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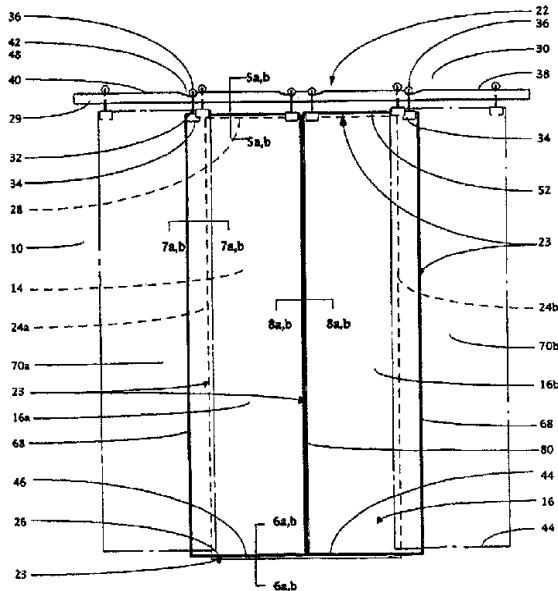
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(54) Title: HOISTWAY DOOR SEAL STRUCTURE

(57) Abstract

A hoistway door seal structure for limiting the flow of air through a hoistway opening when the door is closed. The hoistway door seal structure includes a hoistway door that covers a hoistway entrance defined by an opening in a hoistway wall structure. An elongated door support member is connected to the wall structure and is positioned in a generally horizontal orientation above the hoistway entrance. A seal structure is supported between the hoistway door and the wall structure. A door support is connected to the elongated support member to support the door while permitting movement of the door in a lateral direction between an open position permitting access to the hoistway and a closed position wherein the door substantially covers the hoistway entrance with a space between the hoistway door and the wall structure. The elongated support member includes a guide portion that guides the hoistway door, as the hoistway door is moved to the closed position, in a second direction toward the seal structure. The second direction being different than the lateral direction such that the hoistway door sealably engages the seal structure to seal the space between the door and the wall structure when the door is closed.



Description

HOISTWAY DOOR SEAL STRUCTURE

5 Technical Field

The present invention relates to elevator systems and, more particularly, to a hoistway support assembly and a sealing structure mounted between the hoistway door and hoistway entrance.

10 Background of the Invention

The U.S. Fire Administration and the National Fire Protection Association (NFPA) estimate that 75% of all deaths, injuries and property damage during a building fire is a direct result of smoke. A natural ventilation cycle occurs in the elevator shaft called "stack effect" drawing smoke into the elevator shaft and exhausting in onto upper floor levels. The taller the vertical shaft and the greater the differential between the inside and outside air temperatures, the greater the draft up the shaft. Historically, elevator systems have dealt primarily with providing a safe means of vertical transportation in multi-story building and have not addressed the issue of vertical smoke migration via the hoistway shaft.

15 The World Trade Center building experienced an explosion and fire within a subterranean parking level. The smoke from the fire migrated through the elevator shafts and within minutes following the explosion caused the evacuation of the entire 110 story building complex. The official report of the NFPA noted the inability of the closed hoistway doors to prevent the migration of the smoke as one of the primary sources of the substantial smoke damage experienced throughout the building.

20 The basic configuration and operation of an elevator system is well known. A multiple level building contains a vertical shaft defined by a top, bottom and vertical structural walls through which an elevator cab travels between levels. Adjacent to each floor level an opening in the structural wall forms a hoistway entrance through which building occupants can safely pass when the elevator cab is adjacent to the hoistway entrance and registered with the lobby floor. An interlock mechanism connects the elevator car door to the hoistway door when the elevator is positioned adjacent to a floor such that the elevator car door and the hoistway door are moved together to an open or closed position.

25 The hoistway entrance comprises a hoistway door head frame attached to a headwall and a pair of hoistway door lateral jambs attached to the jambwall. A sill is displaced below the hoistway door at the floor adjacent to the hoistway entrance opening.

A head panel extends from the headwall toward the inner hoistway door to fill the space between the headwall and the hoistway door. The head panel provides an aesthetic shield that blocks the workings of the hoistway door from the view of persons entering or exiting the elevator cab.

5 Conventional hoistway doors include one or more door panels that are movably supported on a horizontal support rail that is connected to the headwall above the hoistway entrance in a generally horizontal orientation. The doors substantially cover the hoistway entrance opening when they are in the closed position. A clearance gap between the hoistway door and the door frame and between the door panels is necessary to allow the
10 door to open and close without excessive resistance due to contact with the door frame. Movement of the hoistway door panels is restricted to a lateral direction parallel to the hoistway door opening such that the clearance gap is maintained as the hoistway door moves between the open and closed position.

Even though the clearance gap between the elevator hoistway door and the
15 hoistway entrance is limited to 0.375 of an inch by recognized industry standards, large quantities of air freely flow through the clearance gap into and out of the elevator shaft. During a building fire, the stack effect can cause the elevator hoistway to become a smoke stack which quickly distributes smoke and toxic gases throughout the building, thereby jeopardizing human life and property far from the source of the fire.

20

Summary of the Invention

The present invention provides a hoistway door seal structure that limits the flow of air through a hoistway opening when the door is in a closed position so as to restrict the passage of smoke in the event of a fire. In a preferred embodiment of the invention, a
25 wall structure has an opening therein defining a hoistway entrance, and a single or multiple of hoistway doors cover the hoistway entrance. Seal structures are positioned between the hoistway doors and the wall structure. The single or multiple hoistway doors are movably supported by an elongated door support member positioned on the wall structure above each of the doors. The door support member is adapted to change the direction of travel of
30 the hoistway door panel relative to the opening and the wall structure as the hoistway door moves between an open position and a closed position.

The door support member further directs the movement of the hoistway door into engagement with the seal structures as the hoistway door is moved to the closed position to cover the hoistway entrance. Accordingly, a barrier is formed as the hoistway
35 door is moved to the closed position, and the barrier blocks smoke and gas migration between the door and the hoistway opening. An interlock catching mechanism, connected

to the hoistway door is sized to engage the interlock mechanism connected to an elevator cab door when the hoistway door panel is in the closed position and the elevator cab door is moved from closed to open.

In the preferred embodiment of the invention, each hoistway door is
5 connected to door support members having support trucks and pulley wheels, and the pulley wheels movably engage the door support member. The door support member has lowered portions sized and located to receive the pulley wheels when the door is moved laterally to the closed position, thereby directing the hoistway door in a second direction, such as downwardly toward the sill, upon closing.

10 In an alternate embodiment, the door support member slopes vertically downward toward the center of the hoistway entrance, with the door support member directing the hoistway door downwardly into engagement with the seal structure as the door panel moves toward the closed position. Thus, the door support member causes the door panel to move laterally and vertically relative to the hoistway opening along the path of
15 travel of each pulley wheel thereby directing the hoistway door panel toward the sill upon closing.

In another alternate embodiment, the door support member has portions that curve inwardly toward the center of the hoistway entrance along the path of travel of each pulley wheel thereby directing the hoistway door panel toward the hoistway entrance upon
20 closing and into sealable engagement with the seal structures.

Accordingly, the instant invention provides an effective barrier to the passage of gas and smoke between the hoistway door and the hoistway entrance, thereby providing an economical solution to the gas/smoke infiltration problem experienced by the elevator industry. Further, the instant invention maintains a high level of safety for passengers
25 traveling in the elevator system by providing a barrier that prevents gas and smoke from entering a hoistway from a floor lobby.

Brief Description of the Drawings

This invention, along with its many attendant advantages and benefits, will
30 become better understood by reading the detailed description of the preferred embodiment with reference to the following drawings, wherein:

FIG. 1 is a sectional view of a multiple level building, showing an elevator system with an embodiment of the elevator hoistway door seal structure in accordance with the present invention, a hoistway door seal structure being shown with a hoistway entrance
35 on each level adjacent to an elevator lobby.

FIG. 2 is an enlarged side elevation view of the elevator hoistway door seal structure of Figure 1 with an opposing hoistway door arrangement shown supported from a support member with lowered portions, the hoistway doors being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position.

5 FIG. 3 is an enlarged fragmentary elevation view of a door support truck and support roller of the hoistway door of Figure 2 with the door support truck and support roller shown in phantom lines in a raised position with the hoistway door in a position prior to closing and shown in solid lines in a lowered position with the hoistway door in a closed position.

10 FIG. 4 is an enlarged plan view of the elevator hoistway entrance of Figure 1 substantially covered with opposing hoistway doors that are movably supported by a support member, the hoistway doors being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position and movably supported by a support member.

15 FIG. 5a is an enlarged cross-sectional view taken substantially along line 5a,b - 5a,b of Figure 2 with the door supports not being shown for clarity, and with a transverse seal structure shown in phantom lines in a raised, unsealed position prior to closing and shown in solid lines in a lowered, sealed position.

20 FIG. 5b is an enlarged cross-sectional view taken substantially along line 5a,b - 5a,b of Figure 2 with the door supports not being shown for clarity, and with an alternate embodiment of a transverse seal structure shown in phantom lines in a raised, unsealed position prior to closing and shown in solid lines in a lowered, sealed position.

25 FIG. 6a is an enlarged cross-sectional view taken substantially along line 6a,b - 6a,b of Figure 2 with a sill seal structure shown in phantom lines in a raised, unsealed position prior to closing and shown in solid lines in a lowered, sealed position.

FIG. 6b is an enlarged cross-sectional view taken substantially along the line 6a,b - 6a,b of Figure 2 shown in phantom lines an alternate embodiment of the sill seal structure in a raised, unsealed position prior to closing and shown in solid lines in a lowered, sealed position.

30 FIG. 7a is an enlarged cross-sectional view taken substantially along the line 7a,b - 7a,b of Figure 2 with a trailing edge seal structure shown in phantom lines in an unsealed position prior to closing and shown in solid lines in a sealed position.

35 FIG. 7b is an enlarged cross-sectional view taken substantially along the line 7a,b - 7a,b of Figure 2 showing in phantom lines an alternate embodiment of the trailing edge seal structure in an unsealed position prior to closing and shown in solid lines in a sealed position.

FIG. 8a is an enlarged cross-sectional view taken substantially along line 8a,b - 8a,b of Figure 2 showing a meeting edge seal structure of the opposing hoistway doors, the meeting edge seal structure being shown in phantom lines in an unsealed position prior to closing and shown in solid lines in a closed, sealed position.

5 FIG. 8b is an enlarged cross-sectional view taken substantially along line 8a,b - 8a,b of Figure 2 showing in phantom lines an alternate embodiment of the meeting edge seal structure in an unsealed position prior to closing and shown in solid lines in a closed, sealed position.

10 FIG. 9 is an enlarged plan view of a hoistway entrance of Figure 1 substantially covered with a single hoistway door arrangement that is movably supported by a support member, the hoistway door being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position.

15 FIG. 10a is an enlarged cross-sectional view of the leading edge seal structure of the hoistway door of Figure 9 shown in phantom lines in an unsealed position prior to closing and shown in solid lines in a closed, sealed position.

FIG. 10b is an enlarged cross-sectional view of an alternate embodiment of the leading edge seal structure of the hoistway door of Figure 9 shown in phantom lines in an unsealed position prior to closing and shown in solid lines in a closed, sealed position.

20 FIG. 11a is an enlarged plan view of the hoistway entrance of Figure 1 substantially covered with a pair of opposing hoistway doors that are movably supported by a support member, the hoistway doors being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position.

FIG. 11b is an enlarged cross-sectional view taken through the trailing support roller and outer support member of Figure 11a.

25 FIG. 11c is an enlarged cross-sectional view taken through the leading support roller and outer support member of Figure 11a.

FIG. 12a is an enlarged sectional view of a lateral edge seal structure between the pair of opposing hoistway doors of Figure 11a shown in phantom lines in an unsealed position prior to closing and shown in solid lines in a closed, sealed position.

30 FIG. 12b is an enlarged sectional view of an alternate embodiment of a lateral edge seal structure between the pair of opposing hoistway doors of Figure 11a shown in phantom lines in an unsealed position prior to closing and shown in solid lines in a closed, sealed position.

35 FIG. 13a is an enlarged cross-sectional view taken substantially along line 13a,b - 13a,b of Figure 11 a with the door supports not shown for clarity, and with the

transverse edge seal structure shown in phantom lines in a raised, unsealed position prior to closing and shown in solid lines in a lowered, sealed position.

FIG. 13b is an enlarged cross-sectional view taken substantially along line 13a,b - 13a,b of Figure 11a with the door supports not shown for clarity, and with an alternate embodiment of the transverse edge seal structure shown in phantom lines in a raised, unsealed position prior to closing and shown in solid lines in a lowered, sealed position.

FIG. 14 is an enlarged side elevation view of an alternate embodiment of the present invention with opposing hoistway door supported from a support member sloping vertically downward toward the center of the hoistway entrance, the hoistway doors being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position.

FIG. 15 is an enlarged fragmentary elevation view of a door support truck and a support roller of the hoistway door of Figure 14 with the door support truck and support roller shown in phantom lines in a raised position with the hoistway door in a position prior to closing and shown in solid lines in a lowered position.

FIG. 16 is an enlarged side elevation view of an alternate embodiment of the present invention with opposing hoistway doors supported from a support member curving horizontally inward toward a headwall, the hoistway doors being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position with the doors moved inwardly toward the hoistway entrance.

FIG. 17 is an enlarged fragmentary elevation view of a door support truck and a support roller of the hoistway door of Figure 16 shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in an inward and closed position.

FIG. 18 is an enlarged partial plan view of the support member and the door support truck and support roller of the hoistway door of Figure 16 shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in an inward and closed position.

FIG. 19 is an enlarged partial plan view of an alternate embodiment of the support member and the door support truck of Figure 16 shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in an inward and closed position.

FIG. 20a is an enlarged cross-sectional view taken substantially along the line 20a-20a of Figure 19 showing the support roller and the support member.

FIG. 20b is an enlarged cross-sectional view taken substantially along the line 20b-20b of Figure 19 showing the support roller and a narrowed portion of the support member.

5 FIG. 21a is an enlarged cross-sectional view taken substantially along the line 21a,b - 21a,b of Figure 16 with the door supports not shown for clarity, and with a transverse edge seal structure of the outer hoistway door, shown in phantom lines in an outwardly, unsealed position prior to closing and shown in solid lines in an inwardly, sealed position.

10 FIG. 21b is an enlarged cross-sectional view taken substantially along the line 21a,b - 21a,b of Figure 16 with the door supports not shown for clarity, and with an alternate embodiment of the transverse edge seal structure shown in phantom lines in an outwardly, unsealed position prior to closing and shown in solid lines in an inwardly, sealed position.

15 FIG. 22 is an enlarged cross-sectional view taken substantially along line 22-22 of Figure 16 with a sill seal structure shown in a position above the sill.

FIG. 23a is an enlarged cross-sectional view taken substantially along the line 23a,b - 23a,b of Figure 16 with the trailing edge seal structure shown in phantom lines in an outwardly, unsealed position prior to closing and shown in solid lines in an inwardly, sealed position.

20 FIG. 23b is an enlarged cross-sectional view taken substantially along the line 23a,b-23a,b of Figure 16 with an alternate embodiment of the trailing edge seal structure shown in phantom lines in an outwardly, unsealed position prior to closing and shown in solid lines in an inwardly, sealed position.

25 FIG. 24a is an enlarged cross-sectional view of the leading edge seal structure on a single hoistway door supported on a support member of Figure 16, with the hoistway door shown in phantom lines in an outwardly, unsealed position and shown in solid lines in an inward, sealed position.

30 FIG. 24b is an enlarged cross-sectional view of an alternate embodiment of the leading edge seal structure of Figure 24a with the hoistway door shown in phantom lines in an outwardly, unsealed position and shown in solid lines in an inward, sealed position.

35 FIG. 25a is an enlarged cross-sectional view of a pair of adjacent support members of Figure 16 supporting pairs of opposing hoistway doors similar to Figure 11a with the door supports not shown for clarity, and with the transverse edge seal structure being shown in phantom lines in an outwardly, unsealed position prior to closing and shown in solid lines in an inwardly, sealed position.

FIG. 25b is an enlarged cross-sectional view of an alternate embodiment of the transverse edge seal structure of Figure 25a, with the door supports not shown for clarity, and with the hoistway door panel shown in phantom lines in an outwardly, unsealed position prior to closing and shown in solid lines in an inwardly, sealed position.

5 FIG. 26 is an enlarged side elevation view of an alternate embodiment of the present invention with an opposing hoistway door arrangement shown supported from a support member with a bottom edge sloping vertically downward toward the center of the hoistway entrance, the hoistway doors being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position.

10 FIG. 27 is an enlarged fragmentary elevation view of a door support truck and a support roller of the hoistway door of Figure 26 shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

15 FIG. 28a is an enlarged cross-sectional view taken substantially along the line 28a,b - 28a,b of Figure 26 with the door supports not shown for clarity, and with a transverse edge seal structure shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

20 FIG. 28b is an enlarged cross-sectional view taken substantially along the line 28a,b - 28a,b of Figure 26 with the door supports not shown for clarity and with an alternate embodiment of a transverse edge seal structure shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

FIG. 29a is an enlarged cross-sectional view showing a transverse edge seal structure in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

25 FIG. 29b is an enlarged cross-sectional view of an alternate embodiment of a transverse edge seal structure of Figure 29a with the door supports not shown for clarity and with the transverse edge seal structure shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

30 FIG. 30 is an enlarged side elevation of an alternate embodiment of the present invention with opposing hoistway doors shown supported from a support member having a bottom edge sloping vertically downwardly, the hoistway doors being shown in phantom lines in a position prior to closing and shown in solid lines in a closed position.

35 FIG. 31 is an enlarged fragmentary elevation view of a door support truck and a support roller of the hoistway door of Figure 30 with the door support truck and the support roller shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

FIG. 32a is an enlarged cross-sectional view taken substantially along the line 32a,b - 32a,b of Figure 30 with the door supports not shown for clarity, and with a transverse edge seal structure shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

5 FIG. 32b is an enlarged cross-sectional view taken substantially along the line 32a,b - 32a,b of Figure 30 with the door supports not shown for clarity, and with an alternate embodiment of a transverse edge seal structure shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

10 FIG. 33a is an enlarged cross-sectional view of a pair of adjacent supports similar to Figure 29a and in accordance with the alternate embodiment of Figure 30, with the door supports not shown for clarity, and with a transverse edge seal structure shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

15 FIG. 33b is an enlarged cross-sectional view of an alternate embodiment of a transverse edge seal structure of Figure 33a, with the door supports not shown for clarity, and with the transverse edge seal structure shown in phantom lines in a position prior to closing and shown in solid lines with the hoistway door in a closed position.

20 Detailed Description of the Invention

Referring now to the drawings wherein like reference characters designate identical or corresponding parts, and more particularly to Figure 1 thereof, there is shown a multiple level building with an elevator hoistway 4 having an upper limit 6 and a lower limit 8, with a wall structure 10 extending therebetween. A hoistway opening 12 in the wall structure 10 occurs at each level, defining a hoistway entrance 14 which is closable by a movable hoistway door assembly 16. When an elevator cab 18 is adjacent to an elevator lobby floor 20 and directly adjacent to the hoistway entrance 14, the hoistway door assembly 16 is moved by a conventional interlock system to an open position to allow passengers to pass through the hoistway entrance, and when the elevator cab is not adjacent to the elevator lobby floor, the hoistway door assembly remains in a closed position.

30 The hoistway door assembly 16 is movably supported by a hoistway door seal structure 22 in accordance with the present invention. The hoistway door seal structure 22 of the preferred embodiment is adjacent to each hoistway entrance 14 and is positioned to provide seals between the hoistway door assembly 16 and the wall structure 10 around the hoistway opening 12.

35

The hoistway door seal structure 22 engageably seals the gap between the hoistway door assembly 16 and the wall structure 10 when the hoistway door is moved from an open position toward a closed position to limit the flow of air through the hoistway opening 12. Accordingly, the hoistway door seal structure 22 restricts the passage of gas and smoke between the hoistway door assembly 16 and the wall structure 10 in the event of a fire. The hoistway door seal structure 22 includes seals, discussed in greater detail below, that are constructed of shaped, temperature resistive material or other material such as light gauge metal, silicone, metallic brushes etc. that can be slightly compressed when the hoistway door assembly 12 is moved into engagement therewith to create an effective seal between the hoistway door assembly and the wall structure 10. Although the embodiments described herein are described in terms of the seals around the hoistway door assembly 12 blocking the flow of smoke and gas in the event of a fire, the seals are also effective in blocking the flow of air or the like between the hoistway door assembly and the wall structure 12 during operation of the hoistway, during maintenance thereof, or the like.

As best seen in Figure 2, the hoistway entrance 14 in the wall structure 10 is a rectangular opening defined by a left lateral jamb 24a, a right lateral jamb 24b, a bottom sill 26, and a head 28 opposite the sill. The hoistway door seal structure 22 adjacent to the hoistway entrance 14 includes the hoistway door assembly 16 that moves laterally relative to the hoistway entrance 14 between an open position, shown in phantom lines, permitting access to the elevator hoistway, and a closed position, shown in solid lines. In the closed position, the hoistway door assembly 16 substantially covers the hoistway entrance 14.

In the illustrated embodiment, the hoistway door assembly 16 includes a pair of opposing doors 16a and 16b that are laterally movably relative to the hoistway entrance 14. The pair of opposing doors 16a and 16b are interconnected in a conventional manner, such that the lateral movement of each of the hoistway doors between the open and closed positions is synchronized. Although the illustrated embodiment includes a pair of opposing doors 16a and 16b, the door assembly 16 can have other configurations, such as a single door configuration, or a configuration having a multiple pair of opposing doors, as discussed below.

The pair of hoistway doors 16a and 16b are movably supported outwardly adjacent to the hoistway entrance 14 by an elongated door support member 29 that is secured to a headwall 30 above the head 28. The door support member 29 is securely mounted in a generally horizontal position above the hoistway entrance 14. Each of the hoistway doors 16a and 16b is movably attached to the door support member 29 by a pair of door supports 32 that move laterally along the door support member when the hoistway doors move between the open and closed positions. Each door support 32 includes a door

support truck 34 secured to the top of the respective hoistway door 16a and 16b, and a support roller 36 rotatably attached to the top portion of the door support truck 34. The support roller 36 movably engages a roller support surface 38 on the top of the door support member 29 so as to permit the lateral movement of the hoistway doors 16a and 16b
5 between an open and closed position.

The hoistway door seal structure 22 also includes a plurality of seals 23 positioned between the hoistway doors 16a and 16b and the wall structure 10 around the hoistway entrance 14. The seals 23 fill and seal spaces between the hoistway doors and the wall structure when the hoistway doors are in the closed position. Accordingly, the seals 23
10 restrict the passage of gas and smoke through the spaces in the event of a fire. The formation of these seals 23 is facilitated by the door support member 29, which is constructed to move the hoistway doors 16a and 16b laterally from the open position shown in phantom lines toward the closed positions shown in solid lines, and as the hoistway doors approach the closed position, the door support member simultaneously moves the hoistway
15 doors in a second direction, such as vertically downward into sealable engagement with the seals. A conventional interlock mechanism is coupled to the hoistway doors so as to engage a conventional elevator cab door of the elevator cab 18, Figure 1, thereby simultaneously moving the hoistway doors and the elevator cab door to the open or closed positions to allow ingress or egress from the elevator cab.

As best seen in Figure 3, the door support member 29 is a substantially horizontal rail with the uppermost edge of the rail forming the roller support surface 38. The door support member 29 includes a plurality of horizontal upper portions 40 and a plurality of lowered portions 42 adjacent to at least one of the upper portions. Each of the lower portions 42 is positioned with the lowered portion providing a recessed area within
20 the support member 29 that is shaped to receive one of the support rollers 36 when the hoistway doors 16a and 16b move to the closed position, as shown in solid lines in Figure 2. Accordingly, the support rollers 36 travel along the horizontal upper portions 40 of the door support member 29 when the hoistway doors are moving to or from the closed position such that the hoistway doors 16a and 16b are in a raised position, as shown in phantom lines
25 in Figure 2. In the raised position as best seen in Figure 2, a bottom edge 44 of each hoistway door 16a and 16b is positioned above the sill 26 with a sill space 46 therebetween.

As the hoistway doors 16a and 16b move laterally from the open and raised positions to the closed and lowered positions, the support rollers 36 move from the horizontal upper portions 40 downwardly into their respective lowered portions 42, thereby
30 causing the hoistway doors to simultaneously move downwardly to a lowered position. In the lowered position the bottom edge 44 of each Hoistway door 16a and 16b is immediately

adjacent to the sill 26. As discussed in greater detail below, when the door panels 16a and 16b move to the closed and lowered position, seals are formed around the hoistway entrance 14 so as to block the flow of smoke and gas between the doors 16a and 16b and the wall structure 10.

5 As best seen in Figure 3, the lowered portion 42 in the door support 29 has a sloped portion 48 that slopes downwardly from the adjacent horizontal upper portion 40, and the sloped portion connects to a curved seat portion 50. Each seat portion 50 has a radius that is slightly greater than the radius of the support roller 36, such that the respective support roller will travel downwardly along the sloped portion 48 and sit within the seat
10 portion when the respective hoistway door is in the closed position. Accordingly, the seat portions 50 facilitate in retaining the hoistway doors 16a and 16b in the closed position. The sloped portions 48 provides a gradual transition for the support rollers 36 as the hoistway doors 16a and 16b move between the closed and lower position and the open and raised position.

