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(54) **FIRE DAMPER ASSEMBLIES**

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Description

Field of the Invention

[0001] The present invention relates to fire damper assemblies. Such assemblies may be placed in a duct and have an open position allowing fluid flow through the duct and a closed position for inhibiting the fluid flow and the transmission of heat along the duct from one side of the damper assembly to the other. Often the fluid is air but the assemblies can also be used with other fluids. Such devices may be employed in a wide variety of applications as safety devices to prevent the spread of fire; most commonly they are placed in a duct, usually interposed along the length of the duct and adjoining confronting, slightly spaced, duct ends, but they may, for example, be placed at one end of a duct or in a dividing wall, floor, ceiling or the like between two open spaces.

Background of the Invention

[0002] A known fire damper assembly comprises a series of blades rotatably mounted in a duct and rotatable between an open position in which flow channels through the duct are defined between adjacent blades and a closed position in which edges of adjacent blades are immediately adjacent to one another to close the flow channels. The blades are in an open position in normal operation and close in an emergency. In the closed position, the blades desirably achieve two objectives: firstly they inhibit fluid flow along the duct preventing, for example, the passage of flames through the duct; secondly they provide a thermal barrier to the passage of heat through the duct. Such fire damper assemblies are mainly left in an open position but it is essential that they are able to close when required. Often the assemblies have to be effective at high temperatures at which conventional seals may be degraded or destroyed; a further problem associated with the high temperatures is that parts of the assembly may expand by different amounts leading to gaps between the blades and the walls of the duct. These factors make it more difficult to provide effective sealing. As well as achieving the sealing function, it is desirable to provide an effective thermal break. That might suggest making the blades of thermally insulating material but it then becomes a challenge to achieve the high temperature sealing functions referred to above.

[0003] US4146048 discloses a butterfly damper with a plurality of blades which can be locked in the open position, and which, when released, rotate about a hinge to the closed position. The damper blades can be insulated to prevent the heat from a fire on one side of the damper from being conducted by the damper to the other side when the blades are in the closed position.

[0004] GB2054132 discloses an air or gas duct that can be fully or partially blocked by pivoted blades. These blades can be operated in two modes, one emergency the other normal. They are spring urged towards the obstructing position and held open by a pneumatic actuator working against the spring. A fusible link device within the duct or a solenoid valve responsive to fire, gas or smoke alarm signals can deprive the actuator of air and cause rapid closure. A pressure controller (20) downstream of the damper blades normally governs the actuator to maintain constant pressure.

[0005] The present invention seeks to mitigate the above-mentioned problems.

Summary of the Invention

[0006] According to the invention, there is provided a fire damper assembly according to claim 1. Optional features of the fire damper assembly according to the invention are defined in claims 2 to 12.

[0007] By providing a sheet metal inner part substantial structural strength can be imparted to the blade, but at the same time the provision of thermally insulating material covering each of the opposite faces of the sheet metal part is able to present a substantial barrier to the transfer of heat through the blade. The insulating material may reduce both conduction and radiation of heat and if fluid flow (typically gas flow where the gas may be air) through the assembly is prevented then there can be no transmission of heat by convection.

[0008] Whilst reference is made to a "fire" damper assembly and in most applications the assembly is employed to inhibit spread of fire, it should be understood that the assembly may also be employed to prevent the spread of heat not associated with fire.

[0009] The thermally insulating material may cover more than 90 per cent of the opposite faces of the sheet metal part. Preferably the material is arranged such that in the closed position of the blade, substantially all of the faces of the blade that are exposed are covered by insulating material.

[0010] Said at least one blade may comprise a plurality of blades. The blades may be mounted on the mounting frame for rotation about parallel axes.

[0011] Said at least one blade, and preferably each blade where there are a plurality of blades, comprises a drive shaft. The sheets of the sheet metal inner part may be fixed to the drive shaft by welding. The distal portions of the sheets may be joined to one another by welding. Thus, the sheets may be separated from one another by the drive shaft in a central region and may converge to meet one another at edge regions spaced from the drive shaft.

[0012] In a case where there are a plurality of blades, a first edge region of one of the blades may be spaced from the axis of rotation of the blade and may define a first sealing face. A second edge region of an adjacent blade spaced from the axis of rotation of the adjacent blade may define a second sealing face that confronts the first sealing face when the blades are in the closed position. The first and second sealing faces may lie approximately in a radial plane passing through the axes

of rotation of the blades. A strip of sealing material may be provided between the first and second sealing faces. This may enhance the sealing between adjacent blades in their closed positions.

[0013] The first edge region of the blade, and preferably an edge region of each blade, may define a recess. The boundary of the recess may be defined partly or wholly by the sheet metal inner parts of the blades. Generally the walls of the recess will be harder and stronger if they are defined by the sheet metal rather than by the thermally insulating material. An edge region of an adjacent blade may be received in the recess in the closed position of the blades. That may facilitate a strong interlock of the blades in their closed positions. An intumescent may be disposed in the recess in the edge region of the blade. Thus the sealing at the junction of two blades may be achieved both by a sealing member (which is not an intumescent) and by an intumescent. Whilst that may seem to be unnecessary duplication it is actually of particular advantage: the sealing member can provide good sealing when the blades are first closed and may not be very hot; as the temperature is then increased the sealing material is liable to degrade and/or be destroyed, but the intumescent will expand to seal the junction between the blades.

[0014] There may be more than one pre-formed block over each face of the sheet metal inner part but it is preferred that there is a single pre-formed block over each face; that avoids the need to have any joins between blocks. The blocks may be fixed to the sheet metal inner part.

[0015] The first and second blocks may have outer substantially planar faces that are approximately parallel to one another. In that case the blade(s) may be of substantially constant overall thickness, although the thickness of the blocks may vary.

[0016] Said at least one blade may further include fastening bolts that extend through the blocks into the sheet metal inner part and fasten the blocks to the sheet metal inner part. As already mentioned, the sheet metal inner part may comprise converging parts. It is desirable, for ease of reliable fastening, that the fastening bolts extend approximately perpendicular to the sheet metal part. Thus, the fastening bolts may be at different inclinations to the outer substantially planar faces of the blocks. The fastening bolts may be at different inclinations and extend into the sheet metal inner part at a substantially perpendicular angle thereto; such an arrangement applies in an embodiment of the invention described below with reference to the drawings. It will be understood that where reference is made in this paragraph to said at least one blade the feature mentioned may be applied to just one blade, some or all the blades.

[0017] The assembly may be oriented such that said at least one blade is mounted for rotation about a horizontal or vertical axis, or indeed an inclined axis. Most commonly the plane of said at least one blade will be approximately vertical when it is closed but it may be horizontal (for example, if the assembly is fitted in a floor, ceiling or vertical duct) or it may be inclined.

[0018] The mounting frame may comprise a flange member projecting inwardly from an interior side of the frame for engagement by an edge region of said at least one blade. Where there are a plurality of blades the flange member may be for engaging one of the blades. The flange member may define a recess along the interior side of the frame, and a sprung closure member may be biased into a first position in which it covers over the recess for preventing dirt from collecting in the recess. The sprung closure member may be in the path of the edge region of said at least one blade, but movable against its bias into a second position out of the path of the edge region of said at least one blade. A sprung closure member of this kind may prevent dirt building up in the recess but is able to be deflected when the blade is closed to allow full rotational movement of the blade into the closed position.

