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# (54) SYSTEMS FOR DETECTION AND SIGNALLING OF READINESS TO RECEIVE IMPACT ON AN AIRBAG, ESPECIALLY A RESCUE CUSHION AND AN AIRBAG CONTAINING THESE SYSTEMS

SYSTEM ZUR DETEKTION UND SIGNALISIERUNG DER AUFPRALLBEREITSCHAFT AUF EINEN AIRBAG, INSBESONDERE RETTUNGSKISSEN UND AIRBAG MIT DIESEN SYSTEMEN

SYSTÈMES DE DÉTECTION ET DE SIGNALISATION DE L'APTITUDE À RECEVOIR UN IMPACT SUR UN COUSSIN GONFLABLE, NOTAMMENT UN COUSSIN DE SAUVETAGE ET COUSSIN GONFLABLE CONTENANT CES SYSTÈMES

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## Description

**[0001]** The subject of the invention are systems for detecting and signalling of readiness to receive the impact by an airbag, especially for use in rescue cushions (safety air cushions, jump cushions) for safe evacuation of people, and an airbag equipped with these systems according to the invention. In addition to rescue cushions, the invention may also be used in other types of airbags, such as those used in aircraft emergency landing systems or crash mitigation barriers.

**[0002]** Rescue cushions based on pneumatic frame are widely used by Fire Departments around the world due to their compact design and relatively low weight. Their design is based on a pneumatic frame inflated from a cylinder with compressed air. There are covers attached to the frame that restrict a certain volume of gas and thus form an air cushion onto which the evacuated person falls. Due to the large volume of the airbag, it is not possible to fill it with compressed air from a cylinder and the airbag is self-inflated with atmospheric air. When the pneumatic frame is unfolded, the gas pressure inside the cushion is equalized due to the inflow of air through holes in the side covers of the rescue cushion.

**[0003]** The rescue cushion can be considered fully deployed and ready to receive the impact when the gas pressure inside the airbag of the rescue cushion is equal to the ambient pressure. Depending on current operational and visibility conditions, it may be difficult to assess the readiness of the rescue cushion to receive an impact. At the same time it is required for the effectiveness of the rescue cushion to be fully inflated before jumping on it. The proposed invention provides automatic detection of the readiness of the rescue cushion by the electronic system and its visual indication, which allows the rescue cushion operator and/or the evacuee to ascertain the possibility of making a safe jump onto the rescue cushion.

**[0004]** The state of the art describes utility model DE20315946 U1, which pertains to a rescue cushion comprising a light source in the form of reflective tapes and or electric lamps. The said electric lamps can be switched on manually or they can switch on automatically when the cushion is filled. The solution presents the concept of using a light signal of the rescue cushion filling. The model does not disclose how and by which technical means the said automatic switching on of the lighting is performed.

**[0005]** Known is the rescue cushion by I.C.Brindle & Co Ltd. The distributor's reference materials do not disclose the presence of lighting or a fill level indication system. Instructional video (https://www.youtube.com/watch?v=yObH6e8BVJ8, accessed: 04 Nov. 2020) indicates the presence of lighting (i.e. a cable with LEDs) on the contour of the jump surface and the presence of an external detachable tie located on the outer surface of the side of the rescue cushion, the tensioning of which is observed when the rescue cushion is deployed. It is not apparent from the materials how the said tie is connected to the lighting or the role of such connection. In addition, a link between the LEDs and the jump-ready indication of the cushion should be excluded, because the LEDs did not light up once during the entire instructional video, which included the unfolding of the cushion, the jump of the evacuated person, the regeneration of the cushion, and its folding.

**[0006]** Known rescue cushions do not have systems for detecting and signalling the readiness of the airbag to take the impact. At the moment, the rescue cushions available on the market are not equipped with a system that would identify and signal the fact of full inflation of the airbag after deployment of the pneumatic frame. The problem is particularly significant when the jumps are made by successive persons (multiple use of the rescue cushion during one rescue operation). It is essential that the evacuee and firefighters have knowledge of the readiness or lack of readiness of the airbag (rescue cushion) to take the impact when another jumping person is landing. The proposed solution is a system for detection of the airbag inflation and the signalling system integrated with it. The functionality and increased safety achieved by the invention are of great importance. It is important to note that under rescue conditions there are difficulties in communication between potential jumpers and rescuers. Use of the invention will enable intuitive, visual communication of the information for device readiness.

**[0007]** The purpose of the invention is to provide an airbag with a system for detecting and signalling the readiness of the airbag to take an impact.

The subject of the invention is an airbag with a system for detection of the airbag readiness according to claim 1.

**[0008]** The connector is attached to the bottom cover, to the side cover, or to a cushion baffle.

**[0009]** The connector is selected from the group consisting of a mechanical connector, a tension sensor, or a combination thereof.

**[0010]** Preferably, the connector is equipped with a filter selected from the group consisting of an analogue filter or a digital filter.

**[0011]** Preferably at least one tie element is attached to the inner side of the cushion cover by spanning it on the side wall vertically, horizontally, or diagonally.

**[0012]** Preferably, at least one tie element is fastened between the top and bottom cover of the cushion or is located in the centre of the circle inscribed in the shape of the top and bottom cover of the cushion.

**[0013]** Preferably, at least one tie element is attached diagonally leading from the edge joining the bottom cover with the side cover to the opposite edge between the top cover and the side cover. Preferably, the system according to the invention comprises one connector, and each of the at least one ties is provided with a guide fastener located in the corner of the cushion.

**[0014]** Preferably, each tie element is provided with a

separate connector.

**[0015]** Preferably, the portable power source is a battery or an accumulator, said portable power source being housed in a pocket at the bottom of the cushion cover, or attached to the inside surface of the bottom cover of the cushion, or placed on the side surface of the cushion.

**[0016]** Preferably, the illumination is a spot light, at least one light strip or a combination thereof, said illumination being located either on the cover of the top cushion or on the side cover of the cushion at the contact point of the side cover and top cover of the cushion, or outside the cushion.

**[0017]** Another subject of the invention is an airbag with a system for detection of airbag readiness according to claim 11.

**[0018]** The system is equipped with an electronic circuit for signal processing consisting of a microprocessor circuit or a microprocessor circuit and a filter.

**[0019]** Preferably, the component is a contact element, and the number of contact elements in the system according to the invention is at least equal to the number of side walls of the cushion, with at least one contact element each arranged in the centre of each side wall.

**[0020]** Preferably, the portable power source is a battery or an accumulator, said portable power source being housed in a pocket at the bottom of the cushion cover, or attached to the inside surface of the bottom cover of the cushion, or placed on the side surface of the cushion.

**[0021]** Preferably, the illumination is a spot light, at least one light strip or a combination thereof, said illumination being located either on the top cover of the cushion or on the side cover of the cushion at the contact point of the side cover and top cover of the cushion, or outside the cushion.

**[0022]** Another subject of the invention is an airbag comprising a system according to the invention, characterized in that on the top cover of the cushion there is at least one pictogram with the desired body position of a jumping person during a jump onto the cushion.

**[0023]** The operation of the system according to the invention is based on the following principle - an airbag (e.g. a rescue cushion) is equipped with a system according to the invention containing a component / components (i.e. tie components, alternatively a material with variable resistance or contact components placed on the cushion cover), mounted in appropriate places, e.g. between the top and bottom cover, between the corners of the airbag, etc. In the event of obtaining a certain tension / contact of the above-mentioned component, an electronic switch is mechanically activated to control lamps or signalling strips, the colour of which changes from the first colour to the second colour (e.g. from red to green), thus indicating that the airbag is ready to take the impact.

**[0024]** The detection system may take one of the following variations. The first variant assumes the use of a tie attached unilaterally to the airbag cover, where the other end of the said tie is attached to the connector. This mechanism is characterised in that the tie is tightened when the cushion is deployed.

**[0025]** The tie may be attached in one of the following arrangements:

- Spanned vertically, horizontally, or diagonally on the side wall.
- Between the top and bottom cover of the cushion, placed in the centre of a circle inscribed in the shape of the top and bottom cover.
- On the diagonal drawn from the edge joining the bottom cover with the side wall to the opposite diagonal edge of the top cover with the side wall.

**[0026]** The tie on one side is fixed permanently to the cover (or e.g. to the cushion frame in the case of cushions with a frame). On the other side, fixed by a switch mechanism or a tie tensioning sensor.

**[0027]** In particular, the mechanical switch may be a two-position mono-stable electrical switch with a lever or an eye. The tension sensor may be based on a strain gauge or piezoelectric actuator. As an alternative to using the tie as a system for detection of correct cushion deployment, it is envisaged to use a variable resistance coating material for detecting correct cushion inflation. The material can form a uniform whole with the cushion cover, as well as be an independent part sewn or glued to the cushion cover. The deformation of the cushion cover causes a change in the material resistance. This information is then processed by the cushion's correct deployment system, which controls the readiness signalling system.

**[0028]** In order to prevent false signals during shape change and vibration of the cover (or tie), the invention is provided with a filter. In the simplest version, the filter may consist of an RC circuit (resistor, capacitor) and in a more complex version it may be a digital filter implemented on a microcontroller chip.

