Pneumatic tyred vehicle wheel and method for adjusting the tyre pressure.

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Description

This invention relates, in a first aspect, to a pneumatic tire wheel for vehicle and, in a second aspect, to a method of adjusting tire pressure; the invention relates also to a vehicle including such wheels and making use of such method.

In the technical field of pneumatic tires for vehicles, there are two major requirements to be met. Firstly, the tire should be prevented from deflating rapidly on the occurrence of a tire blowout or puncture; secondly, the inflation pressure of pneumatic tires should be made adjustable in as automated a manner as possible even with the vehicle running.

To meet the first-noted requirement, the prior art provides pneumatic tires with inflation chambers into which substances can be introduced or released which can stop any minor leaks developed in the tire while the vehicle is running. Examples of such wheels are disclosed in US Patents No.s 3,910,334 and 4,130,144.

However, proper performance of the measures described therein is subordinate to the tire becoming at least partly deflated, and is limited to but very small leaks.

Accordingly, such prior measures cannot perform successfully during the initial stage of the tire deflation, irrespectively of how fast the deflation rate may be, and may prove inadequate even during the final deflation stage if the leak is a serious one.

Inasmuch as, from the standpoint of safety, preventing the tire from deflating at such a fast rate as to cause sudden and uncontrollable skidding of the vehicle has priority of concern over preventing the tire from reaching a flat condition, the measures provided by the prior art cannot be regarded as fully satisfactory.

An improvement in this technology is disclosed by Italian Patent No. 1054139, filed on July 30, 1973 in the name of Dunlop Ltd. This prior patent provides for the leak stopping substances to be additivated with a volatile liquid mixture susceptible to be vaporized by the heat generated within the tire as a result of its running in a deflated condition.

Such volatile liquids are effective to create within the punctured tire pressure conditions which are acceptable at least for short distance running. The effect is brought about, of course, by the leak being stopped by the leak stopping substances.

A first technical solution proposed is of introducing that mixture of liquids in a free state unrestrictedly into the tire inflation chamber. It is recognized, however, in the patent itself, that such an approach results unavoidably in the wheel balance being affected. Alternatively, it is suggested that the mixture be stored in a purposely provided means and released into the inflation chamber on the tire deflating.

Thus, having rejected the use of free liquids in the inflation chamber, also the measures suggested in that patent can only become effective after the punctured tire has become fully deflated.

A pneumatic tire wheel for vehicles is disclosed by DE-A-2902836, which corresponds to the preamble of claim 1, in which a two-phase system, possibly scattered in a spongy matrix and included within a closed bladder, is inserted in the tire chamber. Upon puncture, the tire tends to deflate, thus causing an increase in the amount of heat produced by hysteresis of the tire rubber; such heat increases the pressure and volume of the two phase system, thereby compensating lost air.

The second-mentioned requirement in the foregoing is expressed by the improved performance of wheels, in terms of traction, tire wear, travel speed, and distribution of the load over a yielding roadbed, in dependence on the inflation pressure.

As is known, for instance, in driving from an asphalt course to a sandy, muddy, snow-covered, or otherwise yielding surface, it is highly recommended that the inflation pressure of the wheel tires be decreased to enhance the tire traction and bearing surface on the ground. This is a need which is felt particularly by military, agricultural, and racing vehicles, on account of such vehicles being liable to encounter frequent changes in the nature of the roadbed.

To fill this demand, the prior art proposes complex vehicle-mounted systems whereby compressed air can be supplied to the inflation chamber of each tire even while the vehicle is running. Such systems generally include compressed air ducts which extend through the wheel hubs.

Typical examples of such prior devices are described in European Patents No.s 0071278 and 164017.

Additionally to their highly complex construction, a major drawback of such systems is that a satisfactory seal is difficult to accomplish at the rotary fits provided in the duct paths through the wheel hub.

Such drawbacks have largely frustrated even small-scale attempts to install such systems on vehicles for normal use. Further, the components of said systems considerably burden the vehicle weight and cost.

The problem at the basis of this invention, which is to prevent quick deflation of a punctured tire and to allow adjustments of the tire pressure while the vehicle is running, is solved by a pneumatic tire wheel according to claim 1.