[0019] The sprung closure member may be biased by external means, for example a compression spring, but preferably it is a resilient sheet metal member that is resiliently deformed to move, in use, into its second position. The sprung closure member may be cammingly engaged by the edge region of said at least one blade to move it, in use, into its second position.

[0020] The flange member may comprise a root portion secured to the interior wall of the frame and a lip extending approximately parallel to the interior wall of the frame. The flange member may be a sheet metal member.

[0021] The edge region of said at least one blade may comprise a circumferentially projecting portion for engaging beneath a part of the flange member, for example the lip, when, in use, the blade is rotated into its closed position. The circumferentially projecting portion may be a portion of one of the sheet metal parts.

[0022] The sprung closure member may be cammingly engaged by the circumferentially projecting portion to move it, in use, into its second position.

[0023] At least one strip of intumescent is preferably disposed in the recess along the interior side of the frame. In that case, when the blade or, in the case of a plurality of blades, an adjacent blade is moved to the closed position and a high temperature is reached in the region of the recess, the intumescent may expand, enhancing the seal between the blade and the frame. In a preferred arrangement, a strip of intumescent is provided between the frame and the sprung closure member; that strip presses the closure member against the blade when it expands. A strip of intumescent is also preferably provided in the recess in the region of the root portion of the flange member, preferably on the underside of the flange member; that strip fills the space between the root portion of the flange member, the frame and the blade when it expands.

[0024] Where a plurality of blades are provided, the flange member may be provided along a bottom interior side of the frame and the lowermost blade may engage

the flange member in its closed position. In an alternative embodiment employing a single blade, the flange member and the further flange member engage opposite edge regions of the blade when the blade is in the closed position.

[0025] The arrangement of a flange member described above in respect of one interior side of the frame of the assembly may also or alternatively be provided at the opposite side of the frame. Thus, the mounting frame may further comprise a further flange member projecting inwardly from an opposite interior side of the frame for engagement by an edge region of said at least one blade, the further flange member defining a recess along the opposite interior side of the frame, and a sprung closure member biased into a first position in which it covers over the recess for preventing dirt from collecting in the recess but is in the path of the edge region of said at least one blade, but movable against its bias into a second position out of the path of the edge region of said at least one blade.

[0026] The arrangement comprising the further flange member projecting inwardly from the opposite interior side of the frame and said at least one blade may be substantially the same as the arrangement of the first-mentioned flange member projecting inwardly from the interior side of the frame and said at least one blade as defined above.

[0027] In the embodiment described below, where there are a plurality of blades and the first-mentioned flange member is provided along a bottom interior side of the frame and the lowermost blade engages the flange member in its closed position, and the further flange member is provided along a top interior side of the frame and the uppermost blade engages the further flange member in its closed position.

[0028] The mounting frame may be of a generally rectangular shape, which may be a square shape, comprising a pair of opposite sides approximately perpendicular to the axis of rotation of said at least one blade and a pair of opposite ends approximately parallel to the axis of rotation of said at least one blade. The structure of the ends of the frame may be stiffened such that the resistance of the ends of the frame to bending in a direction that would increase the spacing of the middle portions of the ends of the frame from said at least one blade is increased. By increasing the stiffness of the ends of the frame the tendency of the ends of the frame to move away from the blade(s) is reduced, making it easier to maintain effective seals between the blade(s) and the ends of the frame.

[0029] Stiffening of the sides of the frame is not so important because shaft(s) on which the blade or blades rotate in use may pass through the sides and stops may be fixed on the shaft(s) to prevent outward movement of the sides of the frame. The resistance of the ends of the frame to bending in a direction that would increase the spacing of the middle portions of the ends of the frame from the blade(s) may therefore desirably be greater, for example at least 1.5 times greater, than the resistance of the sides of the frame to bending in a direction that would increase the spacing of the middle portions of the sides of the frame from the blade(s).

[0030] The "ends" of the frame may be the top and bottom of the frame and the "sides" will then extend approximately vertically, but the frame may be placed in other orientations according to the particular application in which it is employed. Typically, the length of the frame, measured in the direction of flow through the duct is less than the height of the frame interior measured between the ends of the frame and greater than the width of the frame interior measured between the sides of the frame.

[0031] The ends of the frame may be formed of elongate sheet metal members. The cross-section of each frame end may comprise at least three stiffening members extending along the ends of the frame and extending outwardly in planes approximately parallel to the plane in which said at least one blade is disposed in its closed position. The stiffening members may be made of sheet metal. Such stiffening members serve to increase the stiffness of the frame in the region of said at least one blade.

[0032] The ends of the frame may be formed of a pair of elongate members of generally C-shaped cross-section disposed side by side. The pair of elongate frame members may be welded together along their lengths. Thermally insulating material may be inserted into the members of C-shaped cross-section to reduce transmission of heat across the frame of the damper assembly. The pair of C-shaped members serve to increase the stiffness of the frame in the region of said at least one blade.

[0033] Each elongate frame member may further comprise a plurality of sheet metal gussets extending in planes transverse to the stiffening members. Such gussets may further strengthen the frame members.

[0034] According to a preferred feature of the invention an interior part of the frame comprises a sealing member for engaging said at least one blade when, in use, rotated to the closed position, a backing member behind the sealing member and an intumescent disposed between the backing member and the sealing member for pressing the sealing member against said at least one blade when, in use, the intumescent expands. The use of an intumescent in this way may enhance sealing at the time when it is needed, namely when the temperature has risen.

[0035] It is possible for the sealing member to be a movably mounted rigid member but it is preferred that the sealing member is flexible. The sealing member may be made of metal, for example of sheet metal.

[0036] The interior part of the frame may be a part extending generally perpendicular to the axis of rotation of said at least one blade. One or more axes of rotation of the blade(s) may pass through the sealing member. In that case when the intumescent expands the sealing member is pressed against the edge(s) of the blade(s). That may prevent the blade(s) from rotating but, since

they will already be in their closed position and it will be desired to maintain them in that position, the inability to rotate may be an advantage.

[0037] The interior part of the frame may be a part extending generally parallel to the axis of rotation of said at least one blade. In that case, the sealing member engages an edge region of a blade at a position spaced from its axis of rotation and even a gap that has become enlarged by separation of the blade from the frame may be traversed by the sealing member, as a result of the expansion of the intumescent.

[0038] The fire damper assembly as defined above may be fitted in a wide variety of locations and in a variety of orientations; most commonly the assembly may be fitted in a duct.

