

Description

The invention relates to a closing panel, especially an explosion relief panel, of the category specified in the pre-characterising parts of claims 1 and 2.

Closing panels for explosion relief of this kind are already known (VDI Guidelines 3673 on Pressure Relief for Dust Explosions of June 1979, pages 5/6). In that case the disc-type closing panel is held in a clamping section element made of rubber. When a no longer allowable positive pressure is reached in a container closed with the closing panel, the disc is pressed out of the clamping section element more particularly in an explosion-like manner. It is possible to inhibit the disc from flying away by means of a holding wire. Because of arms used for supporting purposes, the closing panel is adapted to be blown off only in the outward direction i.e. in the event of excess pressure in the interior space. If the device is to respond also when a negative pressure occurs, a second aperture is needed, with a closing panel inserted in the reverse manner.

Such closing panels are usable especially in plant where there is a risk of dust explosions. Their valve-like action is intended to avoid parts of the plant from being damaged or broken at undesirable places due to a specific positive pressure. The closing flaps represent the "weakest" portions of the plant or container or wall, so that the positive pressure is able to achieve compensation at that portion. Correspondingly such closing panels can also be used in apparatus wherein undesirable negative pressure may occur,

but provided that a further aperture is provided appropriately with a panel situated with its sides exchanged. In addition to this disadvantage, it has been found that the pressure at which the "relief" is to occur is very difficult to adjust, especially if the size of the panel reaches the region of the order of magnitude of 1 m^2 .

It is also known (US-A 4 207 706) to provide the panel with a magnetically operating locking bolt and to articulate the panel directly on the wall. This device is quite complicated. Finally, it is also known (FR-A 2 419 444) to connect the bowed arm, projecting over the closing panel, to the wall by means of a locking element adapted to burst open. Here again pressure relief is possible only to one side.

Therefore, the invention has as its object to improve the closing panel of the category specified initially in such a way as to allow better adjustability to the response, or to the specific positive or negative pressure, in spite of a constructionally simple arrangement.

The invention is claimed in the independent claims 1 and 2. The clamping section element is bridged at least by one lever arm, one end of which is pivotably attached either to the wall or to the panel. The other end of the lever arm on the other hand bears directly or indirectly on the panel, or the wall or clamping section element respectively when a detent element, constructed especially

as a shearing pin, prevents pivoting of the lever arm about the point of articulation in the closure position. When the specific positive or negative pressure occurs, as the case may be, the shearing element shears off and the lever arm is then pivotable about the point of articulation.

In the case of the present invention the holding pressure which holds the panel in the aperture in the wall is transmitted by the sealing element which is constructed as a clamping section element and which consists especially of rubber or elastomeric synthetic plastic material. The lever arm also serves for additional supporting of the panel in one direction. As a result the panel is in fact capable of being blown off in both directions, but yet is readily adjustable as regards the critical pressure.

To allow this supporting force to be adjusted satisfactorily according to a particular feature of the invention it is recommended that the lever arm is provided at the end remote from the articulation with an adjusting element, especially a screw, the tip or the screw head of which can abut against the outside of the panel. By adjusting the screw, the pressure transmission from the lever arm to the panel can also be modified, since the clamping section element of the sealing element is bendable because of its flexurally elastic properties, and the panel can also be deflected somewhat out of the normal holding position.

But if the pressure difference between the outside and the inside of the panel, or of the chamber closed by the panel,

becomes too great, then this force can no longer be taken up by the lever arm, or the detent element, and the latter fails to maintain its detaining action, and allows the lever arm to pivot about the articulation. As a result the panel is allowed to yield in the direction towards the lever arm and to get out from the clamping section element, or force the clamping section element out of the latter's mounting in the wall, to allow pressure equalisation.

By suitable choice of the construction and the material of the detent element, constructed especially as a shearing pin, and also by suitable choice of the spacing of the said element from the articulation it is possible to adjust appropriately the "blowing-off force" which has to be attained to make the detent element cease to carry out its function. To allow adjustability in this respect also, it is recommended that the distance from the detent element to the articulation be made variable.

Further features of the invention are claimed in the subordinate claims, and will be described in more detail hereinafter with reference to the drawings. In these drawings:

Fig. 1 shows a diagrammatic view on to a ship's hold which is closed with an explosion relief panel;

Fig. 2 shows a side view partly in cross-section along the section lines I-I of Fig. 1;

Fig. 3 shows a view - partly broken away - on to the region of the lever arm and the corresponding transition zone from the wall by way of the clamping section element to the panel;

Fig. 4 shows another embodiment of the invention, again as in Fig. 1 as a partial view on to an explosion relief door;

Fig. 5 shows a cross-section through the transition from the wall through the clamping section element to the panel with another construction for the lever arm in side elevation, and

Fig. 6 shows a partial view on to the region of the articulation in the construction shown in Fig. 5.