The invention features and advantages will be more clearly understood from the following detailed description of a preferred, but not exclusive, em-
bodiment thereof, to be taken in conjunction with the accompanying drawings, where:

Figure 1 is a sectional view showing in schematic form a pneumatic tire wheel for vehicles embodying this invention;

Figure 2 shows in a block diagram the components provided, according to the invention, for a vehicle for adjusting the inflation pressure of the pneumatic tire wheel in Figure 1;

Figure 3 is a block diagram of a detail of the wheel shown in Figure 1; and

Figure 4 is an enlarged scale detail view of the wheel shown in Figure 1.

In Figure 1, a pneumatic tire wheel for vehicles, generally designated R, is shown to comprise a pneumatic tire 1, known per se, which is mounted to a rim 15. Between the tire 1 and the rim 15, there is defined a tight sealed chamber 2 into which compressed air is normally introduced through an inflation valve 16 affixed to the rim 15.

Two parallel flanges 15a,b extend from the rim 15 to the interior of the chamber 2. An impermeable, elastically deformable envelope 3 is secured on said flanges 15a,b in a tight manner by means of backing flanges 5.

The envelope 3 is formed preferably from a laminated material including a foil of aluminum or an alloy thereof.

Said envelope 3 borders, with the flanges 15a,b and the rim 15, a continuous toric bladder generally indicated at 4.

The bladder 4 contains a two-phase system, such as a volatile liquid in a balanced state with its own vapor at the temperature and inflation pressure of the tire 1, or alternatively, a solid capable of sublimating significantly under said temperature and pressure conditions.

Preferably, a fluid is employed, such as a mixture of water and alcohol, having a boiling temperature within the range of 50 °C to 100 °C at atmospheric pressure.

The fluid would be distributed through a spongy matrix 44, best shown in Figure 4, which is formed from a heat conductive polymeric material such as polypropylene.

The spongy matrix 44, there are defined plural voids 43 adapted to accommodate the volatile liquid in free form and/or in the form of tiny sealed vesicles, each having an elastically deformable envelope 45.

A peltier-effect thermoelectric element 6, in strip form, extends inside the bladder 4 in thermal contact with the rim 15 of the wheel R. The thermoelectric element 6 is supplied with a DC current and provides a temperature differential across it which results in a transfer of heat between the rim 15 and the bladder 4. By reversing the supply polarity to the thermoelectric element 6, the flow of heat is reversed, or from the toric bladder 4.

When the flow of current through the thermoelectric element 6 is such as to heat the toric bladder 4, some of the volatile liquid contained therein is caused to change its state, thereby the bladder is expanded and the inflation pressure of the tire 1 increased. On reversing the flow of current through the thermoelectric element 6, thereby the bladder 4 becomes cooler, partial condensation of the volatile liquid contained therein is produced causing its volume to decrease. The inflation pressure of the tire 1 will be reduced accordingly.

The thermoelectric element 6 is connected, via a cable 7, to an electronic unit 8. Connected to that same unit 8 is also a pressure transducer 9 via a cable 10.

The unit 8 and thermoelectric element 6 are powered via first and second electromagnetic couplers, respectively an emitting one 11 and receiving one 12, which are mounted at corresponding locations on the vehicle 14 and the rim 15, respectively.

With reference to Figure 2, on the vehicle 14, and preferably the dashboard thereof, there is provided a set 19 of four key switches with light indicators; associated with the set 19 are two additional key switches indicated at 17 and 18, respectively, and a digital display 20.

The switches 17-19 and display 20 are connected electrically in an electronic circuit, schematically indicated at 21.

Said switches 17-19 enable pressure values to be selected, set, and displayed on the display 20, both individually for each wheel R of the vehicle 14 and for groups of wheels R. As an example, in the instance of a four-wheeled vehicle, to change the inflation pressure of the front right wheel, one should depress the keys A and DX in the key set 19 simultaneously, thereby displaying on the display 20 the value of a previously set pressure, and depress either the key 17 or 18 to get a lower or higher pressure value, respectively. By depressing at one time the keys A and P in the key set 19, simultaneous setting is selected of the same pressure value for all four vehicle wheels R.

The newly set pressure value is stored in the electronic circuit 21 upon releasing the key switches 17-19.

Also installed on the vehicle 14 is an oscillator 22 for setting a required carrier for the electromagnetic couplers 11 and 12, as well as a quadruple modulator 23 for modulating the carrier set by the oscillator 22, and a quadruple power driver 24 supplying the emitting electromagnetic couplers 11 related to each wheel.

