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(54) **HEAT ACTUATED LOCKING SYSTEM FOR A PANEL**

(57) Locking system (1) for locking a panel (2) in the event of fire in order to close off an opening between two spaces, comprising a shaft (3) in which a pin (4) is arranged such that it is guidingly displaceable, an activator (5) for driving the pin (4) at least partially out of the shaft (3) in order to lock the panel (2), and a blocking element

(6) in order to prevent the pin (4) from being driven at least partially out of the shaft (3) by the activator (5). The blocking element (6) comprises fusible link (7) and melts, at least partially, under the influence of heat, so that the pin (4) becomes ejectable by the activator (5) in the presence of heat.

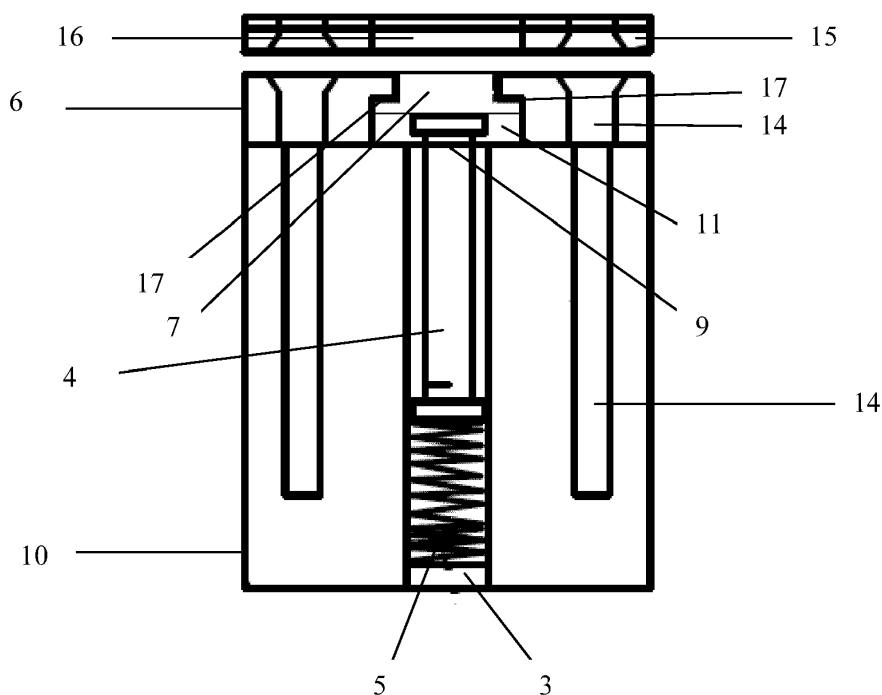


Fig. 3

Description

[0001] This invention relates on the one hand to a locking system for locking a panel in the event of fire in order to close off an opening between two spaces, comprising

- a shaft, in which a pin is arranged such that it is guidingly displaceable;
- an activator for driving the pin at least partially out of the shaft in order to lock the panel;
- a blocking element in order to prevent the pin from being driven at least partially out of the shaft by the activator;

wherein the blocking element at least partially melts under the influence of heat, so that the pin becomes ejectable by the activator in the presence of heat.

[0002] The panel is in particular a glass panel. The panel can be a pivotable door panel of, for example, a swing door, but can also be a fixed panel.

[0003] This invention also relates to a panel comprising such a locking system.

[0004] On the other hand, this invention also relates to a method of producing such a locking system.

[0005] Locking systems of this type are used in fire-resistant panels. These panels can be fixed panels or hinged panels, such as, for example, door panels. In the event of fire, these panels are provided to form, for a certain time, a fire barrier between the two spaces in order thus to avoid fire penetration for a certain time. Thus the panels can be, for example, glass panels, made of fireproof/fire-resistant glass. These fireproof/fire-resistant glass panels can comprise a plurality of glass panes between which fire-resistant material, such as, for example, a fire-resistant gel, is placed. The glass panes can be made of floatglass, pressed glass, toughened glass, thermally tempered glass, laminated glass, layered glass, etc.

