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(54) A SELF-SUPPORTING VEHICLE TYRE

(71) We POLYAIR MASCHINENBAU Ges.m.b.H., an Austrian Company, of Kittsee, Burgenland, Austria, 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:—

The invention relates to a self-supporting vehicle tyre of the kind hereinafter referred to as the kind set forth comprising an outer ring constituting the tread, an inner ring which can be drawn over a rim or placed on a hub, and a cellular structure connecting the two rings, the cellular structure comprising cell walls that extend substantially parallel to the tyre axis.

Various known forms of vehicle tyres differ only with regard to details of construction but all have a very similar shape, which substantially corresponds to a hollow torus bounded on the interior by a rim bed. The reason is that tyres of this kind have carrying capacity only when the interior is filled with compressed air. The air is held either in the inner tube or, in the case of tubeless tyres, in a cavity sealed by the rim. As is known, such tyres are very susceptible to defects, which often have serious consequences, particularly at high speeds.

To obviate this disadvantage, tyres of the kind set forth, but which do not need to be filled with air, have already been proposed. It has been found, however, that the bearing members used in said tyres are not suitable for obtaining running properties similar to those of pneumatic tyres. It is desirable therefore to provide a vehicle tyre having tread properties which are similar to those of pneumatic tyres without having the associated disadvantages.

This desideratum is achieved according to the present invention by providing a tyre of the kind set forth, wherein the average wall thickness of the walls of a cell is less than a thirtieth of the tyre width at the position of the cell and the average cross-sectional area of the interior of a cell, expressed as a number of square centimetres, is less than a tenth of the tyre width at the position of the cell expressed as a number of centimetres.

The cell walls or interiors may be longitudinally frusto-conical and the cells may be sealed in an air-tight manner by lateral walls and the tyre may be filled with air. However, the air filling is only an extra feature. If the tyre leaks, the cell walls can continue to bear or guide the vehicle without difficulty.

The invention will be more fully understood from the following description given by way of example with reference to the embodiments shown in the figures of the accompanying drawing, in which:—

Figure 1 is a schematic partly in section of a tyre constructed according to the invention;

Figure 2 is a scrap section to a larger scale of the cell structure of the tyre of Figure 1;

Figure 3 corresponds to Figure 2, but shows another embodiment of the invention;

Figures 4, 5, 6 and 7 show various tyres according to the invention in radial section.

In the figures of the drawing, a tyre according to the invention comprises three elements—a cellular structure 1, an outer ring 2 constituting the tread and an inner ring 3. The cells 1 are firmly secured to the outer ring 2 and to the inner ring 3. The outer ring 2 corresponds to the tread region of a pneumatic tyre and can be constructed and profiled in similar manner to obtain good tread properties. In Figures 2 and 7, the outer ring 2 can also comprise a belt 21 constructed in the same manner as in pneumatic tyres. The inner ring is either drawn over a rim or secured to a wheel in another way.

Optionally, according to the invention, the three elements—the outer ring 2, the inner ring 3 and the cells 1—can be made simultaneously of the same material, as shown e.g. in Figure 3. In this embodiment the inner ring 3 is formed by suitably thickening the walls of cells 1 forming the inner periphery of the tyre.

Alternatively, to obtain optimum properties of each of the three elements 1, 2 and 3, the elements can be made of different materials. In a tyre of the invention, for example, the tread 2 can be made of rubber having a high frictional coefficient and high

resistance to wear, whereas the cells of the cellular structure are made of resilient, resistant material such as polyurethane and the inner ring is the metal ring of the wheel. Elements 1, 2 and 3 are manufactured separately and then joined together by a suitable known process, e.g. chemically by suitable adhesives.

Figure 2 shows a construction in which the cells of the cellular structure have a substantially square or rectangular diamond like cross-section. In the embodiment in Figure 3, the cell cross-section is hexagonal. In both cases the cross-sectional area A of a cell has a numerical value in square centimetres that is less than a tenth of the width of the tyre where the width is measured at the same radial distance as the cell. Accordingly, a tyre having a width at a particular radial distance of 16.5 cms will have at that position a cell structure of a cross-sectional area of an individual cell expressed in square centimetres that is less than 1.65 cm^2.

In Figure 2, a belt 21 is embedded in the outer ring by means of projections 14^1 which project beyond the cell structure.

In Figure 4, the cell walls 10 are frusto-conical in form. The frusto-conical shape is such that the walls are thickest in the middle of the tyre and taper toward each end. The taper of the wall is relatively small but sufficient to facilitate removal of the tyre from the mould during the manufacture of the tyre. In addition, the tyre becomes self-cleaning owing to the frusto-conical shape of the cell interiors.

