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(72) Inventor(s):

Robin Warmington
Paul Moreton-Smith
Jim Bryant

(73) Proprietor(s):

Jaguar Land Rover Limited
Abbey Road, Whitley, Coventry, Warwickshire,
CV3 4LF, United Kingdom

(74) Agent and/or Address for Service:

Jaguar Land Rover
Patents Department W/1/073, Abbey Road, Whitley,
Coventry, Warwickshire, CV3 4LF, United Kingdom

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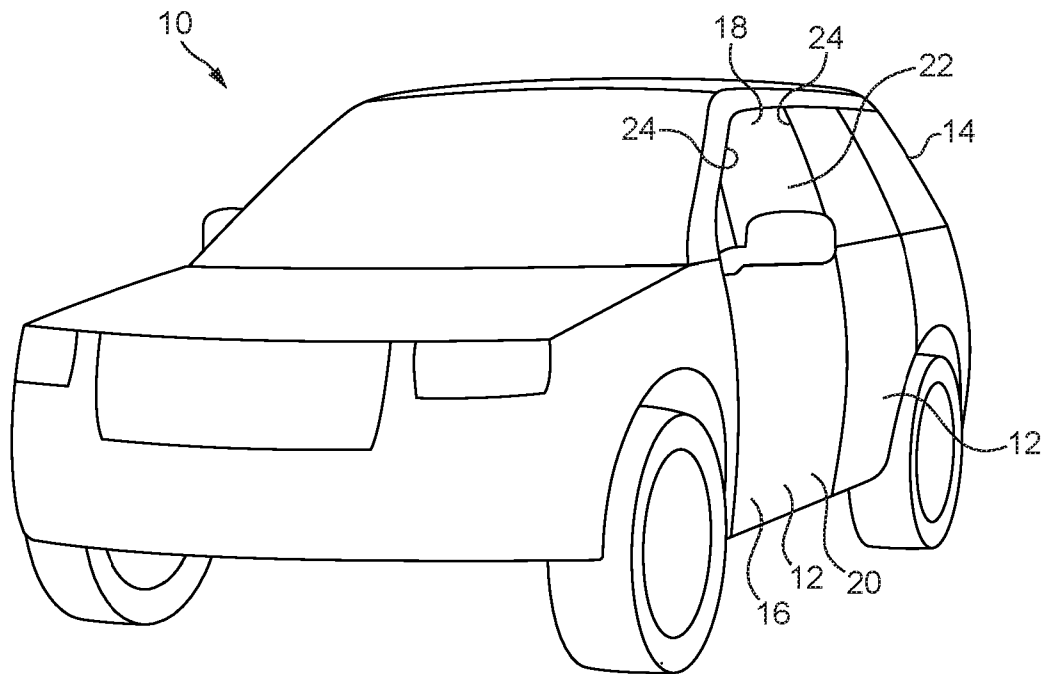


