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COMMONWEALTH OF AUSTRALIA
Patents Act 1952

PATENT

Declaration in Support of an Application for a Patent

*Strike out for non-convention

In support of the *Convention** application made for a patent ~~patent of addition~~ for an invention entitled
INFLATION PRESSURE MONITOR FOR VEHICLE TYRES

Insert full name and address of declarant

I, We, Ralf Holger Behrens and Horst Wierspecker
of P.O. Box 10 60 50, D-7000 Stuttgart 10, Federal Republic of Germany

do solemnly and sincerely declare as follows:

1. ~~I am~~ / ~~We are~~ ~~the applicant(s) for the patent~~ / ~~patent of addition~~
(or in the case of an application by a body corporate)
1. ~~I am~~ / We are authorised by ROBERT BOSCH GMBH
the applicant for the patent / patent of addition to make this declaration on its behalf.

*Strike out Para. 2 for non-convention

2. The basic application(s) as defined by section 141 of the Act is / ~~are~~ —

Filing Date	Country	Applicant(s)
30th January 89	Red.Rep.ofGermany	Robert Bosch GmbH

Insert details for the/or EACH basic application

Strike out Para. 3 for non-convention

3. The basic application(s) referred to in this Declaration was / ~~were~~ the first application(s) made in a Convention country in respect of the invention the subject of the application.

4. ~~I am~~ / ~~We are~~ ~~the actual inventor(s) of the invention.~~
(or, where a person other than the inventor is the applicant:)

Insert full name(s) and address(es) of inventor(s)

4. Hettich, Gerhard
of Martin-Renz-Straße 8
D-8501 Dietenhofen
Federal Republic of Germany

is / are the actual inventor(s) of the invention and the facts upon which the applicant is entitled to make the application are as follows:

Applicant is a person who would, if a patent were granted upon an application made by the said inventor(s), be entitled to have the said patent assigned to it.

See over for instructions

ROBERT BOSCH GMBH

DECLARED AT Stuttgart

this 8th day of March 19 91

No Legalization
No Corporate Seal

Signature of Declarant

To: The Commissioner of Patents.

(12) PATENT ABRIDGMENT (11) Document No. AU-B-43256/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 623442

(54) Title
INFLATION PRESSURE MONITOR FOR VEHICLE TYRES

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(56) Prior Art Documents
DE 3741129
DE 3243854
AU 41863/78 B60C 23/04

(57) Claim

1. Tyre-pressure monitor for vehicles, comprising a pressure switch which is to be fixed to the periphery of the wheel rim of vehicle wheels radially to the wheel axis, is to be actuated by the tyre pressure and has a reference-pressure chamber which is closed off by an electrically conductive diaphragm facing said tyre which is arranged parallel to the tread of the tyre and carries an additional mass provided for increasing the switching threshold as a function of speed, and a contact which is inserted in an electrically insulated manner into the reference-pressure chamber and against which, when air pressure in the tyre is sufficient, a contact area at the centre region of the diaphragm bears for closing an electric circuit, in which arrangement the state of the electric circuit is to be monitored in a cordless manner by a receiver fixed to the vehicle and having an analysing circuit, said additional mass is applied on at least one surface of said diaphragm and said additional mass is made of a material whose modulus of elasticity is less than 1/10th of the modulus of elasticity of the diaphragm.

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INTERNATIONALE ANMELDUNG VEROFFENTLICHT NACH DEM VERTRAG UBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT)

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(81) Bestimmungsstaaten: AT (europäisches Patent), AU, BE (europäisches Patent), CH (europäisches Patent), DE (europäisches Patent), FR (europäisches Patent), GB (europäisches Patent), IT (europäisches Patent), JP, KR, LU (europäisches Patent), NL (europäisches Patent), SE (europäisches Patent), US.