[0039] The provision of both a sealing member (which is not an intumescent) and an intumescent where edge regions of adjacent blades meet in the closed position of the assembly is itself a novel and inventive feature. Accordingly, in an example which is not in accordance with the claimed invention, there is provided a fire damper assembly comprising a mounting frame defining an opening and a plurality of blades disposed in the opening and mounted on the mounting frame for rotation about parallel axes and rotatable between an open position in which flow channels through the opening are defined between adjacent blades and a closed position in which edges of adjacent blades are immediately adjacent to one another to close the flow channels, wherein an edge region of a blade spaced from the axis of rotation of the blade defines a first sealing face, the edge region of the blade also defining a recess in which an edge region of an adjacent blade is arranged to be received in the closed position of the blades with a second sealing face of the edge region of the adjacent blade confronting the first sealing face and a strip of sealing material provided between the first and second sealing faces, and wherein an intumescent is disposed in the recess in the edge region of the blade.

[0040] Providing both a sealing member and an intumescent may seem to be unnecessary duplication, but it is actually of particular advantage: the sealing member can provide good sealing when the blades are first closed and may not be very hot; as the temperature is then increased the sealing material is liable to degrade and/or be destroyed, but the intumescent will expand to seal the junction between the blades.

[0041] In a second example which is not in accordance with the claimed invention, there is provided a fire damper assembly comprising a mounting frame defining an opening and at least one blade disposed in the opening and mounted on the mounting frame for rotation about an axis between an open position in which flow channels through the opening are defined and a closed position in which the flow channels are closed, wherein the mounting frame comprises a flange member projecting inwardly from an interior side of the frame for engagement by an edge region of said at least one blade, the flange member defining a recess along the interior side of the frame, and a sprung closure member biased into a first position in which it covers over the recess for preventing dirt from collecting in the recess and is in the path of the edge region of said at least one blade, but movable against its bias into a second position out of the path of the edge region of said at least one blade.

[0042] A sprung closure member of this kind may prevent dirt building up in the recess but is able to be deflected when the lowermost blade is closed to allow full rotational movement of the blade.

[0043] In a third example which is not in accordance with the claimed invention, there is provided a fire damper assembly comprising a mounting frame defining an opening and at least one blade disposed in the opening and mounted on the mounting frame for rotation about an axis between an open position in which flow channels through the opening are defined and a closed position in which the flow channels are closed, wherein the mounting frame is of a generally rectangular shape comprising a pair of opposite sides approximately perpendicular to the axis of rotation of said at least one blade and a pair of opposite ends approximately parallel to the axis of rotation of said at least one blade, in which the structure of the ends of the frame is stiffened such that the resistance of the ends of the frame to bending in a direction that would increase the spacing of the middle portions of the ends of the frame from said at least one blade is increased.

[0044] By increasing the stiffness of the ends of the frame the tendency of the ends of the frame to move away from the blades is reduced, making it easier to maintain effective seals between the blades and the ends of the frame.

[0045] In a fourth example which is not in accordance with the claimed invention, there is provided a fire damper assembly comprising a mounting frame defining an opening and at least one blade disposed in the opening and mounted on the mounting frame for rotation about an axis between an open position in which flow channels through the opening are defined and a closed position in which the flow channels are closed, wherein an interior part of the frame comprises a sealing member for engaging said at least one blade when, in use, the blade is rotated to the closed position, a backing member behind the sealing member and an intumescent disposed between the backing member and the sealing member for pressing the sealing member against said at least one blade when, in use, the intumescent expands.

[0046] The use of an intumescent in this way may enhance sealing at the time when it is needed, namely when the temperature has risen.

Description of the Drawings

[0047] Embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Fig 1 is an end view of a fire damper assembly;
Fig. 2 is side view showing a drive linkage of the assembly;
Fig. 3 is a sectional side view through blades of the assembly with the blades shown in their closed positions;
Fig. 4 is a sectional view through a middle portion of a blade of the assembly;
Fig. 5A is a sectional side view of part of the assembly, showing a blade at the bottom of the assembly in an open position;
Fig. 5B is a sectional side view of the blade of Fig. 5A, showing the blade in a closed position;
Fig. 5C is a sectional side view of part of the assembly, showing a blade at the top of the assembly in a closed position; and
Fig 6 is a sectional plan view through a side wall of the assembly.

Detailed Description

[0048] Fig. 1 shows a fire damper assembly embodying the invention. The assembly generally comprises a mounting frame 1 defining an opening in which a plurality of blades 2 are rotatably mounted on shafts 3. The shafts 3 of the blades 2 are drivingly coupled via a linkage 4 to an actuator which in this particular example is a motor 5.

[0049] Referring now also to Fig. 2, and describing the particular example shown which employs six blades 2, the linkage 4 comprises a linkage rod 6 to which three pairs of drive linkages are connected at positions along the rod 6. Each pair of drive linkages comprises first linkage comprising a connecting rod 7 and a crank 8 connected to the shaft 3 of one of the blades 2, and a second linkage comprising a crank 9 connected to the shaft 3 of an adjacent blade 2. As can readily be seen in Fig. 2, motion of the linkage rod 6 rotates the cranks 8 and 9 in opposite directions. For example if the linkage rod 6 is moved downwards, as viewed in Fig. 2, the cranks 9 and the shafts 3 to which they are connected are rotated anticlockwise and the cranks 8 and the shafts 6 to which they are connected are rotated clockwise as viewed in Fig. 2. The motor 5 is therefore operative to rotate the blades 2 in unison with each blade rotating in the opposite direction to its adjacent blade(s).

[0050] Referring now to Figs. 3 and 4, it can be seen that the four blades 2 in the middle of the assembly are all of the same construction and that the top and bottom blades 2T and 2B are of similar but slightly different construction. Parts of the construction common to all blades will be described first. Each blade is of composite construction comprising a sheet metal inner part 10 formed of a pair of sheets 10A and 10B and a pair of pre-formed blocks 11A and 11B of thermally insulating material covering the opposite faces of the sheets 10A and 10B.

[0051] As shown in Fig. 4, the sheets 10A and 10B are disposed on opposite sides of the shaft 3 to which they are spot welded. Thus the sheets 10A and 10B are spaced apart from one another in that region but they converge away from the shaft and are joined to one another in their end regions, for example by welds. The preformed blocks 11A and 11B have interior faces adjacent to the sheets 10A and 10B respectively that are shaped to match the profile of those sheets. The opposite, exterior faces of the blocks 11A and 11B are parallel to one another and to the plane in which the axes of rotation of the shafts 3 lie. The blocks 11A and 11B are fastened to the sheets 10A and 10B by bolts 14 which pass through preformed holes in the blocks and screw-threadedly engage in holes in the sheets 10A and 10B, entering the sheets in a direction perpendicular to the sheets. Thus, the bolts 14 are inclined to one another and also to the exterior faces of the blocks 11A and 11B which are formed with recesses 15 shaped to provide square abutment faces for the heads of the bolts 14. The blocks 11A and 11B are also fixed to the sheets 10A and 10B with adhesive.

