

SPECIFICATION

DOOR UNIT OF ELEVATOR

5 TECHNICAL FIELD

The present invention relates to the improvement of a door unit for preventing smoke from passing through a landing entrance of an elevator into a hoistway or vice versa. "The infiltration of smoke" hereinafter means one of the passage
10 of smoke through the landing entrance into the hoistway and the passage of smoke through the hoistway into the landing entrance, or both of these.

BACKGROUND ART

15 The conventional unit is proposed in FIGS. 3 to 5. FIG. 3 is a front view of the conventional door unit for an elevator. FIG. 4 is a view on arrow A-A shown in FIG. 3. FIG. 5 is a view on arrow B-B shown in FIG. 3.

With reference to the drawings described above, the
20 numeral 101 indicates a landing door to be opened in opposite directions at an elevator landing entrance, 102 is a vertical frame of the entrance, 103 is an upper frame of the entrance, 104 is a sill. The vertical frame 102, the upper frame 103 and the sill 104 define an opening of the landing entrance.

The numeral 105a indicates a smoke shielding member which is provided on a side portion of the door 101 and for closing a gap between the door 101 and the vertical frame 102, 105b is a smoke shielding member for closing a gap between the door
5 101 and the upper frame 103, 105c is a smoke shielding member which is inserted into a groove 104a of the sill 104 and for closing a gap thereof. The numeral 106 indicates a screw for mounting the smoke shielding members 105a, 105b, 105c.

With the door unit thus constructed, the smoke
10 shielding members 105a, 105b, 105c provided around the door 101 close gaps between the door and the entrance vertical frame 102, between the door and the entrance upper frame 103, and between the door and the sill 104 when the door is closed, to thereby prevent smoke from flowing into a hoistway
15 even in the event of a fire, whereby the smoke is not distributed to other floor levels through the hoistway (e.g., JP-U No. 79184/1975, JP-A No. 112389/1988).

With the conventional unit, the smoke shielding members 105a, 105b, 105c are always in contact with members opposed
20 to the smoke shielding members, so that the smoke shielding members are caused to wear with normally opening-closing the door, necessitating a proper maintenance work. Furthermore it is extremely difficult to smoothly open/close the landing door 101, to always cause trouble with sliding noise.

Furthermore there is a recent increase in the number of elevators having no machine room, i.e., elevators having equipments installed in the hoistway, such as a drive motor or a control panel to be a source of a fire, (so-called
5 machine-roomless elevators). The interior of the building also becomes a source of fire when a fire breaks out. Therefore, there is a need to take measures for preventing properly the infiltration of smoke regardless of whether the smoke flow comes from the landing hall or from the hoistway.
10 Furthermore, with the conventional unit, as shown in FIG. 6, three or more members are opposed, particularly, at a gap 107 between door stopping portions provided upward or downward of the landing doors 101 and at positions indicated by arrows in FIG. 18, so that it is indispensable to provide device to
15 close the gaps for preventing properly the infiltration of smoke.

In view of the foregoing problems, an object of the present invention is to provide a door unit of an elevator having an excellent smoke shielding performance without
20 causing trouble in a normal door opening-closing operation.

DISCLOSURE OF THE INVENTION

According to the present invention, in an elevator comprising an entrance frame provided on an entrance leading

from a landing hall to a hoistway, having an upper frame and a vertical frame, and landing doors arranged with gaps between the entrance frame and the landing doors, to be guided by a sill for opening-closing an opening of the entrance frame, a smoke shielding member is provided, for preventing the infiltration of smoke, on at least one of a top portion of the landing doors and a member opposed to the top portion of the landing doors, on at least one of a side portion of the landing doors and a member opposed to the side portion of the landing doors, and on at least one of a bottom portion of the landing doors and a member opposed to the bottom portion of the landing doors.

Further according to the present invention, in an elevator comprising an entrance frame provided on an entrance leading from a landing hall to a hoistway, having an upper frame and a vertical frame, and landing doors arranged with gaps between the entrance frame and the landing doors, to be guided by a sill for opening-closing an opening of the entrance frame and having a high-speed door and a low-speed door, a smoke shielding member is provided, for preventing the infiltration of smoke, on at least one of a top portion of the high-speed door and the low-speed door and a member opposed to the top portion of the high-speed door and the low-speed door, on at least one of a side portion of the

high-speed door and the low-speed door and a member opposed to the side portion of the high-speed door and the low-speed door, and on at least one of a bottom portion of the high-speed door and the low-speed door and a member opposed to the
5 bottom portion of the high-speed door and the low-speed door.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing an overall structure of a door unit of an elevator;

10 FIG. 2 is a plan view showing a first embodiment of the door unit embodying the present invention;

FIG. 3 is a front view of a smoke-shielding landing door unit for use in the conventional elevator;

FIG. 4 is a view on arrow A-A shown in FIG. 3;

15 FIG. 5 is a view on arrow B-B shown in FIG. 3;

FIG. 6 is a diagram for describing the problems of the conventional technology;

FIG. 7 is a fragmentary front view of the lower door unit shown in FIG. 2;

20 FIG. 8 is a fragmentary front view of the upper door unit shown in FIG. 7;

FIG. 9 is an enlarged view of a P-portion shown in FIG. 2;

FIG. 10 is an enlarged view of a Q-portion shown in

FIG. 7;

FIG. 11 is a view on arrow A-A shown in FIG. 7;

FIG. 12 is a view on arrow B-B shown in FIG. 7;

FIG. 13 is a view on arrow C-C shown in FIG. 7;

5 FIG. 14 is an enlarged view of an R-portion shown in
FIG. 8;

FIG. 15 is a view on arrow D-D shown in FIG. 14;

FIG. 16 is an enlarged exploded perspective view and a
fragmentary front view illustrating the relationship among
10 the landing door, vertical frame and the upper frame;

FIG. 17 is a view corresponding to FIG. 15 and showing
another example of the present invention;

FIG. 18 is a diagram for describing the problems of the
conventional technology;

15 FIG. 19 is another enlarged exploded perspective view
and another fragmentary front view illustrating the
relationship among the landing door, vertical frame and the
upper frame;

FIG. 20 is a plan view showing a gap between the door
20 and the upper frame and a gap between the doors;

FIG. 21 is a side elevation showing a gap between the
door and the upper frame;

FIG. 22 is a side elevation illustrating a state
wherein a smoke flowing path is closed by a bracket;

FIG. 23 is a perspective view illustrating a state wherein a gap between the doors is closed by the smoke shielding member;

FIG. 24 is a front view showing a second example of the
5 door unit embodying the present invention;