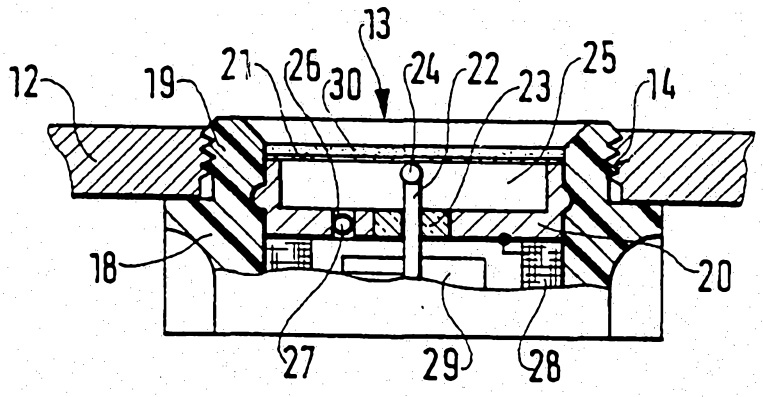
Veröffentlicht
Mit internationalem Recherchenbericht.

(54) Title: INFLATION PRESSURE MONITOR FOR VEHICLE TYRES

(54) Bezeichnung: REIFENDRUCKÜBERWACHER FÜR FAHRZEUGE

(57) Abstract

An inflation pressure monitor for vehicle tyres (13) comprises a pressure switch attached radially with respect to the axletree to the circumference of the rim (12) of a vehicle wheel. The pressure switch comprises a reference pressure chamber (20) which is sealed on the tyre side by an electrically conductive membrane (21). In order to close the circuit, the membrane (21) is compressed when the tyre pressure on a contact pin (22) arranged in an insulated manner in the reference pressure chamber (20) is sufficient. In order to obtain a precise, speed-dependent increase in the switching threshold, the membrane (21) which is free on the tyre side is provided with a supplementary elastic material (30) which is spread on one side of the membrane and which has a modulus of elasticity less than one tenth of the modulus of elasticity of the membrane (21).



(57) Zusammenfassung

Es wird ein Reifendrucküberwacher (13) mit einem am Umfang der Radfelge (12) von Fahrzeugrädern radial zur Radachse zu befestigenden Druckschalter vorgeschlagen, der aus einer Referenzdruckkammer (20) besteht, die zum Reifen hin von einer elektrisch leitenden Membran (21) abgeschlossen ist. Zur Schließung eines Stromkreises wird die Membran (21) bei ausreichendem Reifendruck auf einen in die Referenzdruckkammer (20) isoliert eingesetzten Kontaktstift (22) gedrückt. Zur Erzielung einer definiert bestimmbaren geschwindigkeitsabhängigen Anhebung der Schaltschwelle ist die zum Reifen hin freie Membran (21) mit einer elastischen Zusatzmasse (30) versehen, die auf einer Membranseite flächig aufgebracht ist und deren Elastizitätsmodul im Verhältnis zu dem der Membran (21) kleiner als ein Zehntel ist.

Prior Art

The invention relates to a tyre-pressure monitor for motor vehicles.

For high vehicle speeds of over 160 km/h, tyre and vehicle manufacturers specify increased tyre pressures in order to guarantee driving safety. If it is desired to make allowance for this, the switching threshold of the pressure switch fixed to the wheel must be set to the maximum pressure required. This leads to a loss in comfort at low speeds (German Offenlegungsschrift 3,243,845). If allowance is not made for this and the tyre-pressure sensor is set to the tyre pressure specified in the lower speed range at full load, at high speeds the requisite higher tyre pressure will not be monitored, but on the contrary a safety which is absent will be falsely indicated by the tyre-pressure monitoring device.

It is known from German Offenlegungsschrift 2,626,475 to provide the diaphragm of the reference-pressure chamber of a tyre-pressure monitor with a solid piston against whose end face the tube of the tyre to be monitored bears and which, when air pressure in the tyre is sufficient, presses in the diaphragm against the pressure in the reference-pressure chamber to such an extent that an electrical contact is closed in the reference-pressure chamber. Furthermore, it is mentioned there that centrifugal forces on the piston of the diaphragm, when speed increases, advantageously reduce the force exerted on the diaphragm by the tyre pressure so that, at higher speeds, the tyre pressure must be increased in order to keep the switching contact closed. It is disadvantageous in this solution that the piston used as an additional mass for the diaphragm is covered by the tube of the tyre so that the centrifugal forces acting upon it become effective only partly and in a completely indeterminable manner on the reference-pressure chamber for increasing the switching threshold. Furthermore, it is disadvantageous that this additional mass is securely riveted to the diaphragm in the centre of the same and thereby not only weakens the diaphragm but in addition, through the stiffening at the riveted point, affects the pressure-dependent and centrifugal force-dependent deformation of the diaphragm in a very variable and unpredictable manner. With this solution, therefore, it is not possible to increase the switching threshold to a reproducible extent at a certain speed relative to rest, since the speed-dependent increase in the switching threshold cannot be predetermined in