The electronic circuit 21, whose wiring diagram is not shown because unrelated to this invention, includes a non-volatile memory in which the pres-
sure values set by means of the switches 17-19 are stored. It further drives the displaying of the pressure values on the display 20, sets the control modulation to the quadruple modulator 23, and controls warning signals as follows. The driver 24 includes a circuit for monitoring the power absorbed by each wheel: where the power is below a predetermined minimum, a warning signal is supplied to the electronic circuit 21 on a link 25. Failure of the driver 24 or of a connection or of one or more of the emitting couplers 11 or a malfunction in the adjustment of a tire inflation pressure, all result in a decreased electric power absorption, and hence, in an alert situation.

In an alert situation, the electronic circuit 21 would drive the pair of switches 19 which correspond to the alerted wheel(s) to flash on.

With reference to Figure 3, the receiving electromagnetic coupler 12 receives the modulated power carrier by the desired pressure value set. Indicated at 31 is a power supply to the electronic unit 8 which, by rectifying the power carrier, will supply DC current at the required voltage.

At 32 there is indicated a means, known as, of demodulating the power carrier to derive a signal which is proportional to the pressure value sought for a corresponding wheel R.

Indicated at 33 is a power supply effective to derive a DC current from the power carrier to power the Peltier-effect thermoelectric element 6.

Indicated at 34 is a polarity changeover switch associated with the thermoelectric element 6 to change over its supply polarity, and therefore, reverse the flow of current therethrough depending on whether heat is to be delivered to or subtracted from the toric bladder 4. It further functions as a power sink through the rim 15 in the event that no change is required in the inflation pressure of the tire 1.

The changeover switch 34 serves the additional function of disconnecting the absorption of electric power in the event of a malfunction occurring in the apparatus associated therewith, or where the pressure setting for the corresponding wheel R is impossible to achieve.

Indicated at 36 is an electronic control-adjustment circuit. The reference numeral 37 denotes a signal processor associated with the pressure transducer 9.

The inflation pressure value set in the memory of the electronic circuit 21 is demodulated by the means 32 and supplied to the electronic circuit 36 over a link 39. The actual pressure value of the tire as detected by the pressure transducer 9 is passed to the electronic circuit 36 via a link 40.

Through a link 41, the electronic control-adjustment circuit 36 drives the polarity changeover switch 34 and through it the Peltier thermoelectric element 6 to either heat or cool the volatile liquid contained in the toric bladder 4, or to keep its heat contents unchanged.

Through a link 42, the electronic control-adjustment circuit 36 warns the polarity changeover switch 34 of any alert situations arising from a malfunction, as recognized through a diagnostic cycle, or from the impossibility to achieve the set pressure value. In the instance of the tire being punctured the condition of a pressure setting being impossible to achieve is communicated as warning signal to the electronic circuit 21 on the vehicle 14, and through that circuit, reported to the vehicle dashboard.

Under normal temperature and pressure conditions, relatively to the inflating specifications for the tire 1, the toric bladder 4 expansion would be average, to provide for corresponding increases or decreases of the tire inflation pressure as its volume increases or decreases.

An electric signal which is proportional to the inflation pressure value detected by the pressure transducer 9 is supplied to the electronic circuit 36 from the unit 8. If the value signified by the transducer 9 corresponds to the setting in the memory of the electronic circuit 21, then the heat contents of the two-phase system is left unaltered. If a difference is found between such values, the thermoelectric element 6 is energized through the polarity changeover switch 34 to either heat or cool the two-phase system until such a difference is brought to zero.

As is known, the balance condition in the presence of saturated vapor of the two-phase system is a function of its temperature and pressure conditions. Accordingly, by delivering heat to the two-phase system, this balance condition is upset and partial vaporization of the liquid or solid phase caused until a new balance condition is struck.

This results in the toric bladder 4 being expanded and the inflation pressure of the tire 1 being increased accordingly.

Conversely, if heat is subtracted from the two-phase system, partial condensation of the vapor phase will result to bring about a consequent decrease of the toric bladder 4 volume and ultimate decrease of the tire inflation pressure.

On the occurrence of a puncture to the tire, the inflation pressure in the tight chamber would drop suddenly. Within a very short time, some of the two-phase system would be vaporized to produce a new balance condition to suit the change in pressure.

