

**TITLE OF INVENTION: ARRANGEMENT FOR BLOCKING OR
UNBLOCKING A FLOW OF FLUIDS**

The present invention relates to an arrangement for blocking or unblocking a flow of fluids through a component conducting the fluid from a high pressure side to a low pressure side, said component delimiting a fluid passage, wherein the arrangement comprises

- a. the component which guides the fluid,
- b. a bursting disk as a means for closing the fluid passage through the component, which separates the high pressure side and the low pressure side, wherein the bursting disk is at least indirectly attached to the component, and
- c. a controllable actuator which is actuatable for unblocking the fluid passage.

[0002] From EP 2 347 151 B1, there are known arrangements having bursting disks which close a fluid passage through a component, wherein an actuator is provided which can provide for an unblocking of the fluid passage when needed. The actuators are arranged on the high pressure side of the bursting disks. In order to unblock the fluid passage, the bursting pressure of the bursting disk is reduced with the aid of the actuators, specifically far enough that its bursting pressure falls below the pressure existing on the high pressure side, so that the pressure existing on the high pressure side is sufficient to cause the bursting disk to burst.

[0003] The inventors have made it an object to find an alternative to the known solution.

[0004] The inventors have achieved this object in that the arrangement has a support element which is arranged on the low pressure side of the bursting disk and supports the bursting disk so that the bursting disk withstands a pressure of the fluid on the high pressure side that is higher than a nominal bursting pressure of the bursting disk but is lower than a maximum pressure, wherein the actuator and the support element are arranged relative to one another such that, in order to unblock the fluid passage, the actuator can destroy or damage the support element and a pressure of the fluid on the high pressure side of the bursting disk causes the bursting disk to burst if the pressure is higher than the nominal bursting pressure of the bursting disk.

[0005] Unlike the solution known from EP 2 347 151 B1, the bursting disk is not damaged by the actuator such that the bursting pressure is reduced to below the pressure prevailing on the high pressure side and that the bursting disk therefore bursts. Rather, a bursting disk is used the bursting pressure of which is already so low that it is lower than the bursting pressure prevailing on the high pressure side. The bursting disk of an arrangement according to the invention would therefore burst if the bursting disk were not supported by the support element before the actuation of the actuator. If necessary, the support element is destroyed or damaged by the actuation of the actuator, so that it can no longer fulfill its function as a support. As a result of the failure of the support, the bursting disk then immediately bursts.

[0006] An advantage of the arrangement according to the invention as compared with the known solution is that no consideration need be given, in the design of the solution according to the invention, to which site on the bursting disk must be impacted with what force and at what angle and with what type of object without destroying the bursting disk so that damage is caused to the bursting disk which sufficiently reduces the nominal bursting pressure so that it opens

and unblocks the fluid passage. Rather, a bursting disk for which only the nominal bursting pressure is known can be used. By contrast, in the process of designing the arrangement, attention must be paid to the design of the support. When required, this must collapse so that it no longer supports the bursting disk. However, the design of a support and its adaptation to an actuator is simpler than the selection of a bursting disk for the arrangement known from EP 2 347 151 B1.

[0007] The support element can be configured, in principle, in any desired manner. In order to support the bursting disk, the support element has, in particular, to make at least indirect contact with the low pressure side of the bursting disk in order to absorb a force bearing upon the bursting disk there. In addition, the support element advantageously has at least indirect contact with the component having the fluid passage in order to conduct away the force absorbed by the bursting disk into the component. Between these two contact sites, the force absorbed by the support element is conducted through the support element. By means of the actuator, in principle, damage or destruction can be caused at any desired site between the two contact sites or also to the contact sites themselves, in order to damage or destroy the support element such that it can no longer fulfill its function as a support for the bursting disk.

[0008] The support element can be a disk which abuts the bursting disk at least partially, advantageously in a region in which the bursting disk is exposed to the pressure prevailing on the high pressure side.

[0009] An arrangement according to the invention can be realized with a flat or domed bursting disk, in particular the realization thereof is possible with a forwardly opening bursting disk, a reverse buckling bursting disk, a domed bursting disk or a flat bursting disk. The disk

forming the support element can be at least partially as domed as the bursting disk.

[0010] The support element can have a fastening region with which the support element is at least indirectly fastened to the component conducting the fluid. This fastening region can be a ring or a flange. It can surround a domed central region.

[0011] Between the fastening region and the region abutting the bursting disk, the support element can have a supporting region by way of which the forces are conducted from the region of the support element abutting the bursting disk to the fastening region. The actuator can act upon this fastening region to unblock the fluid passage. The support region can be destroyed or damaged so that the forces conducted from the bursting disk into the support element can no longer be conducted away into the fastening region, with the result that the bursting disk then opens.