this known embodiment.

With the present solution, the aim is to develop a tyre-pressure monitor in which the additional mass is formed and arranged on the diaphragm of the reference-pressure chamber in such a way that the elasticity of the diaphragm is not thereby impaired and the switching threshold is increased as a function of speed by a predeterminable amount relative to rest.

According to the present invention there is provided tyre-pressure monitor for vehicles, comprising a pressure switch which is to be fixed to the periphery of the wheel rim of vehicle wheels radially to the wheel axis, is to be actuated by the tyre pressure and has a reference-pressure chamber which is closed off by an electrically conductive diaphragm facing said tyre which is arranged parallel to the tread of the tyre and carries an additional mass provided for increasing the switching threshold as a function of speed, and a contact which is inserted in an electrically insulated manner into the reference-pressure chamber and against which, when air pressure in the tyre is sufficient, a contact area at the centre region of the diaphragm bears for closing an electric circuit, in which arrangement the state of the electric circuit is to be monitored in a cordless manner by a receiver fixed to the vehicle and having an analysing circuit, said additional mass is applied on at least one surface of said diaphragm and said additional mass is made of a material whose modulus of elasticity is less than 1/10th of the modulus of elasticity of the diaphragm.

The tyre-pressure monitor according to the invention has the advantage that the additional mass, which is flexible compared with the rigid, preferably metallic diaphragm, no longer affects the elasticity and the strength of the diaphragm and in addition, by specific proportioning, permits a reproducible increase in the switching threshold as a function of the speed of the wheel. Thus, at high speeds of the vehicle, a signal is triggered by the tyre-pressure monitoring device whenever the vehicle exceeds the maximum speed permissible for the existing tyre pressure. The monitored minimum pressure in the tyre is consequently increased in a defined manner as speed increases. A further advantage is that the characteristic curve of the threshold value, increasing as a function of speed, of the tyre-pressure monitor, due to the centrifugal forces acting

on the additional mass, progressively rises as speed increases. It is thus possible, over the entire speed range, to keep the

threshold value at a sufficient distance above the pressure value at which the tyre would be destroyed under full load (so-called destruction speed).

In patent application P 3,741,129.2, it has already been proposed to fix the additional mass in the form of a centrifugal weight in as point-like a manner as possible in the centre of the diaphragm by welding in order to maintain the sensitivity of the diaphragm. However, this solution is still unsatisfactory, since the diaphragm is inevitably damaged in its structure by the welding operation and since the strength of such a connection will only withstand the hard operating conditions and environmental influences if the additional mass is fixed to a sufficiently large diaphragm area, which in turn results in stiffening of the diaphragm. These shortcomings are avoided by attaching the elastic additional mass to the diaphragm area over the surface of the same by adhesive bonding, adhesion or the like.

~~Advantageous further developments and improvements of the features specified in the main claim result from the measures recited in the subclaims.~~

Drawing

Exemplary embodiments of the invention are shown in the drawing and described in greater detail below. In the drawing, Figure 1 shows the detail of a vehicle wheel with a tyre-pressure monitor according to the invention inserted in the rim, Figure 2 shows a cross-section through the tyre-pressure monitor according to the invention in an enlarged representation, Figure 3 shows the speed-dependent characteristic curve for increasing the switching threshold, and Figures 4 and 5 show different embodiments for the attachment of the additional mass to the diaphragm.