[0006] Partly as a result of the high temperatures in a fire, such a panel does however have a tendency to deform, with the result that the opening between two spaces, which normally is closed off by the panel, is no longer closed off as effectively. Fire penetration from one space to the other space will hence occur more rapidly. In order to prevent the deformation of the panel, a locking system which locks the panel in the event of fire in order to prevent the deformation of the panel is hence provided. If the panel is a pivotable door panel, then the locking system will also ensure that the door panel will not pivot during the fire, so that the opening is always closed off by the panel.

[0007] Examples of existing locking systems are represented in GB 2321492, EP 2612975 and GB 2237835. These locking systems all comprise a shaft, in which a pin is guidingly arranged, and wherein the pin is at least partially ejectable from the shaft in the presence of heat. In GB 2321492, the pin is ejectable with the aid of a spring and the ejection is prevented by a plastics piece which

melts under the influence of heat. During a fire, this plastics piece will melt, with the result that the spring can eject the pin. In EP 262975, the pin is ejectable in the event of fire with the aid of material which swells under the influence of heat. In GB 2237835, the pin is ejectable with the aid of a spring and the ejection is prevented by wax. In the event of fire, this wax will melt, with the result that the spring can eject the pin.

[0008] The drawback with these existing systems is that the ejection of the pin during fire does not instantly take place. Often the fire has already long been underway before the pin is ejected in order to lock the panel. As a result, it is quite possible that the panel which needs to be locked by the locking system in the event of fire has already been deformed and/or displaced in such a way when the pin is ejected that the risk of rapid fire penetration is high.

[0009] It is therefore an object of the invention to produce a locking system wherein the panel, in the event of fire, is rapidly locked before the panel has the chance to deform and/or shift, so that fire penetration can be avoided for a longer period.

[0010] This object is achieved by providing a locking system for locking a panel in the event of fire in order to close off an opening between two spaces, comprising

- a shaft, in which a pin is arranged such that it is guidingly displaceable;
- an activator for driving the pin at least partially out of the shaft in order to lock the panel;
- a blocking element in order to prevent the pin from being driven at least partially out of the shaft by the activator;

wherein the blocking element at least partially melts under the influence of heat, so that the pin becomes ejectable by the activator in the presence of heat, and wherein the blocking element comprises fusible link.

[0011] When a specific temperature is exceeded, fusible link melts very quickly. As soon as during a fire, at the height of the locking system located on or in the vicinity of the panel, the temperature exceeds the melting temperature of the fusible link, the fusible link will instantly melt. Once the fusible link has melted, the blocking element no longer prevents the ejection of the pin, with the result that the pin is ejected by the activator. Since the melting of the fusible link takes little time, the locking system will also quickly lock the panel in the event of fire. The panel hence does not have time to deform and/or shift, with the result that, during a fire, the opening is always closed off by the panel and fire penetration from one space to the other space is delayed.

[0012] Preferably, the pin is ejected into a cavity which is arranged opposite the locking system. The pin then preferably extends partly into the shaft of the locking system and partly into the said cavity.

[0013] In a preferential embodiment, the locking system comprises a heat transfer element for connecting

the two spaces, wherein the blocking element is in contact with the heat transfer element.

[0014] An additional problem with the existing locking systems is that the blocking element normally, viewed according to the direction running transversely to the panel, is arranged in only one of the two spaces or between the two spaces. When there is then fire in the space in which the blocking element is arranged, there is no problem. The blocking element will be exposed to the heat of the fire and the panel will be locked. However, when the fire is in the space into which the blocking element does not extend, the temperature often does not rise sufficiently at the height of the blocking element, with the result that the pin is only ejected once there is already fire penetration. This problem is solved here by the heat transfer element, which connects the two spaces one to the other and is in contact with the blocking element. The heat transfer element transfers the heat between the two said spaces, so that the blocking element warms up sufficiently during a fire, even if this blocking element is arranged between the two spaces or in the space in which no fire is burning. Thus the fusible link will here always melt in time.

[0015] This problem is also solved by providing an alternative locking system for locking a panel in the event of fire in order to close off an opening between two spaces, comprising

- a shaft in which a pin is arranged such that it is guidingly displaceable;
- an activator for driving the pin at least partially out of the shaft in order to lock the panel;
- a blocking element in order to prevent the pin from being driven at least partially out of the shaft by the activator;

wherein the blocking element is at least partially influenced by heat, so that the pin becomes ejectable by the activator, and wherein the locking system comprises a heat transfer element for connecting the two spaces, wherein the blocking element is in contact with the heat transfer element.