**[0029]** The airbag readiness detection system is powered by a portable power source located in a pocket at the bottom of the airbag cover.

**[0030]** Systems based on direct or mechanical tension detection (tie, cover material) may be replaced by contact systems. For example, it is possible to equip the rescue cushion cover with elements whose contact appears only when the airbag of the rescue cushion is fully deployed. The rest of the solution remains unchanged.

**[0031]** The system for detection and signalling of readiness of an airbag (e.g. a rescue cushion) may consist of four or more light indicators arranged at the corners and / or at several points at the edges of the polygon of the top cover of the cushion, e.g. of the rescue cushion. In particular, it is envisaged to use spot, two-colour light indicators of green and red light.

**[0032]** The light indicators may also be in the form of a light belt (strip) located along the edge of the top cover. The light strip can be continuous or intermittent. In the solution it is possible to use both types of light indicators together.

**[0033]** Signalling that the airbag is ready to absorb an impact is controlled by a system that detects correct deployment and inflation of the airbag.

**[0034]** The invention provides the following advantages:

- Increasing visibility and guiding the jumper to the field of the upper surface of the jump cushion in conditions of limited visibility, smoke, fog, darkness, poor lighting;
- Providing visual signalling of cushion readiness to receive impact after each inflation, which is especially important for multiple use of the jump cushion during one rescue operation (when one person jumps after another);
- The readiness signalling is equally visible to the jumpers and the personnel operating the cushion - i.e. all involved in the evacuation are equally informed;
- The use of light signals eliminates the negative effects of noise on the course of action or other impediments to verbal communication, because the readiness of the cushion to receive an impact is communicated visually in an intuitive form;
- The use of suggestive two-colour lighting, analogous to the signalling at a pedestrian crossing, where the red colour means "stop" and the green colour "jump";
- The change in the colour of the lighting takes place after obtaining a certain tension / contact of the components of the system according to the invention, which activates the lighting control (e.g. via an electronic switch or electric control), which guarantees that the change of the lights will only take place when the cushion is properly deployed;
- Increase of the safety of rescue operations by eliminating injuries resulting from premature jump onto a rescue cushion that is not fully ready to take the impact;
- A pictogram with the appropriate (correct / desired) body position during a jump on the airbag cushion additionally reduces the risk of making an incorrect jump;
- Instructions for making the jump in the form of a series of symbols or images on the top cover of the jump cushion;
- Provision of multiple lighting options: two-colour lights, two/multi-colour strip or two/several strips selected from a group including: continuous strip, intermittent strip, strip in combination with spot lighting;
- The system according to the invention is provided with an analogue filter (passive electronic circuit) or a digital filter (microcontroller-based circuit), which prevents flickering of the lighting during dynamic movements of the rescue cushion due to momentary tension of the elements or momentary contact thereof).

**[0035]** The subject of the invention is depicted in the embodiment shown in the drawing wherein fig. 1 is a schematic drawing of variants of the cushion cover inside which a system according to the invention is mounted; fig. 2 shows a rescue cushion equipped with the subject airbag system for detection and signalling of readiness to receive an impact in a partially inflated condition, wherein the system is in a variant with one component which is a tie element; fig. 3 shows a rescue cushion according to the invention equipped with the subject system for detection and signalling of readiness to receive impact by the airbag when fully inflated and fully ready to receive an impact in the variant with one component, namely the tie; fig. 4 shows a diagram of a lighting management system according to the invention, wherein (A) is a variant of the system with one connector and (B) is a variant with four connectors; fig. 5 shows a rescue cushion provided with the subject system for detection and signalling of readiness to receive an impact by the airbag in a variant with four ties connected to one connector; fig. 6 shows a rescue cushion provided with the subject system for detection and signalling of readiness to receive an impact by the airbag in a variant with four ties, each connected to a separate connector; fig. 7 shows a rescue cushion provided with the system according to the invention in a variant provided with contact elements; fig. 8 shows a jump cushion provided with the system according to the invention in a variant provided with a material of variable resistance.

**Example 1.**

**[0036]** In this non-limiting example, the cushion **1** according to the invention is a rescue cushion, which consists of a pneumatic frame **2** to which the covers are attached. In this example, the cushion **1** is a rescue cushion in the form of a pneumatic cushion stretched over the frame **2.** On the other hand, the system according to the invention is also suitable for installation in cushions without a frame. Moreover, in addition to the rescue cushions, the system according to the invention may also be used in other types of airbags, such as those used in aircraft emergency landing systems or crash mitigation barriers.

**[0037]** In this example, the rescue cushion has four side covers **3a,** a top cover **3b** and a bottom cover **3c,** while the rescue cushion may have a cover **3d** that constitutes a partition dividing the volume of the rescue

cushion into two chambers (such a variant is shown in Fig. 1).

**[0038]** As shown in fig. 2 and 3, in this example the rescue cushion is equipped with the readiness detection and signalling system according to the invention, which consists of one component **5** in the form of a tie element **5a** fastened inside the cushion **1,** where said tie element **5a** is permanently fixed on one side to the edge of the top cover **3b** of the cover of cushion **1** , and on the other hand, said tie **5a** is fixed indirectly via the connector **6** to the bottom cover **3c** of the cushion **1.**

**[0039]** In this example, the tie element **5a** is a nylon cord, while other materials, e.g. a braided steel cord, may also be used to form the tie element **5a.** In turn, the connector **6** is attached to the bottom cover **3c** of the cushion **1.** On the other hand, the connector **6** may also be attached to other covers of the cushion **1,** such as to the side cover **3a** or to the baffle **3d** (if the baffle is present in the cushion).

**[0040]** In this example, the connector **6** is a mechanical, monostable, two-position lever switch with NC (normally closed) contacts. As shown in fig. 4, the mechanical connector has two pairs of contacts, i.e. a normally closed pair and a normally open pair. The normally closed pairs are connected to each other in series. Loosening of the tie component **5a** results in a break in the illumination circuit **9** for the green light source. The normally open contacts are connected in parallel. Closing of any of the contacts closes the lighting supply circuit **9** for the green light.

**[0041]** In this example, the mechanical connector **6** is equipped with a filter **7** which prevents flickering of the lighting **9** during dynamic movements of the cushion resulting in a temporary tensioning of the tie components **5a.** In this example, filter **7** is an RC low pass circuit which allows the lower frequencies to pass and filters out the higher ones. An example of the location of filter **7** is shown in fig. 4A.

**[0042]** Furthermore, the connector **6** is connected to a portable power source **8** which, in this non-limiting example, is a battery (e.g. a Lithium Polymer Li-Po battery) housed in a pocket at the bottom of the cushion cover **1.** On the other hand, the power source **8** can also be attached e.g. to the inside surface of the bottom cover **3c** of the cushion **1** or it can be placed on the side surface **3a** of the cushion **1.**

**[0043]** As discussed above, the system according to the invention is further provided with a variable-colour illumination **9** which is mounted on the top cover **3b** of the cushion **1.** On the other hand, the lighting **9** can also be located at the contact point of the side cover **3a** and the top cover **3b** of the cushion **1.** In addition, the lighting **9** can also be located outside the cushion **1** and be present, similarly to road signs, in the form of a standing signalling device wired or wirelessly connected to the system according to the invention built into the cushion **1.**

**[0044]** Whereby, in this example, the lighting **9** is a two-colour (red-green) lighting, where the first colour (i.e. the red colour) corresponds to the state of lack of readiness of the cushion **1** (as indicated in fig. 2 in dark grey), while the second colour (i.e. green) signals the readiness of the cushion **1** (as indicated in fig. 3 with light grey). When the cushion **1** (i.e. the rescue cushion) is loaded due to the landing of a person or during their dismounting from the rescue cushion, the tension of the element **5a** is low or absent and the lack of readiness of the airbag is indicated by the first colour (e.g. red). Once the cushion **1** has acquired a predetermined shape (i.e. when properly inflated), the colour of the lights automatically changes to a second colour (e.g. green), indicating that the cushion **1** is ready to receive an impact. A diagram of the lighting management **9** is shown in Fig. 4A. In this example, the lighting **9** is a combination of a spotlight **9a** in the form of lamps arranged at the four corners of the cushion **1** with an LED light strip **9b** extending between said lamps.

**[0045]** Whereby, in this non-limiting example, there is a pictogram on the top cover **3b** of the cushion **1** with the appropriate (correct / desired) body position when jumping onto the cushion **1.**

**Example 2.**

**[0046]** Rescue cushion as in embodiment 1, except that the cushion **1** does not have a frame, and the tie element **5a** is attached at one end to the centre of the top cover **3b** of the cushion **1** and at the other end to the connector **6,** which in this embodiment is a mechanical connector with normally open contacts and the portable power source is a Li-Po battery.

**[0047]** Whereby, in this non-limiting embodiment, the top cover **3b** of the cushion **1** has a series of three pictograms representing a pictorial jumping instruction with a model body position at different stages of the jump during the jump onto the cushion **1.**

**Example 3.**

**[0048]** A jump cushion comprising the system according to the invention as in embodiment **1,** except that the tie element **5a** is attached to the outer side of the cushion **1** (e.g. in fabric ducts guided on the outer side of the cushion **1** cover). In this embodiment, the tie element **5a** is fastened on one side between the edge of the top cover **3b** and side cover **3a** and the connector **6** located outside the inner part of the cushion in this case (e.g. on the outer surface of the side cover **3a**).

