

SPECIFICATION

Sliding Door and Seals

This invention relates to seals for sliding doors and, more particularly, to a sliding door system of the type adapted for a rapid transit passenger car.

The sliding doors of a rapid transit passenger car or of another passenger vehicle are subject to heavy use amounting to many opening and closing cycles. It has already been proposed to use inflatable air seals to seal sliding doors, the inflation of the seals being adapted to compensate for a relaxed fit between the doors and the associated door frame. Such seals have been fixed to the sliding doors and have thus been uncovered and easily accessible when the doors are opened.

In accordance with one aspect of the present invention there is provided a sliding door system comprising a side wall having a passageway aperture therethrough and a pair of side wall edge portions extending along opposite edges of said passageway aperture, a pair of doors slidable relative to each other in a direction transverse to said edges and externally of said side wall between open and closed positions, said doors having a combined width exceeding the distance between said edges so as to overlap respective side wall edge portions in any position of said doors, and inflatable seal means fixed to the external side of said side wall, to cooperate with said doors, said seal means including respective intermediate portions connected to the opposed side wall edge portions whereby said intermediate portions of said seal means remain covered by the doors during movement of the doors between said open and closed positions.

In accordance with another aspect of the present invention there is provided a sliding door system comprising a side wall, a passageway aperture in said side wall defined by a pair of spaced vertical edges and upper and lower horizontal edges, a pair of doors slidably mounted for movement transverse to said vertical edges between a closed position in which said doors cover said passageway aperture and an open position in which said doors uncover said passageway, said doors having a combined width greater than the distance between said vertical edges so as to overlap a side portion of said side wall adjacent each of said vertical edges in said closed position, movement of said doors to the open position being limited to ensure said side portions are covered by said doors in said open position, and inflatable seal means extending around the periphery of said aperture to provide a seal between said doors and said side wall upon supply of pressurised fluid to said seal, said seal means being attached to said side wall at each said side portion so as to be covered by said doors at all positions thereof.

The seal means preferably includes at least two separate elongate seals each of which extend partially around the periphery of the passageway

aperture and each of which includes a respective one of the intermediate portions.

By securing the seals to the fixed side wall rather than to the movable doors, the seals are concealed at least against direct exposure to contamination and tampering.

A failsafe locking arrangement is preferably provided by independently pressurising each of the seals and by interconnecting the two doors such that they move together. The doors are then effectively locked by frictional braking engagement of one seal on one of the doors even if the other inflatable seal fails.

The inflatable seals preferably are protected by static weather seals and so is the internal surface of each door against which a corresponding inflatable seal operatively engages. Moreover, when used in a passenger vehicle, the inflatable seal may seal the vehicle against sound and vibration of the doors when the vehicle is in operation, and the static weather seals may be adapted to seal against contamination when the vehicle is not in operation such as when a rapid transit car is parked on a track.

A bottom portion of each inflatable seal may be concealed under a threshold such that it is protected against undue wear and tear by the passenger traffic.

The above and other features of the invention will be better understood with reference to the following detailed description of a preferred embodiment thereof which is illustrated, by way of example, in the accompanying drawings; in which:

Figure 1 is a side elevation view of a pair of sliding doors and associated elements on one side of a rapid transit passenger car and embodying a sliding door system according to the present invention;

Figure 2 is a cross-sectional view as seen along line 2—2 in Figure 1;

Figure 2a is a cross-sectional and enlarged scale view of the left portion of Figure 2;

Figures 2b and 2c correspond to Figures 2 and 2a respectively but with the doors open;

Figures 3, 4 and 5 are cross-sectional views as seen along lines 3—3, 4—4 and 5—5 respectively in Figure 1; and

Figures 6 and 7 are mere cross-sectional views of the inflatable seal in inoperative and operatively sealing positions respectively, and

Figure 8 is a simplified diagram of the air pressure supply circuit to separately pressurize the two inflatable seals.

The illustrated sliding door system includes a side wall comprising a lateral sill 1 and a metal skin 2. An elongated cant rail 3 covers the longitudinal junction between the roof framework and the side wall. The side wall is formed with a passageway aperture 4 therethrough. The system also includes a pair of sliding doors 5 and 6 which slide edgewise longitudinally and externally relative to the side wall and to and fro relative to each other.

The sliding doors 5 and 6 are actuated and

deflated, to form a barrier against tampering with the inflatable seal, and to prevent contamination of the inner side of the doors when the passenger car is in motion or parked with door closed.

- 5 The inflatable seals 22 are of any known type having a tubular form with a solid base portion 30 engaged in a clamping strip 31 and opposite to the movable sealing portion 32.