[0016] Here the heat transfer element will ensure that the temperature of the blocking element will always rise sufficiently in the event of fire, even if the fire occurs in a said space and the blocking element extends substantially into the other said space.

[0017] Even if the blocking element comprises no fusible link, but other elements or components which melt, deform, shift, etc. in the presence of heat, so that the activator can drive the pin at least partially out of the shaft, the said additional problem is solved.

[0018] In the first-named locking system according to the invention and in the alternative locking system, the heat transfer element preferably comprises a metal plate. Metal is a good heat conductor and is thus well capable of transferring heat to the blocking element. Moreover, a plate can be thinly constructed, so that not too much heat

is conducted from one space to the other space and thus heat is transmitted above all to the blocking element. The metal plate can be of either curved or uncurved construction.

[0019] Further preferably, the metal plate is a perforated metal plate. The metal plate here ensures the connection between the two spaces. The connection is normally realized by virtue of the fact that the metal plate extends between the frame of the opening and the panel and is thus in contact with the two spaces. It is not desirable for the panel or the environment, at the height of this panel, to heat up a lot. It is simply the aim that the blocking element acquires the necessary heat. Hence the metal plate is provided with perforations or openings, above all at the height of the panel.

[0020] The activator is preferably provided to drive the pin through an ejection opening of the shaft, wherein the blocking element at least partially closes off this ejection opening. In order to be able to lock the panel, the pin is then driven at least partially through this ejection opening. When, in the event of fire, the fusible link melts, a hole must be formed in the blocking element, through which the pin can be ejected. Hence the hole must at least correspond with the dimensions of the pin. If less than the full ejection opening is freed by the melting of the fusible link, it can be provided, for example, that the portion around the formed hole detains the pin after this has been in large part ejected. For this purpose, the pin can be provided at the bottom, for example, with a widened foot, in which case this widened foot is too wide to move through the formed hole, with the result that the pin is detained.

[0021] Preferably, the shaft is accommodated in a housing, and the blocking element is provided to be connected to the housing. The blocking element can then here be provided as a separate component. The housing and the blocking element can hence initially be produced separately, after which they are then subsequently fastened to each other. The production of the locking system can hereby proceed smoothly and rapidly.

[0022] In a preferential embodiment, the activator comprises a compressible spring. When the blocking element no longer prevents the activator from at least partially ejecting the pin, the pin will be very rapidly ejected with the aid of the spring. In the event of fire, the panel is then instantly locked as soon as the blocking element no longer obstructs the activator, with the result that the chance that the panel has time to deform and/or shift is very small.

[0023] Preferably, the blocking element comprises a cavity, which connects to the shaft and in which the fusible link is at least partially arranged, wherein this cavity comprises a locking element, extending at a distance from the shaft, for locking the fusible link according to the direction with which the pin is ejectable from the shaft by the activator. The activator aims to drive the pin at least partially out of the shaft. The blocking element prevents this when there is no fire. When the fusible link melts, the activator will eject the pin according to a specific direction.

This direction can be denoted by the term direction of ejection. The locking element prevents the fusible link in its solid state from shifting in the cavity according to the direction of ejection. When no fire is burning, the fusible link cannot therefore leave the cavity. This serves to still better ensure that the blocking element prevents the pin from being driven at least partially out of the shaft by the activator. This locking element is further preferably a locking rim. If the shaft is of elongate construction, then this said cavity can consist, for example, of at least two parts, i.e., viewed according to the direction of ejection, a first part having a larger cross section and a second part having a smaller cross section, such that a locking rim is formed there between the two parts. When then at least a portion of the fusible link extends into the first part and this said portion has a larger cross section than the second part, the fusible link cannot leave the cavity when it is in its solid state. Thus in a specific embodiment in which the activator presses the pin against the fusible link, the fusible link, when there is no fire, will not be able to be shifted by the pin.

[0024] In a particularly preferential embodiment, the locking system comprises

- a second shaft, in which a second pin is arranged such that it is guidingly displaceable;
- a second activator for driving the second pin at least partially out of the second shaft in order to lock the panel;
- and a second blocking element in order to prevent the second pin from being driven at least partially out of the second shaft by the second activator;

wherein this second blocking element is at least partially influenceable by heat, so that the second pin becomes ejectable by the second activator.