15 Accordingly, the support rollers 36 travel along the horizontal upper portions 40 of the door support member 29 as the left and right hoistway doors 16a and 16b, Figure 2, are moved laterally from the open position toward the closed position. When the hoistway doors 16a and 16b approach the closed position, each of the support rollers 36 move downwardly into a respective one of the lowered portions 42 and the hoistway doors
20 are moved vertically downward toward the sill 26. When the left and right hoistway doors 16a and 16b move away from the closed position, the support rollers 36 move from the lowered portions 42 upwardly along the sloped portions 48 toward the horizontal upper section 40. Accordingly, the hoistway doors 16a and 16b are lifted from the lowered position to the raised position. Thereafter, the hoistway doors 16a and 16b move
25 horizontally to the fully open position, and the necessary force exerted on the hoistway doors is required to overcome only the minimal amount of frictional resistance between the support rollers 36 and the roller support surface 38.

The hoistway doors 16a and 16b move together in a synchronized manner between an open and raised position, shown in phantom lines in Figure 4 that permits access
30 to the elevator cab 18, and a closed and lowered position, shown in solid lines, where the hoistway doors substantially cover the hoistway entrance 14.

As best seen in Figure 4, the door support member 29 is connected to the headwall 30 with brackets 58, and the roller support surface 38 is positioned outwardly away from the headwall. Each of the hoistway doors 16a and 16b has a transverse edge
35 portion 52 along the top of the door that is outwardly adjacent to the headwall 30, thereby providing a transverse space 54 between the transverse edge portion and the headwall. An

elongated transverse seal structure 56 is positioned between the transverse edge portion 52 and the headwall 30 above the hoistway entrance 14. When the hoistway doors 16a and 16b are in the closed and lowered position, as shown in solid lines, the transverse seal structure 56 substantially fills the transverse space 54, for example, to block the passage of
5 gas or smoke therethrough in the event of a fire or the like.

As best seen in Figure 5a, the transverse seal structure 56 has an elongated transverse extension 60 and an elongated transverse seal 62, wherein the elongated transverse extension is securely fastened to the transverse edge 52 of each hoistway door 16a and 16b such that the transverse extension 60 extends along the transverse edge
10 portion of the door. The transverse seal 62 is secured to the headwall 30 near the head 28 below the transverse extension 60 such that the transverse seal 62 extends along the length of the hoistway doors 16a and 16b when in the closed and lowered position. The transverse extension 60 extends away from its respective hoistway door 16a or 16b into the transverse space 54 toward the headwall 30, and provides a horizontal blade-like structure along the
15 top edge of the hoistway doors. The transverse seal 62 projects outwardly away from the headwall 30 toward the hoistway doors 16a and 16b in such a position wherein the transverse extension 60 is in an overlapping relationship with the transverse seal.

The transverse extension 60 is above and out of engagement with the transverse seal 62 when the respective hoistway doors 16a and 16b are in the open and raised position, shown in phantom lines, thereby avoiding frictional resistance between the
20 transverse extension and the transverse seal as the door is moving between the open and closed positions. When the hoistway doors 16a and 16b are moved to the closed and lowered position, shown in solid lines, the transverse extension 60 moves downwardly into sealable engagement with the transverse seal 62 so as to seal the transverse space 54,
25 thereby blocking the flow of gas or smoke through the transverse space in the event of a building fire or the like.

In the preferred embodiment, the transverse extension 60 is a substantially rigid, blade-like member. The elongated transverse seal 62 is a shaped, resilient temperature resistive structure that is slightly compressed by the transverse extension 60 when the
30 hoistway doors 16a and 16b are moved to the closed and lowered position. The shaped, resilient temperature resistive structure is adapted to maintain its structural integrity in elevated temperatures, such as the temperature experienced in a building fire. Accordingly, a seal is maintained between the hoistway doors 16a and 16b and the headwall 30 during a fire or the like.

35 As best seen in Figure 5b, an alternate embodiment of the transverse seal structure 56 has an elongated transverse extension 61 securely mounted to the head 28

along the head's length. The transverse extension 61 extends away from the headwall 30 toward the hoistway doors 16a and 16b and into the transverse space 54. An elongated transverse seal 63 is securely attached along the length of the top of each of the hoistway doors 16a and 16b adjacent to the transverse edge portion 52, and the transverse seal
5 extends away from the hoistway door toward the headwall 30. The transverse seals 63 are positioned above the transverse extension 61 in an overlapping relationship. Accordingly, when the hoistway doors 16a and 16b are moved from the open and raised position, shown in phantom lines, to the closed and lowered position, shown in solid lines, the transverse seal 63 moves downwardly into sealable engagement with the transverse extension 61 and
10 seals the transverse space 54.

Referring to Figure 2, the bottom edge 44 of each hoistway door 16a and 16b is positioned above the sill 26 as a selected distance that defines a sill space 46 between the hoistway doors and the sill. As best seen in Figure 61, a bottom door seal structure 64 of the seals 23 is securely attached to the bottom edge 44 of each hoistway door 16a and
15 16b. The bottom door seal structure 64 includes elongated inner and outer bottom door seals 66a and 66b spaced apart on the bottom edge 44 of each hoistway door 16a and 16b such that the bottom door seals extend the length of the respective door.

The bottom door seals 66a and 66b extend downwardly toward the sill 26. When the hoistway doors 16a and 16b are in the open and raised position, shown in
20 phantom lines, the bottom door seals 66a and 66b are above and out of engagement with the sill 26 so as to minimize frictional resistance to lateral motion of the hoistway doors. When the hoistway doors 16a and 16b are moved to the closed and lowered position, as discussed above, the bottom door seals 66a and 66b are lowered into sealable engagement with the sill 26 and seal the sill space 46. In the preferred embodiment, the bottom door seals 66a
25 and 66b are a shaped, resilient temperature resistive material that are slightly compressed against the sill 26 when the hoistway doors 16a and 16b are moved to the closed and lowered position.

An alternate embodiment of the bottom door seal structure 64 is illustrated in Figure 6b wherein a single bottom door seal 67 is securely attached to the bottom edge 44
30 of each of the hoistway doors 16a and 16b. The single bottom door seal 67 extends along the bottom edge 44 of the respective hoistway door and extends downwardly from the bottom edge 44 of the respective door. The bottom seal 67 sealably engages the sill 26 when the hoistway doors 16a and 16b are moved to the closed and lowered position, shown in solid lines, thereby sealing the sill space 46.

35 As best seen in Figures 2 and 4, each of the hoistway doors 16a and 16b has a trailing edge portion 68 that is positioned outwardly adjacent to a respective left and right

jambwall 70a and 70b. As best seen in Figure 4, each of the hoistway doors 16a and 16b is positioned such that a trailing edge lateral space 72 is located between the trailing edge portion 68 of the respective hoistway door 16a and 16b and the respective left and right jambwall 70a and 70b. A trailing edge seal structure 74 of the seals 23 is positioned
5 between the trailing edge portion 68 of each hoistway door 16a and 16b and the jambwalls 70a and 70b to seal the trailing edge lateral spaces 72 when the hoistway doors are in the closed position.

As best seen in Figure 7a, the trailing edge seal structure 74 includes an elongated lateral extension 76 secured to the trailing edge portion 68 of each of the
10 hoistway doors 16a and 16b. The lateral extension 76 extends along the trailing edge portion 68 of the respective door 16a and 16b. The lateral extension 76 also extends toward the respective jambwall 70a and 70b and into the trailing edge lateral spaces 72. An elongated trailing edge lateral seal 78 is connected to each of the left and right jambwalls 70a and 70b near the lateral jamb 24. The trailing edge lateral seal 78 extends
15 into the trailing edge space 72 in an overlapping relationship with the associated lateral extension 76.

When the hoistway doors 16a and 16b are moved to and from the open position, the lateral extension 76 does not engage the respective jambwalls 70a and 70b, thereby minimizing frictional resistance to lateral movement of the hoistway doors. When
20 the hoistway doors 16a and 16b are moved to the closed position, each of the lateral extensions 76 is pressed against and sealably engages the trailing edge lateral seal 78 to seal the trailing edge space 72 along the height of the hoistway doors. In the preferred embodiment, each of the elongated lateral extensions 76 is a substantially rigid, blade-like member, and each of the trailing edge lateral seals 78 is a shaped, resilient temperature
25 resistive material that is slightly compressed by the lateral extension when the hoistway doors 16a and 16b are moved to the closed position.

In an alternate embodiment, illustrated in Figure 7b, the trailing edge seal structure 74 includes an elongated lateral extension 77 that is secured to each of the left and right jambwalls 70a and 70b near the jamb 24. The lateral extensions 77 project outwardly
30 from the jambs toward the respective hoistway doors 16a and 16b. Each of the lateral extensions 77 is an L-shaped bracket with one leg parallel to the respective jambwall 70a and 70b, and a second leg perpendicular to the jambwall and extending into the trailing edge space 72. An elongated trailing edge lateral seal 79 is securely attached to the hoistway doors 16a and 16b adjacent to the trailing edge portion 68. The trailing edge lateral seal
35 extends into the trailing edge space 72 toward the jambwalls 70a and 70b. The trailing edge

lateral seal 79 is positioned in an overlapping relationship with the second leg of the associated lateral extension 77.

When the hoistway doors 16a and 16b are moved to and from the open position, the trailing edge lateral seal 79 is not in engagement with the lateral extension 77 so as to minimize resistance to lateral movement of the hoistway doors. When the hoistway doors 16a and 16b are moved to the closed position, the trailing edge lateral seal 79 presses against the second leg of the lateral extension 77 and seals the trailing edge space 72, for example, to limit smoke and gas flow therethrough in the event of a fire or the like. Although the lateral extension 77 of the alternate embodiment is illustrated as an L-shaped member, the lateral extension could be a blade structure or other structure against which the trailing edge lateral seal 79 can sealably press to seal the trailing edge space 72.

As best seen in Figure 2, each of the hoistway doors 16a and 16b has a meeting edge 80 that extends between the transverse edge 52 and the bottom edge 44 of the respective hoistway door. As best seen in Figure 4, the hoistway doors 16a and 16b are configured such that a meeting edge space 82 is provided between the meeting edges 80 of the doors when the hoistway doors 16a and 16b are in the closed position. A meeting edge seal structure 84 is provided between the meeting edges 80 of the hoistway doors 16a and 16b to seal the meeting edge space 82 when the hoistway doors are in the closed position.

As best seen in Figure 8a, an elongated meeting edge seal 86 is securely attached to the meeting edge 80 of the left hoistway door 16a and extends along the length of the meeting edge. The meeting edge seal 86 extends away from the left hoistway door's meeting edge 80 toward the meeting edge of the right hoistway door 16b. When the hoistway doors 16a and 16b are in the closed position, shown in solid lines, the meeting edge seal 86 is pressed into sealable engagement with the meeting edge 80 of the right hoistway door 16b, thereby sealing the meeting edge space 82. In the preferred embodiment, the meeting edge seal 86 is a shaped resilient temperature resistive material that is slightly compressed when the hoistway doors 16a and 16b are moved to the closed position.

In an alternate embodiment illustrated in Figure 8b, the meeting edge seal structure 84 includes an elongated meeting edge seal 87a securely attached to the meeting edge 80 of the left hoistway door 16a, and a similar elongated meeting edge seal 87b securely attached to the length of the meeting edge 80 of the right hoistway door 16b opposite the left meeting edge seal 87a. The left and right meeting edge seals 87a and 87b extend away from their respective meeting edges 80 and toward each other such that when the hoistway doors 16a and 16b are in the closed position, shown in solid lines, the meeting edge seals press against and sealably engage each other. The sealably engaged meeting edge

seals 87a and 87b extend across the meeting edge space 82 and form a seal therein. In the illustrated embodiment, each of the left and right meeting edge seals 87a and 87b are constructed of a shaped resilient temperature resistive material that is positioned substantially along the meeting edges 80 of the respective hoistway doors 16a and 16b.

5 Accordingly, the meeting edge seals 87a and 87b press against each other and slightly compress in order to form an effective seal therebetween, for example, to block the flow of gas and smoke through the meeting edge space in the event of a fire.

Therefore, when the hoistway doors 16a and 16b illustrated in Figure 2 are moved from the open and raised position to the closed and lowered position, the hoistway
10 doors move laterally and downwardly just as the doors reach the closed position. When the hoistway doors 16a and 16b are in the closed position, seals are formed around the hoistway entrance 14 between the hoistway door assembly 16 and the wall structure 10 and between the meeting edges 80 of the hoistway doors 16a and 16b. Thus, all of the spaces around and between the hoistway doors 16a and 16b are effectively sealed off with the seals 23 when
15 the doors are in the closed and lowered position, for example, to limit the flow of gas or smoke between the doors and the hoistway entrance in the event of a fire, thereby minimizing migration of smoke through a building.

Although the embodiments described herein are described in terms of the seals 23 around and between the hoistway doors blocking the flow of smoke and gas in the
20 event of a fire, the seals also block the flow of air or other gas between the hoistway door and the wall structure during normal operation or maintenance of the hoistway.

In an alternate embodiment of the present invention, as illustrated in Figure 9, a single hoistway door 88 is movably supported on an elongated support member 90 by a pair of door supports 32 in the manner discussed above. The single
25 hoistway door 88 moves between an open position, shown in phantom, that permits access to the elevator cab 18, and a closed position, shown in solid lines, wherein the hoistway door substantially covers the hoistway entrance 14. The door support member 90 is rigidly secured to the headwall 30 with brackets 92 in a generally horizontal orientation above the hoistway entrance 14. The door support member 90 is configured to move the hoistway
30 doors downwardly relative to the hoistway entrance as described above and illustrated in Figure 3. Seals are formed between the transverse edge portion 52 of the door and the headwall 30 and between the bottom edge 44 of the door and the sill 26, as discussed above. Similarly, seals are formed between the trailing edge portion 68 of the hoistway door and the left jambwall 70a similar to the trailing edge seal structure 74 discussed above.

35 The single hoistway door 88 includes a leading edge portion 94 that is positioned outwardly away from the right jambwall 70b to define a leading edge lateral

space 96 between the hoistway door and the jambwall. A leading edge seal structure 98 is mounted to the right jambwall 70b and positioned such that the leading edge portion 94 of the hoistway door 88 moves into sealable engagement therewith when the hoistway door is in the closed position, thereby sealing the leading edge lateral space 96.

5 As best seen in Figure 10a, the leading edge seal structure 98 has an elongated leading edge lateral extension 100 that has an L-shaped cross-section with an attachment leg 102 of the extension securely fastened to the right jambwall 70b. An engagement leg 104 of the leading edge lateral extension 100 extends perpendicularly away from the right jambwall 70b and substantially parallel to the leading edge portion 94 of the
10 single hoistway door 88. An elongated leading edge lateral seal 106 is securely attached to the engagement leg 104 along the length of the lateral extension 100. The leading edge lateral seal 106 extends toward the hoistway door 88 such that when the hoistway door is in the closed position, the leading edge portion 94 of the hoistway door sealably engages the leading edge lateral seal 106. Accordingly, the leading edge lateral seal 106 extends across
15 the leading edge lateral space 96 and forms a seal therein between the lateral extension 100 and the single hoistway door 88.

In the preferred embodiment, the engagement leg 104 is a substantially rigid, blade-like member and the leading edge lateral seal 106 is a shaped, resilient temperature resistive material that is slightly compressed by the leading edge portion 94 of the hoistway
20 door 88 when the hoistway door is in the closed position.

In an alternate embodiment of the leading edge seal structure 98, illustrated in Figure 10b, the leading edge lateral extension 100 is mounted to the right jambwall 70b as discussed above, and a leading edge lateral seal 107 is securely attached to the length of the leading edge portion 94 of the hoistway door 88. The leading edge lateral seal 107 extends
25 away from the leading edge portion 94 toward the leading edge lateral extension 100. When the hoistway door 88 is in the closed position, the leading edge lateral seal 107 is pressed into sealable engagement with the engagement leg 104 of the leading edge lateral extension 100 and seals the leading edge lateral space 96.

An alternate of the present invention is illustrated in Figure 11a wherein the
30 hoistway door seal structure 22 includes opposing left and right inner hoistway doors 108a and 108b and opposing left and right outer hoistway doors 110a and 110b. The inner and outer hoistway doors 108a, 108b, 110a, and 110b move together between an open position, shown in phantom lines that permits access to the elevator cab 18, and a closed position, shown in solid lines, wherein the inner and outer hoistway doors substantially cover the
35 hoistway entrance 14.

The inner hoistway doors 108a and 108b are supported outwardly adjacent to the hoistway entrance 14 by an elongated inner door support member 112 that is rigidly secured to the headwall 30 with brackets 114 in a generally horizontal orientation above the hoistway entrance. The outer hoistway doors 110a and 110b are supported outwardly adjacent to the inner hoistway doors 108a and 108b by an elongated outer door support member 116 that is secured to the inner door support member 112 with brackets 118. The outer door support member 116 is secured in a generally horizontal orientation such that the inner door support member 112 is between the headwall 30 and the outer support member.

Each of the inner hoistway doors, 108a and 108b are movably supported on the inner door support member 112 by a pair of door supports 32 discussed above. The inner door support member 112 has lowered portions 42 therein that are positioned to receive the support rollers 36 of the door supports 32 as the inner hoistway doors 108a and 108b are moved from the open and raise position and approach the closed position, thereby moving the inner hoistway doors laterally and downwardly relative to the hoistway entrance 14 to the closed and lowered position.

Each of the outer hoistway doors 110a and 110b are movably supported on the outer door support member 116 by a leading door support 313 and a trailing door support 315. The leading door support 313 is connected to the respective outer hoistway door 110a and 110b generally adjacent to the meeting edge 80, and the trailing door support 315 is connected to the respective outer hoistway door generally adjacent to the trailing edge portion 68. The leading door support 313 has a leading support roller 113 and the trailing door support 315 has a trailing support roller 115, each of which travels over the outer door support member 116 as the outer hoistway doors 110a and 110b move between the open and raised position and the closed and lowered position.

The outer door support member 116 also has lowered portions 42 therein that receive the leading and trailing support rollers 113 and 115 as the outer hoistway doors 110a and 110b approach the closed and lowered position. As can be seen in Figure 11a, each of the outer hoistway doors 110a and 110b travel approximately half the length of the outer door support member 116 as it moves from the open position to the closed position. Accordingly, the leading edge support roller 113 travels over the lowered portions 42 for the trailing support roller 115 as the outer hoistway doors 110a and 110b move between the open and closed positions.

As best seen in Figures 11b and 11c, the outer door support member 116 and the leading support roller 113 are constructed such that the lead support roller will not move downwardly into the lowered portion 42 for the trailing support roller 115, while the trailing support roller is constructed to move downwardly into its lowered portion. The outer door

support member 116 has a channel 117 within its upper portion along the length of the outer door support member. The sides of the channel 117 are defined by sidewalls 317 that terminate at their upper ends and provide an upper roller support surface 119. As best seen in Figure 11b, the trailing support roller 115 has a narrowed, annular outer portion 121 that is movably positioned within the channel 117 in the outer door support member 116. The annular outer portion 121 travels in the channel 117 as the respective outer hoistway door 110a and 110b moves between the open and closed positions. The lower portion 42, shown in hidden lines, for the trailing support roller 115 extends downwardly from the channel 117 between the sidewalls 317 such that the trailing support roller's annular portion 121 follows the channel downwardly into the lowered portion as the respective outer hoistway door 110a and 110b approach the closed position.

As best seen in Figure 11c, the leading support roller 113 has an annular channel 123 therein that receives the top portion of the outer door support member 116. The leading support roller 113 straddles the outer door support member 116 and travels along the upper roller support surface 119 above the channel 117 as the outer hoistway doors 110a and 110b move between the open and closed positions. Accordingly, the upper roller support surface 119 supports the leading support roller 113 above the trailing support roller's lowered portion 42 within the channel 117, so the leading support roller will not move downwardly into the trailing support roller's lowered portion. A lowered portion 42, shown in hidden lines, is positioned in the outer door support member 116 to receive the leading support roller 113 when the respective outer hoistway door 110a and 110b approaches the closed position. Therefore, the leading and trailing support rollers move into and out of their respective lowered portions 42 simultaneously and uniformly only when the outer hoistway doors are moving into or out of the closed position.

The inner hoistway doors 108a and 108b are coupled to the outer hoistway doors 110a and 110b in a conventional manner, such that lateral and vertical movement of the hoistway doors is synchronized to move between the open and closed positions. The conventional interlock mechanism maintains engagement between the elevator cab door and the hoistway door as the hoistway doors are moved to and from the closed and lowered position.

As best seen in Figure 11a, seals are formed between the trailing edge 68 of the inner hoistway doors 108a and 108b and the respective jambwalls 70a and 70b similar to the trailing edge seal structure 74 discussed above. Likewise, seals are formed between the transverse edge portion 52 of the inner hoistway doors 108a and 108b and the headwall 30 similar to the transverse edge seal structure 56 discussed above. Likewise, seals are formed between the bottom edge 44 of the inner hoistway doors 108a and 108b and of the outer

hoistway doors 110a and 110b and the sill 26 as discussed above and illustrated in Figures 61 and 6b. Likewise, seals are formed between the meeting edge portion 80 of the outer hoistway doors 110a and 110b as discussed above.

The left hoistway door 108a is positioned outwardly away from the left outer
5 hoistway door 110a to define an interdoor lateral space 120 between the left inner hoistway door and the left outer hoistway door. The right inner hoistway door 108b is positioned outwardly away from the right outer hoistway door 110b to define an interdoor lateral space 120 between the right inner hoistway door and the right outer hoistway door. An interdoor seal structure 122 is attached to each pair of the inner and outer hoistway
10 doors 108a/110a and 108b/110b, so as to seal the interdoor spaces 120 when the hoistway doors are in the closed position.

As best seen in Figure 12a, the interdoor seal structure 122 includes an elongated interdoor lateral extension 124 secured to the trailing edge portion 68 of each of the outer hoistway doors 110a and 110b such that the interdoor lateral extension extends
15 along the height of the respective hoistway door. The interdoor lateral extension 124 extends inwardly toward the respective inner hoistway door 108a and 108b and into the interdoor lateral space 120. An elongated interdoor lateral seal 126 is connected to each of the inner hoistway doors 108a and 108b adjacent to the leading edge portion 94 such that the interdoor lateral seal extends into the interdoor lateral space 120 in an overlapping
20 relationship with the associated interdoor lateral extension 124.

When the hoistway doors 108a, 108b, 110a and 110b are moved to and from the open position, shown in phantom lines, the interdoor lateral extension 124 does not engage the respective interdoor lateral seal 126, thereby minimizing frictional resistance to lateral movement of the hoistway doors. When the hoistway doors 108a, 108b, 110a, and
25 110b are moved to the closed position, as shown in solid lines in Figure 12a, the interdoor lateral extension 124 presses against and sealably engages the interdoor lateral seal 126 to seal the interdoor lateral space 120 along the height of the hoistway doors, for example, to block the flow of gas or smoke through the interdoor lateral space 120 in the event of a fire or the like. In the preferred embodiment, the interdoor lateral extension 124 is a
30 substantially rigid, blade-like member and the interdoor lateral seal 126 is shaped, resilient temperature resistive material that is slightly compressed by the interdoor lateral extension when the hoistway doors 108a, 108b, 110a and 110b are in the closed position.

In an alternate embodiment illustrated in Figure 12b, the interdoor lateral seal structure 122 includes an elongated interdoor lateral extension 125 that is secured to the
35 leading edge portion 94 of each of the left and right inner hoistway doors 108a and 108b, and that projects outwardly toward the respective outer hoistway doors 110a and 110b. An

elongated interdoor lateral seal 127 is securely attached to each of the outer hoistway doors 110a and 110b adjacent to the trailing edge portion 68 and extends into the interdoor lateral space 120 toward the respective inner hoistway door 108a and 108b. The interdoor lateral seal 127 is positioned in an overlapping relationship with the associated interdoor lateral extension 125. When the hoistway doors 108a, 108b, 110a and 110b move to and from the open position shown in phantom lines, the interdoor lateral seal 127 is not in engagement with the interdoor lateral extension 125. When the hoistway doors 108a, 108b, 110a, and 110b are in the closed position shown in solid lines, the interdoor lateral seal 127 presses against the interdoor lateral extension 125 and provides a seal in the interdoor lateral space 120.

As best seen in Figure 11a, the transverse edge portion 52 of the outer hoistway doors 110a and 110b are positioned outwardly adjacent to the inner hoistway doors 108a and 108b and the headwall 30 to define a transverse head space 128 when the outer hoistway doors 110a and 110b are in the closed position. An elongated transverse head seal structure 130 is mounted to the headwall 30 between the inner hoistway doors 108a and 108b and extends outwardly from the headwall 30 toward the outer hoistway doors 110a and 110b to substantially fill the transverse head space 128.

As best seen in Figure 13a, the elongated transverse head seal structure 130 comprises an elongated transverse extension 136 that is securely fastened to the length of the transverse edge portion 52 of each outer hoistway door 110a and 110b and that extends away from its respective outer hoistway door 110a and 110b into the transverse head space 128 toward the headwall 30. An elongated transverse head panel 132 is mounted to the headwall 30 between the inner hoistway doors 108a and 108b. The transverse head panel 132 extends outwardly from the headwall 30 into the transverse head space 128 toward the outer hoistway doors 110a and 110b. An elongated transverse head panel seal 138 is secured along the length of the transverse head panel 132 and extends upwardly away from the transverse head panel toward the transverse extension 136 in such a position wherein the transverse extension 136 is in an overlapping relationship with the transverse head panel seal.

