

**FLAT-RUNNING DEVICE FOR MOTOR VEHICLE AND MOUNTED
ASSEMBLY INCORPORATING SAME**

The present invention relates to a flat-running device designed
5 to be fitted to a tubeless mounted assembly for a motor vehicle and such a
mounted assembly incorporating this device, making it possible to travel a
considerable distance at relatively high speed when the mounted assembly is
partially or totally deflated. This flat-running device is able to be used notably
for fitment to a military vehicle designed to travel over all types of terrains
10 including sandy terrains.

The known flat-running devices usually consist of a supporting
ring mounted with clearance around a wheel rim inside a tire casing. This ring,
because of its width at its base, exerts a force pressing the casing onto the
rim. Sometimes used are rigid devices in several sectors that are attached in
15 twos. Thus, document EP-A-1 541 384 in the name of the Applicant presents
a flat-running device for a mounted assembly with a rim with several portions
of the bolted type comprising, on the one hand, a supporting ring of the hollow
type designed to be mounted around the rim and divided into at least two ring
sectors mounted independently of one another and, on the other hand, means
20 for locking the beads of the casing against the rim edges that are designed to
connect the ring sectors to these beads, for the purpose of ensuring the
driving function of the mounted assembly in the event of reduced or zero
pressure in the latter.

Document EP-A-233 547 also discloses a flat-running device
25 for a multilock rim (i.e. not bolted) which is mounted on the rim by means of a
flexible elastic shoe, the ribbed lateral edges of which are designed to press
against the beads of the tire casing. In this device, the ring sectors are
articulated together in twos by fitting into one another in the circumferential
direction, via an axial pivot forming a hinge which passes right through the two
30 sectors that it connects and on which these sectors can pivot.

A major drawback of the latter flat-running device with sectors articulated by hinges lies notably in the rigid character of these articulations because of the aforementioned fitment and hinge.

Document EP-A-1 588 870 presents an annular supporting
5 structure with articulated ring sectors specifically for a one-piece wheel rim with circumferential well, the structure being able to be used without means for locking the beads against the rim edges. Each articulation between sectors consists of at least two link rods articulated on one another thus forming a complex deformable articulation with the two articulation holes in which the
10 two transverse spindles are mounted that belong respectively to both link rods and not to only one and the same rigid lug, which notably has the drawback of making the articulations complex.

One object of the present invention is to propose a flat-running device designed to be fitted to a tubeless mounted assembly for a motor
15 vehicle which comprises a wheel rim in several parts and a tire casing comprising beads mounted against edges of said rim, said device comprising:

- an annular supporting structure which is designed to be mounted around the rim for the purpose of supporting the casing, following a drop in inflation pressure inside the mounted assembly, and which is divided
20 into at least two ring sectors in an arc of a circle suitable for forming the structure by juxtaposition in the circumferential direction, these sectors being articulated together in twos in this direction by connection means, and

- means for locking the beads against these edges which are designed to connect said annular supporting structure to these beads,
25 which notably makes it possible to remedy this drawback by giving the device increased flexibility.

For this purpose, a device according to the invention is such that said connection means are located between the two lateral faces of each of the two sectors that they articulate together, and comprise two spindles
30 extending in the axial direction of the device which are respectively attached in two facing connection ends of these sectors and which are connected together by an articulation extending in the circumferential direction of the

device, said articulation consisting of at least one rigid lug with two through-holes or else of at least one flexible link with two loops, said at least one lug or said at least one link being articulated on these spindles by these two holes or loops, respectively.

5 “Spindles” in this instance mean in a known manner pivots on which, according to the present invention, said articulation articulates in the manner of a movable joint, which confers the desired flexibility on the device according to the invention.

10 For each articulation, it will be noted that the or each lug or else the or each flexible link, as appropriate, is articulated alone on these two spindles, unlike each complex articulation of the aforementioned document EP-A-1 588 870.

15 According to another feature of the invention, said locking means may advantageously comprise a pair of one-piece annular wedges which are pressed axially on either side of said supporting structure and facing a radially internal zone of this structure where said spindles are mounted so as to position and to immobilize the latter inside the corresponding sectors by the lateral locking of these spindles at the radial height determined by these wedges.

20 Each of these two wedges may have a substantially trapezium-shaped axial section the small and large bases of which define respectively radially inner and outer surfaces of said locking means, each wedge preferably being based on rubber that is reinforced by a circumferential reinforcing element.