Description of the exemplary embodiments

In Figure 1, the detail of a motor vehicle is shown in cross-section to a reduced scale and is designated by 10. It shows a tyre 11 which is fixed to a wheel

rim 12. A tyre-pressure monitor 13 is fixed to a section, directed to the inside, of the wheel rim 12 radially to the wheel axis in a tapped bore 14 of the wheel rim 12. At a slight distance therefrom, in the region of the tyre-pressure monitor 13, a signal receiver 15 is fixed to the wheel suspension (not shown) of the vehicle, the end face of which signal receiver 15 is directed towards the tyre-pressure monitor 13 and induced [sic] a high-frequency oscillation in the tyre-pressure monitor 13 as soon as the latter runs past it during every rotation of the vehicle wheel 10. The receiver 15, together with the receivers of the other vehicle wheels, is connected to an analysing circuit 16 having a warning indicator 17 connected thereto, which warning indicator 17 transmits a warning signal when air pressure in one of the tyres is too low.

The construction of the tyre-pressure monitor 13 is shown in Figure 2. It consists of a housing 18 which is made of insulating material and which, with a threaded extension 19, is to be screwed into the tapped bore 14 of the wheel rim 12. The housing 18 is open at the front towards the tyre 11. A reference-pressure chamber 20 made of steel is inserted in a positive-locking manner in the housing 18, which reference-pressure chamber 20 is closed off towards the tyre by an electrically conductive diaphragm 21 made of high-grade steel. In the centre of the reference-pressure chamber 20, a contact pin 22, with a glass lead-through bushing 23, is fixed in a pressure-tight and electrically insulated manner in the bottom of the reference-pressure chamber 20. At its front end, it carries a welded-on contact ball 24, preferably made of gold. The diaphragm 21, in its outer region, is firmly welded by laser welding to the reference-pressure chamber 20 in a pressure-tight and stress-free manner. In the pressure space 25 formed by the reference-pressure chamber 20 and the diaphragm 21, air or nitrogen is fed at the required reference pressure via a feed channel 26 so that the diaphragm 21 only touches the contact ball 24 if the air pressure acting from outside on the

diaphragm 21 reaches the minimum pressure to be monitored in the tyre of the vehicle, i.e. the so-called threshold value. After the reference-pressure chamber 20 is filled, the feed channel 26 is closed pressure-tight by a ball 27 pressed or welded therein. Arranged below the reference-pressure chamber 20 is a toroidal coil 28 as well as a capacitor 29 in the housing 18 which are connected to one another in series and form an oscillating circuit which is opened or closed via the diaphragm 21 and the contact pin 22. For this purpose, the free end of the toroidal coil 28 is connected to the diaphragm 21 via the reference-pressure chamber 20, and, not discernible, the free end of the capacitor 29 is electrically bonded to the bottom end of the contact pin 22. If there is sufficient air pressure, the oscillating circuit is consequently closed, as a result of which the oscillation induced by the signal receiver 15 is dampened. The damping at sufficient air pressure through the closed oscillating circuit or the lack of damping at an air pressure which is too low through the opened oscillating circuit is detected by the analysing circuit 16.

An elastic additional mass 30 is applied over the surface to the outside of the diaphragm 21, which, in the assembled state of the tyre-pressure monitor 13, lies parallel to the tread of the tubeless tyre, the material of which additional mass 30 has a modulus of elasticity which is considerably less than 1/10th of the modulus of elasticity of the diaphragm 21. In the example according to Figure 2, the additional mass 30 is applied with uniform thickness and over the full surface to the side of the diaphragm 21 directed towards the tyre. Its material consists of a silicone adhesive which is filled with a metal powder. To increase the centrifugal force effect through the additional mass, provision is made to make this additional mass from a material having a higher specific weight compared with the diaphragm. In the example, the material of the additional mass 30 consists of a silicone adhesive having approximately 5% by volume of tungsten powder.

