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DESCRIPTION

[0001] This invention relates to a sealing for a partition of a cut-off fire damper of a rectangular cross-section, which upon closing prevents spreading out smoke and fire from a zone in which a fire hazard occurred.

[0002] A cut-off fire damper is destined for all buildings in which the evacuation procedure is based on separating the zone in fire. It satisfies the requirements of all buildings in which separation of the zone being in fire is planned, among other means by remote-controllable closing fire dampers in this zone and continuous operation of the ventilation and air-conditioning systems in other zones.

[0003] A cut-off fire damper is used in the points in which ventilation or air-conditioning ducts pass through elements of the anti-fire separation system. In case of fire the fire damper enables the zone being in fire to be cut-off. After closing the partition, the fire damper allows to preserve the resistance to fire of the element of the anti-fire separation system through which the ventilation or air-conditioning duct is led. Thereby other zones are protected against hot smoke and gases, and normal operation of the ventilation or air-conditioning system is possible.

[0004] Various solutions for sealing the partition of the movable fire damper are applied to ensure the above mentioned features. The most commonly used is a sealing comprising, directly or indirectly, a stop for the motion of the partition of the cut-off fire damper, which may have a form of angle bars mounted inside the frame perpendicularly to the direction of the air flow.

[0005] In known technical solutions, rectangular fire dampers most commonly contain partition stops having a form of an angle bar mounted to the frame which limit the motion of the partition and are used as an additional sealing element.

[0006] The so-called "retaining angle bars" are known, against which seals are pressed.

[0007] The document DE 84 35 118 U1 discloses a fire damper having a frame of rectangular cross-section provided with a movable cut-off partition. The sealing material of this fire damper is located on an element of a "S" cross-section so as to form a stopper for the partition in its closed position. The stopper, bearing against the impact of the moving partition, must be a solid element able to support the sealing in order to ensure the function of the fire damper.

[0008] Installing such stoppers increases the hydraulic resistance for the flowing air that involves the increase of the dimensions of the ventilators and the increase of the energy use for supplying them. The stops themselves are also an additional source of the fire dampers' own noise. They are a source of contamination of the microclimatic environment inside buildings and, obviously, they constitute an additional construction element increasing the costs

of manufacturing a fire damper. During normal operation of the ventilation system the fire damper is open (rests in the waiting position). The zone in which fire is detected becomes separated by closing the partition (i.e., moving the fire damper to the safety position):

- automatically - by the action of a fuse-element due to an increase of the temperature in the duct to 72°C, or
- remotely - by the transmission of the control signal from the fire signal center. Closing the fire damper is performed by releasing the potential energy stored in a tensioned spring of the closing mechanism. Additionally, the closing mechanism is equipped with a manual trigger that allows to close the fire damper manually. In the case of closing the fire damper remotely, reopening of the partition, i.e. restoring the waiting position is possible by manual tensioning the spring of the closing mechanism with a key or remotely by a cylinder. In the case of closing the fire damper automatically by the action of the fuse-element, it is necessary to replace it first and then perform the above-described operations for opening the partition. The fire damper exposed to fire is to be replaced. Signaling the position of the cut-off partition is ensured by marginal indicators.

[0009] In the present application the term "line of the fire damper's frame" is to be understood as the inner surfaces of the frame and the term "external contour of the fire damper" is to be understood as the external surfaces of the frame, i.e., the external contour of the frame.

[0010] The fire damper is defined by the dimensions L (width) and H (height). The names of spacers originate from these designations. The spacer installed on the sidewalls H of the fire dampers will be called spacer "H", the spacer installed on the sidewalls L of the fire dampers will be called spacer "L". The spacers are installed perpendicularly to each other such that with the fire damper's partition being closed their external surfaces are adjacent to the partition, i.e., to its side surfaces. The spacers are joined to each other at their ends, defining a thermal insulation layer for both parts of the fire damper's frame.