**Example 4.**

**[0049]** A rescue cushion comprising the system according to the invention as in embodiment 3, except that the tie element **5a** is fastened on one side between the upper part of the side cover **3b** and the connector **6** located outside the inner part of the cushion in this case.

**Example 5.**

**[0050]** Rescue cushion as in embodiment 1, but the system according to the invention is equipped with four tie elements **5a** connected to one connector **6.** An exemplary topology of such a system is shown in fig. 5, wherein the first tie **5a** fastened to the connector **6** is routed diagonally from the edge joining the bottom cover **3c** with the side cover **3a** to the opposite edge of the top cover **3b** with the side cover **3a.** Further tie elements **5a** span diagonally across the side covers **3a.**

**[0051]** Whereby the topology of the arrangement of the tie elements **5a** may be different, and the variant illustrated in fig. 5 is only an example of an embodiment and cannot limit the protection of the present invention.

**[0052]** Other example combinations of fastenings of the tie elements **5a** include, e.g., spreading the tie element **5a** on the side cover **3a** vertically or horizontally, and spreading the tie element **5a** between the top cover **3b** and the bottom cover **3c** of the cushion **1,** in particular placing it in the centre of a circle inscribed in the shape of the top cover **3b** and bottom cover **3c.**

**[0053]** However, in the case of using a solution with a single connector **6** (as in the present embodiment), it must be ensured that there is as little friction as possible on the guide fasteners **10.** The role of the guide fasteners **10** is to change the direction of tension of the tie element **5a** at the transition from one wall of the cushion **1** to the other and to reduce the friction in the respective node. In this non-limiting embodiment, the guide fasteners **10** are teflon blocks. Whereas, the guide fastener **10** can be made of both a low-friction (e.g. teflon) and a rolling (e.g. stainless steel or aluminium alloy) sliding element. As shown in fig. 5 guide fasteners **10** are arranged at the corners of the rescue cushion.

**Example 6.**

**[0054]** Rescue cushion as in embodiment 1, but the system according to the invention is equipped with four tie elements **5a,** each of which is equipped with a separate connector **6.** An exemplary topology of such a system is shown in fig. 6.

**[0055]** In this embodiment, the connector **6** is a mechanical, monostable, two-position lever switch with NC (normally closed) contacts. As shown in fig. 4B, each mechanical connector has two pairs of contacts, i.e. a normally closed pair and a normally open pair. The normally closed pairs are connected to each other in series. Loosening of any tie component **5a** results in a break in the circuit for the green light source. The normally open contacts are connected in parallel. Closing of any of the contacts closes the supply circuit 9 for the green light.

**Example 7.**

**[0056]** Rescue cushion as in embodiment 1, except that the tie element **5a** is replaced by contact elements **5b.** An example of a topology of contact elements **5b** is shown in fig. 7. As shown in fig. 7, the example of topology assumes placing contact elements **5b** on the centres of the side covers **3a** - one contact element **5b** in the centre of each side wall **3a.**

**[0057]** Whereas, in this embodiment, the system according to the invention does not have a connector **6.** Connector **6** is redundant, because its role is played by contact elements (they correspond to switch **6,** but without a lever), and simply the tensioning of the cover causes the electric circuit to be closed or interrupted. In this non-limiting embodiment, the contact elements are made of aluminium with a conductive anti-corrosion coating. However, aluminium may be replaced by another material (e.g. copper).

**[0058]** The contact elements **5b** are fixed in such a way that, when the covers of the cushion **1** are not tensioned, their mutual contact will not take place, and when the covers of the cushion **1** are tensioned, mutual contact occurs, as a result of which the power supply circuit of the lighting signalling system **9** is closed or interrupted.

**[0059]** However, the above topology of the arrangement of contact elements is only an example of an embodiment and cannot limit the protection of the present invention. For example, in the case where the cushion **1** is a cylinder (cylindrical cushion), several contact elements **5b** would have to be mounted on the side wall. As an alternative, the contact elements **5b** may also be attached differently, e.g. in such a way that, when the covers are not tensioned, their mutual contact is ensured, and with the tension of the covers the contact elements **5b** become disconnected.

**Example 8.**

**[0060]** Rescue cushion as in embodiment 1, except that the tie element **5a** is replaced by a material of variable resistance **5c** which replaces at least one side cover **3a.** In this embodiment, the variable resistance material **5c** replaces the two side covers **3a** as shown in Fig. 8. In this non-limiting embodiment, a fabric made of nylon and spandex covered with a conductive coating is used as the variable resistance material **5c.** However, other known variable resistance materials can be used.

**[0061]** Whereas, the topology of variable resistance material **5c** shown in Fig. 8 is only an example of an embodiment and cannot limit the protection of the present invention. The resistance material **5c** may e.g. not replace the covers of the cushion **1** but form part of the cover(s) **3a** or be placed on the cover(s) **3a** in the form of a patch.

**[0062]** Regardless of the selected variant, in the case of using the resistance material **5c,** the system according to the invention should additionally be equipped with an electronic system **11** allowing for the processing of the electric signal and lighting control **9.** In this embodiment, the said electronic circuit **11** consists of a microprocessor circuit. The microprocessor is used to analyse the ana-

logue signal from the covers with variable resistance **5c** and control the logic of the light signalling system. Alternatively, the electronic circuit **11** may also be equipped with an analogue signal filter **7** in the form of an RC circuit or digitally implemented on a microprocessor.

**Example 9.**

**[0063]** *The method of filling the cushion and an example operation of the system for detecting and signalling the readiness of the cushion*

**[0064]** In this embodiment, the cushion **1** is a rescue cushion provided with a system according to the invention as in embodiment 1, which obtains its rectangular shape when the pneumatic frame **2** is filled with gas, e.g. from a compressed air cylinder.

**[0065]** The appearance of the cushion **1** during the filling of the frame **2** with gas is shown in Fig. 2. While the frame **2** is being filled, the lighting **9** lights up red (the first colour is shown in dark grey in Fig. 2), indicates that cushion **1** is not ready to receive the impact. The deployment of the frame **2** and the stretching of the rescue cushion covers results in the tension of the tie element **5a.** Together with the tensioning of the tie element **5a ,** the state of the switch **6** changes mechanically, which results in a change in its electrical state and the switching of the lighting colour **9** from the first colour (e.g. red) to the second colour (e.g. green), signalling that the cushion **1** is ready to receive impact.

**Example 10.**

**[0066]** The method is as in embodiment 9, but the deployed cushion is provided with the system according to the invention, in which the elements **5** are contact elements **5b** as in embodiment 7.

**[0067]** The deployment of the frame **2** and the stretching of the rescue cushion covers results in contact of the contact elements **5b.** If the contact elements **5b** are used, they perform a function analogous to that of the connector **6** and cause a direct change in the electrical state which determines the colour of the lighting **9.**

**[0068]** Whereas in this embodiment, in the state of non-contact of the contact elements **5b,** depending on the solution variant, the colour of the illumination **9** is red, and in the condition of presence of contact of the contact elements **5b,** the colour of the illumination **9** is green.

**Claims**

**1.** An airbag with a system for detection of the airbag readiness, wherein,

- the airbag (1) comprises a pneumatic frame (2) with an airbag cover, having side covers (3a), a top cover (3b) and a bottom cover (3c), preferably wherein the airbag (1) additionally comprises a baffle (3d) dividing the volume of the airbag into two chambers;
- the system comprises at least one constituent component (5), a power source (8), a connector (6), an electronic system with at least two -colour variable colour lighting (9) connected to

constituent component (5), wherein the electronic system is configured to determine the state of the lighting (9);
wherein at least one constituent component (5) is in the form of a tie element (5a), one end of which is attached in a fixed manner to the top (3b) or side (3a) cover of the air-bag (1) and the other end attached to the connector (6), and
wherein said tie element (5a) is fixed indirectly via the connector (6) to the airbag cover, preferably to the baffle (3d) of the airbag (1),
wherein the connector (6) is attached to the airbag cover which is the bottom cover (3c), the side cover (3a), preferably to baffle (3d),
wherein the connector (6) is a mechanical connector or a tension sensor or combination thereof,
wherein the power source (8) is portable and at least two-colour variable colour lighting (9) are connected
to constituent component (5),
wherein connector (6) detects tension of tie element (5a) for signalling by lighting (9) the first colour of lighting (9) when the airbag is not ready to receive an impact, while the second colour signals when the airbag is ready to receive the impact.

**2.** The airbag according to claim 1, **characterised in that:**
the connector (6) is provided with a filter (7) selected from the group consisting of an analogue filter or a digital filter.

**3.** The airbag according to any of the preceding claims 1 to 2, **characterized in that** at least one tie element (5a) is fastened to the inside of the airbag (1) cover by spreading it vertically, horizontally, or diagonally on the side wall (3a).