In Figure 3, the characteristic curve a shows the progression of the switching threshold for a tyre-pressure monitor 13 having the additional mass 30 as a function of the driving speed. Relative to the rest value, the threshold value of the tyre-pressure monitor 13, at a driving speed of 260 km/h, is here increased by p = 0.5 bar. Without an additional mass 30, the threshold value according to characteristic curve b, by the mass of the diaphragm 21, would only increase insignificantly by about 0.1 bar. The characteristic curve c shows the minimum tyre pressure up to which the tyre would be destroyed under full load. This characteristic curve likewise rises progressively with the speed and intersects the characteristic curve b before the maximum speed is reached. Without an additional mass 30, the tyre, at high speeds and when air pressure is not increased, would consequently be damaged without warning from the tyre-pressure monitoring device. By the additional mass 30, the threshold value is now increased from the characteristic curve b to the characteristic curve a so that the characteristic curve c is no longer intersected. The result of this is that a tyre pressure, sufficient in the lower speed range, of, for example, 2.1 bar is now sufficient only up to a speed of 130 km/h. At higher speeds, the threshold value of the tyre-pressure monitor 10 according to characteristic curve a is increased above the existing tyre pressure by the additional mass 30. The diaphragm 21 consequently lifts from the contact 24 and a warning signal is transmitted to the warning indicator 17, which signals to the driver to reduce the vehicle speed or increase the tyre pressure.

In calculating a silicone layer, as an additional mass, applied uniformly to the top side of the diaphragm and filled with tungsten powder, first of all the stiffening factor of the diaphragm is calculated in a known manner. It is dependent upon the modulus of elasticity $E = 200{,}000\ N/mm^2$ for steel, the diaphragm thickness and the transverse extension $\nu = 0.3$ for steel. With this stiffening factor K, the deflection of the diaphragm

centre at a certain increase in the tyre pressure Δp at a known diaphragm radius can be calculated. This deflection must now be compensated by the centrifugal forces effective on the additional mass 30 and the diaphragm 21 in order to thereby increase the threshold value by Δp [***] as a function of speed in accordance with the characteristic curve a in Figure 3. The total mass exposed to the centrifugal forces can be determined in a known manner with the rotational radius of the diaphragm, the driving speed of the vehicle, the diaphragm diameter and the stiffening factor. The mass of the diaphragm, which mass is of the dimensions and the density $\delta = 7.9$ g/cm^3 for steel, is subtracted from the total mass thus determined, and the required value for the quantity of the additional mass 30 is thus obtained. In the example, a thickness of 1.0 mm is obtained at a density of $\delta \approx 3$ g/cm^3 for the material of the additional mass 30 applied in a uniformly distributed manner.

Instead of the additional mass 30 applied uniformly to the entire diaphragm area, this additional mass can also be applied in a uniformly distributed manner to the diaphragm surface in a grid according to Figure 4. Here, too, the additional mass 30a can be determined in the abovementioned manner. The quantity of the additional mass is expediently determined here per unit of area of the diaphragm and attached to the topside of diaphragm sheets by printing, adhesive bonding or the like in a grid-shaped surface pattern before the diaphragm is punched out.

According to Figure 5, however, the additional mass 30b can also be adhesively bonded in a heaped manner to the centre region remote from the contact area of the diaphragm 21. Here, however, at the same increase, as a function of speed, according to the characteristic curve a from Figure 3, a smaller quantity of silicone adhesive, as additional mass 30b, filled with metal powder is required, since this additional mass 30b only acts in the centre region of the diaphragm and would thereby cause greater deflection of the diaphragm 21. In this

[***] missing from German document !

arrangement of the additional mass 30b, to determine the centrifugal force-dependent deflection of the diaphragm, a correction value to be determined empirically or by calculation has to be taken into account due to the non-point-like fixing of the additional mass in the diaphragm centre. However, in the case of a silicone adhesive filled with metal powder and having a modulus of elasticity E = 10 N/mm^2, here, too, due to the elasticity of the additional mass 30b, no stiffening of the diaphragm is to be found.

