

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 0 675 255 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
27.05.1998 Bulletin 1998/22

(51) Int Cl.⁶: **E05F 15/00**

(21) Application number: **95301792.8**

(22) Date of filing: **17.03.1995**

(54) **Deformable system**

Verformbares System

Système déformable

(84) Designated Contracting States:
DE ES FR GB IT SE

(30) Priority: **31.03.1994 GB 9406485**
04.07.1994 GB 9413398

(43) Date of publication of application:
04.10.1995 Bulletin 1995/40

(73) Proprietor: **Standard Products Limited**
Huntingdon Cambridgeshire PE18 6NU (GB)

(72) Inventors:
• **Bickley, Alan Charles**
Huntingdon, Cambs PE8 8XR, (GB)

• **Hall, John Nicholas**
Peterborough, Cambridgeshire PE6 9HP (GB)
• **Parnham, Laurence John**
Huntingdon, Cambs PE19 4PX (GB)

(74) Representative: **Jones, Michael Raymond et al**
Haseltine Lake & Co.,
Imperial House,
15-19 Kingsway
London WC2B 6UD (GB)

(56) References cited:
DE-U- 8 608 064 **FR-A- 2 200 882**
FR-A- 2 612 027

EP 0 675 255 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

This invention relates to a deformation detection system intended to assist, for example, in the control of an electrically powered window pane when an object is trapped against an upper sealing member.

A number of safety systems have been developed to reduce the possibility of objects being trapped between the top of an upwardly moving window pane and the surround of a vehicle door or the like. Some systems have been developed to monitor the action of the motor with the aim of detecting a trapped body by sensing a change in the current drawn by, or the speed of, a motor powering an electrically operated window pane. These systems have been found to be sensitive to variations in door build and/or environmental conditions and therefore their reliability is poor.

Touch sensors are also known which may be based on many different technologies such as conductive rubber switches, piezo electrical cables, or piezo resistive films. In such cases the sensor is mounted in the upper window or door frame of a vehicle but this method has the drawback that the systems rely on significant squeezing of an obstruction to generate the force required to activate the system. Therefore, the trapped item is subjected to a significant force before it is detected and before the system is activated.

Also, no-touch sensors are known which use an infra-red or optical beam sent from an emitter positioned on the window or door frame and detected by a detector positioned across the window or door opening. Such sensors do not follow the complex curved contour shape of a window or door frame window spacing or the like and therefore may not be activated by a body trapped in the curved portion.

FR-A-2 612 027, disclosing the features of the preamble of claim 1, relates to an ultrasonic sensor comprising an ultrasonic emitter, an ultrasonic receiver and a tubular guide for acoustic waves. The tubular guide is formed of a deformable material and the sensor is capable of detecting an event which modifies the transmission between the emitter and receiver.

According to a first aspect of the present invention, there is provided a deformation detection system comprising:

- an elongate element including a deformable wall member which is a wall of a bore in the elongate element which provides a radiation transmission path defined by the internal surface of the bore;
- a sound radiation transmission source positioned to transmit radiation in the form of audible or inaudible sound waves along the radiation transmission path; and
- a sound radiation detector positioned to detect the radiation transmitted from said radiation source along the radiation transmission path, which radiation detector is provided with a means for monitor-

ing an attenuation of the radiation; the arrangement being such that a deformation of the wall member of the elongate element at least partially interrupts the radiation transmission path, whereby radiation being transmitted along the said path to the detector is attenuated, wherein the transmission path is defined by two substantially parallel sections, an end of each section being operatively linked with one another by an intervening device capable of receiving the radiation signal transmitted from the radiation transmission source down a first one of the said two sections and capable of retransmitting the radiation signal along the second section to the detector, the transmission source and detector being positioned substantially adjacent one another at the same ends respectively of the first and second sections opposite the ends linked by the intervening device,

characterised in that the wall of one section is stiffer than the wall of the other section.

Thus, the receiver measures a change in magnitude of the signal received.

The term "radiation" as used herein is the process by which energy is emitted from molecules and atoms owing to internal changes, as defined in Websters New International Dictionary (Second Edition).

Preferably, the radiation transmission source transmits continuous radiation. This has the advantage over a pulsed transmission that an improved reaction time is achieved. Additionally, the system operation is less susceptible to variations in pressure and water vapour content of the air, or other environmental effects. The speed of sound is dependent on such factors, which implies that a pulsed system operating on a "time of flight" system may fail to safe when not necessary. By continuously monitoring the magnitude of the signal, the system is less susceptible to false triggering due to environmental effects.

The detector is preferably capable of producing a signal indicative of the detection of a deformation in the said wall member.

Preferably, the transmitter and/or the receiver are piezoelectric components. Such piezoelectric components are small, robust, cost effective and generally insensitive to the environment. As an example, a suitable material for the transmitter and/or receiver is polyvinylidene fluoride.

