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(54) Benævnelse: **Apparat til begrænsning af en brudskives åbningsvinkel**

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US-B1- 6 192 914

The present invention relates to an arrangement made of a rupture disc and a device for limiting an opening angle of the rupture disc, wherein the rupture disc has edge regions by means of which the rupture disc can be mounted on edge regions of an opening of a technical apparatus, and has a central region situated between these with which the opening of the technical installation can be closed.

A rupture disc is known, for example, from the patent specification EP 0 773 393 B2. Rupture discs are used for explosion protection and can be used both as overpressure protection and for explosion pressure relief in silos, filter systems, bunkers, cyclones and many other applications. During trouble-free operation of the technical apparatus to be protected, rupture discs close an opening in a wall, a floor or a ceiling. In the event of an overpressure, especially as a result of an explosion, or an underpressure, the rupture disc bursts and can thus ensure a pressure equalization between the cavity in the technical apparatus to be protected and the environment of this technical apparatus, without the technical apparatus itself being destroyed.

The advantage of rupture discs is that pressure is relieved at a point on the protected technical apparatus intended for this purpose, namely at the point where the rupture disc is installed.

At the point where the rupture disc is installed, a pressure wave and/or a flame can escape from the protected apparatus. Therefore, it must be ensured that the region in front of the rupture disc is free so that the pressure wave and/or the flame cannot cause any damage to objects or persons.

The rupture disc must therefore be mounted at a point of the protected apparatus where an unhindered propagation of the pressure wave and/or flame can occur in the environment. Thus, the choice of the points of the technical apparatus where a rupture disc can be mounted is limited, for example, by the surrounding buildings. Likewise, if the apparatus secured with the rupture disc is already present, the design of the environment cannot be made without taking the existing rupture disc into account.

A device for limiting an opening angle of a rupture disc can provide a remedy. By limiting the opening angle of the rupture disc, it is possible to influence the direction of propagation of a pressure wave and/or flame. By means of the device, it can be effected that the rupture disc is not pivoted by up to 180° from the initial position in the case of relief, as is usually the case, but is pivoted by smaller angles. In this way, it can be achieved that the pressure wave and/or flame is directed in a preferred direction by the rupture

disc. This makes it possible to choose more freely the point where the rupture disc is mounted and to design the environment of the protected technical apparatus more freely.

Such a device for limiting the opening angle of a rupture disc is known from the utility model specification DE 202 15 501 U1. The device for limiting the opening angle is formed by triangular pieces, referred to in the utility model specification as bellows, which are attached to the side of the rupture disc and are made of a flexible material not specified in more detail in the utility model specification. The triangular pieces are mounted with an edge on an edge of the opening that is closed by the rupture disc. Another edge is fastened to an edge of the rupture disc. These two edges of the triangular piece abut in a region where the rupture disc pivots in the case of relief. However, the entire device known from the utility model specification DE 202 15 501 U1 can also be regarded as a device for limiting an opening angle of a rupture disc. Then the triangular pieces and the rupture disc correspond to a first region of a plate of a device mentioned at the beginning. These triangular pieces are then part of the plate, which may have flexible regions.

From the utility model specification DE 20 2006 002 760 U1 a device for limiting an opening angle of a pressure relief flap is further known, which is differently designed but can fulfill the same purpose.

The device for limiting the opening angle of a rupture disc known from the utility model specification DE 202 15 501 U1 has the disadvantage that the triangular pieces made of the flexible material are exposed to the weather and other environmental influences without protection. Over the long periods of time that a rupture disc remains in use, damage can therefore occur to the triangular pieces, impairing the function of the device for limiting the opening angle or even the rupture disc.

The device for limiting the opening angle known from the utility model specification DE 202 15 501 U1 has not become established in practice.

The document US 6 192 914 B2 discloses in Figs. 1 to 4 and the description belonging thereto a turn-over bursting disc 28. The "*safety member*" designated in the document US 6 192 914 B2 with the reference sign 36, i.e. referred to as the safety part. The safety part has the tasks and functions shown in column 3, lines 15 to 20 of the document US 6 192 914 B2 and in column 5, lines 11 to 52 of US 6 192 914 B2.