25 According to another feature of the invention, said spindles may be formed of two spindles for example with shoulder which are respectively mounted in said two through-holes or loops of said articulation and which are attached inside the two corresponding articulated sectors.

30 According to one exemplary embodiment of the invention, one of the ends of each sector, or male end, may advantageously terminate in a fitting male member which protrudes in the circumferential direction radially

above said articulation and which is capable of partially fitting into a female end of the adjacent sector.

As a variant, the articulated sectors may be capable of moving reversibly relative to one another in the axial direction and in torsion about the circumferential direction via said locking means, under the effect of lateral shearing or compression forces applied to the casing when running flat or in the inflated state. This device according to the invention can therefore absorb the impacts while running flat and in the low-pressure inflated state by reversible both axial and torsional adjustments, via the ability of these connection means to deform.

The articulation according to this variant is then for example of the rigid type and consists of said at least one (for example metal or plastic) lug or pin articulated on these spindles which is capable of sliding axially and of pivoting on the latter so as to allow this reversible movement of the sectors thus articulated. As a variant, this articulation may be of deformable type and consist of said at least one flexible link articulated via said two loops on these spindles, such as at least one textile cable and/or one metal cable, this link being capable of moving on these spindles so as to allow this reversible movement of the sectors.

According to another feature of the invention, the two ends of each sector may be recessed over a substantially middle portion of their axial width so as to form, in each sector end, a recess which extends over at least a portion of the length of the sector in the circumferential direction and which is delimited axially by two axial recess faces both traversed by said spindle attached to this sector end.

Advantageously, each spindle may axially traverse right through the sector incorporating it, via an axial through-housing which is formed between each axial recess face and the lateral face facing this sector and which receives this spindle.

According to another feature of the invention, said two recesses of the two respective connection ends of each sector may extend

radially from the radially inner face of this sector, each recess having a substantially rectangular axial section.

According to a first embodiment of the invention, said two recesses of each sector extend to the radially outer face of this sector, thus
5 traversing in the radial direction of the latter.

According to a second embodiment of the invention, said two recesses of each sector terminate radially at a distance from the radially outer face of this sector, thus being blind in the radial direction of the latter, each sector optionally being surmounted by a rubber-based protective coating. This
10 protective coating may advantageously consist of a rigid rubber or else of a flexible rubber/reinforcement elements composite.

It will be noted that this rubber protective portion makes it possible not only to protect the radially outer face of the annular supporting structure, but also to protect the tire casing when running in the inflated state
15 when there is an impact for example, in the event of contact of the device with the sidewalls or the top of the casing.

According to another feature of the invention that is common to these two embodiments, each of said sectors may, without distinction, have a solid, hollow or holed structure (for example holed on its radially inner face
20 and/or on its lateral faces), and it is preferably made of a plastic or composite material. Still more preferably, a composite material is used that can comprise a polymer matrix (for example a polyamide or an epoxy resin) reinforced by a framework of glass or carbon fibers.

A tubeless mounted assembly according to the invention for a
25 motor vehicle comprises a wheel rim in several parts, a tire casing comprising beads respectively mounted against axially inner and outer edges of the rim, and a flat-running device mounted around the rim between said edges, and this mounted assembly is characterized in that the device is as defined above.

Advantageously, said rim is of the two-part bolted type and
30 may have a substantially flat rim bottom (that is, with no rim well).

Other features, advantages and details of the present invention will emerge on reading the following description of several

embodiments of the invention given by way of illustration and not being limiting, said description being made with reference to the appended drawings, amongst which:

Figure 1 is a view in axial half-section of a mounted assembly
5 incorporating a flat-running device according to a first embodiment of the invention incorporating rigid means of connection between sectors,

Figure 2 is a view in circumferential half-section along the plane II-II of Figure 1 of this mounted assembly,

Figure 3 is a view in perspective of a sector in an arc of a
10 circle of the annular supporting structure of the device according to Figure 1,

Figure 4 is a view in perspective of the annular supporting structure of the device according to Figure 1 comprising two sectors according to Figure 3 that have been connected together,

Figure 5 is a view in perspective of a sector in an arc of a
15 circle of an annular supporting structure of a flat-running device according to a second embodiment of the invention,

Figure 6 is an exploded view in perspective of the supporting structure of a device with three sectors according to Figure 5 to be connected together via rigid connection means according to the invention, which can also
20 be used in the first embodiment of Figures 1 to 4,