[0025] Since here there are two pins, the panel will be locked still better in the event of fire. As a result, fire penetration will be able to occur still less rapidly. The second blocking element further preferably comprises fusible link, so that in the event of fire this fusible link melts and thus the second activator is no longer prevented from at least partially ejecting the second pin.

[0026] Further preferably, viewed according to the direction transversely to the panel, the first said pin is provided to extend into one said space next to the panel, and the second said pin is provided to extend into the other said space next to the panel. The locking system can then here prevent the panel from bending in the direction of one of the two spaces. This locking system is also very suitable for a panel which is a pivotable door panel of a swing door. With the aid of this locking system, the door panel is then prevented from being able to pivot. Preferably, the locking system here therefore comprises a heat transfer element which is in contact with both blocking elements, so that heat is also transferred to the blocking element which is not located in the space in which fire is burning. In this way, the pins will be ejected

virtually at the same moment in the event of fire, with the result that the panel is immediately locked very securely.

[0027] Preferably, the locking system comprises a detaining element in order to prevent the pin from being driven fully out of the shaft by the activator. The pin then remains partially in the shaft in the event of fire. Movement of the panel, when the pin has been partially ejected from the shaft, is therefore partially absorbed by the shaft. Examples of a detaining element can be a frame or a protruding pin. The pin is then here preferably itself provided with a protruding portion which then butts against the frame or the pin during the ejection of the pin, with the result that the pin is then no longer further ejected.

[0028] The melt temperature of the fusible link is preferably between 50 °C and 70 °C, more preferably between 55 °C and 65 °C. The fusible link is preferably a composition of bismuth and/or cadmium and/or lead and/or tin and/or indium. It preferably comprises no cadmium and lead, since these substances are harmful to health. Thus the fusible link can be, for example, 'Field's metal'. This fusible link comprises the following percentages by weight: +/- 32.5% bismuth, +/- 51% indium and +/- 16.5% tin.

[0029] This invention also relates to a panel for closing off an opening between two spaces, comprising a locking system in order to lock the panel in the event of fire, wherein the locking system is a locking system as described above. The locking system which is described above is thus preferably provided to be mounted on a panel. The panel is, for example, a pivotable door panel of a swing door. For the locking of the panel in the event of fire, no adaptations have here to be made at the height of the frame of the opening closed off by the panel. The above-described advantages of the locking system are also applicable to this panel.

[0030] The locking system could also however be fastened to the frame of the opening closed off by the panel.

[0031] The panel can be, for example, a fixed panel, or can be constructed as a pivotable door leaf. Preferably, the panel is a glass panel. A glass panel is a panel comprising one or more glass surfaces. Between these various glass surfaces can be found other materials, such as, for example, air, fire-resistant material, such as fire-resistant gel, cladding material, etc. The glass surfaces themselves can also be coated or uncoated. Glass panels can, inter alia, be of translucent, matt, sun-shielding or reflective construction. More specifically, the door panel can be made of fire-resistant glass. Such fire-resistant glass comprises one or more glass panes, between which fire-resistant material is placed. In this case, depending on the fire resistance requirements, the glass panes can be made of floatglass, pressed glass, toughened glass, thermally tempered glass, laminated glass, layered glass, etc.

[0032] The aforesaid object is also achieved by providing a method for producing a locking system, wherein the locking system is a locking system as described above, and wherein the blocking element comprises a

cavity into which the fusible link is fitted in its molten state.

[0033] By bringing the fusible link in its molten state directly into the cavity of the blocking element, one has no need to bring the fusible link beforehand into a suitable solid form in order to be able to fit it into the blocking element. When this cavity comprises a locking element, extending at a distance from the shaft, for locking the fusible link according to the direction of ejection of the pin, then this is a good method of getting the fusible link in the cavity.

[0034] Further preferably, the fusible link is fitted in a solid state at the top of the cavity in order subsequently to be exposed to a heat source, so that the fusible link melts and thus at least partially fills the cavity. Thus, a piece of fusible link, for example, can be fitted into the cavity and this then melted so that it assumes the correct form in the cavity.

[0035] This invention is now explained in greater detail on the basis of the hereinafter following detailed description of a preferential embodiment of a locking system, a panel and a method according to this invention. The aim of this description is solely to provide illustrative examples and to indicate further advantages and particularities of this locking system, this panel and this method, and can thus by no means be interpreted as a limitation of the field of application of the invention or of the patent rights claimed in the claims.

