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(54) **Smoke seal device for sliding fire door**

(57) The hot smoke seal device for sliding fire doors provided in a building (22), comprising at least two metal profile bars (16.3, 18.2), of which a first profile bar (16.3) is directly or indirectly fixed to the building (22) in which the door is provided, while the second profile bar (18.2) is fixed to the upper edge of the door panel (10.2). The two profile bars (16.3, 18.2) have parts intended to mu-

tually interfere in the case of fire, thermo-expanding gas-kets (36) being provided in correspondence with these parts. The cross-section through at least one (16.3) of the two profile bars (16.3, 18.2) is deformable in order to maintain mutual interference notwithstanding the horizontal withdrawal of the upper edge of the door panel (10.2) in the case of fire.

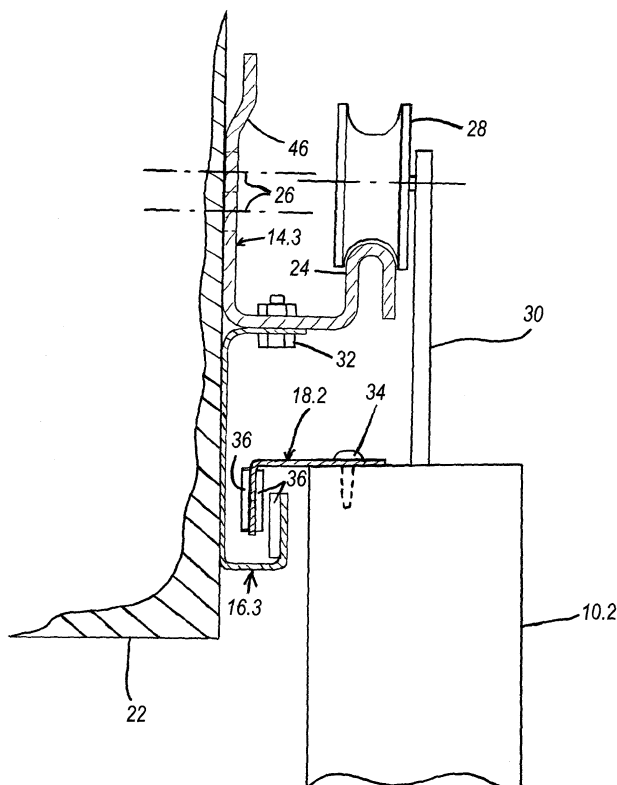


FIG. 5

Description

[0001] The present invention relates to a hot smoke seal device for sliding fire doors.

[0002] Sliding doors are known to be normally suspended on a horizontal slide guide, fixed to the building or the like in which the aperture to be closed by said door is provided. This latter can slide in both directions along said guide, between a closed position and a maximum open position. Door sliding is facilitated by being suspended on the guide via two or more wheels rotatably fixed to the door, to rotate along the guide and hence considerably reduce the force required to open and close the door.

[0003] For sliding fire doors, the relative regulations initially prescribed tests which did not include a hot smoke seal test. Fire regulations were then modified with the addition of a requirement for a hot smoke seal. To provide this seal, various solutions were adopted over the course of time, these being adapted to the continuing development of the slide guide. These solutions, shown in the accompanying Figures from 1 to 4, are summarized below.

[0004] The first solution historically adopted is illustrated schematically in Figure 1, which shows only the upper part of a panel 10.1 of a sliding door. As can be seen, in the vicinity of the upper edge of the panel 10.1 two or more pairs of opposing wheels 12.1 are fixed, enclosed together with the upper edge of the panel 10.1 within a slide guide 14.1 formed from a steel profile bar of box cross-section (so-called "omega"). The guide 14.1 extends horizontally, is open lowerly and presents two downwardly facing free edges 16.1. On the face of this latter, respective thermo-expanding gaskets 20.1 are arranged which, in the case of fire, increase in volume to prevent the hot smoke from seeping into the guide 14.1 and hence passing beyond the door.

[0005] From the hot smoke sealing aspect, this solution has proved effective and satisfies regulations, even though such a guide is quite costly. In this situation it is however difficult to adjust the wheels 12.1.