FIG. 1

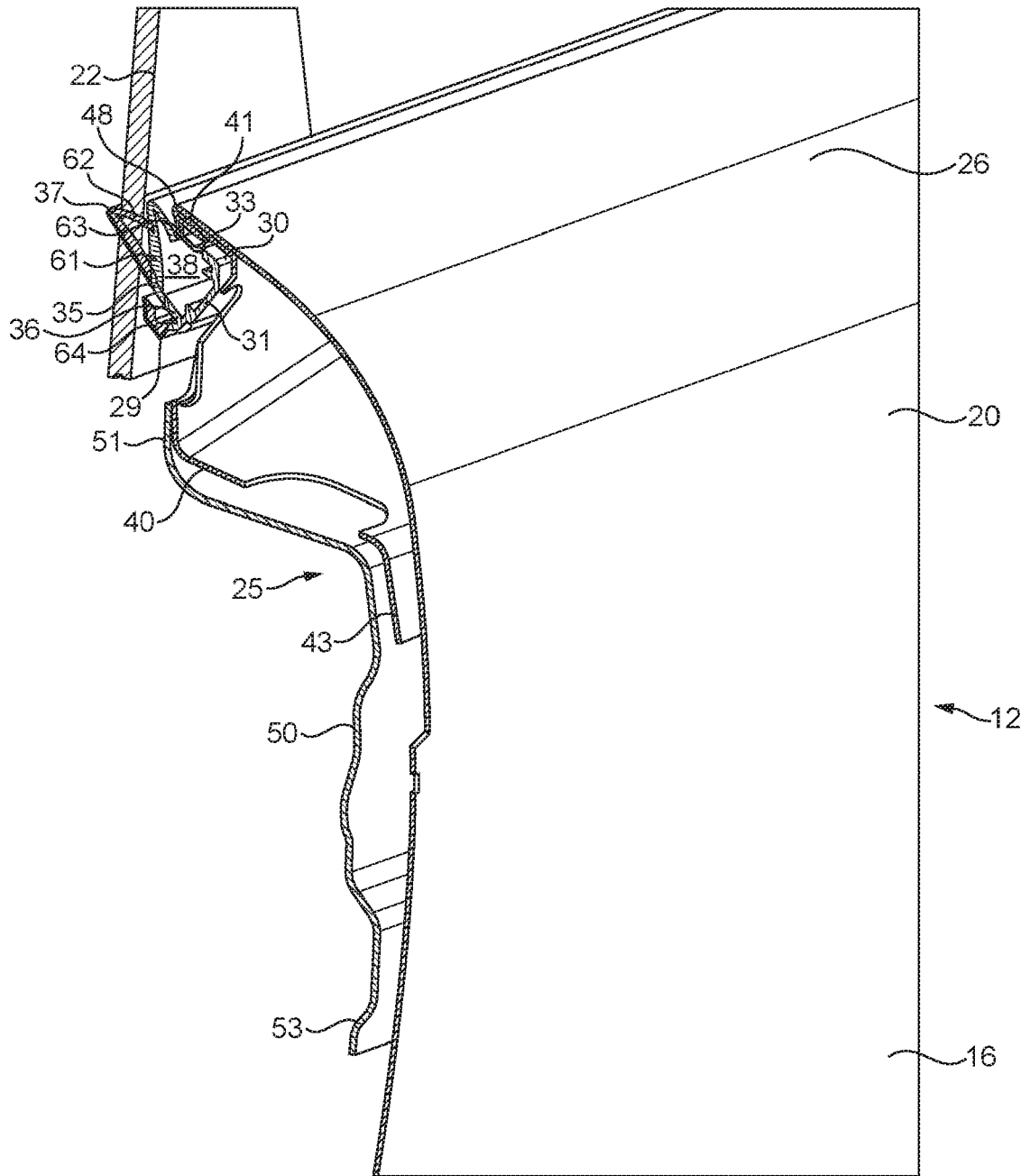


FIG. 2

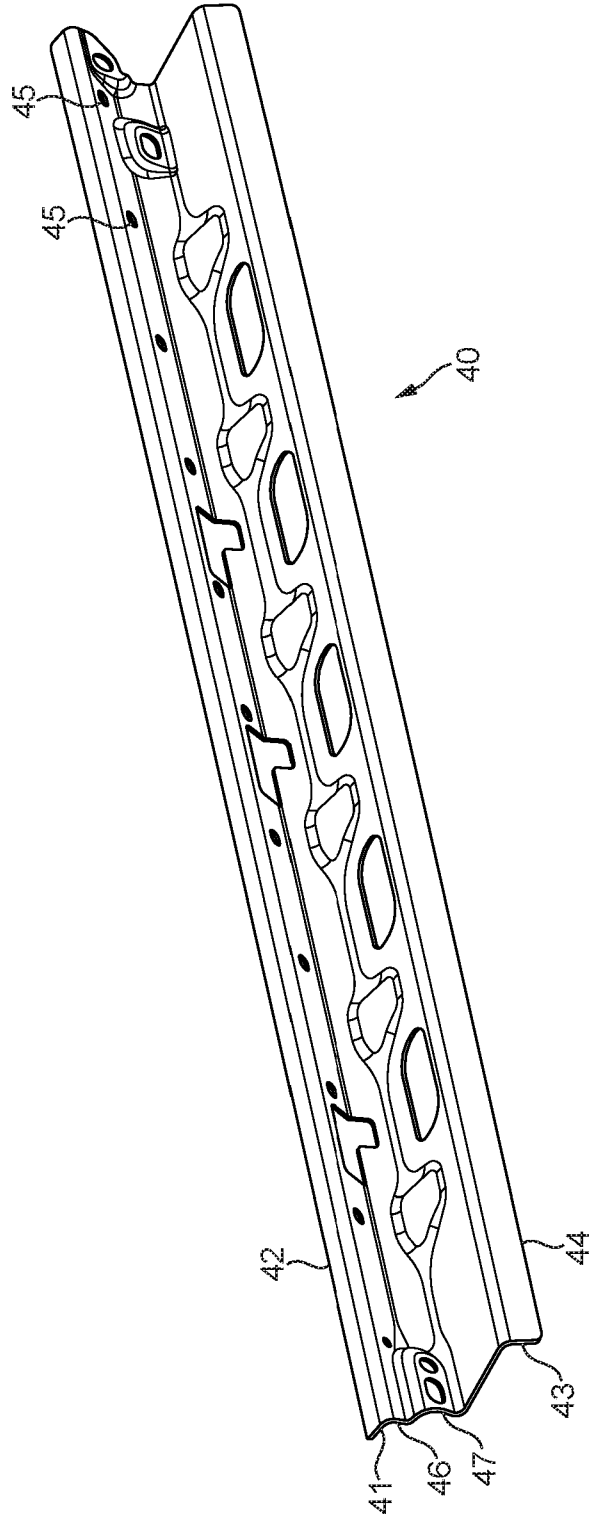


FIG. 3

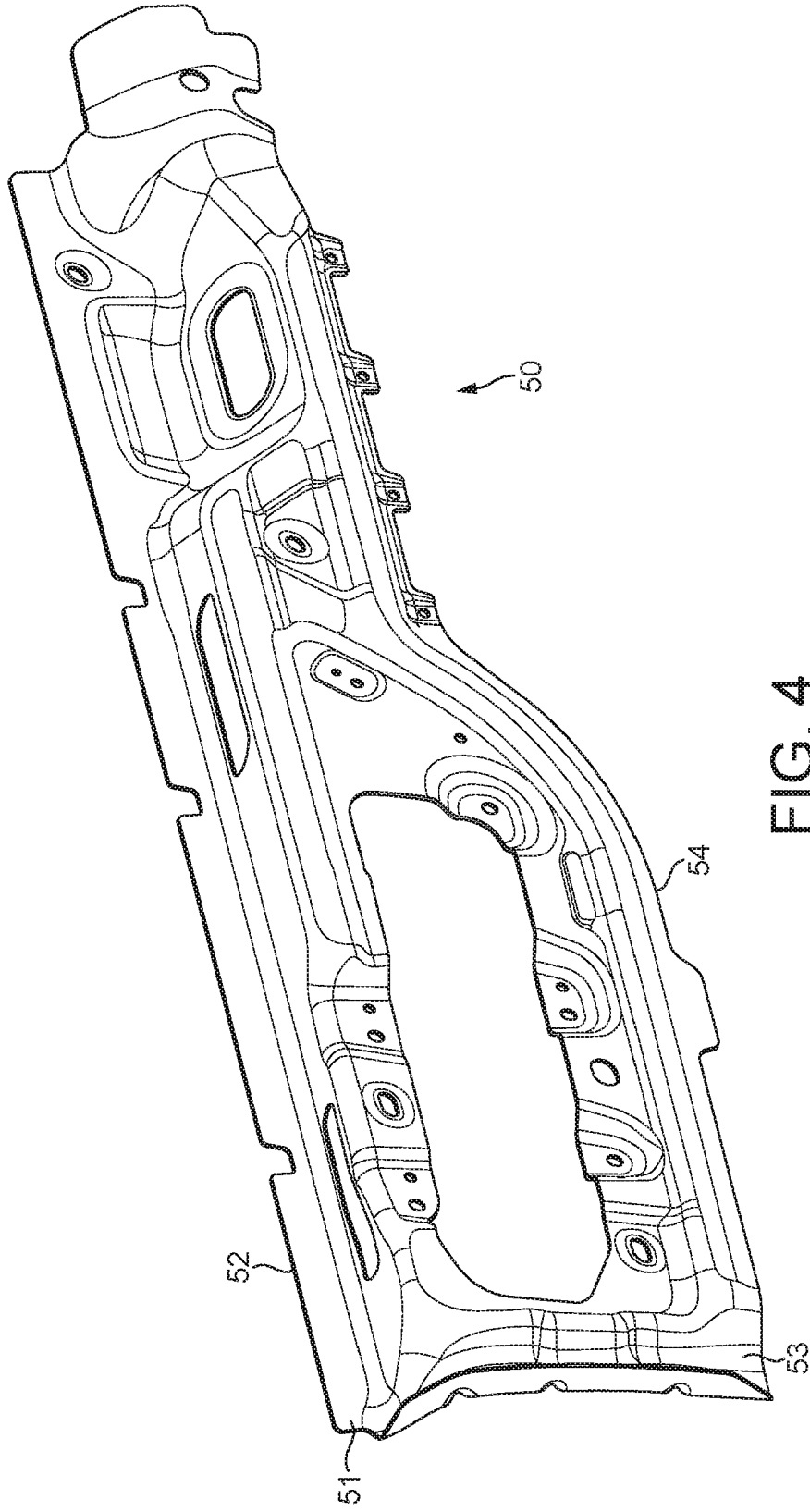


FIG. 4

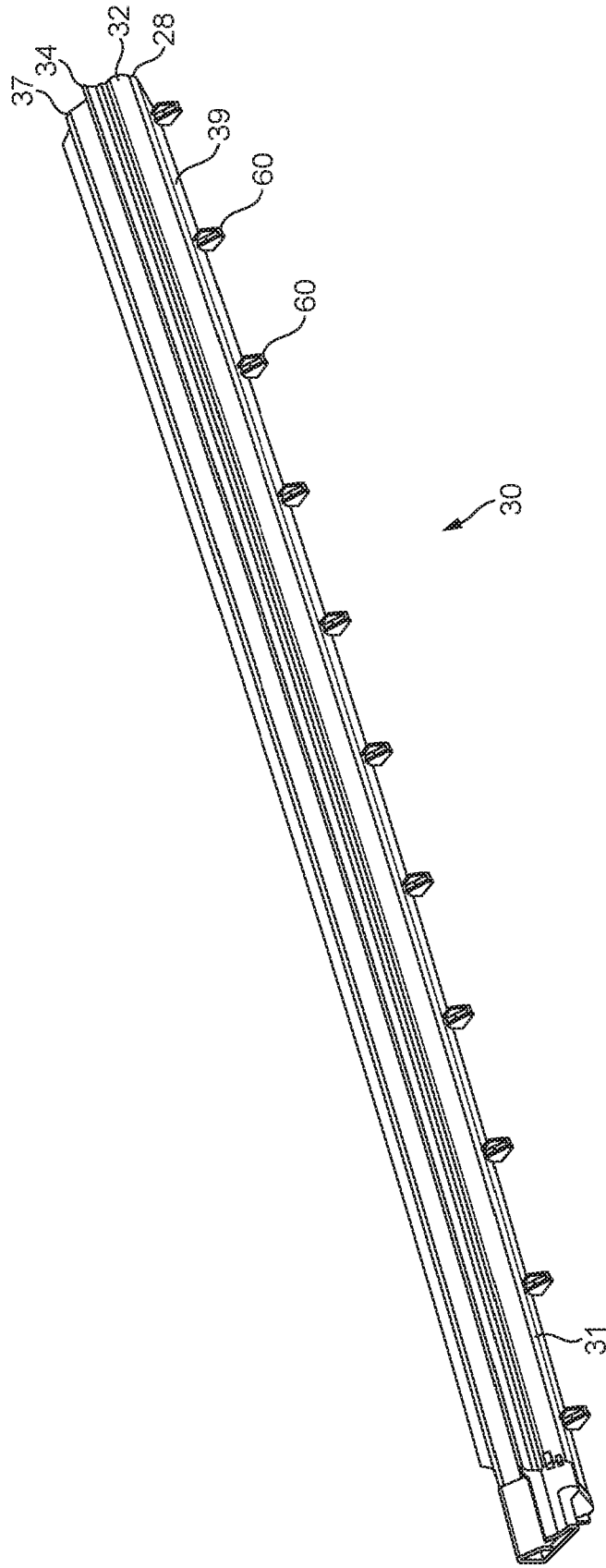


FIG. 5

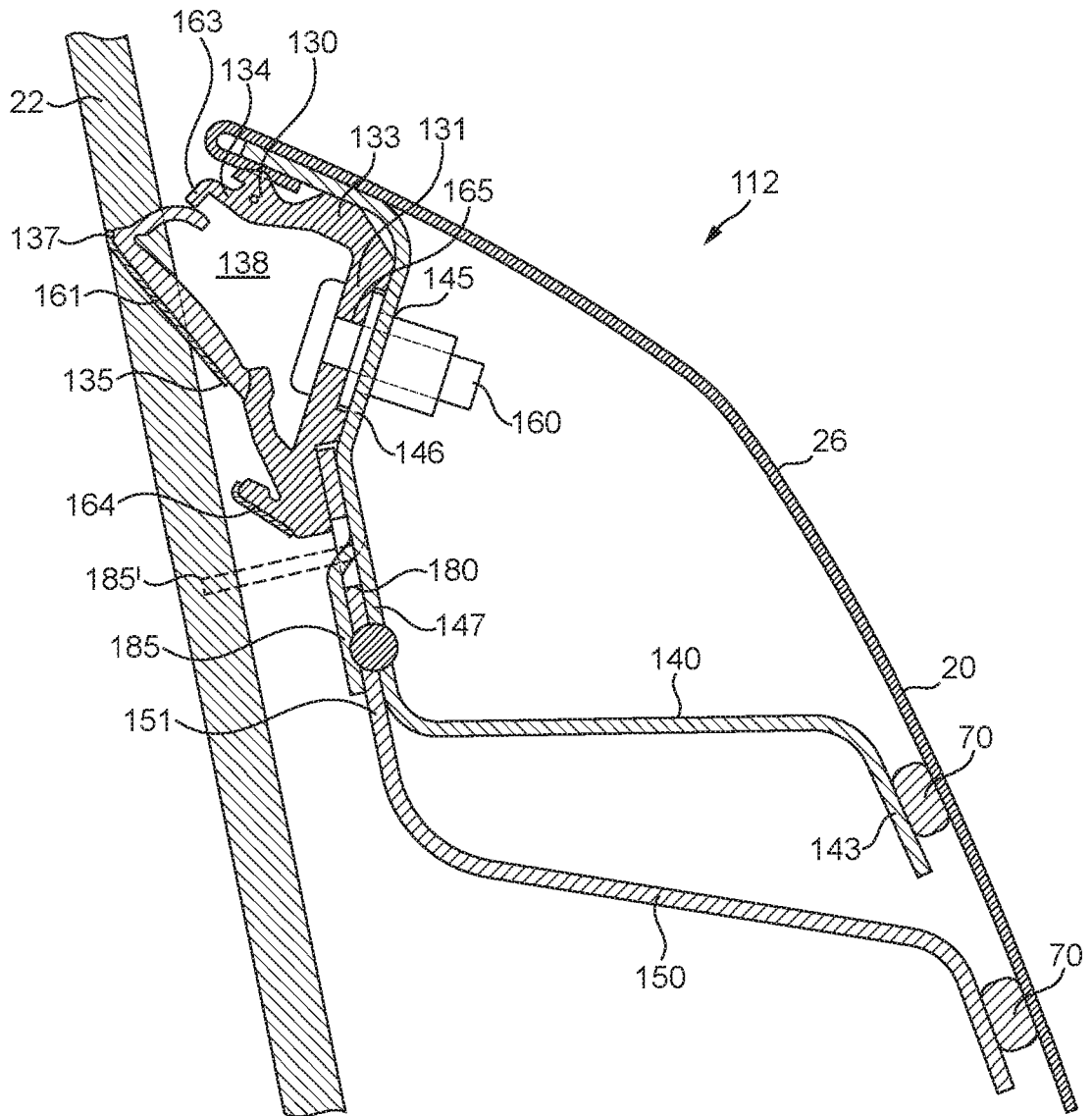


FIG. 6

A Vehicle Door

TECHNICAL FIELD

5 The present disclosure relates to an assembly for a vehicle door. The present disclosure also relates to a seal assembly for a vehicle door and to a vehicle door. In addition, the present disclosure relates to a method of assembling a vehicle door.

BACKGROUND

10 The driver and passenger doors of passenger and commercial vehicles typically comprise an external waist seal to prevent water ingress into the interior of the vehicle door via the gap which exists between the uppermost edge of the outer door panel and the moveable glass window. A secondary purpose of the waist seal is to damp vibrations of the glass when it is in the open position and hence located partially or fully within the structure of the door.