[0036] In this detailed description, reference is made by means of reference numerals to the accompanying drawings, wherein

- Figure 1 is a top view of a locking system according to the invention;
- Figure 2 is a side view of the locking system represented in Figure 1;
- Figure 3 is a cross section of the locking system, represented in Figures 1 and 2, and of a positioning element;
- Figure 4 is a top view of a pivotable door and a wall on which the door is pivotably connected, wherein the pivotable door comprises a locking system as represented in Figures 1 to 3.

[0037] The locking system (1) is used to lock a panel (2) in the event of fire. The panel (2) is here a glazed door panel (2) which is pivotably connected to a wall (12). By means of the locking system (1), the door panel (2) is lockable in its closed position, as depicted in Figure 4, i.e. the position in which the door panel (2) closes off an opening between two spaces. By locking the door panel (2) in the event of fire, a situation in which the door panel (2) deforms or pivots during a fire is avoided.

[0038] The locking system (1) comprises a first housing (10) and a second housing (10), as can be seen in Figures 2 and 4. As can be seen in Figure 3, each housing (10) comprises a shaft (3) in which a pin (4) is arranged such that it is guidingly displaceable. The locking system (1) further comprises two blocking elements (6), which are

each connected to a said housing (10) and close off an ejection opening (9) of the shaft (3). The blocking elements (6) are for this purpose provided with fusible link (7). The connection between a said blocking element (6) and a said housing (10) is made with the aid of screws. The blocking elements (6) and the housings (10) are for this purpose provided with bores (14) comprising a screw thread in which a screw can engage. In addition, in each housing (10) a helical spring (5) is arranged in the shaft (3) opposite the ejection opening (9), for driving the pin (4) partially out of the shaft (3). When the fusible link (7) is unmelted, thus when no fire has yet occurred in one of the said spaces, the helical spring (5) is compressed and presses the pin (4) against the fusible link (7). The fusible link (7) is for this purpose located in a cavity (11) of the blocking element (6), which cavity extends at the height of the ejection opening (9). During a fire, the temperature at the height of the fusible link (7) will increase, with the result that the fusible link (7) melts and the helical spring (5) can drive the pin (4) partly out of the shaft (3). This cavity (11) of the blocking element (6) is arranged opposite the shaft and the fusible link (7) extends into this cavity (11). In addition, this cavity (11) consists of two parts, which, viewed according to the longitudinal direction of the shaft (3), have two different cross sections, wherein a first part, which is located close to the shaft (3), has a larger cross section. Between these two parts there is hence a locking rim (17). The fusible link (7) is arranged in both parts and that part of the fusible link (7) which is arranged in the first part extends between the stop rim (17) and the pin (4). The fusible link (7) here securely detains the pin (4).

[0039] The locking system (1) is provided to be connected to the door panel (2) in such a way that one housing (10), viewed according to the transverse direction of the panel (2), extends on one side of the door panel (2), and the other housing (10) extends on the other side of the door panel (2). This is apparent in Figure 4.

[0040] In addition, the locking system (1) comprises a heat transfer element (8). This heat transfer element (8) is a bent plate, having a central portion and two upright portions, whereof the cross section is U-shaped. Each upright portion of the heat transfer element (8) is connected to a said housing (10) and to a said blocking element (6) and extends on a side of the door panel (2). With the aid of this heat transfer element (8), heat is exchangeable between the said spaces. Thus the heat present in one said space during a fire will be transmitted by the heat transfer element (8) to the blocking element (6) located in the other space. The fusible link (7) will hereby acquire the necessary heat. It is hereby ensured that both pins (4) are ejected almost simultaneously during a fire.

[0041] The central portion of the heat transfer element (8) comprises perforation openings (13). Through these perforation openings (13), the heat is substantially exchanged between the blocking elements (6) and the heat is not conducted to other elements or components, such

as, for example, the space extending around the opening.
[0042] In addition, the wall (12) to which the door panel (2) is pivotably connected is provided with positioning elements (15) at the height of the locking system (1). Such a positioning element (15) is found opposite each housing (10). These positioning elements (15) comprise a cavity (16) in which the pin (4) from the corresponding housing (10) can engage after the ejection thereof. When the pin (4) is ejected in the event of a fire, the pin (4) will then extend partly into a said positioning element (15) and partly into the shaft (3) of the housing (10), with the result that the door panel (2) is no longer pivotable relative to the wall (12) and is not deformable.