FIG. 25 is an enlarged view on arrow A-A shown in FIG.
24;

FIG. 26 is an enlarged view on arrow B-B shown in FIG.
24;

10 FIG. 27 is a view on arrow C-C shown in FIG. 24;

FIG. 28 is an enlarged view of a Z-portion shown in
FIG. 27;

FIG. 29 is a view on arrow D-D shown in FIG. 27;

FIG. 30 is a view on arrow E-E shown in FIG. 24;

15 FIG. 31 is a fragmentary view on arrow F-F shown in
FIG. 27;

FIG. 32 is a perspective view showing the relationship among a high-speed door, an upper frame and a vertical frame;

FIG. 33 is a plan view of FIG. 32;

20 FIG. 34 is a perspective view showing the relationship between an upper portion of the low-speed door on the side of the high-speed door and the upper frame;

FIG. 35 is a perspective view and an enlarged fragmentary view showing the relationship among the low-speed

door, the upper frame and the vertical frame;

FIG. 36 is a diagram illustrating the effect of the present embodiment;

FIG. 37 is a diagram showing another construction
5 example of the present embodiment;

FIG. 38 is an overall view of a lock assembly of the door unit in a third embodiment of the present invention;

FIG. 39 is a view on arrow B-B shown in FIG. 38;

FIG. 40 is a diagram for illustrating the operation of
10 the lock assembly;

FIG. 41 is a fragmentary front view showing the door unit of the present invention;

FIG. 42 is a left side elevation of FIG. 40;

FIG. 43 is a front view showing another example of the
15 door unit;

FIG. 44 is a right side elevation of FIG. 43;

FIG. 45 is a front view showing another example of a device for increasing door-closing force;

FIG. 46 is a front view showing further another example
20 of a device for increasing door-closing force;

FIG. 47 is a sectional view showing a smoke shielding mechanism;

FIG. 48 is a sectional view showing a structure of the upper smoke shielding mechanism;

FIG. 49 is a sectional view showing a smoke-shielding member provided on an upper portion;

FIG. 50 is a sectional view showing a structure of the lower smoke shielding mechanism;

5 FIG. 51 is a sectional view showing a smoke-shielding member provided on a lower portion.

BEST MODE FOR CARRYING OUT THE INVENTION

First Embodiment

10 With reference to the drawings, a first embodiment of a door unit of an elevator of the present invention will be described below.

As seen in FIG. 1, an elevator comprises an upper frame 103 and a pair of opposite vertical frames 102, 102 which
15 define an opening leading from a landing to a hoistway. The opening is provided with a pair of opposite landing doors 110, 110 which are opened laterally from the center. The doors 110, 110 are hung on a pair of hangers 109, 109 reciprocally movably engaged with a rail 4. A sill 104 is
20 provided on a lower edge of the opening. Lower ends of the doors 110, 110 are slidably fitted into the sill 104.

FIG. 2 is a perspective plan view showing the door unit of the present embodiment. FIG. 7 is a fragmentary front view of the lower door unit shown in FIG. 2. FIG. 8 is an

upper fragmentary front view of the door unit shown in FIG. 7. FIG. 9 is an enlarged view of a P-portion shown in FIG. 2. FIG. 10 is an enlarged view of a Q-portion shown in FIG. 7. FIG. 11 is a view on arrow A-A shown in FIG. 7. FIG. 12 is a view on arrow B-B shown in FIG. 7. FIG. 13 is a view on arrow C-C shown in FIG. 7. FIG. 14 is an enlarged view of an R-portion shown in FIG. 8. FIG. 15 is a view on arrow D-D shown in FIG. 14. FIG. 16 is an enlarged exploded perspective view and a fragmentary front view illustrating the relationship between the landing door 110 and vertical frame 102.

In FIGS. 3 to 6, like parts are designated by like reference numerals or symbols. In FIG. 8, the numeral 110 indicates a door hung on a door hanger 109, 110a in FIGS. 2, 7, 9, 10 and 12 are guide shoes to be guided by a groove 104a of the sill 104 and which is attached to a bottom portion of the door 110 with a bracket 110b shown in FIG. 12. The numeral 111 in FIGS. 10 and 11 indicates smoke shielding members comprising a pair of projections spreading toward an outer end, for example, and made of fire retardant rubber. The smoke shielding members are attached to the bottom portion of the landing door 110 with a bracket 110c so as to be fitted into a recess portion, and are provided on portions besides the portions to which guide shoes 110a are attached.

The landing door 110 is given a door-closing force by a weight at all times, as not illustrated but already known.

In FIGS. 10 and 13, the numerals 112, 112' indicate rubber door stoppers which are provided on a side portion of the landing doors 110 and further serve as smoke shielding members. The rubber door stopper so hangs downward as to be inserted into the groove 104a of the sill 104, i.e., the rubber door stopper hangs downward toward a position wherein the rubber door stopper covers an end of the smoke shielding member 111. The rubber door stoppers 112, 112' and the smoke shielding members 111 are so arranged as to be positioned on the same vertical plane, for example, and are arranged as contactable with each other. One of the rubber door stoppers 112, 112' is formed with a recess while the other is formed with a projection, for example, so that the two rubber door stoppers are firmly in intimate contact with each other when the landing doors 110 are closed. The two rubber door stoppers are therefore brought into contact with each other with no space therebetween.

The smoke shielding member 111 is bendable so that outer ends of a pair of its projections are not in contact with side walls of the groove 104a when the door is being opened or closed to thereby suppress the occurrence of wear at the outer ends of the smoke shielding member 111 when the

door is normally being opened or closed. In the event of a fire, air in space on fire is thermally expanded to force out high-pressure air containing smoke through a bottom portion of the door. When the air flows into the smoke shielding member 11 provided on the bottom portion of the door, the projection of the smoke shielding member adjacent to a room not on fire is pressed against a side wall of the groove 104a, to thereby reliably ensure the sufficient airtightness in accordance with a direction of smoke flow. In this case when the landing doors 110 are closed, the rubber door stoppers 112, 112' and the smoke shielding members 111 are moderately in contact with each other by the door-closing force to thereby close a bottom gap with the aforementioned operational advantage. The smoke shielding member 111 can be formed so that the outer ends of a pair of projections are bent slightly inwardly. It is also possible to eliminate a hanging portion of the rubber door stoppers 112, 112' by moderately bringing the smoke shielding members 111 provided on the landing doors 110 into contact with each other when the right and left landing doors 110 are closed.