[0011] The sealing according to the invention, for a movable cut-off partition installed in a fire damper having a frame of rectangular cross-section, the sidewalls of the frame being provided with fireproof spacers the external surfaces of which are adjacent to the side surfaces of the partition in its closed position, is characterized by seals located on the fireproof spacers such that they extend into the inside of the fire damper beyond the line of the fire damper frame.

[0012] Preferably, the dimensions of the movable cut-off partition are smaller than the internal dimensions of the fire damper frame.

[0013] One of the seals is preferably a swelling seal.

[0014] The other seal has a O-shaped cross-section and is preferably a silicon seal.

[0015] The inner surfaces of the fireproof spacers are preferably situated below the line of the

fire damper frame.

[0016] The seal according to the invention ensures tightness in normal conditions, i.e. in ambient temperatures, as well as flame resistance, smoke tightness and insulating properties in fire conditions.

[0017] The invention is intended to be used in spots where ventilating ducts are passing through partitions of the fire separation system. In case of fire the fire damper enables the immediate separation of the zone in fire and preserves the fire-resistance of the construction fire damper for 120 minutes, protecting other zones against hot smoke and gases. Fast and smooth closing, within 4 seconds, ensures immediate separation of the zone endangered by fire. The design with no stops preventing the partition of the fire damper increases its active area, thereby decreasing hydraulic resistance and its "own" noise. Employing the inventive solution allows to control the appropriate operation before and after connecting the fire damper to the system of fire detection.

[0018] The solution based on the cooperation of the seals with the partition in its closed position has eliminated the need of welding and spot bonding, and, as a consequence, the need for anticorrosive protection of the joining spots.

[0019] Reduced hydraulic resistance of the fire damper saves electricity used in buildings by lowering the desired compression of ventilators.

[0020] The new solution reduces the manufacture costs - additional construction elements, i.e., the stops are eliminated, the hydraulic resistance and the own noise are reduced, thereby the exploitation is cheaper - by using ventilators of a smaller compression, and the noise is lower.

[0021] The most important functional feature of the fire damper according to the invention, i.e. the fire resistance, satisfies the corresponding compulsory standards. The fire dampers according to the invention are tight in normal conditions, i.e. in ambient temperatures, where to satisfy the EIS 120 class it is necessary to preserve the tightness below the value of $200 \text{ m}^3/\text{h} \times \text{m}^2$ of the fire damper area at a differential pressure between both sides of the fire damper, as well as in the conditions of a fire test, which means that during 120 minutes of the increase of temperature in the testing oven, according to the corresponding standard curve referenced in the currently valid standards, the leakage cannot exceed the value of $200 \text{ m}^3/\text{h} \times \text{m}^2$ of the fire damper area.

[0022] The invention is shown by embodiments illustrated in the drawing, in which:

- Fig. 1 shows the state of the art solution;
- Fig. 2 shows a side view of the partition being closed;
- Fig. 3 shows a front view of the closed partition;
- Fig. 4 shows a cross-section along the line A-A of Fig. 2;

- Fig. 5 shows a cross-section along the line B-B of Fig. 3;
- Fig. 6 shows detail D of Fig. 4;
- Fig. 7 shows detail C of Fig. 5;
- Fig. 8 shows a perspective view of the cut-off fire damper with the partition being open;
- Fig. 9 shows a perspective view of the cut-off fire damper with the partition being closed;
- Fig. 10 shows a side view of the cut-off fire damper with the partition being open in a partial cross-section; and
- Fig. 11 shows an enlarged view of a detail of Fig. 2 with a seal according to the invention.

[0023] In the solution known from the state of the art, as shown in Fig. 1, a stop is shown, denoted with reference number 1, the stop being eliminated in the solution according to the invention.

[0024] Figs 2 -11 show construction details of the sealing of the fire damper according to the invention. Fig. 6 shows a seal 6 with an O-shaped cross-section in a free position with the fire damper partition being open, and Fig. 7 shows the same seal squeezed between the closed fire damper partition and a spacer 3.

