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(54) **VENTILATION ELEMENT WITH SEALS**

(57) Ventilation element (1) comprising a body (2) and one or more damper blades (4) which are arranged rotatably in the body passage (3), wherein one or more of these damper blades (4) each comprises a base part and at least one intumescent seal (9), wherein each base part of a said damper blade (4) comprises at least one groove (5) in which the respective intumescent seal (9) at least partially extends, wherein the thickness of each said groove (5) is at least three times smaller than the height of the groove (5).

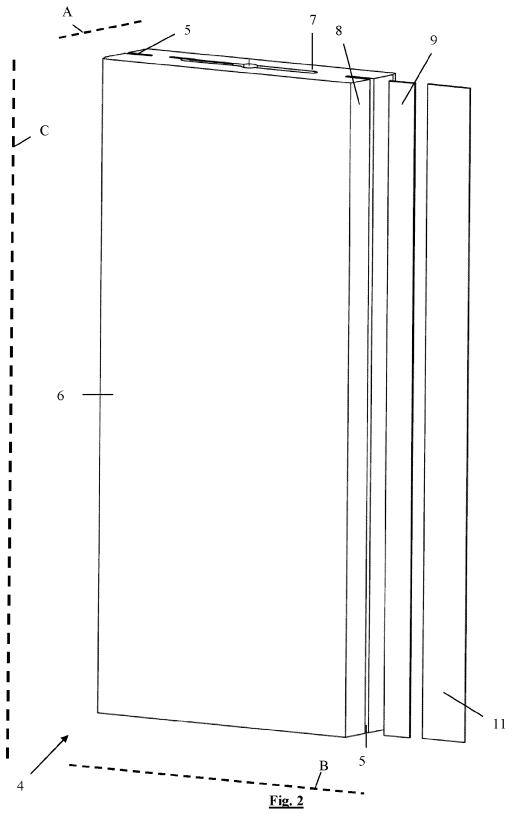

Fig. 2

EP 3 916 316 A1

Description

[0001] The invention concerns a ventilation element comprising a body which surrounds a body passage extending in a first direction, and comprising one or more damper blades which are arranged rotatably in the body passage and are rotatable between an open state allowing ventilation through the body passage and a closed state preventing ventilation through the body passage, wherein said one or more damper blades each comprise a base part made of a fire-resistant and heat-insulating material, wherein the base part comprises two visible surfaces arranged opposite one another in the thickness direction and one or more sealing surfaces which connect the visible surfaces together, wherein in the closed state the one or more damper blades divide the passage opening, viewed in the first direction, into two successive parts in order to thus prevent ventilation between these parts, wherein for this in the closed state the thickness direction of each base part extends approximately in the first direction, and each said sealing surface approximately adjoins the body or a respective sealing surface of a successive damper blade, and a said damper blade comprises at least one intumescent seal, wherein the base part of said damper blade comprises at least one groove in which the intumescent seal at least partially extends, and said groove opens into a said sealing surface, and viewed in the thickness direction is surrounded by the material of the base part and has a specific thickness, and viewed in a cross-section perpendicular to the thickness direction and at the height of the groove, has a specific height to the sealing surface viewed in a height direction which extends perpendicularly to the thickness direction, and has a specific length viewed along the sealing surface.

[0002] Such a ventilation element serves to allow ventilation through a wall. The wall may for example be a vertical wall, a ceiling or a floor. The ventilation element is arranged in a passage of the wall and comprises a body with a body passage through which ventilation is possible. The one or more damper blades may also be described as one or more louvres, depending on the form of the body and/or the damper blades. The ventilation elements may for example be fire dampers with one or more damper blades/louvres which are provided to close the body passage immediately in the case of fire. The ventilation elements may also be smoke extraction dampers with one or more damper blades/louvres which are provided to ensure suitable smoke extraction in the event of fire. The body may for example be tubular with a circular cross-section, wherein then for example one damper blade is present with a circular cross-section. The body may also have a rectangular cross-section, wherein then for example one or more louvre-like damper blades are present. The damper blades may for example have the form of a bar or slat. In the case of several damper blades, these are preferably arranged so as to be rotatable simultaneously between two extreme states, being an open state in which the possible ventilation through the body passage is maximal and a closed state in which ventilation through the passage body is prevented, such that almost no ventilation is possible through the body passage. Preferably, states are possible between these two extreme states in order thus to control the quantity of ventilation. In order to ensure a good seal in the closed state and in the case of fire, it is important that the damper blades lie tightly against the body and/or against successive damper blades. The ventilation element comprises for this one or more intumescent seals which are arranged in respectively one or more grooves. In the event of fire, these intumescent seals will fill the spaces between the body and the damper blades and also the spaces between successive damper blades, so that the propagation of fire through the one or more damper blades is prevented for a specific time.

[0003] The body of this ventilation element is for example mainly made of a fire-resistant and preferably heat-insulating material, such as gypsum, calcium silicate etc. Thus the body may be formed from gypsum panels and/or calcium silicate panels. The body may also be made substantially from a metal. The base parts of the one or more damper blades are made from a fire-resistant and heat-insulating material such as gypsum, calcium silicate etc. Thus the base parts may be made from gypsum panels and/or calcium silicate panels. It is easy to produce and/or provide the necessary grooves in the desired sealing surfaces in said panels.

[0004] In the event of fire, it is important that the body passage can be completely closed in order to prevent fire propagation from the time that this is desired. In the case of fire dampers, this is immediately on the occurrence of fire; for smoke extraction dampers, this is when no more smoke extraction is required. The invention relates specifically to smoke extraction dampers of the manual activation type (MA). With this type of smoke extraction damper, during a fire the one or more damper blades may continue to be turned for a specific time period by issue of a manual command for bringing the one or more damper blades to the open state or closed state. This ensures that during a fire, the firefighters may provide suitable smoke extraction.

[0005] During a fire, the intumescent seals, being the seals comprising intumescent material, will expand. In the existing ventilation elements, the intumescent material will react very quickly and hence expand very quickly. For fire dampers - certainly if prior to the occurrence of the fire, the one or more damper blades are approximately in the closed state - this is usually positive, since in the event of fire, the damper blades will move very quickly to the closed state and the intumescent material will very quickly fill the clear space between successive damper blades and between the damper blades and the body. However, if the one or more damper blades of the damper are in the open state, or in the case of smoke extraction dampers, the very quick reaction of the intumescent material may cause problems. Thus the intumescent mate-

rial may already be partially expanded before reaching the closed state of the one or more damper blades, so that the seal in the closed state is not as good. In the case of smoke extraction dampers of the manual activation type, it is important that during the fire, the one or more damper blades can still be turned for a specific time period in order to extract smoke. This time period is for example 25 minutes. If for example the damper blades are rotated to the open state after 10 minutes in order to extract smoke from the room, it may be desirable after e.g. 5 minutes of smoke extraction to return the damper blades to the closed state. The problem with the existing smoke extraction dampers is that the intumescent material reacts very quickly and hence expands very quickly, so that after rotating the damper blades back to the closed state when no further smoke extraction is required, the intumescent material has already reacted. As a consequence, the damping blades can no longer properly close the ventilation passage in the closed state because there is no more reactive intumescent material present to fill the spaces between successive damper blades and/or between damper blades and the body.

