

PATENT SPECIFICATION

(11) 1359 468

1359 468

- (21) Application No. 30034/70 (22) Filed 20 June 1970
 (23) Complete Specification filed 9 June 1971
 (44) Complete Specification published 10 July 1974
 (51) International Classification B60C 17/00//B60B 21/02 B60C 3/00
 (52) Index at acceptance
 B7C 3B12 3B9 5H X9
 (72) Inventors LESLIE VERNON POWELL and
 REGINALD HAROLD EDWARDS



(54) IMPROVEMENTS IN OR RELATING TO PNEUMATIC TYRES AND TO TYRE AND WHEEL RIM ASSEMBLIES

(71) We, DUNLOP HOLDINGS LIMITED, formerly The Dunlop Company Limited, a British Company of Dunlop House, Ryder Street, St. James's, London SW 1., 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:—

10 This invention relates to pneumatic tyres and to tyre and wheel rim assemblies.

Upon partial or complete deflation of a pneumatic tyre mounted on a wheel rim during the running of a vehicle opposite portions of the interior surface of the tyre come into contact with one another under more or less load according to whether or not the deflation is complete; the portions of the interior surface which normally come into contact are those close to but radially outwardly of the wheel rim flanges and those close to but radially inwardly of the tread edges.

When these portions of the interior surface come into contact considerable heat is generated within the rubber and textile components of the tyre and very rapid structural failure ensues. It has been discovered that the major source of heat generated is caused by the relative movement of the portions in contact and under load and the temperature rise is particularly marked because of the high coefficient of friction of dry rubber to dry rubber.

According to the present invention there is provided a pneumatic tyre, which, when mounted on a wheel rim for which it is designed and inflated to its normal working pressure, has an aspect ratio of between 30 and 75% and a tread portion whose width is greater than the width between the bead heels, having a coating of a lubricating material disposed on at least a portion of its interior surface to facilitate relative movement between contacting portions of the interior surface of the tyre when the tyre is used in a deflated condition.

The tyre may be a tubeless tyre provided

with an inner liner in which the lubricating material is a liquid material insoluble in rubber incorporated within the rubber compound of the inner liner, the liquid material, e.g. castor oil, migrating gradually to the exposed surface of the liner and remaining thereon to form a coating of lubricant.

Alternatively, the coating of lubricating material may be a coating applied to the exposed surface of the interior of the tyre, e.g. a coating of solid particles of poly-tetrafluoro-ethylene.

Instead of being applied in the form of a solid the lubricating material may be applied in the form of a gel but the lubricating material should not be capable of flowing away from the surface or each portion of the interior on which it is applied.

The tyre advantageously has an aspect ratio between 55 per cent and 70 per cent to lessen the difference in ride height of the tyre between the inflated and the deflated condition.

The lubricating material may be applied to the whole of the interior surface of the tyre or, alternatively, may be applied only to those portions of the interior surface of the tyre which come into contact when the tyre is deflated i.e. those close to but radially outwardly of the rim flanges and those close to but radially inwardly of the tread edges.

The coating of lubricating material should be able satisfactorily to withstand temperatures of at least 145°C without deterioration of the coating or its lubricating properties since when used in a deflated condition the tyre may attain such high temperature. The thickness of the coating will depend on the particular lubricant used but will generally be in the range 0.001 to 0.025 inches.

The present invention also provides a tyre and wheel rim assembly having a single inflation chamber comprising a wheel rim having a pair of annular bead retaining flanges, a tyre having an aspect ratio of between 30 and 75% and a tread portion whose width is greater than the width of the wheel rim

measured between the flanges, a coating of a lubricating material disposed on at least a portion of the interior surface of the tyre to facilitate relative movement between contacting portions of the interior surface of the tyre when the assembly is used with the tyre deflated, and means for preventing the tyre from being dislodged from the wheel rim when the assembly is used with the tyre deflated.