Claims

1. Locking system (1) for locking a panel (2) in the event of fire in order to close off an opening between two spaces, comprising

- a shaft (3) in which a pin (4) is arranged such that it is guidingly displaceable;
- an activator (5) for driving the pin (4) at least partially out of the shaft (3) in order to lock the panel (2);
- a blocking element (6) in order to prevent the pin (4) from being driven at least partially out of the shaft (3) by the activator (5);

wherein the blocking element (6) at least partially melts under the influence of heat, so that the pin (4) becomes ejectable by the activator (5) in the presence of heat, **characterized in that** the blocking element (6) comprises fusible link (7).

2. Locking system (1) according to Claim 1, **characterized in that** the locking system (1) comprises a heat transfer element (8) for connecting the two spaces, wherein the blocking element (6) is in contact with the heat transfer element (8).

3. Locking system (1) according to Claim 2, **characterized in that** the heat transfer element (8) comprises a metal plate.

4. Locking system (1) according to one of the preceding claims, **characterized in that** the activator (5) is provided to drive the pin (4) through an ejection opening (9) of the shaft (3), wherein the blocking element (6) at least partially closes off this ejection opening (9).

5. Locking system (1) according to one of the preceding claims, **characterized in that** the shaft (3) is accommodated in a housing (10), wherein the blocking element (6) is provided to be connected to the housing (10).

6. Locking system (1) according to one of the preceding claims, **characterized in that** the activator (5) comprises a compressible spring.

7. Locking system (1) according to one of the preceding claims, **characterized in that** the blocking element (6) comprises a cavity (11), which connects to the shaft (3) and in which the fusible link (7) is at least partially arranged, wherein this cavity (11) comprises a locking element (17), extending at a distance from the shaft (3), for locking the fusible link (7) according to the direction with which the pin (4) is ejectable from the shaft (3) by the activator (5).

8. Locking system (1) according to Claim 7, **characterized in that** the locking element (17) is a locking rim.

9. Locking system (1) according to one of the preceding claims, **characterized in that** the locking system (1)

- comprises a second shaft (3), in which a second pin (4) is arranged such that it is guidingly displaceable;
- comprises a second activator (5) for driving the second pin (4) at least partially out of the second shaft (3) in order to lock the panel (2);
- and comprises a second blocking element (6) in order to prevent the second pin (4) from being driven at least partially out of the second shaft (3) by the second activator (5);

wherein this second blocking element (6) is at least partially influenceable by heat, so that the second pin (4) becomes ejectable by the second activator (5).

10. Locking system (1) according to Claim 9, **characterized in that**, viewed according to the direction transversely to the panel (2), the first said pin (4) is provided to extend into one said space next to the panel (2), and the second said pin (4) is provided to extend into the other said space next to the panel (2).

11. Locking system (1) according to one of the preceding claims, **characterized in that** the locking system (1) comprises a detaining element in order to prevent the pin (4) from being driven fully out of the shaft (3) by the activator (5).

12. Panel (2) for closing off an opening between two spaces, comprising a locking system (1) in order to lock the panel (2) in the event of fire, **characterized in that** the locking system (1) is a locking system according to one of the preceding claims.

13. Panel (2) according to Claim 12, **characterized in that** the panel (2) is a glass panel.

14. Method for producing a locking system (1), **characterized in that** the locking system (1) is a locking system according to one of the preceding claims, and **in that** the blocking element (6) comprises a cavity (11), into which the fusible link (7) is fitted in its molten state. 5

15. Method according to Claim 14, **characterized in that** the fusible link (7) is fitted in a solid state at the top of the cavity (11) in order subsequently to be exposed to a heat source, so that the fusible link (7) melts and thus at least partially fills the cavity (11). 10