The pressure drop is also detected by the transducer 9, which would control the thermoelectric element 6 to turn on and deliver heat to the two-phase system.
If, after a predetermined time period, it is found that the inflation pressure cannot be restored within the wheel R as preset through the switches 17-19, then the electronic circuit 21 turns on the flashing feature of the set of switches 19 which correspond to the damaged wheel.

In all cases, the punctured tire deflation rate is slowed up considerably by virtue of the partial pressure compensation provided by the increased volume of the toric bladder 4.

The pneumatic tire wheel of this invention has several additional advantages over conventional like wheels. For example, by subjecting the two-phase system to a pressure increase, some of the vapor will condense and temporarily issue heat which raises the temperature of the pressurized air within the tight chamber. However, the air would expand very little for a temperature change of but few degrees.

This affords improved absorption of the shocks, for example, from the road surface, thus improving also the vehicle running comfort. In fact, once the shock load is removed, the heat energy stored up in the pressurized air will flow back into the bladder to restore the former pressure condition.

Further, by measuring the power input devoted to maintaining a desired pressure within a tire, any alterations occurring to the tire may be detected which could result in a sharp change of the inflation pressure.

Additional advantages are afforded on the occurrence of a tire puncture or blowout. The liquid contained in the toric bladder and/or the sealed vesicles through the spongy matrix would then be vaporized and retard the deflation process. At the same time, the alert situation would be monitored from the vehicle dashboard, and heat added to the two-phase system in order to increase its vapor content and further retard the tire deflation.

Even in the instance of the toric bladder being punctured can the wheel of this invention retain some of its performance by virtue of the sealed vesicles scattered through the spongy matrix and of the heat-conducting properties of the latter.

It is important to observe, moreover, that despite the many advantages afforded by the wheel of this invention, it can be particularly light in weight.

**Claims**

1. A pneumatic tire wheel for vehicles, comprising a pneumatic tire (1) so mounted to a tire rim (15) as to define a tight sealed chamber (2) for inflating said tire (1), at least a sealed elastically deformable toric bladder (4) mounted to the rim (15) of said tire wheel within said tight chamber (2), a predetermined amount of a two phase system, particularly a volatile liquid, introduced into said toric bladder (4), said two phase system being in a substantially saturated vapor balance state at the temperature and inflation pressure of said tire, an increase of temperature of the two phase system resulting in the bladder (4) being expanded and the inflation pressure of the tire being increased accordingly, characterized by comprising a thermoelectric element (6) for selectively increasing and/or decreasing the temperature of the two-phase system.

2. A pneumatic tire wheel according to claim 1, comprising a spongy matrix (44) within said bladder (4), said two-phase system being at least partly scattered through said spongy matrix (44).

3. A pneumatic tire wheel according to claim 2, comprising a plurality of sealed, elastically deformable vesicles (45) containing said two-phase system and being scattered through said spongy matrix (44).

4. A pneumatic tire wheel according to claim 2 or 3, wherein said spongy matrix (44) is made of a heat conductive polymeric material.

5. A pneumatic tire wheel according to claim 4, wherein the heat conductive material of the spongy matrix (44) is polypyrrol.

6. A pneumatic tire wheel according to claim 1, wherein said thermoelectric element for selectively increasing and/or decreasing the temperature of the two-phase system is a Peltier-effect thermoelectric element (6).

7. A pneumatic tire wheel according to claim 6, wherein said Peltier-effect thermoelectric element (6) is mounted to the rim (15) under mutual heat transfer conditions within said bladder (4).

8. A vehicle characterized in that it comprises a plurality of wheels (R) according to one or more of the preceding claims.

9. A vehicle according to claim 8, characterized in that it comprises, for each wheel, first and second electromagnetic couplers (11, 12) mounted on the vehicle and the wheel (R), respectively, for powering said thermoelectric element (6).

10. A vehicle according to claim 9, characterized in that it comprises:
a pressure transducer (9) associated with
the inflation chamber (2) of each wheel (R) and
adapted to generate a signal proportional to
the value of the pressure within said inflation
chamber (2),

a means (21) of storing a desired pressure
value for each wheel (R),
an oscillator (22) adapted to generate a
carrier and connected to said first electromagnetic
coupler (11),
a modulator (23) for modulating said car-
rier according to the stored pressure value,
a polarity changeover switch (34) associ-
ated with said thermoelectric element, and
an electronic circuit (36) mounted to the
wheel (R), connected to the pressure trans-
ducer (9), second electromagnetic coupler
(12), and polarity changeover switch (34), and
adapted to demodulate the carrier induced in
the second electromagnetic coupler (12) to de-
rive a signal proportional to the stored pres-
sure value, compare said signal with the value
generated by the pressure transducer (9), and
drive said polarity changeover switch (34) ac-
cording to the difference between the signals
so compared.