The means for preventing the tyre from being dislodged from the wheel rim may comprise a substantially non-decreasing diameter of the wheel rim between the flanges such that the wheel rim is without a well into which the tyre beads can fall. When using this type of rim if the beads are dislodged from their seats they tend to return to their correct positions during rotation of the tyre. Alternatively the means for preventing the tyre from being dislodged from the wheel rim may comprise bead retaining means for physically restraining at least one tyre bead from moving from its seat, suitable means for example a bead spacer ring, or removable studs or projections on the wheel rim. The use of bead retaining means enables a well-base rim to be used in the assembly is desired.

An example of the tyre of this invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, of which:—

Figure 1 shows in section a tyre inflated and mounted on a wheel rim and

Figure 2 shows the tyre in the deflated condition and compressed as when it is passing through the tyre/ground contact patch.

As shown in Figure 1 a pneumatic tyre 1 is mounted on a flat base wheel rim shown schematically at 2. The wheel rim may be, for example, a rim in which a well has been closed by axial compression or a split rim. The whole of the interior surface of the tyre is provided with a layer 3 of rubber having castor oil absorbed therein the castor oil migrating to the exposed surface of the layer to form a coating of lubricant thereon.

The rubber composition of the layer has the following formulation:—

	Parts by Weight
50 Natural rubber	100
Sulphur	2.75
Santocure	
(Registered Trade Mark)	1.0
55 Stearic Acid	1.0
Castor Oil	25.0
Zinc oxide	5.0
GPF Black (ASTM number	
N 660 obtained from Columbian	60.0
60 International	
	194.75

Between this layer and the remainder of

the tyre carcass there is provided a barrier layer 4 of a rubber composition which is impermeable by the lubricating material to prevent the lubricating material migrating to the carcass during use of the tyre. Thus any risk of the lubricating material degrading the materials of the tyre carcass and causing tyre failure is obviated.

The barrier layer is made of the following rubber composition:—

	Parts by Weight	
Natural Rubber	100	75
Sulphur	2.75	
Stearic Acid	1.0	
Santocure	1.0	
Mineral Oil	5.0	80
Zinc Oxide	50.0	
GPF Black (ASTM number		
N 660 obtained form Columbian	50.0	
International)		
	164.75	85

While the above rubber compositions refer to the use of natural rubber, compositions incorporating synthetic rubber polymers may also be used.

Referring still to figure 1 the portions A and B, C and D of the layer 3 which are shown in dotted lines may be provided alone if desired. In this case the lubricant layer is positioned only on the portions of the internal surface of the tyre which come into intimate contact when the tyre is used in the deflated state.

Figure 2 shows the tyre in the deflated condition collapsed on to the wheel rim in the manner in which it will appear in the tyre/ground contact patch and it will be noted that in this condition the portions A and B, also C and D are in contact.

The tyre and wheel rim assembly may be one in which the tyre can be removed from the rim or, alternatively, in which the tyre is not removable therefrom, i.e. in which the two form a permanent assembly, for example, when the rim is swaged over the beads after assembly of the tyre and rim.

This invention is applicable in particular to tyres having a breaker assembly and a carcass of radial cords but can be applied to carcasses of crossply cords with or without breaker assemblies.

The present invention may be used in conjunction with the inventions of our co-pending UK Patent Application Nos. 30029/70; 30030/70 and 30031/70 (Serial Nos. 1359463 1359464 and 1359465).

The present invention may also be used, with particular advantage, with many embodiments of the invention described in our co-pending UK Patent Application No. 30027/70 (Serial No 1359461) in which is described a

rrier
 h is
 l to 65
 g to
 any
 the
 tyre 70
 wing
 s by
 ight 75
 75
 0
 0
 0 80
 0
 0
 75 85
 er to
 incor-
 also
 as A 90
 are
 alone
 er is
 ernal
 mate 95
 lated
 con-
 the
 tyre/ 100
 oted
 d B,
 y be
 from 105
 re is
 the
 mple,
 after 110
 lar to
 carcass
 asses
 maker 115
 con-
 nding
 7/70;
 9463 120
 used,
 bodi-
 co-
 7/70
 ed a 125

5 pneumatic tyre and wheel rim assembly comprising an enclosing means for a lubricating material for the interior surfaces of the tyre said lubricating material being automatically releasable from the enclosing means into the inflation chamber defined by the tyre and wheel rim upon substantial loss of inflation pressure or deflation of the tyre. Use of the tyre of the present invention in this tyre and wheel rim assembly will ensure that the tyre sustains no damage before the lubricating material released from the enclosing means is thoroughly dispersed around the tyre.
 10