**4.** The airbag according to any of the preceding claims 1 to 3, **characterized in that** at least one tie element (5a) is fastened between the top (3b) and bottom (3c) airbag (1) covers or is located in the centre of the circle inscribed in the shape of the top (3b) and bottom covers (3c) of the airbag (1).

**5.** The airbag according to any of the preceding claims 1 to 4, **characterized in that** at least one tie element

(5a) is attached diagonally leading from the edge joining the bottom cover (3c) with the side cover (3a) to the opposite edge between the top cover (3b) and the side cover (3a).

**6.** The airbag according to any of the preceding claims 1 to 5, **characterized in that** it comprises one connector (6), and each of the at least one tie element (5a) is provided with a guide fastener (10) located in the corner of the airbag (1).

**7.** The airbag according to any of the preceding claims 1 to 6, **characterised in that** each tie element (5a) is equipped with a separate connector (6).

**8.** The airbag according to any of the preceding claims 1 to 7, **characterized in that** the power source (8) is a battery or an accumulator, said portable power source being housed in a pocket at the bottom of the airbag cover (1), or attached to the inside surface of the bottom cover (3c) of the airbag (1) or placed on the side surface (3a) of the airbag (1).

**9.** The airbag according to any of the preceding claims1 to 8, **characterized in that** the illumination (9) is a spot light (9a), at least one light strip (9b) or a combination thereof, said illumination (9) being located on the top cover (3b) of the airbag (1) ) or on the side cover (3a) of the airbag (1) at the contact point of the side cover (3a) and the top cover (3b) of the airbag (1), or outside the airbag (1).

**10.** The airbag according to any of the preceding claims, wherein the airbag is in the form of rescue cushion.

**11.** An airbag with a system for detection of airbag readiness, wherein

- the airbag (1) comprises a pneumatic frame (2) with an airbag cover, having side covers (3a), a top cover (3b) and a bottom cover (3c), preferably wherein the airbag (1) additionally comprises a baffle (3d) dividing the volume of the airbag into two chambers;
- the system comprises at least one constituent component (5), a power source (8), an electronic circuit with at least two colour variable colour lighting (9), wherein the electronic circuit (11) is for signal
processing and lighting (9) control;

wherein the constituent component (5) is a contact element (5b) mounted on the side wall (3a) of the airbag (1) or a material of variable resistance (5c) which simultaneously constitutes at least the side cover (3a) of the airbag (1) or which is provided on at least one side cover (3a) in the form of a patch, while the power supply is portable and
wherein the at least two-colour lighting (9) with variable colour is connected to constituent component (5),
wherein constituent component (5) detects airbag cover tension for signalling by lighting (9) the first colour of lighting (9) when the airbag is not ready to receive an impact, and the second colour signals when the airbag is ready to receive the impact.

**12.** The airbag according to claim 11, **characterized in that** electronic circuit (11) consists of a microprocessor circuit or a microprocessor circuit and a filter (7).

**13.** The airbag according to claim 11, **characterized in that** the constituent component (5) is a contact element (5b) and the number of contact elements (5b) is at least equal to the number of side walls (3a) of the airbag (1), whereas at the centre of each side wall (3a) at least one contact element (5b) is provided.

**14.** The airbag according to any of the preceding claims 11 to 13, **characterized in that** the portable power source (8) is a battery or an accumulator, said portable power source being housed in a pocket at the bottom of the airbag cover (1), or attached to the inside surface of the bottom cover (3c) of the airbag (1) or placed on the side surface (3a) of the airbag (1).

**15.** The airbag according to any of the preceding claims 11 to 14, **characterized in that** the lighting (9) is a spot light (9a), at least one light strip (9b) or a combination thereof, said lighting (9) being located on the top cover (3b) of the airbag (1) or on the side cover (3a) of the airbag (1) at the contact point of the side cover (3a) and the top cover (3b) of the airbag (1), or outside the airbag (1).

**16.** The airbag according to claims 11-15, wherein the airbag is in the form of rescue cushion.

**17.** The airbag according to any of the preceding claims, **characterized in that** on the top cover (3b) of the airbag there is at least one pictogram with the desired body positioning of a person jumping during a jump onto the airbag (1).

**Patentansprüche**

**1.** Airbag mit einem System zur Erkennung der Airbag-Bereitschaft, wobei,

- der Airbag (1) einen pneumatischen Rahmen (2) mit einer Airbagabdeckung umfasst, die seitliche Abdeckungen (3a), eine obere Abdeckung

(3b) und eine untere Abdeckung (3c) aufweist, wobei der Airbag (1) vorzugsweise zusätzlich ein Ablenkblech (3d) umfasst, das das Volumen des Airbags in zwei Kammern unterteilt;
- das System umfasst mindestens ein Bauteil (5), eine Stromquelle (8), einen Stecker (6), ein elektronisches System mit mindestens zweifarbiger, variabler Farbbeleuchtung (9), das mit dem Bauteil (5) verbunden ist,

wobei das elektronische System so konfiguriert ist, dass es den Zustand der Beleuchtung (9) bestimmt;
wobei mindestens ein Bestandteil (5) die Form eines Bindeelements (5a) hat, dessen eines Ende fest mit der oberen (3b) oder seitlichen (3a) Abdeckung des Airbags (1) und dessen anderes Ende mit dem Verbindungsstück (6) verbunden ist, und
wobei das Verbindungselement (5a) indirekt über das Verbindungsstück (6) an der Airbagabdeckung, vorzugsweise an der Prallplatte (3d) des Airbags (1), befestigt ist,
wobei das Verbindungsstück (6) an der Airbagabdeckung, d.h. der unteren Abdeckung (3c), der seitlichen Abdeckung (3a), vorzugsweise an der Prallplatte (3d), befestigt ist,
wobei das Verbindungsstück (6) ein mechanisches Verbindungsstück oder ein Spannungssensor oder eine Kombination davon ist,
wobei die Stromquelle (8) tragbar ist und mindestens eine zweifarbige, farbveränderliche Beleuchtung (9) mit dem Bauteil (5) verbunden ist,
wobei der Verbinder (6) die Spannung des Bindeelements (5a) erfasst, um durch die Beleuchtung (9) zu signalisieren, dass die erste Farbe der Beleuchtung (9) anzeigt, wenn der Airbag nicht bereit ist, einen Aufprall aufzunehmen, während die zweite Farbe signalisiert, wenn der Airbag bereit ist, den Aufprall aufzunehmen.

**2.** Airbag nach Anspruch 1, **dadurch gekennzeichnet, dass:** das Verbindungsstück (6) mit einem Filter (7) versehen ist, der aus der Gruppe ausgewählt ist, die aus einem analogen Filter oder einem digitalen Filter besteht.

**3.** Airbag nach einem der vorhergehenden Ansprüche 1 bis 2, **dadurch gekennzeichnet, dass** mindestens ein Bindeelement (5a) an der Innenseite der Abdeckung des Airbags (1) befestigt ist, indem es vertikal, horizontal oder diagonal auf der Seitenwand (3a) ausgebreitet wird.

**4.** Airbag nach einem der vorhergehenden Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** mindestens ein Bindeelement (5a) zwischen der oberen (3b) und unteren (3c) Abdeckung des Airbags (1) befestigt ist oder sich in der Mitte des Kreises befindet, der in die Form der oberen (3b) und unteren Abdeckung (3c) des Airbags (1) eingeschrieben ist.

**5.** Airbag nach einem der vorhergehenden Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** mindestens ein Bindeelement (5a) diagonal führend von der Kante, die die untere Abdeckung (3c) mit der seitlichen Abdeckung (3a) verbindet, zur gegenüberliegenden Kante zwischen der oberen Abdeckung (3b) und der seitlichen Abdeckung (3a) angebracht ist.

**6.** Airbag nach einem der vorhergehenden Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** er ein Verbindungselement (6) umfasst und jedes der mindestens einen Verbindungselemente (5a) mit einem Führungselement (10) versehen ist, das sich in der Ecke des Airbags (1) befindet.

**7.** Airbag nach einem der vorhergehenden Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** jedes Bindeelement (5a) mit einem separaten Verbinder (6) ausgestattet ist.

**8.** Airbag nach einem der vorhergehenden Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** die Energiequelle (8) eine Batterie oder ein Akkumulator ist, wobei die tragbare Energiequelle in einer Tasche an der Unterseite der Airbagabdeckung (1) untergebracht oder an der Innenseite der Bodenabdeckung (3c) des Airbags (1) befestigt oder auf der Seitenfläche (3a) des Airbags (1) angeordnet ist.

**9.** Airbag nach einem der vorhergehenden Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Beleuchtung (9) ein Lichtpunkt (9a), mindestens ein Lichtstreifen (9b) oder eine Kombination davon ist, wobei die Beleuchtung (9) auf der oberen Abdeckung (3b) des Airbags (1) oder auf der seitlichen Abdeckung (3a) des Airbags (1) am Kontaktpunkt der seitlichen Abdeckung (3a) und der oberen Abdeckung (3b) des Airbags (1) oder außerhalb des Airbags (1) angeordnet ist.)