- 10 Each of the two aforementioned air seals 22 is separately inflatable by any appropriate air pressure supply device or pump also required to actuate the pneumatic cylinder actuator 11, as schematically shown in Figure 8. The two air seals are therefore connected to the air pressure supply pump 33 by two distinct dispensing circuits each embodying an appropriate flow restrictor 34 such that the failure of one seal 22 will not impair the operation of the other seal. The pump 33 is
15 powered by a motor 35 to inflate the air seals 22 upon selective actuation of the solenoid valves 36. With the aforescribed air pressure supply system, when one seal 22 fails, the flow restrictors 34 ensure that the other seal remains inflated. This cooperates with the aforementioned
20 intercoupling cable 12 to hold the two doors closed upon failure, puncturing or leaking of one seal.

- The doors 5 and 6 are frictionally braked against opening thereof by the pressurized inflatable seals 22, when the passenger car is in operation. If one seal 22 fails, the other seal remains pressurized and directly holds the corresponding door against opening. The intercoupling cable 12 is thus held fixed by this
35 directly braked door, and consequently, indirectly holds the other door closed due to the positive interconnection which it provides between the doors.

Claims

- 40 1. A sliding door system comprising a side wall having a passageway aperture therethrough and a pair of side wall edge portions extending along opposite edges of said passageway aperture, a pair of doors slidable relative to each other in a
45 direction transverse to said edges and externally of said side wall between open and closed positions, said doors having a combined width exceeding the distance between said edges so as to overlap respective side wall edge portions in
50 any position of said doors, and inflatable seal means fixed to the external side of said side wall, to cooperate with said doors, said seal means including respective intermediate portions connected to the opposed side wall edge portions
55 whereby said intermediate portions of said seal means remain covered by the doors during movement of the doors between said open and closed positions.

2. A sliding door system according to Claim 1,
60 wherein said seal means includes at least two separate elongate seals each of which extend partially around the periphery of said passageway aperture and includes one of the said intermediate portions.

- 65 3. A sliding door system according to Claim 2, wherein each of said seals includes a pair of end portions which are disposed at opposite ends of said intermediate portion and extend along the periphery of said passageway aperture in a
70 direction transverse to said intermediate portion.

4. A sliding door system according to Claim 2 or Claim 3, wherein said seals are independently inflatable from a source of pressurised fluid.

5. A sliding door system according to Claim 4,
75 wherein said doors are interconnected by a coupling device so that displacement of one of said doors produces an equal displacement in the opposite direction of the other of said doors.

6. A sliding door system according to Claim 5,
80 wherein said seals are engagable with said doors upon supply of pressurised fluid from said source to provide a retarding force to said doors, said coupling device transmitting a retarding force from one door to another upon failure of one of
85 said seals.

7. A sliding door system according to Claim 6, wherein said doors are spaced from said side wall and include a peripheral lip directed toward and terminating in close proximity to said side wall.

8. A sliding door system according to claim 7,
90 wherein a threshold member is attached to a lower edge of said passageway aperture and projects toward said doors, said lip, threshold member and side wall defining a cavity in which
95 one of said end portions of each said seal is located, said threshold member inhibiting contact with said end portions upon opening of said doors.

9. A sliding door system according to any one
100 of claims 1 to 8 including a static seal attached to said side wall outwardly of said seal means.

10. A sliding door system comprising a side wall, a passageway aperture in said side wall defined by a pair of spaced vertical edges and
105 upper and lower horizontal edges, a pair of doors slidably mounted for movement transverse to said vertical edges between a closed position in which said doors cover said passageway aperture and an open position in which said doors uncover said
110 passageway, said doors having a combined width greater than the distance between said vertical edges so as to overlap a side portion of said side wall adjacent each of said vertical edges in said closed position, movement of said doors to the
115 open position being limited to ensure said side portions are covered by said doors in said open position, and inflatable seal means extending around the periphery of said aperture to provide a seal between said doors and said side wall upon
120 supply of pressurised fluid to said seal, said seal means being attached to said side wall at each said side portion so as to be covered by said doors at all positions thereof.

11. A sliding door system according to claim
125 10, wherein said seal means includes a pair of elongate seals, each having an intermediate portion and a pair of terminal portions disposed at opposite ends of said intermediate portion, said intermediate portions being attached to the



deflated, to form a barrier against tampering with the inflatable seal, and to prevent contamination of the inner side of the doors when the passenger car is in motion or parked with door closed.

- 5 The inflatable seals 22 are of any known type having a tubular form with a solid base portion 30 engaged in a clamping strip 31 and opposite to the movable sealing portion 32.