The functions of the safety part are as follows: The safety part has a ring 40 on which points 44 are provided that can exert a pressure or, more likely, a force concentrated at locations of a rupture disc to cause the rupture disc to tear (see US6 192 914 B2, column 3, lines 15 to 20 and column 5, lines 11 to 38). Thus, the function of the safety part 36 is to achieve that the rupture disc tears in the event of an overpressure in the container or pipe secured by the rupture disc.

The safety part further comprises a catcher bar 42. This catcher bar supports a hinge region 50 of the rupture disc 28 when the rupture disc is turned over and teared and brakes a blow-out portion 48 of the rupture disc, which is a central region of the rupture disc 28, when turning over into the free interior of a pipe socket 14. Supporting the hinge region 50 and braking the blow-out portion 48 of the rupture disc by the catcher bar 42 prevents the blow-out portion 48 from being separated or torn away from the remaining region of the rupture disc (US6 192 914 B2, column 5, lines 39 to 52). Thus, the function of the safety part 36 is to also prevent the blow-out portion 48 of the rupture disc from being separated or torn away.

When the rupture disc 28 known from the document US6 192 914 B2 is turned over and torn open, the blow-out portion 48 strikes the catcher bar 42 of the safety part 36 (column 5, lines 39 and 40, comparison of figures 1 and 4). The opening angle of the rupture disc is limited to 90° at best by the catcher bar.

This is where the present invention comes in.

The invention was based on the problem of proposing an arrangement with a device for limiting the opening angle, which remains unaffected in its function despite environmental influences and with which an opening angle can be limited to less than 90°.

According to the invention, this problem is solved by an arrangement having the features of claim 1, In the case of relief, the central region of the rupture disc presses on the at least one first region of the device according to the invention and deflects or bulges it. The at least one first region of the device thereby puts up a resistance to the opening movement of a part of the central region of the rupture disc, while another part or other parts of the central region of the rupture disc, in comparison to it, are little or not hindered by the at least one first region of the device in the opening movement. This deliberately induced obstruction of the opening movement of a part of the central region of the rupture disc can give the rupture disc, in the case of relief, a shape which results in a pressure wave and/or a flame being given a predetermined direction.

The plate of an arrangement according to the invention has, on sides of the first region which are opposite to one another, second regions, in particular flanges, by means of which the plate can be fastened, wherein the first region is connected to the second regions which are arranged on the sides of the first region which are opposite to one another. These second regions can be congruent with edge regions of the rupture disc by means of which the rupture disc is fastened to the technical apparatus to be protected. If aligned holes are provided in the second regions of the device and in the edge regions of the rupture disc, these can be used to fasten the device according to the invention and the rupture disc to the apparatus to be protected using the same screws.

The plate of a device of an arrangement according to the invention may comprise a third region which is not, or is less, distensible or deflectable in comparison to the first region. The third region may be arranged between the second regions and adjacent to the at least one first region. The third region may be located at an edge of the plate. In combination with a rupture disc, the third region may be adjacent to a region of the rupture disc in which the central region of the rupture disc is pivoted relative to an edge region of the rupture disc in the case of relief.

The at least one first region of a device of an arrangement according to the invention may have at least one incision, one indentation, one notch, or the like. The at least one first incision, the at least one first indentation or the at least one first notch advantageously protrude from a first edge into the at least one first region of the plate. The incision, the indentation, or the notch allows the first region of the plate provided therewith to be more easily bulged out or deflected in comparison to a design without an incision, indentation, or notch.

The at least one first region may comprise or be formed by a stripe which is meander-shaped, jagged, zig-zag-shaped, or similar. Such a stripe may be more easily bulged out or deflected than a stripe extending in a straight line.

The at least one first region and the third region may be directly connected to one another at one or more points or in one or more sections.

The at least one first region and the third region of a device according to the invention may enclose a hole in the plate. The hole may be triangular or virtually triangular.