[0012] The actuator can have a plunger and a drive to operate the plunger. In order to unblock the fluid passage, the drive of the actuator can strike the plunger against the supporting region. The drive can be an electric or electromagnetic drive. The drive can also be a propellant charge. This can be ignited electrically.

[0013] The support element can have at least one intended breaking site, intended breaking line or suchlike. In particular, the supporting region of a support element can have the intended breaking site, intended breaking line or suchlike or one or more of the intended breaking sites, intended breaking lines or suchlike.

[0014] Furthermore, the support element can have slits, holes or perforations.

[0015] An arrangement according to the invention for blocking or unblocking a flow of fluids can have a manometer and/or a pressure sensor. The manometer and/or pressure sensor can detect the pressure on the high pressure side of the bursting disk. For this purpose, the component can have at least one hole. The manometer and/or the pressure sensor can be inserted into the hole or holes.

[0016] Further features and advantages of an exemplary embodiment of the invention are disclosed in greater detail in the drawings. In the drawings:

Fig. 1 shows a perspective view of an extinguishing agent bottle which is closed with an arrangement according to the invention and can be opened therewith,

Fig. 2 shows a perspective view of the arrangement,

Fig. 3 shows a plan view of the arrangement,

Fig. 4 shows a view of the side of the arrangement on which an actuator of the arrangement is provided,

Fig. 5 shows a view of the side of the arrangement on which a manometer is provided,

Fig. 6 shows a view of the arrangement from the front,

Fig. 7 shows a view of the arrangement from underneath,

Fig. 8 shows a section through the arrangement along the line VIII-VIII in Fig. 3,

Fig. 9 shows a perspective view of a component of the arrangement with a fluid passage,

Fig. 10 shows a perspective view of a bursting disk of the arrangement,

Fig. 11 shows a side view of the bursting disk,

Fig. 12 shows a perspective view of a support element of the arrangement,

Fig. 13 shows a plan view of the support element,

Fig. 14 shows a side view of the support element,

Fig. 15 shows a view of the bursting disk, the support element and the actuator from the front,

Fig. 16 shows a view of the support element and the actuator from the side on which the actuator is arranged.

[0017] It is not necessary for an apparatus according to the invention to have all the features described below. It is also possible that an apparatus according to the invention has only individual features of the exemplary embodiment described below.

[0018] The extinguishing agent bottle B shown in Fig. 1 is filled with an extinguishing agent. It can be used in technical installations in order to deliver and introduce extinguishing agent, in particular an extinguishing powder, for example into a container or a conduit, in the event of a fire.

[0019] The arrangement A according to the invention has a component 1 which forms a fluid passage through which the extinguishing agent can emerge from the bottle B. In the normal case, this fluid passage is closed by a bursting disk 2 of the arrangement A.

[0020] On a side facing the bottle B at the end of the fluid passage, the component 1 has an internal thread 11 with which the bottle B a neck of the bottle B can be attached to an external thread at the opening of the bottle B. On the opposite side, the component 1 forms a flange 12 by way of which the extinguishing agent bottle B can be attached to the conduit or the container into which the extinguishing agent is to be introduced. This flange 12 has a plurality of screw holes 121 for screw fastening to a flange of, for example, the conduit or the container.

[0021] The fluid passage extends from the internal thread 11 to the flange 12. Provided in the wall delimiting the fluid passage of the component 1 is a shoulder 13 on which the wall is offset externally, viewed in the direction from the internal thread 11 to the flange. Screw holes 14 are provided in the shoulder 13. In addition, a through hole 15 is provided through which the actuator 3 of the arrangement A protrudes. Screws 7 are screwed into the screw holes 14.

[0022] The bursting disk 2 of the arrangement A is placed on the shoulder 13. The bursting disk 2 has an annular, flat fastening region 21 and a domed sealing region 22 which lies within the fastening region 21. The curvature is directed toward the extinguishing agent bottle. The bursting disk 2 is a bursting disk that is domed in the direction of the extinguishing agent bottle. The fluid passage is closed by the bursting disk 2. By means of an opening of the bursting disk 2, the fluid passage for the egress of the extinguishing agent from the bottle is unblocked. In an edge region of the shoulder 13, a seal 6, specifically an O-ring, is provided which prevents the fluid from penetrating between the bursting disk 2 and the component 1. The fastening region 21 of the bursting disk 2 has through holes for the screws 7 which are screwed into the screw holes 14 in the shoulder 13. In addition, a through hole is provided through which the actuator 3 of the arrangement A protrudes.