[0006] It is then an object of the invention to produce such ventilation elements in which the intumescent seals can react for a longer period during a fire.

[0007] This object is achieved by providing a ventilation element as presented in the first paragraph of this description, wherein the thickness of a said groove is at least three times smaller than the height of said groove. Preferably, each said damper blade comprises at least one intumescent seal, wherein each base part of the damper blades comprises at least one said groove in which the respective intumescent seal at least partially extends. In an alternative embodiment, if there are at least two damper blades, the damper blades alternately comprise a said intumescent seal which at least partially extends in a said groove of the base part.

[0008] The intumescent seal comprises intumescent materials such as graphite or sodium silicate. Thus the intumescent seal may be a strip of intumescent material. In the event of fire, these intumescent seals will react under the influence of heat and hence expand. Said one or more intumescent seals are here arranged in said respective grooves. These are always narrow grooves with a specific depth (height), wherein the depth is at least three times as large as the thickness. The intumescent seals, at the level of the grooves, are also surrounded by the base part viewed in the thickness direction. Since each base part is made of a heat-insulating and fire-resistant material, this means that the intumescent seals are at least partially protected from the heat which occurs during a fire. Said grooves here also form insulated grooves and may be described as "insulated grooves". The base part may also comprise additional groove-shaped recesses, wherein said recesses cannot be regarded as narrow and deep grooves. Because of the insulating effect of the base part, the intumescent material, which is at least partially present in said insulated grooves, will be able to react for a longer period and hence expand for a longer period. In the case of smoke extraction dampers of the manual activation type, this means that if a suitable smoke extraction is desired during a fire, a certain period is available after occurrence of the fire for turning the damper blades to the open state and thus providing suitable smoke extraction, and then thereafter moving the one or more damper blades back to the closed state while the intumescent seals are still able to provide the necessary sealing effect. This is because the intumescent seals can react for a specific time period. During said period, therefore a command may be given to rotate the one or more damper blades between the open state and the closed state. Thus it may be provided that, by the choice of intumescent material and dimensions of the groove, the intumescent material will be gradually heated in the case of a fire such that the intumescent material can react for at least 5 minutes, preferably at least 10 minutes, more preferably at least 15 minutes. It may even be provided that the intumescent material reacts for 25 minutes, and/or does not react immediately in the event of fire. This means that for example after 25 minutes, the intumescent material has not yet fully reacted. If, within 25 minutes after the start of the fire, it is then decided that the one or more damper blades should be rotated to the closed state, intumescent material which is able to swell is still present. Spaces between successive damper blades and/or between a damper blade and the body will then be sufficiently closed to prevent fire propagation through the ventilation element. Thus the groove may have a thickness of approximately 3 mm and a height of approximately 20 mm, while the thickness of the base part is between 30 mm and 40 mm.

[0009] The intumescent seal may extend completely in the respective groove, and here completely or only partially fill the groove, for example viewed in the height direction. Thus the intumescent seal, viewed in the height direction, may only fill half or three-quarters of the groove, and mainly in the part which is furthest away from the respective sealing surface. The intumescent seal may also extend partially past the respective sealing surface, viewed in the height direction.

[0010] In the case of ventilation elements with a circular body passage, for example one damper blade is provided, having a base part with a circular cross-section perpendicularly to the thickness direction and a diameter which is slightly smaller than the diameter of the body passage. The base part then for example has two said visible surfaces and one said sealing surface which connects the two visible surfaces together. The height direction of the base part then corresponds to a direction along the diameter, and the length of the groove then extends along the circumference of the base part. Preferably, the groove then extends over approximately the complete circumference with the exception of the location where the physical rotational axis extends.

[0011] In the case of ventilation elements with a bar-

shaped body passage, for example one or more louvre-like damper blades are present which extend next to or above one another. The bar-shaped body passage then extends in a length direction corresponding to the first direction, a height direction and a width direction. If several damper blades are present, these extend successively in the height direction or width direction of the body passage, wherein then in the closed state, the height direction of the base parts extends respectively in the height direction or width direction of the body passage, and the length direction of the base parts extends respectively in the width direction or height direction of the body passage. If the base parts are approximately bar-shaped, the visible surfaces extend parallel to one another, and in the closed state extend approximately perpendicularly to the first direction. If several damper blades are present, then in closed state the respective visible surfaces of the base parts preferably extend in two planes which are situated at a distance from one another in the thickness direction.

[0012] In this patent application, the phrase "extends approximately perpendicularly to a direction or plane" means that the angle is preferably between 70° and 90°, more preferably between 80° and 90°, and most preferably between 85° and 90°. The phrase "extends approximately parallel to a direction or a plane" in this application means that the angle is preferably between 0° and 20°, more preferably between 0° and 10°, and most preferably between 0° and 5°.

[0013] The height of the groove may be constant over the complete thickness direction, but may also have two dimensions, a maximum and minimum dimension. The latter is the case for example if the sealing surface in which the groove opens does not extend in the thickness direction in the closed state at the level of the groove. This is the case for example for base parts with sealing surfaces which are chamfered, curved, stepped etc. The dimensions of the groove are then preferably such that the maximum thickness of the groove is at least three times smaller than the minimum height of the groove. Viewed in all cross-sections extending perpendicularly to the thickness direction at the level of the groove, the maximum thickness of the groove is then at least three times smaller than the height of the groove.

[0014] If a base part comprises several sealing surfaces, several recesses may be provided which each open in a said sealing surface, wherein for example a said recess opens in each sealing surface, or wherein for example recesses only open in certain sealing surfaces. Some of these recesses may then be insulated grooves, wherein an intumescent seal is arranged in each of these grooves. However, it is also possible that each said base part comprises only one insulated groove, or certain base parts comprise no insulated grooves.

[0015] Preferably, the dimension of the thickness of the groove is between 0.05 and 0.3 times the dimension of the thickness of the base part, more preferably between 0.05 and 0.1 times the dimension of the thickness of the base part. Thus sufficient fire-resistant and heat-insulating material is present to insulate said intumescent seal from heat for a specific time during a fire.