Embodiments of devices according to the invention will be explained in more detail with reference to the drawings. Therein shows:

Fig. 1 a front view of a first device which is according to the invention and preferred,

Fig. 1a a front view of an arrangement of a rupture disc and the first device,

Fig. 1b a front view of the arrangement of the rupture disc and the first device after a case of relief,

Fig. 1c a side view of the arrangement of the rupture disc and the first device after a case of relief,

Fig. 2 a front view of a second device according to the invention,

Fig. 3 a front view of a third device according to the invention.

The devices according to the invention for limiting an opening angle of a rupture disc shown in figures 1 to 3 have a plate 1 made of a stainless steel sheet by cutting, punching and/or perforating. The stainless steel sheet may have a thickness of 0.5 mm, for example.

The plates 1 have different regions 11, 12, 13 that perform different functions for the device according to the invention.

First regions 11 of the plates 1 can be bulged and/or deflected perpendicularly to the plate 1 under the influence of force. These first regions 11 serve to form a central region 21 of a rupture disc 2. Second regions 12 of the plates 1 serve to fasten the plates 1 to an apparatus protected by the rupture disc 2. While all the devices illustrated in the figures have at least one first region 11 and two second regions 12, only the embodiment example according to figure 1 has a third region 13. The embodiment examples according to figures 2 and 3 do not have a third region 13. The third region 13, which in comparison to the first region 11 can be bulged and/or deflected perpendicularly to the plate 1 to a lesser extent or not at all under the influence of force, serves, as already the first region 11, to form the central region 21 of the rupture disc 2.

The first region 11 of the embodiment example according to figure 1 comprises a stripe in the form of a jag 111, the ends 112 of which are connected to the second regions 12. In the region of the connection between the first region 11 and the second regions 12, the plate 1 is perforated (perforations P). The third region 13 of the embodiment example according to figure 1 is formed by a virtually rectilinear stripe, the ends 131 of which are also separated by perforations P from the second regions 12. The jag 111 of the first region and the stripe of the third region 13 enclose a hole L that is virtually triangular in shape.

Holes 121 are provided in the second regions 12, which can be used to fasten the device by means of screws 3 (figures 1a to 1c). Preferably, the second regions 12 have a hole pattern formed by the holes 121, which corresponds to a hole pattern in an edge region 22 of a rupture disc 2. Thus, the screws 3 can be used to simultaneously fasten the device according to the invention and a rupture disc 2, as shown in figures 1a to 1c. When a rupture disc 2 according to the invention and a device according to the invention are assembled into an arrangement as shown in figures 1a to 1c, a central region 21 of the rupture disc 2 is partially covered by the first region 11 and the third region 13. The third region 13 of the device according to the invention is thereby adjacent to the region of the rupture disc which connects the central region 21 to the edge region 22 in the manner of a hinge. In this region, unlike the other regions connecting the central region 21 and the edge regions 22, the rupture disc has no perforations along which the rupture disc is torn open and opens in the case of relief.

In a case of relief, the central region 21 of the rupture disc 2 is separated from the edge regions 22 along the perforations of the rupture disc and pivots about an axis in the region connecting the central region 21 and the edge region 22 in the manner of a hinge. As a result, the opening that was closed by the rupture disc is released and a pressure wave and/or a flame can escape.

The central region is pressed against the first region 11 and the third region 13 by the pressure wave. The first region 11 bulges forward and is thereby deformed. The perforations P between the first region 11 and the second regions 12 are stretched and the jag 111 buckles forward. However, the device according to the invention is not torn open in the first region 11 and at the connections between the first region 11 and the second regions 12. Thus, the device according to the invention prevents the central region 21 from pivoting more than a desired angle from its original position.

The embodiment example illustrated in figure 2 has a plurality of first regions 11 formed of meandering stripes, wherein the strength of the meandering, i.e., the depth of the indentations, decreases from a center of the plate 1 to a lower edge of the plate 1, thus allowing for more bulging in the center than at the lower edge.