On the other hand, the numerals 113, 113' in FIG. 14 indicate smoke shielding members provided on upper ends of the landing doors 110. As in the same manner of the rubber door stoppers 112, 112', the smoke shielding members 113,

113' are brought into contact with each other with no space therebetween by forming a recess with one of the smoke shielding members 113, 113' and a projection with the other so that the two members are firmly in intimate contact with each other when the landing doors 110 are closed. The provision of the rubber door stoppers 112, 112' and the smoke shielding member 113 which is arranged on a position in contact with the rubber door stoppers 112, 112' reliably eliminates an upper gap when the landing doors 110 are closed. Accordingly, when the landing doors 110 are closed, the door closing force not only closes a gap between the landing doors 110, but moderately closes the gaps on the top and bottom portions. The structure leaving no space between any components is not limited to the embodiment wherein the projection is fitted into the recess, but various structures can be considered.

In FIGS. 8 and 15, the numeral 120 indicates, for example, a hollow smoke shielding member which is slopingly mounted on an upper end of the landing door 110 and which is removably inserted into a U-groove bracket 114. The smoke shielding member 120 is so arranged slopingly as to be positioned at a higher level as being away from the vertical frame 102. The numeral 121 indicates a stop board which is adjustable in a direction perpendicular to the upper frame

103. The stop board 121 is brought into contact with the smoke shielding member 120 when the landing door 110 is closed to close a gap therebetween. The stop board 121 is also so arranged slopingly as to be positioned at a higher
5 level as being away from the vertical frame 2. It is possible to eliminate the smoke shielding members 113, 113' by the arrangement wherein the smoke shielding members 120 provided on the opposed landing doors 110 are in contact with each other when the pair of landing doors 110 are closed.

10 Next, FIG. 16(a) is an enlarged exploded perspective view showing the relationship among the landing door 110, the vertical frame 102 and the upper frame 103. FIG. 16(b) is a fragmentary front view of FIG. 16(a). The numeral 115 indicates an L-shaped bracket provided on the side portion of
15 the landing door 110. A smoke shielding member 130 is removably inserted into a U-shaped groove bracket 132 provided on a bracket 131. The bracket 131 having the smoke shielding member 130 is attached to the bracket 115 as adjustable widthwise of the landing door 110 through a long
20 hole 115a. Therefore the smoke shielding member 120 is always in contact with the smoke shielding member 130. The smoke shielding member 120 and the smoke shielding member 130 are most preferably provided on the same vertical plane. The numeral 122 indicates a bracket provided on the vertical

frame 2 so that the bracket extends upwardly. The upper frame 103 is placed on the vertical frame 102 such that the upper frame 103 covers the vertical frame 102, so that the bracket 122 is so arranged as to cover a part of the side
5 portion of the upper frame 103. The numeral 140 indicates a cover for covering an upper portion of the smoke shielding member 130. When the landing door 110 is being closed, the smoke shielding member 130 is pressed into contact with one surface of the bracket 122, whereby the provision of the
10 smoke shielding member 120 and the smoke shielding member 130 properly closes a gap among the landing door 110, the vertical frame 102 and the upper frame 103.

Taken as another example is an arrangement shown in FIG. 19. An L-shaped bracket 115', a bracket 131' and smoke
15 shielding member 130 each merely has the same height level as that of the vertical frame 102, so that an L-shaped bracket 133 having rubber applied to its mounting surface and the bracket is arranged on the same plane as the smoke shielding member 120 and the smoke shielding member 130, covers
20 simultaneously both the side of the upper frame 103 and the upper surface of the vertical frame 102 to thereby eliminate the gap.

Accordingly, when a pair of the landing doors 110 are closed, the gap between the vertical frame 102 and the

landing door 110 is closed by the smoke shielding member 130, the gap between the upper frame 103 and the landing door 110 is closed by the smoke shielding member 120, the gap between the landing doors 110 is closed by the rubber door stopper
5 112, 112', the gap between the landing doors 110 and the sill 104 is closed by the smoke shielding member 111, the gap between the landing doors 110 and the sill 104 is closed by the smoke shielding member 111 and the rubber door stopper 112, 112', the gap between the landing doors 110 and the
10 upper frame 103 is closed by the rubber door stopper 112, 112', and the smoke shielding member 113, 113' or the smoke shielding members 120. This can reliably prevent the passage of the smoke through a landing hall into the hoistway or through the hoistway into the landing hall.

15 The material and shape of the smoke shielding members 120, 130 and the smoke shielding member 111 should be determined in accordance with the respective roles, functions and characteristics. As to the smoke shielding member 130, a surface of the member 130 is merely pressed, so that only the
20 smoke shielding performance should be fulfilled while the consideration of the movement with friction is not particularly required. On the other hand, as to the smoke shielding member 111, relative motion between the member 111 and the sill 104 always occurs with door opening-closing

operation, so that there is a need to consider not only the smoke shielding performance but friction (including the problem of vibration and noise), and function for performing a smooth sliding operation is required. Furthermore, the smoke shielding member 120 is subject to friction due to relative motion between the stop board 121 and the member 120 just before the door is fully closed, so that the smoke shielding member 120 needs to have a function for performing a smooth sliding operation, although its smoothness is not as good as that of the smoke shielding member 111. Therefore, the smoke shielding member 120 desirably has both the smoke shielding performance and sliding performance.

In the event of a fire, temperature and pressure are particularly variable. Therefore it is effective that the members to be deformed due to the variations of temperature and pressure, e.g., the smoke shielding members 120, 130 are such that a hollow portion is slightly expanded, or said members, e.g., the smoke shielding member 111 are such that a pair of projections are deformed in accordance with a direction of smoke flow. Furthermore in addition to the case wherein the shape of the smoke shielding member is altered in accordance with pressures difference, the same effect can be obtained, for example, by the arrangement wherein the member (U-groove bracket, etc.) for supporting the smoke shielding

member is movable. The specification on the smoke shielding performance provides that the smoke leakage be not greater than $0.2 \text{ m}^3/\text{min} \times \text{m}^2$ when pressure difference between opposite sides of the door is 19.6 Pa, so that complete smoke shielding performance is not required, and therefore the members are not necessarily in complete intimate contact with each other.

FIG. 17 shows the case wherein used as the smoke shielding member 120' is the same member as the smoke shielding member 111. Thus sharing parts as much as possible reduces the number of parts, hence convenience. However, in accordance with characteristics, roles, functions which the members are required to be provided with, materials and shapes can be suitably selected and determined.