[0006] Consequently the solution of Figure 2 was then conceived, in which the door panel 10.2 is suspended by ties 24 from trolleys provided with pairs of wheels 12.2 which can slide within a guide similar to that of Figure 1 but with its free edges facing upwards. In this case the seal against the hot smoke is provided by a separate device, consisting very simply of a first profile bar of Z cross-section, indicated by 16.2, which is fixed (for example by expansion plugs) to the constructional element 22 of the building, and by a second profile bar of L cross-section, indicated by 18.2, one side of which is fixed to the upper edge of the panel 10.2. On those parts which face the profile bars 16.2 and 18.2, thermo-expanding gaskets (not shown in Figure 2 for simplicity) are applied which, as in the preceding case, increase in volume in case of fire, to prevent the hot smoke from passing beyond the door.

[0007] Although this solution enables the wheels 12.2 to be more easily adjusted, there is the drawback that the guide 14.2 itself is still fairly costly.

To reduce costs, slide guides of much simpler cross-section were subsequently proposed and widely used, of the type shown schematically in Figure 3, consisting essentially of a steel profile bar 14.3 of U cross-section but with the sides of the U of different length, the longer side enabling it to be fixed (for example by expansion plugs shown schematically and indicated by 26) to the constructional element 22 of the building. The upper edge 24 of the other side of the U-shaped profile bar 14.3 acts as a track for grooved wheels 12.3 from which the panel 10.2 is suspended by ties 30. In a variant of this type of guide, that edge thereof acting as the track is bent over to provide a cross-section of curved profile matching the profile of the groove in the wheels 12.3.

[0008] As can be seen, the seal device shown in Figure 3 is very similar to that of Figure 2 (this latter could also be used in this case, if desired), with the only difference that instead of the Z-shaped profile bar, the U-shaped profile bar 16.3 is used. Again, the usual thermo-expanding gaskets (not shown for simplicity) are provided.

[0009] Figure 4 shows an even simpler variant of the described hot smoke seal device, also usable with the guide 14.3. of Figure 3. As can be seen, this device still comprises a first U-shaped profile bar 16.4, but disposed inverted and fixed directly to the guide 14.3, and a flat second profile bar 18.3 applied to a side of the panel 10.2 to project vertically upwards from the upper edge of the panel 10.2. Thermo-expanding gaskets are again provided, not shown for simplicity.

[0010] Experience gained with time has shown that if a fire effectively occurs, the smoke seal devices of Figures 2-4 present a serious common drawback. In this respect, it has been found that in the case of fire (assuming that the fire occurs on the right side of the panel 10.2), because of the expansion of the materials forming the door, the upper edge of the panel 10.2, or at least a part thereof, tends to gradually move towards the right. Consequently, the constituent profile bars of the smoke seal device (16.2 and 18.2, 16.3 and 18.2, 16.4 and 18.3 respectively, going from Figure 2 to Figure 4) withdraw from each other in a substantially horizontal direction, to firstly make mutual contact and then, as the phenomenon continues, to deform to the extent of becoming unhooked, to leave a space open through which the hot smoke can pass. It has been found that this problem cannot be prevented by providing stronger profile bars, as it is not possible to use profile bars of greater thickness than a determined limit, neither is it convenient to use high strength steels.

[0011] An object of the present invention is therefore to provide a hot smoke seal device for sliding fire doors which does not present the aforescribed drawback.

[0012] This object is attained by the hot smoke seal device of the present invention, comprising at least two metal profile bars, of which a first profile bar is directly or

indirectly fixed to the building in which the door is provided, while the second profile bar is fixed to the upper edge of the door panel, the two profile bars having parts intended to mutually interfere in the case of fire, thermo-expanding gaskets being provided in correspondence with these parts, characterised in that the cross-section through at least one of the two profile bars is deformable in order to maintain mutual interference, notwithstanding the horizontal withdrawal of the upper edge of the door panel in the case of fire.

[0013] If the conventional steel normally used in these cases is used for the profile bars of the aforescribed seal device, by choosing a sufficiently slim cross-section for one or both of the profile bars, this is able to support a sufficiently large deformation such that the two profile bars do not become unhooked from each other.

[0014] According to one embodiment of the device of the present invention, the first profile bar has a hook-shaped cross-section, the profile bar being fixed directly or indirectly to the structural element only in the vicinity of its upper edge; whereas the second profile bar has an L-shaped cross-section, one side of the L being intended to interfere with the hook-turned lower part of the first profile bar.