[0023] The bursting disk 2 blocks the fluid passage and separates a high pressure region of the fluid passage, on one side of the bursting disk 2, which opens into the bottle B, from a low pressure region of the fluid passage, on the other side of the bursting disk 2, which opens in the flange 12 of the component 1 forming the fluid passage.

[0024] Arranged on the fastening region 21 of the bursting disk 2 is a so-called pressure ring 8 by means of which the fastening region 21 of the bursting disk 2 is pressed against the shoulder 13. The pressure ring 8 is a ring which has through holes that are coincident with the screw holes 14 in the shoulder 13 and the through holes in the fastening region 21 of the bursting disk 2 for the screws 7 that are screwed into the screw holes 14. On the side facing toward the bursting disk 2, the pressure ring 8 has a planar area with which the pressure ring lies on the bursting disk 2.

[0025] On the side facing away from the bursting disk 2, the pressure ring 8 has a gutter-like concavity 81 which begins at the side of the pressure ring 8 facing away from the bursting disk 2 and ends at an inner side of the pressure ring 8 and extends evenly around the entire circumference of the pressure ring 8. A through hole for the actuator 3 opens into this gutter-like concavity, said hole being a continuation of the through hole of the bursting disk 2 and the component 1 provided for the actuator 3.

[0026] The support element 4 is placed on the pressure ring 8. The support element 4 is made from a metal sheet, similarly to the bursting disk 2. In the support element 4, at least three regions 41, 42, 43 can be distinguished. Firstly, there is a fastening region 41 which is formed by a flat ring. This fastening region 41 lies on the side of the pressure ring 8 facing away from the bursting disk 2. It has through holes that are coincident with those in the pressure ring 8 and the bursting disk 2 for the screws 7 with which the bursting disk 2, the

pressure ring 8 and the support element 4 are fastened on the component 1 which forms the fluid passage.

[0027] The fastening region 41 of the support element 4 surrounds a curvature which forms the two further regions 42, 43. Adjoining the fastening region 41, there is firstly an annular support region 42 which, with a side facing toward the bursting disk 2, abuts the gutter-like concavity 81 of the pressure ring 8. It touches a region 43 which does not abut the pressure ring 8, but rather abuts the bursting disk 2. In this region 43 of the support element 4 abutting the bursting disk 2, forces that are conducted into the bursting disk 2 on the high pressure side of the bursting disk 2 are conducted into the support element 4. These forces are then conducted within the support element 4 by way of the support region 42 into the fastening region 41. From there, the forces pass, by way of the screws 7 with which, inter alia, the support element 4 is fastened to the component 1 which forms the fluid passage, the pressure ring 8 and the bursting disk 2, into the component 1.

[0028] In the supporting region 42, two long intended breaking lines 44, 45 are provided which extend almost parallel to an edge of the pressure ring 8 and are formed by a groove in the support element 4. The long intended breaking lines 44, 45 extend over an angle of approximately 25° to 35° . The through hole of the pressure ring 8, into which the actuator 3 projects, ends at these intended breaking lines. By means of an actuation of the actuator 3, it can act upon the long intended breaking lines 44, 45.

[0029] Beginning approximately at the ends of the long intended breaking lines 44, 45 are slits (46) which have a zigzag path and each extend at a spacing from the aforementioned edge of the pressure ring 8 along this edge over angular regions from approximately 85° to 115° . A zigzag slit 46 could begin at the end of each of the intended

breaking lines 44, 45. In the example shown, there is a plurality of successive zigzag slits 46 which are interrupted by sections which form webs between the slits 46. These webs can have short intended breaking lines 47. A section 421 of the supporting region 42 opposite the long intended breaking line 44, 45 is free of slits and intended breaking lines. This section 421 forms a hinge, as described below.

[0030] A locking ring 9 is placed upon the fastening region of the support element 4. This also has through holes for the screws 7 which are screwed into the screw holes 14 in the shoulder 13 of the component 1 which forms the fluid passage. The through holes have two steps. A first step facing away from the bursting disk 2, which has a first diameter and a second step facing toward the bursting disk 2, which has a second diameter that is smaller than the first diameter. The screws 7 are inserted through these through holes. The heads 71 of the screws 7 have a diameter that is smaller than the first diameter and larger than the second diameter and abut a shoulder between the two steps. By tightening the screws 7, the locking ring 9, the support element 4, the pressure ring 8 and the bursting disk 2 are pulled against the shoulder 13 of the component 1 which forms the fluid passage.

