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⑤④ **Device suitable for detecting changes in the state of rest or of rectilinear uniform motion of a body.**

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Description

The present invention relates to a device suitable for detecting changes of the state of rest or of rectilinear uniform motion of a body, whether said states are absolute or relative, and moreover whether the changes relate to the whole body or they relate only to one or more parts of said body.

For simplicity in the text of the specification and in the claims instead of the words "body or one or more parts of a body" only the word "body" will be used.

Devices suitable for said purpose are employed e.g. in antitheft warning appliances for detecting movements or vibrations of movable or fixed bodies protected by said appliances, caused by thefts or theft attempts, see for example US—A—3 611 345; in devices for detecting vibrations either of fixed structures for control or of motors or in general of machines with parts in movement for control and/or for eventual stopping or governing said ones; and moreover in the sismographs.

Said devices are constructed till now principally on the ground of the principle or the pendulum, or by lamellar or not elements, which, when they start to vibrate, close contacts, or by transducers in general piezoelectric, which transform mechanical pulses in signals of other kind, or with employment of bulbs with mercury with electrical terminals connected to special circuits in particular for detecting also very slow changes of state, which cause changes of orientation of said body.

The drawback of the pendulum systems employed in the control and measure instruments as the sismographs and the sismometers consists in the complexity of said systems, which does not make them suitable for easier appliances as e.g. in antitheft appliances for cars, while the pendulum devices employed in these cases are very simplified so as their detections are limited to determinate stresses and with few or any abilities to analyze or to select them with regard to the reasons which caused them, moreover said devices are not able to be installed in particular on mobile bodies.

The drawback of the devices with bulb of mercury consists in the fact that their employment is not suitable for many appliances in particular for detecting vibrations, and moreover their installation is not very easy; this last drawback is very serious because on the correct or incorrect installation depends the correct or incorrect working of the device.

The devices with impact contacts or with piezoelectric transducers are not sensitive to all kinds of perturbations due to the change of state of a body in particular if said changes occur with very low accelerations.

The invention as claimed is intended to remedy all the drawbacks of the above mentioned and known to the prior art devices, carrying out a device which has the following advantages:

—greatest facility of installation in all kinds of appliances,

—ability of detecting all kinds of state variations, from the smallest vibrations to the slow changes of orientation of the body,

—high easiness of connection to electronic circuits or to other instruments suitable in general for analyzing and selecting the output signals of the device and therefore for eliminating the signals not due to causes, which do not concern the specific appliance, as e.g. the accidental causes not relating to theft attempts in the case of antitheft warning appliances.

On the whole therefore the great advantage of the invention consists in the great simplicity and universality of its employment.

The device suitable for detecting changes of the state of rest or of the rectilinear uniform motion of a body, in conformity with the present invention comprises: —a hollow member suitable for being fixed to said body and made of ultra-sounds opaque material, —one or more elements inside the hollow member, made at least partially of ultra-sound opaque material and completely mobile relative to said member, —suitable means for emitting ultra-sounds of a frequency fixed in advance, —suitable means for receiving ultra-sounds and converting them into signals of another kind of energy; the hollow member being equipped with two or more connection elements rigidly fixed to it, made of the same or different materials, provided that these materials are ultra-sounds opaque, and with shape and size suitable for housing and holding on, in ultra-sound tight manner, the emitting part of the emission means and the receiving part of the receiving means, the parts of the hollow member, corresponding to the inside of said connection elements, being made of ultra-sounds transparent material and equipped with one or more holes with shapes and sizes suitable both for the passage of the ultra-sounds respectively from the emitting means to the inside of the hollow member and from the inside of said member to the receiving means, and for not modifying the resistance that the inner element or elements have to overcome for moving relative to the rest of the inner surface of the hollow member; the space inside the hollow member and the connection elements as far as the emitting and the receiving surfaces of said means being filled with a fluid suitable for the ultra-sounds propagation, preferably air; the shape and the consistency of the inner surface of the hollow member and the shape and the consistency of the outside surface and the homogeneity of the mass of the inner element or elements, with regard to the greatest sensitivity of the device fixed in advance being such that, in case of a change of the state of rest or of the rectilinear uniform motion of the body and therefore of the hollow member fixed to it, there follows a relative movement of the internal element(s) and a Doppler effect change of frequency of at least a part of the reflected ultra-sounds picked up by the receiving means, which therefore output signals altered relative to the signals emitted by them when there are no state