[0015] Those parts of the two profile bars intended to mutually interfere are, obviously, provided with conventional thermo-expanding gaskets.

[0016] The invention will be more apparent from the ensuing description of one embodiment thereof given by way of example. In this description reference is made to the accompanying Figure 5, which shows a cross-section through a slide guide provided with a hot smoke seal device of the invention.

[0017] As can be seen from Figure 5 (in which parts equal or similar to those of the preceding figures are indicated by the same reference numeral), the slide guide is substantially of the type shown in Figures 3 and 4 (and is hence again indicated by 14.3), although in this specific case the relative steel profile bar presents an outwardly and downwardly turned edge 24, this edge forming the slide track for the wheels. As can be seen, the slide edge 24 has an arched profile matching the profile of the groove in the wheels 28 which form part of trolleys which, by means of ties 30, support the panel 10.2 of a fire door.

[0018] The relative hot smoke seal device comprises a first steel profile bar 16.3 of hook-shaped or rather G cross-section. In this specific case the first profile bar 16.3 is fixed directly to the slide guide 14.3 (and hence indirectly to the structural element 22) by bolts 32, so that in practice it is suspended below this latter, even though it adheres via its left side to the structural element 22.

[0019] A downwardly facing side of a second steel profile bar 18.2 of L cross-section is inserted into the hook-shaped lower part of the first profile bar 16.3, the longer side of the L being fixed by screws 34 to the upper edge of the door panel 10.2.

[0020] As stated, in the case of fire the upper edge of the door panel 10.2 gradually moves towards the right

(with reference to Figure 5), to drag the second profile bar 18.2, the vertical side of which hence interferes (via the interposed thermo-expanding gaskets 36) with the free end part of the first profile bar 16.3. With the increasing rightward movement of the panel 10.2 with time, if the sheet metal of the first profile bar 16.3 is fairly thin and the steel used is not high-strength (the usual conventional steel for this purpose being particularly used) and if the distance between the region of interference between the two profile bars 16.3 and 18.2 and the fixing region of the first profile bar 16.3 is sufficiently large, it happens that the first profile bar 16.3 firstly deforms and follows the movement of the second profile bar 18.2 without interference between the two profile bars being interrupted. In this respect, that vertical wall of the first profile bar 16.3 adjacent to the structural element 22 deforms, this deformation preventing the two profile bars from separating.

[0021] Alternatively, the first profile bar can be fixed directly to the structural element 22 (for example by expansion plugs), but at the highest point of its cross-section. In this case the cross-section through the first profile bar can conveniently be of U shape but with the arms of the U decidedly unequal, the longer arm of the U being that adjacent to the structural element 22 and having a length sufficient to be able to deform to an extent enabling the first profile bar to follow the movement of the second profile bar 18.2 without separating therefrom when the door panel moves as the result of a fire.