[0025] The figures show the design of the sealing according to the invention, wherein a swelling seal 2 and a silicon seal 6 are placed on protective spacers 3. The spacer L made from a fire-resisting board is denoted with reference number 3, the spacer H also made from a fire-resisting board is denoted with reference number 4. The cut-off partition 5 is mounted via a lever and connected with a tension member. A drive mechanism M is mounted from outside to the frame 17 of the fire damper.

[0026] The spacers extend for 5.5 mm into the fire damper. The seals 2 and 6 are placed on the surfaces of the spacers extending into the fire damper frame. The seals 2 are mounted to the spacers 3 and 4 by means of stitches along their whole length. Preferably, the dimensions of the cross-section of the seal 2 are 40 mm x 2 mm. The seal 6 is glued to the seal 2 and additionally stitched with stitches to the spacers via the seals 6. The seals mounted in neighboring spacers 3 and 4 are configured perpendicularly to each other, similarly to the spacers. Due to extending the spacers into the fire damper one reduces the risk of jamming the partition against the ventilation ducts, particularly for large dimensions of the fire dampers (for $H > 400$ mm) because of protruding the open partition beyond the fire damper frame 17. The spacers have rectangular cross-section of recommended dimensions 40.0 x 36.5 mm.

[0027] The seal 6 is mounted on fireproof spacers 3, thereby eliminating the risk of accidental tearing the seal 6 off or tearing it off during transporting, installing or the start-up of the installation. The seal 6 having the O-shaped cross-section is designed especially for investigation and is claimed as an industrial design. Mounting it does not require any additional mounting rail, as is the case in known designs, which should ensure permanent attachment of

the seal but is an additional cost which is avoided in the design according to the invention.

[0028] By mounting the fireproof spacers "L" 3 and "H" 4, on which both seals 2 and 6 are installed, such that the spacers extend slightly into the fire damper beyond the line of the fire damper frame 17 (Figs 6 and 10), still another practical feature has been obtained, namely that the dimensions of the movable cut-off partition 5 made from a fire resistant material are sufficiently smaller than the internal dimensions of the fire damper frame 17, thereby in case of connecting the ventilating ducts inappropriately, i.e., entering the internal space of the fire damper frame 17 (so called non-axial attachment) or connecting ventilation ducts which are smaller than the internal cross-section of the fire damper frame 17, e.g., due to inaccurate manufacture of the ventilation duct, one significantly reduces the risk of jamming the partition in the event that due to the size of the fire damper, the cut-off partition 5 in the open position extends beyond the external contour of the fire damper, which significantly reduces the occurrence of inaccuracies leading to a dispute between the fire damper's manufacturer and the company performing the installation. The seal 2 extends above the line of the frame 17 for 2 mm and the seal 6, when non-squeezed, extends for ca. 10 mm into the fire damper frame 17, thereby the dimensions of the fire damper may be L: 22 mm x H: 24 mm, correspondingly.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- DE8435118U1 [0007]

Patentkrav

- 1.** Brandspjæld med en ramme (17) med rektangulært tværsnit, en bevægelig afskæringsskillevæg (5) installeret deri og tætning af nævnte
- 5 afskæringsskillevæg, hvor alle fire sidevægge i rammen (17) er forsynet med brandsikre afstandsstykker (3, 4), hvis udvendige overflader støder op til sideoverfladerne af skillevæggen (5) i dens lukkede position, hvor tætninger (2, 6) er placeret på de brandsikre afstandsstykker (3, 4), således at de strækker sig ind i indersiden af brandspjældet ud over linjen af brandspjældsrammen (17)
- 10 **kendetegnet ved, at** tætningen (6) har et O-formet tværsnit.
- 2.** Brandspjæld ifølge krav 1, hvor dimensionerne af den bevægelige afskæringsskillevæg (5) er mindre end de indvendige dimensioner af brandspjældsrammen (17).
- 15 **3.** Brandspjæld ifølge krav 1, hvor tætningen (2) er en kvældende tætning.
- 4.** Brandspjæld ifølge et hvilket som helst foregående krav, hvor tætningen (6) er en silikonetætning.
- 20 **5.** Brandspjæld ifølge de foregående krav, hvor de indvendige overflader af de brandsikre afstandsstykker (3, 4) er placeret under linjen af brandspjældsrammen (17).