The transverse extension 136 is out of engagement with the transverse head panel seal 138 when the respective outer hoistway doors 110a and 110b are in the open and raised position, shown in phantom lines, thereby avoiding frictional resistance between the transverse extension and the transverse head panel seal. When the outer hoistway doors 110a and 110b are moved to the closed and lowered position shown in solid lines, the transverse extension 136 moves downwardly into sealable engagement with the transverse head panel seal 138 and seals the transverse head space 128 adjacent to the outer hoistway

doors. In the preferred embodiment, the transverse extension 136 is a substantially rigid, blade-like member and the transverse head panel seal 138 is a shaped, resilient temperature resistive material that is slightly compressed by the transverse extension 136 when the outer hoistway doors 110a and 110b are in the closed position.

5 In an alternate embodiment illustrated in Figure 13b, the transverse head panel 132 is mounted to the headwall 30 as described above. An elongated transverse head panel seal 139 is mounted to each of the outer hoistway doors 110a and 110b along the length of the door near the transverse edge 52. The transverse head panel seal 139 extends inwardly into the transverse head space 128 and is positioned in an overlapping relationship
10 with the transverse head panel 132 such that, when the outer hoistway doors 110a and 110b are in the closed position, shown in solid lines, the transverse head panel seal is pressed into sealable engagement with the transverse head panel, thereby providing a seal within the transverse head panel space 128.

In another embodiment of the present invention illustrated in Figure 14, a
15 sloped door support member 140 is securely mounted to the headwall 30 above the hoistway entrance 14. The sloped door support member 140 slopes downwardly from each of its outer ends toward the center of the hoistway entrance 14. The sloped door support member 140 is illustrated with the opposing hoistway doors 16a and 16b discussed above. Although the illustrated embodiment includes a pair of opposing doors 16a and 16b, the
20 door assembly 16 can have other configurations, such as a single door configuration, or a configuration having a multiple pair of opposing doors.

Each of the hoistway doors 16a and 16b are movably supported on the sloped door support member 140 by a pair of door supports 142 that move laterally along the sloped door support member as the hoistway doors move between the open and closed
25 positions. Each door support 142 includes a door support truck 144 secured to the top of the respective hoistway door 16a or 16b and a support roller 146 rotatably attached to the top of the door support truck. The support roller 146 is adapted to movably engage a roller support surface 148 on the top of the sloped door support member 140 to permit the lateral movement of the hoistway doors 16a and 16b between the open and closed positions.

30 When the hoistway doors 16a and 16b are in the open position, shown in phantom lines, the doors supports are located at the raised ends of the sloped door support member 140, such that the doors are in a raised position above the sill 26. As the hoistway doors 16a and 16b move from the open and raised position to the closed position, the support rollers 146 move laterally and downwardly along the upper roller support
35 surface 148 of the sloped door support member 140, thereby causing the hoistway doors 16a and 16b to simultaneously move downwardly relative to the wall structure 10 to a

lowered position such that the bottom edge of each hoistway door moves downwardly toward the sill 26.

The seal structure around the hoistway entrance and the hoistway doors, and the alternative embodiment of the seal structures are the same as the seal structures described above. The transverse seal structure 56 is mounted between the top portion of the hoistway doors and the headwall 30. The trailing edge seal structure 74 is mounted between the trailing edge portion of the respective hoistway doors and the left and right jambwalls 70a and 70b. The meeting edge seal structure 84 is mounted between the meeting edges 80 of the doors. The bottom door seal structure 64 is mounted between the bottom edge of the door and the sill 26. These seal structures form the seals 23 around and between the hoistway doors 16a and 16b when the hoistway doors 16a and 16b laterally and downwardly move from the open and raised position to the closed and lowered position. Accordingly, the sloped door support member 140 simultaneously directs the hoistway doors lateral and vertically, thereby forming seals that, for example, block the flow of smoke and gas between the hoistway doors 16a and 16b and the wall structure.

As best seen in Figure 15, the sloped door support member 140 is oriented to provide a gradual transition for the support rollers 146 as the hoistway doors 16a and 16b move between the closed and lowered position shown in solid lines, and the open and raise position shown in phantom lines. Accordingly, as the left and right hoistway doors 16a and 16b are moved laterally from the closed position toward the open position, the support rollers 146 travel upwardly along the roller support surface 148, thereby lifting the hoistway doors from the lowered position to the raised position. As a result, the hoistway doors 16a and 16b avoid frictional resistance from the seal structures and can be moved to the open position with a minimal amount of force.

In another embodiment of the present invention illustrated in Figure 16, the hoistway entrance 14 in the wall structure 10 is a rectangular opening defined by the left lateral jamb 24a, the right lateral jamb 24b, the sill 26, and the head 28. The hoistway door seal structure 22 is adjacent to the hoistway entrance 14. The hoistway door seal structure 22 includes the hoistway door assembly 16 that moves laterally relative to the hoistway entrance 14 between the open position, shown in phantom lines, permitting access to the elevator hoistway, and the closed position, shown in solid lines, wherein the hoistway door assembly 16 substantially covers the hoistway entrance 14. In the illustrated embodiment, the hoistway door assembly 16 includes the pair of opposing doors 16a and 16b that are laterally movable relative to the hoistway entrance 14. The pair of opposing doors 16a and 16b are coupled together in a conventional manner, such that the lateral movement of each of the hoistway doors is synchronized to move together between the

open and closed positions. Although the illustrated embodiment includes the pair of opposing doors 16a and 16b, the door assembly can have other configurations, such as the single door configuration, or the configuration having a multiple pair of opposing doors.

5 The pair of hoistway doors 16a and 16b are movably supported outwardly adjacent to the hoistway entrance 14 by a segmented door support member 152 that is securely mounted to the headwall 30 above the head 28 in a generally horizontal orientation. Each of the hoistway doors 16a and 16b are movably attached to the segmented door support member 152 by a pair of door supports 154 that move laterally along the segmented door support member as the hoistway doors move between the open and closed positions.

10 Each door support 154 includes a door support truck 156 that is pivotally secured to the top of the respective hoistway door 16a and 16b, and a support roller 158 is rotatably attached to the top of the door support truck 156. The support roller 158 movably engages a roller support surface 160 on the top of the segmented door support member 152 to permit the lateral movement of the hoistway doors 16a and 16b between an open and closed position.

15 The hoistway door seal structure 22 further includes the plurality of seals positioned between the hoistway doors 16a and 16b and the wall structure 10 around the hoistway entrance 14, and, as discussed in detail below, the seals are adapted to seal spaces between the hoistway doors and the wall structure when the doors are in the closed position, for example, to restrict the passage of gas and smoke through the spaces in the event of a fire. The formation of these seals is facilitated by the segmented door support member 152, which is constructed to guide the hoistway doors 16a and 16b laterally as the doors move from the open position shown in phantom lines toward the closed position shown in solid lines. As the hoistway doors 16a and 16b approach the closed position, the segmented door support member 152 also simultaneously guide the hoistway doors

20 inwardly toward the wall structure, thereby forming seals between and around the hoistway doors.

As best seen in Figure 16 and 17, the segmented door support member 152 is a substantially horizontal rail sized to the opening distance traveled by the support rollers 158 as the hoistway doors moved between the open and closed positions, with the uppermost edge of a rail forming the roller support surface 160. The segmented door support member 152 includes a plurality of segments 161 secured to the headwall 30, with each door support 154 traveling on a separate segment.

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Each segment 161 has an elongated straight portion 162, and a curved end portion 164 secured to the end of each straight portion closest to the center of the hoistway entrance 14. The location of the innermost end of the curved end portion 164 corresponds to the location of the respective support roller 158 when the hoistway doors 16a and 16b

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are in the closed position. Each of the curved end portions 164 is positioned to receive the support roller 158 from the straight portions 162 as the hoistway doors 16a and 16b approach the closed position. As best seen in Figure 18, the straight portion 162 of each segment 161 is positioned outwardly away from the headwall 30 such that the
5 corresponding hoistway door 16a and 16b is supported outwardly away from the wall structure 10 as the hoistway door moves between the open and closed positions. The curved end portion 164 curves inwardly from the end of the straight portion 162 and terminates at the headwall 30.

Accordingly, each of the support rollers 158 travel along the roller support
10 surface 160 of the respective segment 161 such that the hoistway doors 16a and 16b are in the outward position, shown in phantom lines in Figure 18, as the support rollers travel over the support member's straight portion 162. As the hoistway doors 16a and 16b move laterally from the open and outer position and approach the closed position, the support rollers 158 move from the straight portions 162 to their respective curved end portions 164,
15 thereby causing the hoistway doors 16a and 16b to simultaneously move laterally and inwardly, relative to the wall structure, to the closed position.

As best seen in Figure 17, the door support truck 156 has an upper
portion 157 that rotatably carries the support roller 158, and a lower portion 159 that is securely fastened to the respective hoistway door 16a and 16b. The upper and lower
20 portions 157 and 159 are connected to each other by a pivotal member 166 such that the upper portion is pivotal relative to the lower portion and relative to the hoistway door. As seen in Figure 17 and 18, each of the support rollers 158 movably engages the roller support surface 160 and, as the hoistway doors 16a and 16b move laterally from the open and outward position toward the closed and inward position, the upper portion 157 of the door
25 support truck 156 pivots as the support roller 158 follows the curved end portion 164, thereby causing the hoistway doors 16a and 16b to simultaneously move inwardly toward the hoistway entrance 14.

As best seen in Figure 18, the terminating end 170 of the straight portion 162
of each segment 161 is attached to the headwall 30 with brackets 168. The curved end
30 portion 164 opposite the terminating end 170 is secured directly to the headwall. The segments 161 of the segmented door support member 152 are constructed so the support rollers 158 simultaneously travel over the same area of their respective segment such that the hoistway doors 16a and 16b move in a uniform manner and remain substantially parallel to the hoistway entrance 14 as they move between the open and closed positions.

35 In an alternate embodiment of the segmented support member 152, illustrated in Figure 19, the segmented support member 152 is a substantially horizontal rail

with the uppermost edge of the rail forming a roller support surface 172. Each of the hoistway doors 16a and 16b are movably attached to the segmented door support member 152 by a pair of the non-pivotal door supports 32 described generally above and illustrated in Figure 3. The segmented door support member 152 includes a plurality of segments 173, each having a straight portion 174 and a narrowed, curved portion 176 that is connected to the end of the straight portion 174. Each of the narrowed, curved portions 176 is positioned to receive the support roller 158 when the hoistway doors 16a and 16b approach the closed position. As the hoistway doors 16a and 16b are moved laterally from the open and outward position shown in phantom lines toward the closed and inward position, the support rollers 158 move from the straight portion 174 and follow the narrowed, curved portion 176 as the hoistway doors approach the closed position.

As best seen in Figure 20a, the support roller 36 has an annular groove 178 therein that receives the top of the door support member 152, such that the support rollers straddles the door support member. The straight portion 174 of the segmented door support member 152 is sized slightly narrower than the width an annular groove 178 so as to minimize the frictional resistance between the support roller and the roller support surface 172. When the hoistway doors are in the closed position, the support rollers 36 are located at a position on the respective narrowed, curved portion 176, as best seen in Figure 20b, where the narrowed, curved portion has a thickness that is approximately less than half the width of the annular groove 178. The narrowed, curved portion 176 is shaped and sized to direct the respective non-pivotal support roller 36 inwardly as the hoistway doors approaches the closed position. The annular groove 178 is shaped to accommodate the curvature of the narrowed, curved portion 176 so the non-pivotal support roller 36 travels freely over the narrowed, curved portion without binding or experiencing excessive frictional resistance between the sides of the annular groove and the segmented door support member 152.

As best seen in Figures 18 and 19, each of the hoistway doors 16a and 16b have the transverse edge portion 52 along the top of the door that is outwardly adjacent to the headwall 30 so as to define the transverse space 54 between the transverse edge and the headwall 30. An elongated transverse seal structure 179 is positioned between the transverse edge portion 52 and the headwall 30 such that when the hoistway doors 16a and 16b are in the closed position as shown in solid lines, the elongated transverse seal structure 179 substantially fills the transverse space 54, for example, so as to block the passage of gas or smoke therethrough in the event of a fire or the like.

As best seen in Figure 21a, the elongated transverse seal structure 179 comprises an elongated transverse seal 180 securely fastened to the headwall 30 adjacent to

the head 28. The transverse seal 180 extends outwardly toward the hoistway doors 16a and 16b and into the transverse space 54. The transverse seal 180 is out of engagement with the hoistway doors 16a and 16b when the doors are in the open and outward position shown in phantom lines, thereby avoiding frictional resistance between the transverse seal 180 and the hoistway door. When the hoistway doors 16a and 16b are moved from the open and outward position to the closed and inward position, the hoistway doors move into sealable engagement with the transverse seal 180 so as to seal the transverse space 54. In the preferred embodiment, the transverse seal 180 is a shaped, resilient temperature resistive material that is slightly compressed by the top of the hoistway doors 16a and 16b when it is moved to the closed and inward position.

In an alternate embodiment illustrated in Figure 21b, the elongated transverse seal structure 179 comprises elongated transverse seals 181 attached to the top portion of each of the hoistway doors 16a and 16b adjacent to the transverse edge portion 52. Each transverse seal 181 extends along the length of the respective hoistway door 16a and 16b, and the transverse seal 181 extends along the length of the respective hoistway door 16a and 16b, and the transverse seal extends inwardly into the transverse space 54 toward the headwall 30. When the hoistway doors 16a and 16b are in the closed and inward position shown in solid lines, the elongated transverse seal 181 presses against the headwall 30 to form a seal in the transverse space 54.

Referring to Figure 16, the bottom edge 44 of each hoistway door 16a and 16b is positioned above the sill 26 at a selected distance that defines a sill space 46 between the hoistway doors and the sill. As best seen in Figure 22, a bottom door seal structure 182 is securely attached to the entire bottom edge 44 of each of the hoistway doors 16a and 16b. The bottom edge seal structure 182 includes elongated inner and outer bottom seals 184a and 184b spaced apart on the bottom edge 44 of each hoistway door 16a and 16b, such that the inner and outer bottom seals 184a and 184b extend the length of the respective hoistway door, and the bottom seals extend downwardly toward the sill 26. The bottom door seals 184a and 184b are sized such that they substantially fill the space 46 so as to, as an example, limit the flow of gas or smoke therethrough in the event of a fire. In the preferred embodiment, the bottom door seals 184a and 184b are a stainless steel brushes that lightly touches the sill as the hoistway doors 16a and 16b are moved to the closed position thereby minimizing the frictional resistance during movement of the hoistway doors.

As best seen in Figure 16, each of the hoistway doors 16a and 16b has a trailing edge portion 68 that is positioned outwardly adjacent to the respective left and right jambwalls 70a and 70b. As best seen in Figure 23a, each of the hoistway doors 16a and 16b is positioned such that the trailing edge lateral space 72 is located between the hoistway

doors 16a and 16b adjacent to the trailing edge portion 68 and the respective left and right jambwalls 70a and 70b. An elongated trailing edge seal 186 is connected to the left and right jambwalls 70a and 70b along their length. The trailing edge seal 186 projects outwardly from the respective jambwall 70a and 70b toward the respective hoistway door 16a and 16b such that the trailing edge lateral seal 186 extends into the trailing edge space 72. The hoistway doors 16a and 16b are out of engagement with the respective trailing edge seal 186 when the hoistway doors are in the open and outward position, thereby avoiding frictional resistance therebetween as the doors are moving between the open and closed positions.

When the hoistway doors 16a and 16b are moved to the closed and inward position, as shown in solid lines in Figure 23a, the hoistway doors 16a and 16b pressed against and sealably engages the trailing edge seal 186 to seal the trailing edge space 72 along the height of the hoistway doors. In the preferred embodiment, the trailing edge seal 186 is a shaped, resilient temperature resistive material that is slightly compressed by the hoistway door when it is moved to the closed and inward position.

In an alternate embodiment illustrated in Figure 23b, an elongated trailing edge seal 187 is attached to the entire length of the hoistway door 16a and 16b near the trailing edge portion 68 and extends into the trailing edge space 72 toward the jambwalls 70a and 70b. Accordingly, when the hoistway doors 16a and 16b are moved from the open and outward position shown in phantom lines toward the closed and inward position shown in solid lines, the trailing edge lateral seals 187 press against the respective right and left jambwalls 70a and 70b to form a seal in the trailing edge space 72.

The meeting edge seals and their alternate embodiments are as described above and shown in Figure 8a/b. The interdoor seals and the alternate embodiments for a pair or multiple pair of hoistway door configurations are as described above and shown in Figure 12a/b.

In an alternate embodiment (not shown) of the present invention having the segmented door support structure 152, the door seal structure 22 includes the single hoistway door 88 having the leading edge portion 94 that is positioned outwardly away from the right jambwall 70b to define a leading edge lateral space 96 between the hoistway door and the jambwall. As best seen in Figure 24a, a leading edge lateral seal 188 is attached to the right jambwall 70b and projects outwardly away from the jambwall into the leading edge lateral space 96 toward the hoistway door 88. The leading edge lateral seal 188 is out of engagement with the jambwall 70b when the hoistway door 88 is in the open and outward position, thereby avoiding frictional resistance between the leading edge lateral seal 188 and the jambwall 70b as the door is moving between the open and closed

positions. When the hoistway door 88 is moved to the closed and inward position, the hoistway door 88 moves inwardly into sealable engagement with the leading edge lateral seal 188 so as to seal the leading edge space 96. In the preferred embodiment, the leading edge lateral seal 188 is a shaped, resilient temperature resistive material that is slightly compressed by the hoistway door 88 near the leading edge portion 94 when the hoistway door is moved to the closed and inward position.

In an alternate embodiment, illustrated in Figure 24b, a leading edge lateral seal 189 is mounted to the hoistway door 88 near the leading edge portion 94 along the height of the door, and the leading edge lateral seal extends inwardly toward the right jambwall 70b and into the leading edge space 96. As the hoistway door 88 is moved from the open and outward position, shown in phantom lines, into the closed and inward position, shown in solid lines, the leading edge seal 189 is pressed into sealable engagement with the jambwall 70a to form a seal therein, for example, that limits smoke and gas flow through the leading edge space 96 in the event of a fire or the like.

In a single hoistway door configuration, seals are formed between the transverse edge of the door and the headwall as discussed above and illustrated in Figure 21a and 21b, between the bottom edge of the door and the sill as discussed above and illustrated in Figure 22, and between the trailing edge of the door and the jambwall as discussed above and shown in Figures 23a and 23b.

In an alternative embodiment of the present invention, the hoistway door seal structure 22 includes a segmented door support member 152, as discussed above, and the door assembly includes opposing left and right inner hoistway doors 108a and 108b and opposing left and right outer hoistway doors 110a and 110b, similar to the hoistway door arrangement illustrated in Figure 16. As best seen in Figure 25a, the transverse edge portion 52 of the outer hoistway doors 110a and 110b is outwardly adjacent to the headwall 30, and the elongated transverse head panel seal structure 124 is attached to the headwall 30 between the headwall and the transverse edge portion 52 of the outer hoistway doors 110a and 110b. The transverse head panel seal structure includes a transverse head panel 191 having an L-shaped cross section with a first leg 193 securely attached to the headwall 30 and extending outwardly substantially perpendicular to the headwall. An upwardly projecting second leg 192 is connected to the outward end of the first leg 193 adjacent to the transverse edge portion 52 of the outer hoistway doors 110 and 110b. A transverse head panel space 194 is located between the upwardly projecting second leg 192 and the transverse edge portions of outer hoistway doors 110a and 110b.

An elongated transverse head panel seal 196 is secured along the length of the upwardly projecting second leg 192 of the transverse head panel 191 and extends

toward the outer hoistway doors 110a and 110b into the transverse head panel space 194. The transverse head panel seals 196 are out of engagement with the outer hoistway doors 110 and 110b when the respective doors are moved to and from the open and outward position, thereby avoiding frictional resistance between the transverse head panel seal 196 and the outer hoistway doors 110a and 110b. When the outer hoistway doors 110a and 110b are moved to the closed and inward position, they move into sealable engagement with the transverse head panel seal 196 so as to seal the transverse head panel space 914. In the preferred embodiment, the transverse head panel seal 196 is a shaped, resilient temperature resistive material that is slightly compressed by the outer hoistway door 110a and 110b when the hoistway doors are moved to the closed and inward position.

In an alternate embodiment illustrated in Figure 25b, the transverse head panel seal 197 is mounted to the outer hoistway doors 110a and 110b near the transverse edge portion 52 along the length of the respective outer hoistway door, and the transverse head panel seal extends inwardly toward the upwardly projecting second leg 192 of the transverse head panel 191 such that when the outer hoistway doors 110 and 110b are in the closed and inward position, shown in solid lines, the transverse head panel seal 197 is pressed into sealable engagement with the upwardly projecting second leg 192 thereby forming a seal within the transverse head panel space 194.

In the alternate embodiments having the segmented door support member 152 and a door assembly having opposing inner and outer hoistway doors, 108a, 108b, 110a, and 110b, as illustrated in Figure 25a and 25b, seals are formed between the transverse edge portion 52 of the inner hoistway doors and the headwall 30 as described above and illustrated in Figures 21a and 21b. Thus, the transverse seal 180 is securely connected to the headwall 30, or alternatively to the top portion of each inner hoistway doors 108a and 108b, and the transverse seal is slightly compressed when the inner hoistway doors are in the closed and inward position. A sill seal is formed between the bottom edge of the inner and outer hoistway doors 108a, 108b, 110a, and 110b, and the sill 26 as discussed above and illustrated in Figure 22. A trailing edge seal structure 186 is attached to the trailing edge portion of the inner hoistway doors 108a and 108b, or alternatively to the respective left and right jambwall 70a and 70b in a manner substantially identical as is described above and illustrated in Figures 23a and 23b for the door assembly with two opposing door panels.

In the alternate embodiments having the segmented door support member 52 and a door assembly with inner and outer hoistway doors 108a, 108b, 110a, and 110b, the hoistway doors move in unison from the outward position to the inward position as the hoistway doors close. Accordingly, the interdoor lateral space 120 between the leading

edge portions of the inner hoistway doors 108a and 108b and the trailing edge portions of the outer hoistway doors 110a and 110b remain substantially the same size as the hoistway doors move between the open and outward position and the closed and inward position. Accordingly, the interdoor lateral space 120 is sealed by an interdoor seal structure 122 in the same manner as discussed above and illustrated in Figures 12a and 12b.

When the inner and outer hoistway doors 108a, 108b, 110a, and 110b move from the open and outward position, shown in solid lines in Figure 16, to the closed position, shown in phantom lines, the inner and outer hoistway doors move laterally and inwardly as the doors approach and reach the closed and inward position. When the inner and outer hoistway doors 108a, 108b, 110a, and 110b are in the closed and inward position, seals are formed around and between the inner and outer hoistway doors 108a, 108b, 110a, and 110b and are effectively sealed off, for example, to limit the flow of gas or smoke therethrough in the event of a fire, thereby minimizing migration of smoke through a building during a fire or the like.

In yet another embodiment of the present invention illustrated in Figure 26, a door assembly 16 has a pair of opposing hoistway doors 202a and 202b that are supported outwardly adjacent to the hoistway entrance 14 by an elongated door support member 198. The door support member 198 is rigidly secured to the headwall 30 by brackets 200 in a generally horizontal orientation above the hoistway entrance 14. Although the illustrated embodiment includes a pair of opposing doors 202a and 202b, the door assembly 16 can have other door configurations, such as a single door, or a multiple pair of opposing doors, as discussed above.

As best seen in Figures 26 and 27, the elongated door support member 198 is a rail with a horizontal top edge 203 and a sloped bottom edge 204 that slopes downwardly from each of its outer ends toward the centerline of the hoistway entrance 14. The sloped bottom edge 204 is directly above the hoistway doors 202a and 202b. Each of the hoistway doors 202a and 202b have a sloped transverse edge 206 that slopes downwardly from the hoistway door's trailing edge portion to its leading edge portion. The slope of the sloped transverse edge 206 substantially corresponds to the slope of the door support member's sloped bottom edge 204.

As best seen in Figure 26, each of the hoistway doors 202a and 202b are movably supported on the door support member 198 by a leading door support 212a and a trailing door support 212b that move laterally along the horizontal top edge 203 as the hoistway doors move laterally between the open and closed positions. Each of the leading and trailing door supports 212a and 212b includes a door support truck 214 secured to the top of the respective hoistway door 202a and 202b, and a support roller 216 rotatably

attached to the top of the door support truck. The support roller 216 rolls along the door support member's horizontal top edge 203 upon movement of the hoistway doors.

The door support trucks 214 of the leading and trailing door supports 212a and 212b are sized such that the sloped transverse edge 206 of the respective hoistway door 202a and 202b is immediately adjacent to the door support member's sloped bottom edge 204 when the hoistway doors are in the closed position. Accordingly, the door support truck 214 of the leading door support 212a is longer than the door support truck 214 of the trailing door support 212b to accommodate the deeper section of the door support member near its middle portion. When the hoistway doors 202a and 202b are moved toward the open position, the distance between the hoistway door's sloped transverse edge 206 and the door support member's sloped bottom edge 204 increases because of the sloped bottom edge.