[0052] The blades 2T and 2B differ from the other blades in two respects. Firstly, they have a different configuration in those edge regions of the blades that, when the blades are moved to their closed positions, engage the mounting frame 1; that different configuration will be described later. Secondly they have an extended length to one side of the shaft 2: as can readily be seen in Fig.3, in the closed position of the blades, the upper portion of the blade 2T above the shaft 2 extends over a greater height than the lower portion of that blade; similarly, the lower portion of the blade 2B below the shaft 2 extends over a greater height than the upper portion of that blade. The extent of the additional height of the blades 2T and 2B is determined by the overall height of the duct. Whilst the number of blades may be altered according to the desired overall height, it is convenient to have a fixed spacing of the shafts 2; it is then desirable to alter the heights of the blades 2T and 2B to match the precise height required, according to the size of the duct into which the assembly is to be fitted.

[0053] Referring now also to Figs. 5A to 5C, the structure of the blade 2B at the edge region that is the top edge region when the blade is in its closed position shown in Fig. 5B will now be described. It can be seen from Figs. 5A and 5B that in the top edge region the sheet 10A extends beyond the sheet 10B and defines a sealing face 16 on which a sealing strip 17 is fixed. The sheet 10B also has a free end 18 that extends outwardly away from the sheet 10A and defines an inclined face on which an intumescent strip 19 is fixed. Thus the sealing face 16 of the sheet 10A and the free end 18 of the sheet 10B together define a "V" shaped recess in the edge region of the blade. As can be seen from Fig. 3, the other blades 2, apart from the top blade 2T have the same top edge region as just described in relation to the bottom blade 2B.

[0054] Fig. 3 shows how adjacent edges of adjacent blades interengage in the closed positions of the blades. Each of the bottom edge regions of the blades 2 and 2T, but not of the bottom blade 2B, are of similar construction

to the top edge regions just described but with the sealing face 16 provided on the sheet 10B and the inclined free end provided on the sheet 10A. In the closed position, the sealing faces 16 of adjacent blades overlap and are received in the recesses formed at the edge regions of adjacent blades; the sealing strip 17 provides a seal between the confronting sealing faces 16.

[0055] Referring to Figs. 5A and 5B, the engagement of the blade 2B with the frame 1 will now be described. Along the bottom of the frame 1, a flange member 20 is fixed. The flange member 20 has a base part 21 welded to the base of the frame 1, an upwardly inclined part 22 and a horizontal lip 23. Spaced along the bottom of the frame 1 from the flange member 20, is another member 24 welded to the base of the frame 1. A sprung closure member 25 is held between the members 20 and 24 and under the lip 23. The flange member 20 and the sprung closure member 25 thus form an enclosure along the bottom of the frame. A strip 27 of intumescent is fixed on the base of the frame within the enclosure and another strip 26 of intumescent is fixed on the inclined part 22 of the flange member 20. The strip 27 is relatively thin, and may be referred to as paper, compared to the strip 26 which may be referred to as board.

[0056] Fig. 5B shows the bottom blade 2B in its closed position. It will be seen that the sheet 10A of the bottom blade 2B ends at its bottom in a flange 30 which projects transverse to the general plane of the sheet 10A and is received beneath the lip 23 of the flange member 20. This engagement of the flange 30 beneath the lip 23 prevents the bottom of the frame 1 moving away from the bottom blade 2B. Also the sheet 10B of the bottom blade 2B extends around the bottom of the pre-formed block 11B to provide a metal face 32 in that region. As the bottom blade 2B moves into its position shown in Fig. 5B, the metal face 32 cammingly engages the sprung closure member 25 depressing it against its resilient bias and forming a seal with the sprung closure member.

[0057] As can be seen from Fig. 5C, the arrangement along the top of the frame 1, adjacent to the top blade 2T when the blade is in its closed position, is substantially the same as the arrangement just described for the bottom blade and is designated by the same reference numerals as are used in Fig. 5B. It may be noted that in Fig. 5C, the member 24 which locates the sprung closure member 25 is bolted to the frame 1 rather than being welded. This is simply an alternative fastening which may be employed at either the top or the bottom of the frame.

[0058] Another special feature of the assembly is shown in Figs. 5A to 5C and that concerns the structure defining the top and bottom of the mounting frame. Referring first to Figs. 5A and 5B, the frame 1 is formed of a pair of elongate frame members 40A and 40B of generally C-shaped cross-section disposed side-by-side and welded together. At intervals along the length of the members, sheet metal gussets 41A and 41B are provided, those gussets extending perpendicular to the longitudinal axes of the members 40A and 40B. The provision of a structure of this kind stiffens the bottom of the frame.

[0059] As can be seen from Fig. 5C, the arrangement of the top of the frame 1, adjacent to the top blade 2T when the blade is in its closed position, is substantially the same as the arrangement just described for the bottom blade and is designated by the same reference numerals as are used in Figs. 5A and 5B.

[0060] A further special feature of the assembly will now be described with reference to Fig. 3 and Fig. 6. It concerns the arrangement of a pair of sealing members 50 at the opposite sides of the frame 1, between the frame 1 and the sides of the blades 2. As shown in Fig. 3 a metal sealing member 50 extends down the length of each side of the frame on the inside of the frame side wall 51. The sealing member 50 is located in a shallow recess of the frame with its side edges held against the side wall but has a slightly bowed shape when viewed in cross-section as in Fig.6, so that a shallow cavity is formed behind the bowed sealing member. A strip 52 of intumescent is disposed in the cavity along the length of the sealing member 50. The sealing member 50 has openings along its length to allow the unobstructed passage of the shafts 3. Whilst the sealing member 50 is shown in Fig.6 as smoothly curved it may have other cross-sectional shapes, such as a multifaceted shape following approximately the same curve. The member is sufficiently thin that it can be resiliently deformed quite easily. In ordinary use when there is no heat and the blades 2 are in their open positions, the sealing member 50 is immediately adjacent to the blades 2 in the region of the shafts 3, but makes no contact or only very light contact with the blades.

[0061] The operation of the fire damper assembly may already be understood from the description above, but for the sake of clarity will now be described.

[0062] The assembly is interposed in a duct where a fire break or the like is required and the interior of the frame 1 is sized to match the interior of the duct in which the assembly is fitted. In normal use, the blades 2 are all in the open position shown in Fig.5A; in that position the blades produce little obstruction to fluid flow along the duct and the parallel outer faces of the blades promote smooth flow through the assembly. In the event of excess heat being detected on one side of the duct by a detection system (not shown), or in the event of a test, the motor 5 or another actuator is operated and drives the linkage 4 to move all the blades 2 into the position shown for example in Fig. 3. In moving to this position adjacent blades are rotated in opposite directions and edge regions of adjacent blades interengage as described above and the junctions of adjacent blades are sealed by the sealing strips 17. Also the top and bottom blades 2T and 2B engage flange members 20 as already described. If the detection is a result of a test or the heat diminishes, then an operator is able to return the blades to the open position by operation of the motor 5.

[0063] If, however, heat continues to build up, then the various strips of intumescent described above will swell.