The surface of the wall member is preferably capable of reflecting radiation; this permits the radiation transmission path to be curved.

The wall member is a wall of a bore in the said elongate member, so that the radiation transmission path is defined by the internal surface of the bore. For example, the elongate element may be in the form of a hollow tube. The bore defined by the internal surface conveniently has a circular cross-section, but the cross-section may be any suitable shape, for example oval. In a pre-

ferred embodiment, when the bore has a circular cross-section, the internal diameter of the bore is about 4mm. The internal surface is preferably formed of a highly reflective material. The elongate element is typically formed of EPDM (Ethylene Propylene Diene Monomer).

Typically the detector will detect a clear signal when the elongate element is compressed and the signal passing that portion is decreased. As a portion of the elongate element is compressed the signal passing that portion is decreased. The detector circuit may typically be set up so that it decides a trap has occurred when the received signal has been attenuated to the level which corresponds to a deformation of 50% of the elongate element height at some point along its length.

The bore may be divided into two sections linked by, for instance, a reflecting member, or other intervening device capable of receiving and retransmitting the radiation signal from the radiation transmission source. This enables the two bores to be substantially parallel and permits the transmission source and the detector to be conveniently positioned substantially adjacent one another at the same end of the bores. One bore is thereby made stiffer than the other bore. This has advantages of allowing overtravel. Whilst overtravel is not essential, it does allow the peak force experienced during a trap to be reduced.

The transmission source and/or the detector are positioned at respective ends of the radiation transmission path. Since the said path is defined by a bore, each of the transmission source and/or the detector may be in the form of a removable plug, a portion of which can be positioned in the respective end of the bore.

In a preferred embodiment, the elongate element is a window pane sealing member capable of effecting sealing a window opening of a motor vehicle against a window pane. In this embodiment, the wall member of the elongate element may be deformed under the action of an object trapped between an electrically operated window pane as it closes and the periphery of the window opening about which the sealing member is positioned. On detection of attenuation in the radiation being transmitted along the transmission path, the detector produces a signal indicative of the detection of a deformation in the wall member, and this may be used to control the operation of the window drive or wind mechanism. For instance, the signal may be used to control (e.g. stop or reverse) the action of the motor driving the window. Preferably, the radiation transmission source and radiation detector are energized only when the window pane is closing or attempting to close, and preferably when the window closure is depressed.

Conveniently, the elongate element can be manufactured by extrusion.

According to a second aspect of the present invention, there is provided a motor vehicle having a body opening in which a closure member is movable towards a peripheral edge of the body opening to close the opening, an electrically operated drive mechanism being pro-

vided to effect movement of the closure member;

characterised in that said peripheral edge of the body opening is provided with a deformation detection system according to the first aspect of the invention, and which further comprises

means for controlling operation of said drive mechanism in response to detection by the detection device of the attenuation in the radiation transmitted from the radiation source.

The deformation of the wall member of the elongate element may be as a consequence of an object becoming trapped between the device and the closure member.

The body opening may be a window opening in which case the closure member is a window pane. Alternatively, the body opening may be an opening in the roof of the vehicle (a "sun roof" opening), in which case the closure member is a sun roof member. In either of these cases, the deformable device may be part of a sealing member around the periphery of the body opening.

The drive mechanism may include an electric motor.

The drive mechanism may be controlled in such a way that movement of the closure member is stopped or reversed, so as to prevent the trapped object from being crushed and to permit release of the trapped object. In an alternative embodiment, the drive mechanism can be disabled. Preferably, the radiation transmission source and the radiation detector are only energized when the drive mechanism moves, or attempts to move, the closure member.

As mentioned above, the radiation transmission source may emit audible or inaudible (i.e. ultrasound) sound waves to be detected by the radiation detector. If an audible sound source is used, it may act as a warning that the window pane or closure member is closing. In one embodiment, the note of the audible sound may change to serve as a warning of a trapped object.

Typically, a maximum force of about 10N is exerted on a trapped body with the system of the present invention.

For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a perspective view of a deformation detection system;

Figure 2 is a longitudinal sectional view of the embodiment shown in Figure 1;

Figure 3 is a perspective view of another deformation detection system;

Figure 4 is a perspective view of one embodiment of the present invention; and

Figure 5 shows a side view of a vehicle in which the present invention may be used.

Whilst Figures 1 to 3 do not illustrate a system falling within the scope of the present invention, they are included to aid its understanding.