changes, alteration, which when analyzed and selected in a suitable way by devices connected downstream from said receiving means, are able to act on means for signaling and/or controlling possible automatic devices suitable for removing or modifying the causes which have brought about the detected changes.

One way of carrying out the invention is described in detail below with reference to drawings which illustrate only one specific embodiment, in which:

Figure 1 is a cross schematic view,

Figure 2 is a block diagram.

The embodiment of the invention described in the example is the detecting element of an anti-theft alarm appliance for a motorcar.

The device A is composed by a ball 1 of plastic material, made of two parts 1a and 1b assembled, after inserting the iron ball 2, in such a way as to ensure a perfect continuousness of the inner surface 1i of the ball 1. The semiball 1a is equipped during the manufacturing phase with two sleeves 3 and 4, the parts 5 and 6 of the wall of the ball 1 being provided with the cylindrical holes 5a and 6a.

In the sleeves 3 and 4 are inserted with pressure and in a tight manner the cylindrical parts respectively of emission 7a and of reception 8a of the ultra-sounds of the emitting transducer 7 and the receiving transducer 8. The spaces 9, 10 and 11 inside respectively the ball 1 and the sleeves 3 and 4 are filled with air at atmospheric pressure.

The transducer 7 is connected upstream with an oscillatory circuit 12 suitable for emitting electrical signals with 40 Hz frequency, having therefore the same frequency also the ultra-sounds emitted by the transducer and which go inside the ball 1 through the holes 5a. The ultra-sounds reflected by the inner wall 1a of the wall 1 and by the external wall 2a of the ball 2 and picked up by the transducer 8 have the same 40 Hz frequency of the ultra-sounds emitted by the transducer 7 when the ball 1 is in state of rest and i.e. the motor car is perfectly still, said ball 1 being rigidly fixed to the structure of the motorcar.

When instead the structure of the motorcar and therefore the ball 1 make the least movement, the ball 2 moves immediately relative to the ball 1, and that in relation both to the great smoothness of the wall 1i of the ball 1 and of the external wall 2e of the ball 2, and to the perfect homogeneity of the mass of the ball 2; said movement of the ball 2 relative to the ball 1 causes for Doppler effect a change of frequency of at least a part of the ultra-sounds picked up by the transducer 8.

Said transducer 8 is connected downstream with the electronic circuit, the block diagram of which is represented in Figure 2 and which comprises an amplification circuit 13 of the output signal of the transducer 8, a frequency demodulation circuit 14, a pulse emitter circuit 15, which directly or indirectly through the reset circuit 16 transmits the pulses, selected and worked by said circuits, to the counter circuit 17, which on the ground of the regulation made also on installation

of the appliance of the motorcar, sends control signals through the output circuit 18 to the power circuit for acting the antitheft warning devices and eventual locks connected with it.

Analysis, selection and integration of the signals, which have to release the warning, are obtained through the above cited circuits, which are not described in detail because they may be carried out in conformity with the required performances of the appliance by any person skilled in the art on the ground of the prior art. The detecting device, in conformity with the present invention is available obviously for acting e.g. the warning not only because of vibrations caused by effraction attempts of the lock system of the accesses of the motorcar but also because of the mere lifting, however carried out with the greatest caution, of the car for also stealing merely the wheels or other parts of said car.