More particularly, the strip 19 of intumescent at the junction of adjacent blades will swell and provide a seal between the blades, so that any degradation or loss of sealing by the sealing strips 17 (which may be reduced by employing high temperature seals) is not significant. The strips 27 of intumescent fixed to the top and bottom of the frame 1 will swell pressing the closure members 25 against the adjacent blades 2T and 2B and the strips 26 of intumescent fixed to the undersides of the flange members 20 will swell filling the space between the root portions of the flange members 20, the frame 1 and the blades 2T and 2B, thus helping to ensure that the seal between the blades 2T and 2B and the top and bottom of the frame 1 are maintained. The frame 1 may itself expand as a result of becoming hot, but movement of the top and bottom parts of the frame is reduced by the engagement of the top and bottom blades 2T and 2B under the lips 23 and the stiffened construction of the top and bottom parts of the frame. At each side of the frame 1, the strip 52 of intumescent becomes hot and swells pressing the sealing member 50 against the sides of the blades 2 and sealing the space between the side wall of the frame 1 and the blades 2; in this case there is less need for stiffening of the frame because outward movement of the sides of the frame can be limited by stops on the shafts 3. In order to reduce heat transfer through the frame 1 itself, the voids in the elongate frame members 40A and 40B may be filled with insulating material.

[0064] It can thus be seen that in the event of excess heat, the assembly can provide an effective barrier to prevent fluid flow along the duct and also reduce very considerably transmission of heat along the duct.

[0065] The materials employed for the various parts may be of any appropriate kind known per se. In a particular example of the invention the sheet metal parts are made of stainless steel and the pre-formed blocks are of calcium silicate.

[0066] Whilst the present invention has been described and illustrated with reference to one particular embodiment, it will be appreciated by those of ordinary skill in the art that the invention lends itself to many different variations not specifically illustrated herein. For example, if the damper assembly is to be fitted to a duct of very large cross-section, for example more than 1m x 1m, it may be desirable to provide a framework which defines a grid of openings between horizontal and vertical frame members with respective blade assemblies within each opening in the grid; that limits the amount of expansion that any single blade assembly and surrounding frame has to accommodate.

[0067] Where in the foregoing description, integers or elements are mentioned which have known, obvious or foreseeable equivalents, then such equivalents are herein incorporated as if individually set forth. Reference should be made to the claims for determining the true scope of the present invention, which should be construed so as to encompass any such equivalents. It will also be appreciated by the reader that integers or features of the invention that are described as preferable, advantageous, convenient or the like are optional and do not limit the scope of the independent claims. Moreover, it is to be understood that such optional integers or features, whilst of possible benefit in some embodiments of the invention, may not be desirable, and may therefore be absent, in other embodiments.

Claims

1. A fire damper assembly comprising a mounting frame (1) defining an opening and at least one blade (2) disposed in the opening and mounted on the mounting frame (1) for rotation about an axis between an open position in which flow channels through the opening are defined between said at least one blade (2) and the frame (1), and a closed position in which the flow channels are closed, wherein said at least one blade (2) is of composite construction comprising a sheet metal inner part (10), a first piece of thermally insulating material (11A) covering one face (10A) of the sheet metal inner part (10), and a second piece of thermally insulating material (11B) covering a second, opposite face (10B) of the sheet metal inner part (10), **characterised in that** the at least one blade further comprises a drive shaft (3) and the sheet metal inner part (10) comprises sheets (10A, 10B) having middle portions in the region of the drive shaft (3) that are spaced from one another and on opposite sides of the drive shaft (3), and distal portions which are joined to one another, and **in that** the first and second pieces of thermally insulating material are pre-formed blocks of material.

2. A fire damper assembly according to claim 1, in which the thermally insulating material covers more than 90 per cent of the opposite faces of the sheet metal part (10).

3. A fire damper assembly according to claim 1 or 2, in which the first and second blocks (11A, 11B) have outer substantially planar faces that are approximately parallel to one another.

4. A fire damper assembly according to claim 3, in which said at least one blade (2) further includes fastening bolts (14) that extend through the blocks (11A, 11B) into the sheet metal inner part (10) and fasten the blocks (11A, 11B) to the sheet metal inner part (10).

5. A fire damper assembly according to claim 4 when dependent upon claim 3, in which the fastening bolts (14) are at different inclinations to the outer substantially planar faces.

6. A fire damper assembly according to claim 4 or 5, in which the fastening bolts (14) are at different inclinations and extend into the sheet metal inner part (10) at a substantially perpendicular angle thereto.

7. A fire damper assembly according to any preceding claim, in which said at least one blade (2) comprises a plurality of blades (2) mounted on the mounting frame (1) for rotation about parallel axes.

8. A fire damper assembly according to claim 7, in which a first edge region of one of the blades (2) is spaced from the axis of rotation of the blade (2) and defines a first sealing face (16) and a second edge region of an adjacent blade (2) spaced from the axis of rotation of the adjacent blade (2) defines a second sealing face (16) that confronts the first sealing face (16) when the blades (2) are in the closed position.

9. A fire damper assembly according to claim 8, in which a strip of sealing material (17) is provided between the first and second sealing faces (16).

10. A fire damper assembly according to claim 8 or 9, in which the first edge region of the blade (2) defines a recess.

11. A fire damper assembly according to claim 10, in which an intumescent is disposed in the recess in the first edge region of the blade (2).

12. A fire damper assembly according to any preceding claim, in which said at least one blade (2) is mounted for rotation about a horizontal axis.

Patentansprüche

1. Brandschutzklappenanordnung, umfassend einen Montagerahmen (1), der eine Öffnung definiert, und wenigstens eine in der Öffnung angeordnete und am Montagerahmen (1) montierte Klappe (2), die sich um eine Achse zwischen einer offenen Position, in der Strömungskanäle durch die Öffnung zwischen der wenigstens einen Klappe (2) und dem Rahmen (1) definiert sind, und einer geschlossenen Position, in der die Strömungskanäle geschlossen sind, drehen kann, wobei die wenigstens eine Klappe (2) eine Verbundbauweise besitzt, die ein Metallblech-Innenteil (10), ein erstes Stück thermisch isolierendes Material (11A), das eine Seite (10A) des Metallblech-Innenteils (10) bedeckt, und ein zweites Stück thermisch isolierendes Material (11B), das eine zweite, gegenüberliegende Seite (10B) des Metallblech-Innenteils (10) bedeckt, umfasst,
dadurch gekennzeichnet, dass die wenigstens eine Klappe ferner eine Antriebswelle (3) umfasst und das Metallblech-Innenteil (10) Bleche (10A, 10B) umfasst, die Mittelteile im Bereich der Antriebswelle (3), die voneinander beabstandet sind und sich an gegenüberliegenden Seiten der Antriebswelle (3) befinden, und distale Teile, die miteinander verbunden sind, umfassen, und dass das erste und das zweite Stück thermisch isolierendes Material vorgeformte Materialblöcke sind.

2. Brandschutzklappenanordnung gemäß Anspruch 1, bei der das thermisch isolierende Material mehr als 90 Prozent der gegenüberliegenden Seiten des Metallblechteils (10) bedeckt.

3. Brandschutzklappenanordnung gemäß Anspruch 1 oder 2, bei der der erste und der zweite Block (11A, 11B) im Wesentlichen planare Außenflächen besitzen, die ungefähr parallel zueinander sind.