Referring firstly to Figure 1, there is shown a tubular member shown generally at 2, a radiation transmitting source 4 and a radiation detector 6. The tubular member 2 is hollow and has a bore 10 having an internal surface 8 having a highly reflective finish. Radiation is transmitted from the transmitting source 4 to the detector 6 along the bore 10. This is shown in greater detail in Figure 2. A first radiation beam 12 may be transmitted through the centre of the bore 10 of tubular member 2 without touching the internal surface 8. However, a second radiation beam 14 which is transmitted from the transmitting source 4 does not pass through the central region of the bore 10, but instead hits the internal surface 8 at incident points 16A and 16B. The second radiation beam 14 is reflected by the internal surface 8 at points 16A and 16B due to the high gloss finish. In this way, the second radiation beam 14 may pass down the bore 10 and reaches the detector 6 shown in Figure 1.

As the tubular member 2 is made of a deformable material, deformation of the tubular member 2 causes deformation of the internal surface 8 and thereby restricts the size of the opening of the bore 10. When the size of the opening of the bore 10 is so restricted, the detector 6 detects attenuated radiation from the transmitting source 4. Whilst it is not shown in the drawings, the detector may be connected to a motor in such a manner that when deformation of the tubular member 2 is detected by detection of attenuated radiation, the motor can be stopped and/or reversed. Therefore, if the motor is controlling an electrically powered window pane, the continued rising of the window pane will be stopped and/or reversed on deformation of tubular member 2.

Turning now to Figure 3 there is shown a window sealing member shown generally at 18. The sealing member 18 has a bore 10 of the same form as shown in Figures 1 and 2. The sealing member 18 also comprises flange receiving portions 20 and 22, and a glazing panel receiving channel 24. Flange receiving portions 20 and 22 enable attachment of sealing member 18 to, for example, a header portion of a window or door frame joining "A" and "B" pillars of the front door. The glazing panel receiving channel 24 receives a glazing panel (not shown), which is movable in an upward and downward direction, when such a glazing panel is in its fully upward configuration. As discussed in relation to Figures 1 and 2 a radiation transmission source and a radiation detecting source can be placed at either end of the bore 10. When a glazing panel moves towards its upward position, a body trapped between it and the sealing member 18 will deform the bore 10 and thereby stop the upward movement of the glazing panel or even reverse that upward movement by detection of attenuated radiation.

In a further embodiment shown in Figure 4, which can also be adapted to be formed in a weatherstrip shown in Figure 3, there is shown a first bore section 26

and a second bore section 28 running substantially parallel thereto. At one end of the first bore section 26 and second bore section 28 there is positioned a radiation transmitting source 30 and a radiation detector 32 of a form suitable for plugging into a first bore section 26 and second bore section 28, respectively. Plugged into the opposite ends of first bore section 26 and second bore section 28 is a radiation reflecting member 34, the radiation reflecting member 34 comprising two reflecting parts 36, 38. The bore sections 26 and 28 are of the form shown in Figures 1 to 3. In use, radiation from the transmitting source 30 travels down the first bore section 26, is reflected by reflecting parts 36 and 38 and is then transmitted along second bore section 28 to the detector. As previously, the detector is able to detect an attenuation in transmitted radiation and thus deformation of one or both of the bore sections 26, 28 and may thereby stop or reverse a motor to which it is connected. The embodiment shown in Figure 4 allows both the transmitting source 30 and detector 32 to be positioned at one end of the bore sections 26, 28. In a preferred embodiment, one of the bore sections 26 or 28 may be made stiffer than the other bore section. When a body is trapped, the less stiff bore section collapses and attenuates the radiation detected by the detector 32. The stiffer bore section would then deflect at higher loads but may also allow overtravel so that there is sufficient time for the electrical system to which the detector is connected to respond.

Figure 5 shows a vehicle 40 in which a sealing member 42 is positioned on a header portion 44 connecting "A" pillar 46 and "B" pillar 48. The sealing member 42 is of the form of that shown in Figure 3, but may be of any suitable form for being positioned on or adjacent the header portion 44. The vehicle 40 has a door 52 within which a window pane 50 is positioned. The window pane 50 is movable in an upward and downward motion within door 52. The sealing member 42 has a bore, as shown in Figure 3. A radiation transmitter (not shown) is positioned in the region of end 54 of the sealing member 42 and a detector (not shown) in the region of end 56 of the sealing member at the other end of the bore. The detector is connected to a motor 58 which controls the upward and downward motion of the window pane 50. In use, the transmitter transmits a radiation signal along the bore to the detector. As the motor 58 causes the upward motion of the window pane 50, an object trapped between it and sealing member 42 deforms the bore and the detector then detects an attenuated signal from the transmitter and stops the motor 58 which therefore stops the upward movement of window pane 50 preventing significant crushing of the trapped object.