15 Waist seals are typically located along the uppermost edge of the outer door panel such that they fulfil a dual purpose of preventing water ingress and providing an aesthetic trim for the edge of the door panel.

20 Vehicle styling is of vital importance in the competitive passenger vehicle market, especially so for premium brands that compete not only on vehicle performance but also on superior styling. It is desirable from an aesthetic point of view for the waist seal to be hidden from the view of a vehicle user when the vehicle is viewed by the user in normal use. That is to say, when a user observes the vehicle when it is parked or in motion, when opening and closing the doors, and when driving the vehicle or riding in the vehicle as a passenger.

25 For the waist seal to be hidden from view, it is necessary to locate it inside the structure of the door below the uppermost edge of the outer door panel. However, this presents a problem as relocation of the waist seal from the uppermost edge of the outer door panel to the interior of the door structure deprives the uppermost edge of the outer door panel of its finishing trim.

30 This is somewhat less of a problem for frameless doors, such as used for convertible and cabriolet style vehicles, which may be fabricated with a hemmed connection between the outer door panel and the door structure. However, for framed doors found on the majority of roofed vehicles, it is not possible to hem the uppermost edge of the outer door panel as the posts of the window frame prevent access of the hemming tool along the whole width of the uppermost
35 edge of the outer door panel.

It is against this background that the present invention has been developed.

SUMMARY OF THE INVENTION

5 Aspects and embodiments of the invention provide an assembly for a vehicle framed door, a vehicle framed door seal assembly, a vehicle door and a vehicle comprising said vehicle door. Aspects and embodiments of the invention also provide a method of assembling a vehicle framed door.

10 According to an aspect of the present invention there is provided an assembly for a vehicle framed door, the assembly comprising: an outer door panel skin; a waist rail; and a seal carrier rail, wherein the seal carrier rail is attached to the waist rail, and wherein the outer door panel skin is attached to a portion of the seal carrier rail. This arrangement is advantageous as it allows for the outer door panel skin to be attached to the seal carrier rail before the seal carrier rail is attached to the waist rail thereby making access for tooling easier during the skin attachment process.

15 The waist rail comprises a first portion located adjacent a first edge of the waist rail, and a second portion located adjacent a second edge of the waist rail. The seal carrier rail comprises a first portion located adjacent a first edge of the seal carrier rail, and a second portion located adjacent a second edge of the seal carrier rail, wherein the outer door panel skin is attached to the first portion of the seal carrier rail. The seal carrier rail is attached to the waist rail such that the first portion of the seal carrier rail extends beyond the first edge of the waist rail, and the second portion of the waist rail extends beyond the second edge of the seal carrier rail. This arrangement advantageously places the door skin well above the waist rail thereby improving aesthetic appearance.

The seal carrier rail comprises a seal attachment portion located adjacent the first portion of the seal carrier rail to facilitate attachment of a waist seal proximate the top of the vehicle door.

30 The seal attachment portion may comprise a plurality of apertures for receiving mechanical fixings.

35 In one example the seal carrier rail comprises a mid-portion located adjacent the seal attachment portion, wherein the mid-portion of the seal carrier rail is attached to the first portion of the waist rail allowing for attachment of the waist rail below the waist seal location in the assembled door.

Optionally the seal carrier rail comprises a plurality of fixing elements located on the mid-portion of the seal carrier rail, and wherein the waist rail comprises a plurality of apertures located in the first portion of the waist rail, wherein at least some of the fixing elements of the seal carrier rail pass through at least some of the apertures in the waist rail. This arrangement facilitates attachment of the seal carrier rail to the waist rail.

The outer door panel skin is attached to the first portion of the seal carrier rail by a hemmed connection to provide a desirable aesthetic.

The second portion of the waist rail is connected to the outer door panel skin to help prevent flutter of the outer door panel skin. The second portion of the seal carrier rail may also be connected to the outer door panel skin to help prevent flutter of the outer door panel skin.