Figure 7 is an exploded partial view in perspective of a supporting structure according to the second embodiment in which the sectors are to be connected together via rigid connection means similar to those of Figure 6 and also by fitting of their facing ends,

25 Figure 8 is an exploded partial view in perspective of a supporting structure according to the first embodiment in which the sectors are to be connected together via the rigid connection means of Figure 7 and by fitting of their facing ends,

Figure 9 is an exploded partial view in perspective of a
30 supporting structure according to this first embodiment corresponding to a variant of Figure 8, in which the sectors are to be connected together via these rigid connection means and by fitting of their facing ends, and

Figure 10 is an exploded partial view in perspective of a supporting structure according to the second embodiment of the invention in which the sectors are to be connected together via deformable connection means and also by fitting of their facing ends.

5 In the present description, the expressions "axially inner" and "axially outer" refer respectively to the sides of the wheel rim which are designed to be turned toward the inside and toward the outside of the motor vehicle, following the mounting onto a vehicle of a mounted assembly comprising this rim.

10 The mounted assembly 1 according to the invention, which is illustrated in Figure 1, comprises a wheel rim 10 with two parts 10a and 10b secured to one another by attachment means (not illustrated) of the bolt type.

The two parts 10a and 10b comprise respectively axially inner and outer edges 12 and 13 delimiting respectively two rim seats 14 and 15
15 extending axially from the edges 12 and 13, a tire casing 20 of which the beads 21 and 22 are mounted resting on the seats 14 and 15 against the edges 12 and 13, and a flat-running device 30 mounted around the rim 10 inside the casing 20 and designed to support the latter following a drop in inflation pressure inside the mounted assembly 1.

20 In the example of Figure 1, the device 30 is mounted on a rim bottom 10 that is of the substantially flat type. This device 30 comprises:

- an annular supporting structure 31 which is designed to be mounted on the rim 10 for the purpose of supporting the casing 20, following a drop in inflation pressure inside the mounted assembly 1, and which is divided
25 into ring sectors 32 each in an arc of a circle and of solid structure which are articulated together via connection means 33 and which are suitable for forming the structure 31 by juxtaposition in the circumferential direction of the latter, and

- annular wedges 34 for locking the beads 21 and 22 against
30 the edges 12 and 13 which are designed to connect the structure 31 to the beads 21 and 22 and which are each in a single piece, being based on rubber that is reinforced by a circumferential reinforcement element (not illustrated),

these wedges 34 being pressed laterally on a radially inner zone of the sectors 32 situated facing the connection means 33 so as to hold them in position when running.

Each ring sector 32 is preferably made of a composite material, such as a polyamide matrix reinforced by a framework of glass fibers, and it is according to this first embodiment surmounted radially by a protective coating 32a with a preferably rigid rubber base. It will be noted however that this coating 32a could, as a variant, consist of a flexible rubber/reinforcing elements composite.

As for the geometry of each ring sector 32, it has, in the example of Figure 1 (see also Figures 3 and 4):

- in said radially inner zone on which the locking wedges 34 rest, a substantially trapezoidal axial section which widens axially on the radially inner face of the sector 32 in order to form a base 32b of the latter and,

- in a radially outer zone surmounting the foregoing, an axial section substantially in the shape of an isosceles trapezium the large base of which coincides with the protective coating 32a.

As illustrated in Figures 1, 2 and 6, the connection means 33 for articulating the sectors 32 together in twos are located between the two lateral faces 32c of each of the two sectors 32 which they articulate together, and comprise two spindles 33a of the shouldered spindle type extending in the axial direction of the device 30, which are respectively attached in two facing connection ends of these sectors 32 via circumferential recesses 32d arranged in these ends (see Figures 2 and 6) and which are connected together by an articulated lug or pin 33b extending in the circumferential direction of the device 30.

More precisely, it is shown in Figure 3 that the recess 32d formed at each end of a sector 32 extends over a portion of the length of this sector 32 in its circumferential direction and over a middle portion of its axial width like a gulley, and that each recess 32d is delimited axially by two axial recess faces 32e both traversed by the spindle 33a attached to this end of a

sector 32. As can be seen in Figures 2 and 6, the two spindles 33a are respectively mounted in two through-holes 33c of the lug 33b and each traverse axially right through the corresponding end of a sector 32, via two axial through-housings 32f, 132f receiving each spindle 33a through this end
 5 of a sector 32, 132. It can be seen in Figures 1 and 6 that each of the two spindle housings 32f, 132f emerges both on an axial face 32e, 132e of a recess and on the lateral face 32c, 132c facing the sector 32.