Claims

1. A deformation detection system comprising:

an elongate element including a deformable wall member which is a wall of a bore (26, 28) in the elongate element which provides a radiation transmission path defined by the internal surface of the bore (26, 28);

a sound radiation transmission source (30) positioned to transmit radiation in the form of audible or inaudible sound waves along the radiation transmission path; and

a sound radiation detector (32) positioned to detect the radiation transmitted from said radiation source along the radiation transmission path, which radiation detector (32) is provided with a means for monitoring an attenuation of the radiation;

the arrangement being such that a deformation of the wall member of the elongate element at least partially interrupts the radiation transmission path, whereby radiation being transmitted along the said path to the detector (32) is attenuated,

wherein the transmission path is defined by two substantially parallel sections, an end of each section being operatively linked with one another by an intervening device (36, 38) capable of receiving the radiation signal transmitted from the radiation transmission source (30) down a first one of the said two sections and capable of retransmitting the radiation signal along the second section to the detector (32), the transmission source (30) and detector (32) being positioned substantially adjacent one another at the same ends respectively of the first and second sections (26, 28) opposite the ends linked by the intervening device (36, 38),

characterised in that the wall of one section is stiffer than the wall of the other section.

2. A deformation detection system according to claim 1, wherein the radiation transmission source (30) transmits continuous radiation.

3. A deformation detection system according to claim 1 or 2, wherein the transmission source (30) and detector (32) are piezoelectric.

4. A deformation detection system according to any preceding claim, wherein the detector (32) is capable of producing a signal indicative of the detection of a deformation in the said wall member.

5. A deformation detection system according to any preceding claim, wherein the surface of the wall member defining the radiation transmission path is capable of reflecting radiation.

6. A deformation detection system according to any

preceding claim, wherein the bore (26, 28) has a circular or oval cross-section.

7. A deformation detection system according to of any preceding claim, wherein the internal surface of the bore (26, 28) is formed of a highly reflective material.

8. A deformation detection system according to any preceding claim, wherein the transmission source (30) and/or the detector (32) is in the form of a removable plug, a portion of which is positioned in the respective end of the bore.

9. A deformation detection system according to any preceding claim, wherein the elongate element is a window pane sealing member (42) capable of effecting sealing a window opening of a motor vehicle against a window pane (50).

10. A deformation detection system according to claim 9, wherein the wall member of the elongate element is deformed under the action of an object trapped between an electrically operated window pane (50) as it closes and the periphery of the window opening about which the sealing member (42) is positioned.

11. A deformation detection system according to claim 9 or 10, wherein, on detection of attenuation in the radiation being transmitted along the transmission path, the detector (32) produces a signal indicative of the detection of a deformation in the wall member, and this is used to control the operation of a window drive or wind mechanism.

12. A deformation detection system according to any one of claims 9 to 11, wherein the radiation transmission source (30) and radiation detector (32) are energized only when the window pane (50) is closing or attempting to close.

13. A motor vehicle (40) having a body opening in which a closure member (50) is movable towards a peripheral edge of the body opening to close the opening, an electrically operated drive mechanism (58) being provided to effect movement of the closure member (50);

characterised in that said peripheral edge of the body opening is provided with a deformation detection system according to any preceding claim, and which further comprises

means for controlling operation of said drive mechanism in response to detection by the detection device of the attenuation in the radiation transmitted from the radiation source.

14. A motor vehicle according to claim 13, wherein the deformation detection device is part of a sealing

member (42) around the periphery of the body opening.

15. A motor vehicle according to claim 13 or 14, wherein the drive mechanism (58) is controlled in such a way that movement of the closure member (50) is stopped or reversed so as to prevent an object trapped between the deformation device (42) and the closure member (50) from being crushed and to permit its release.

16. A motor vehicle according to any one of claims 13 to 15, wherein the radiation transmission source (30) and the radiation detector (32) are only energized when the drive mechanism moves, or attempts to move, the closure member.

17. A deformation detection system or motor vehicle according to any preceding claim, wherein, when an audible sound source is used, it acts as a warning that the window pane or closure member is closing.

18. A deformation detection system or motor vehicle according to claim 17, wherein the note of the audible sound may change to serve as a warning of a trapped object.

Patentansprüche

1. Verformungsnachweissystem enthaltend:

ein längliches Element mit einem verformbaren Wandglied, welches die Wand einer Bohrung (26, 28) in dem länglichen Element ist, welches einen Strahlendurchlaßpfad bildet, welcher durch die Innenfläche der Bohrung (26, 28) bestimmt wird;

eine Schallstrahlenquelle (30), die so angeordnet ist, daß sie Strahlung in Gestalt von hörbaren oder nicht-hörbaren Schallwellen entlang des Strahlendurchlaßpfades überträgt; und einen Schallstrahlendetektor (32), der so angeordnet ist, daß er die von der Strahlenquelle entlang des Strahlendurchlaßpfades ausgesandte Strahlung nachweist, bei welchem der Strahlendetektor (32) mit einer Einrichtung zum Überwachen einer Schwächung der Strahlung ausgestattet ist;