Fig. 1 shows the wall 3, for example a ship's deck which forms the upper boundary of a hold, as having a loading aperture with an opening area of for example several metres square which is closed by means of a panel 4, the latter forming the explosion relief panel according to the invention, which panel may also be referred to as a hatch. The outer edge of the panel 4 is set into a recess of the clamping section element 1 whose opposite recess - as Fig. 2 shows especially - is fitted on to the edge 9 of the wall 3 which bounds the aperture. In this closure position the clamping section element 1 forms a sealing element, so that rain or sea water cannot penetrate into the hold covered by the panel 4. The clamping section element 1 also holds the panel 4 fast in the desired position.

But over and above this holding arrangement for the panel 4, which represents a known arrangement, the panel is also supported by means of the lever arm 2 which at its end shown at the left in Fig. 2 is pivotably connected by means of a screw bolt at the articulation 7 to a bearing block 6 of U-shaped cross-section whose web portion is

secured by welding on the wall 3. At the opposite end the lever arm 2 is provided with an adjusting element 8 which is constructed as a screw and whose free end can be screwed into contact against the outer side of the panel 4. The spacing C from the top edge of the lever arm 2 to the outer side of the panel 4 can then be modified by screwing the screw i.e. the adjusting element 8. In order that, when the spacing C is modified in this way, forces can also be transmitted through the lever arm 2 to the panel 4 the lever arm 2 is additionally connected to the bearing block 6 at a distance A from the articulation 7 by means of a shearing pin acting as detent element 5. This distance A for example amounts to 70 mm when a spacing B from the point at which the adjusting element 8 acts on the panel to the articulation 7 is approximately 30 cm. A screw with an M 12 screwthread is used for example as the adjusting element, whereas the shearing pin is made of aluminium with a diameter of 6 mm. The bearing block 6 is a U-iron with a thickness of 4 mm and dimensions of 40 x 50 x 40 mm. The lever arm 2 is also a U-iron but with dimensions of 40 x 60 x 40 mm, so that no play exists at the two sides between the outer sides of the legs of the bearing block 6 and the inner sides of the legs of the lever arm 2. The leg height D of the bearing block is, therefore, 40 mm. The spacing G from the articulation 7 to that edge 9 of the wall 3 which bounds the aperture amounts to approximately 12 cm in this example of embodiment. The width of the lever arm 2 amounts to 60 mm and the width F

of the bearing block 6 to 50 mm.

If the pressure in the interior space i.e. below the panel 4, becomes unallowably great, then such a great force is transmitted from the panel 4 by way of the adjusting element 8 and the lever arm 2 and the detent element 5 to the bearing block 6 and to the wall 3 that when a critical value is reached or exceeded the detent element 5 shears through and the lever arm 2 leaves its detaining position and can move pivotably about the articulation 7. As a result the lever arm 2 can no longer transmit force to the panel 4, so that the latter is ripped out of the clamping section element 1, or the latter out of the wall 3. The "valve action" of the explosion relief panel is thereby ensured.

In the other embodiment of the invention shown in Fig. 4, the panel 4 is pivotably fastened to the wall 3 at the left-hand side with conventional articulations, whereas when a specific critical pressure is exceeded the said panel is torn out of the blocking position into the opened position only at the right-hand side by means of the lever arm 2 and otherwise the same construction as in Fig. 1. The articulations 10 ensure that the panel 4 is not hurled away, but remains on the wall 3.

According to Fig. 5 the bearing block 6 is secured to the underside of the panel 4, so that the holding force is adjustable by means of the lever arm 2 and the adjusting element 8 in that the screw forming the holding element 8 is pressed on to the inner side of the wall 3 and the pressure

is intensified by screwing-on further. When the preset limit pressure is exceeded, the detent element 5 shears through, so that the lever arm 2 moves pivotably in the counter-clockwise direction, and the panel 4 can be torn out of the elastomeric clamping section element 1. In contradistinction to the constructional form shown in Figs. 1 to 4, in the form shown in Figs. 5 and 6 the detent element 5 is arranged at that side of the articulation 7 of the lever arm 2 which is opposite from the adjusting element 8. But here again the torque is determined by the distance A between the articulation 7 and the detent element 5. The ratio of this spacing A relatively to the spacing B also defines the force relationships between the force serving for shearing the detent element 5 and the pressure force which acts on the panel 4.