Claim

Device suitable for detecting changes of state of rest or of the rectilinear uniform motion of a body comprising: —a hollow member (1) suitable for being fixed to said body and made of ultra-sounds opaque material, —one or more elements (2) inside the hollow member (1), made at least partially of ultra-sounds opaque material and completely mobile relative to said member (1), —suitable means (7) for emitting ultra-sounds of frequency fixed in advance; —suitable means (8) for receiving ultra-sounds and converting them into signals of another kind of energy; the hollow member (1) being equipped with two or more connection elements (3, 4) rigidly fixed to it, made of the same or different materials, provided that these materials are ultra-sounds opaque, and with shape and size suitable for housing and holding on, in ultra-sounds tight manner, the emitting part of the emission means (7) and the receiving part of the receiving means (8), the parts (5, 6) of the hollow member (1), corresponding to the inside of said connection elements (3, 4) being made of ultra-sounds transparent material and/or equipped with one or more holes (5a, 6a) with shapes and sizes suitable both for the passage of the ultra-sounds respectively from the emitting means (7) to the inside of the hollow member (1) and from the inside of said member (1) to the receiving means (8), and for not modifying the resistance that the inner element or elements (2) have to overcome for moving relative to the rest of the inner surface (1i) of the hollow member (1); the spaces (9, 10, 11) inside the hollow member (1) and the connection elements (3, 4) as far as the emitting and the receiving surfaces (7a, 8a) of said means (7, 8) being filled with a fluid suitable for ultra-sounds propagation, preferably air; the shape and consistency of the inner surface (1i) of the hollow member (1) and the shape and consistency of the outside surface (2e) and the homogeneity of the mass of the inner element or elements (2), with regard to the greatest sensitivity of the device fixed in advance, being such

that, in case of a change of the state of rest or of the rectilinear uniform motion of the body and therefore of the hollow member (1) fixed to it, there follows a relative movement of the internal element(s) and a Doppler effect change of frequency of at least a part of the reflected ultrasounds picked up by the receiving means (8), which therefore output signals altered relative to the signals emitted by them when there are no state changes, alterations, which when analyzed and selected in a suitable way by devices (13—18) connected downstream from said receiving means (7), are able to act on means for signalling and/or controlling possible automatic devices suitable for removing or modifying the causes which have brought about the detected changes.

Patentanspruch

Vorrichtung zum Detektieren von Änderungen des Ruhezustandes oder der geradlinigen, gleichförmigen Bewegung eines Körpers, bestehend aus: —Einem Hohlelement (1), das für die Befestigung an dem Körper geeignet ist, und das aus einem ultraschallundurchlässigen Material hergestellt ist, —einem oder mehreren Elementen (2) innerhalb des Hohlelements (1), die wenigstens teilweise aus ultraschall-undurchlässigem Material hergestellt sind, und gegenüber dem Element (1) vollständig beweglich sind; —einer geeigneten Einrichtung (7) zum Emittieren von Ultraschallwellen mit einer vorher festgelegten Frequenz, —einer geeigneten Einrichtung (8) zum Empfangen von Ultraschallwellen und Umwandeln derselben in Signale einer anderen Energieform; wobei das Hohlelement (1) mit zwei oder mehreren Anschlußelementen (3, 4) ausgestattet ist, die an ihm starr befestigt sind, und aus demselben oder anderen Materialien, vorausgesetzt, daß diese ultraschall-undurchlässig sind, hergestellt sind, und bezüglich Form und Größe zur ultraschalldichten Aufnahme und Befestigung des emittierenden Teils der emittierenden Einrichtung (7) und des Empfängerteils der empfangenden Einrichtung (8) geeignet sind, wobei die Teile (5, 6) des Hohlelementes (1), die der Innenseite der Anschlußelemente (3) entsprechen, aus ultraschall-durchlässigem Material bestehen und/oder mit einem oder mehreren Löchern (5a, 6a) versehen sind, deren Form und Größe sowohl für den Durchlaß der Ultraschallwellen jeweils von der emittierenden Einrichtung (7) zum Innenraum des Hohlelements (1) und vom Innenraum des Elements (1) zu der empfangenden Einrichtung (8) geeignet ist, als auch dafür geeignet ist, den Widerstand, den das oder die inneren Elemente (2) überwinden müssen, um sich relativ zum Rest der inneren Oberfläche (1i) des Hohlelementes (1) zu bewegen, nicht zu ändern; wobei die Räume (9, 10, 11) innerhalb des Hohlelementes (1) und der Anschlußelemente (3, 4) bis zu den emittierenden und empfangenden Oberflächen (7a, 8a) dieser Einrichtungen (7, 8) mit einem Fluid, vorzugsweise Luft, gefüllt sind, das für die Ultraschall-Übertragung geeignet ist, wobei die Form