[0031] The actuator 3 which is inserted into the component and is fastened there and protrudes through the fastening region 21 of the bursting disk 2 and projects into the pressure ring 8 has a housing in which a propellant charge and a plunger 31 are arranged. If the propellant charge is electrically ignited, the plunger 31 speeds forward and impacts against the long intended breaking lines 44, 45 in the supporting region 41 of the support element 4. As a result of this impact, the long intended breaking lines 44, 45 break. What follows now is a chain reaction: the pressure bearing upon the high pressure side of the bursting disk 2 can no longer be conducted away by the support element 4 as before due to the broken long intended breaking

lines 44, 45. The bursting disk 2 thereby presses against the still remaining short intended breaking lines 46 which, due to this pressure, also break. The pressure bearing upon the bursting disk 2 is then even less able to be conducted away by the support element 4. It is then only the hinge 421 that connects the region 43 of the support element 4 abutting the bursting disk 2 and the fastening region 41 of the support element 4 by way of which the force coming from the bursting disk 2 can be conducted into the component 1 to one another and can conduct the force away into the component 1. The bursting disk therefore presses into the zigzag edges 461 of the slits 46 of the support element 4, and simultaneously, the bursting disk 2 begins to pivot. During the pivoting, the zigzag edges 461 tear the bursting disk 2 open. The hinge 421 and the tearing of the bursting disk 2 along the zigzag edges 461 of the slits 46 in the support element 4 bring about a controlled opening of the bursting disk 2, as far as possible without parts of the bursting disk 2 tearing off and being carried along with the fluid flowing out of the bottle B.

[0032] In the component 1 which forms the fluid passage, a through hole is provided in a part adjoining the bottle B, by way of which, firstly, the bottle B can be filled and, secondly, a manometer 10 is connected with which the pressure of the fluid in the bottle B can be monitored. In addition, a pressure sensor can be provided with which pressure can be measured on the high pressure side of the bursting disk.

Claims:

[Claim 1]

An arrangement (A) for blocking or unblocking a flow of fluids through a component (1) conducting the fluid from a high pressure side to a low pressure side, said component delimiting a fluid passage (F), wherein the arrangement comprises

- the component (1) which conducts the fluid,
- a bursting disk (2) as a means for closing the fluid passage through the component (1), said bursting disk separating the high pressure side and the low pressure side, wherein the bursting disk (2) is at least indirectly attached to the component (1), and
- a controllable actuator (3) which is actuatable for unblocking the fluid passage,

characterized in that

the arrangement (A) has a support element (4) which is arranged on the low pressure side of the bursting disk (2) and supports the bursting disk (1) so that the bursting disk (2) withstands a pressure of the fluid on the high pressure side that is higher than a nominal bursting pressure of the bursting disk (2) but is lower than a maximum pressure, wherein the actuator (3) and the support element (4) are arranged relative to one another such that, in order to unblock the fluid passage, the actuator (3) can destroy or damage the support element (4) and a pressure of the fluid on the high pressure side of the bursting disk causes the bursting disk (2) to burst if the pressure on the high pressure side of the bursting disk (2) is higher than the nominal bursting pressure of the bursting disk (2).

[Claim 2]

The arrangement according to claim 1, characterized in that the bursting disk (2) is a domed bursting disk, in particular a forwardly opening bursting disk, a reverse buckling bursting disk, a domed bursting disk, in particular a bursting disk domed toward the high pressure side, or a flat bursting disk.

[Claim 3]

The arrangement according to claim 1 or 2, characterized in that the support element (4) is a disk which abuts the bursting disk (2) at least partially, advantageously in a region (43) in which the bursting disk (2) is exposed to the pressure prevailing on the high pressure side.

[Claim 4]

The arrangement according to claim 2 and 3, characterized in that the disk forming the support element (4) is at least partially as domed as the bursting disk (2).

[Claim 5]

The arrangement according to one of claims 1 to 4, characterized in that the support element (4) has a fastening region (41) with which the support element (4) is at least indirectly fastened to the component (1) conducting the fluid.

[Claim 6]

The arrangement according to claim 3 and 5, characterized in that the support element (4) has a supporting region (42) between the fastening region (41) and the region (43) abutting

the bursting disk, with which the actuator (3) cooperates to unblock the fluid passage.

[Claim 7]

The arrangement according to claim 6, characterized in that the actuator (3) has a plunger (31) and a drive to operate the plunger (31) and in that the drive of the actuator (3) impacts the plunger (31) against the supporting region to unblock the fluid passage.

[Claim 8]

The arrangement according to one of claims 1 to 7, characterized in that the support element (4) has at least one intended breaking site, intended breaking line (44, 45) or suchlike.

[Claim 9]

The arrangement according to claim 6 and claim 8, characterized in that the supporting region (42) has the intended breaking site, intended breaking line (44, 45, 47) or suchlike or one or more of the intended breaking sites, intended breaking lines or suchlike.

[Claim 10]

The arrangement according to claim 3, characterized in that the support element (4) has slits (46), in particular in the supporting region (42).