With the first embodiment described, there exists a gap between the upper frame 103 and the door 110, as shown in FIGS. 20 and 21. Even if smoke is passed through the gap into a header, the brackets 122, 133 shown in FIGS. 16 and 19 block a smoke path indicated by hatching shown in FIG. 22 to prevent the smoke from passing therethrough horizontally. Furthermore, there exists a gap G (about 2 mm) between a pair of doors 110, 110, but the gap G is closed by the smoke shielding member 113, 113' shown in FIG. 23 to prevent smoke from flowing upwardly.

Further, with the first embodiment described, there is very few likelihood of interferences such as vibration or noise with usual opening-closing operation of the door. The door closed state reliably blocks the gap between the landing
5 door and the entrance frame or between the landing door and the sill in accordance with the occasions, so that even if a fire breaks out at any time, the infiltration of smoke can be properly blocked. Furthermore there is no need to provide a special drive system or device for the function of smoke
10 shielding and smoke prevention. The device of the present embodiment has an advantage of being additionally employed in existing elevators.

Second Embodiment

With reference to the drawings, a second embodiment of
15 the present invention will be described below.

FIG. 24 is a front view showing an example of an elevator-landing door embodying the present invention. FIG. 25 is an enlarged view on arrow A-A shown in FIG. 24. FIG. 26 is an enlarged view on arrow B-B shown in FIG. 24. FIG.
20 27 is a view on arrow C-C shown in FIG. 24. FIG. 28 is an enlarged view of Z-portion shown in FIG. 27. FIG. 29 is a view on arrow D-D shown in FIG. 27. FIG. 30 is a view on arrow E-E shown in FIG. 24. FIG. 31 is a fragmentary view on arrow F-F shown in FIG. 27. FIG. 32 is a perspective view

showing the relationship among a high-speed door 311, an upper frame 301 and a vertical frame 302. FIG. 33 is a plan view of FIG. 32. FIG. 34 is a perspective view showing the relationship between an upper portion of the low-speed door 312 on the side of the high-speed door 311 and the upper frame 301. FIG. 35 is a perspective view and an enlarged fragmentary view showing the relationship among the low-speed door 312, the upper frame 301 and the vertical frame 302.

In FIG. 24, the numerals 311 and 312 indicate single open doors which are respectively hung on door hangers 307, 308. The door moving with high-speed is a high-speed door 311, and the door moving with low-speed is a low-speed door 312. Guide shoes 311a, 312a are respectively guided by grooves 305a, 305b of a sill 305 shown in FIG. 26. The landing doors 311, 312 are respectively given a door-closing force by a weight or a spring at all times, as not illustrated but well known. Incidentally the door 312 has an end portion adjacent to the opposite door 311 which is slightly bent owing to the reason to be described below.

In FIGS. 27 and 32, the numeral 313 indicates a rubber door stopper which is provided on the door 311 adjacent to an opposite door 312. The numeral 314 indicates a rubber door stopper which is provided on the vertical frame 302 as opposed to the rubber door stopper 313. One of the rubber

door stoppers 313, 314 is formed with a recess while the other is formed with a projection so that the two rubber door stoppers are firmly in intimate contact with each other. The two rubber door stoppers are therefore brought into contact
5 with each other with no space therebetween as serving as smoke shielding members. The arrangement wherein the two rubber door stoppers are in contact with no space is not limited to the present embodiment, but various arrangements can be given besides fitting of the recess and the
10 projection.

In FIGS. 27 and 28, the numeral 315 indicates a smoke shielding member provided, with a bracket 315a, on an outer surface of the high-speed door 311 and adjacent to the low-speed door 312. The smoke shielding member 315 is in contact
15 with the door 312 when the landing door is closed, to seal a gap 301s. The end portion of the door 312 adjacent to the opposite door 311 is bent slightly (one dimension: l_1 , the other dimension: l_2 , $l_1 > l_2$) so that the smoke shielding member 315 is not in contact with the door 312 when the landing door
20 is opened. That is the door 312 has one side portion which is adjacent to the opposite door 311 and which is thinner than the other side portion. The numeral 341 to be described below indicates a smoke shielding member which is provided on an outer surface of the door 312 adjacent to the opposite

door 311. The smoke shielding member 341 is in contact with the vertical frame 302 when the landing door is closed, to seal a gap 302s.

In FIG. 26, the numerals 317, 318 indicate smoke
5 shielding members each comprising a pair of projections spreading toward an outer end, for example, and made of fire retardant rubber. The smoke shielding members 317, 318 are provided so as to be fitted into bottom recess portions of the doors 311, 312, and are mounted on portions besides the
10 portions on which guide shoes 311a, 312a are mounted as shown in FIG. 24. The smoke shielding members 317, 318 can be bent so that outer ends of a pair of projections are not in contact with side walls of sill grooves 305a, 305b when the door is being opened or closed to thereby suppress the
15 occurrence of wear of the outer ends of the smoke shielding members 317, 318 when normally opening-closing the door. In the event of a fire, air in space on fire is thermally expanded to force out high-pressure air containing smoke through a bottom portion of the door. When the air flows
20 into the smoke shielding members 317, 318 provided on the bottom end of the door, one of the projections of the smoke shielding members adjacent to space not on fire is pressed against side walls of the sill grooves 305a, 305b to thereby reliably ensure the sufficient airtightness in accordance

with a direction of smoke flow. The smoke shielding members 317, 318 can be formed so that the outer ends of a pair of projections are bent slightly inwardly.

In FIG. 25, the numerals 321, 322 indicate, for
5 example, hollow smoke shielding members which are slopingly mounted on an upper portion of the doors 311, 312 and which are removably inserted into U-groove brackets 323, 324 shown in FIG. 24. The smoke shielding members 321, 322 are so arranged slopingly as to be positioned at a higher level as
10 being close to a door closed position. The U-groove bracket 323 and the smoke shielding member 321 are arranged in a cutout 312b of the door 312. The numerals 325, 326 indicate stop boards which are adjustable in a direction perpendicular to the upper frame 301. The stop boards are brought into
15 contact with the smoke shielding members 321, 322 when the doors 311, 312 are closed to close gaps 303s, 304s. The stop boards 325, 326 are also so arranged slopingly as shown in FIG. 24.

In FIG. 32, the numeral 327 indicates a flat board for
20 covering an end portion of the board 325, and 328 is a base provided so as to be in contact with the flat board 327. A rubber door stopper 329 is mounted on the base 328. When the door 311 is being closed, the rubber door stoppers 313, 314 come into intimate contact with each other while there exists

a gap 303s between the door 311 and the vertical frame 302 in an upward direction as shown in FIG. 33. The rubber door stopper 329 covers the gap 303s to thereby close properly the gap 303s. Used as the rubber door stopper 329 is the same
5 member as the aforementioned rubber door stoppers 313, 314 according to the example, but the rubber door stopper 329 can be formed into a flat board.