As best seen in Figures 28a and 28b, the door support member 198 is outwardly supported away from the headwall 30 by the brackets 200 to define a transverse door support space 208 between the door support member and the headwall 30. A sloped transverse seal 210 is connected to the headwall 30 and extends outwardly to the door support member 198 adjacent to the sloped bottom edge 204 of the door support member 198. The transverse seal 210 is a blade-like structure having a slope that substantially corresponds to the slope of the sloped bottom edge 203, and the sloped transverse seal fills the transverse door support space 208 to block for example, the flow of smoke and gas between the door support member 198 and the headwall 30.

As best seen in Figures 26 and 27, when the hoistway doors 202a and 202b are in the closed position, shown in solid lines, the sloped transverse edge 206 of each hoistway door positioned below the door support member's sloped bottom edge 204 defines a sloped transverse space 220 therebetween. As best seen in Figure 28a, an elongated transverse seal 222 is attached to the door support member's sloped bottom edge 204, and the transverse seal extends downwardly toward the sloped transverse edge 206 of hoistway doors 202a and 202b into the transverse space 220.

When the hoistway doors 202a and 202b are in the closed position, shown in solid lines, the sloped transverse edge 206 of each hoistway door 202a and 202b sealably engages the transverse seal 222 on the door support member 198, such that the transverse seal 222 fills the transverse space 220, for example, to block the flow of smoke and gas between the doors 202a and 202b and the headwall 30. When the hoistway doors 202a and 202b are moved to and from the open position, shown in phantom lines, the transverse seal 222 is out of engagement with the sloped transverse edge 206 of the hoistway doors, thereby avoiding frictional resistance between the sloped transverse edges and the transverse

seal as the hoistway doors move between the open and closed positions. In the preferred embodiment, the transverse seal 222 is a shaped, resilient temperature resistive material that is slightly compressed by the sloped transverse edges 206 when the hoistway doors 202a and 202 are moved to the closed position.

5 In an alternate embodiment of the present invention having the door support member 198 with a sloped bottom edge 204, as best seen in Figure 28b, the sloped transverse seal 210 extends between the door support member and the headwall 30, as discussed above. An elongated sloped transverse seal 225 is securely mounted to the sloped transverse edge 206 of each of the hoistway doors 202a and 202b. The sloped transverse seal 225 extends upwardly away from the sloped transverse edge 206 into the transverse space 220 toward the sloped bottom edge 204 of the door support member 198. When the hoistway doors 202a and 202b are in the closed position, shown in solid lines, the sloped transverse seal 225 is in sealable engagement with the door support member's sloped bottom edge 204 so as to seal the sloped transverse space 220 and block gas or smoke from flowing therethrough in the event of a fire. When the hoistway doors 202a and 202b are moved toward the open position, shown in phantom lines, the sloped transverse seal 225 moves out of engagement with the door support member 198, so as to avoid frictional resistance therebetween as the hoistway doors move between the open and closed positions.

10 In the embodiments having the door support member 198 with a sloped bottom edge 204, additional seals are provided around and between the hoistway doors 202a and 202b, for example, to block gas or smoke from flowing between the hoistway doors and the wall structure 10 around the hoistway entrance. As best seen in Figure 26, a trailing edge seal structure 74 as is described above and illustrated in Figures 7a and 7b is positioned between the trailing edge 68 of the respective hoistway door and the respective jambwall 70a and 70b. A meeting edge seal 86 as described above and illustrated in Figures 8a and 8b is positioned between the meeting edges 80 of the hoistway doors. A bottom door seal structure 812 as is described above and illustrated in Figure 22 is positioned between the bottom edge 44 of each hoistway door and the sill 26. In the embodiment (not shown) wherein a single hoistway door is movably supported on the door support member having a sloped bottom edge, a leading edge seal structure as is described above and illustrated in Figures 10a and 10b is positioned between the leading edge of the hoistway door and the respective jambwall.

15 In an alternate embodiment having opposing outer and inner hoistway doors 226a, 226b, 228a, and 228b, as best seen in Figure 29a and 29b, the outer hoistway doors are movably supported on an elongated outer door support member 234 and the inner hoistway doors are movably supported on an elongated inner door support member 232.

Each of the inner and outer door support members 232 and 234 have a horizontal top edge 235 and a sloped bottom edge 238 that slopes downwardly toward the center of the hoistway entrance. Each of the outer and inner hoistway doors 226a, 226b, 228a, and 228b have a sloped transverse edge 240 that slopes downwardly toward the center of the hoistway entrance, and the slope of each transverse edge corresponds to the downward slope of the sloped bottom edge 238 of the respective inner and outer door support members 232 and 234. The sloped transverse edges 240 of the outer hoistway doors 226a and 226b are positioned outwardly adjacent to the inner hoistway doors 228a and 228b and the headwall 30 to define a sloped transverse head panel space 230 between the inner door support member 232 and the outer door support member 234. An outer sloped transverse seal structure 236 is mounted between the inner door support member 232 and the outer door support member 234 adjacent to the sloped bottom edge 238 to substantially fill the sloped outer transverse head panel space 230. An inner sloped transverse seal structure 237 is mounted between the inner door support member 232 and the headwall 30 adjacent to the sloped bottom edge 238 to substantially fill the sloped inner transverse head panel space 231.

As best seen in Figure 29a, an elongated outer transverse seal 244 is secured to the length of the sloped bottom edge 238 of the outer door support member 234. The outer transverse seal 244 extends downwardly away from the sloped bottom edge 238 toward the sloped transverse edge 240 of the outer hoistway doors 226a and 226b into an outer transverse space 242 that is between the respective outer hoistway door and the outer door support member 234. The outer transverse seals 244 are out of engagement with the transverse edge 240 of the respective outer hoistway doors 226a and 226b when the hoistway doors are in the open position, shown in phantom lines. This arrangement avoids resistance between the outer transverse seals 244 and the sloped transverse edge 240 as the outer hoistway doors 228a and 228b are moved between the open and closed positions.

When the outer hoistway doors 226a and 226b are moved to the closed position the sloped transverse edges 240 move laterally into sealable engagement with the outer transverse seal 244, so as to seal the outer transverse space 242. The outer transverse seal 244 is preferably a shaped, resilient temperature resistive material that is slightly compressed by the sloped transverse edge 240 of the respective outer hoistway door 226a and 226b when the outer hoistway doors are in the closed position.

An elongated inner transverse seal 243 is secured to the length of the sloped bottom edge 238 of the inner door support member 232. The inner transverse seal 243 extends downwardly away from the sloped bottom edge 238 toward the sloped transverse edge 240 of the inner hoistway doors 228a and 228b into an inner transverse space 239

between the respective inner hoistway door and the inner door support member 232. The inner transverse seals 243 are out of engagement with the sloped transverse edge 240 of the respective inner hoistway doors 228a and 228b when the hoistway doors are in the open position, shown in phantom lines.

5 When the inner hoistway doors 228a and 228b are moved to the closed position, shown in solid lines, the sloped transverse edges 240 move laterally into sealable engagement with the inner transverse seal 243, so as to seal the inner transverse space 239. The inner transverse seal 243 is preferably a shaped, resilient temperature resistive material that is slightly compressed by the sloped transverse edge 240 of the respective inner
10 hoistway doors 228a and 228b when the inner hoistway doors are in the closed position.

 In an alternate embodiment illustrated in Figure 29b, an outer transverse seal 245 is mounted to the outer hoistway door 226a and 226b along the sloped transverse edge 240 and an inner transverse seal 247 is mounted to the inner hoistway doors 228 and 228b along the sloped transverse edge 240. Each of the inner and outer transverse seals 245
15 and 247 extend upwardly toward the respective inner and outer door support members 232 and 234. The inner and outer transverse seals 247 and 245 extend away from the respective sloped transverse edge 240 such that when the hoistway doors are in the closed position, shown in solid lines, the inner and outer transverse seals are pressed into sealable engagement with the respective sloped bottom edges 238 so as to form a seal within the
20 respective inner and outer transverse edge spaces 242.

 In another alternate embodiment of the present invention, as illustrated in Figure 30, an elongated door support member 246 is securely mounted to the headwall 30 above the hoistway entrance 14. The elongated door support member 246 is illustrated with the opposing hoistway doors 202a and 202b discussed above. Although the illustrated
25 embodiment includes a pair of opposing doors, the door assembly can have other configuration, such as a single door configuration, or a configuration having a multiple pair of opposing doors, as discussed above. Each of the hoistway doors 202a and 202b are movably attached to the elongated door support member 246 by a pair of door supports 212 as discussed above and shown in Figure 26.

30 The hoistway door seal structure 22 further includes a plurality of seals positioned between the hoistway doors 202a and 202b and the wall structure 10 around the hoistway entrance 14, to seal spaces between the hoistway doors and the wall structure when the doors are in the closed position, for example, to restrict the passage of gas and smoke through the spaces in the event of a fire. The formation of these seals is facilitated by
35 the elongated door support member 246, which is constructed to move the hoistway doors 202a and 202b laterally from the open position, and as the hoistway doors approach

the closed position, the door support member is adapted to move the hoistway doors into sealable engagement with the seals.

As best seen in Figures 30 and 31, the elongated door support member 246 is a substantially horizontal rail with the uppermost edge of the rail forming a horizontal roller support surface 248. A sloped transverse seal structure 250 is mounted to the headwall 30 below the elongated door support member 246 and slopes downwardly from its outer ends toward the centerline of the hoistway entrance 14 and as best seen in Figures 32a and 32b, has an L-shaped cross-section, wherein an attachment leg 252 of the structure is securely fastened to the headwall 30 in a conventional manner. An engagement leg 254 extends perpendicularly away from the headwall 30. A sloped transverse edge 206 of the hoistway doors 202a and 202b substantially corresponds to the slope of the sloped transverse seal structure 250.

As best seen in Figure 31, when the hoistway doors 202a and 202b are moved to the closed position, shown in solid lines, the sloped transverse edge 206 of the hoistway doors 202a and 202b are positioned below the engagement leg 254 of the sloped transverse seal structure 250 to define a sloped transverse space 256.

As best seen in Figure 32a, an elongated transverse seal 258 is secured to the length of the engagement leg 254 of the sloped transverse seal structure 250. The elongated transverse seal 258 extends downwardly away from the engagement leg 254 toward the sloped transverse edge 206 of the hoistway doors 202a and 202b. The elongated transverse seals 258 are out of engagement with the sloped transverse edge 206 when the respective doors 202a and 202b are in the open position shown in phantom lines, thereby avoiding frictional resistance between the elongated transverse seal and the sloped transverse edge as the door moves between the open and closed positions. When the hoistway doors 202a and 202b are moved to the closed position shown in solid lines, the sloped transverse edge 206 is moved into sealable engagement with the elongated transverse seal 258 as to seal the sloped transverse space 256. In the preferred embodiment, the elongated transverse seal 258 is a shaped, resilient temperature resistant material that is slightly compressed by the sloped transverse edge 206 when the hoistway doors 202a and 202b are moved to the closed position.

As best seen in Figure 32b, an alternate embodiment of the elongated transverse seal 259 is securely mounted to the length of the sloped transverse edge 206 of the hoistway doors 202a and 202b. The elongated transverse seal 259 extends upwardly away from the sloped transverse edge 206 toward the engagement leg 254 of the sloped transverse seal structure 250. Accordingly, when the hoistway doors 202a and 202b are moved to the closed position, shown in solid lines, the elongated transverse seal 259 moves

into sealable engagement with the engagement leg 254 to seal the sloped transverse space 256.

The seal structures along the bottom edge of the hoistway doors are as described above and illustrated in Figure 22. The seal structures along the trailing edges of the hoistway doors are as described above and illustrated in Figures 7a and 7b. The seal structures along the meeting edge of an opposing door configuration are as described above and illustrated in Figures 8a and 8b. In a configuration with a single hoistway door, the seal structures along the leading edge of the single hoistway door is as described above and illustrated in Figure 10a and 10b. In a configuration having pairs of opposing inner and outer hoistway doors, the seal structures along the trailing edge of the outer hoistway door and the leading edge of the inner hoistway door are as described above for a pair or multiple pairs of hoistway doors and illustrated in Figure 12a and 12b.

In an alternate embodiment, illustrated in Figures 33a and 33b, the sloped transverse edge 240 of the outer hoistway doors 226a and 226b are positioned outwardly adjacent to the inner hoistway doors 228a and 228b, and to the headwall 30 to define a sloped transverse head panel space 260. A sloped transverse seal structure 262 is mounted to the headwall 30 above the hoistway entrance and below inner and outer elongated door support members 263 and 265 that are also mounted to the headwall. The sloped transverse seal structure 262 slopes downwardly from its outer ends toward the centerline of the hoistway entrance and has an L-shaped cross section, wherein an attachment leg 264 of the structure is securely fastened to the headwall 30 in a conventional manner. An engagement leg 266 extends perpendicularly away from the headwall 30. The sloped transverse edge 240 of the outer hoistway doors 226a and 226b substantially corresponds to the slope of the sloped transverse seal structure 262. When the outer hoistway doors 226a and 226b are moved to the closed position, shown in solid lines, the transverse edge 240 of the outer hoistway doors 226a and 226b are outwardly positioned from the engagement leg 266 to define a sloped transverse space 268. The outer ends of the sloped transverse seal structure 262 terminate at a position above the left and right jambwalls 70a and 70b (shown in Figure 30), such that the sloped transverse seal structure does not interfere with lateral movement of the inner hoistway doors 228a and 228b as they move toward the closed position.

As best seen in Figure 33a, an elongated sloped transverse seal 270 is secured to the length of the engagement leg 266 of the sloped transverse seal structure 262. The elongated sloped transverse seal 270 projects downwardly away from the engagement leg 266 toward the sloped transverse edge 240 of the outer hoistway doors 226a and 226b into the sloped transverse space 268. The elongated sloped transverse seals 270 are out of

engagement with the sloped transverse edge 240 when the respective outer hoistway doors 226a and 226b are in the open position shown in phantom lines. When the outer hoistway doors 226a and 226b are moved to the closed positions shown in solid lines, the sloped transverse edge 240 moves laterally into sealable engagement with the elongated sloped transverse seal 270 so as to seal the sloped transverse space 268. In the preferred embodiment, the elongated sloped transverse seal 270 is a shaped, resilient temperature resistive material that is slightly compressed by the sloped transverse edge 240 when the outer hoistway doors 226a and 226b are moved to the closed position.

In an alternate embodiment illustrated in Figure 33b, an elongated sloped transverse seal 271 is mounted to the outer hoistway door 226a and 226b along the entire sloped transverse edge 240 oriented toward the engagement leg 266 into the sloped transverse space 268. The elongated sloped transverse seal 271 extends away from the sloped transverse edge 240 such that when the hoistway doors are in the closed position, shown in solid lines, the elongated sloped transverse seal 271 is pressed into sealable engagement with the engagement leg 266 so as to form a seal within the sloped transverse edge space 268 and block any gas or smoke from flowing therethrough in the event of a fire or the like.

Accordingly, when the outer hoistway doors 226a and 226b are moved from the open position to the closed position, the hoistway doors move laterally to form seals around the entire hoistway entrance between the hoistway door assembly and the wall structure and between the meeting edges, bottom edges and interdoor edges of the hoistway doors. Thus, all of the spaces around and between the hoistway doors are effectively sealed off when the doors are in the closed position so as to limit the flow of gas or smoke in the event of a fire, thereby minimizing migration of smoke through a building during a fire or the like.

Although the embodiments described herein are described in terms of the seals around the hoistway door blocking the flow of smoke and gas in the event of a fire, the seals are also effective in blocking the flow of air or the like between the hoistway door and the wall structure during operation of maintenance of the hoistway.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or group of integers or steps but not



the exclusion of any other integer or group of integers or steps.

From the foregoing, it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the
5 invention is not limited except as by the appended claims.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the door is closed, comprising:
 - a wall structure having an opening therein defining a hoistway entrance;
 - 5 a hoistway door for covering the hoistway entrance;
 - a seal structure supported between the hoistway door and the wall structure;
 - an elongated door support member positioned in a generally horizontal orientation, connected to the wall structure;
 - a door support connected to the hoistway door and movably connected to the elongated
 - 10 support member to support the door while permitting movement of the door in a lateral direction between an open position permitting access to the hoistway and a closed position wherein the door substantially covers the hoistway entrance with a space between the hoistway door and the wall structure; and
 - wherein the elongated support member has a guide portion adapted to guide the
 - 15 hoistway door in a second direction toward the seal structure, the second direction being different than the lateral direction when the hoistway door is moved to the closed position to cause the hoistway door to sealably engage the seal structure to seal the space between the door and the wall structure when the door is closed to limit smoke flow, the guide portion being a downwardly sloped portion that is engaged by the door support that directs the
 - 20 hoistway door downwardly when the hoistway door moves from the open position toward the closed position.
2. The hoistway door seal structure assembly of claim 1 wherein the guide portion is a radiused portion curved inwardly toward the wall, said radiused portion receiving the door support and directing the hoistway door toward the hoistway opening when the hoistway door
- 25 is moved to the closed position.
3. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the door is closed, comprising:
 - a wall structure having an opening therein defining a hoistway entrance having a headwall, a pair of lateral jambwalls, and a sill;
 - a moveable, hoistway door that removably covers the hoistway entrance, the hoistway



door having a leading edge and a trailing edge;

a door support rail positioned in a generally horizontal orientation and connected to the wall structure, the door support rail having a roller support surface;

a plurality of spaced, door support trucks connected to the hoistway door, each truck
5 having a support roller engaging the roller support surface of the support rail and supporting the hoistway door while permitting lateral movement of the hoistway door between an open position permitting access to the hoistway and a closed position wherein the door substantially covers the hoistway entrance with the door spaced from the sill to define a sill space, spaced from the headwall to define a transverse space and spaced from the jambwalls to define
10 trailing edge and leading edge lateral spaces;

a leading edge sealing structure supported between the hoistway door and the wall structure, the leading edge sealing structure sealing the leading edge lateral space when the hoistway door is in the closed position and restricting the passage of smoke in the event of a fire;

15 a trailing edge sealing structure supported between the hoistway door and the wall structure, the trailing edge sealing structure sealing the trailing edge lateral space when the hoistway door is in the closed position and restricting the passage of smoke in the event of a fire;

a transverse sealing structure supported between the hoistway door and the wall
20 structure, the transverse sealing structure sealing the transverse space when the hoistway door is closed; and

a sill sealing structure connected to the bottom of the door, the sill sealing structure sealing the sill space when the hoistway door is closed;

wherein the roller support surface of the support rail has guide portions engaged by
25 each support roller, the guide portions guiding the hoistway door in a second direction different than the lateral direction when the hoistway door is moved to the closed position and causing the sill sealing structure to engage the sill to seal the sill space and causing the transverse sealing structure to seal the transverse space when the door is in the closed position, the guide portion being a downwardly sloped portion that is engaged by the door
30 support that directs the hoistway door downwardly when the hoistway door moves from the



open position toward the closed position.

4. The hoistway door seal structure assembly of claim 3 wherein the guide portions are downwardly sloped portions engaged by the door support trucks, the downwardly sloped portions guiding the hoistway door downwardly when the hoistway door moves from the open position toward the closed position.

5. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the doors are closed to restrict the passage of smoke in the event of a fire, comprising:

a wall structure having an opening therein defining a hoistway entrance having a headwall;

a pair of opposing hoistway doors that movably cover the hoistway entrance;

an elongated door support member positioned in a generally horizontal orientation and connected to the wall structure;

spaced, door supports connected to each door, each support movably connected to the elongated support member, the door supports supporting an associated door while permitting lateral movement of the door between an open position permitting access to the hoistway and a closed position wherein the doors substantially cover the hoistway entrance with the doors each spaced from the headwall to define transverse spaces;

transverse seal structures supported between each door and the wall; and

wherein the door support member has guide portions engaged by the door supports, the guide portions guiding the hoistway door in a second direction toward the transverse seal structures, the second direction being different than the lateral direction when the hoistway door is moved to the closed position, the movement of the doors in the second direction sealing the transverse space with the transverse sealing structures when the doors are in the closed position, the guide portion being a downwardly sloped portion that is engaged by the door support that directs the hoistway door downwardly when the hoistway door moves from the open position toward the closed position.

6. The hoistway door seal structure assembly of claim 5 wherein the hoistway entrance has a pair of lateral jambs, and the doors substantially cover the hoistway entrance with the doors each spaced from the jambwall to define lateral spaces, and further comprising lateral



sealing structures supported between each door and the wall, the lateral sealing structures sealing the lateral spaces when the doors moved to the closed position, the guide portions of the door supported member moving the doors into sealable engagement with the transverse sealing structures to seal the transverse spaces when the doors are moved to the closed position.

7. The hoistway door seal structure assembly of claim 5 wherein the hoistway entrance has a sill, and the doors substantially cover the hoistway entrance with the doors each spaced from the sill to define sill spaces and spaced from each other to define a meeting edge space, and further comprising an elongated seal connected to the meeting edge of one of the doors sized to contact the meeting edge of the other door when the doors are in a closed position to seal the meeting edge space, and an elongated seal is connected to the bottom of each door, the guide portions of the door support member directing the doors so the elongated seal sealably engages the sill and seals the sill spaces when the doors are in the closed position.

8. The hoistway door seal structure assembly of claim 5 wherein the guide portions are downwardly sloped portions engaged by the door support trucks, the downwardly sloped portions directing the hoistway door vertically downward when the hoistway door moves from the open position toward the closed position.

9. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the doors are closed to restrict the passage of smoke in the event of a fire, comprising:

a wall structure having an opening therein defining a hoistway entrance having a headwall, a pair of lateral jambs and a sill;

a pair of opposing hoistway doors for movably covering the hoistway entrance;

a door support rail positioned in a generally horizontal orientation and connected to the wall structure, the door support rail having a roller support surface;

a plurality of spaced, door support trucks connected to each door, each truck having a support roller engaging the roller support surface of the support rail to support the associated door while permitting lateral movement of the door between an open position permitting access to the hoistway and a closed position wherein the doors substantially cover the hoistway entrance with the doors each spaced from the sill to define sill spaces, spaced



from the headwall to define transverse spaces, spaced from the jambs to define lateral spaces and spaced from each other to define a meeting edge space;

an elongated lateral extension extending from the lateral portion of each door toward the wall;

5 lateral seals, each extending from the wall toward the associated door in an overlapping relationship to the lateral door extensions to contact the lateral door extensions to seal the associated lateral spaces when the doors are in the closed position;

an elongated seal connected to the meeting edge of one of the doors sized to contact the meeting edge of the other door when the doors are in the closed position to seal the
10 meeting edge space;

elongated transverse extensions projecting from the top portion of each door toward the wall;

elongated transverse seals projecting from the wall in an overlapping relationship with respect to the associated transverse door extension; and

15 an elongated seal connected to the bottom of each door; and

wherein the roller support surface of the support rail has guide portions engaged by each support roller, the guide portions guiding the hoistway doors downwardly in a second direction different than the lateral direction when the hoistway doors are moved to the closed position to cause the bottom door seals to engage the sill to seal the sill spaces and to cause
20 the transverse seals to engage the transverse door extensions to seal the transverse spaces when the doors are closed.

10. The hoistway door seal structure assembly of claim 9 wherein the guide portions are lowered portions and the second direction is vertically downward toward the sill, the lowered portions directing the doors to a lowered position when the doors are moved to the closed
25 position to cause the bottom door seals to engage the sill to seal the sill spaces.

11. The hoistway door seal structure assembly of claim 9 wherein the guide portions are downwardly sloped portions and the second direction is vertically downward toward the sill, the downwardly sloped portions directing the doors downwardly toward the sill when the doors are moved toward the closed position to cause the bottom door seals to engage the sill
30 to seal the sill spaces.



12. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the doors are closed to restrict the passage of smoke in the event of a fire, comprising:

a wall structure having an opening therein defining a hoistway entrance having a
5 headwall, a pair of lateral jambs and a sill;

a pair of opposing hoistway doors movably adjacent to the hoistway entrance;

a door support rail positioned in a generally horizontal orientation and connected to
the wall structure, the door supported rail having a roller support surface;

a plurality of spaced, door support truck connected to each door, each truck having
10 a support roller engaging the surface of the support rail to support the associated door while
permitting lateral movement of the door between an open position permitting access to the
hoistway and a closed position wherein the doors substantially cover the hoistway entrance
with the doors each spaced from the sill to define sill spaces, spaced from the headwall to
define transverse spaces, spaced from the jambs to define lateral spaces and spaced from each
15 other to define a meeting edge space;

elongated lateral extensions on either side of the hoistway entrance, each projecting
toward an associated one of the doors;

lateral seals projecting from each of the doors toward the wall in an overlapping
relationship with the lateral wall extensions to contact the lateral wall extensions to seal the
20 associated lateral spaces when the doors are in the closed position;

an elongated seal connected to the meeting edge of one of the doors sized to contact
the meeting edge of the other door when the doors are in the closed position to seal the
meeting edge space;

elongated transverse extensions projecting from the top portion of each door toward
25 the wall;

elongated transverse seals projecting from the wall in an overlapping relationship with
respect to the associated transverse door extension;

an elongated bottom door seal connected to the bottom of each door; and

wherein the roller support surface of the support rail has guide portions engaged by
30 each support roller, the guide portions guiding the hoistway doors downwardly in a second



direction different than the lateral direction when the hoistway doors are moved toward the closed position to cause the bottom door seals to engage the sill to seal the sill spaces and to cause the transverse seals to engage the transverse door extensions to seal the transverse spaces.