DRAWINGS

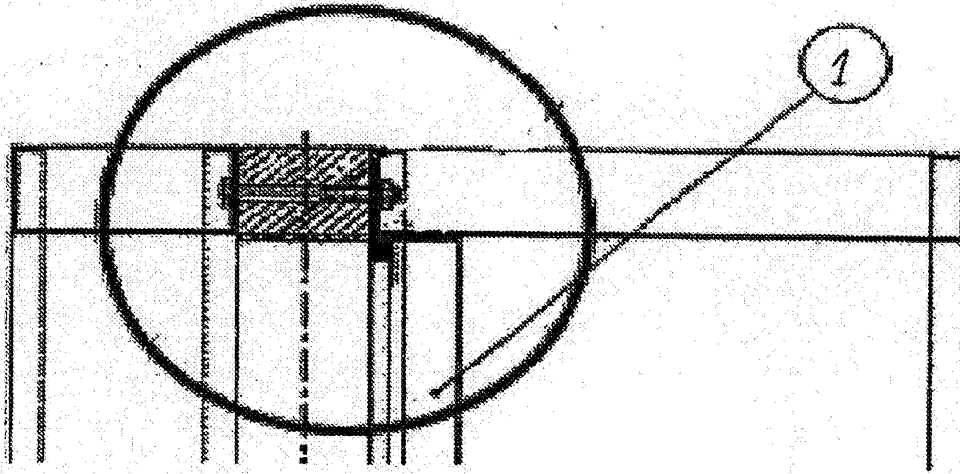


Fig. 1

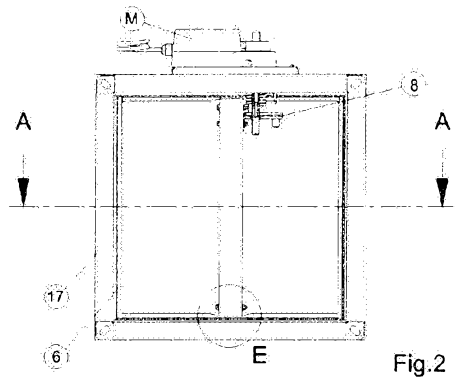


Fig.2

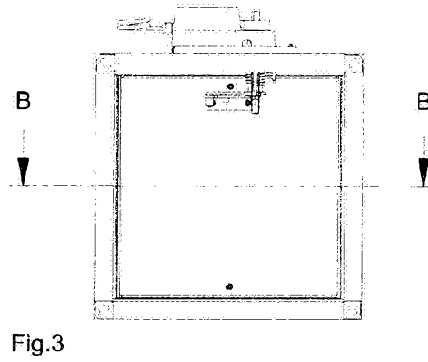


Fig.3

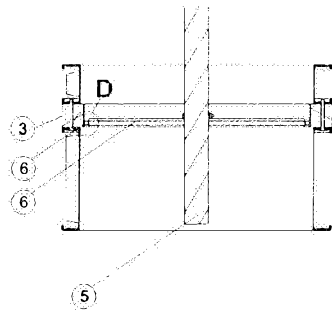


Fig.4

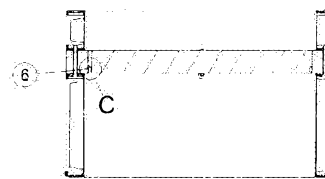


Fig.5