und Konsistenz der inneren Oberfläche (1i) des Hohlelementes (1) und die Form und Konsistenz der äußeren Oberfläche (2e) und die Homogenität der Masse des oder der Innenelemente (2) mit bezug auf die vorher festgelegte größte Empfindlichkeit der Vorrichtung derart sind, daß im Fall der Änderung des Ruhezustandes oder der geradlinigen, gleichförmigen Bewegung des Körpers und damit des daran befestigten Hohlelementes (1) eine relative Bewegung des oder der inneren Elemente und eine Änderung der Frequenz nach dem Doppler-Effekt von wenigstens einem Teil der reflektierten Ultraschallwellen, die von der Empfängereinrichtung (8) aufgenommen werden, erfolgt, und die daher Signale abgibt, welche relativ zu dem von der Einrichtung (8) bei keiner Statusänderung emittierten Signalen geändert sind, wobei die Änderungen bei geeigneter Analyse und Auswahl mittels der Einrichtungen (13—18), die unterhalb der Empfängereinrichtung (8) liegen, auf eine Einrichtung wirken, um mögliche automatische Einrichtungen, welche zum Entfernen oder Modifizieren der Ursachen für die detektierten Änderungen dienen, mit Signalen zu versorgen und/oder zu steuern.

Revendication

Dispositif destiné à détecter des variations de l'état de repos ou de mouvement rectiligne uniforme d'un corps, comprenant:

—un élément creux (1) destiné à se fixer sur le corps et réalisé dans un matériau opaque aux ultrasons,

—un ou plusieurs éléments (2) placés à l'intérieur de l'élément creux (1), réalisés au moins partiellement dans un matériau opaque aux ultrasons et complètement mobiles par rapport à l'élément (1),

—des moyens convenables (7) permettant d'émettre des ultrasons à une fréquence fixée à l'avance,

—des moyens convenables (8) permettant de recevoir les ultrasons et de les transformer en signaux d'un autres type d'énergie;

l'élément creux (1) étant équipé de deux ou plusieurs éléments de liaison (3, 4) fixés rigidement à celui-ci, réalisés dans le même matériau ou dans des matériaux différents, à condition que ces matériaux soient opaques aux ultrasons et présentant une forme et une taille convenables pour loger et maintenir, d'une manière étanche aux ultrasons, la partie émettrice des moyens d'émission (7), et la partie réceptrice des moyens de réception (8), les parties (5, 6) de l'élément creux (1) correspondant à l'intérieur des éléments de liaison (3, 4), étant réalisées dans un matériau transparent aux ultrasons et/ou équipées d'un ou plusieurs trous (5a, 6a), avec des formes et des tailles permettant d'obtenir à la fois le passage des ultrasons respectivement des moyens d'émission (7) vers l'intérieur de l'élément creux (1) vers les moyens de réception (8) et de ne pas modifier la résistance que l'élément ou les éléments intérieurs (2) ont à surmonter pour se