The embodiment example shown in figure 3 has two first regions 11, which are also formed by meandering stripes.

Patentkrav

1. Indretning af en brudskive (2) og et apparat (1) til begrænsning af en åbningsvinkel for brudskiven (2), idet brudskiven (2) har randområder, over hvilke brudskiven (2) kan anbringes på randområder af en åbning i en teknisk indretning, og et mellem disse liggende mellemområde, med hviket åbningen i den tekniske indretning kan lukkes,
hvori apparatet har en plade (1) til begrænsning af åbningsvinklen, som har et første område (11), der under kraftpåvirkning kan hvælves og/eller bøjes vinkelret på pladens (1) plan, at pladen (1) på over for hinanden liggende sider af det første område (11) har andre områder (12), med hvilke pladen (1) kan fastgøres, at det første område (11) er forbundet med de på de over for hinanden liggende sider af det første område (11) anbragte andre områder (12), og at brudskivens (2) randområder og de andre områder i apparatet til begrænsning af en åbningsvinkel ligger over hinanden.

2. Indretning ifølge krav 1, **kendetegnet ved, at** pladen (1) omfatter et tredie område (13), der i sammenligning med det første område (11) ikke eller kun i mindre grad kan hvælves eller bøjes.

3. Indretning ifølge krav 2, **kendetegnet ved, at** det tredie område (13) er anbragt mellem de andre områder (12) og stødende op til det mindst ene første område (11).

4. Indretning ifølge et af kravene 1 til 3, **kendetegnet ved, at** det første område (11) har mindst et indsnit, en indbugtning eller et indhug.

5. Indretning ifølge krav 4, **kendetegnet ved, at** det mindst ene første indsnit, den mindst ene første indbugtning eller det mindst ene første indhug fra en første rand rager ind i det mindst ene første område (11) af pladen (1).

6. Indretning ifølge et af kravene 1 til 5, **kendetegnet ved, at** det mindst ene første område omfatter en stribe, der er mæanderformet, savtakformet,

zigzagformet eller lignende.

7. Indretning ifølge et af kravene 1 til 6, **kendetegnet ved, at** det mindst ene første område (11) og det tredie område (13) er direkte forbundet med hinanden.

8. Indretning ifølge et af kravene 1 til 7, **kendetegnet ved, at** det mindst ene første område (11) og det tredie område (13) indeslutter et hul i stanseemnet (1).