5 13. The hoistway door seal structure assembly of claim 12 wherein the guide portions are lowered portions and the second direction is vertically downward toward the sill, the lowered portions directing the doors to a lowered position when the doors are moved to the closed position.

14. The hoistway door seal structure assembly of claim 13 wherein the guide portions are
10 downwardly sloped portions and the second direction is vertically downward toward the sill, the downwardly sloped portions direct the doors downwardly toward the sill when the doors are moved to the closed position.

15. A hoistway door seal structure assembly for limiting the flow of air through a
15 a fire, comprising:

a wall structure having an opening therein defining a hoistway entrance having a head,
a pair of lateral jambs and a sill;

a pair of opposing hoistway doors movably adjacent to the hoistway entrance;

a door support rail positioned in a generally horizontal orientation and connected to
20 the wall structure, the door support rail having a roller support surface;

a plurality of spaced, door support trucks connected to each door, each truck having
a support roller engaging the surface of the support rail to support the associated door while
permitting lateral movement of the door between an open position permitting access to the
hoistway and a closed position wherein the doors substantially cover the hoistway entrance
25 with the doors each spaced from the sill to define sill spaces, spaced from the headwall to
define transverse spaces, spaced from the jambwall to define lateral spaces and spaced from
each other to define a meeting edge space;

an elongated lateral extension projecting from the lateral portion of each door towards
the wall;

30 lateral seals, each projecting from the wall toward the associated door in an



overlapping relationship to the lateral door extensions to contact the lateral door extensions to seal the associated lateral spaces when the doors are in the closed position;

an elongated seal connected to the meeting edge of one of the doors sized to contact the meeting edge of the other door when the doors are in the closed position to seal the meeting edge space;

an elongated transverse extension projecting from the wall above the hoistway entrance towards the doors;

elongated transverse seals projecting from each of the doors in an overlapping relationship with respect to the associated transverse wall extension; and

10 an elongated seal connected to the bottom of each door; and

wherein the roller support surface of the support rail has guide portions engaged by each support roller, the guide portions guiding the hoistway doors downwardly in a second direction different than the lateral direction when the hoistway doors are moved toward the closed position to cause the bottom door seals to engage the sill to seal the sill spaces and to cause the transverse seals to engage the transverse wall extensions to seal the transverse spaces.

16. The hoistway door seal structure assembly of claim 15 wherein the guide portions are lowered portions and the second direction is vertically downward toward the sill, the lowered portions directing the doors to a lowered position when the doors are moved to the closed position.

17. The hoistway door seal structure assembly of claim 15 wherein the guide portions are downwardly sloped portions and the second direction is vertically downward toward the sill, the downwardly sloped portions directing the doors downwardly toward the sill when the doors are moved to the closed position.

25 18. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the doors are closed to restrict the passage of smoke in the event of a fire, comprising:

a wall structure having an opening therein defining a hoistway entrance having a head, a pair of lateral jambs and a sill;

a pair of opposing hoistway doors adjacent to the hoistway entrance;



a door support rail positioned in a generally horizontal orientation and connected to the wall structure, the door support rail having a roller support surface;

a plurality of spaced, door support trucks connected to each door, each truck having a support roller engaging the surface of the support rail to support the associated door while
5 permitting lateral movement of the door between an open position permitting access to the hoistway and a closed position wherein the doors substantially cover the hoistway entrance with the doors each spaced from the sill to define sill spaces, spaced from the headwall to define transverse spaces, spaced from the jambwall to define lateral spaces and spaced from each other to define a meeting edge space;

10 elongated lateral wall extensions on either side of the hoistway entrance, each of the elongated lateral wall extensions projecting towards the associated door;

lateral seals projecting from each of the doors toward the wall in an overlapping relationship with the lateral wall extensions to contact the lateral wall extensions to seal the associated lateral spaces when the doors are closed;

15 an elongated seal connected to the meeting edge of one of the doors, the elongated seal contacting the meeting edge of the other door when the doors are in the closed position and sealing the meeting edge space;

an elongated transverse extension extending from the wall above the hoistway entrance towards the doors;

20 elongated transverse seals extending from each of the doors in an overlapping relationship with respect to the associated transverse wall extension; and

an elongated seal connected to the bottom of each door; and

wherein the roller support surface of the support roller has guide portions engaged by each support roller, the guide portions guiding the hoistway doors downwardly in a second
25 direction different than the lateral direction when the hoistway doors are moved to the closed position to cause the bottom door seals to engage the sill to seal the sill spaces and to cause the transverse seals to engage the transverse wall extensions to seal the transverse spaces when the doors are closed.

19. The hoistway door seal structure assembly of claim 18 wherein the guide portions are
30 lowered portions and the second direction is vertically downward toward the sill, the lowered



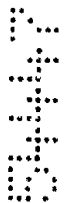
portions directing the doors to a lowered position when the doors are moved to the closed position.

20. The hoistway door seal structure assembly of claim 18 wherein the guide portions are downwardly sloped portions and the second direction is vertically downward toward the sill, 5 the downwardly sloped portions directing the doors downwardly toward the sill when the doors are moved to the closed position.

21. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the doors are closed, comprising:

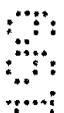
a wall structure having an opening therein defining a hoistway entrance having a head, 10 a pair of lateral jambs and a sill;

a pair of laterally moveable, opposing double hoistway doors moveable between an open position permitting access to the hoistway and a closed position substantially covering the hoistway entrance with each double door including an inner door panel and an outer door panel;



15 a door support rail structure positioned in a generally horizontal orientation and connected to the wall structure, the door support rail structure having a plurality of support rails with each rail having a roller support surface;

a transverse head panel connected to the headwall adjacent to the inner door panels when the doors are in the closed position;



20 a plurality of spaced, door support trucks connected to each door, each door support truck having a support roller engaging the surface of one of the support rails to support the associated door while permitting lateral movement of the door between the open position and the closed position, the doors each being spaced from the sill to define sill spaces, the outer doors being spaced from the headwall to define transverse headwall spaces, the inner doors 25 being spaced from the headwall to define transverse headwall spaces, the outer doors being spaced from the jambwall to define outer door lateral spaces, and the inner doors being spaced from each other to define a meeting edge space;



a first sealing structure supported between the outer door and the jambwall, the first sealing structure sealing the outer door lateral spaces when the doors are in the closed

30 position;



a second sealing structure supported between the outer door and the inner door of each double door, the second sealing structure sealing the lateral interdoor space when the doors are in the closed position;

a third sealing structure supported between each outer door and the headwall;

- 5 a fourth sealing structure supported between each inner door and the headwall; and
an elongated seal connected to the bottom of each door;

wherein the roller support surface of the support rails have lowered portions engaged by each support roller, the lowered portions directing the doors to a lowered position when the doors are moved to the closed position to cause the bottom door seals to engage the sill
10 to seal the sill spaces and to cause the transverse seal structure to seal the transverse spaces when the doors are in the closed position.

22. The hoistway door seal structure assembly of claim 21 wherein the door support structure comprises an inner door support member and an outer door support member, each outer door panel has a leading door support with a leading support roller and a trailing door
15 support with a trailing support roller, the leading support roller and the trailing support roller engaging the roller support surface of the outer door support member, the roller support surface having a leading lowered portion and a trailing lowered portion, the trailing lowered portion receiving the trailing support roller when the doors are moved to the closed position, and the trailing lowered blocking the leading support roller from moving into the trailing
20 lowered portion when the doors are moving between the open and closed positions.

23. A hoistway door seal structure assembly for limiting the flow of air through a hoistway opening when the door is closed to restrict the passage of smoke in the event of a fire, comprising:

a wall structure having an opening therein defining a hoistway entrance;

- 25 a hoistway door for covering the hoistway entrance, the hoistway door having a sloped top edge portion that sloped downwardly at an angle;

an elongated door support member positioned in a generally horizontal orientation and connected to the wall structure, the elongated support member having a generally horizontal support surface and sloped bottom surface opposite the horizontal support surface, the sloped
30 bottom surface sloping downwardly at approximately the angle of the door's sloped top edge



portion;

a seal structure supported between the sloped bottom surface of the elongated door support and the sloped top edge portion of the hoistway door;

a door support connected to the hoistway door and movably connected to the support surface of the elongated support member to support the door while permitting movement of the door in a lateral direction between an open position permitting access to the hoistway and a closed position wherein the door substantially covers the hoistway entrance with a space between the hoistway door and the wall structure, the door support retaining the sloped top edge portion at approximately the same distance from the support surface when the hoist way door moves between the open and closed positions; and

wherein the sloped top edge of the hoistway door is immediately adjacent to the sloped bottom surface of the elongated support member and the sloped top edge sealably engages the seal structure when the hoistway door is moved to the closed position to seal the space between the door and the wall structure when the door is in the closed position, and the sloped top edge of the hoistway door is positioned below and away from the sloped bottom surface of the elongated support member with an unsealed space therebetween when the hoistway door is moved toward the open position to allow uninhibited movement of the hoistway door between the open and closed positions.

24. The hoistway door seal structure assembly of claim 23 wherein said hoistway door includes first and second opposing door panels, said first door panel having a first sloped top edge portion the slopes downwardly at a first angle toward said second opposing door panel, said second panel having a second sloped top edge portion that slopes downwardly at a second angle toward said first opposing door panel, and said sloped bottom surface of said door support having opposing first and second sloped sections, said first sloped section being positioned above said first door panel and sloping downwardly toward said second door panel and said second sloped section being positioned above said second door panel and sloping downwardly toward said first door panel, said first sloped section of said door support engaging said first sloped edge portion of said first door panel and said second sloped section of said door support engaging said second sloped edge portion of said second door panel when said door is closed.



25. The hoistway door seal structure assembly of claim 23 wherein said hoistway entrance has a headwall, a pair of lateral jambwalls, and a sill, said hoistway door has a leading edge and a trailing edge, and said seal structure includes a leading edge sealing structure supported between the hoistway door and the wall structure for sealing the leading edge lateral space
5 when the hoistway door is in the closed position, a trailing edge sealing structure supported between the hoistway door and the wall structure for sealing the trailing edge lateral space when the hoistway door is in the closed position, a transverse sealing structure supported between the hoistway door and the wall structure for sealing the transverse space when the hoistway door is in the closed position, a sill sealing structure connected to the bottom of the
10 door for sealing the sill space when the hoistway door is in the closed position, wherein said sloped bottom edge of the elongated support member engages the hoistway door and causes the sill structure to engage the sill to seal the sill space and causes the transverse sealing structure to seal the transverse space when the door is in the closed position.

26. A method of restricting smoke flow past a hoistway door that covers a hoistway
15 entrance defined by an opening in a wall structure, the hoistway door being movably attached by a door support to an elongated support member that is connected to the wall structure and positioned in a generally horizontal orientation, and a seal structure is between the hoistway door and the wall structure, the elongate support member having a lowered portion along which the door support travels when the hoistway door is moved toward a closed position,
20 comprising the steps of:

moving the door support in a first direction along the elongated support member to
move the hoistway door in a lateral direction from an open position that permits access to the
hoistway entrance toward the closed position wherein the hoistway door substantially covers
the hoistway entrance with a space between the hoistway door and the wall structure;

25 moving the door support a second direction that is different from the first direction and that is downwardly along the lowered portion of the elongate support member to cause the hoistway door to move a direction different from the lateral direction when the hoistway door is moved to the closed position so the hoistway door is lowered into sealable engagement with the seal structure when the hoistway door is moved to the closed position; and

30 pressing the hoistway door into sealable engagement with the seal structure to from



seal between the hoistway door and the wall structure when the hoistway door is in the closed position.

27. The method of claim 26 wherein the hoistway door has a leading edge and a trailing edge, and a leading edge seal structure and a trailing edge seal structure are positioned
5 between the hoistway door, further including the steps of forming a seal between the leading edge of the hoistway door and the leading edge seal structure when the door is in the closed position and forming a seal between the trailing edge of the hoistway door and the trailing edge seal structure when the door is in the closed position.

28. The method of claim 26 wherein the hoistway entrance has a sill and a sill sealing
10 structure is attached to the bottom of the door, and the step of moving the door support a second direction that is different from the first direction includes moving the door support downwardly, to cause the hoistway door to be lowered, and the step of pressing the hoistway door into sealable engagement with the seal structure includes lowering the sill sealing structure into sealable engagement with the sill when the hoistway door is moved to the closed
15 position.

29. An assembly substantially as hereinbefore described with reference to the accompanying drawings.

30. A method substantially as hereinbefore described with reference to the accompanying
20 drawings.

DATED this 8th day of January 1999

by DAVIES COLLISON CAVE

25 Patent Attorneys for the Applicants



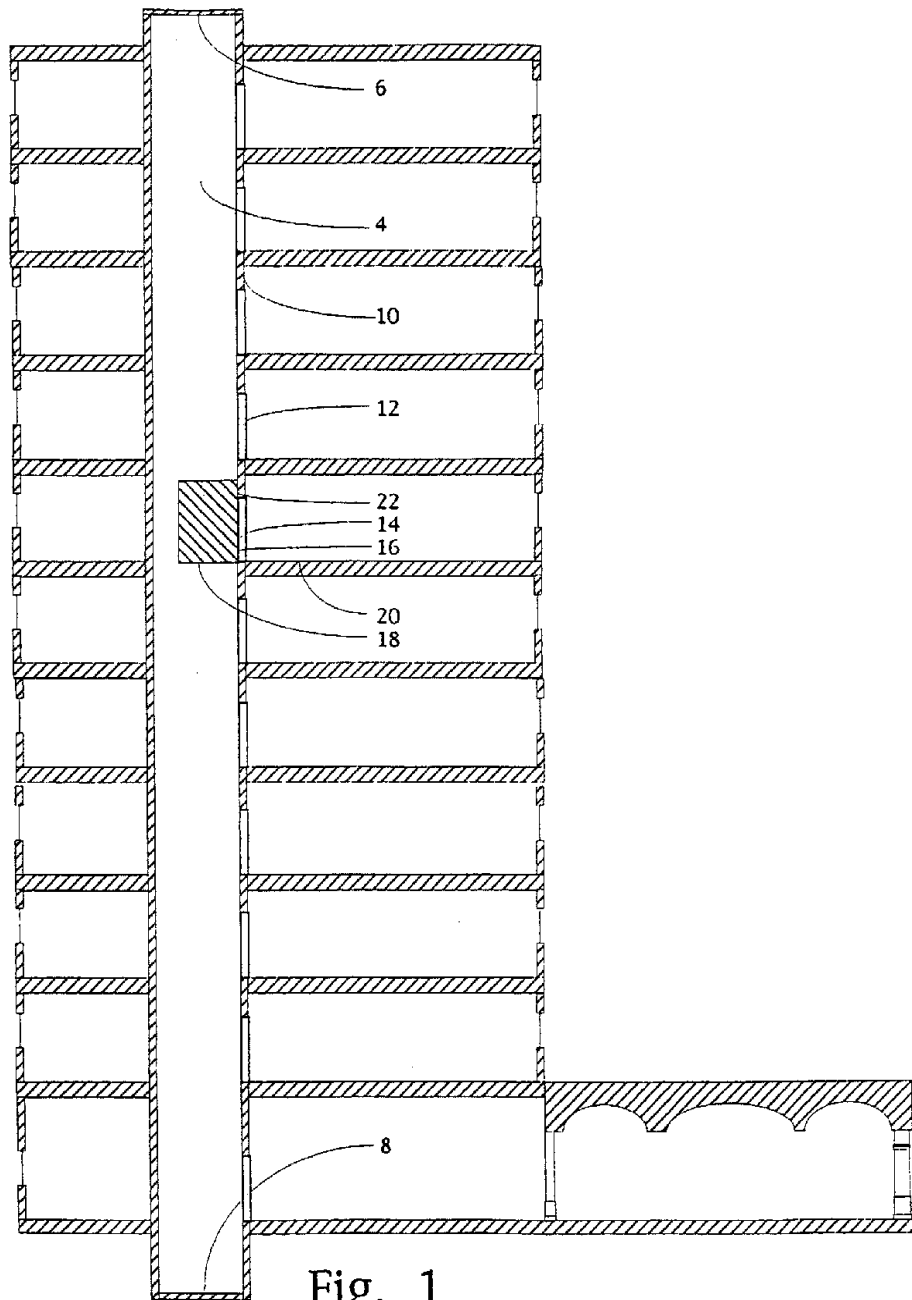


Fig. 1

SUBSTITUTE SHEET (RULE 26)

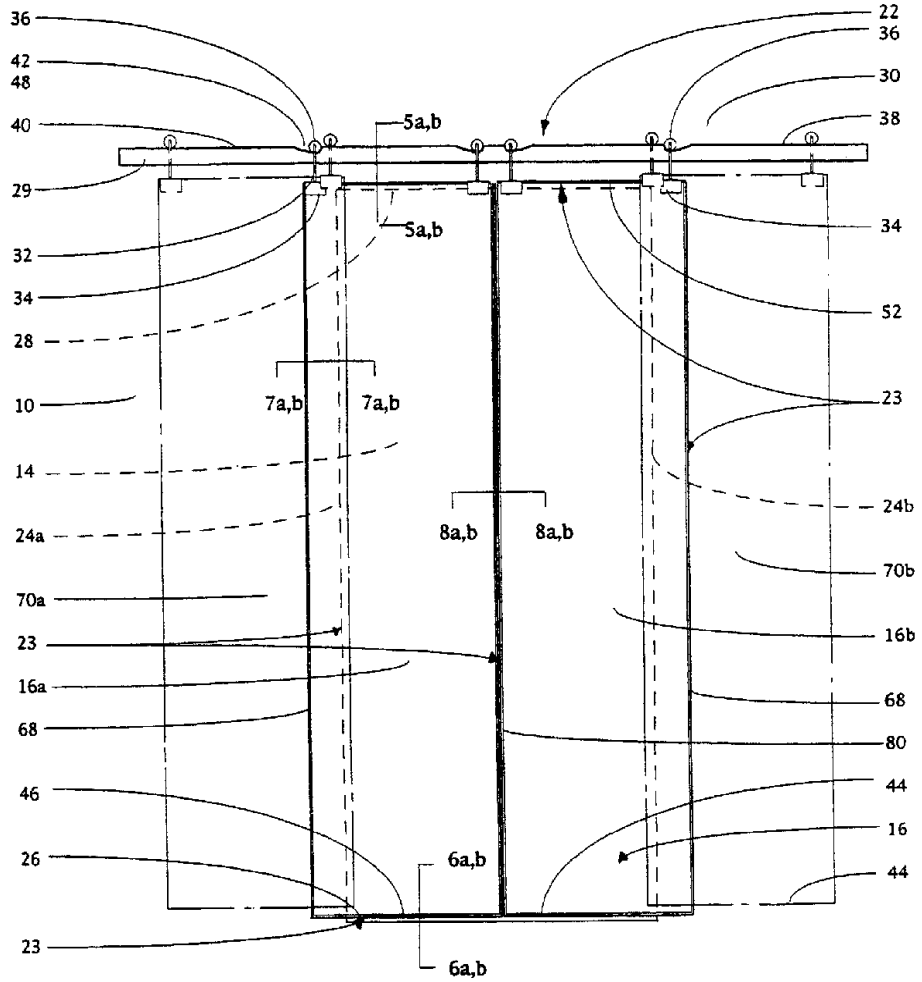


Fig. 2

SUBSTITUTE SHEET (RULE 26)

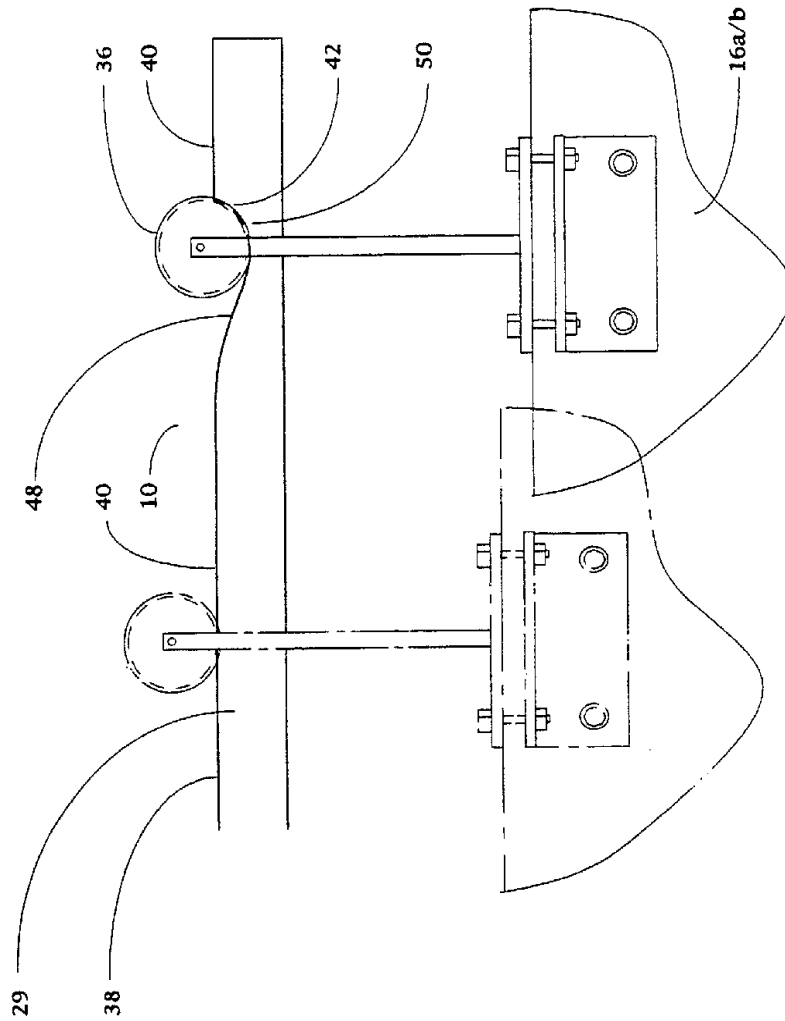


Fig. 3

SUBSTITUTE SHEET (RULE 26)

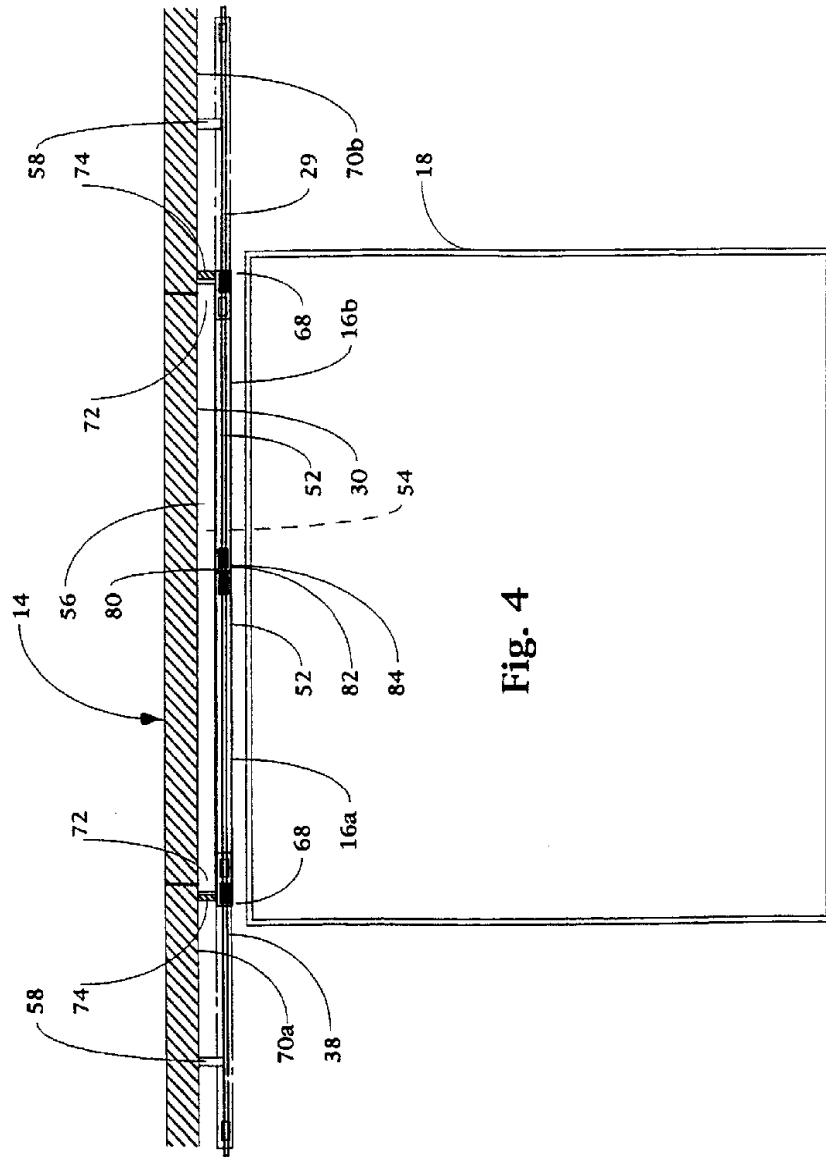


Fig. 4

SUBSTITUTE SHEET (RULE 26)