déplacer par rapport au reste de la surface intérieure (1i) de l'élément creux (1); les espaces (9, 10, 11) situés à l'intérieur de l'élément creux (1) et des éléments de liaison (3, 4), jusqu'aux surfaces d'émission et de réception (7a, 8a) des moyens (7, 8), étant remplis d'un fluide permettant la propagation des ultrasons, de préférence de l'air; la forme et la consistance de la surface intérieure (1i) de l'élément creux (1), ainsi que la forme et la consistance de la surface extérieure (2e) et l'homogénéité de la masse de l'élément intérieur ou des éléments (2), pour ce qui concerne la sensibilité maximum fixée à l'avance du dispositif, étant telles que, dans le cas d'une variation de l'état de repos ou du mouvement rectiligne uniforme du corps et par conséquent de l'élément creux (1)

5 fixé à celui-ci, il en résulte un mouvement relatif de l'élément ou des éléments intérieurs et une variation de fréquence par effet Doppler d'une partie au moins des ultrasons réfléchis détectés par les moyens de réception (8), qui fournissent ainsi des signaux de sortie modifiés par rapport aux signaux émis par ceux-ci, lorsqu'il n'y a pas de variations d'état, modifications qui, lorsqu'elles sont analysées et sélectionnées de manière convenable par des dispositifs (13—18) branchés en aval des moyens de réception (7), sont capables d'agir sur des moyens destinés à signaler et/ou commander des dispositifs automatiques possibles permettant de supprimer ou de modifier les causes qui ont provoqué les variations détectées.

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FIG. 1

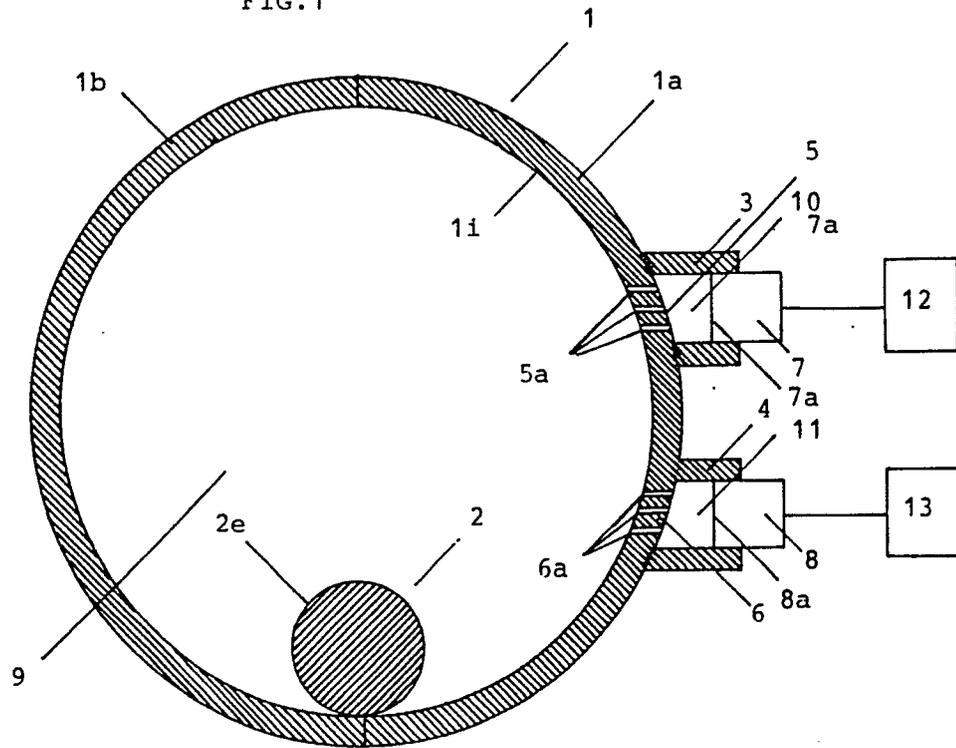


FIG. 2