[0016] Preferably, the parts of the base part which are situated on either side of said groove, viewed in the thickness direction, have a thickness which is at least three times the thickness of the groove. A groove divides the base part into two parts/pieces viewed in the thickness direction, wherein these two parts are then situated on either side of the groove viewed in the thickness direction. Here, the thickness of the two parts is sufficiently great to ensure good heat insulation in the case of fire on both sides of the groove viewed in thickness direction, whereby the intumescent seal does not react immediately and/or reacts for a sufficiently long time.

[0017] Also preferably, on either side of the groove viewed in the thickness direction, there is present at least 10 mm of fire-resistant and heat-insulating material of the base part.

[0018] Further preferably, the maximum thickness of the groove is at least three times smaller than the height of the groove. Even more preferably, the maximum thickness of the groove is at least five times smaller than the height of the groove.

[0019] In a preferred embodiment, the ventilation element comprises a cold seal, wherein the cold seal and a respective intumescent seal extend together in a said groove. Cold seals are useful if there is no fire. If there is no fire and if ventilation through the body passage is not desired, the one or more damper blades are moved to the closed state. Using cold seals, in the closed state, ventilation between successive damper blades and/or between a damper blade and the body can be prevented. For this, a said cold seal preferably extends past its respective sealing surface viewed in the height direction, such that the cold seal can make contact with the body or with an adjacent damper blade in order thus to prevent ventilation between the body and the damper blade or between two successive damper blades. The cold seals may for example comprise rubber. By providing a cold seal and an intumescent seal in a said groove, ventilation through the body passage in the closed state is securely prevented both when there is no fire and in the case of fire. By arranging the cold seal in the groove, the cold seal may be attached to the base part in a simple fashion without a loss of stiffness of the base part. A said base part may also comprise a groove-like recess in which only a cold seal is arranged. A cold seal may also be attached to the base part such that it does not extend in a groove of the base part. Said damper blades here comprise a base part, at least one intumescent seal and at least one cold seal.

[0020] In an alternative embodiment, when there are at least two damper blades, the damper blades alternately comprise a damper blade with a said intumescent seal, wherein each base part of this damper blade contains at least one said groove in which the intumescent seal at least partially extends, and a successive damper blade

with a cold seal. This cold seal may extend in a recess of the base part but may also be attached to the base part. The recess may be structured similarly to a said insulated groove. The damper blades comprise for example alternately a damper blade with two insulated grooves which extend opposite one another and wherein a said intumescent seal is arranged in both insulated grooves, and a damper blade with two cold seals which extend opposite one another such that, in the case of two successive damper blades, an intumescent seal of the one damper blade extends opposite a cold seal of the other damper blade in the closed state.

[0021] Further preferably, in a said groove in which both a said cold seal and a said intumescent seal are situated, the cold seal and the intumescent seal extend one behind the other in the groove viewed in the thickness direction. The cold seal and the intumescent seal then extend next to each other, preferably over the complete length of the groove. Thus a strip of intumescent material may be provided for the intumescent seal, and a strip of rubber or similar for the cold seal. In an alternative embodiment, the intumescent seal may be worked into the cold seal. Thus the intumescent seal may for example extend in a cavity of the cold seal.

[0022] Also further preferably, at least the cold seal extends past the sealing surface viewed in the height direction. Thus the cold seal may be able to make contact with a successive damper blade or the body in the closed state, to ensure a good seal and hence securely prevent ventilation through the passage body.

[0023] In a highly preferred embodiment, viewed in a cross-section extending in the thickness direction and the height direction, a said groove has the form of a quadrangle with a first pair of mutually opposite sides and a second pair of mutually opposite sides, wherein the first pair of sides extends approximately perpendicularly to the thickness direction, and at least the side of the second pair of sides which extends furthest from the sealing surface extends approximately in the thickness direction. This also concerns a bar-shaped groove. If the sealing surface in which the groove opens extends in the thickness direction, at least at the level of the groove, the groove has a rectangular form. If the sealing surface is chamfered, curved, stepped with respect to the thickness direction at the level of the groove, the groove for example has the form of a quadrangle with a first pair of mutually parallel sides and a second pair of mutually parallel sides, wherein the one side of the second pair extends perpendicularly to the first pair of mutually opposite sides, and the other side of the second pair makes an angle with the first pair of sides. It is simple to make such a groove in the base part, for example via milling. In addition, it is also easy to arrange an intumescent seal, and where applicable a said cold seal where present, in such a groove. The one or more seals may for example be riveted into the groove, or the one or more seals may be provided with an undercut or similar so that once these are arranged in the groove, they cannot easily become detached.

[0024] In a specific embodiment, the body passage is bar-shaped, wherein the one or more damper blades are arranged rotatably around one or more rotational axes which extend approximately perpendicularly to the first direction and parallel to one another, wherein each base part has an approximately hexagonal form with three pairs of two mutually opposite rectangular outer surfaces, being respectively the visible surfaces which extend approximately perpendicularly to the thickness direction, and a first and a second pair of said sealing surfaces, wherein each rotational axis extends through the respective base part and extends approximately perpendicularly to the first pair of sealing surfaces, wherein the height direction of each base part and a said groove extends approximately parallel to the first pair of sealing surfaces, and wherein the length direction of the base part and a said groove extends approximately perpendicularly to the first pair of sealing surfaces. In such a body passage, one rotatable damper blade may be provided which is designed to close the complete body passage in the closed state, or several damper blades which are arranged above or next to one another and designed to jointly close the complete body passage in the closed state. The body may comprise four wall surfaces adjoining one another, which together enclose the bar-shaped body passage, wherein these four wall surfaces for this comprise two pairs of two mutually opposite wall surfaces extending at a distance from one another, being two rotational wall surfaces which extend approximately parallel to one another, and two sealing wall surfaces. The first pair of sealing surfaces of the base parts then approximately adjoins the respective rotational wall surfaces, while in the case of one damper blade, the second pair of sealing surfaces approximately adjoins the sealing wall surfaces of the body in the closed state. If there are two or more damper blades, the two outermost sealing surfaces of said second pair of sealing surfaces approximately adjoin the sealing wall surfaces of the body, while the other sealing surfaces successively adjoin one another in pairs. At the height of the second pair of sealing surfaces of the base parts, the form may deviate from a hexagon so as to keep the distance between two successive base parts in the closed state, or between a base part and the body, as small as possible. Thus the sealing surfaces may be designed partially or fully chamfered and/or curving and/or stepped. At the height of the one or more damper blades, the body is then for example designed correspondingly, for example by providing a notch in the body which serves as a stop, and/or attaching a corresponding stop element to the body, so that the distance between the body and a following base part is as small as possible.