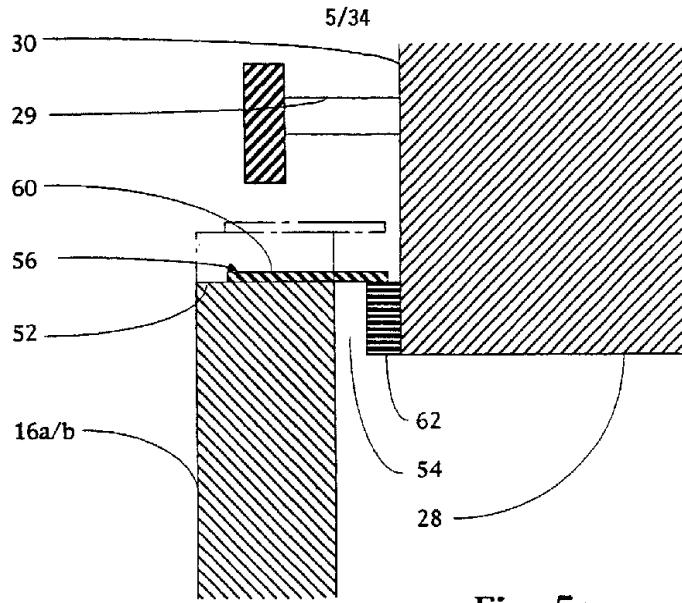


Fig. 5a

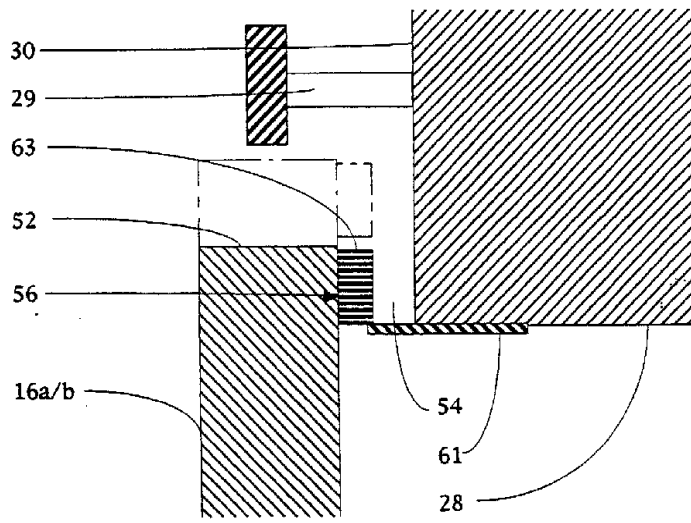


Fig. 5b

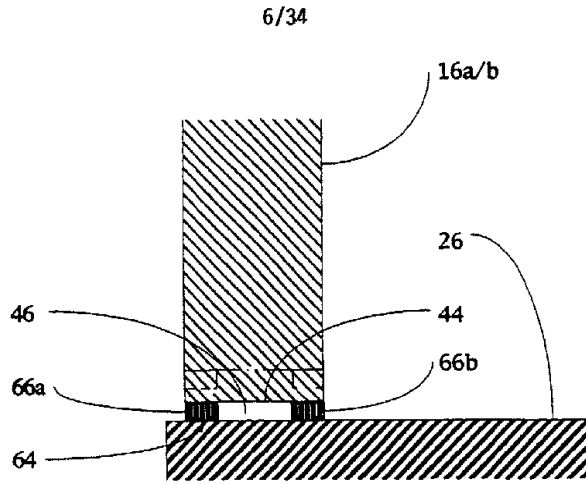


Fig. 6a

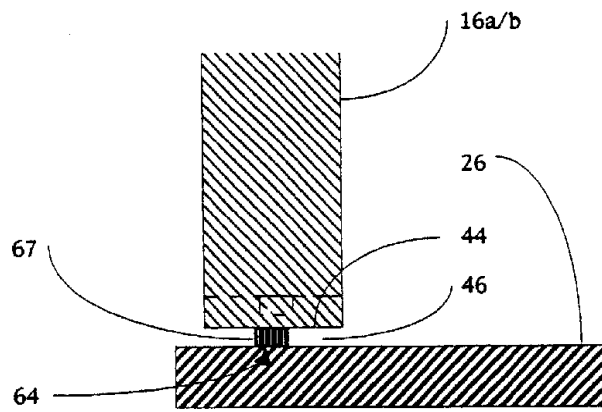


Fig. 6b

SUBSTITUTE SHEET (RULE 26)

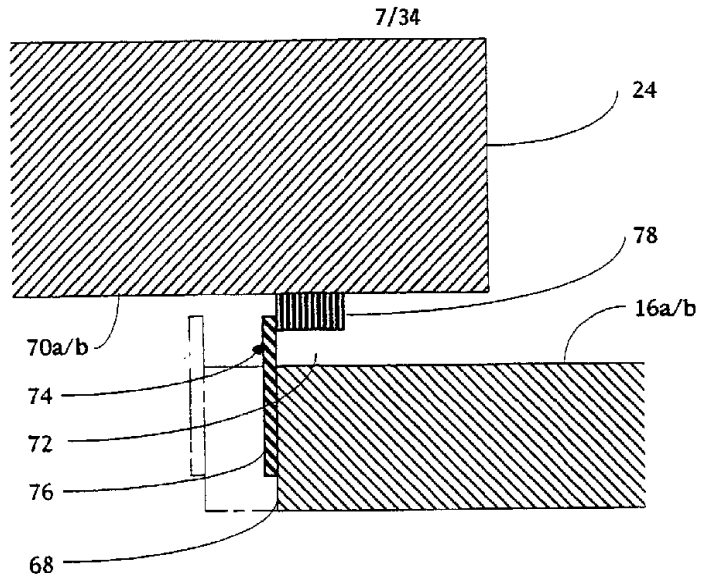


Fig. 7a

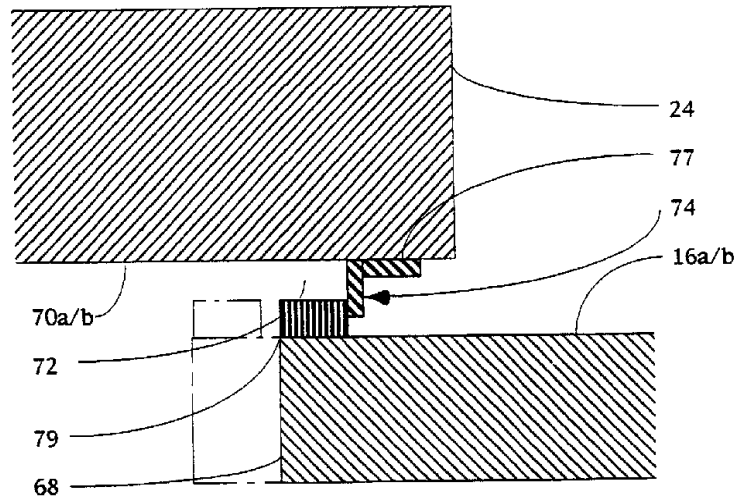


Fig. 7b

SUBSTITUTE SHEET (RULE 26)

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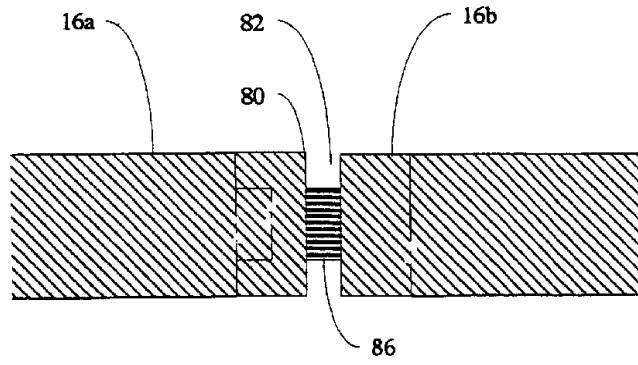


Fig. 8a

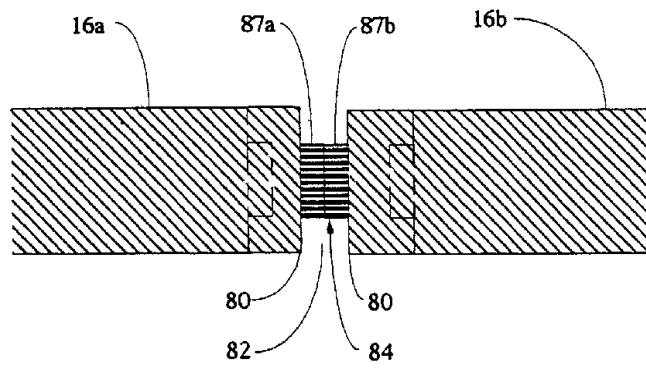


Fig. 8b

SUBSTITUTE SHEET (RULE 26)

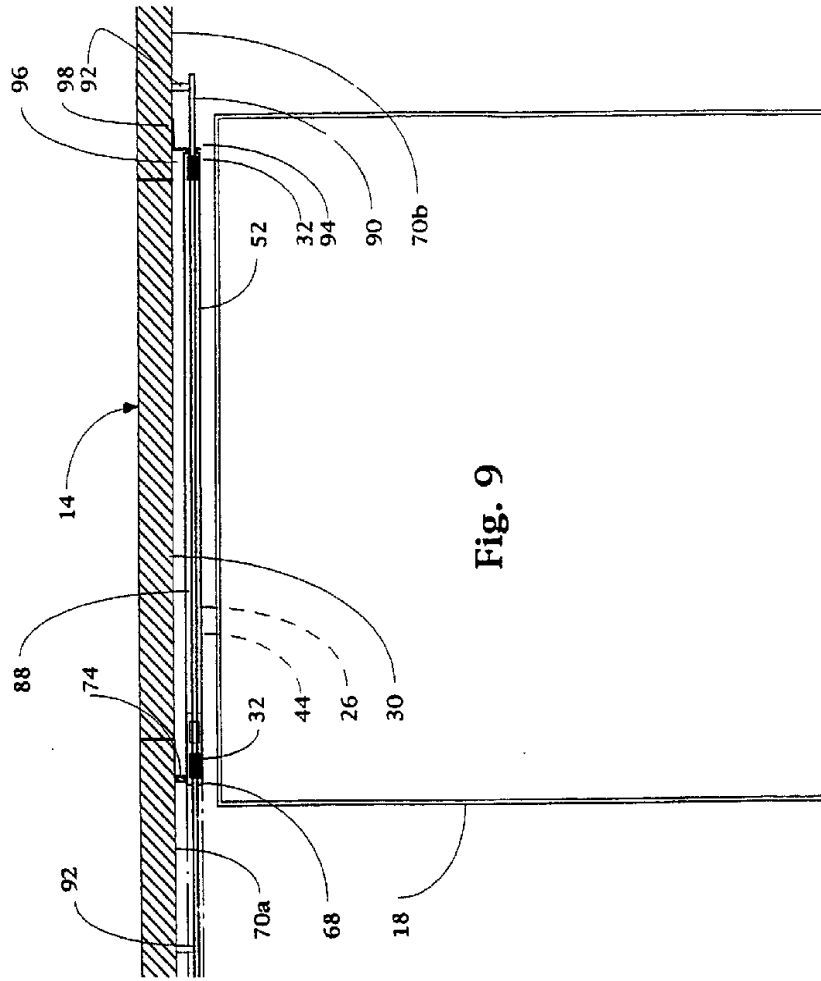


Fig. 9

SUBSTITUTE SHEET (RULE 26)

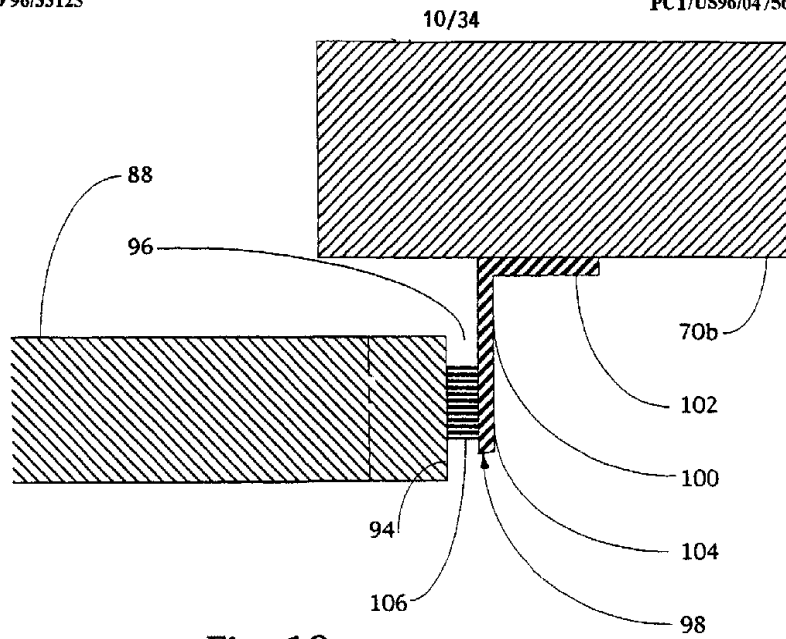


Fig. 10a

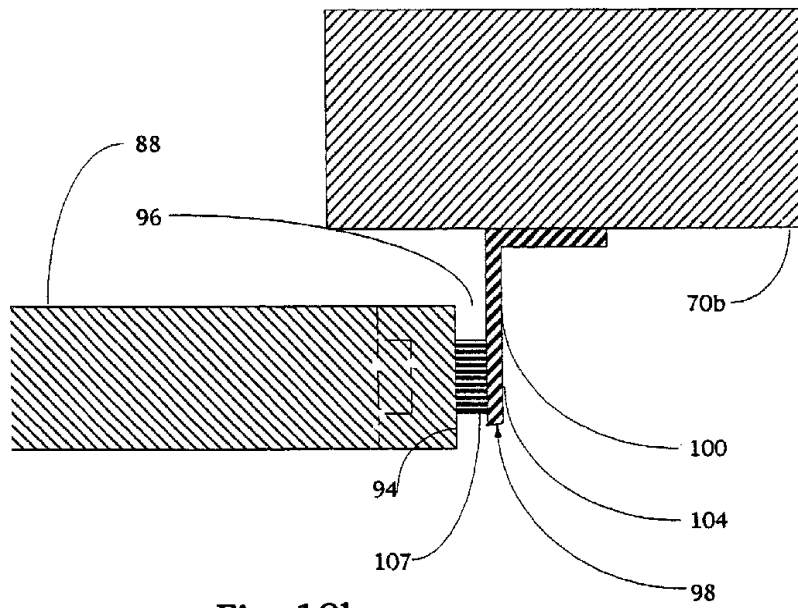
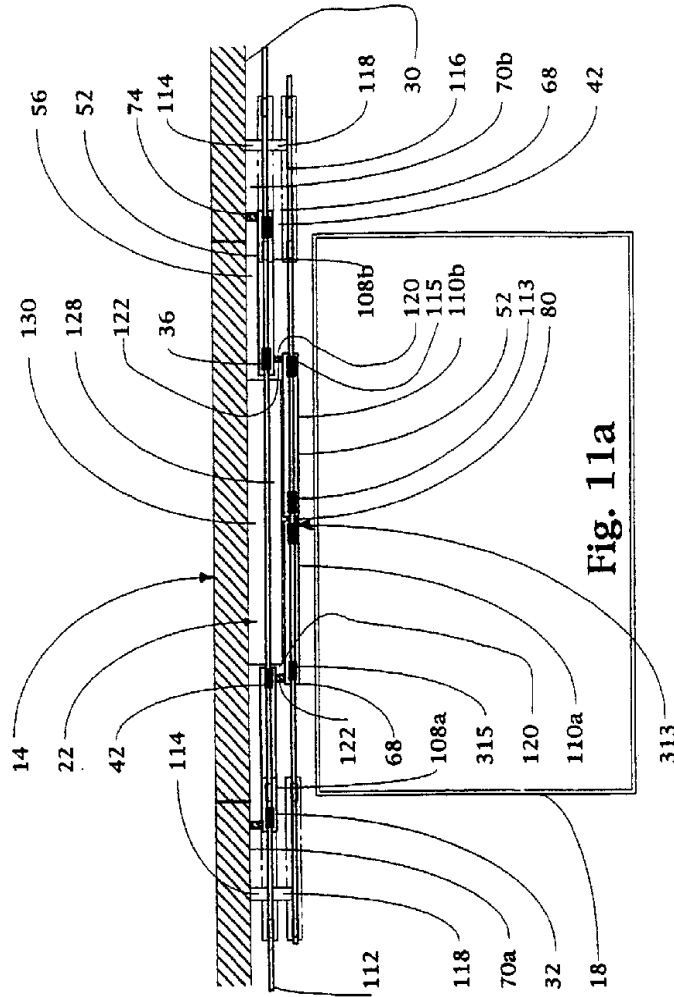


Fig. 10b

SUBSTITUTE SHEET (RULE 26)