In FIGS. 27, 31 and 34, the numeral 330 indicates a flat board for covering end portions of the smoke shielding
10 member 322, the stop board 326, and the U-groove bracket 324 when the door 312 is closed, and which is mounted on the upper frame 301 with an L-shaped bracket 331. In FIGS. 27, 28, 29 and 30, the numeral 332 indicates a flat board having an elastic body and which is arranged in a cutout portion of
15 the bracket 315a on an outer surface of a bottom end side of the door 311. The flat board 332 has a function for closing a gap 305s of a lower portion of the smoke shielding member 315 when the door 311 is closed. A flat board 333 having the same elastic body in shape and structure as that of the flat
20 board 332 is, as in the same manner, arranged in a cutout portion of the bracket 340 (to be described below) on an outer surface of a bottom end side of the door 312. The flat board 333 closes a gap 306s of a lower portion of the smoke shielding member 341 to be described below when the door 312

is closed. The shape and structure of the flat boards 332, 333 can be altered in accordance with occasions. Furthermore the flat boards 332, 333 are not limitedly mounted in the position as described in the embodiment.

5 In FIG. 35, the numeral 340 indicates an L-shaped bracket provided on an outer surface of a side portion of the door 312. A smoke shielding member 341 is removably inserted into a U-shaped groove bracket 343 provided on a bracket 342. The bracket 342 having the smoke shielding member 341 is
10 attached to the bracket 340 as adjustable widthwise of the door 312 through a long hole 340a. Therefore the smoke shielding member 322 is always in contact with the smoke shielding member 341. The smoke shielding member 322 and the smoke shielding member 341 are most preferably arranged on
15 the same vertical plane.

 The numeral 344 indicates a bracket provided on the vertical frame 302 such that the bracket extends upwardly. The upper frame 301 is placed on the vertical frame 302 such that the upper frame 301 covers the vertical frame 302, so
20 that the bracket 344 is so arranged as to cover a part of the side portion of the upper frame 301. The numeral 350 indicates a cover for covering an upper portion of the smoke shielding member 341. When the door 312 is being closed, the smoke shielding member 341 is pressed into contact with one

surface of the bracket 344, whereby the provision of the smoke shielding member 322 and the smoke shielding member 341 closes a gap 307s among the door 312, the vertical frame 302 and the upper frame 301.

5 Accordingly, when the landing doors 311, 312 are closed, a gap between the vertical frame 302 and the door 311 is closed by the rubber door stopper 313, the rubber door stopper 314 and the rubber door stopper 329, a gap between the door 312 and the vertical frame 302 is closed by the
10 bracket 344 and the smoke shielding member 341, a gap between the door 311 and the door 312 is closed by the flat board 332 and the smoke shielding member 315, a gap between the upper frame 301 and the door 311 is closed by the smoke shielding member 321, the stop board 325 and the rubber door stopper
15 329, a gap between the door 312 and the upper frame 301 is closed by the flat board 330, the smoke shielding member 322 and the stop board 326, a gap between the door 311 or the door 312 and the sill 305 is closed by the smoke shielding members 317, 318 and the flat board 332, 333, to thereby
20 reliably prevent the passage of smoke through the landing hall into the hoistway and the passage of smoke through the hoistway into the landing hall. Particularly the passage of smoke can reliably be blocked through gaps indicated by arrows in FIG. 36 wherein three or more components are

opposed to each other, whereby the smoke shielding effect is fully established.

The materials and shapes of the smoke shielding members 317, 318, the smoke shielding members 321, 322, and the smoke
5 shielding members 315, 341 should be determined in accordance with the respective roles, functions and characteristics. As to the smoke shielding members 315, 341, a surface of the members 315, 341 is merely pressed, so that only the smoke shielding performance should be fulfilled while the
10 consideration of the movement with friction is not particularly required. On the other hand, as to the smoke shielding members 317, 318, relative motion between the members 317, 318 and the sill 305 always occurs with door opening-closing operation, so that there is a need to
15 consider not only the smoke shielding performance but friction (including the problem of vibration and noise), and function for performing a smooth sliding operation is required. Furthermore, the smoke shielding members 321, 322 are subject to friction due to relative motion between the
20 stop boards 325, 326 and the members 321, 322 just before the door is fully closed, so that the smoke shielding members 321, 322 need to have a function for performing a smooth sliding operation, although its smoothness is not as good as that of the smoke shielding members 317, 318. Therefore, it

is desirable to have both the smoke shielding performance and sliding performance. The doors 311, 312 are closed as pressed against by the door stopping boards 325, 326 at ends of closed doors. This state occurs with friction, so that
5 the smoke shielding members 321, 322 are to be subject to a special work for improving wear resistance with low coefficient of friction. It is effective to apply to the side of the stop boards 325, 326, a tape, etc. having an excellent sliding performance.

10 In the event of a fire, temperature and pressure are particularly variable. Therefore it is effective that the members to be deformed due to the variations of temperature and pressure, e.g., the smoke shielding members 321, 322, 341 are such that a hollow portion is slightly expanded, or said
15 members, e.g., the smoke shielding members 317, 318 are such that a pair of projections are deformed in accordance with a direction of smoke flow. Furthermore in addition to the case wherein the shape of the smoke shielding member is altered in accordance with pressure difference, the same effect can be
20 obtained by the arrangement wherein the member (U-groove bracket, etc.) for supporting the smoke shielding member is movable. Furthermore the specification on the smoke shielding performance provides that the smoke leakage be not greater than $0.2 \text{ m}^3/\text{min} \times \text{m}^2$ when pressure difference between

opposite sides of the doors is 19.6 Pa, so that the smoke shielding performance is not completely required, and therefore the members are not necessarily in complete intimate contact with each other.

5 FIG. 37 shows the case wherein the members for use as the smoke shielding members 321', 322' are the same members as those for use as the smoke shielding members 317, 318. Thus sharing parts as much as possible reduces the number of parts, hence convenient. However, in accordance with
10 characteristics, roles, functions which the members are required to be provided with, materials and shapes can be suitably selected and determined.

 Further, with the second embodiment described, there is very few likelihood of interferences such as vibration or
15 noise with usual opening-closing operation of the door. The door closed state reliably blocks the gap between the landing door and the entrance frame, between the landing door and the sill, or between the doors, in accordance with the occasions, so that even if a fire breaks out at any time, the
20 infiltration of smoke can be properly blocked. Furthermore there is no need to provide a special drive system or device for the function of smoke shielding and smoke prevention. The device of the present embodiment has an advantage of being additionally employed in existing elevators.