[0025] Further preferably, a said groove extends approximately centrally in the respective base part viewed in the thickness direction. The term "extends centrally" means that, viewed in the thickness direction, the groove extends substantially in the central part of the base part

which is situated between 0.3 times the dimension of the base part and 0.7 times the dimension of the base part, viewed in the thickness direction. This means that on either side of the groove, fire-resistant and heat-insulating material is present with a substantial thickness, so that the intumescent seal present in the groove is safely protected from the heat which occurs in a fire. Even more preferably, the groove extends completely in the part of the base part which lies between 0.3 times the dimension of the base part and 0.7 times the dimension of the base part, viewed in the thickness direction, and most preferably in the part of the base part which is situated between 0.4 times the dimension of the base part and 0.6 times the dimension of the base part, viewed in the thickness direction.

[0026] Also preferably, in said specific embodiment, the ventilation element comprises at least two damper blades, wherein in the closed state, sealing surfaces of the second pair of sealing surfaces of successive base parts approximately adjoin one another, wherein the base parts at the level of the approximately mutually adjoining sealing surfaces each comprise a said groove which opens in the respective sealing surface. An insulated groove opens in the sealing surface in each of the two mutually adjoining sealing surfaces of two successive base parts in the closed state. An intumescent seal is arranged in both insulated grooves. This means that an intumescent seal is present at both said sealing surfaces, whereby a very good seal can be ensured between these sealing surfaces in the closed state in the case of fire.

[0027] Furthermore, even more preferably, a said intumescent seal and a cold seal are arranged in the grooves which open in the respective approximately mutually adjoining sealing surfaces, wherein each cold seal extends past the groove viewed in the height direction. In this way, if there is no fire, a good seal between the successive damper blades can be ensured in the closed state. Said cold seals in the closed state may bear on one another or be situated at a distance from one another viewed in the first direction.

[0028] Also even more preferably, viewed in the height direction, the grooves which open in the respective approximately mutually adjoining sealing surfaces extend in one another's length in the closed state. In an alternative embodiment, said two grooves are shifted away from one another viewed in the thickness direction.

[0029] Preferably, in said specific embodiment, the sealing surfaces of the second pair of sealing surfaces are designed chamfered, curved and/or stepped with respect to the thickness direction. In this way, the rotation of the one or more damper blades may take place smoothly, while the distance between the base parts of two successive damper blades, or between a damper blade adjoining the body, in the closed state, may be kept sufficiently small. The form of the base parts may here again deviate slightly locally from the hexagonal form at the second pair of sealing surfaces.

[0030] Also preferably, in said specific embodiment, each base part comprises two said grooves which open respectively in the sealing surfaces of the second pair of said sealing surfaces. Here, each damper blades may be designed identically. In addition, it is not necessary to provide seals at the level of the body. However, seals may indeed be provided at the body. Further preferably, the same seals, namely a said intumescent seal and a said cold seal, are arranged in all said grooves. Here both types of seal are then present, whereby in normal use - but also in the case of fire - a good seal is always ensured in the closed state and thus ventilation through the body passage can be securely prevented. The damper blade may also be designed as described above in a ventilation element with only one damper blade.

[0031] Preferably, each groove extends over almost the complete length of its respective sealing surface. Said seals then also preferably extend over the complete length of the groove, so that ventilation is securely prevented in the closed state and in the event of fire.

[0032] The ventilation element is for example a smoke extraction damper or a fire damper which forms part of a ventilation system. Using such ventilation elements, the desired ventilation can be safely provided while the desired smoke extraction or desired seal is ensured in the case of fire.

[0033] The invention is now explained in more detail with reference to the following detailed description of a preferred embodiment of a ventilation element according to this invention. The aim of this description is exclusively to give clarifying examples and indicate further advantages and features, and it may thus in no way be interpreted as a restriction of the area of application of the invention or of the patent rights claimed in the claims.

[0034] In this detailed description, by means of reference numerals, reference is made to the appended drawings in which:

- figure 1 is a perspective illustration of a ventilation element according to a first embodiment of the invention, wherein said ventilation element comprises several damper blades, and these damper blades are in an open state in order to allow ventilation;
- figure 2 is an open, perspective view of a damper blade of the ventilation element shown in figure 1, wherein the seals are not shown for one groove;
- figure 3 is a detail illustration of the ventilation element shown in figure 1, in the closed state and at the level of two mutually adjacent damper blades;
- figure 4 is a detail illustration of a ventilation element according to a second embodiment of the invention, in the closed state and at the level of two mutually adjacent damper blades;
- figure 5 is a detail illustration of a ventilation element according to a third embodiment of the invention, in the closed state and at the level of two mutually adjacent damper blades;
- figure 6 is a detail illustration of a ventilation element

according to a fourth embodiment of the invention, in the closed state and at the level of two mutually adjacent damper blades.

[0035] The fire-resistant ventilation element (1) according to the invention, which is shown in figure 1, is a smoke extraction damper (1) of the manual activation type, which forms part of a ventilation system. By means of this ventilation element (1), the appropriate smoke extraction can be provided in the event of fire. This ventilation element (1) comprises a body (2) structured from four mutually adjoining panels. These panels are gypsum panels or calcium silicate panels. These panels form four mutually adjoining, inwardly directed wall surfaces which together enclose an approximately bar-shaped body passage (3). This body passage (3) extends in a first direction (A). These wall surfaces comprise a first pair and a second pair of two approximately mutually parallel wall surfaces extending at a distance from one another, being respectively two rotational wall surfaces which extend vertically in figure 1, and two sealing wall surfaces which extend horizontally in figure 1. The sealing wall surfaces each comprise a local recess which serves as a stop for damper blades (4) of the ventilation element (1).

[0036] The ventilation element (1) comprises four damper blades (4) which are each arranged rotatably about a rotational axis. These four damper blades (4) are rotatable simultaneously between two extreme states, namely an open state in which the possible ventilation through the body passage (3) is maximal, and a closed state in which the damper blades (4) close the body passage (3) and thus almost completely prevent ventilation through the body passage (3). The rotational axes extend parallel to one another and each approximately perpendicularly to the rotational wall surfaces and perpendicularly to the first direction (A).

[0037] The ventilation element (1) furthermore comprises a control system and drive elements for rotating the damper blades (4). The control system and some of the drive elements are arranged next to the body passage (3) (see figure 1).