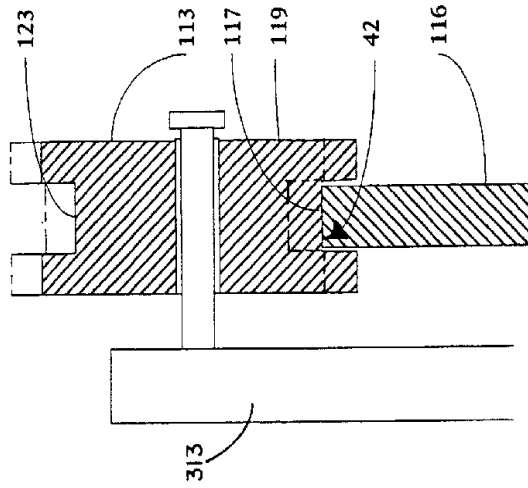


Fig. 11c

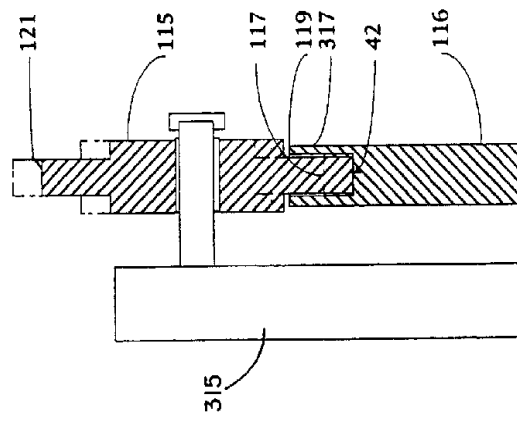


Fig. 11b

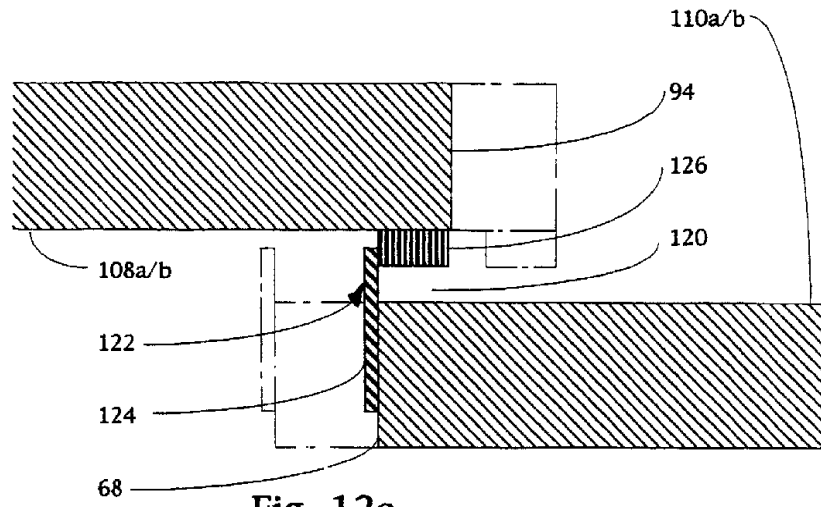


Fig. 12a

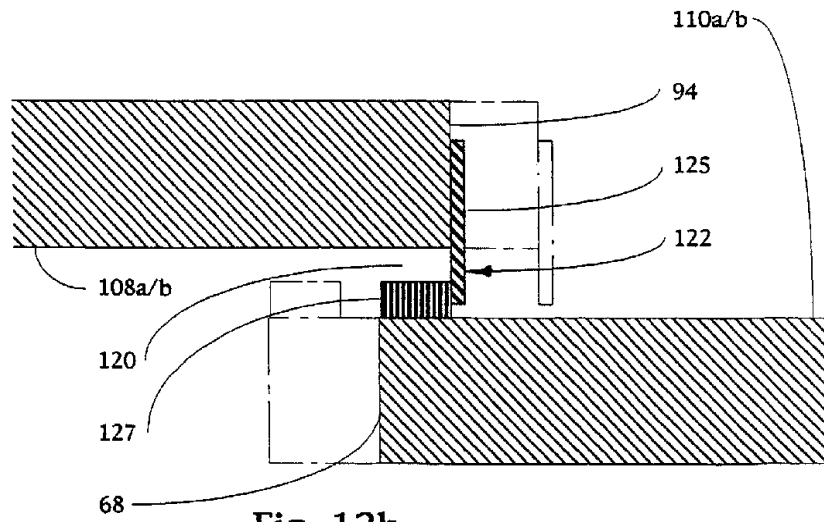


Fig. 12b

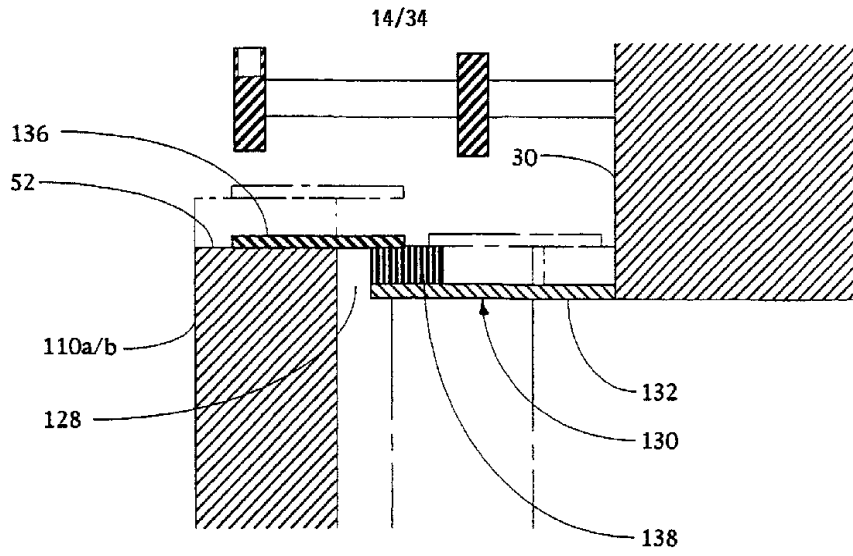


Fig. 13a

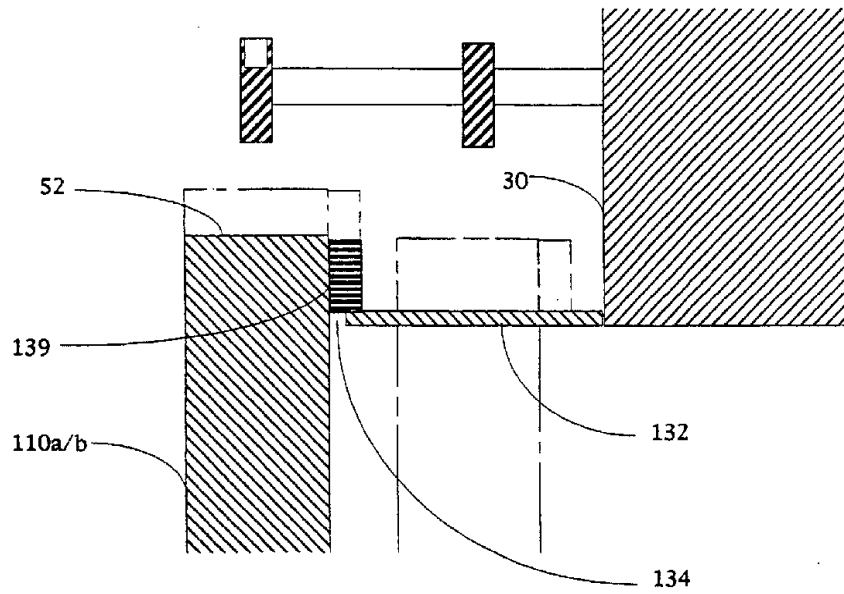


Fig. 13b

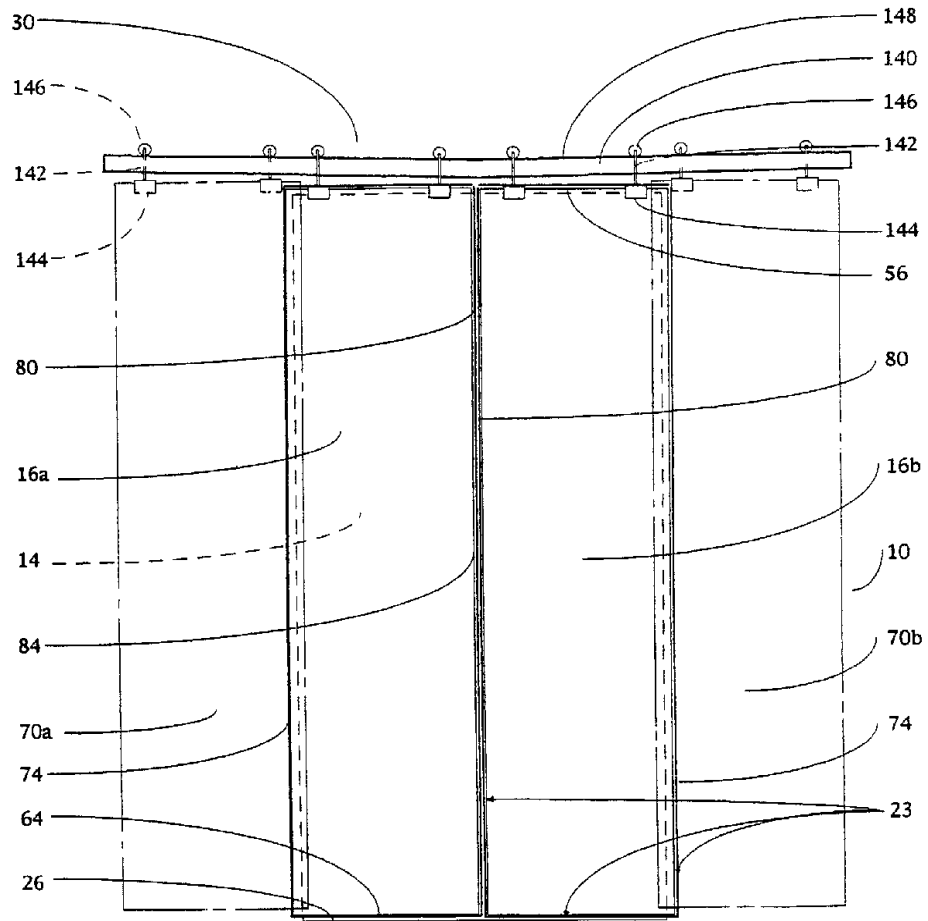


Fig. 14

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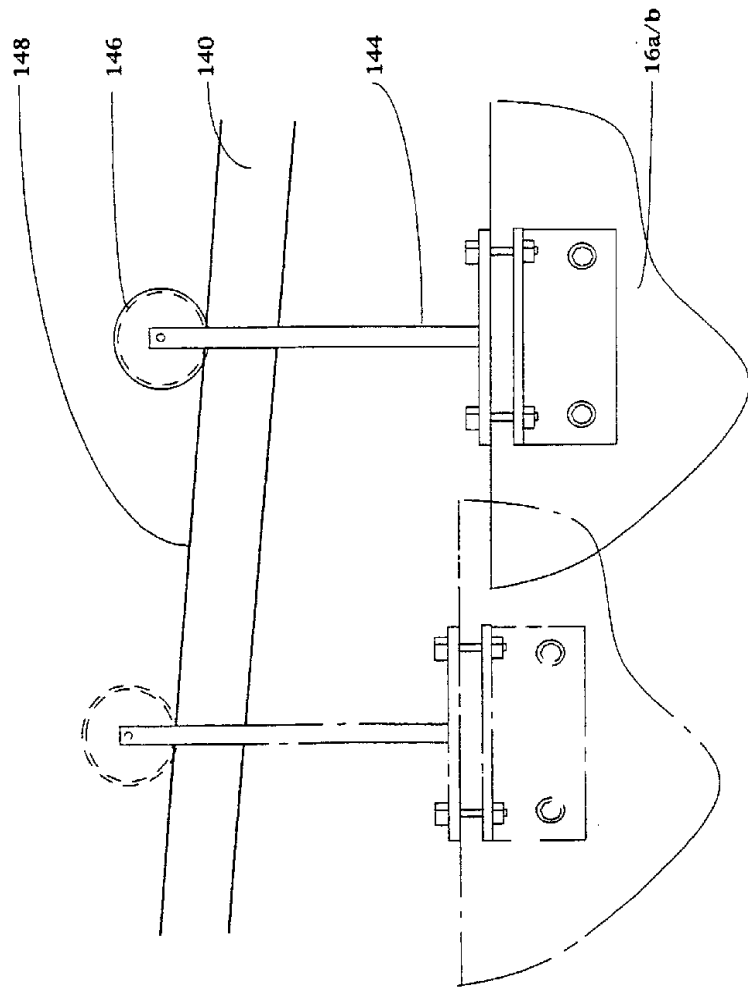


FIG. 15

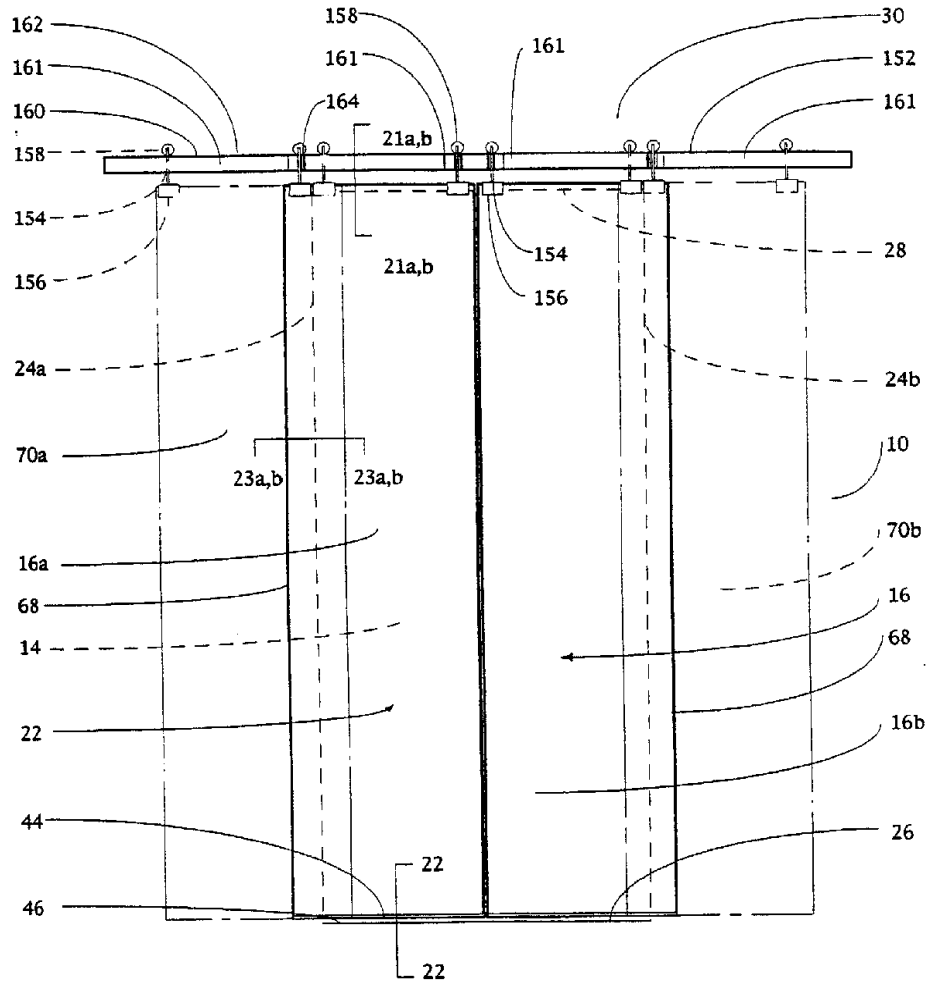


Fig. 16

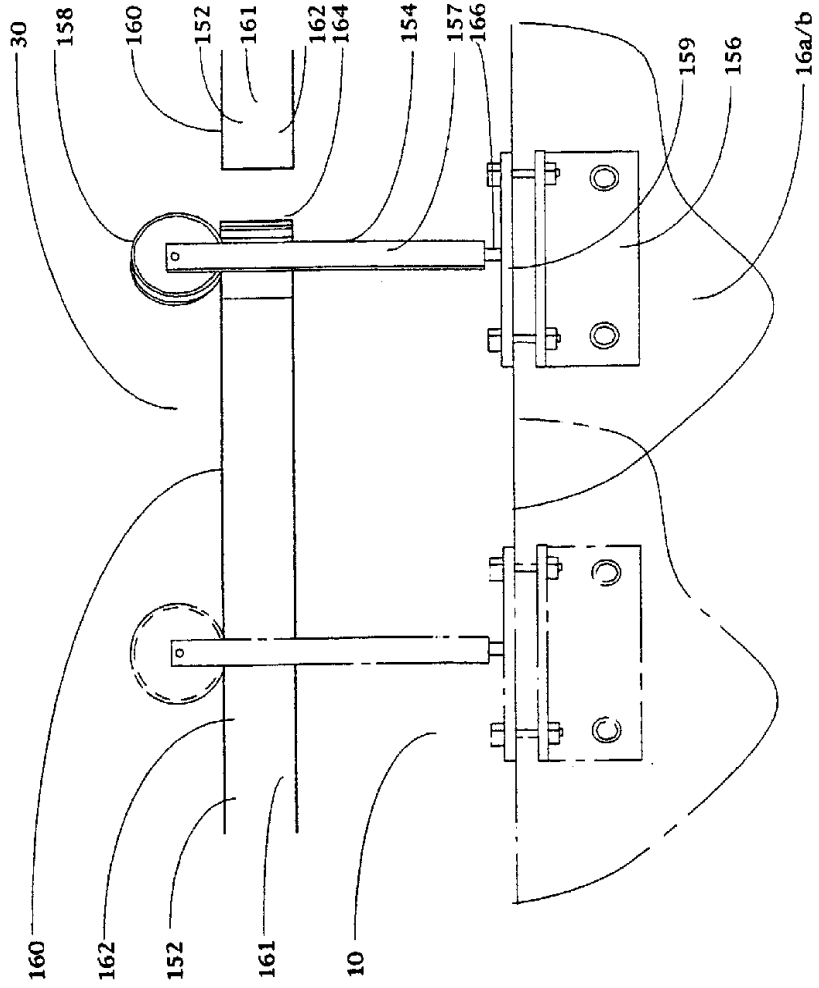


FIG. 17

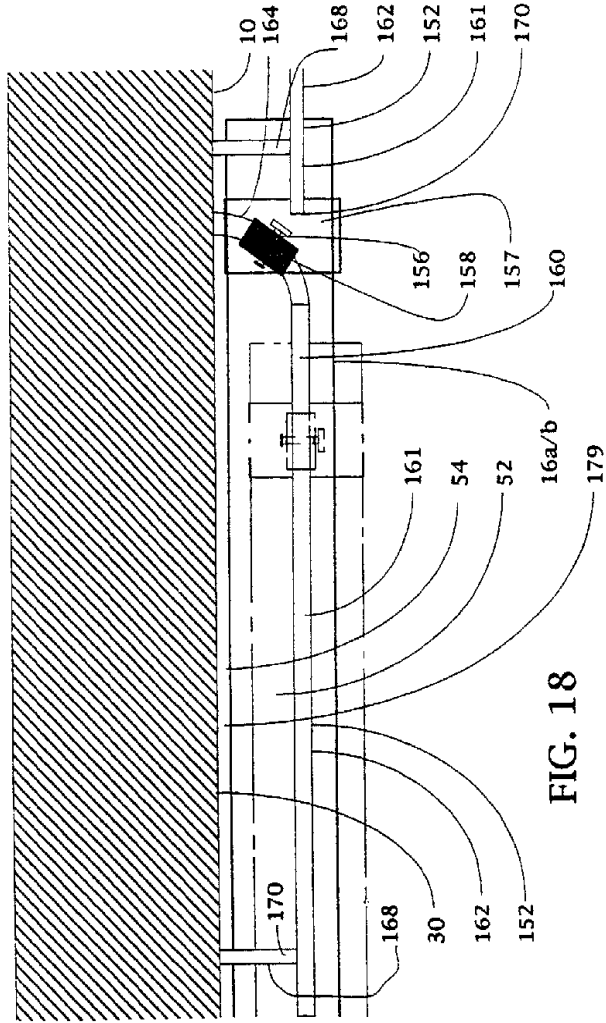


FIG. 18

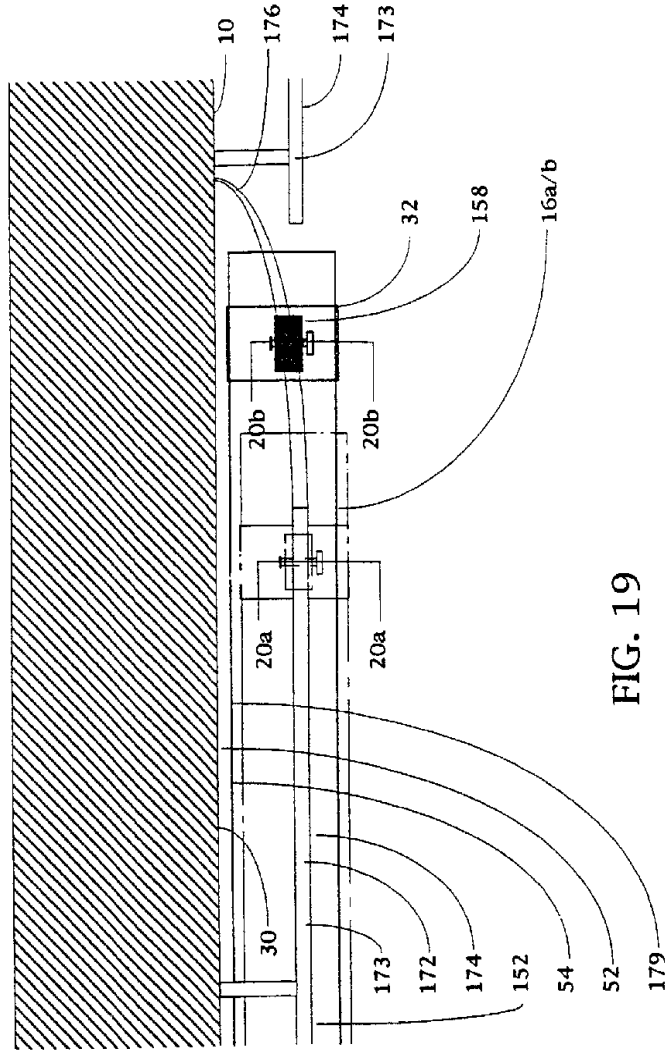


FIG. 19

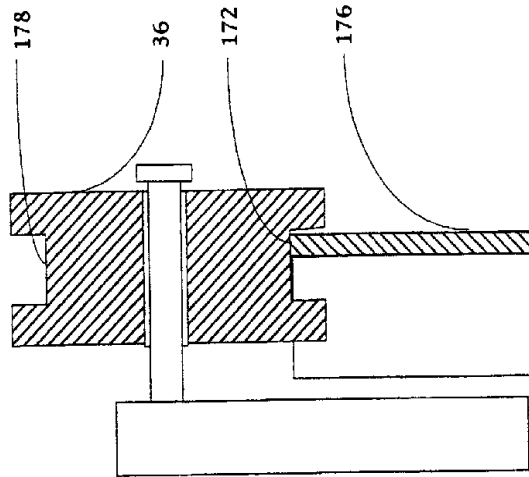


Fig. 20b

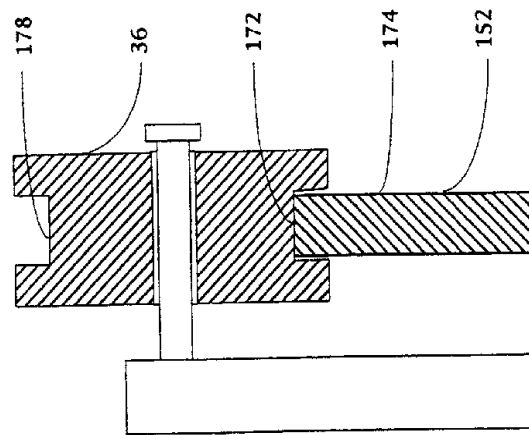


Fig. 20a

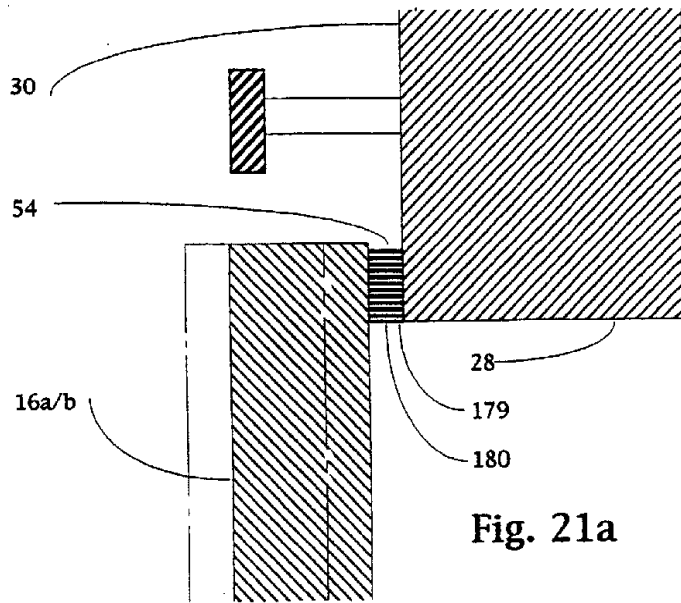


Fig. 21a

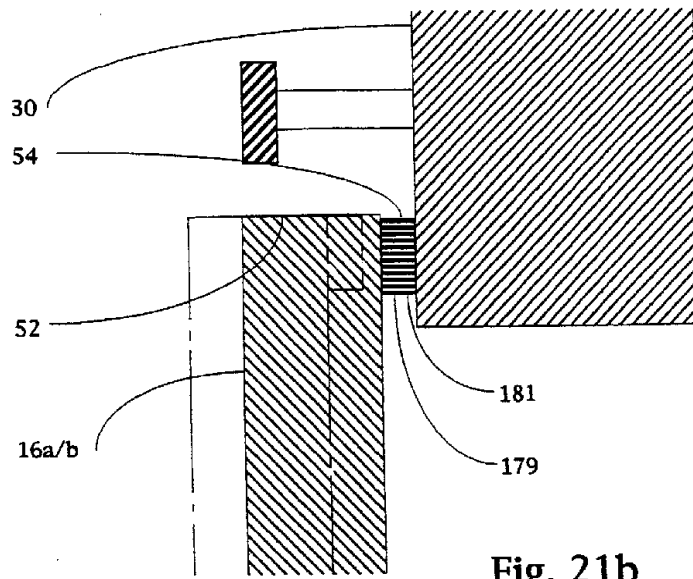


Fig. 21b

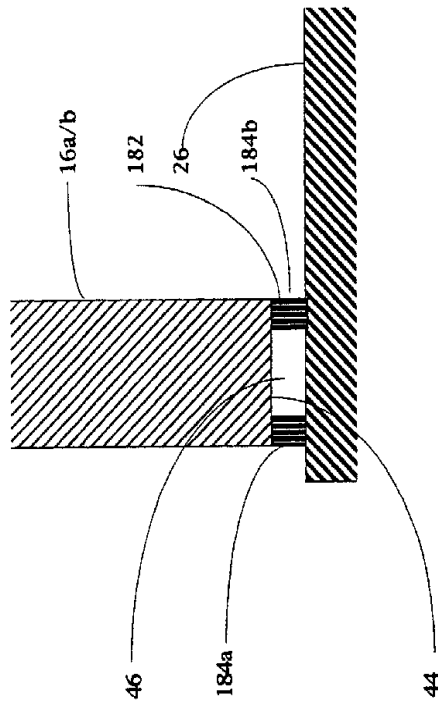


Fig. 22

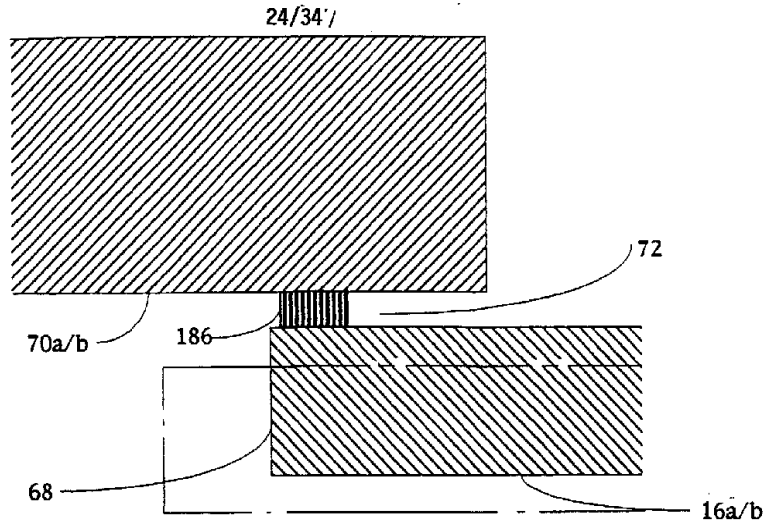


Fig. 23a

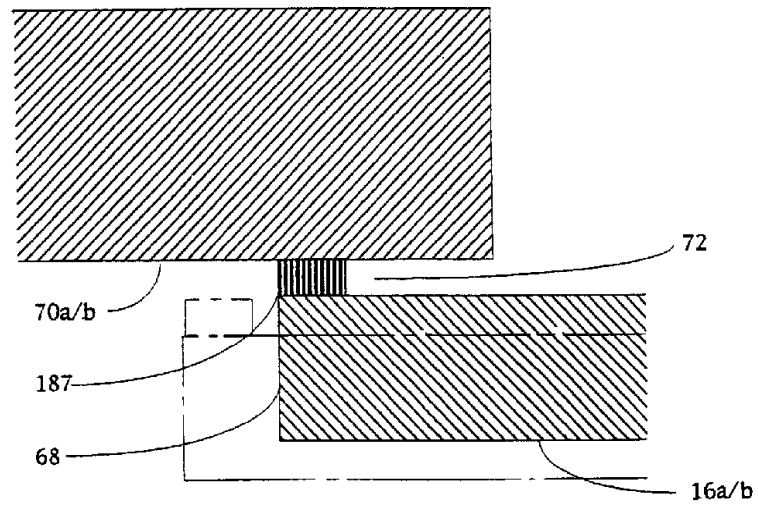


Fig. 23b

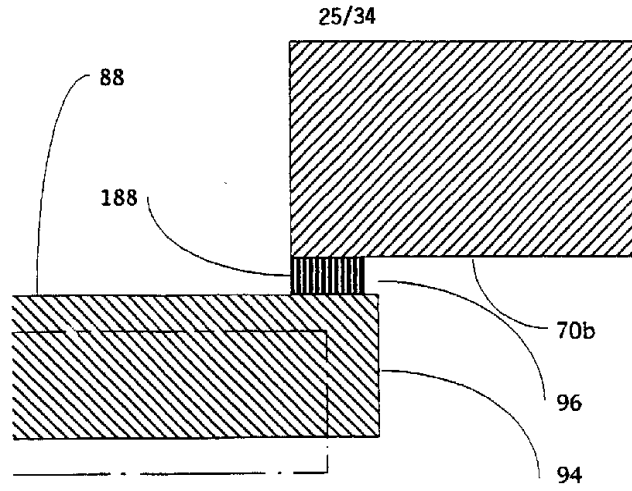


Fig. 24a

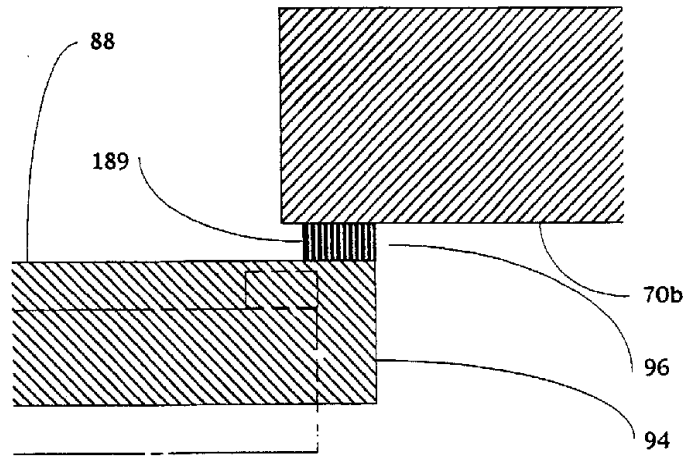


Fig. 24b

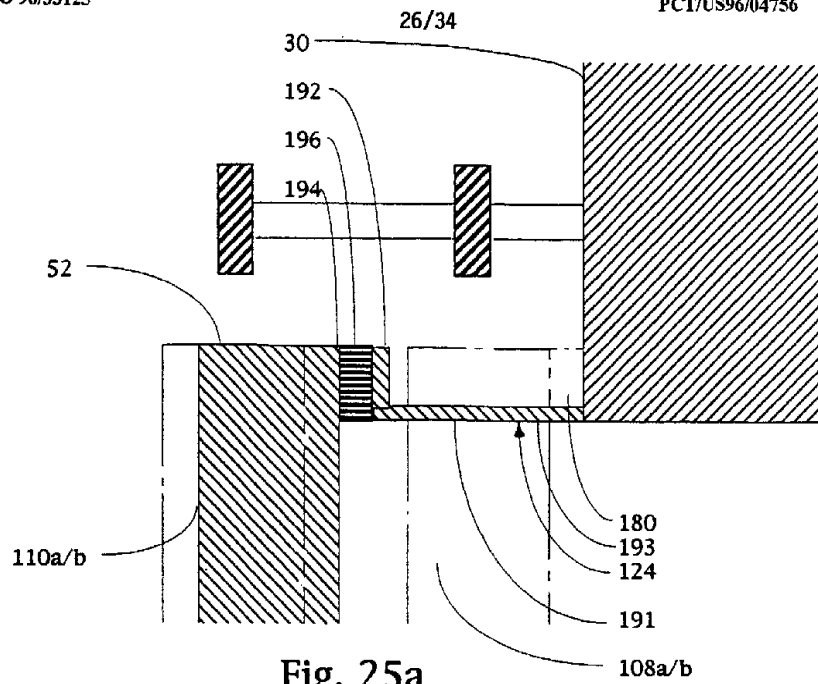


Fig. 25a

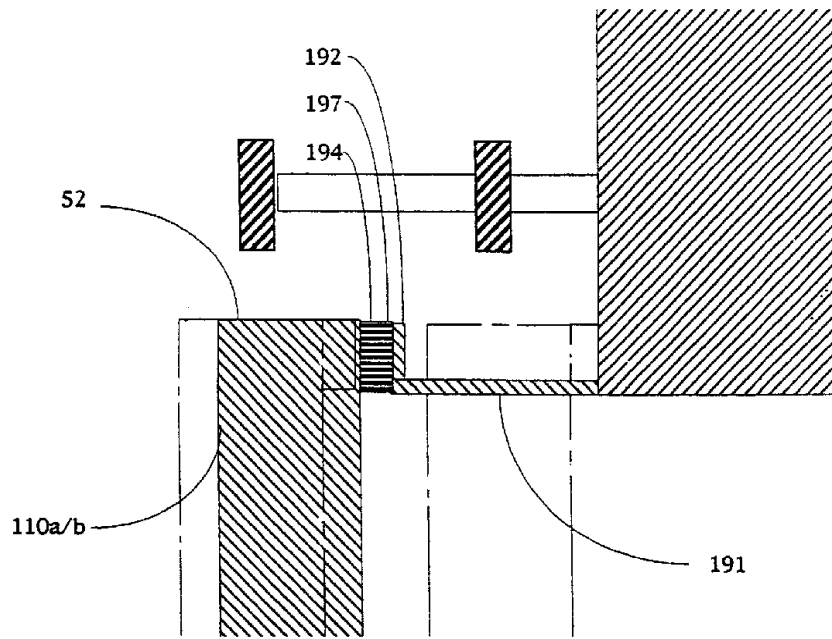


Fig. 25b

SUBSTITUTE SHEET (RULE 26)