Third Embodiment

FIG. 38 is an overall view showing an example of a lock assembly embodying the present invention. FIG. 39 is a view on arrow B-B shown in FIG. 38. FIG. 40 is a diagram for
5 illustrating the operation of the present invention unit.

The numeral 201 in the drawings indicates a landing door having a hollow member 211 arranged therein with a nut 212. The numeral 220 indicates a valve which is supported by, for example, a hinge mechanism and which is provided in
10 the landing door 201 so as to be opposed to a key hole 202 and which has a packing 220a closing an opening 211a of the hollow member 211 to thereby fulfill smoke shielding performance. The opening 211a is normally held closed by a torsion 220b. The hollow member provides a specified
15 distance from a surface of the landing door 210 to thereby prevent the control with a merely piece of wire and discourage tampering.

The numeral 230 indicates a lever for manipulating a lock fitting 240. The lever 230 has an end connected to the
20 lock fitting 240 and has the other end arranged, for example, around a lower portion of the hollow member 211. On the other hand, the numeral 250 indicates an unlock key embodying the present invention. The unlock key 250 is in the form of an L-shape, for example, and has an outer end bendable in a

specified direction. According to the embodiment illustrated, an outer end of the unlock key is bendable in the opposite direction to the L-shape.

Next, an unlocking operation of this assembly will be
5 described with reference to the drawings. First, an outer end of the unlock key 250 is inserted into a key hole 202 with one side part of the key 250 directed upward. Then the key 250 thrust deeply, to allow its outer end to extend through the hollow member 211, pressing rearward the packing
10 220a. This packing 220a turns backward against spring force of the torsion spring 220b as shown in FIG. 40(b) simultaneously when an end portion of the unlock key 250 is bent downward by its own weight and is then hung downward.

Subsequently, with reference to FIGS. 38 and 40(b), the
15 side part of the unlock key 250 in an upward direction is turned forward, bringing an end portion 250a into contact with the lever 230, to press the lever 230 rearward shown in FIG. 38, i.e., rotating the lever 230 in the direction of an arrow as shown in FIG. 39, to rotate upward the lock fitting
20 240, thereby unlocking the lock. Therefore opening the key hole 202 and unlocking the lock are organically linked. This makes it possible to open-close the landing doors so smoothly, whereby rescue and maintenance works can be performed readily. Incidentally, the provision of the hollow

member 211 and the arrangement relationship between the lever 230 and the hollow member 211 prevent the control with merely a piece of wire, to obviate tampering for opening the landing doors 210, but the other arrangement is also available
5 wherein the key hole 2 of the landing door is merely covered with the valve 220.

In this case, the outer end portion of the unlock key 250 is bent by its own weight. Alternately the outer end portion can also be bent in the opposite direction to the
10 opening direction of the valve 210. On the other hand, the other end of the lever 230 can be arranged not only around the lower portion, but around the opening side of the valve 210.

According to the third embodiment, the opening-closing
15 valve can reliably prevent the infiltration of smoke, keeping the smoke shielding performance extremely excellent. Furthermore unlocking the landing door can be performed so readily without any problem.

Fourth Embodiment

20 A door unit of the present embodiment has smoke shielding members 95, 96, which are respectively mounted on a bottom end portion of a door 110 and on a top portion of a rear surface of the door 110 as shown in FIG. 47. The upper smoke shielding member 96 comes into sliding contact with a

stop board 94 projecting from an upper frame 91 thereof, as shown in FIG. 48, while the door 9 is moved from a position in the vicinity of a fully closed position to a fully closed position, to block the smoke in the event of a fire. Further
5 the lower smoke shielding member 95 is slidably fitted into a groove of a sill 93 as shown in FIG. 50, blocking the smoke in the event of a fire.

The upper smoke shielding member 96 is made from synthetic resin and has a portion in sliding contact with the
10 stop board 94 and which is in the form of a ring in section as shown in FIG. 49. The smoke shielding member 96 has a surface subject to coating 96a by surface-activity-modifying treatment, e.g., silicon polymer, etc., thereby suppressing wear of the smoke shielding member 96 due to friction with
15 the stop board 94, and noise occurrence.

The bottom smoke shielding member 95 is made from synthetic resin and is formed in section such that a portion in sliding contact with the sill 93 spreads downward as shown in FIG. 51. The smoke shielding member 95 has a surface
20 subject to coating 95a by surface-activity-improving treatment, e.g., urethane polymer, etc., thereby suppressing wear of the smoke shielding member 95 due to friction with the sill 93 and noise occurrence. Various methods of surface-treatment of the smoke shielding members 96, 95 can

be adopted besides this method as long as the methods are excellent in slipperiness and wear-resistance. Furthermore, whereas the smoke shielding members 96, 95 are each surface-treated, only one of the members can be surface-treated.

5 A header 3 is mounted on an upper position of an opening leading from a landing hall to a hoistway as seen in FIG. 41. The header 3 is provided with a rail 4 horizontally. The rail 4 is movably provided with a pair of hangers 109, 109 along the rail 4. The header 3 has a pair
10 of pulleys 6, 7 arranged on opposite ends thereof. Wire 5 is wound around the pulleys 6, 7. Opposite ends of wire are connected to one of hangers 109. A grip 8 is secured to an intermediate position of wire 5 extending between the pulleys 6, 7. The grip 8 is connected to the other hanger 109. This
15 causes the two hangers 109, 109 to move in opposite directions to each other.

The two pulleys 6, 7 are supported in an inclined posture as shown in FIG. 42, whereby space is effectively used.

20 With reference to FIG. 41, the other hanger 109 aforementioned is provided with a lock assembly 10 for locking the door at a fully closed position. A spring 11 extends between the hanger 109 and the header 3. The pair of hangers 109, 109 are always biased by the spring 11 in a

door-closing direction.

Furthermore the other hanger 109 is coupled to a device 20 for increasing door-closing force embodying the present invention. With the device 20 for increasing door-closing
5 force, a cam 21 is secured to the header 3. An intermediate portion of the lever 23 is pivotally supported by a bracket 24 on the hanger 109. A spring 25 is connected to a base end of the lever 23. The lever 23 is always biased counterclockwise by the spring 25. A roller 22 is rotatably
10 supported on an outer end of the lever 23. The biasing force of the spring 25 presses the roller 22 into contact with the cam 21.