[0038] The damper blades (4) each comprise a bar-shaped base part with three pairs of mutually parallel rectangular surfaces (6, 7, 8) directed towards the outside, being respectively a first pair of sealing surfaces (7), a second pair of sealing surfaces (8), and two visible surfaces (6), wherein the respective rotational axis extends approximately perpendicularly to the first pair of sealing surfaces (7) and passes through the base part. Each base part extends in a thickness direction (A) which extends perpendicularly to the two visible surfaces (6), wherein said thickness direction (A) in closed state corresponds approximately to the first direction (A). Each base part furthermore extends in a length direction (C) which extends along the rotational axis, and in a height direction (B) which extends perpendicularly to the thickness direction (A), and in the length direction (C).

[0039] The base part is made from a fire-resistant and heat-insulating material. The base part may be made for example from a gypsum panel or a calcium silicate panel. Each first pair of sealing surfaces (7) extends parallel to the rotational wall surfaces and approximately adjoins these rotational wall surfaces. The sealing surfaces (7) of the first pair of sealing surfaces (7) may for example each be provided with a sealing element, made for example from high-temperature fibres, wherein each sealing element forms an outer surface of the damper blade (4) which is designed to move along a respective rotational wall surface. Said sealing element ensures a good seal between the body (2) and the first pair of sealing surfaces (7). The rotational wall surfaces may be provided with a cladding material such as aluminium film, in order to prevent wear on the sealing elements as a result of rotation. The sealing surfaces (8) of the second pair of sealing surfaces (8) of each base part are designed to adjoin, in the closed state, respectively a said sealing wall surface or a sealing surface (8) of the second pair of sealing surfaces (8) of a successive damper blade (4). In the closed state, the space between the base parts of successive damper blades (4), and between the base parts of the outermost damper blades (4) and the respective sealing wall surfaces of the body (2), is small so that said damper blades (4) are able to securely prevent ventilation in the closed state.

[0040] The base parts each comprise two grooves (5), wherein said grooves (5) open into the respective sealing services (8) of the second pair of sealing surfaces (8). These grooves (5) are bar-shaped with a specific thickness viewed in the thickness direction (A), a specific height viewed in the height direction (B), and a specific length viewed in the length direction (C). The length of each groove (5) corresponds to the length of the base part, so that each groove (5) extends over the complete length of the base part. The minimum height of each groove (5) is at least five times greater than the thickness of the groove (5). The grooves (5) are then also narrow grooves (5) with a specific depth (height), and may then also be described as insulated grooves (5). The thickness of the grooves (5) is at most 15% of the total thickness of the base part. In addition, on either side of each groove (5) viewed in the thickness direction (A), part of the base part is present which has a thickness of at least 30% of the total thickness of the base part. In this way, sufficient heat-insulating and fire-resistant material is present on either side of each groove (5), and each groove (5) is safely protected from heat during a fire. Each damper blade (4) contains an intumescent seal (9) for each groove (5), being a strip of intumescent material with a length which corresponds to the length of the groove (5) and a thickness of approximately two-thirds of the thickness of the groove (5), and also a cold seal (11), being for example a rubber strip with a length which corresponds to the length of the groove (5) and a thickness of approximately one-third of the thickness of the groove (5). The thicknesses of said seals (9, 11) may also be different, wherein the important factor is that the sum of

the thicknesses of the two said seals (9, 11) corresponds approximately to the thickness of said groove (5). In figure 2, the total thickness of the base part is for example +/- 40 mm, and the thickness of each groove (5) is +/- 3 mm, the thickness of the intumescent seal (9) is +/- 2 mm and the thickness of the cold seal (11) is +/- 1 mm.

[0041] Figures 1, 2 and 3 show a first embodiment. The remaining figures each show a different embodiment. The difference in these embodiments lies in the finish of the second pair of sealing surfaces (8), the location of the grooves (5) and the intumescent seals (9) used. In all embodiments, the cold seals (11) extend past their respective sealing surfaces (8) viewed in the height direction (B), so that in closed state they can make contact with a successive damper blade (4) or a respective sealing wall surface. This ensures a good seal in closed state and if there is no fire. In figures 3 to 6, in each case two successive damper blades (4) are partly visible, and in the middle, the figure shows how two successive damper blades (4) adjoin one another in closed state and in a situation in which there is no fire.

[0042] In the first embodiment, the sealing surfaces (8) of the second pair of sealing surfaces (8) are chamfered with respect to the thickness direction (A). This chamfer allows the damper blades (4) to be arrangeable at a specific distance from one another and rotatable, so that in closed state the distance between two sealing surfaces (8) of two successive damper blades (4) is limited. The grooves (5) here always extend centrally and approximately in the middle of the base parts viewed in the thickness direction (A). In the closed state, all grooves (5) lie in one another's length viewed in the height direction (B). In closed state and when there is no fire, the cold seals (11) at successive damper blades (4) always make contact with the base part of the successive damper blade (4). This is clearly visible in figure 3. There is then also a good seal between successive damper blades (4). In the case of fire, the cold seals (11) will degrade and the intumescent seals (9) take over the sealing task. In view of the limited distance between two successive sealing surfaces (8) of two successive damper blades (4), this distance can easily be bridged by the intumescent material of the intumescent seals (9), which expands in a fire. The intumescent seals (9) here extend over the complete height of the grooves (5). The base parts safely protect the intumescent seals (9) from heat during a fire, whereby these intumescent seals (9) can react and thus expand for a relatively long time. This is ideal for smoke extraction dampers (1) of the manual activation type.

[0043] In the second embodiment shown in figure 4, the chamfer of the second pair of sealing surfaces (8) is similar to that of the first embodiment. The grooves (5) here do not extend in the middle of the base parts viewed in the thickness direction (A). In the closed state, the mutually opposite grooves (5) of successive damper blades (4) are situated at a distance from one another viewed in the first direction (A). As visible in figure (4), the cold seals (11) touch one another in the closed state. Here too, the intumescent seals (9) extend over the complete height of the grooves (5).

[0044] In the third embodiment shown in figure 5, the chamfer of the second pair of sealing surfaces (8) is similar to that of the first embodiment. The grooves (5) here do not extend in the middle of the base part viewed in the thickness direction (A). In the closed state, the mutually opposite grooves (5) of successive damper blades (4) are situated at a distance from one another viewed in the first direction (A). As visible in figure (5), the cold seals (11) do not touch one another in the closed state. Here, the intumescent seals (9) extend over the complete height of the grooves (5) and also past the respective sealing surfaces (8) in the height direction (B), so that each intumescent seal (9), in closed state and when the intumescent seal (9) has not yet reacted, makes contact with the sealing surface (8) of the next damper blade (4).