4. Brandschutzklappenanordnung gemäß Anspruch 3, bei der die wenigstens eine Klappe (2) ferner Befestigungsschrauben (14) umfasst, die durch die Blöcke (11A, 11B) in das Metallblech-Innenteil (10) reichen und die Blöcke (11A, 11B) am Metallblech-Innenteil (10) befestigen.

5. Brandschutzklappenanordnung gemäß Anspruch 4, wenn dieser von Anspruch 3 abhängig ist, bei der die Befestigungsschrauben (14) in verschiedenen Neigungen zu den im Wesentlichen planaren Außenflächen stehen.

6. Brandschutzklappenanordnung gemäß Anspruch 4 oder 5, bei der die Befestigungsschrauben (14) in verschiedenen Neigungen stehen und in das Metallblech-Innenteil (10) in einem im Wesentlichen senkrechten Winkel dazu reichen.

7. Brandschutzklappenanordnung gemäß einem vorhergehenden Anspruch, bei dem die wenigstens eine Klappe (2) mehrere Klappen (2) umfasst, die am Montagerahmen (1) montiert sind, um sich um parallele Achsen drehen zu können.

8. Brandschutzklappenanordnung gemäß Anspruch 7, bei der ein erster Randbereich einer der Klappen (2) von der Drehachse der Klappe (2) beabstandet ist und eine erste Dichtfläche (16) definiert, und ein zweiter Randbereich einer benachbarten Klappe (2), von der Drehachse der benachbarten Klappe (2) beabstandet, eine zweite Dichtfläche (16) definiert, die der ersten Dichtfläche (16) gegenübersteht, wenn die Klappen (2) sich in der geschlossenen Position befinden.

9. Brandschutzklappenanordnung gemäß Anspruch 8, bei der ein Streifen Dichtmaterial (17) zwischen der ersten und der zweiten Dichtfläche (16) bereitgestellt wird.

10. Brandschutzklappenanordnung gemäß Anspruch 8 oder 9, bei der der erste Randbereich der Klappe (2) eine Aussparung definiert.

11. Brandschutzklappenanordnung gemäß Anspruch 10, bei der sich ein intumeszentes Mittel in der Aussparung im ersten Randbereich der Klappe (2) befindet.

12. Brandschutzklappenanordnung gemäß einem vorhergehenden Anspruch, bei der die wenigstens eine Klappe (2) montiert ist, um sich um eine horizontale Achse drehen zu können.

Revendications

1. Ensemble clapet coupe-feu comprenant un bâti de montage (1) qui définit une ouverture, et au moins une lame (2) disposée dans l'ouverture et montée sur le bâti de montage (1), destinée à tourner autour d'un axe entre une position ouverte dans laquelle sont définis des canaux de flux à travers l'ouverture, entre ladite au moins une lame (2) et le bâti (1), et une position fermée dans laquelle les canaux de flux sont fermés, dans lequel ladite au moins une lame (2) est une construction composite qui comprend une partie intérieure de tôle (10), une première partie de matériau thermiquement isolant (11A) qui couvre une face (10A) de la partie intérieure de tôle (10), et une seconde partie de matériau thermiquement isolant (11B) qui couvre une seconde face opposée (10B) de la partie intérieure de tôle (10),
caractérisé en ce que l'une au moins des lames comprend en outre un axe d'entraînement (3), et la partie intérieure de tôle (10) comprend des tôles (10A, 10B) qui présentent des parties médianes dans la région de l'axe d'entraînement (3) qui sont espacées les unes des autres, et sur les bords opposés de l'axe d'entraînement (3), et des parties distales qui sont jointes les unes aux autres, et **en ce que** les première et seconde parties de matériau thermiquement isolant, sont des blocs de matériau préformés.

2. Ensemble clapet coupe-feu selon la revendication 1, dans lequel le matériau thermiquement isolant couvre plus de 90 pour cent des faces opposées de la partie de tôle (10).

3. Ensemble clapet coupe-feu selon la revendication 1 ou 2, dans lequel les premier et second blocs (11A, 11B) présentent des faces sensiblement planes extérieures, qui sont approximativement parallèles les unes aux autres.

4. Ensemble clapet coupe-feu selon la revendication 3, dans lequel ladite au moins une lame (2) comprend en outre des boulons de fixation (14) qui s'étendent à travers les blocs (11A, 11B) dans la partie intérieure de tôle (10), et qui permettent de fixer les blocs (11A, 11B) sur la partie intérieure de tôle (10).

5. Ensemble clapet coupe-feu selon la revendication 4 si elle dépend de la revendication 3, dans lequel les boulons de fixation (14) présentent des inclinaisons différentes par rapport aux faces sensiblement planes extérieures.

6. Ensemble clapet coupe-feu selon la revendication 4 ou 5, dans lequel les boulons de fixation (14) présentent des inclinaisons différentes et s'étendent dans la partie intérieure de tôle (10) sous un angle sensiblement perpendiculaire à celle-ci.

7. Ensemble clapet coupe-feu selon l'une quelconque des revendications précédentes, dans lequel ladite au moins une lame (2) comprend une pluralité de lames (2) montées sur le bâti de montage (1), destinées à tourner autour d'axes parallèles.

8. Ensemble clapet coupe-feu selon la revendication 7, dans lequel une première région de bord de l'une des lames (2) est espacée de l'axe de rotation de la lame (2), et définit une première face d'étanchéité (16), et une seconde région de bord d'une lame adjacente (2) espacée de l'axe de rotation de la lame adjacente (2), définit une seconde face d'étanchéité (16) qui fait face à la première face d'étanchéité (16), lorsque les lames (2) se trouvent dans la position fermée.

9. Ensemble clapet coupe-feu selon la revendication 8, dans lequel une bande de matériau d'étanchéité (17) est disposée entre les première et seconde faces d'étanchéité (16).

10. Ensemble clapet coupe-feu selon la revendication 8 ou 9, dans lequel la première région de bord de la lame (2) définit un renfoncement.

11. Ensemble clapet coupe-feu selon la revendication 10, dans lequel un matériau ignifuge est disposé dans le renfoncement dans la première région de bord de la lame (2).

12. Ensemble clapet coupe-feu selon l'une quelconque des revendications précédentes, dans lequel ladite au moins une lame (2) est montée afin de tourner autour d'un axe horizontal.