**10.** Airbag nach einem der vorhergehenden Ansprüche, wobei der Airbag die Form eines Rettungskissens hat.

**11.** Airbag mit einem System zur Erkennung der Airbag-Bereitschaft, wobei

- der Airbag (1) einen pneumatischen Rahmen (2) mit einer Airbagabdeckung umfasst, die seit-

liche Abdeckungen (3a), eine obere Abdeckung (3b) und eine untere Abdeckung (3c) aufweist, wobei der Airbag (1) vorzugsweise zusätzlich ein Ablenkblech (3d) umfasst, das das Volumen des Airbags in zwei Kammern unterteilt;
- das System umfasst mindestens ein Bauteil (5), eine Stromquelle (8), eine elektronische Schaltung mit mindestens zwei farbveränderlichen Beleuchtungen (9), wobei die elektronische Schaltung (11) zur Signalverarbeitung und Steuerung der Beleuchtung (9) dient;

wobei der Bestandteil (5) ein an der Seitenwand (3a) des Airbags (1) angebrachtes Kontaktelement (5b) oder ein Material mit variablem Widerstand (5c) ist, das gleichzeitig mindestens die Seitenabdeckung (3a) des Airbags (1) bildet oder das auf mindestens einer Seitenabdeckung (3a) in Form eines Pflasters vorgesehen ist, während die Energieversorgung tragbar ist und
wobei die mindestens zweifarbige Beleuchtung (9) mit variabler Farbe mit dem Bauteil (5) verbunden ist,
wobei die Komponente (5) die Spannung der Airbagabdeckung erfasst, um durch Beleuchtung (9) zu signalisieren, dass die erste Farbe der Beleuchtung (9) signalisiert, wenn der Airbag nicht bereit ist, einen Aufprall zu empfangen, und die zweite Farbe signalisiert, wenn der Airbag bereit ist, den Aufprall zu empfangen.

**12.** Airbag nach Anspruch 11, **dadurch gekennzeichnet, dass** die elektronische Schaltung (11) aus einer Mikroprozessorschaltung oder einer Mikroprozessorschaltung und einem Filter (7) besteht.

**13.** Airbag nach Anspruch 11, **dadurch gekennzeichnet, dass** das Bauteil (5) ein Kontaktelement (5b) ist und die Anzahl der Kontaktelemente (5b) mindestens gleich der Anzahl der Seitenwände (3a) des Airbags (1) ist, wobei in der Mitte jeder Seitenwand (3a) mindestens ein Kontaktelement (5b) vorgesehen ist.

**14.** Airbag nach einem der vorhergehenden Ansprüche 11 bis 13, **dadurch gekennzeichnet, dass** die tragbare Energiequelle (8) eine Batterie oder ein Akkumulator ist, wobei die tragbare Energiequelle in einer Tasche an der Unterseite der Airbagabdeckung (1) untergebracht oder an der Innenseite der Bodenabdeckung (3c) des Airbags (1) befestigt oder auf der Seitenfläche (3a) des Airbags (1) angeordnet ist.

**15.** Airbag nach einem der vorhergehenden Ansprüche 11 bis 14, **dadurch gekennzeichnet, dass** die Beleuchtung (9) ein Lichtpunkt (9a), mindestens ein Lichtstreifen (9b) oder eine Kombination davon ist, wobei die Beleuchtung (9) auf der oberen Abdeckung (3b) des Airbags (1) oder auf der seitlichen Abdeckung (3a) des Airbags (1) am Kontaktpunkt der seitlichen Abdeckung (3a) und der oberen Abdeckung (3b) des Airbags (1) oder außerhalb des Airbags (1) angeordnet ist.

**16.** Airbag nach einem der Ansprüche 11-15, wobei der Airbag die Form eines Rettungskissens hat.

**17.** Airbag nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** auf der oberen Abdeckung (3b) des Airbags mindestens ein Piktogramm mit der gewünschten Körperpositionierung einer Person, die bei einem Sprung auf den Airbag (1) springt, vorhanden ist.

**Revendications**

**1.** Un airbag avec un système de détection de l'état de préparation de l'airbag, dans lequel,

- le coussin gonflable (1) comprend un cadre pneumatique (2) avec un couvercle de coussin gonflable, avec des couvercles latéraux (3a), un couvercle supérieur (3b) et un couvercle inférieur (3c), de préférence dans lequel le coussin gonflable (1) comprend en outre un déflecteur (3d) divisant le volume du coussin gonflable en deux chambres ;
- le système comprend au moins un élément constitutif (5), une source d'énergie (8), un connecteur (6), un système électronique avec au moins un éclairage bicolore variable (9) connecté à l'élément constitutif (5),

le système électronique est configuré pour déterminer l'état de l'éclairage (9) ;
dans lequel au moins un composant (5) se présente sous la forme d'un élément de liaison (5a), dont une extrémité est fixée de manière fixe au couvercle (3b) ou au couvercle latéral (3a) du sac gonflable (1) et dont l'autre extrémité est fixée au connecteur (6), et
dans lequel ledit élément de liaison (5a) est fixé indirectement par l'intermédiaire du connecteur (6) au couvercle du coussin gonflable, de préférence au déflecteur (3d) du coussin gonflable (1),
dans lequel le connecteur (6) est fixé au couvercle du coussin gonflable qui est le couvercle inférieur (3c), le couvercle latéral (3a), de préférence au déflecteur (3d),
dans lequel le connecteur (6) est un

connecteur mécanique ou un capteur de tension ou une combinaison de ceux-ci,
dans lequel la source d'énergie (8) est portable et au moins un éclairage bicolore à couleur variable (9) est connecté à l'élément constitutif (5),
le connecteur (6) détecte la tension de l'élément de liaison (5a) pour signaler par l'éclairage (9) la première couleur de l'éclairage (9) lorsque le coussin gonflable n'est pas prêt à recevoir un impact, tandis que la seconde couleur signale que le coussin gonflable est prêt à recevoir l'impact.

**2.** Airbag selon la revendication 1, **caractérisé par le fait que :** le connecteur (6) est pourvu d'un filtre (7) choisi dans le groupe constitué d'un filtre analogique ou d'un filtre numérique.

**3.** Airbag selon l'une des revendications précédentes 1 à 2, **caractérisé par le fait qu'**au moins un élément d'attache (5a) est fixé à l'intérieur de la housse du coussin gonflable (1) en l'étalant verticalement, horizontalement ou en diagonale sur la paroi latérale (3a).

**4.** Airbag selon l'une des revendications précédentes 1 à 3, **caractérisé par le fait qu'**au moins un élément de liaison (5a) est fixé entre les couvercles supérieur (3b) et inférieur (3c) du coussin gonflable (1) ou est situé au centre du cercle inscrit dans la forme des couvercles supérieur (3b) et inférieur (3 c) du coussin gonflable (1).

**5.** Airbag selon l'une des revendications précédentes 1 à 4, **caractérisé par le fait qu'**au moins un élément d'attache (5a) est fixé en diagonale depuis le bord reliant le couvercle inférieur (3c) au couvercle latéral (3a) jusqu'au bord opposé entre le couvercle supérieur (3b) et le couvercle latéral (3a).

**6.** Airbag selon l'une des revendications précédentes 1 à 5, **caractérisé en ce qu'**il comprend un connecteur (6), et chacun des au moins un élément d'attache (5a) est pourvu d'une attache de guidage (10) située dans le coin du coussin gonflable (1).

**7.** Airbag selon l'une des revendications précédentes 1 à 6, **caractérisé par le fait que** chaque élément d'attache (5a) est équipé d'un connecteur séparé (6).

**8.** Airbag selon l'une des revendications précédentes 1 à 7, **caractérisé par le fait que** la source d'énergie (8) est une pile ou un accumulateur, ladite source d'énergie portable étant logée dans une poche au bas de la housse du coussin gonflable (1), ou fixée à la surface intérieure de la housse inférieure (3c) du coussin gonflable (1) ou placée sur la surface latérale (3a) du coussin gonflable (1).

**9.** Airbag selon l'une des revendications précédentes 1 à 8, **caractérisé en ce que** l'éclairage (9) est un spot lumineux (9a), au moins une bande lumineuse (9b) ou une combinaison de ceux-ci, ledit éclairage (9) étant situé sur le couvercle supérieur (3b) du coussin gonflable (1)) ou sur le couvercle latéral (3a) du coussin gonflable (1) au point de contact du couvercle latéral (3a) et du couvercle supérieur (3b) du coussin gonflable (1), ou à l'extérieur du coussin gonflable (1).

**10.** Airbag selon l'une des revendications précédentes, dans lequel le coussin gonflable se présente sous la forme d'un coussin de sauvetage.