[0045] In the fourth embodiment shown in figure 6, the sealing surfaces (8) of the second pair of sealing surfaces (8) are partially chamfered except at the level of the grooves (4), where each sealing surface (8) extends in the thickness direction (A) and in the length direction (C). The grooves (5) here do not extend in the middle of the base parts, viewed in the thickness direction (A). In the closed state, the mutually opposite grooves (5) of successive damper blades (4) are slightly shifted with respect to one another, viewed in the first direction (A). As visible in figure (6), the cold seals (11) touch one another in the closed state. Here too, the intumescent seals (9) extend over the complete height of the grooves (5). The grooves (5) here have a rectangular cross-section.

Claims

1. Ventilation element (1) comprising a body (2), which surrounds a body passage (3) extending in a first direction (A), and comprising one or more damper blades (4) which are arranged rotatably in the body passage (3) and are rotatable between an open state allowing ventilation through the body passage (3) and a closed state preventing ventilation through the body passage (3), wherein said one or more damper blades (4) each comprise a base part made of a fire-resistant and heat-insulating material, wherein the base part comprises two visible surfaces (6) arranged opposite one another in a thickness direction (A) and one or more sealing surfaces (7, 8) which connect the visible surfaces (6) together, wherein in the closed state the one or more damper blades (4) divide the passage opening (3), viewed in the first direction (A), into two successive parts in order to thus prevent ventilation between these parts, wherein for this in the closed state the thickness direction (A) of each base part extends approximately in the first direction (A), and each said sealing surface (7, 8) approximately adjoins the body (2) or a respective sealing surface (8) of a successive damper blade

(4), and a said damper blade (4) comprises at least one intumescent seal (9), wherein the base part of said damper blade (4) comprises at least one groove (5) in which the intumescent seal (9) at least partially extends, and said groove (5) opens into a said sealing surface (8) and viewed in the thickness direction (A) is surrounded by the material of the base part and has a specific thickness, and viewed in a cross-section perpendicular to the thickness direction (A) and at the height of the groove (5), has a specific height to the sealing surface (8) viewed in a height direction (B) extending perpendicularly to the thickness direction (A), and has a specific length viewed along the sealing surface (8), **characterized in that** the thickness of a said groove (5) is at least three times smaller than the height of said groove (5).

2. Ventilation element (1) according to claim 1, **characterized in that** the parts of the base part which are situated on either side of said groove (5) viewed in the thickness direction (A), have a thickness which is at least three times the thickness of the groove (5).

3. Ventilation element (1) according to claim 1 or 2, **characterized in that** the maximum thickness of the groove (5) is at least five times smaller than the height of the groove (5).

4. Ventilation element (1) according to any of the preceding claims, **characterized in that** the ventilation element (1) comprises a cold seal (11), wherein the cold seal (11) and a respective intumescent seal (9) extend together in a said groove (5).

5. Ventilation element (1) according to claim 4, **characterized in that** in a said groove (5) in which both a said cold seal (11) and a said intumescent seal (9) are situated, the cold seal (11) and the intumescent seal (9) extend one behind the other in the groove (5) viewed in the thickness direction (A).

6. Ventilation element (1) according to claim 4 or 5, **characterized in that** at least the cold seal (11) extends past the sealing surface (8) viewed in the height direction (B).

7. Ventilation element (1) according to any of the preceding claims, **characterized in that**, viewed in a cross-section extending in the thickness direction (A) and the height direction (B), a said groove (5) has the form of a quadrangle with a first pair of mutually opposite sides and a second pair of mutually opposite sides, wherein the first pair of sides extends approximately perpendicularly to the thickness direction (A), and at least the side of the second pair of sides which extends furthest from the sealing surface (8) extends approximately in the thickness direction (A).

8. Ventilation element (1) according to any of the preceding claims, **characterized in that** the body passage (3) is bar-shaped, wherein the one or more damper blades (4) are arranged rotatably around one or more rotational axes which extend approximately perpendicularly to the first direction (A) and parallel to one another, wherein each base part has an approximately hexagonal form with three pairs of two mutually opposite rectangular outer surfaces (6, 7, 8), being respectively the visible surfaces (6) which extend approximately perpendicularly to the thickness direction (A), and a first and a second pair of said sealing surfaces (7, 8), wherein each rotational axis extends through the respective base part and extends approximately perpendicularly to the first pair of sealing surfaces (7), wherein the height direction (B) of each base part and a said groove (5) extends approximately parallel to the first pair of sealing surfaces (7), and wherein the length direction (C) of the base part and a said groove (5) extends approximately perpendicularly to the first pair of sealing surfaces (7).

9. Ventilation element (1) according to claim 8, **characterized in that** said groove (5) extends approximately centrally in the respective base part viewed in the thickness direction (A).

10. Ventilation element (1) according to claim 8 or 9, **characterized in that** the ventilation element (1) comprises at least two damper blades (4), wherein in the closed state, sealing surfaces (8) of the second pair of sealing surfaces (8) of successive base parts approximately adjoin one another, wherein the base parts at the level of the approximately mutually adjoining sealing surfaces (8) each comprise a said groove (5) which opens in the respective sealing surface (8).

11. Ventilation element (1) according to claim 10, **characterized in that** a said intumescent seal (9) and a cold seal (11) are arranged in the grooves (5) which open in the respective approximately mutually adjoining sealing surfaces (8), wherein each cold seal (11) extends past the groove (5) viewed in the height direction (B).

12. Ventilation element (1) according to claim 10 or 11, **characterized in that** viewed in the height direction (B), the grooves (5) which open in the respective approximately mutually adjoining sealing surfaces (8) extend in one another's length in the closed state.

13. Ventilation element (1) according to any of claims 8 to 12, **characterized in that** the sealing surfaces (8) of the second pair of sealing surfaces (8) are designed chamfered, curved and/or stepped with respect to the thickness direction (A).

14. Ventilation element (1) according to any of claims 8 to 13, **characterized in that** each base part comprises two said grooves (5) which open respectively in the sealing surfaces (8) of the second pair of said sealing surfaces (8).

15. Ventilation element (1) according to any of claims 8 to 14, **characterized in that** each groove (5) extends over the complete length of its respective sealing surface (8).