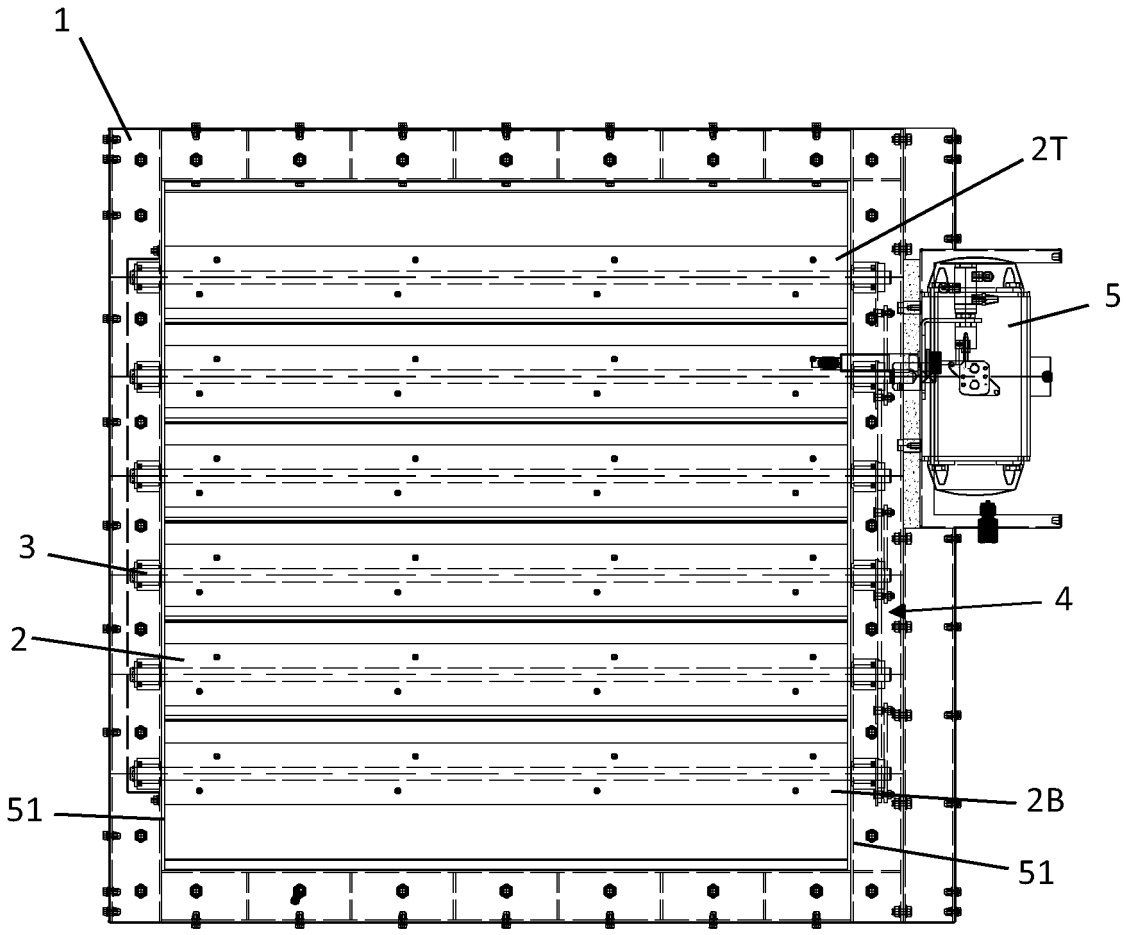

Fig. 1

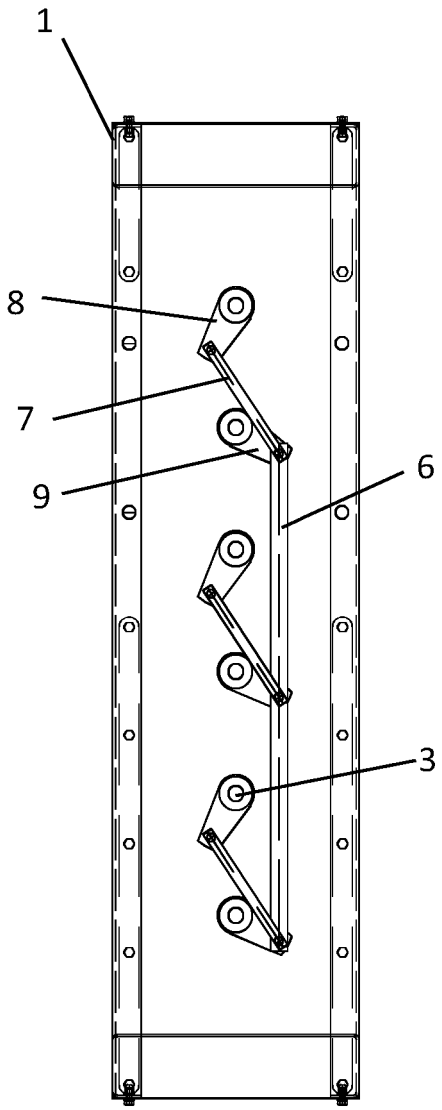

Fig. 2

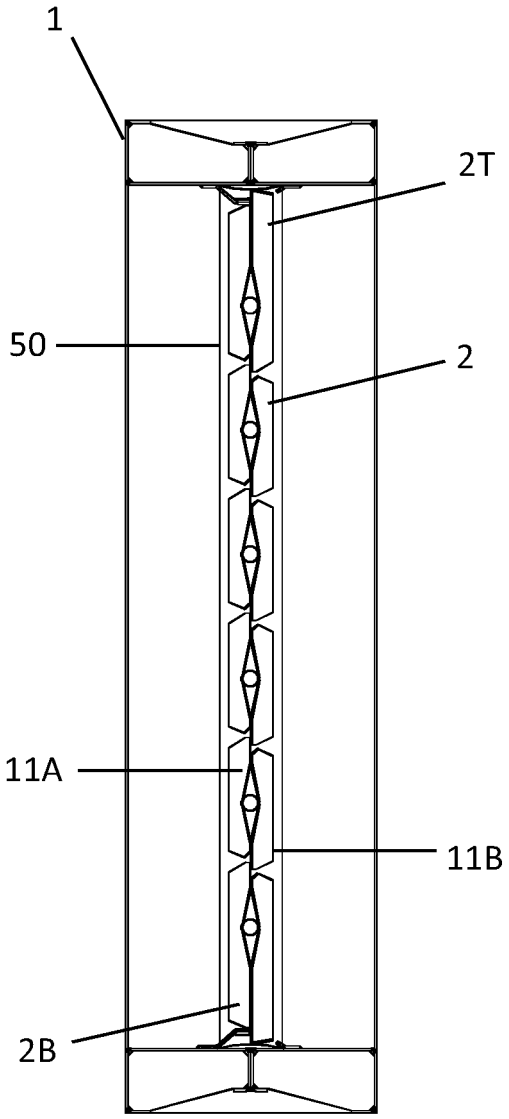

Fig. 3

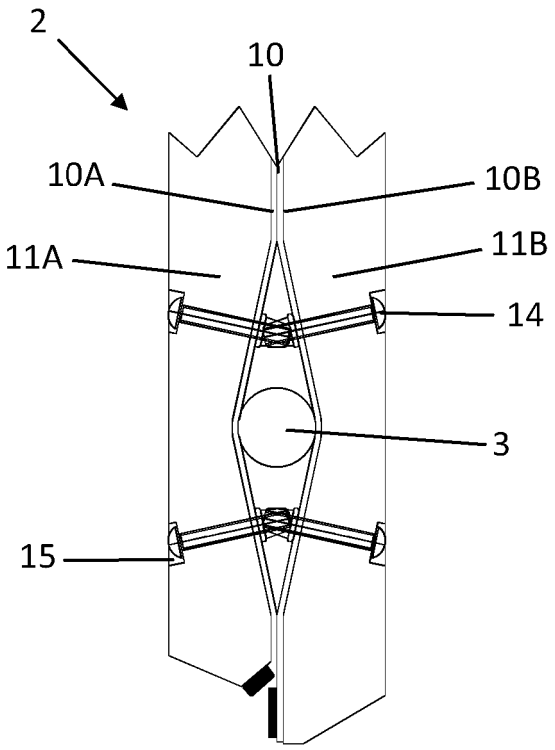
2
10
10A
10B
11A
11B
14
3
15

Fig. 4

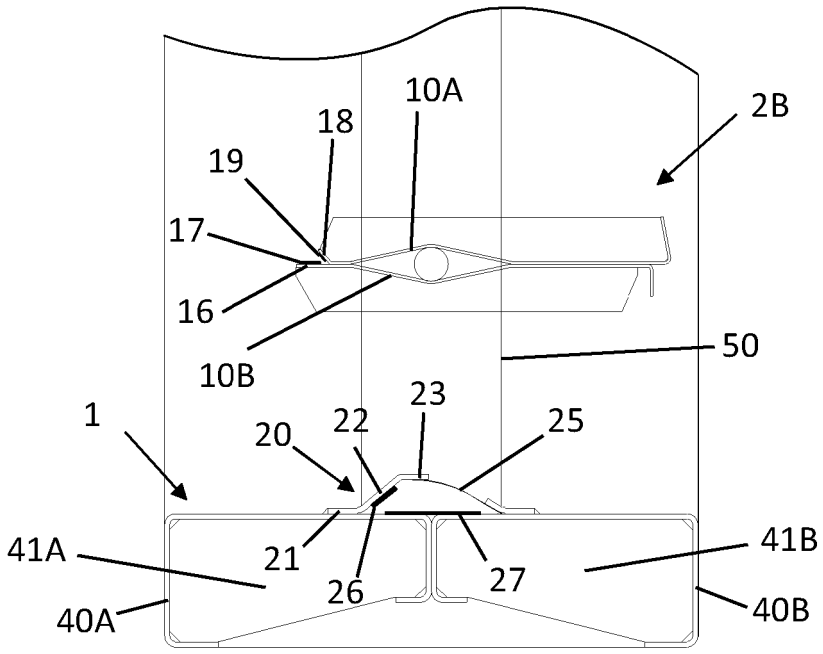
10A
2B
18
19
17
16
10B
50
1
23
20
22
25
41A
21
26
27
41B
40A
40B

Fig. 5A