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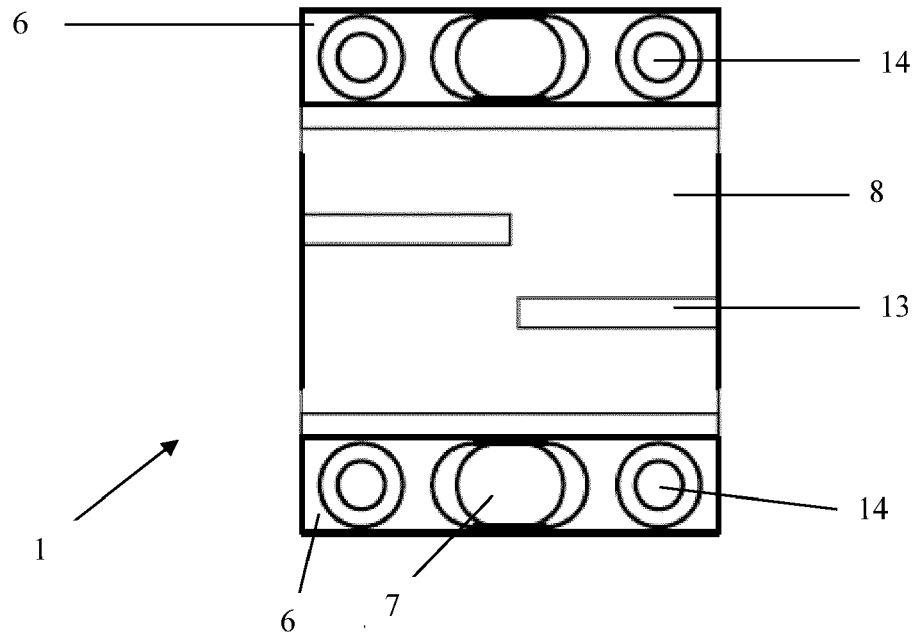