9. Indretning ifølge krav 8, **kendetegnet ved, at** hullet er trekantet eller tilnærmelsesvis trekantet.

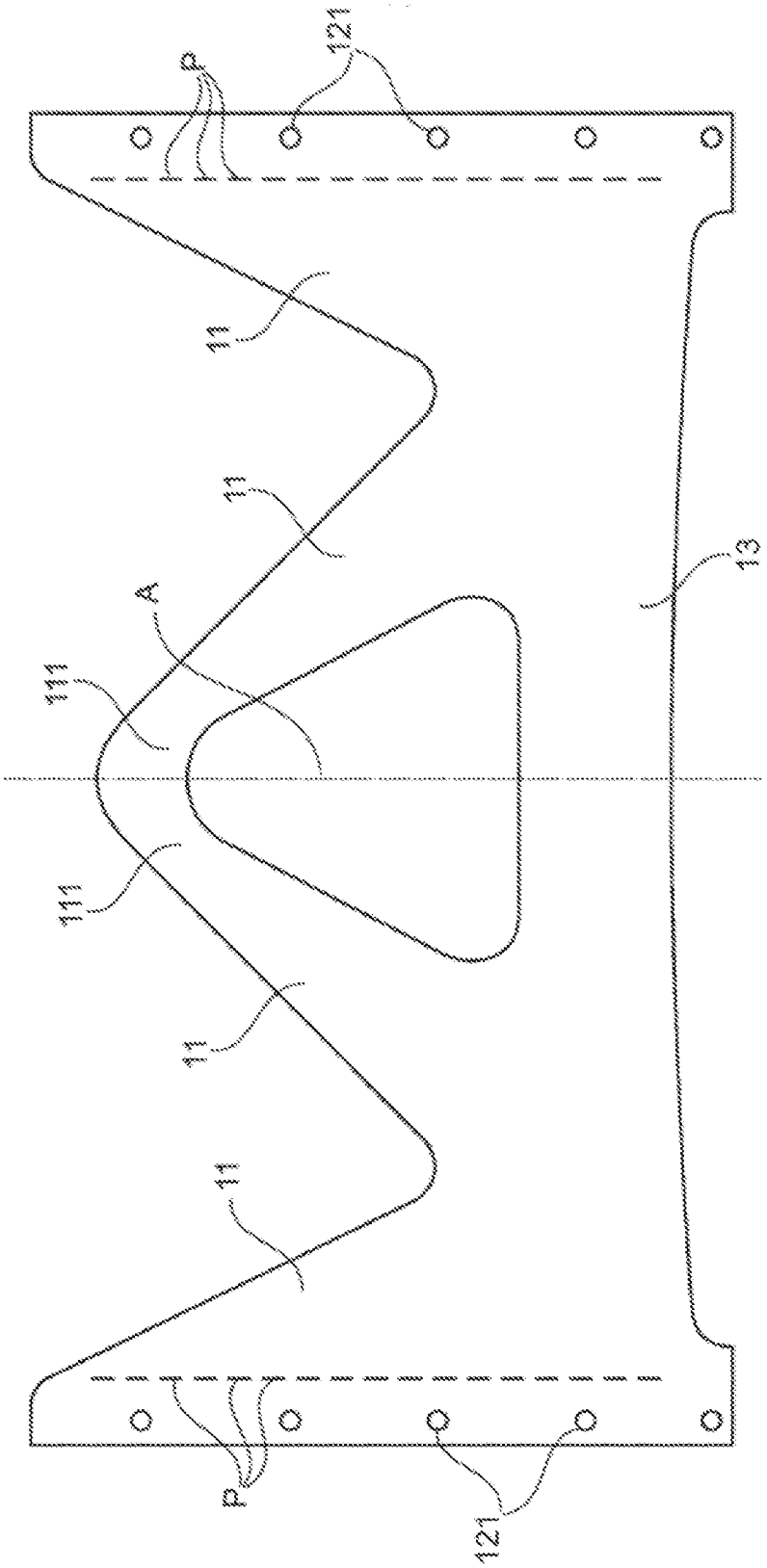

Fig. 1

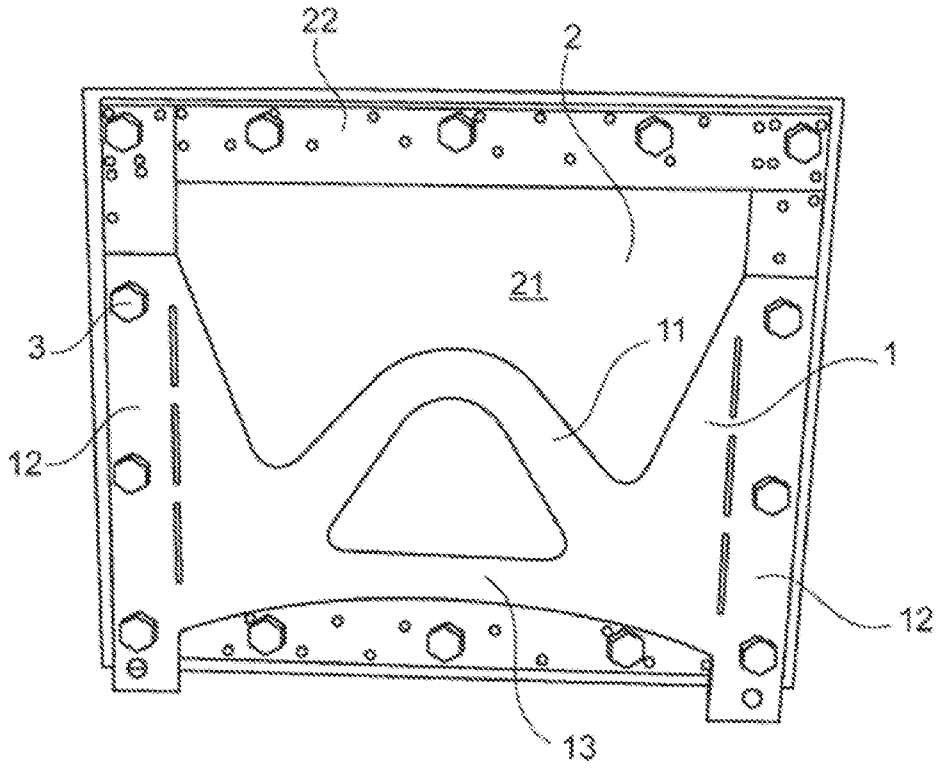

Fig. 1a