wobei die Anordnung derart ist, daß eine Verformung des Wandgliedes des länglichen Elementes zumindest teilweise den Strahlendurchlaßpfad unterbricht, wodurch entlang des Pfades an den Detektor übertragene Strahlung abgeschwächt wird,

wobei der Durchlaßpfad von zwei im wesentlichen parallelen Abschnitten bestimmt ist, de-

ren jeweilige Enden durch eine Zwischenvorrichtung (36, 38) wirksam miteinander verbunden sind, welche in der Lage ist, das Strahlungssignal entlang des zweiten Abschnitts an den Detektor (32) zurückzuübertragen, wobei die Strahlenquelle (30) und der Detektor (32) im wesentlichen benachbart zueinander jeweils an denselben Enden des ersten und des zweiten Abschnitts (26, 28) gegenüber den Enden angeordnet sind, welche von der Zwischenvorrichtung (36, 38) miteinander verbunden sind,

dadurch gekennzeichnet, daß die Wand eines Abschnitts steifer ist als die Wand des anderen.

2. Verformungsnachweissystem nach Anspruch 1, bei welchem die Strahlenquelle (30) kontinuierliche Strahlung entsendet.

3. Verformungsnachweissystem nach Anspruch 1 oder 2, bei welchem die Strahlenquelle (30) und der Detektor (32) piezoelektrisch sind.

4. Verformungsnachweissystem nach einem der vorhergehenden Ansprüche, bei welchem der Detektor (32) in der Lage ist, ein Signal zu erzeugen, welches den Nachweis einer Verformung in dem Wandglied anzeigt.

5. Verformungsnachweissystem nach einem der vorhergehenden Ansprüche, bei welchem die Oberfläche des Wandglieds, welches den Strahlungsdurchlaßpfad definiert, in der Lage ist, Strahlung zu reflektieren.

6. Verformungsnachweissystem nach einem der vorhergehenden Ansprüche, bei welchem die Bohrung (26, 28) einen kreisförmigen oder ovalen Querschnitt aufweist.

7. Verformungsnachweissystem nach einem der vorhergehenden Ansprüche, bei welchem die Innenfläche der Bohrung (26, 28) aus einem stark reflektierenden Material gebildet ist.

8. Verformungsnachweissystem nach einem der vorhergehenden Ansprüche, bei welchem die Strahlenquelle (30) und/oder der Detektor (32) die Form eines entfernbaren Einschubes hat, wovon sich ein Teil an dem jeweiligen Ende der Bohrung befindet.

9. Verformungsnachweissystem nach einem der vorhergehenden Ansprüche, bei welchem das längliche Element eine Fensterscheibendichtung (42) ist, welche in der Lage ist, eine Fensteröffnung eines Kraftfahrzeuges gegen eine Fensterscheibe (50) abzudichten.

10. Verformungsnachweissystem nach Anspruch 9, bei welchem das Wandglied des länglichen Elementes unter der Einwirkung eines Gegenstandes verformt wird, welcher zwischen einer elektrisch betriebenen Fensterscheibe (50) und der Umrandung der Fensteröffnung, um welche die Dichtung (42) angeordnet ist, beim Schließen eingeklemmt wird. 5
11. Verformungsnachweissystem nach Anspruch 9 oder 10, bei welchem der Detektor (32) bei Feststellung einer Abschwächung der entlang des Durchlaßpfades übertragenen Strahlung ein Signal erzeugt, welches die Verformung in dem Wandglied anzeigt und dieses zur Betriebssteuerung eines Fensterantriebes oder Windenmechanismus dient. 10 15
12. Verformungsnachweissystem nach einem der Ansprüche 9 bis 11, bei welchem die Strahlenquelle (30) und der Strahlendetektoren (32) nur dann angeschaltet sind, wenn sich die Fensterscheibe schließt oder dies versucht. 20
13. Kraftfahrzeug (40) mit einer Karosserieöffnung, in welcher ein Verschlußglied (50) zu der Umrandungskante der Karosserieöffnung hin beweglich ist, um die Öffnung zu schließen, wobei ein elektrisch betriebener Antriebsmechanismus (58) so beschaffen ist, daß er eine Bewegung des Verschlußgliedes (50) bewirkt; 25
dadurch gekennzeichnet, daß die Umrandungskante der Karosserieöffnung mit einem Verformungsnachweissystem nach einem der vorhergehenden Ansprüche versehen ist, und welches weiterhin Mittel zum Steuern des Betriebes des Antriebsmechanismus in Antwort auf die von dem Detektor nachgewiesene Abschwächung der von der Strahlungsquelle ausgesandte Strahlung aufweist. 30 35
14. Kraftfahrzeug nach Anspruch 13, bei welchem die Verformungsnachweisvorrichtung Teil einer Dichtung (42) um die Umrandung der Karosserieöffnung ist. 40
15. Kraftfahrzeug nach Anspruch 13 oder 14, bei welchem der Antriebsmechanismus (58) so gesteuert ist, daß eine Bewegung des Verschlußgliedes (50) gestoppt oder umgekehrt wird, um so zu verhindern, daß ein zwischen der Verformungsvorrichtung (42) und dem Verschlußglied (50) eingefangener Gegenstand eingequetscht wird, und um seine Freigabe zu ermöglichen. 45 50
16. Kraftfahrzeug nach einem der Ansprüche 13 bis 15, bei welchem die Strahlenquelle (30) und der Strahlendetektor (32) nur dann angeschaltet sind, wenn sich der Antriebsmechanismus das Verschlußglied bewegt oder dies versucht. 55