As described above, while one of the pair of hangers 109, 109 is provided with the device 20 for increasing door-
15 closing force, the other hanger 109 is provided with the lock assembly 10. Therefore, even though the wire 5 is cut due to the occurrence of fire, etc., the door supported by the one hanger 109 is held at a closed position owing to the operation of the device 20 for increasing door-closing force,
20 and the door supported by the other hanger 109 cannot be manually opened owing to the operation of the lock assembly 10. Thus the doors are held closed, hence safe.

The device 20 for increasing door-closing force can be provided with an adjusting mechanism for adjusting the

magnitude of door-closing force increasing and a position of the door at which the door-closing force starts to increase. For example, usable as the adjusting mechanism is one for shifting vertically or horizontally a position of a roller supporting mechanism comprising the roller 22 and the lever 5 23 and another one for adjusting the amount of initial deformation of the spring 25. This makes it possible to adjust readily the door-closing force on the site.

With reference to FIG. 41, indicated by chain double-dashed lines are the positions of the hangers 109, 109 and 10 the roller 22 in the door fully-opened state, while indicated by solid lines are the positions of the hangers 109, 109 and the roller 22 in the door fully-closed state. During the transition from the door fully-opened state to the door 15 fully-closed state, the roller 22 is first guided by a horizontal plane of the cam 21. At this time the spring 25 exerts on the roller 22 a reaction force perpendicular to the horizontal cam while a horizontal component does not occur, so that the door is biased by the spring 11 as in the case 20 with the conventional device to drive the door into the closing direction. Thereafter, right before the transition progresses to the door fully-closed state, the roller 22 is pressed into contact with an inclined cam surface of the cam 21 to exert on the roller 22 a reaction force perpendicular

to the inclined cam surface. The reaction force has a horizontal component, which biases the hanger 109 into the closing direction. Consequently the door-closing force by the bias of the spring 11 and the door-closing force by the horizontal component are simultaneously applied to the door to increase the door-closing force.

With the door unit described, while the door is moved from the position in the vicinity of the fully closed position to the fully closed position, the upper smoke shielding member 96 starts to be into sliding contact with the stop board 94 particularly right before the door fully-closed state, to exert a resistance force on the movement of the door. However, the device 20 for increasing door-closing force increases the door-closing force such that the magnitude of the door-closing force exceeds the resistance force, whereby the door is completely closed.

Furthermore, even though the great resistance force is exerted right before the door fully-closed state in the case where an outdoor elevator is greatly influenced by wind in opening-closing door or in other various cases, increasing the door-closing force by the device 20 for increasing door-closing force closes the door completely.

FIGS. 43 and 44 show a door unit with a single open structure and which comprises two doors to be opened from one

side into a single direction. Because the structure offers a relatively enough space, a part of a device 20 for increasing door-closing force' is disposed on a hanger 109' comprising the lock assembly 10 and having a high-speed door hung
5 therefrom. That is while a cam 21' is provided on the header 3, the roller 22' is mounted on the hanger 109' by the lever 23' and the bracket 24', and the other end of the lever 23' is biased by the spring 25.

With the door unit, the roller 22' is pressed into
10 contact with the inclined cam surface of the cam 21' during the transition from right before the door fully-closed state to the door fully-closed state, to increase the door-closing force by a horizontal component exerted on the roller 22', as in the case with the aforementioned device.

15 Furthermore, FIGS. 45 and 46 show another example of a roller supporting device with the device for increasing door-closing force. With the example shown in FIG. 45, used as a member for biasing the roller 32 is a torsion spring 31. A T-shaped lever 33 having the roller 32 provided on its one
20 end is rotatably biased clockwise by the torsion spring 31. The roller 32 is pressed into contact with the cam 21 (21') to achieve space saving.

On the other hand, with an example shown in FIG. 46, the lever is omitted, and the roller 32' is biased vertically

upward by a coil spring 41. This allows the use of the spring 41 having a small spring constant.

As described above, with the door unit of the present embodiment, a simple structure is added to the conventional
5 unit whereby the door can be reliably closed to a fully closed position despite the provision of the smoke shielding mechanism and the environmental conditions around the door unit.

CLAIMS

1. (Amended) In an elevator comprising an entrance
frame provided on an entrance leading from a landing hall to
5 a hoistway, having an upper frame and a vertical frame, and
landing doors arranged with a gap between the entrance frame
and the landing doors, to be guided by a sill for opening-
closing an opening of the entrance frame, a door unit of the
elevator being characterized in that the door unit of the
10 elevator includes smoke shielding members, for preventing the
infiltration of smoke, on at least one of a top portion of
the landing doors and a member opposed to the top portion of
the landing doors, on at least one of a side portion of the
landing doors and a member opposed to the side portion of the
15 landing doors, and on at least one of a bottom portion of the
landing doors and a member opposed to the bottom portion of
the landing doors, the landing door is coupled to a door-
closing force increasing device for pressing the landing door
into a door fully-closed position when the door is closed to
20 the vicinity of the door fully-closed position.

2. (Amended) In an elevator comprising an entrance
frame provided on an entrance leading from a landing hall to
a hoistway, having an upper frame and a vertical frame, and
landing doors arranged with a gap between the entrance frame

and the landing doors, to be guided by a sill for opening-closing an opening of the entrance frame and having a high-speed door and a low-speed door, a door unit of the elevator being characterized in that the door unit of the elevator

5 includes smoke shielding members, for preventing the infiltration of smoke, on at least one of a top portion of the high-speed door and the low-speed door and a member opposed to the top portion of the high-speed door and the low-speed door, on at least one of a side portion of the

10 high-speed door and the low-speed door and a member opposed to the side portion of the high-speed door and the low-speed door, and on at least one of a bottom portion of the high-speed door and the low-speed door and a member opposed to the bottom portion of the high-speed door and the low-speed door,

15 the landing door is coupled to a door-closing force increasing device for pressing the landing door into a door fully-closed position when the door is closed to the vicinity of the door fully-closed position.

3. (Amended) A door unit according to claim 2 wherein

20 the low-speed door has one side portion adjacent to an opposite high-speed door, which portion is thinner than the other side portion.

4. (Amended) A door unit according to claim 2 wherein a cutout is provided in the top portion of the low-speed door,

and the smoke shielding member for the high-speed door is arranged in the cutout.

5. (Amended) A door unit according to claim 2 wherein a flat board to be in contact with the top portion of the low-speed door is provided on the high-speed door, on the low-speed door or on the upper frame.

6. (Amended) A door unit according to any one of claims 1 to 5 wherein one of the smoke shielding member and the opposed member is adjustably provided.

10 7. (Amended) A door unit according to claim 6 wherein a stop board is provided on the opposed member to be opposed to the smoke shielding member provided on the upper portion of the landing doors, and the stop board is adjustably arranged.