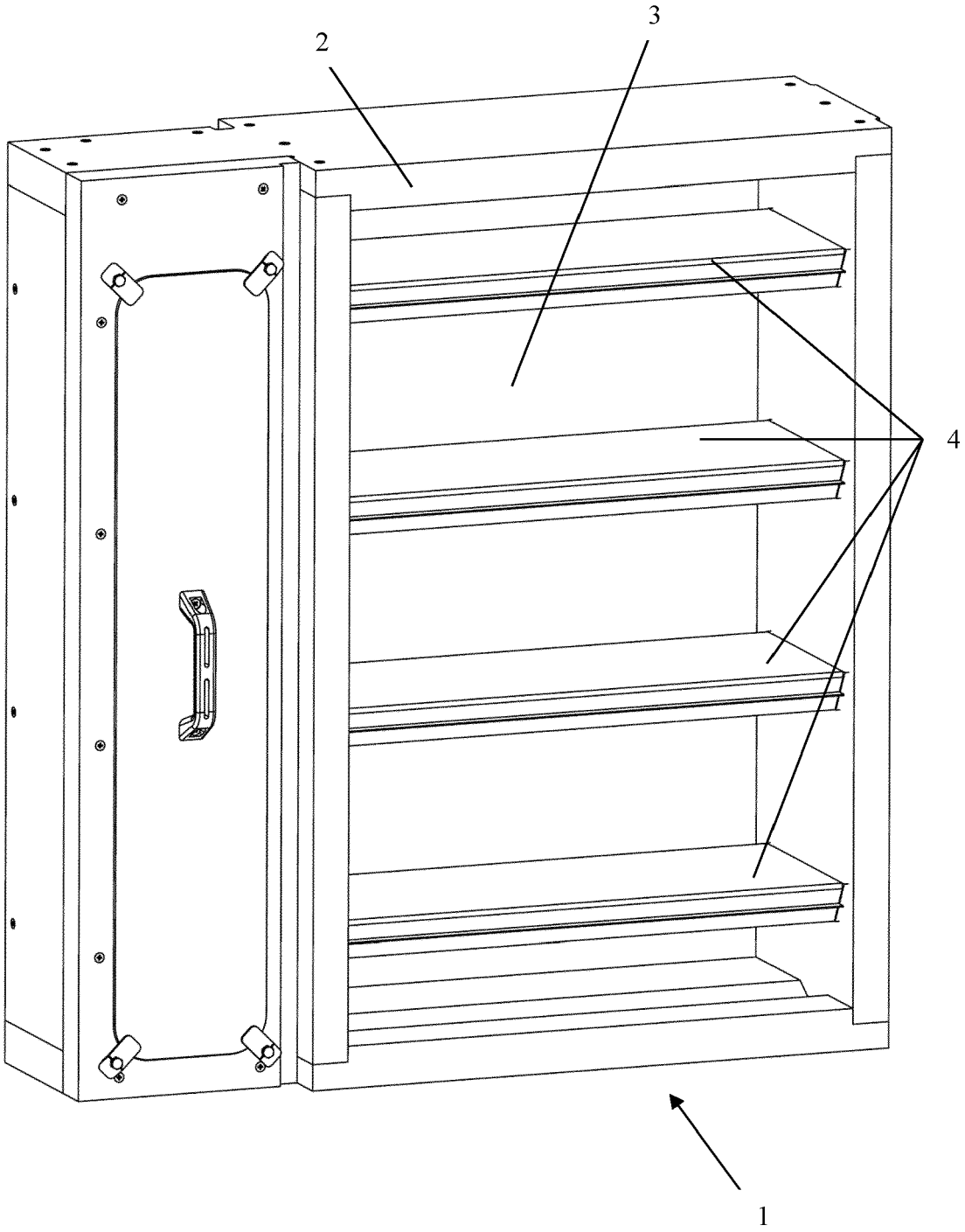

Fig. 1

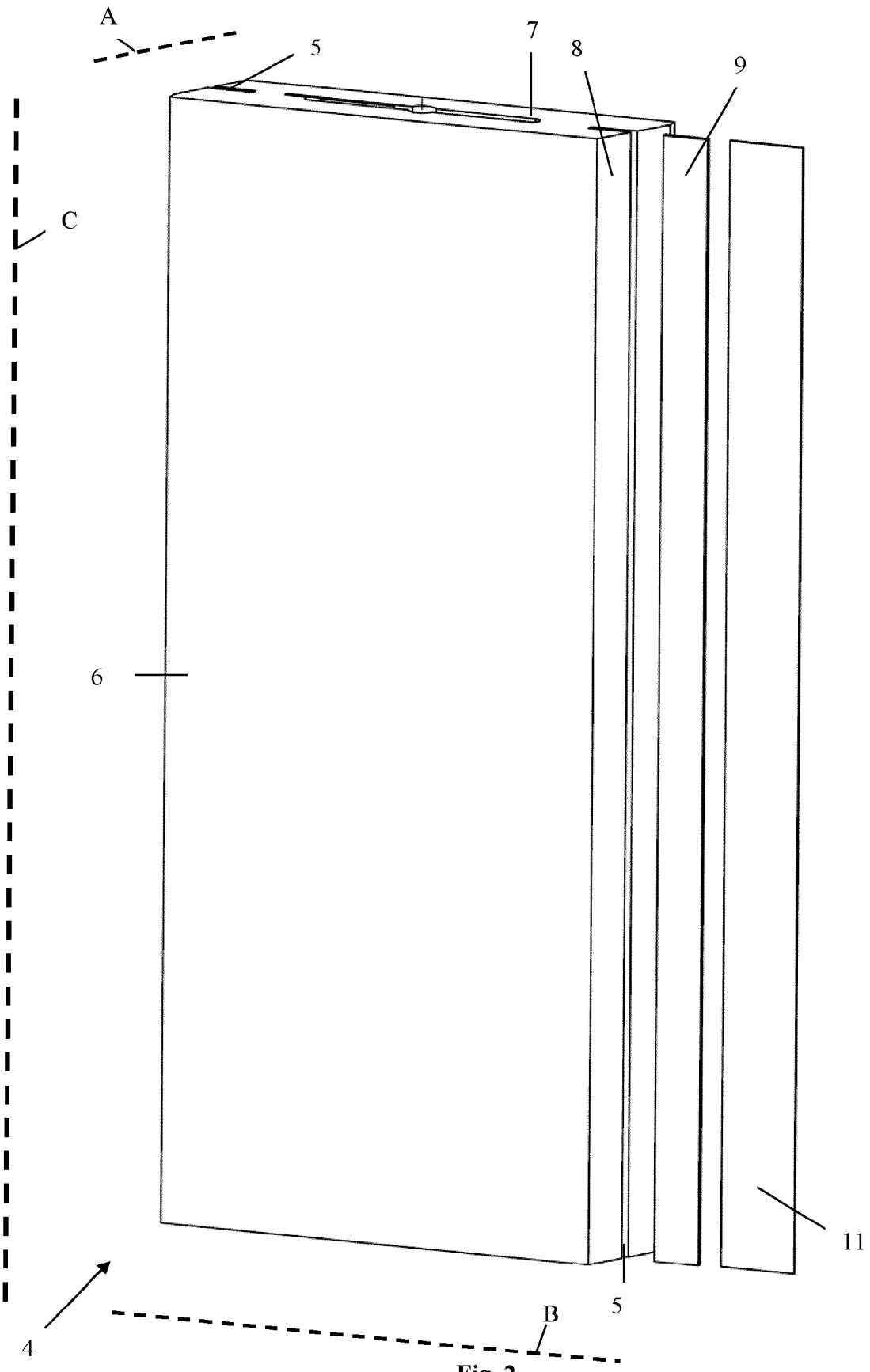

Fig. 2

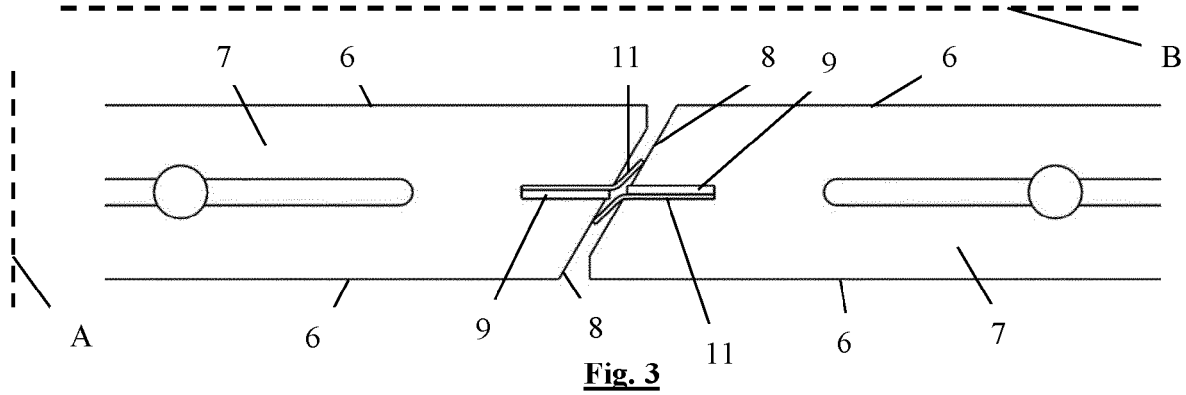

Fig. 3

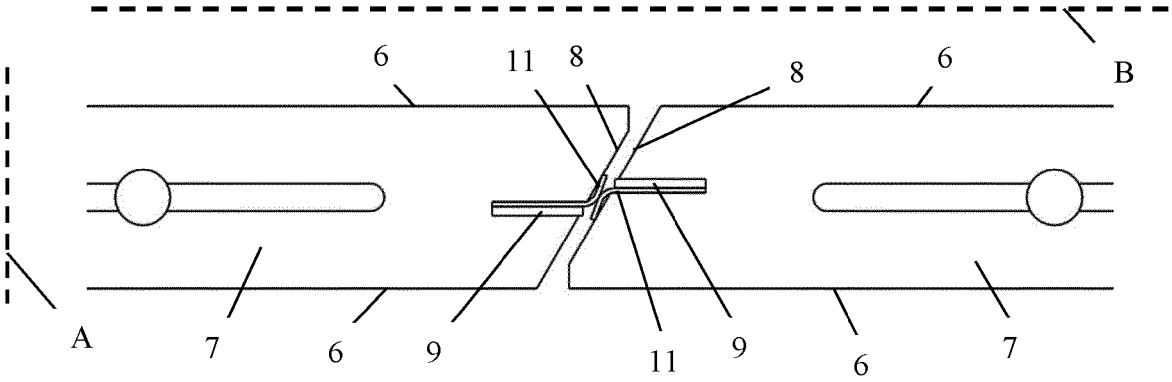

Fig. 4

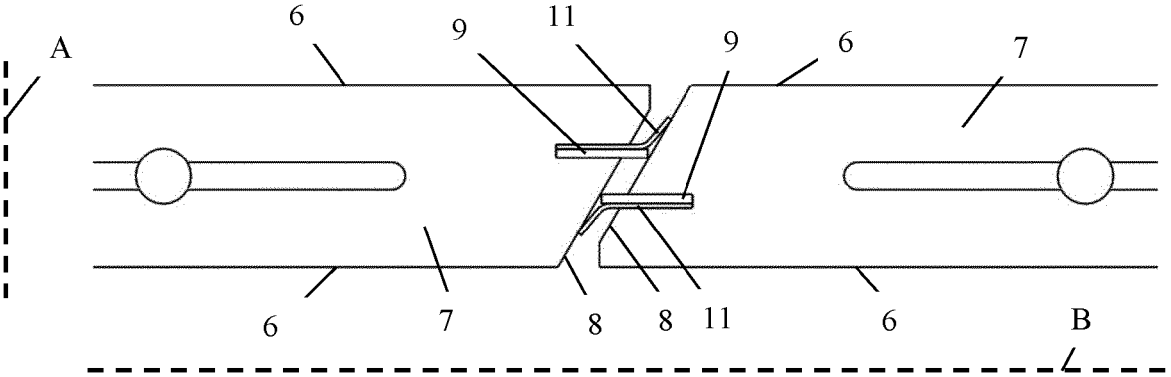

Fig. 5