17. Verformungsnachweissystem oder Kraftfahrzeug nach einem der vorhergehenden Ansprüche, bei welchem es, bei Verwendung einer hörbaren Schallquelle, als Warnung dafür dient, daß sich die Fensterscheibe oder das Verschlußglied schließt.

18. Verformungsnachweissystem oder Kraftfahrzeug nach Anspruch 17, bei welchem sich der Ton des hörbaren Schalles ändern kann, um als Warnung bezüglich eines eingefangenen Gegenstandes zu dienen.

Revendications

1. Système de détection de déformation, comprenant:

un élément allongé qui inclut un élément de paroi déformable qui est une paroi d'un perçage (26, 28) dans l'élément allongé qui constitue un trajet de transmission de rayonnement défini par la surface interne du perçage (26, 28) ;

une source d'émission de rayonnement sonore (30) positionnée de façon à émettre un rayonnement sous la forme d'ondes sonores audibles ou inaudibles le long du trajet de transmission de rayonnement ; et

un détecteur de rayonnement sonore (32) positionné de façon à détecter le rayonnement transmis depuis ladite source de rayonnement le long du trajet de transmission de rayonnement, ledit détecteur de rayonnement (32) étant pourvu de moyens pour surveiller une atténuation du rayonnement ;

l'agencement étant tel qu'une déformation de l'élément de paroi de l'élément allongé interrompt au moins partiellement le trajet de transmission du rayonnement, en raison de quoi le rayonnement qui est transmis le long dudit trajet vers le détecteur (32) est atténué,

dans lequel le trajet de transmission est défini par deux tronçons sensiblement parallèles, une extrémité de chaque tronçon étant fonctionnellement reliées l'une à l'autre par un dispositif intervenant (36, 38) capable de recevoir le signal de rayonnement transmis depuis la source d'émission de rayonnement (30) le long d'un premier desdits deux tronçons, et capable de retransmettre le signal de rayonnement le long du second tronçon vers le détecteur (32), la source d'émission (30) et le détecteur (32) étant positionnés sensiblement en position adjacente l'un à l'autre aux mêmes extrémités respectivement du premier et du second tronçon

(26, 28) opposées aux extrémités reliées par le dispositif intervenant (36, 38),

caractérisé en ce que la paroi d'un tronçon est plus raide que la paroi de l'autre tronçon.

2. Système de détection de déformation selon la revendication 1, dans lequel la source d'émission de rayonnement (30) émet un rayonnement continu.

3. Système de détection de déformation selon l'une ou l'autre des revendications 1 et 2, dans lequel la source d'émission (30) et le détecteur (32) sont piézoélectriques.

4. Système de détection de déformation selon l'une quelconque des revendications précédentes, dans lequel le détecteur (32) est capable de produire un signal indicatif de la détection d'une déformation dans ledit élément de paroi.

5. Système de détection de déformation selon l'une quelconque des revendications précédentes, dans lequel la surface de l'élément de paroi définissant le trajet de transmission de rayonnement est capable de réfléchir le rayonnement.

6. Système de détection de rayonnement selon l'une quelconque des revendications précédentes, dans lequel le perçage (26, 28) a une section circulaire ou ovale.

7. Système de détection de déformation selon l'une quelconque des revendications précédentes, dans lequel la surface interne du perçage (26, 28) est formé d'un matériau hautement réfléchissant.

8. Système de détection de déformation selon l'une quelconque des revendications précédentes, dans lequel la source d'émission (30) et/ou le détecteur (32) a la forme d'un bouchon amovible, dont une partie est positionnée dans l'extrémité respective du perçage.

9. Système de détection de déformation selon l'une quelconque des revendications précédentes, dans lequel l'élément allongé est un élément d'étanchement (42) pour vitre de fenêtre capable d'effectuer l'étanchement d'une ouverture de fenêtre d'un véhicule automobile contre une vitre de fenêtre (50).