- 10 Each of the two aforementioned air seals 22 is separately inflatable by any appropriate air pressure supply device or pump also required to actuate the pneumatic cylinder actuator 11, as schematically shown in Figure 8. The two air seals are therefore connected to the air pressure supply pump 33 by two distinct dispensing circuits each embodying an appropriate flow restrictor 34 such that the failure of one seal 22 will not impair the operation of the other seal. The pump 33 is powered by a motor 35 to inflate the air seals 22 upon selective actuation of the solenoid valves 36. With the aforescribed air pressure supply system, when one seal 22 fails, the flow restrictors 34 ensure that the other seal remains inflated. This cooperates with the aforementioned intercoupling cable 12 to hold the two doors closed upon failure, puncturing or leaking of one seal.

- The doors 5 and 6 are frictionally braked against opening thereof by the pressurized inflatable seals 22, when the passenger car is in operation. If one seal 22 fails, the other seal remains pressurized and directly holds the corresponding door against opening. The intercoupling cable 12 is thus held fixed by this directly braked door, and consequently, indirectly holds the other door closed due to the positive interconnection which it provides between the doors.

Claims

- 40 1. A sliding door system comprising a side wall having a passageway aperture therethrough and a pair of side wall edge portions extending along opposite edges of said passageway aperture, a pair of doors slidable relative to each other in a direction transverse to said edges and externally of said side wall between open and closed positions, said doors having a combined width exceeding the distance between said edges so as to overlap respective side wall edge portions in any position of said doors, and inflatable seal means fixed to the external side of said side wall, to cooperate with said doors, said seal means including respective intermediate portions connected to the opposed side wall edge portions whereby said intermediate portions of said seal means remain covered by the doors during movement of the doors between said open and closed positions.

- 60 2. A sliding door system according to Claim 1, wherein said seal means includes at least two separate elongate seals each of which extend partially around the periphery of said passageway aperture and includes one of the said intermediate portions.

- 65 3. A sliding door system according to Claim 2, wherein each of said seals includes a pair of end portions which are disposed at opposite ends of said intermediate portion and extend along the periphery of said passageway aperture in a direction transverse to said intermediate portion.

- 70 4. A sliding door system according to Claim 2 or Claim 3, wherein said seals are independently inflatable from a source of pressurised fluid.

- 75 5. A sliding door system according to Claim 4, wherein said doors are interconnected by a coupling device so that displacement of one of said doors produces an equal displacement in the opposite direction of the other of said doors.

- 80 6. A sliding door system according to Claim 5, wherein said seals are engagable with said doors upon supply of pressurised fluid from said source to provide a retarding force to said doors, said coupling device transmitting a retarding force from one door to another upon failure of one of said seals.

- 85 7. A sliding door system according to Claim 6, wherein said doors are spaced from said side wall and include a peripheral lip directed toward and terminating in close proximity to said side wall.

- 90 8. A sliding door system according to claim 7, wherein a threshold member is attached to a lower edge of said passageway aperture and projects toward said doors, said lip, threshold member and side wall defining a cavity in which one of said end portions of each said seal is located, said threshold member inhibiting contact with said end portions upon opening of said doors.

- 100 9. A sliding door system according to any one of claims 1 to 8 including a static seal attached to said side wall outwardly of said seal means.

- 105 10. A sliding door system comprising a side wall, a passageway aperture in said side wall defined by a pair of spaced vertical edges and upper and lower horizontal edges, a pair of doors slidably mounted for movement transverse to said vertical edges between a closed position in which said doors cover said passageway aperture and an open position in which said doors uncover said passageway, said doors having a combined width greater than the distance between said vertical edges so as to overlap a side portion of said side wall adjacent each of said vertical edges in said closed position, movement of said doors to the open position being limited to ensure said side portions are covered by said doors in said open position, and inflatable seal means extending around the periphery of said aperture to provide a seal between said doors and said side wall upon supply of pressurised fluid to said seal, said seal means being attached to said side wall at each said side portion so as to be covered by said doors at all positions thereof.

- 110 11. A sliding door system according to claim 10, wherein said seal means includes a pair of elongate seals, each having an intermediate portion and a pair of terminal portions disposed at opposite ends of said intermediate portion, said intermediate portions being attached to the



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respective vertical side portions of the side wall
and said terminal portions being attached to said
side wall to extend partially along the respective
horizontal edges of the aperture, said seals
5 thereby cooperating to encompass said
passageway aperture.

12. A sliding door system according to claim
11, wherein a threshold member projects from
said lower horizontal edge of said threshold
10 members to provide protection for said terminal
portions located adjacent said lower

horizontal edge.

13. A sliding door system according to Claim
11 or Claim 12, wherein said doors are
15 interconnected by a coupling device to transmit
displacement forces between the doors, one of
said seals thereby applying a retarding force to
both doors upon failure of one of said seals.

14. A sliding door system substantially as
20 herein described with reference to the
accompanying drawings.