**11.** Un airbag avec un système de détection de l'état de préparation de l'airbag, dans lequel

- le coussin gonflable (1) comprend un cadre pneumatique (2) avec un couvercle de coussin gonflable, avec des couvercles latéraux (3a), un couvercle supérieur (3b) et un couvercle inférieur (3c), de préférence dans lequel le coussin gonflable (1) comprend en outre un déflecteur (3d) divisant le volume du coussin gonflable en deux chambres ;
- le système comprend au moins un élément constitutif (5), une source d'énergie (8), un circuit électronique avec au moins deux éclairages de couleur variable (9), le circuit électronique (11) étant destiné au traitement des signaux et à la commande de l'éclairage (9) ;

dans lequel le composant (5) est un élément de contact (5b) monté sur la paroi latérale (3a) du coussin gonflable (1) ou un matériau à résistance variable (5c) qui constitue simultanément au moins la paroi latérale (3a) du coussin gonflable (1) ou qui est placé sur au moins une paroi latérale (3a) sous la forme d'un patch, alors que l'alimentation en énergie est portable et
dans lequel l'éclairage au moins bicolore (9) à couleur variable est relié à l'élément constitutif (5),
dans lequel le composant (5) détecte la tension du couvercle du coussin gonflable pour signaler par l'éclairage (9) la première couleur de l'éclairage (9) lorsque le coussin gonflable n'est pas prêt à recevoir un impact, et la seconde couleur signale que le coussin gonflable est prêt à recevoir l'impact.

**12.** Airbag selon la revendication 11, **caractérisé par le**

**fait que le** circuit électronique (11) est constitué d'un circuit à microprocesseur ou d'un circuit à microprocesseur et d'un filtre (7).

**13.** Airbag selon la revendication 11, **caractérisé par le fait que** le composant (5) est un élément de contact (5b) et que le nombre d'éléments de contact (5b) est au moins égal au nombre de parois latérales (3a) du coussin gonflable (1), tandis qu'au centre de chaque paroi latérale (3a), au moins un élément de contact (5b) est prévu.

**14.** Airbag selon l'une des revendications précédentes 11 à 13, **caractérisé par le fait que** la source d'énergie portable (8) est une pile ou un accumulateur, ladite source d'énergie portable étant logée dans une poche au bas de la housse du coussin gonflable (1), ou fixée à la surface intérieure de la housse inférieure (3c) du coussin gonflable (1) ou placée sur la surface latérale (3a) du coussin gonflable (1).

**15.** Airbag selon l'une des revendications précédentes 11 à 14, **caractérisé en ce que** l'éclairage (9) est un spot lumineux (9a), au moins une bande lumineuse (9b) ou une combinaison de ceux-ci, ledit éclairage (9) étant situé sur le couvercle supérieur (3b) du coussin gonflable (1) ou sur le couvercle latéral (3a) du coussin gonflable (1) au point de contact du couvercle latéral (3a) et du couvercle supérieur (3b) du coussin gonflable (1), ou à l'extérieur du coussin gonflable (1).

**16.** Airbag selon les revendications 11 à 15, dans lequel le coussin gonflable se présente sous la forme d'un coussin de sauvetage.

**17.** Airbag selon l'une des revendications précédentes, **caractérisé par le fait que** sur le couvercle supérieur (3b) du coussin gonflable figure au moins un pictogramme indiquant la position souhaitée du corps d'une personne sautant sur le coussin gonflable (1).