Within the scope of the invention, it is also possible to attach the additional mass to the side of the diaphragm 21 directed towards the reference-pressure chamber 20, in particular in an annular shape around the contact pin 22, where it is better protected against mechanical damage, for example during assembly of the tyre-pressure monitor 13. Likewise, the additional mass can be attached in a distributed manner to both diaphragm sides. Thus, for example for various characteristic curves, a quantity of additional mass which is always the same can be attached to the inside and a balancing quantity can be attached to the outside of the diaphragm 21. It is essential to the invention in all these solutions of identical effect that the total mass of the diaphragm 21 for increasing the switching-threshold value as a function of speed is increased without having an effect on the rigidity and shape of the diaphragm. Particularly suitable for this are materials having a very low modulus of elasticity and high density. By such an additional mass, the centrifugal-force effect during the increase in the threshold value can be set in a defined, inexpensive and simple manner. The material of the mass is to be selected in such a way that its modulus of elasticity is considerably less than 1/10th, preferably at least 1/100th of the modulus of elasticity of the diaphragm 21.

The claims defining the invention are as follows:-

1. Tyre-pressure monitor for vehicles, comprising a pressure switch which is to be fixed to the periphery of the wheel rim of vehicle wheels radially to the wheel axis, is to be actuated by the tyre pressure and has a reference-pressure chamber which is closed off by an electrically conductive diaphragm facing said tyre which is arranged parallel to the tread of the tyre and carries an additional mass provided for increasing the switching threshold as a function of speed, and a contact which is inserted in an electrically insulated manner into the reference-pressure chamber and against which, when air pressure in the tyre is sufficient, a contact area at the centre region of the diaphragm bears for closing an electric circuit, in which arrangement the state of the electric circuit is to be monitored in a cordless manner by a receiver fixed to the vehicle and having an analysing circuit, said additional mass is applied on at least one surface of said diaphragm and said additional mass is made of a material whose modulus of elasticity is less than 1/10th of the modulus of elasticity of the diaphragm.

2. Tyre-pressure monitor according to Claim 1, wherein the additional mass is a silicone adhesive filled with a metal powder, preferably of tungsten.

3. Tyre-pressure monitor according to either of Claims 1 or 2, wherein the additional mass is applied with uniform thickness and over the full surface to the side of the diaphragm directed towards the tyre.

4. Tyre-pressure monitor according to either of Claims 1 or 2, wherein the additional mass is applied in a uniformly distributed grid shape to the surface of the diaphragm directed towards the tyre.

5. Tyre-pressure monitor according to either of Claims 1 or 2, wherein the additional mass on the centre region of the diaphragm is adhesively bonded in a heaped manner to the side remote from the contact area.

6. Tyre-pressure monitor for vehicles substantially as hereinbefore described with reference to the accompanying drawings.

D A T E D this 6th day of February 1992.

ROBERT BOSCH GMBH

By its Patent Attorneys:

CALLINAN LAWRIE

FIG.1

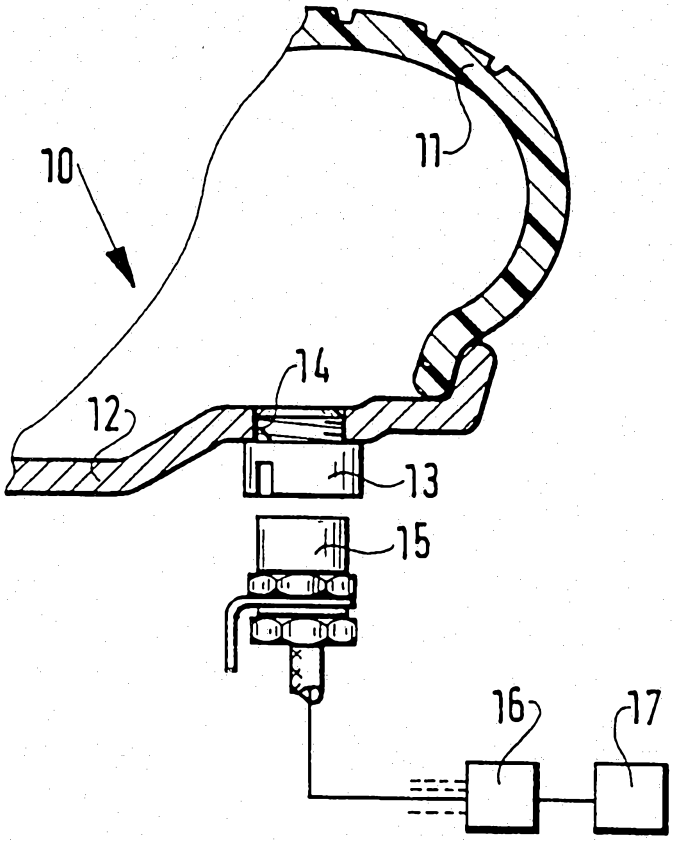


FIG.2

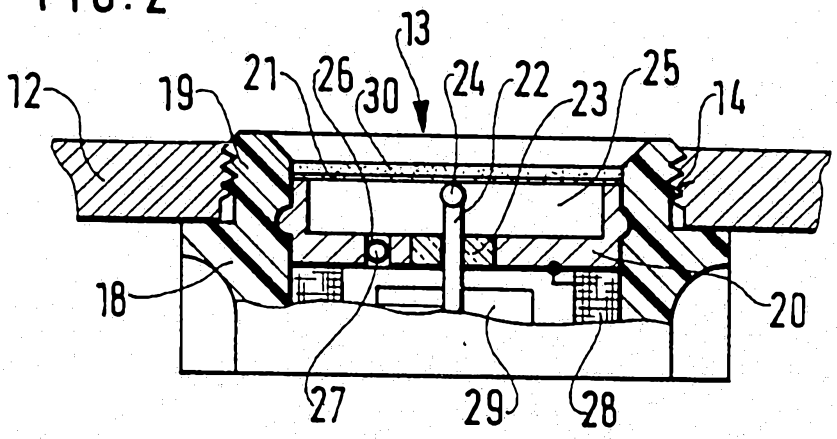


FIG. 3

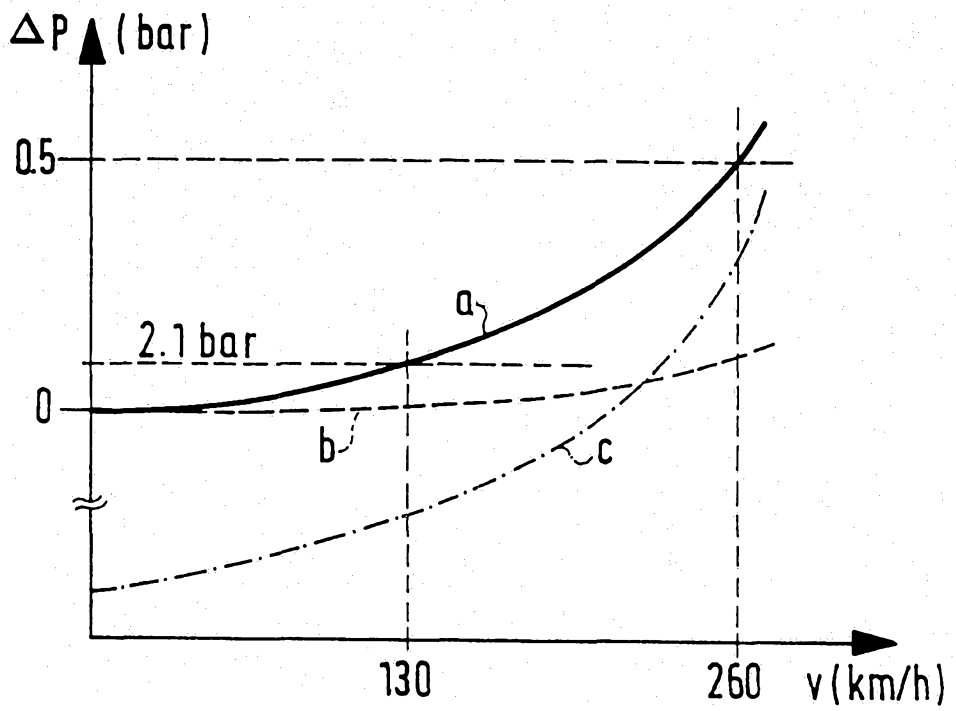


FIG. 4

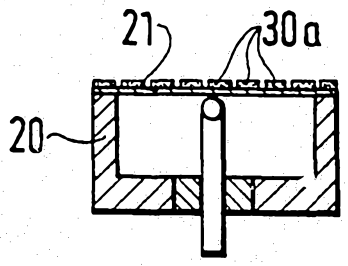
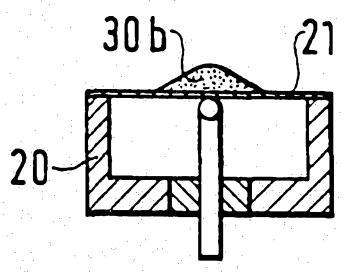