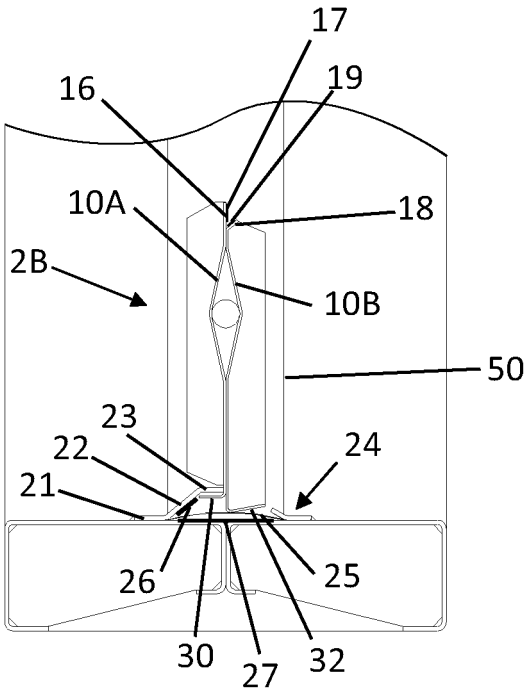
17
19
16
10A
18
2B
10B
50
23
22
24
21
26
25
30
27
32

Fig. 5B

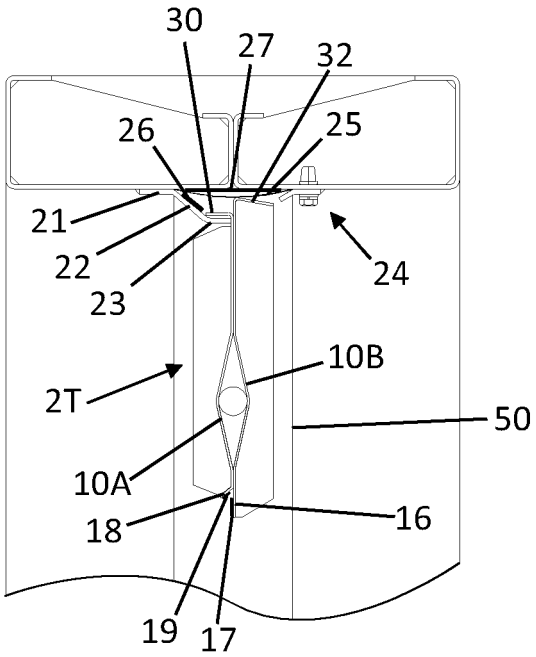
30
27
32
26
25
21
22
24
23
10B
2T
50
10A
18
16
19
17

Fig. 5C

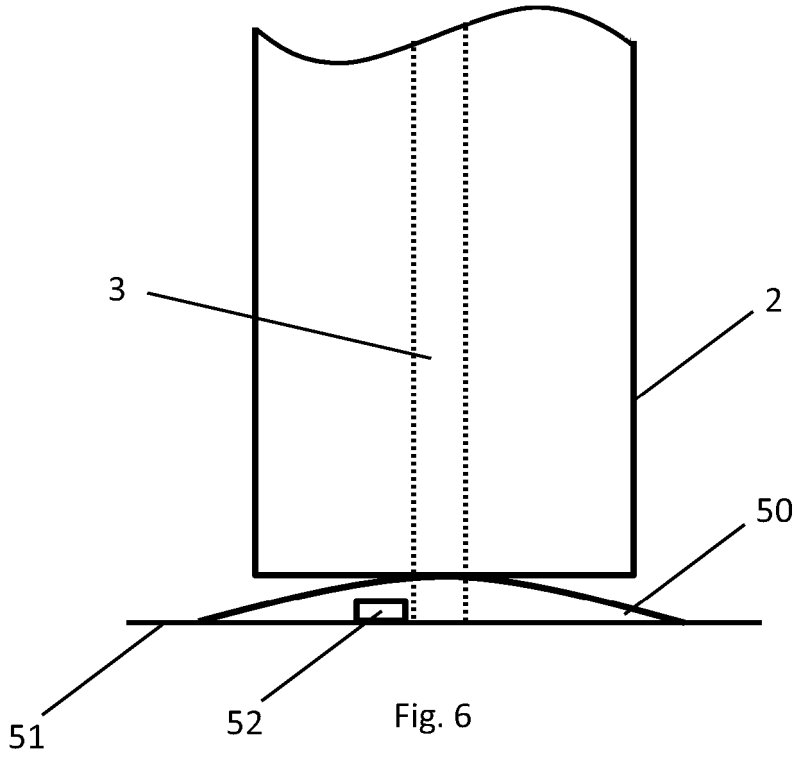

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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- GB 2054132 A **[0004]**