Fig. 1

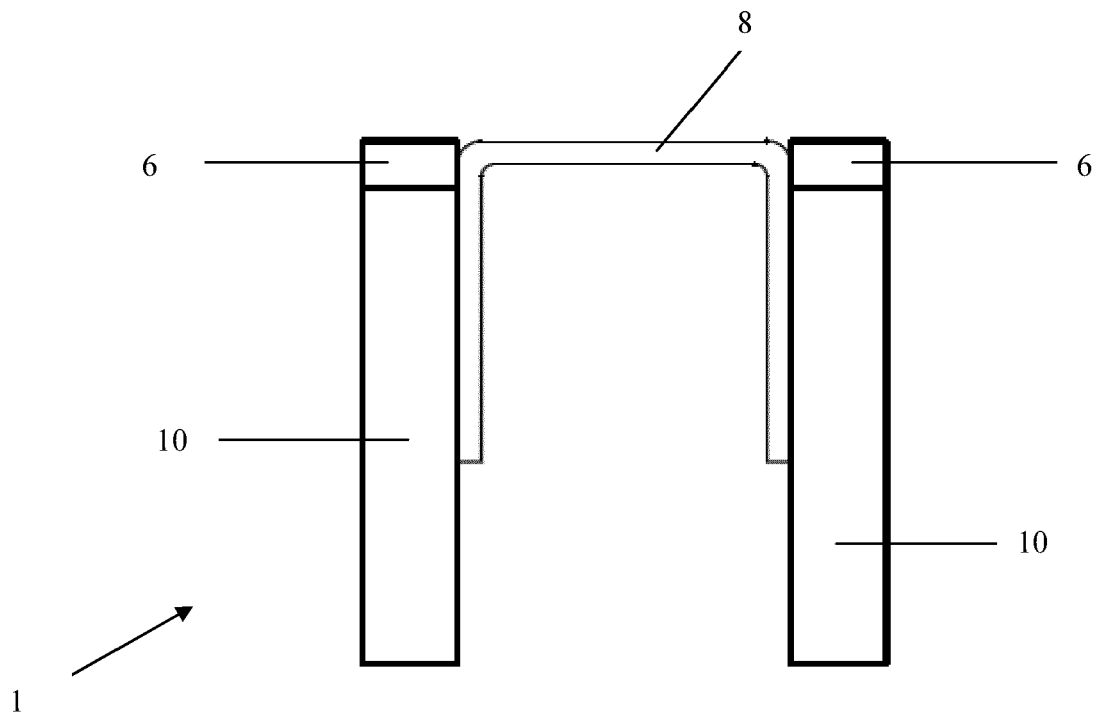


Fig. 2

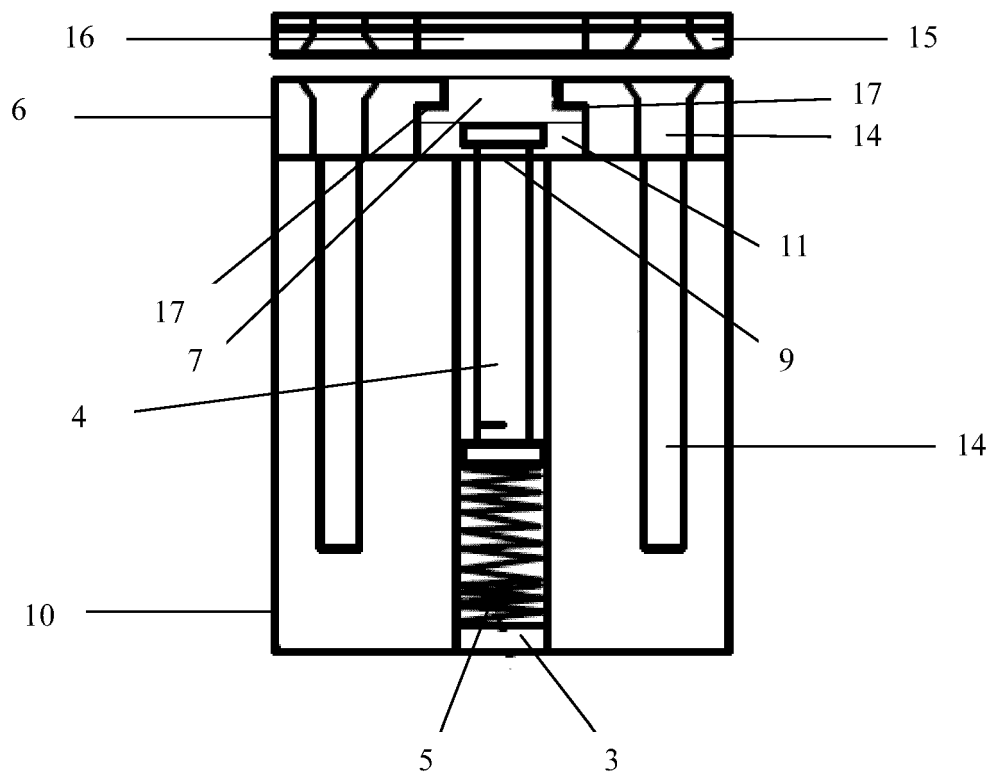


Fig. 3

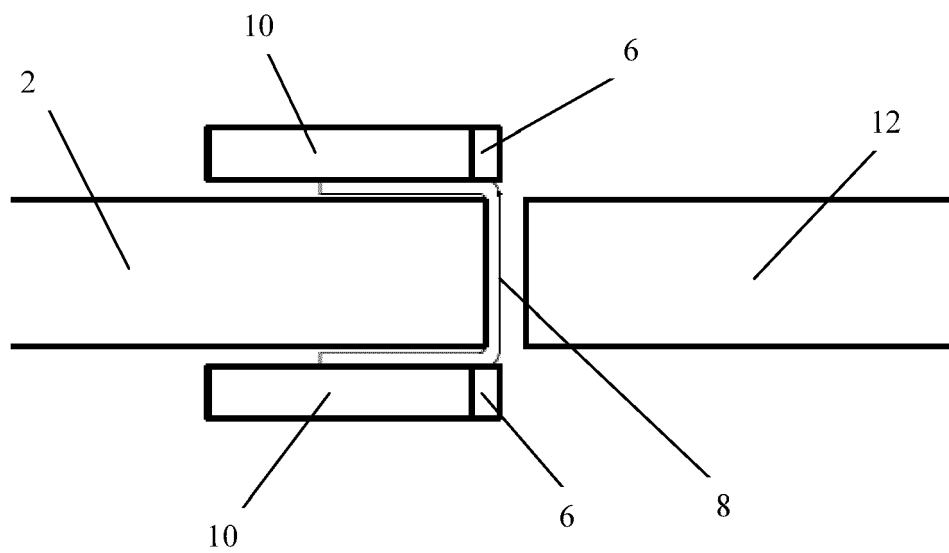


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 15 19 9602

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Place of search The Hague		Date of completion of the search 4 April 2016	Examiner Van Beurden, Jason
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