10. Système de détection de déformation selon la revendication 9, dans lequel l'élément de paroi de l'élément allongé est déformé sous l'action d'un objet emprisonné entre une vitre de fenêtre à actionnement électrique (50) tandis qu'elle se ferme et la périphérie de l'ouverture de fenêtre autour de laquelle est positionné l'élément d'étanchement (42).

11. Système de détection de déformation selon l'une ou l'autre des revendications 9 et 10, dans laquelle, lors de la détection de l'atténuation du rayonnement qui est transmis le long du trajet de transmission, le détecteur (32) produit un signal indicatif de la détection d'une déformation de l'élément de paroi, et celui-ci est utilisé pour commander le fonctionnement d'un entraînement ou d'un mécanisme de fenêtre.

12. Système de détection de déformation selon l'une quelconque des revendications 9 à 11, dans lequel la source d'émission de rayonnement (30) et le détecteur de rayonnement (32) sont excités uniquement lorsque la vitre de fenêtre (50) se ferme ou tente de se fermer.

13. Véhicule à moteur (40) ayant une ouverture de carrosserie dans laquelle un élément de fermeture (50) est mobile en direction d'un bord périphérique de l'ouverture de carrosserie pour fermer l'ouverture, un mécanisme d'entraînement à actionnement électrique (58) étant prévu pour assurer le mouvement de l'élément de fermeture (50); caractérisé en ce que ledit bord périphérique de l'ouverture de carrosserie est pourvu d'un système de détection de déformation selon l'une quelconque des revendications précédentes, et qui comprend en outre des moyens pour commander le fonctionnement dudit mécanisme d'entraînement en réponse à la détection par le dispositif de détection de l'atténuation dans le rayonnement transmis depuis la source de rayonnement.

14. Véhicule à moteur selon la revendication 13, dans lequel le dispositif de détection de déformation fait partie d'un élément d'étanchement (42) autour de la périphérie de l'ouverture de carrosserie.

15. Véhicule à moteur selon l'une ou l'autre des revendications 13 et 14, dans lequel le mécanisme d'entraînement (58) est commandé d'une manière telle que le mouvement de l'élément de fermeture (50) est arrêté ou inversé de façon à empêcher qu'un objet emprisonné entre le dispositif de déformation (42) et l'élément de fermeture (50) soit écrasé, et à permettre sa libération.

16. Véhicule à moteur selon l'une quelconque des revendications 13 à 15, dans lequel la source d'émission de rayonnement (30) et le détecteur de rayonnement (32) sont uniquement excités lorsque le mécanisme d'entraînement déplace, ou tente de déplacer l'élément de fermeture.

17. Système de détection de déformation, ou véhicule à moteur, selon l'une quelconque des revendications précédentes, dans lequel, lorsqu'on utilise une

source sonore audible, celle-ci agit comme avertissement que la vitre de fenêtre ou l'élément de fermeture est en train de se fermer.

- 18.** Système de détection de déformation, ou véhicule à moteur, selon la revendication 17, dans lequel la note du son audible peut changer pour servir comme avertissement d'un objet emprisonné.