11. A method of adjusting the inflation pressure of
a pneumatic tire wheel according to one or
more of the claims 1 to 7, characterized in that
said pressure adjusting function is accom-
plished by changing the heat content of the
two phase system so as to change its con-
dition of saturated vapor balance at the tire
temperature and inflation pressure.

Patentansprüche

1. Luftreifenrad für Fahrzeuge mit einem Luftrei-
fen (1), der so auf einer Felge (15) montiert ist,
daß er eine fest abgedichtete Kammer (2) zum
Aufblasen des Luftreifens (1) bildet, minde-
stens einem abgedichteten, elastisch verform-
baren torischen Balg (4), welcher auf der Felge
(15) innerhalb der Kammer (2) montiert ist,
einer vorbestimmten Menge eines
Zweiphasen-Systems, vorzugsweise einer
flüchtigen Flüssigkeit, welche in den torischen
Balg (4) eingebracht ist, wobei das
Zweiphasen-System bei Temperatur und Auf-
blasdruck des Reifens in einem ausgegele-
sten Zustand gesättigten Dampfs ist und eine
Erhöhung der Temperatur des Zweiphasen-Sy-
tems zu einer Ausdehnung des Balges (4)
und einer entsprechende Erhöhung des Auf-
blasdruckes des Reifens führt, dadurch ge-
kennzeichnet, daß ein thermoelektrisches
Element (6) zum wahlweisen Erhöhen und/
or Vermindern der Temperatur des
Zweiphasen-Systems vorgesehen ist.

2. Luftreifenrad nach Anspruch 1 mit einem
Schwammkörper (44) in dem Balg (4), wobei
das Zweiphasen-System mindestens teilweise
über den Schwammkörper (44) verteilt ist.

3. Luftreifenrad nach Anspruch 2 mit mehreren
abgedichteten, elastisch verformbaren Blasen
(45), welche das Zweiphasen-System enthalten
und über den Schwammkörper (44) verteilt
sind.

4. Luftreifenrad nach Anspruch 2 oder 3, bei dem
der Schwammkörper (44) aus einem wärmelei-
tenden Polymermaterial besteht.

5. Luftreifenrad nach Anspruch 4, bei dem das
wärmeleitende Material des Schwammkörpers
(44) Polypyrrol ist.

6. Luftreifenrad nach Anspruch 1, bei dem das
thermoelektrische Element zum wahlweisen Er-
höhen und/oder Vermindern der Temperatur
des Zweiphasen-Systems ein nach dem
Peltier-Effekt arbeitendes thermoelektrisches
Element (6) ist.

7. Luftreifenrad nach Anspruch 6, bei dem das
nach dem Peltier-Effekt arbeitende thermoelek-
trische Element (6) an der Felge (15) unter
wechselseitigen Wärmeübergangsbedingun-
gen innerhalb des Balges (4) montiert ist.

8. Fahrzeug, dadurch gekennzeichnet, daß es
mehrere Räder (R) aufweist, die nach einem
der vorangehenden Ansprüche ausgebildet
sind.

9. Fahrzeug nach Anspruch 8, dadurch gekenn-
zeichnet, daß
für jedes Rad erste und zweite elektromagneti-
sche Koppler (11, 12) jeweils am Rad (R) und
am Fahrzeug zur Energieversorgung des ther-
moelektrischen Elementes (6) vorgesehen
sind.

10. Fahrzeug nach Anspruch 9, dadurch gekenn-
zeichnet, daß es umfaßt:
eden Druckgeber (9), welcher der Aufblaszam-
mer (2) jedes Rades (R) zugeordnet und dazu
errichtet ist, ein Signal proportional dem
Druck innerhalb der Aufblaszammer (2) zu er-
zeugen,
Mittel (21) zum Speichern eines gewünschten
Druckwertes für jedes Rad (R),
einen Oszillator (22), welcher zum Erzeugen
Verfahren zum Einstellen des Aufblasdruckes eines Luftreifenrades nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß die Druckeinstellfunktion durch Verändern des Wärmehaltes des Zweiphasen-Systems bewerkstelligt wird, um seinen ausgeglichenen Dampfsättigungszeitstand bei der Reifentemperatur und dem Aufblasdruck zu verändern.