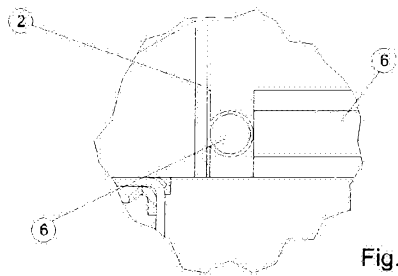


Fig.6

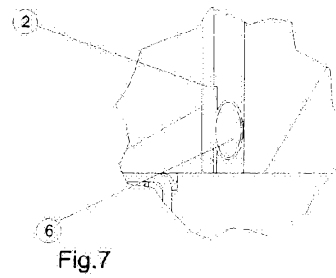


Fig.7

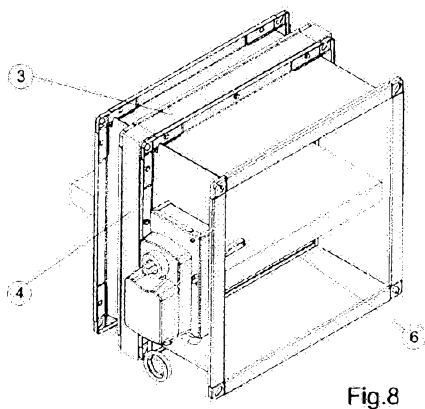


Fig.8

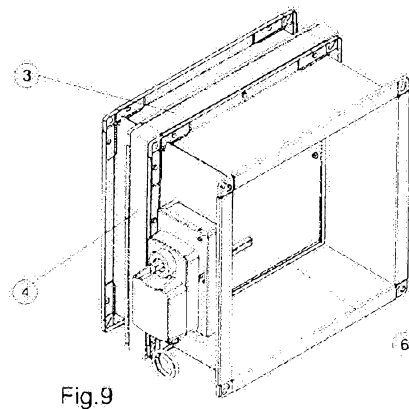


Fig.9

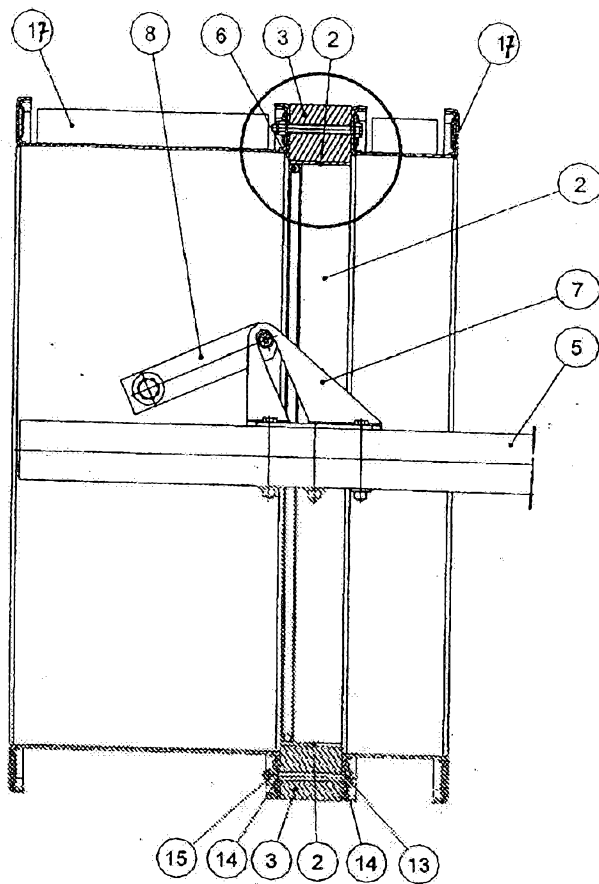


Fig. 10

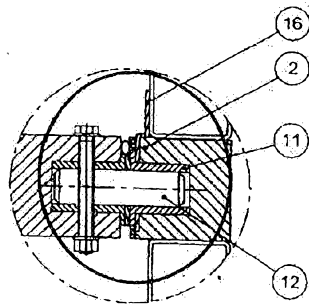


Fig. 11