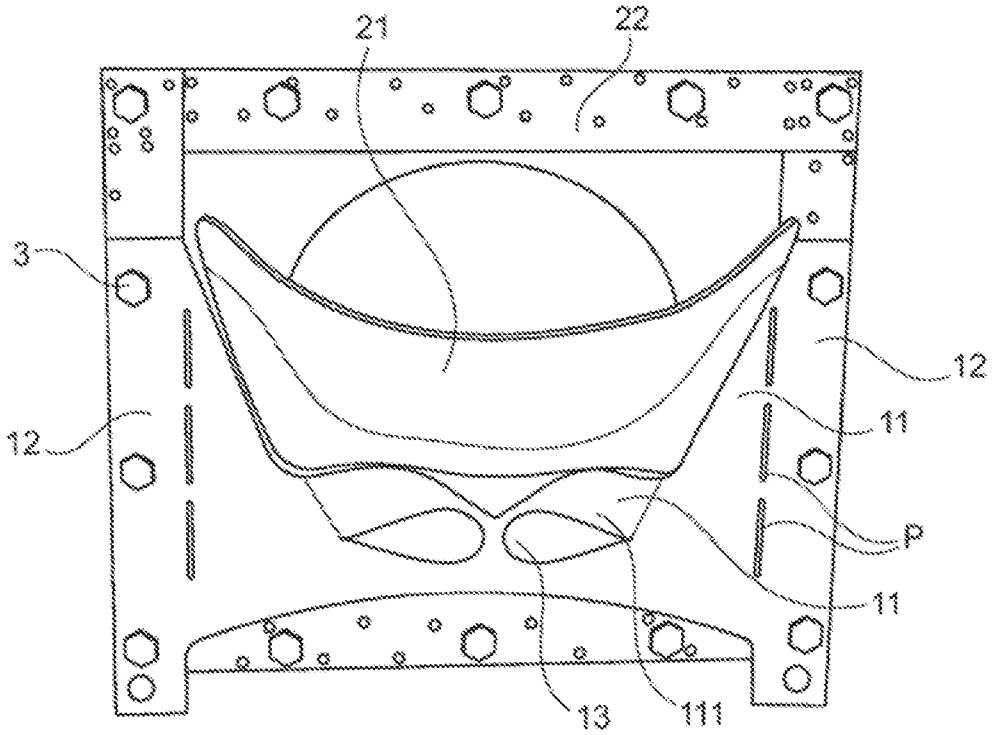

Fig. 1b

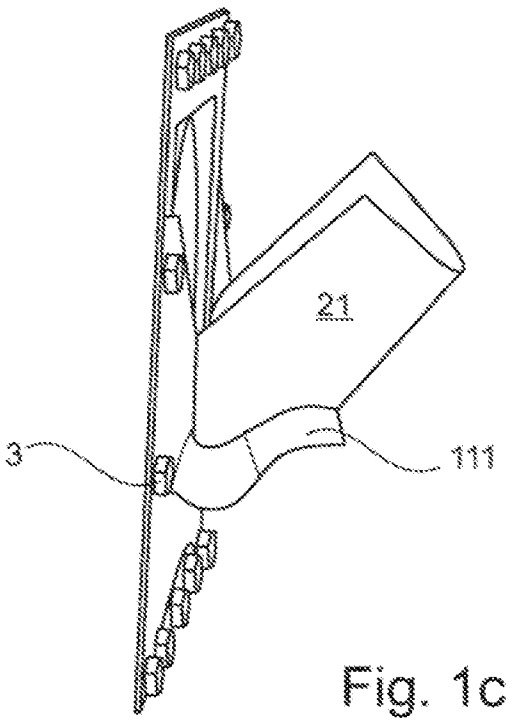

Fig. 1c