As illustrated in all of Figures 1 to 6, the recess 32d which each of the two connection ends of a sector 32 has extends radially from the
 10 radially inner face of this sector 32 along a substantially rectangular axial section.

As illustrated in Figures 1 to 4 for the first embodiment of the invention according to which each sector 32 is surmounted by the protective coating 32a, the two recesses 32d of each sector 32 terminate radially at a
 15 distance from this coating 32a, thus being blind in the radial direction of the sector 32.

As illustrated in Figures 5 and 6 for the second embodiment of the invention according to which each sector 132 of the device 130 differs from each sector 32 according to the first embodiment only in that it is not
 20 surmounted by such a protective coating 32a, the two recesses or gulleys 132d of each sector 132 extend to the radially outer face of this sector 132, thus traversing in the radial direction of the latter. It will be noted that, according to this second embodiment, the connection means 33 are unchanged compared with those of the first embodiment of Figures 1 to 4.

25 To mount the flat-running device 30, 130 according to one or other of these two embodiments, the user advantageously proceeds in the following manner:

- the sectors 32, 132 are first inserted end-to-end and not connected together inside the tire casing 20;
- 30 - these sectors 32, 132 are placed facing one another inside the casing 20, both axially and radially as well as circumferentially,

- the sectors 32, 132 are connected together inside the casing 20 by assembling the connection means 33 (insertion of each lug 33b into the recesses 32d, 132d between two sectors 32, 132 and of the spindles 33a in the corresponding housings 32f, 132f, axially on either side of these recesses 32d, 132d),

- the two locking wedges 34 are positioned axially against these sectors thus connected and radially facing the spindles 33a in order to hold them in position when running,

- the flat-running device 30, 130 thus assembled is made to slide over the axially inner portion 10a of the bolted rim 10, then

- the axially outer portion 10b of this rim 10 is bolted to the portion 10a.

As indicated above, it will be noted that the sectors 32, 132 thus articulated can move reversibly relative to one another both axially and in mutual torsion, via the combined axial sliding and pivoting of the lug or pin 33b on the two spindles 33a and via the flexibility of the locking wedges 34, under the effect of lateral shearing or compression forces applied to the casing when running flat or in the inflated state.

The sectors 232 illustrated in Figure 7 are according to the second embodiment of the invention in that their facing terminal recesses 232d extend in a traversing manner in the radial direction of these sectors 232. The connection means 33 used for these sectors 232 consist of a lug 33b articulated on two spindles 33a as has just been described with reference to Figures 1 to 6, but also of a tooth-shaped male member 232A by which one of the male ends of each sector 232 terminates and which protrudes in the radially circumferential direction above the lug 33a while being capable of partially fitting into a female end 232B of the adjacent sector 232. It will be noted that this partially fitted male member 232A is thus visible from the radially outer face of the corresponding supporting structure 231.

The sectors 332 illustrated in Figure 8 are according to the first embodiment of the invention in that their facing terminal recesses 332d terminate at a distance from the radially outer face of these sectors 332

because of the substantially " π " shape of each end face of the sector 332 delimiting this recess 332d. The connection means 33 used for these sectors 332 consist of a lug 33b articulated on two spindles 33a as above, and also of a tooth-shaped male member 332A (of a lesser radial height than that of the visible member 232A) by which one of the male ends of each sector 332 terminates and which protrudes in the radially circumferential direction above the lug 33a while being capable of partially fitting into a female end 332B of the adjacent sector 332. It will be noted that this partially fitted male member 332A is therefore not visible from the radially outer face of the corresponding supporting structure 331.

The sectors 432 illustrated in Figure 9 also conform to the first embodiment of the invention and differ only from those of Figure 8 in that the basic structure of each sector 432 provided with a male member 432A fitted into the adjacent female end 432B is covered with a rubber-based coating 432a defining the radially outer face of the corresponding supporting structure 431.

The sectors 532 illustrated in Figure 10 are according to the second embodiment of the invention for the supporting structure 531 in that their facing terminal recesses 532d traverse in the radial direction of the sectors 532. The connection means 33' used for these sectors 532 consist of a flexible link 33b' for example consisting of a textile or metal cable which forms two loops (for example in the shape of a figure 8) articulated on two spindles 33a similar to those cited above, but also a tooth-shaped male member 532A similar to that of Figure 7 which partially fits into the female end 532B of the adjacent sector 532.