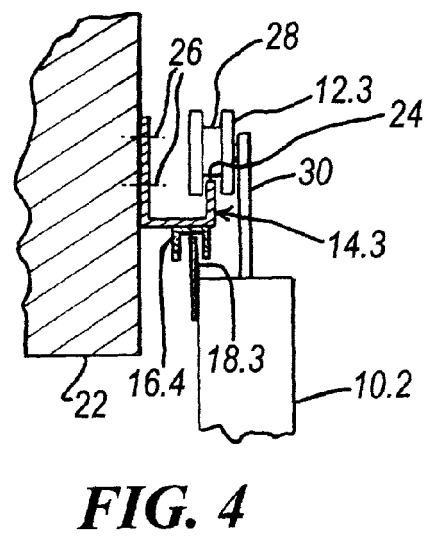
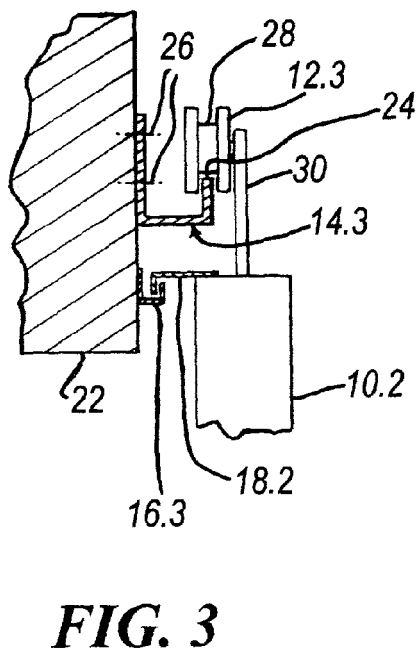
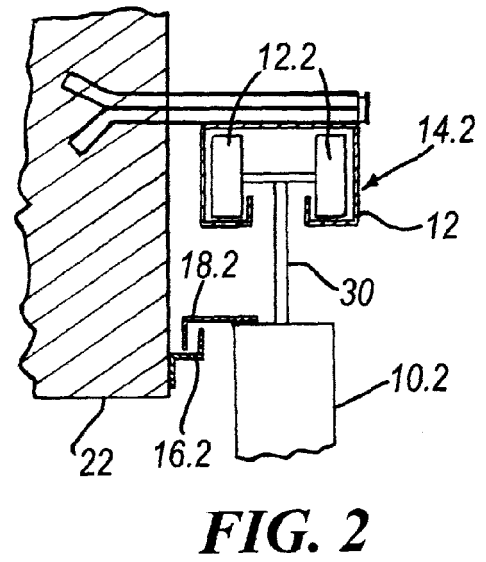
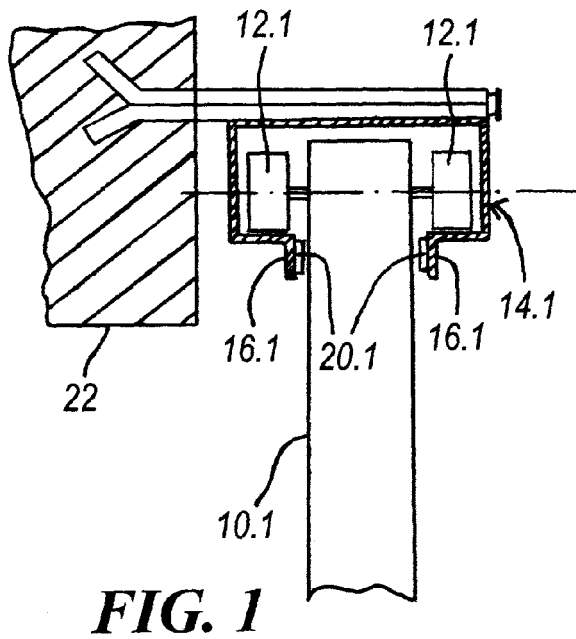
[0022] The device of the present invention can be formed in a different manner from the aforescribed. In particular it can be of the type shown in Figure 4, in which the second profile bar 18.3, being a flat profile bar, must have a cross-section of such thickness and height as to enable it to deform without separating from the inverted U-shaped first profile bar 16.4 as the result of a fire.

[0023] Relative thermo-expanding gaskets are again provided in this case.

Claims

1. A hot smoke seal device for sliding fire doors provided in a building (22), comprising at least two metal profile bars (16.3, 18.2), of which a first profile bar (16.3) is directly or indirectly fixed to the building (22) in which the door is provided, while the second profile bar (18.2) is fixed to the upper edge of the door panel (10.2), the two profile bars (16.3, 18.2) having parts intended to mutually interfere in the case of fire, thermo-expanding gaskets (36) being provided in correspondence with these parts, **characterised in that** the cross-section through at least one (16.3) of the two profile bars (16.3, 18.2) is deformable in order to maintain mutual interference notwithstanding the horizontal withdrawal of the upper edge of the door panel (10.2) in the case of fire.

2. A hot smoke seal device as claimed in claim 1, wherein the first profile bar (16.3) has a hook-shaped cross-section, whereas the second profile bar (18.2) has an L-shaped cross-section, one side of the L facing downwards and being intended to interfere with the hook-turned lower part of the first profile bar (16.3). 5
3. A hot smoke seal device as claimed in claim 2, wherein the cross-section through the first profile bar (16.3) is G-shaped, the first profile bar (16.3) being fixed, in the vicinity of its upper edge, to the slide guide (14.3) such as to be suspended below this latter (14.3). 10 15
4. A hot smoke seal device as claimed in claim 2, wherein the first profile bar (16.3) is fixed, in the vicinity of its upper edge, to the building (22).
5. A hot smoke seal device as claimed in claim 1, wherein the first profile bar (16.4) has an inverted U cross-section and is fixed below the slide guide (14.3), the second profile bar (18.3) being a flat profile bar, fixed to the upper edge of the door panel (10.2) in such a manner as to project vertically upwards therefrom such that its upper part enters the first profile bar (16.4). 20 25 30 35 40 45 50 55