WHAT WE CLAIM IS:—

- 15 1. A pneumatic tyre which, when mounted on a wheel rim for which it is designed and inflated to its normal working pressure, has an aspect ratio of between 30 and 75% and a tread portion whose width is greater than the width between the bead heels, having a coating of a lubricating material disposed on at least a portion of its interior surface to facilitate a relative movement between contacting portions of the interior surface of the tyre when the tyre is used in a deflated condition.
- 20 2. A tyre according to claim 1 in which the aspect ratio is in the range 55% to 70%.
- 25 3. A tyre according to claim 1 or claim 2 in which the coating of lubricating material is able satisfactorily to withstand temperatures of at least 145°C. without deterioration of the coating or its lubricating properties.
- 30 4. A tyre according to any one of claims 1 to 3 which is a tubeless tyre provided with an inner liner and in which the lubricating material is a liquid material insoluble in rubber incorporated within the rubber compound of the inner liner, the liquid material migrating gradually to the exposed surface of the liner and remaining thereon to form a coating of lubricating material.
- 35 5. A tyre according to claim 4 in which the liquid material is castor oil.
- 40 6. A tyre according to any one claims 1 to 3 in which the coating of lubricating material is a coating applied to the exposed surface of the interior of the tyre.
- 45 7. A tyre according to claim 6 in which the coating is a coating of solid particles of polytetrafluoroethylene.
- 50 8. A tyre according to any one of claims 1 to 3 in which the lubricating material is applied in the form of a gel which is not capable of flowing away from the or each
- 55

portion of the interior surface to which it is applied.

9. A tyre according to any one of the preceding claims in which the coating of lubricating material extends over the whole of the interior surface of the tyre. 60

10. A tyre according to any one of claims 1 to 8 in which the coating of lubricating material is applied only to the portions of the interior surface of the tyre which come into contact when the tyre is deflated. 65

11. A tyre according to any one of the preceding claims in which the tread portion is braced by a breaker assembly. 70

12. A tyre according to any one of the preceding claims comprising a carcass of radial cords.

13. A pneumatic tyre substantially as described herein with reference to and as illustrated in the accompanying drawings. 75

14. A pneumatic tyre and wheel rim assembly having a single inflation chamber comprising a wheel rim having a pair of annular bead retaining flanges, a tyre having an aspect ratio of between 30 and 75% and a tread portion whose width is greater than the width of the wheel rim measured between the flanges, a coating of a lubricating material disposed on at least a portion of the interior surface of the tyre to facilitate relative movement between contacting portions of the interior surface of the tyre when the assembly is used with the tyre deflated, and means for preventing the tyre from being dislodge from the wheel rim when the assembly is used with the tyre deflated. 80

15. A pneumatic tyre and wheel rim assembly according to claim 14 in which the means for preventing the tyre from being dislodged from the wheel rim comprises a substantially non-decreasing diameter of the wheel rim between the flanges such that the wheel rim is without a well into which the tyre beads can fall. 85

16. A pneumatic tyre and wheel rim assembly according to claim 14 or 15 in which the means for preventing the tyre from being dislodged from the wheel rim comprises bead retaining means for restraining at least one tyre bead from moving from its seat. 90

17. A pneumatic tyre and wheel rim assembly substantially as described herein with reference to the accompanying drawings. 105

R I G McAY
 Agent for the Applicants

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1974.
 Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.



* C L M S *

1,359,468

barrier
 ich is
 rial to 65
 ing to
 us any
 ng the
 g tyre 70
 lowing
 arts by
 Weight 75
 0
 2.75
 1.0
 1.0
 5.0 80
 0.0
 3.0
 4.75 85
 fer to
 incor-
 y also
 ons A 90
 ch are
 alone
 yer is
 ernal
 timate 95
 eflated
 d con-
 in the
 tyre/
 noted 100
 nd B,
 ay be
 from 105
 tyre is
 h the
 mple,
 after 110
 lar to
 arcess
 asses
 reaker 115
 i con-
 nding
 9/70;
 59463 120
 used,
 bodi-
 r co-
 27/70
 sed a 125

5 pneumatic tyre and wheel rim assembly com-
 10 prising an enclosing means for a lubricating
 material for the interior surfaces of the tyre
 said lubricating material being automatically
 releasable from the enclosing means into the
 inflation chamber defined by the tyre and
 wheel rim upon substantial loss of inflation
 pressure or deflation of the tyre. Use of the
 tyre of the present invention in this tyre and
 wheel rim assembly will ensure that the tyre
 sustains no damage before the lubricating
 material released from the enclosing means is
 thoroughly dispersed around the tyre.