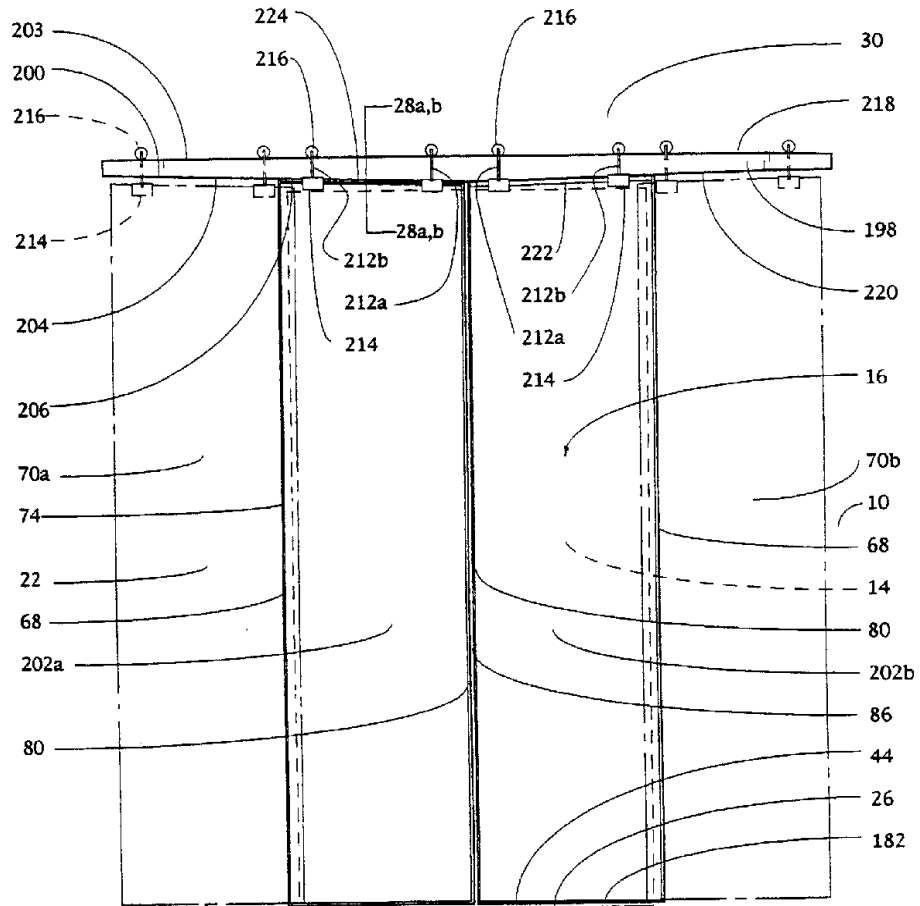


Fig. 26

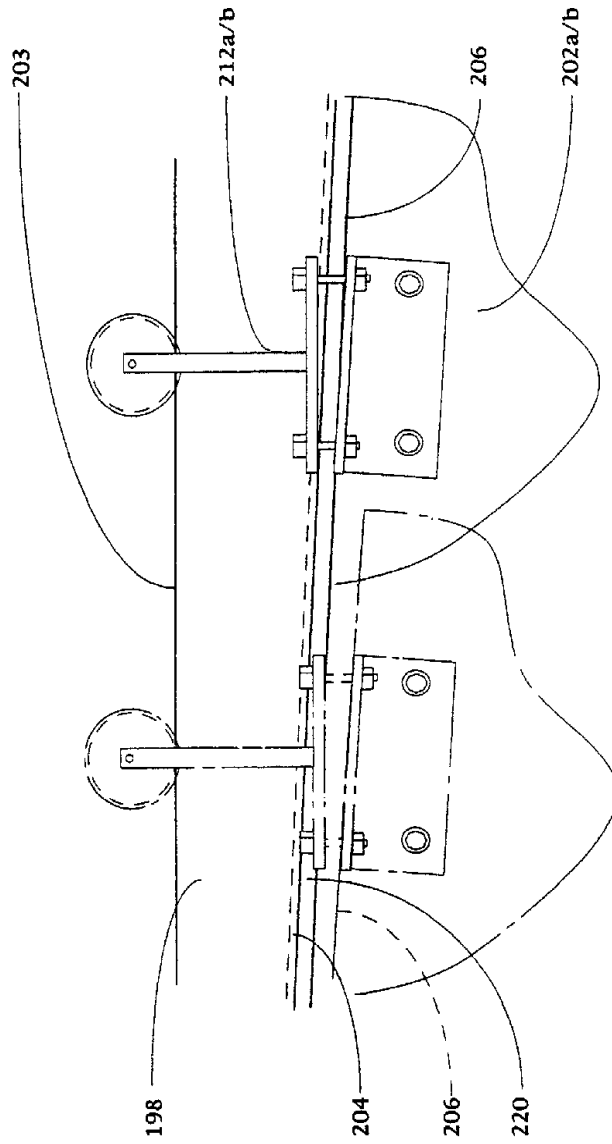


FIG. 27

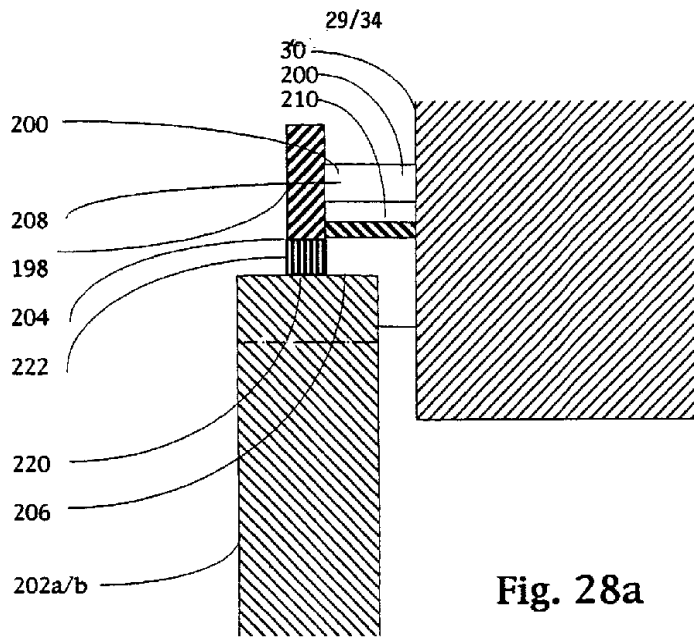


Fig. 28a

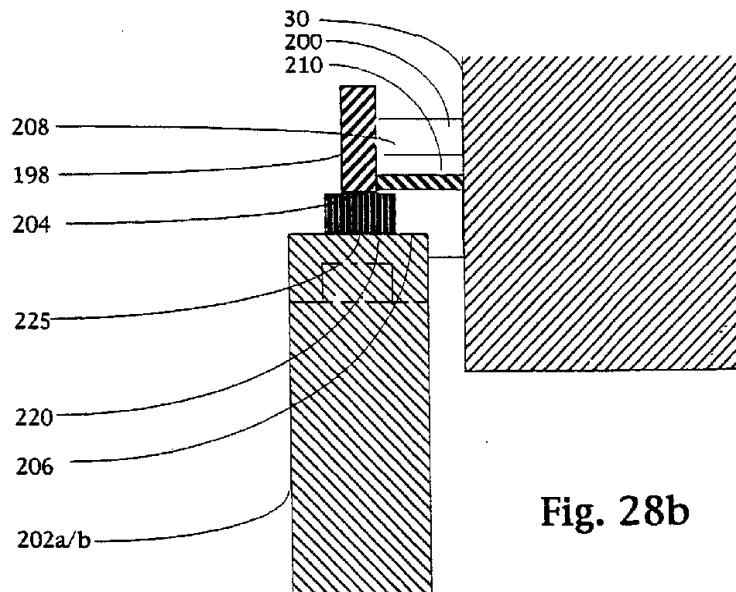


Fig. 28b

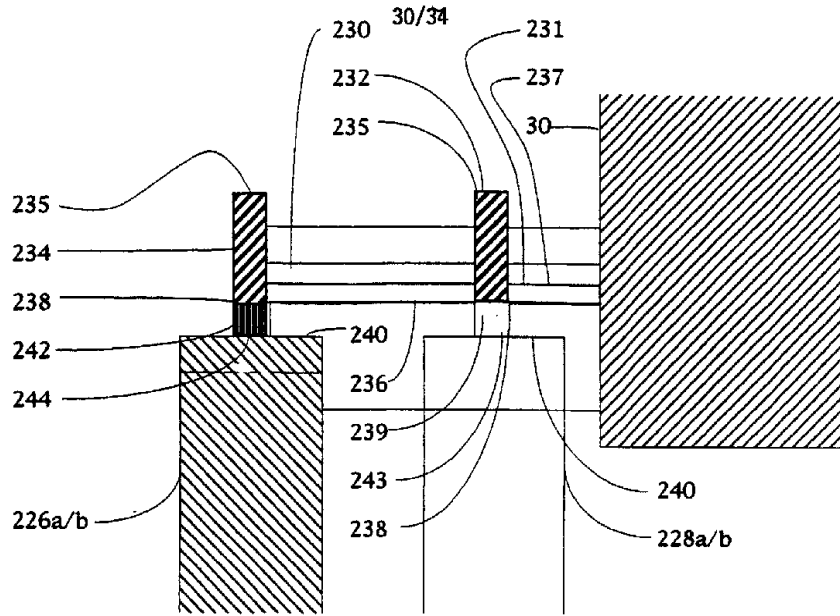


Fig. 29a

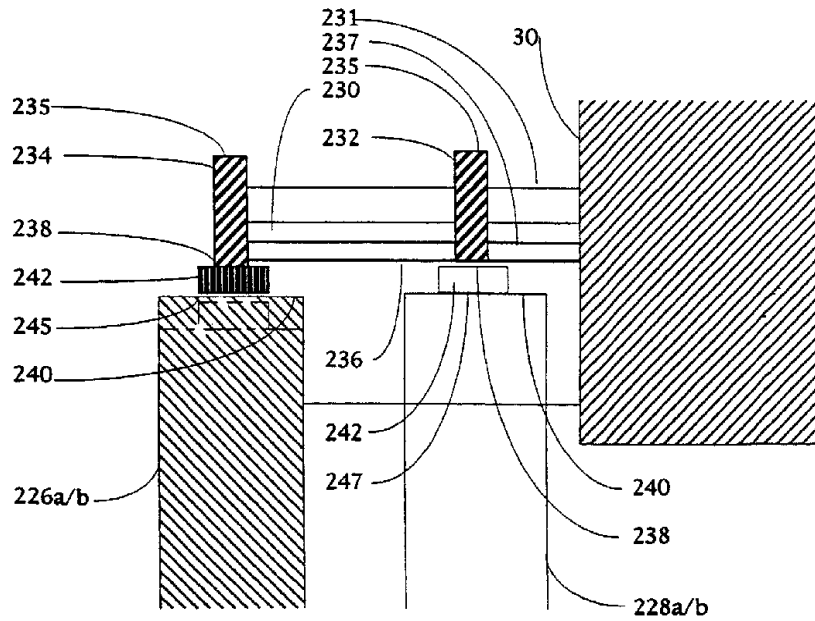


Fig. 29b

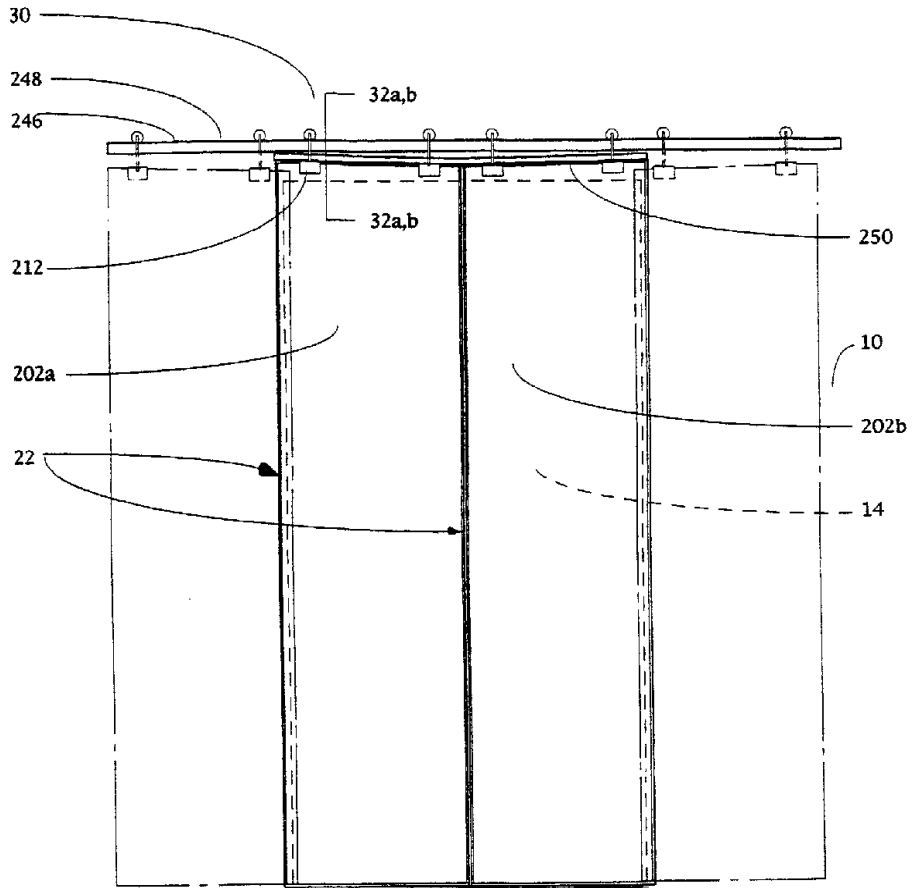


Fig. 30

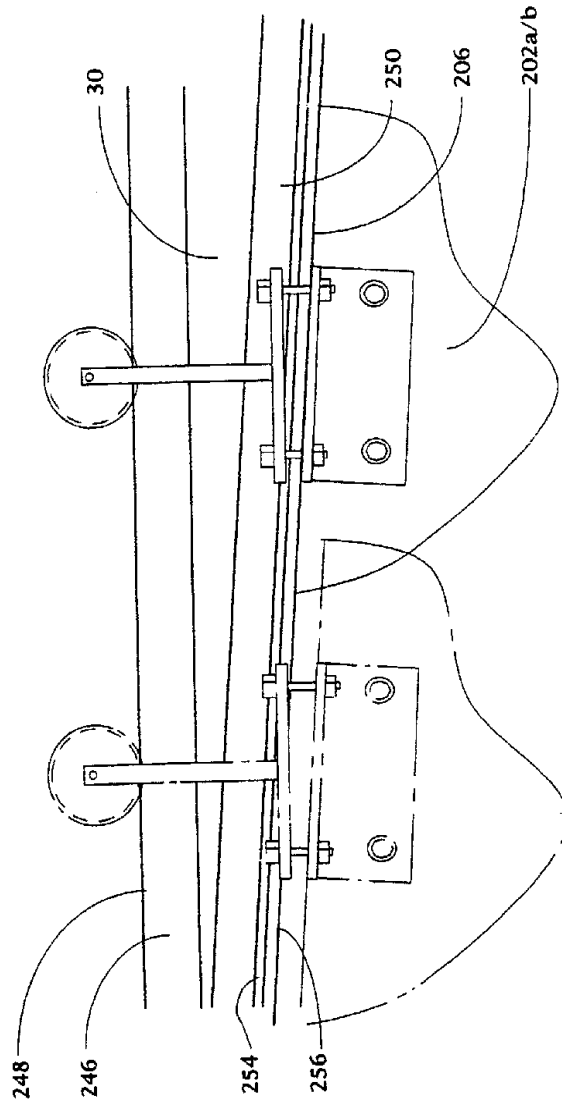


FIG. 31

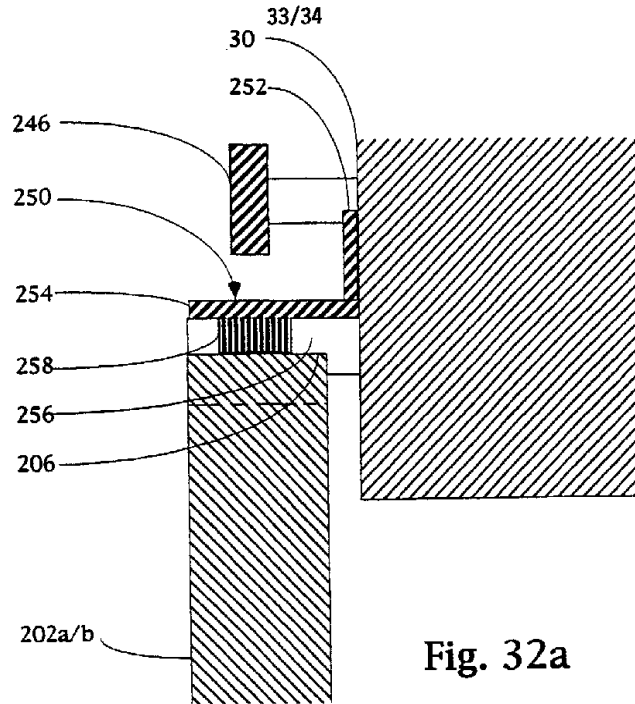


Fig. 32a

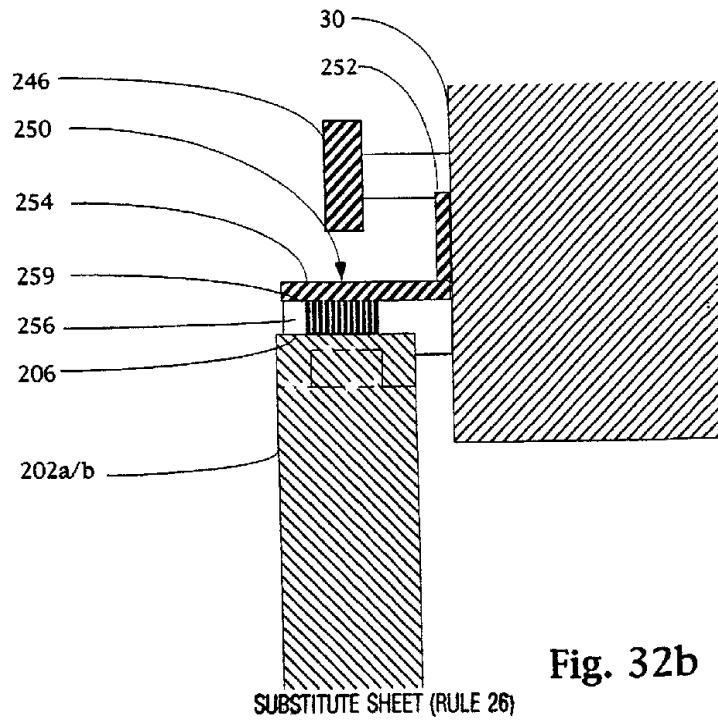


Fig. 32b

SUBSTITUTE SHEET (RULE 26)

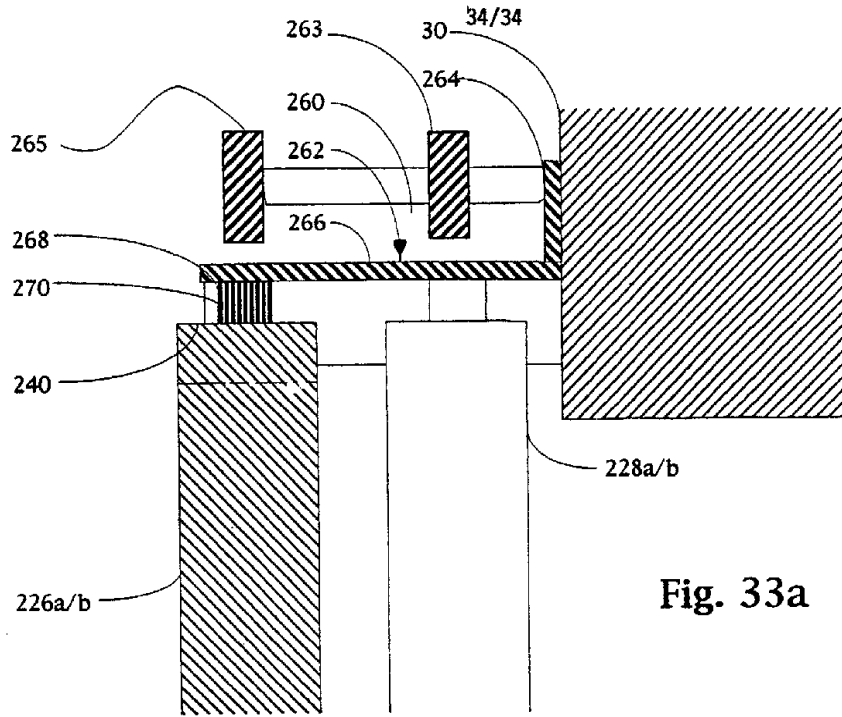


Fig. 33a

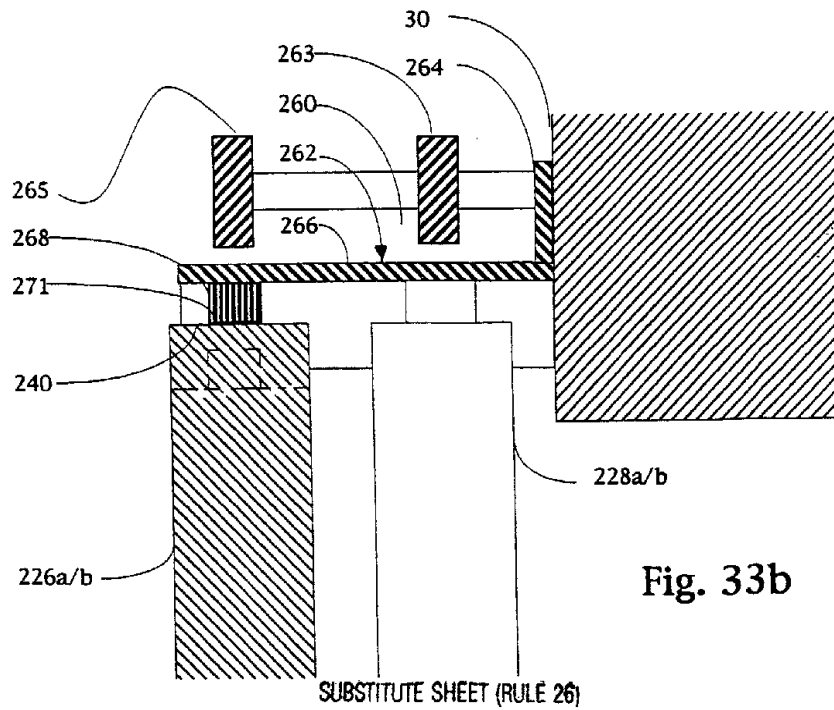


Fig. 33b