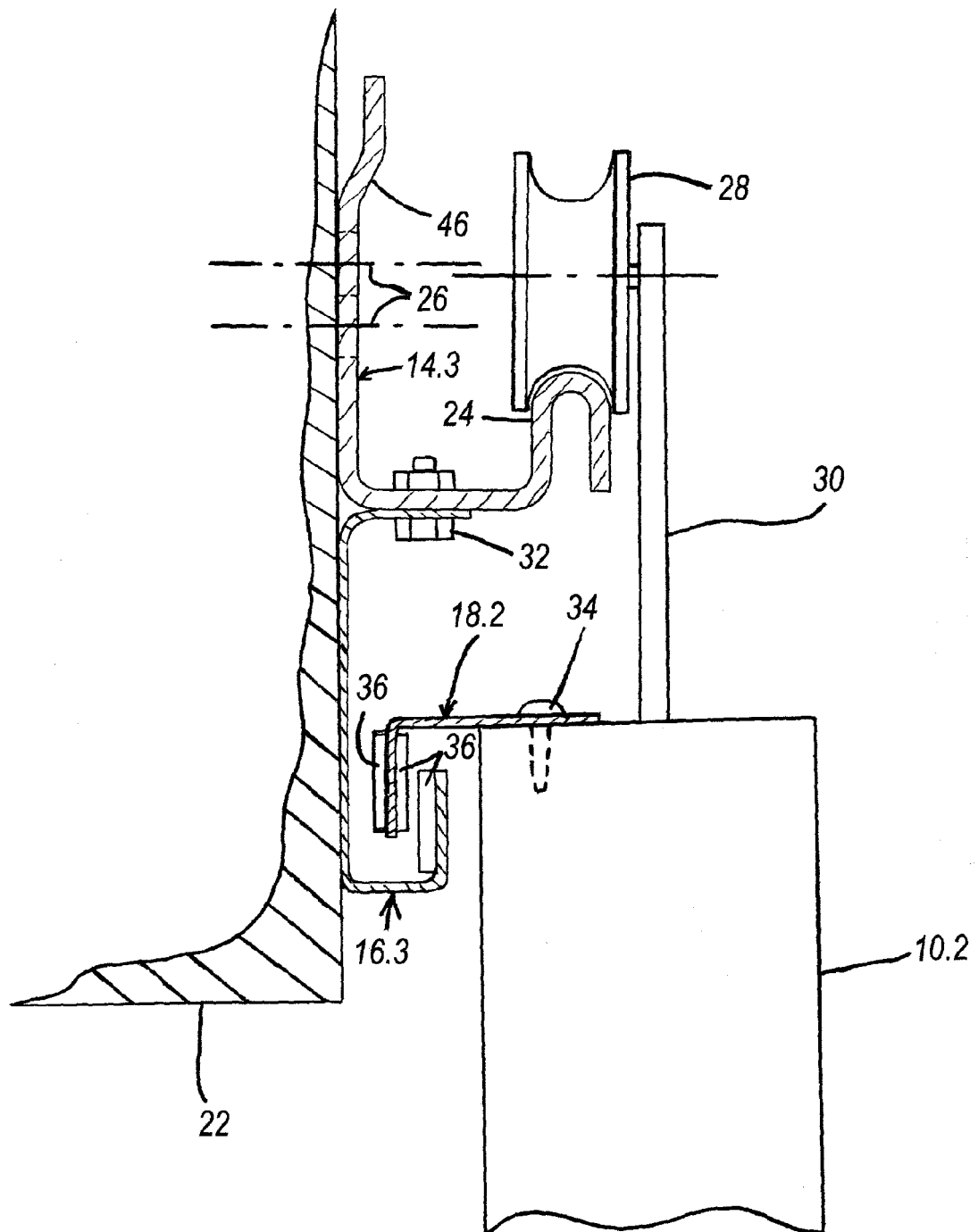


FIG. 5