The thinnest part S of the cell walls 10 is less than a thirtieth of the tyre width B. As a result of these relative dimensions, the tyre has resilience and tread properties equal to those of good pneumatic tyres.

Figure 5, shows a variant of the tyre in Figure 4, in which a central wall 11 is inserted.

In the embodiments in Figures 6 and 7, the cells are sealed in air-tight manner by lateral walls 12, 13 respectively. The cells are connected by openings 14, 15 respectively and can therefore be filled with air by providing a suitable valve (not shown), as used e.g. in tubeless pneumatic tyres.

In the embodiment in Figure 6, the tyre has two symmetrical rings of cells, the space between them forming the connecting opening 14.

Figure 7 shows an embodiment of a tyre for heavy vehicles providing with double tyres in conventional manner. In this embodiment the cell structure consists of three rings, the outer two rings being closed by the lateral walls 13. In order substantially to eliminate damage to the lateral walls, they are inset a small distance $d1$. The tyre is provided with a belt 21.

WHAT WE CLAIM IS:—

1. A self-supporting vehicle tyre of the kind set forth, wherein the average wall thickness of the walls of a cell is less than a thirtieth of the tyre width at the position of the cell and the average cross-sectional area of the interior of a cell, expressed as a number of square centimetres is less than a tenth of the tyre width, at the position of the cell expressed as a number of centimetres.

2. The vehicle tyre according to claim 1, wherein the cells have the form of a honeycomb cell.

3. The vehicle tyre according to claim 1 or claim 2, wherein the cell walls or interiors are longitudinally frusto-conical.

4. The vehicle tyre according to claim 1, 2 or 3, wherein the cells are sealed in air-tight manner by lateral walls and the tyre can be filled with air.

5. The vehicle tyre according to claim 4, wherein there are at least two rings of cells, separated from one another in the axial direction of the tyre.

6. The vehicle tyre according to claims 4 and 5, wherein the lateral walls are offset inwardly, and the cell walls project beyond the lateral walls.

7. A vehicle tyre constructed and arranged substantially as described and shown in Figures 1, 2, 4, 5, 6 and 7.

8. A vehicle tyre constructed and arranged substantially as described and shown in Figures 1, 3, 4, 5, 6 and 7.

For the Applicants:
F. J. CLEVELAND & COMPANY,
Chartered Patent Agents,
40/43 Chancery Lane,
London WC2A 1JQ.

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1583272 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG.1

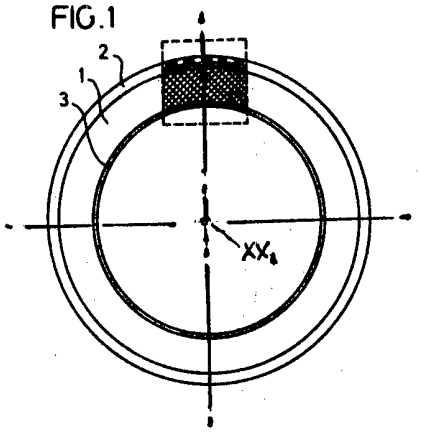

FIG.2

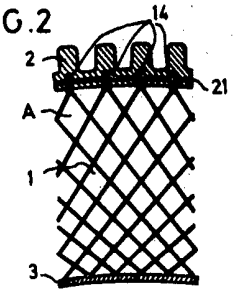

FIG.3

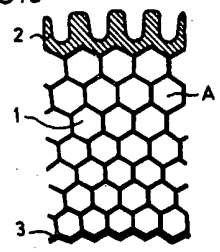

FIG.4

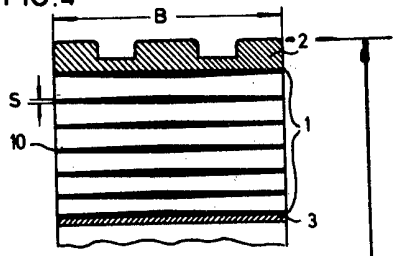

FIG.5

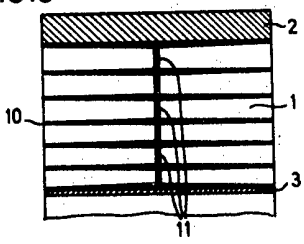

FIG.6

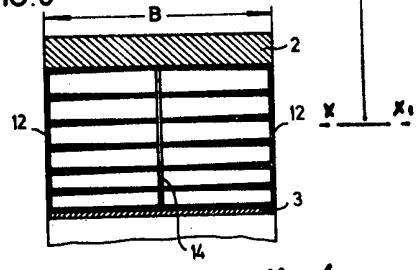

FIG.7