Revendications

1. Roue à pneumatique pour véhicule, composant un bandage pneumatique (1) monté sur une jante de roue (15) de façon à définir une chambre étanche fermée (2) pour gonfler le pneu (1), au moins une vessie torique fermée élastiquement déformable (4) montée sur la jante (15) de ladite roue à pneumatique à l’intérieur de la chambre étanche (2), une quantité prédéterminée d’un système à deux phases, particulièrement un liquide volatile, étant introduit dans ladite vessie torique (4), le dit système à deux phases étant à un état d’équilibre de vapeur pratiquement saturée à la température et à la pression de gonflage dudit pneumatique, une augmentation de la température du système à deux phases ayant pour résultat que la vessie torique (4) est dilatée et que la pression de gonflage du pneu est par suite accrue, caractérisée en ce qu'elle comprend un élément thermoélectrique (6) pour augmenter et/ou diminuer sélectivement la température du système à deux phases.

2. Roue à pneumatique selon la revendication 1, comprenant une masse spongiguese (44) à l'intérieur de ladite vessie torique (4), le dit système à deux phases étant au moins partiellement dispersé à travers ladite masse spongiguese (44).

3. Roue à pneumatique selon la revendication 2, comprenant une pluralité de vessies fermées élastiquement déformables (45) contenant le dit système à deux phases et étant dispersées à travers ladite masse spongiguese (44).

4. Roue à pneumatique selon la revendication 2 ou 3, dans laquelle ladite masse spongiguese (44) est constituée d’un matériau polymère conducteur de la chaleur.

5. Roue à pneumatique selon la revendication 4, dans laquelle le matériau conducteur de la chaleur de la matrice spongiguese (44) est du polypyrrol.

6. Roue à pneumatique selon la revendication 1, dans laquelle le dit élément thermoélectrique pour augmenter et/ou diminuer sélectivement la température du système à deux phases est un élément thermoélectrique à effet Peltier (6).

7. Roue à pneumatique selon la revendication 6, dans laquelle le dit élément thermoélectrique à effet Peltier (6) est monté sur la jante (15) dans des conditions de transfert mutuel de chaleur à l’intérieur de ladite vessie torique (4).

8. Véhicule caractérisé en ce qu'il comprend une pluralité de roues (R) selon une ou plusieurs revendications précé dentes.

9. Véhicule selon la revendication 8, caractérisé en ce qu'il comprend pour chaque roue, des premier et second couplages électromagnétiques (11, 12) montés sur le véhicule et sur la roue (R), respectivement, pour alimenter le dit élément thermoélectrique (6).

10. Véhicule selon la revendication 9, caractérisé en ce qu'il comprend : un transducteur de pression (9) associé à la chambre à air (2) de chaque roue (R) et prévu pour produire un signal proportionnel à la valeur de la pression à l'intérieur de ladite chambre à air (2), un moyen (21) pour mémoriser une valeur de pression désirée pour chaque roue (R), un oscillateur (22) prévu pour produire une onde portée et connecté audit premier couplage électromagnétique (11), un moduleur (23) pour moduler ladite onde portée conformément à la valeur de pression...
mémorisée,
un commutateur de polarité (34) associé
à l'élément thermoélectrique, et
un circuit électronique (36) monté sur la
roue (R) connecté au transducteur de pression
(9), au second coupleur électromagnétique (12)
et au commutateur de polarité (34), et prévu
pour démoduler la porteuse induite dans le
second coupleur électromagnétique (12) pour
obtenir un signal proportionnel à la valeur de
pression mémorisée, pour comparer le signal à
la valeur produite par le transducteur de pres-
sion (9) et pour actionner le commutateur de
polarité (34) conformément à la différence en-
tre les signaux ainsi comparés.

11. Procédé pour régler la pression de gonflage
d'une roue à pneumatique selon uns ou plu-
sieurs des revendications 1 à 7, caractérisé en
cette opération d'ajustement de la
pression est accomplie en changeant la teneur
en chaleur du système à deux phases de
façon à changer sa condition d'équilibre à
tulpe saturée à la température et à la pres-
sion de gonflage du pneu.