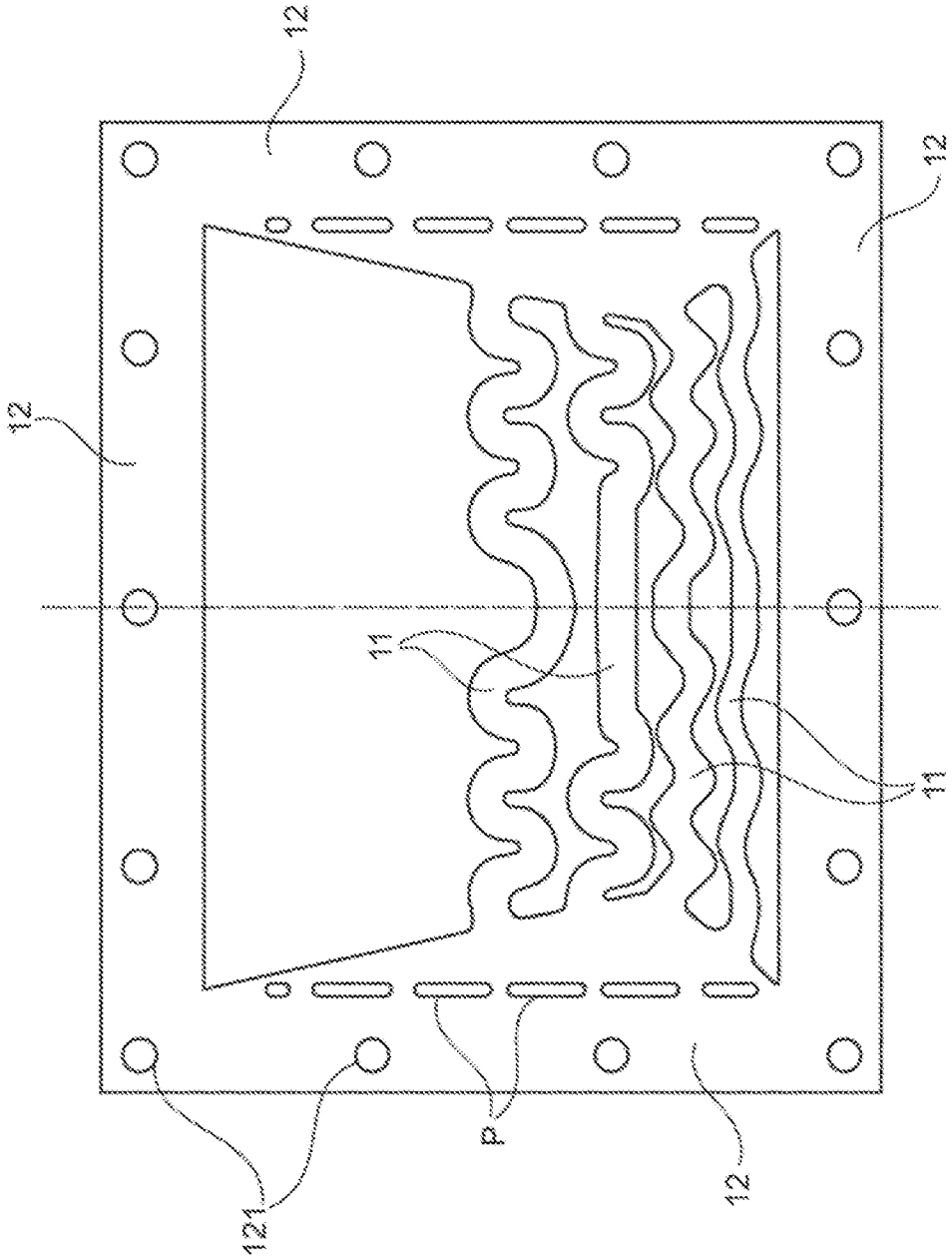

Fig. 2

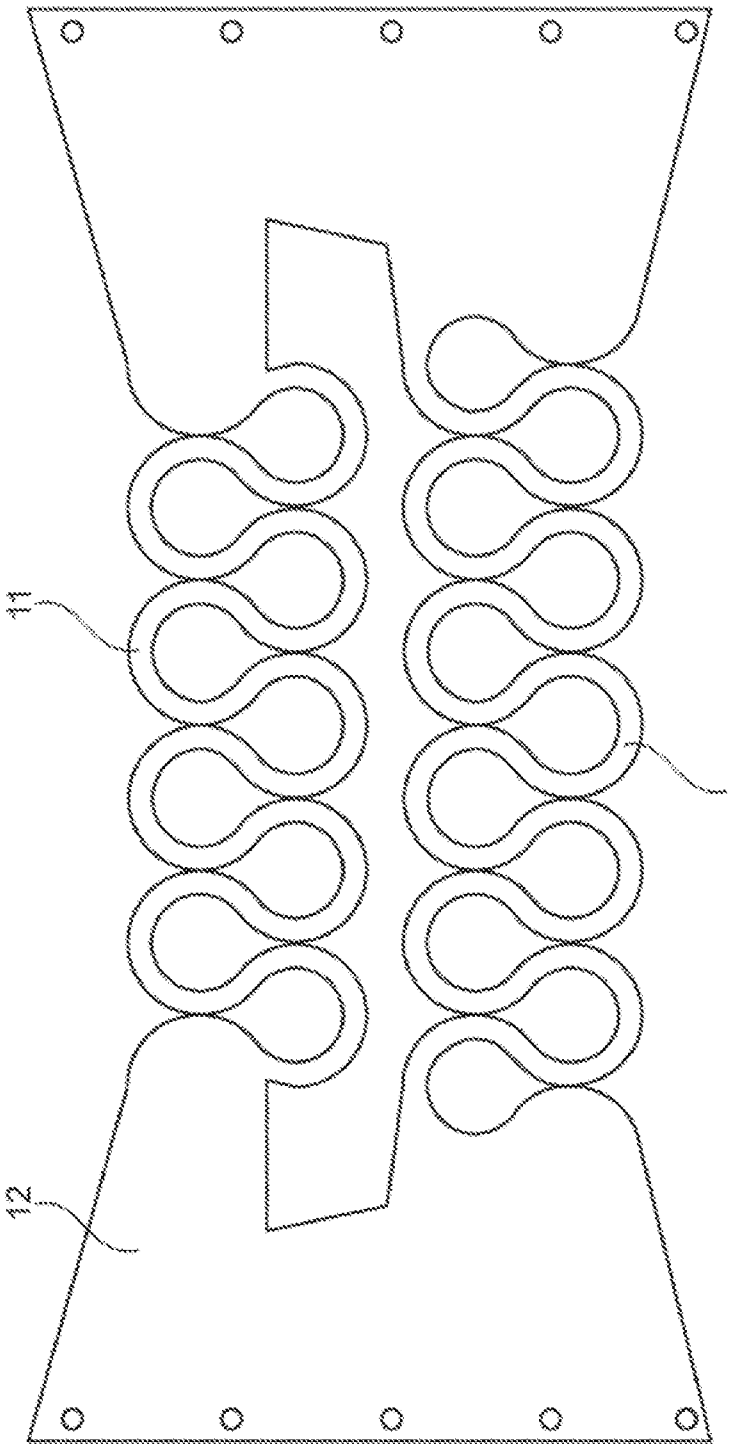

Fig. 3