10

15

20

25

30

35

40

45

50

55

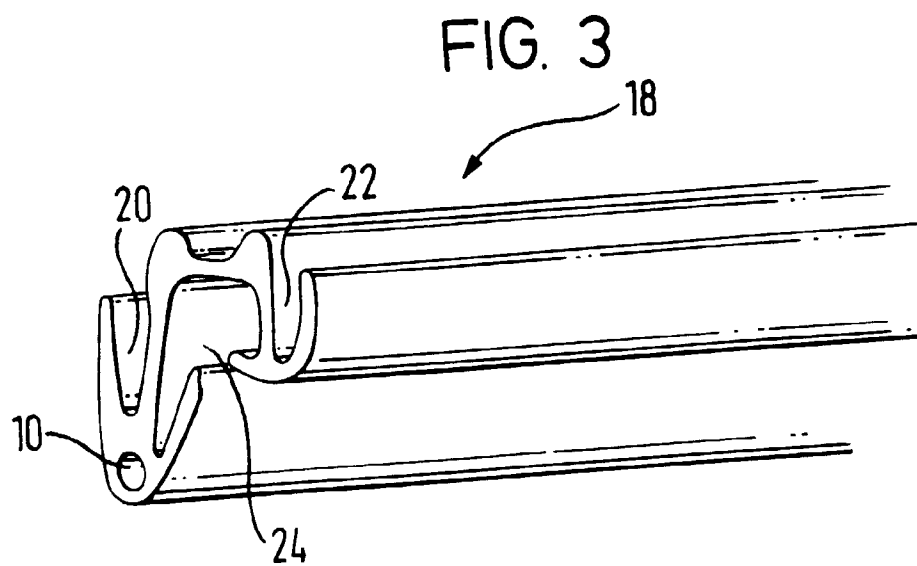
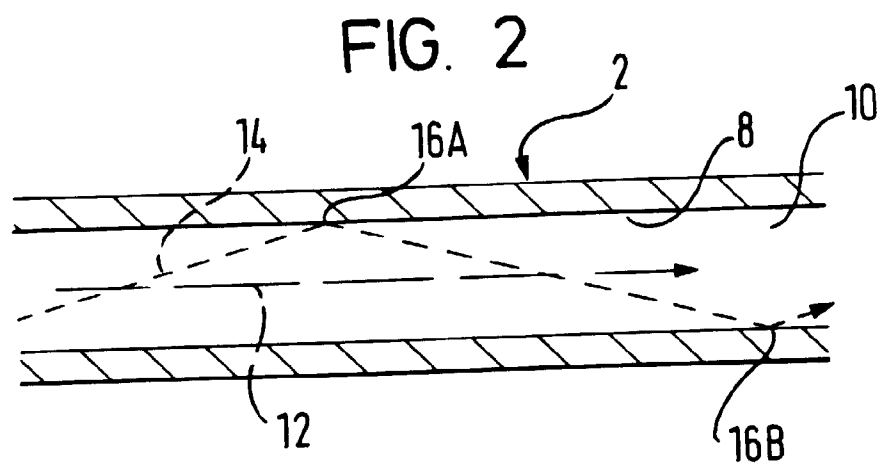
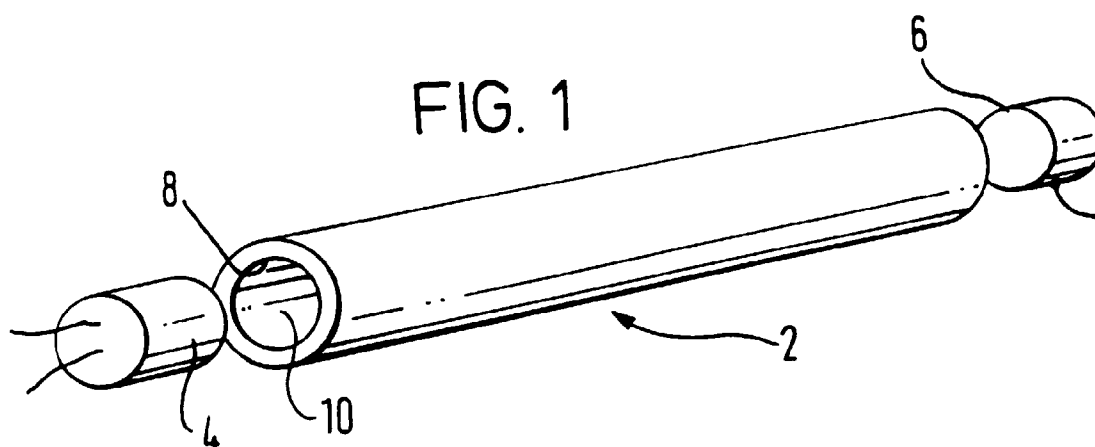


FIG. 4

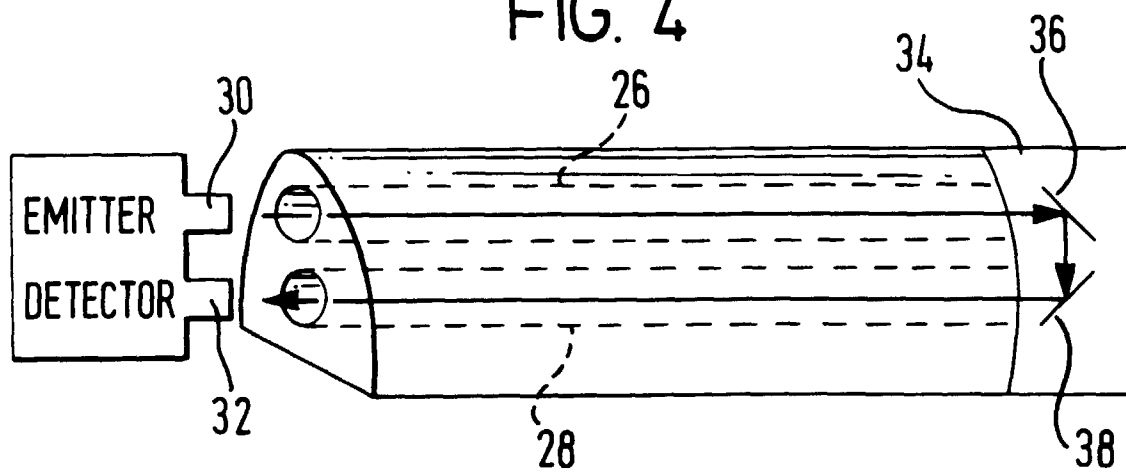


FIG. 5