The spacing between the point of action of the adjusting element 8 on the panel 4 and the detent element 5, or the articulation 7, can also be made adjustable.

Claims

1. Closing panel (4), especially explosion relief panel, which is holdable by means of flexurally elastic clamping section elements (1) in sealing-tight manner in an aperture in a wall (3) of a room or chamber which is to be closed, e.g., a storage bin, and can be pressed out of the wall or from the clamping section element when a specific positive pressure or negative pressure occurs in the chamber, to free the aperture at least partly, wherein the clamping section element is bridged at least by one arm (2) one end of which



is intensified by screwing-on further. When the preset limit pressure is exceeded, the detent element 5 shears through, so that the lever arm 2 moves pivotably in the counter-clockwise direction, and the panel 4 can be torn out of the elastomeric clamping section element 1. In contradistinction to the constructional form shown in Figs. 1 to 4, in the form shown in Figs. 5 and 6 the detent element 5 is arranged at that side of the articulation 7 of the lever arm 2 which is opposite from the adjusting element 8. But here again the torque is determined by the distance A between the articulation 7 and the detent element 5. The ratio of this spacing A relatively to the spacing B also defines the force relationships between the force serving for shearing the detent element 5 and the pressure force which acts on the panel 4.

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Claims

1. Closing panel (4), especially explosion relief panel, which is holdable by means of flexurally elastic clamping section elements (1) in sealing-tight manner in an aperture in a wall (3) of a room or chamber which is to be closed, e.g, a storage bin, and can be pressed out of the wall or from the clamping section element when a specific positive pressure or negative pressure occurs in the chamber, to free the aperture at least partly, wherein the clamping section element is bridged at least by one arm (2) one end of which



is secured to the wall (3) and the other end bears on the panel (4), characterised in that the arm is constructed as a lever arm (2) and is so secured to the wall (3) by means of an articulation that a detent element (5) prevents pivotal movement of the lever arm (2) about the articulation in the closure position but, by shearing when a specific positive or negative pressure occurs, allows pivoting movement of the lever arm (2) about the articulation at this occurrence.

2. Closing panel (4), especially explosion relief panel, which is holdable by means of flexurally elastic clamping section elements (1) in sealing-tight manner in an aperture in a wall (3) of a room or chamber which is to be closed, e.g. a storage bin, and can be pressed out of the wall or from the clamping section element when a specific positive pressure or negative pressure occurs in the chamber, to free the aperture at least partly, wherein the clamping section element is bridged at least by one arm (2) one end of which is secured on the panel (4) and the other end bears on the wall, characterised in that the arm is constructed as a lever arm (2) and is so secured to the panel (4) by means of an articulation that a detent element (5) prevents pivotal movement of the lever arm (2) about the articulation in the closure position but allows pivoting movement of the lever arm (2) about the articulation by shearing when a specific positive or negative pressure occurs.

3. Closing panel according to claim 1 or 2, characterised in that the detent element (5) is constructed as a shearing pin.



4. Closing panel according to one of the preceding claims, characterised in that there is secured to the wall (3) or to the panel (4) in the vicinity of the clamping section element (1) a bearing block (6) which comprises both the articulation, in the form of a pivoting bearing (7), and also the bearing means for the detent element (5).
5. Closing panel according to claim 4, characterised in that the bearing block (6) is constructed as a U-section and is welded on to the wall (3) externally.
6. Closing panel according to one of the preceding claims, characterised in that the lever arm (2) is constructed as a U-section.
7. Closing panel according to one of the preceding claims, characterised in that at that end of the lever arm (2) which is remote from the articulation there is arranged an adjusting element (8) which is pressable adjustably on to the panel (4) or on to the wall (3).
8. Closing panel according to claim 7, characterised in that a screw is used for the adjusting element (8).
9. Closing panel according to claim 7 or 8, characterised in that the spacing A, in the longitudinal direction of the lever arm (2), from the articulation to the detent element (5) is substantially smaller than the distance B from the articulation to the adjusting element (8).
10. Closing panel according to claim 9, characterised in that the ratio of the distances B:A amounts to about 4:1 to 5:1.
11. Closing panel according to claim 9 or 10, characterised



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in that the spacing G from the articulation to that edge (9) of the wall (3) which is covered by the clamping section element (1) amounts to substantially double the distance A.

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