15 8. (Amended) A door unit according to claim 6 wherein the smoke shielding member provided on the side portion of the landing door is fitted into a recess of a bracket, and the bracket is adjustably arranged.

9. (Amended) A door unit according to any one of claims 1 to 8 wherein the smoke shielding member on the side portion is in contact with the smoke shielding member on the bottom portion at a lower position.

10. (Amended) A door unit according to any one of claims 1 to 9 wherein the smoke shielding member on the side portion is arranged so as to be in contact with the smoke

shielding member on the top portion at an upper position.

11. (Amended) A door unit according to claim 9 wherein the smoke shielding member on the side portion and the smoke shielding member on the bottom portion are arranged on the
5 same vertical plane.

12. (Amended) A door unit according to claim 11 wherein the two smoke shielding members are connected to each other on respective ends thereof.

13. (Amended) A door unit according to claim 10 wherein
10 the smoke shielding member on the side portion and the smoke shielding member on the top portion are arranged on the same vertical plane.

14. (Amended) A door unit according to claim 13 wherein the two smoke shielding members are connected to each other
15 on respective ends thereof.

15. (Amended) A door unit according to any one of claims 1 to 14 wherein the smoke shielding member is deformed in accordance with temperature or pressure difference of the environment.

20 16. (Amended) A door unit according to any one of claims 1 to 14 wherein the smoke shielding member is mounted thereon with a member to be moved in accordance with pressure difference.

17. (Amended) A door unit according to any one of

claims 1 to 16 wherein the smoke shielding member on the bottom portion is provided on a portion besides the portion to which a guide shoe is attached.

18. (Amended) A door unit according to any one of
5 claims 1 to 17 wherein the smoke shielding members arranged on the side portion and the bottom portion of the landing doors are different members.

19. (Amended) A door unit according to claim 18 wherein
10 the smoke shielding member provided on the side portion of the landing doors is a hollow member or an L-shaped member.

20. (Amended) A door unit according to claim 18 wherein the smoke shielding member on the bottom portion or on the upper portion comprises a pair of projections gradually spreading toward an outer end.

15 21. (Amended) A door unit according to any one of claims 1 to 20 wherein the landing doors are central open doors, and the opposed smoke shielding members provided on the opposed landing doors are in contact with each other without a gap therebetween.

20 22. (Canceled)

23. (Canceled)

24. (Canceled)

25. (Canceled)

26. (Canceled)

27. (Canceled)

28. (Canceled)

29. (Canceled)

30. (Amended) In an elevator comprising an entrance
5 frame provided on an entrance leading from a landing hall to
a hoistway, having an upper frame and a vertical frame, and
landing doors arranged with a gap between the entrance frame
and the landing doors, to be guided by a sill for opening-
closing an opening of the entrance frame, and smoke shielding
10 members, for preventing the infiltration of smoke, on at
least one of a top portion of the landing doors and a member
opposed to the top portion of the landing doors, on at least
one of a side portion of the landing doors and a member
opposed to the side portion of the landing doors, and on at
15 least one of a bottom portion of the landing doors and a
member opposed to the bottom portion of the landing doors, a
lock assembly of the landing door for the elevator being
characterized in that the lock assembly includes a lock
fitting to be unlocked by the manipulation of a lever through
20 a hole provided on the landing door and a valve having a
packing for opening-closing the hole in the rear of the hole.

31. A lock assembly according to claim 30 wherein the
lock assembly comprises, in the rear of the hole, a valve
having a hollow member and for opening-closing an opening of

the hollow member.

32. A lock assembly according to claim 30 or 31 wherein the valve is movably supported by a hinge mechanism.

33. A lock assembly according to claim 32 wherein the
5 hinge mechanism is provided with a coil spring.

34. A lock assembly according to any one of claims 30 to 33 wherein the valve is opened or closed by an unlock key.

35. A lock assembly according to claim 34 wherein an end of the unlock key is bent downward by its own weight.

10 36. A lock assembly according to claim 34 wherein an end of the lever is arranged around an opening of the valve, an outer end of the unlock key is bendable in a predetermined direction, and the outer end can be engaged or disengaged with an end of the lever.

15 37. A lock assembly according to any one of claims 34 to 36 wherein the unlock key is in the form of an L-shape.

38. (Amended) In an elevator comprising an entrance frame provided on an entrance leading from a landing hall to a hoistway, having an upper frame and a vertical frame, and
20 landing doors arranged with a gap between the entrance frame and the landing doors, to be guided by a sill for opening-closing an opening of the entrance frame, and smoke shielding members, for preventing the infiltration of smoke, on at least one of a top portion of the landing doors and a member

opposed to the top portion of the landing doors, on at least one of a side portion of the landing doors and a member opposed to the side portion of the landing doors, and on at least one of a bottom portion of the landing doors and a
5 member opposed to the bottom portion of the landing doors, a door unit of the elevator being characterized in that the landing door is coupled to a door-closing force increasing device for pressing the landing door into a door fully-closed position when the door is closed to the vicinity of the door
10 fully-closed position.

39. A door unit according to claim 38 wherein a header mounted on an upper position of the opening has a rail horizontally provided thereon, the rail has a hanger movably provided therealong, the hanger has the door hung therefrom,
15 and the door is biased into a closing position by a biasing device over all the area between a door-fully open position to a door-fully closed position.

40. A door unit according to claim 39 wherein the biasing device is a spring mounted on the header.

20 41. A door unit according to any one of claims 38 to 40 wherein the door-closing force increasing device comprises a cam provided on the header, a roller provided on the hanger and a biasing device for pressing the roller against the cam, the cam comprises a horizontal cam surface and an inclined

cam surface slopingly extending continuously to the horizontal cam surface, the roller is pressed into contact with the inclined cam surface of the cam during the transition from the vicinity of the door-fully closed position to the door-fully closed position to generate a force pressing the door into the fully closed position.

42. A door unit according to any one of claims 38 to 41 wherein the doors include a plurality of doors for opening the opening from the center into opposite directions.

10 43. A door unit according to any one of claims 38 to 41 wherein the doors open the opening from one side into one direction.

44. A door unit according to any one of claims 38 to 42 wherein one door of the two doors constituting the doors has coupled thereto a lock assembly for locking the door at a fully-closed position while the other door has the door-closing force increasing device coupled thereto.

45. (Canceled)

46. (Amended) A door unit according to any one or
20 claims 1 to 21 or according to any one of claims 30 to 44 wherein the smoke shielding member has a body made from elastic material and having a surface subject to coating by surface-activity-modifying treatment.