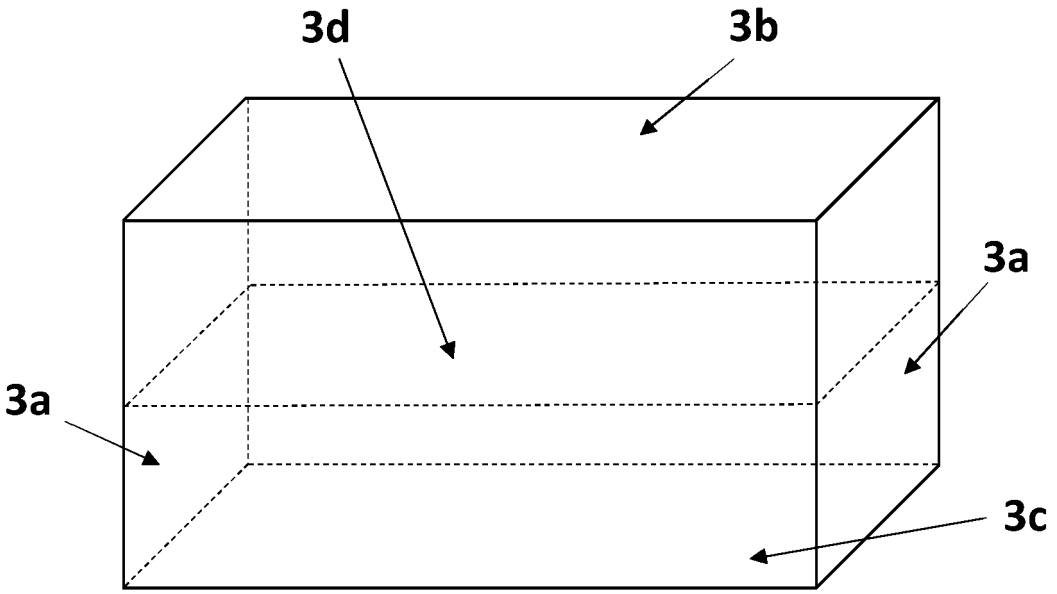


Fig. 1

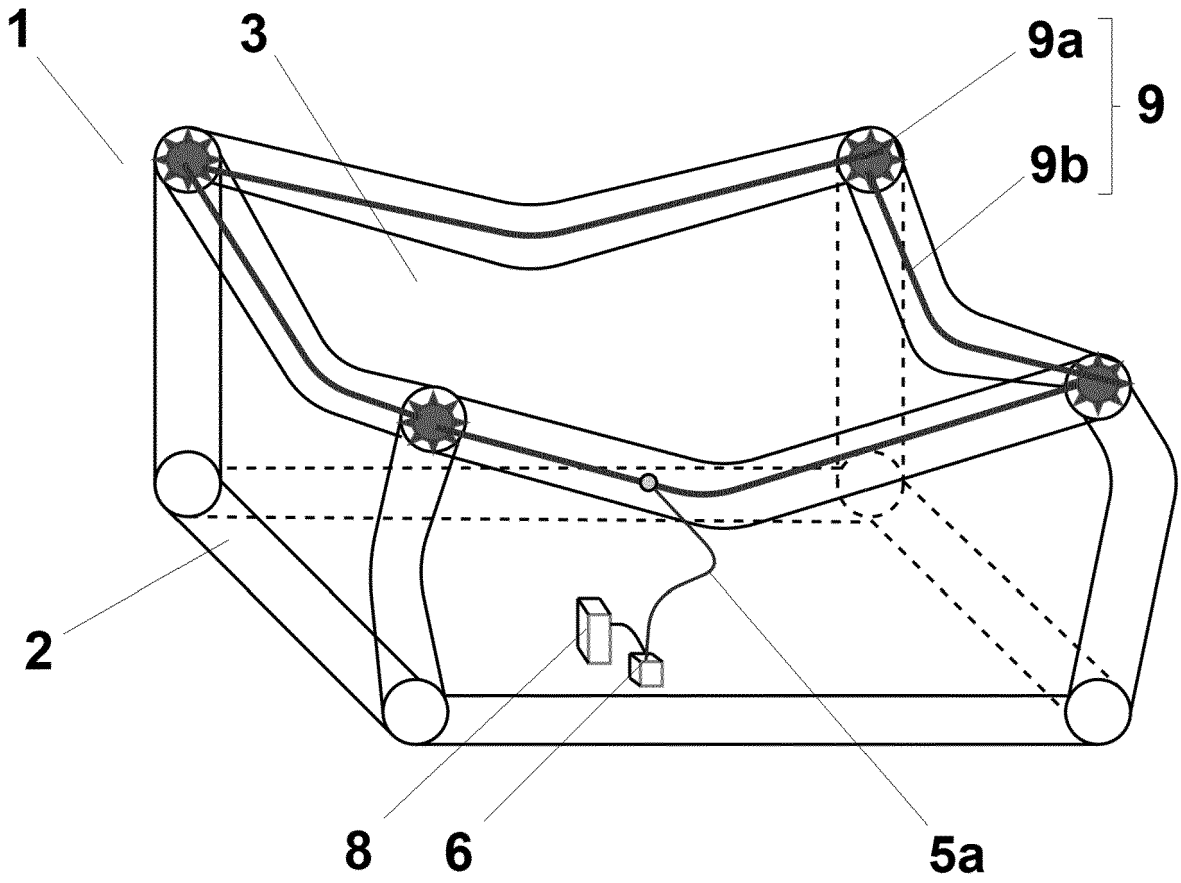


Fig. 2

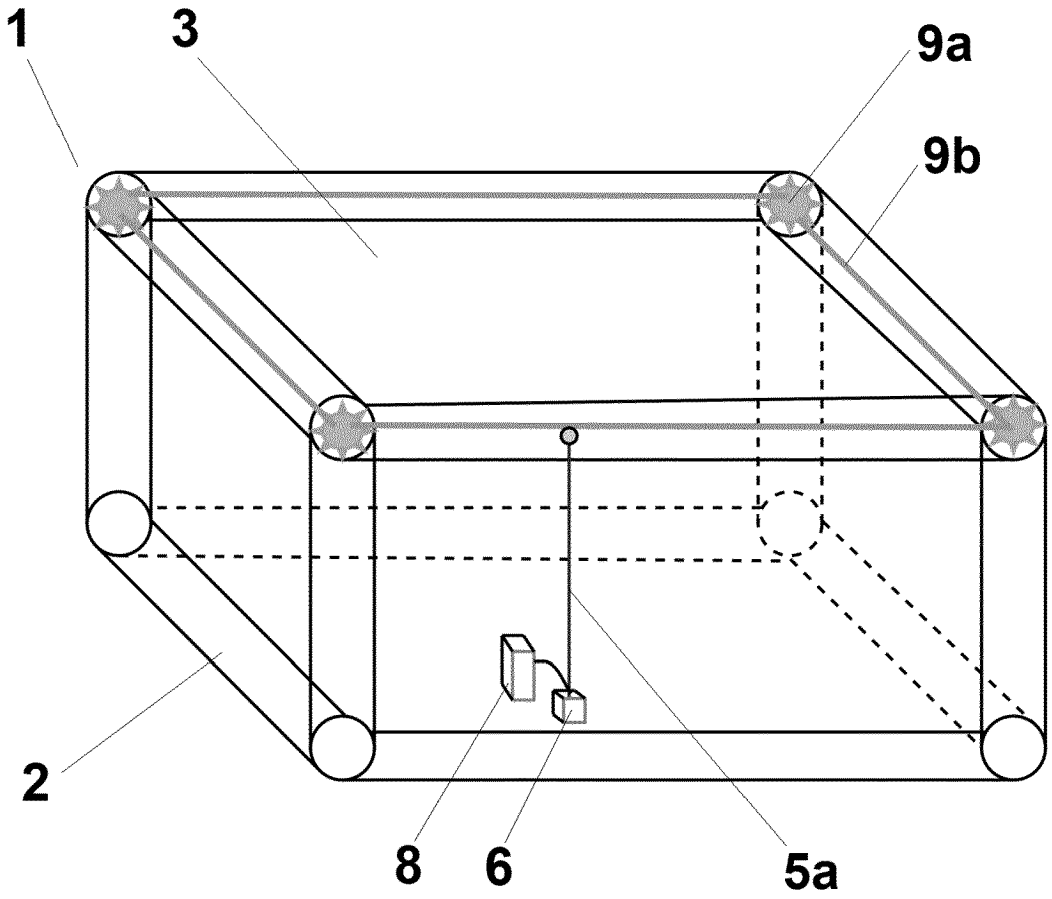


Fig. 3

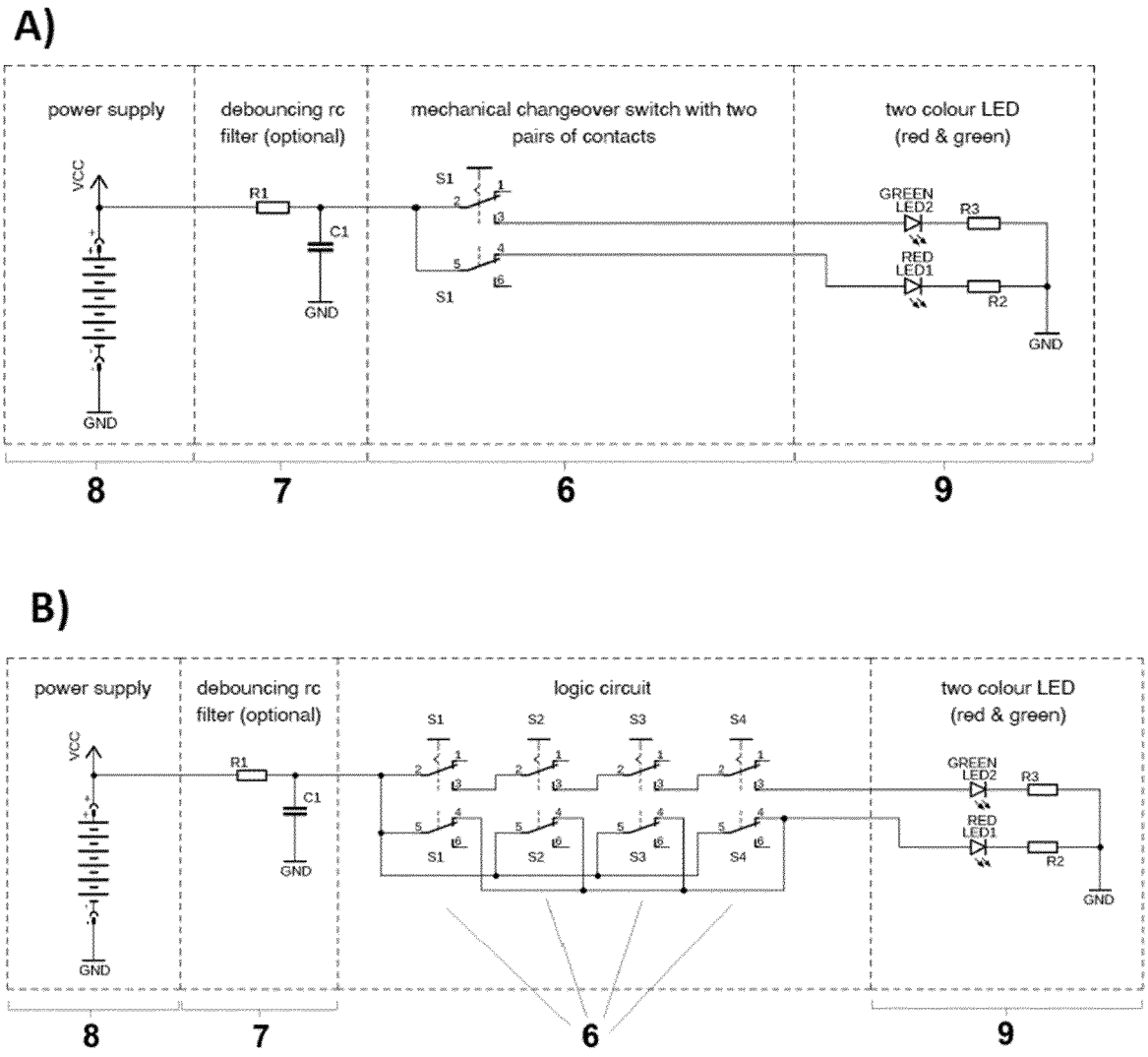
A)
power supply
debouncing rc filter (optional)
mechanical changeover switch with two pairs of contacts
two colour LED (red & green)
VCC
R1
C1
GND
S1
GREEN LED2
R3
RED LED1
R2
8
7
6
9
B)
power supply
debouncing rc filter (optional)
logic circuit
two colour LED (red & green)
S2
S3
S4