FIG. 5



INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen PCT/DE 89/00624

I. KLASSIFIKATION DES ANMELDUNGSGEGENSTANDS (bei mehreren Klassifikationssymbolen sind alle anzugeben)[6]

Nach der Internationalen Patentklassifikation (IPC) oder nach der nationalen Klassifikation und der IPC

Int.Kl. 5 B60C23/04

II. RECHERCHIERTE SACHGEBIETE

Recherchierter Mindestprüfstoff [7]

Klassifikationssytem	Klassifikationssymbole
Int.Kl. 5	B60C

Recherchierte nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Sachgebiete fallen [8]

III. EINSCHLAGIGE VEROFFENTLICHUNGEN [9]

Art.°	Kennzeichnung der Veröffentlichung [11], soweit erforderlich unter Angabe der maßgeblichen Teile [12]	Betr. Anspruch Nr.[13]
A,P	DE,A,3741129 (ROBERT BOSCH GMBH) 15 Juni 1989 siehe das ganze Dokument (in der Anmeldung erwähnt) ---	1
A	DE,A,3243854 (ROBERT BOSCH GMBH) 30 Mai 1984 siehe Figuren; Ansprüche ---	1
A	DE,A,2626475 (SOCIETE INTERNATIONALE DE MECANIQUE INDUSTRIELLE S.A.) 23 Dezember 1976 siehe Figuren; Ansprüche (in der Anmeldung erwähnt) ---	

° Besondere Kategorien von angegebenen Veröffentlichungen [10] :

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"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

IV. BESCHEINIGUNG

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
11.DEZEMBER 1989	28. 12. 89
Internationale Recherchenbehörde	**Unterschrift des bevollmächtigten Bediensteten**
EUROPAISCHES PATENTAMT	L. ROSSI

Formblatt PCT/ISA/210 (Blatt 2) (Januar 1985)

ANHANG ZUM INTERNATIONALEN RECHERCHENBERICHT ÜBER DIE INTERNATIONALE PATENTANMELDUNG NR.

DE 8900624
SA 31335

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben.
Die Angaben über die Familienmitglieder entsprechen dem Stand der Datei des Europäischen Patentamts am 19/12/89
Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

Im Recherchenbericht angeführtes Patentdokument	Datum der Veröffentlichung	Mitglied(er) der Patentfamilie	Datum der Veröffentlichung
DE-A-3741129	15-06-89	WO-A- 8905239	15-06-89
DE-A-3243854	30-05-84	Keine	
DE-A-2626475	23-12-76	Keine	

EPO FORM P0473

Für nähere Einzelheiten zu diesem Anhang : siehe Amtsblatt des Europäischen Patentamts, Nr.12/82

INTERNATIONAL SEARCH REPORT

International Application No PCT/DE 89/00624

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl.[5] B60C 23/04

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
Int.Cl.[5]	B60C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A,P	DE, A, 3741129 (ROBERT BOSCH GMBH) 15 June 1989 see the whole document (cited in the application) --	1
A	DE, A, 3243854 (ROBERT BOSCH GMBH) 30 May 1984 see figures;claims --	1
A	DE, A, 2626475 (SOCIETE INTERNATIONALE DE MECANIQUE INDUSTRIELLE S.A.) 23 December 1976 see figures;claims (cited in the application)	

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* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
11 December 1989 (11.12.89)	28 December 1989 (28.12.89)
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

DE 8900624
SA 31335

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 19/12/89.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A-3741129	15-06-89	WO-A- 8905239	15-06-89
DE-A-3243854	30-05-84	None	
DE-A-2626475	23-12-76	None	