CLAIMS

1. Flat-running device configured to be fitted to a tubeless mounted assembly for a motor vehicle which comprises a wheel rim in several parts and a tire casing comprising beads mounted against edges of said rim, said device comprising:

- an annular supporting structure configured to be mounted around the rim for the purpose of supporting the casing, following a drop in inflation pressure inside the mounted assembly, and which is divided into at least two ring sectors in an arc of a circle suitable for forming said structure by juxtaposition in the circumferential direction, these sectors being articulated together in twos in this direction by connection means, and

- means for locking the beads against these edges which are configured to connect said annular supporting structure to these beads,

characterized in that said connection means are located between two lateral faces of each of the two sectors that they articulate together, and comprise two spindles extending in an axial direction of the device which are respectively attached in two facing connection ends of these sectors and which are connected together by an articulation extending in the circumferential direction of the device, said articulation consisting of at least one rigid lug with two through-holes or else of at least one flexible link with two loops, said or each lug or said or each link being articulated on these spindles by these two holes or loops, respectively.

2. The flat-running device according to Claim 1, characterized in that said locking means comprise a pair of one-piece annular wedges which are pressed axially on either side of said supporting structure and facing a radially inner zone of said supporting structure where said spindles are mounted so as to immobilize the latter inside the corresponding sectors.

3. The flat running device according to Claim 2, characterized in that each of said two wedges has a trapezoid-shaped axial section a small and large bases of which define respectively radially inner and outer surfaces of said locking means, each wedge consisting of rubber that is reinforced by a circumferential reinforcing element.

4. The flat-running device according to claim 1, characterized in that said spindles are formed of two spindles having shoulders which are respectively mounted in said two through-holes or loops of said articulation and which are attached inside the two corresponding articulated sectors.

5. The flat-running device according to claim 1, characterized in that one of the ends of each sector, or male end, terminates in a fitting male member which protrudes in the circumferential direction radially above said articulation and which is capable of partially fitting into a female end of the adjacent sector.

6. The flat running device according to Claim 4, characterized in that the articulated sectors are capable of moving reversibly relative to one another in the axial direction and in torsion about the circumferential direction via said locking means, under the effect of lateral shearing or compression forces applied to the casing when running flat or in the inflated state.

7. The flat-running device according to Claim 6, characterized in that each articulation, of rigid type and consisting of said at least one lug articulated on said spindles, is configured to slide axially and of pivoting on said spindles, so as to allow this reversible movement of the sectors thus articulated.

8. The flat-running device according to Claim 6, characterized in that each articulation of deformable type and consisting of said at least one flexible link articulated via said two loops on said spindle, such as at least one textile cable and/or one metal cable, is capable of moving on these spindles so as to allow this reversible movement of the sectors thus articulated.

9. The flat-running device according to claim 1, characterized in that the two ends of each sector are recessed over a substantially middle portion of their axial width so as to form, in each sector end, a recess which extends over at least a portion of the length of the sector in the circumferential direction and which is delimited axially by two axial recess faces both traversed by said spindle attached to this sector end.

10. The flat-running device according to Claim 9, characterized in that each spindle axially traverses right through the sector incorporating it, via an axial through-housing which is formed between each axial recess face and the lateral face facing this sector and which receives this spindle.

11. The flat-running device according to Claim 9, characterized in that said two recesses of the two respective connection ends of each sector extend radially from the radially inner face of this sector, each recess having a substantially rectangular axial section.

12. The flat-running device according to Claim 11, characterized in that said two recesses of each sector extend to the radially outer face of this sector, thus traversing in the radial direction of the latter.

13. The flat-running device according to Claim 11, characterized in that said two recesses of each sector terminate radially at a distance from the radially outer face of this sector, thus being blind in the radial direction of the latter, each sector optionally being surmounted by a rubber-based protective coating.

14. The flat-running device according to claim 1, characterized in that each of said sectors is made of a plastic or composite material.

15. A tubeless mounted assembly for a motor vehicle, comprising a wheel rim in several parts, a tire casing comprising beads respectively mounted against axially inner and outer edges of the rim, and a flat-running device mounted around the rim between said edges, characterized in that said flat-running device is as defined in claim 1.

16. The mounted assembly according to Claim 15, characterized in that said rim is of the two-part bolted type and has a substantially flat rim bottom.