Fig. 4

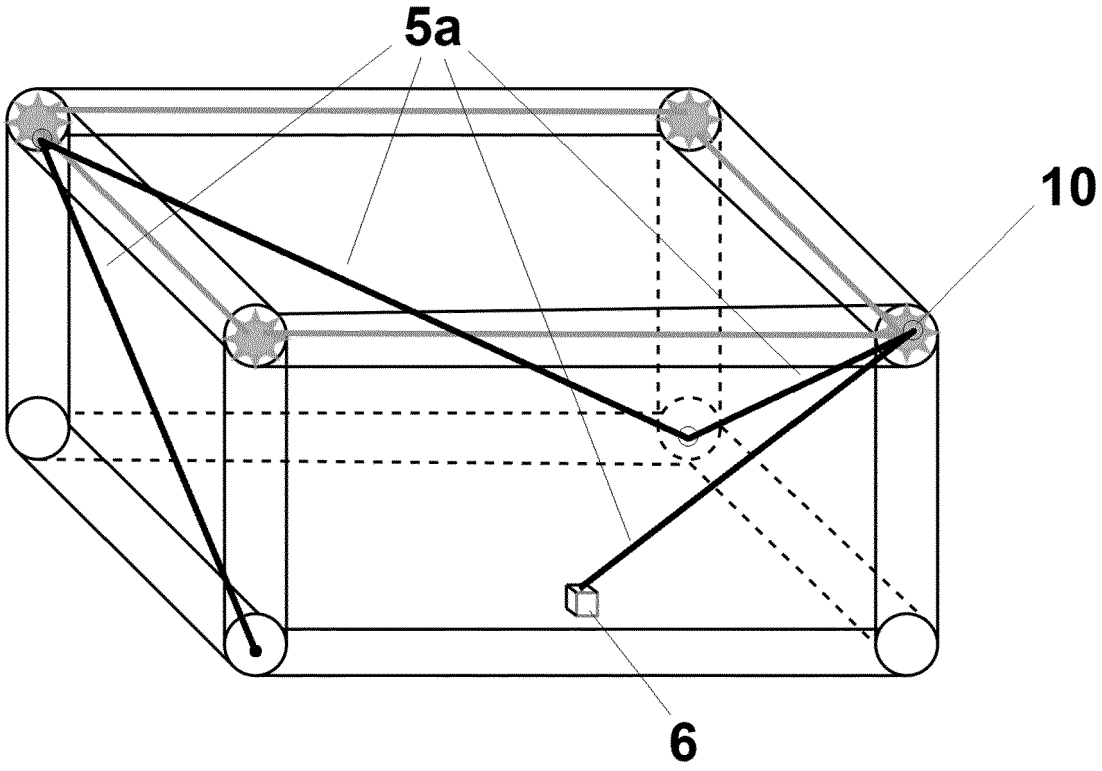


Fig. 5

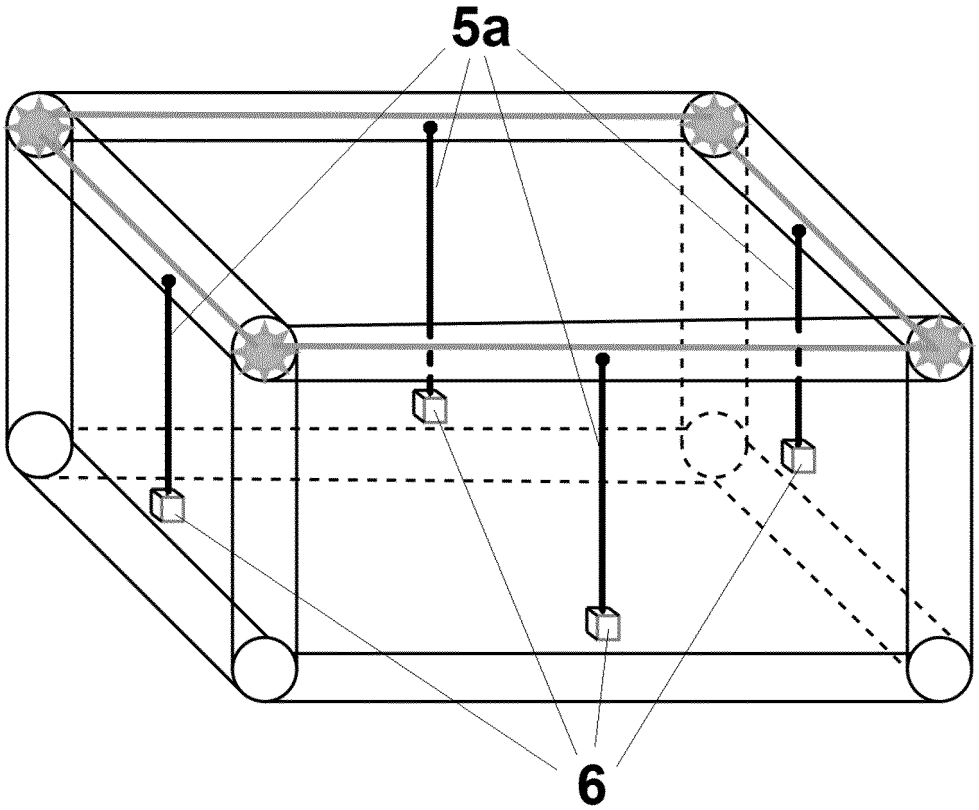


Fig. 6

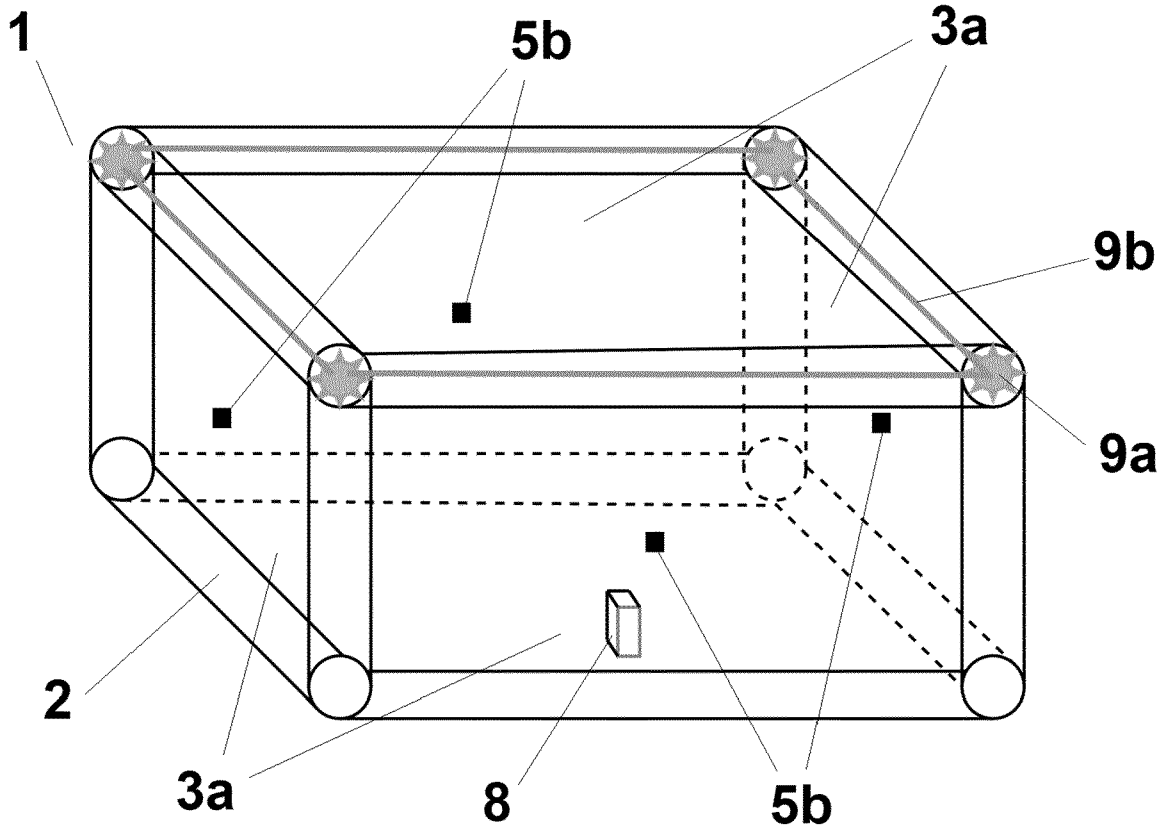


Fig. 7

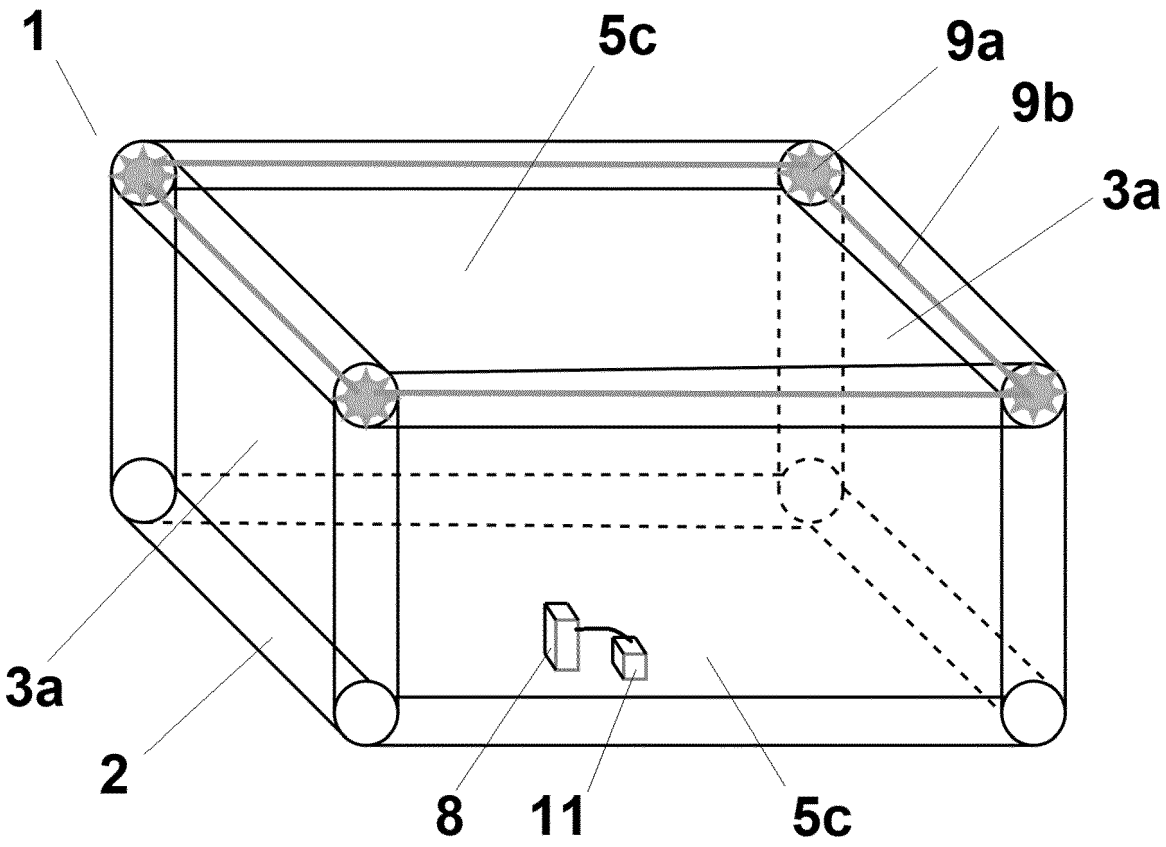


Fig. 8

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- DE 20315946 U1 **[0004]**