WHAT WE CLAIM IS:—

- 15 1. A pneumatic tyre which, when mounted
on a wheel rim for which it is designed and
inflated to its normal working pressure, has
an aspect ratio of between 30 and 75%
and a tread portion whose width is greater
20 than the width between the bead heels,
having a coating of a lubricating material
disposed on at least a portion of its
interior surface to facilitate a relative move-
ment between contacting portions of the
25 interior surface of the tyre when the tyre is
used in a deflated condition.
2. A tyre according to claim 1 in which
the aspect ratio is in the range 55% to
30 70%.
3. A tyre according to claim 1 or claim 2
in which the coating of lubricating material
is able satisfactorily to withstand tempera-
tures of at least 145°C. without deterioration
of the coating or its lubricating properties.
- 35 4. A tyre according to any one of claims
1 to 3 which is a tubeless tyre provided with
an inner liner and in which the lubricating
material is a liquid material insoluble in
rubber incorporated within the rubber com-
40 pound of the inner liner, the liquid material
migrating gradually to the exposed surface
of the liner and remaining thereon to form
a coating of lubricating material.
5. A tyre according to claim 4 in which
45 the liquid material is castor oil.
6. A tyre according to any one claims 1 to
3 in which the coating of lubricating
material is a coating applied to the exposed
surface of the interior of the tyre.
- 50 7. A tyre according to claim 6 in which
the coating is a coating of solid particles of
polytetrafluoroethylene.
8. A tyre according to any one of claims
1 to 3 in which the lubricating material is
55 applied in the form of a gel which is not
capable of flowing away from the or each

portion of the interior surface to which it is applied.

9. A tyre according to any one of the pre-
ceding claims in which the coating of
lubricating material extends over the whole
of the interior surface of the tyre.

10. A tyre according to any one of claims
1 to 8 in which the coating of lubricating
material is applied only to the portions of
the interior surface of the tyre which come
into contact when the tyre is deflated.

11. A tyre according to any one of the
preceding claims in which the tread portion
is braced by a breaker assembly.

12. A tyre according to any one of the
preceding claims comprising a carcass of
radial cords.

13. A pneumatic tyre substantially as
described herein with reference to and as
illustrated in the accompanying drawings.

14. A pneumatic tyre and wheel rim
assembly having a single inflation chamber
comprising a wheel rim having a pair of
annular bead retaining flanges, a tyre having
an aspect ratio of between 30 and 75% and
a tread portion whose width is greater than
the width of the wheel rim measured
between the flanges, a coating of a lubricat-
ing material disposed on at least a portion of
the interior surface of the tyre to facilitate
relative movement between contacting por-
tions of the interior surface of the tyre when
the assembly is used with the tyre deflated,
and means for preventing the tyre from
being dislodge from the wheel rim when the
assembly is used with the tyre deflated.

15. A pneumatic tyre and wheel rim
assembly according to claim 14 in which the
means for preventing the tyre from being dis-
lodged from the wheel rim comprises a sub-
stantially non-decreasing diameter of the wheel
rim between the flanges such that the wheel
rim is without a well into which the tyre beads
can fall.

16. A pneumatic tyre and wheel rim
assembly according to claim 14 or 15 in
which the means for preventing the tyre
from being dislodged from the wheel rim
comprises bead retaining means for restrain-
ing at least one tyre bead from moving from
its seat.

17. A pneumatic tyre and wheel rim
assembly substantially as described herein
with reference to the accompanying draw-
ings.

R I G McAY
Agent for the Applicants

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1974.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from
which copies may be obtained.