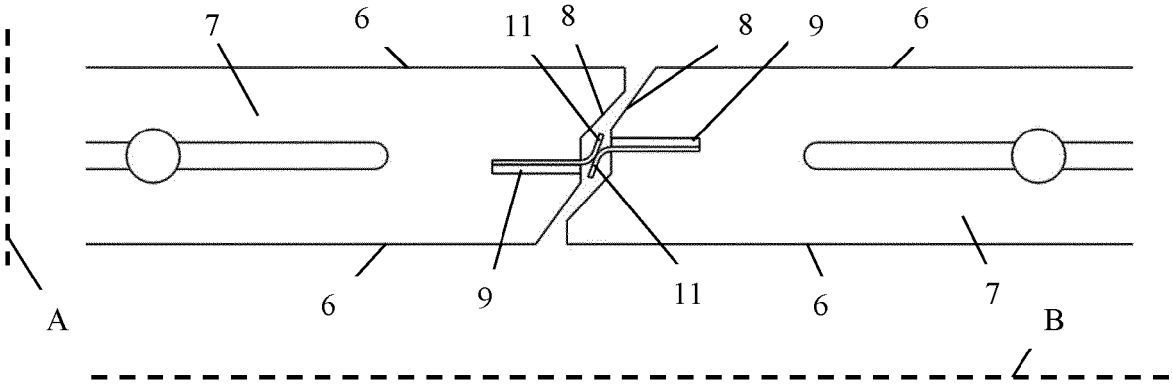

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 21 17 6634

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	3 October 2021	Mattias Grenbäck

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