remote surfaces of the tabs 122 adjacent the slots 123. Thus they hold the tabs and hence the band-like portions

together under circumferential tension when it is placed on a rim.

If the retainer means such as a rivet 128 is used it may again be inserted from a radial direction and then an enlargement 134 be formed in the shank so as to hold the tabs 122 firmly together. The rivet may be a pop rivet with a hollow shank. Although the use of a rivet is advantageous under in-line conditions of assembly i.e. on a conveyor assembly line, the bands are only removable after destruction of the rivet.

The forms of construction described with reference to Figures 7 to 11 are able to be subjected to automatic or semi-automatic assembly steps in in-line fashion.

WHAT WE CLAIM IS:—

1. A wheel rim having a base, a tyre bead retaining flange at each axial side of the base, a seat for a respective bead of a tyre on the base adjacent each flange, a well in the base axially between the bead seats and projecting radially inwardly of the bead seats, the well having side walls and a well base and being circumferentially continuous around the rim; the rim having also a removable well obstructor positionable so that it occupies the well with a band-like portion of the obstructor at the mouth of the well to deny the tyre beads access to any substantial circumferential length of the well, retaining means to act between a pair of ends of the band-like portion of the obstructor to positively restrain the obstructor, in use, against radial or circumferential expansion, the obstructor having also at positions circumferentially distributed around the obstructor lugs projecting inwardly to enter into the well when the band-like portion of the obstructor is at the mouth of the well, the lugs being (a) to define a position of the obstructor axially in the rim by abutment against at least one radially inward portion of the well by virtue of the retention of the obstructor in the rim by the retaining means, and/or (b) to assure concentricity of the band-like portion of the obstructor in the rim.

2. A wheel rim according to Claim 1 wherein the lugs abut against at least one side wall of the well to define the axial position of the obstructor.

3. A wheel rim according to Claim 1 or Claim 2 wherein the lugs abut against the well base.

4. A wheel rim according to any one of the preceding claims wherein the lugs are positioned at each axial edge of the band-like portion of the obstructor, each extending along the said edge at which it is positioned and being at an angle to the band-like portion so as to project into the



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well, whereby the lugs on the two edges abut against both side walls of the well.

5. A wheel rim according to Claim 4 wherein the side walls of the well are frusto-conical annuli such that the well narrows in the inward direction away from its mouth and the lugs are turned to an angle conforming substantially to the angle of taper of the side walls of the well.

6. A wheel rim according to any one of Claims 1 to 3 wherein the lugs extend in an axial direction.

7. A wheel rim according to Claim 6 wherein the lugs or some of them are punched out of the material of the band-like portion at an axially intermediate part thereof.

8. A wheel rim according to Claim 6 or Claim 7 wherein the lugs or some of them are tabs bent over at adjacent ends of the band-like portion.

9. A wheel rim according to any one of the preceding claims wherein the band-like portion of the obstructor comprises a plurality of elongate arcuate segments.

10. A wheel rim according to Claim 9 wherein there are only two such parts.

11. A wheel rim according to any one of the preceding claims wherein means are provided on the obstructor for permitting the retaining means to be inserted from a radial direction.

12. A wheel rim according to Claim 11 wherein the retaining means include a shank with two enlargements, there being a radially directed and radially outwardly open slot in a tab at each said end of the band-like portion, the slot being of a width to allow passage of the shank but not of the enlargements, and an abutment for the enlargement on the tab adjacent the slot.

13. A wheel rim according to any one of the preceding claims wherein the retaining means extend tangentially of the rim and the retaining means at a said pair of ends act to place the band-like portion of the obstructor under tension in the rim.

14. A wheel rim according to Claim 13 wherein the tensioning retaining means is screw-threaded.

15. A wheel rim according to Claim 13 wherein the tensioning retaining means is a rivet.

16. A wheel rim substantially as herein described with reference to and as illustrated in the accompanying drawings.

17. A wheel incorporating a wheel rim according to any one of the preceding claims.

18. A wheel according to Claim 17 wherein a tubeless pneumatic tyre is fitted to the rim with its beads seated against the respective bead seats, and an inflation valve offers the only path through the rim.

19. A method of assembling a wheel rim according to Claim 9 comprising offering up the plurality of elongate segments of the band-like portion of the obstructor radially to the well from respectively different directions, urging them into their respective intended positions, holding them there, inserting by a radial movement a retaining means between each adjacent pair of ends of the segments and tightening at least one of those means to hold the obstructor in position in the rim.

20. A method according to Claim 19 wherein there are only two elongate segments of the obstructor and these are substantially semi-circular, which includes offering these up to the well from respectively opposite radial directions, and inserting retaining means between each of the two said pairs of ends, respectively by radial movements in a direction perpendicular to the first mentioned radial directions.

21. A wheel rim having a continuous well in its base and tyre bead seats at each side of the well adjacent respective bead-retaining flanges and also having a well obstructor with a band-like portion at the mouth of the well to prevent ingress of a tyre bead into any part of the circumferential length of the well, the band-like portion being made up of two semicircular segments pivotally attached together at one pair of adjacent ends and releasably held together at their other pair of adjacent ends by retaining means exerting tension on the band-like portion to hold it in the rim, and a plurality of lugs on the band-like portion spaced around the well and projecting into the well from the band-like portion, the lugs being in pairs punched out of the material of the band-like portion and intermediate of the ends and the width of the segments and intumed, the lugs being for defining by interaction with at least one of the side walls and/or with the base of the well an axial position and/or the concentricity of the band-like portion of the obstructor in the rim.

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- 5 22. A wheel rim according to Claim 21 wherein the lugs are to abut on the base of the well whereby the rim may be any one of a number of rims with wells of equal base diameter but different width.

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