According to another aspect of the present invention there is provided a vehicle framed door seal assembly comprising: a vehicle framed door assembly as described above and a waist seal comprising: an elongate support portion; an elongate inner-side portion; and an elongate outer-side portion, wherein the inner-side portion and the outer-side portion each comprise a proximal end connected to the support portion and a distal end remote from the support portion, wherein the inner-side portion and the outer-side portion each extend away from opposing sides of the support portion such that together the inner-side portion, the outer-side portion and the support portion form a channel, wherein the support portion is attached to the seal support rail of the vehicle door assembly. Attachment of the support portion directly to the seal support rail is advantageous since the seal need not be provided with a separate connection feature thereby reducing complexity and cost.

Optionally the support portion of the waist seal comprises a plurality of apertures, wherein the waist seal is attached to the seal carrier rail by a plurality of mechanical fixings which pass through the apertures in the support portion. Alternatively or additionally the support portion of the waist seal optionally comprises a plurality of mechanical fixings, wherein the waist seal is attached to the seal carrier rail by the plurality of mechanical fixings. The plurality of mechanical fixings may be integrally formed with the waist seal.

According to a further aspect of the present invention there is provided a vehicle door comprising a vehicle framed door seal assembly as described above.

Optionally the waist seal is located within the door in normal use so that it is hidden from view for a user such as a driver or passenger, or for any other person observing the vehicle in day-to-day use.

5 According to a still further aspect of the present invention there is provided a vehicle comprising a vehicle door as described above.

10 According to another aspect of the present invention there is provided a method of assembling a vehicle framed door, the method comprising: attaching an outer door panel skin to a seal carrier rail; and attaching the seal carrier rail to a waist rail, wherein the outer door panel skin is attached to the seal carrier rail before the seal carrier rail is attached to the waist rail. This method of assembly is advantageous as it allows for the outer door panel skin to be attached to the seal carrier rail before the seal carrier rail is attached to the waist rail thereby making access for tooling easier during the skin attachment process.

15 Optionally the outer door panel skin is attached to the seal carrier rail by a hemmed connection.

20 The method may optionally comprise attaching a waist seal to the seal carrier rail before or after attachment of the seal carrier rail to the waist rail.

25 The waist seal may comprise: an elongate support portion; an elongate inner-side portion; and an elongate outer-side portion, wherein the inner-side portion and the outer-side portion each comprise a proximal end connected to the support portion and a distal end remote from the support portion, wherein the inner-side portion and the outer-side portion each extend away from opposing sides of the support portion such that together the inner-side portion, the outer-side portion and the support portion form a channel, wherein the support portion is configured for attachment to the seal carrier rail.

30 In one example the waist seal is attached to the seal carrier rail by a plurality of mechanical fixtures each of which passes through a respective aperture in the support portion of the waist seal.

35 Optionally the waist seal is attached to the seal carrier rail by a plurality of mechanical fixtures each of which passes through a respective aperture in the seal carrier rail. The mechanical fixtures are optionally integrally formed with the waist seal.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

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BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

15 Figure 1 shows a vehicle comprising a vehicle door assembly according to the present invention;

Figure 2 shows an isometric view of a cross-section taken through a portion of the outer-side of a door of the vehicle.

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Figure 3 shows an isometric view of a seal carrier rail;

Figure 4 shows an isometric view of a structural waist rail;

25 Figure 5 shows an isometric view of a waist seal; and

Figure 6 shows a cross-sectional view taken through a portion of the outer-side of a door assembly comprising an alternative embodiment of a waist seal to that shown in Figure 5.

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DETAILED DESCRIPTION

Figure 1 shows a vehicle 10 comprising four side-doors 12 and one luggage compartment door 14. The description below is given in the context of the side-doors 12. However, the waist seal and door construction described below may also be used for the luggage compartment door 14 if desired.

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Each side-door 12 comprises a lower portion 16 and an upper portion 18. The lower portion 16 comprises an outer door panel 20 which forms part of the exterior surface of the vehicle 10. As will be described in greater detail below, the outer door panel 20 is attached to an internal structural frame (not shown in Figure 1) which provides structural strength and rigidity to the door 12. The upper portion 18 of the door 12 comprises a moveable glass pane 22 which is supported, when in the closed position, by a window frame 24.

Figure 2 shows an isometric view of a cross-section taken through a portion of the outermost side of the door 12. As discussed above, the lower portion 16 of the door 12 comprises an outer door panel 20 and an inner structural frame 25. The outer door panel 20 itself comprises an outer door panel skin 26 and a seal carrier rail 40. The inner structural frame 25 comprises a waist rail 50 to which a seal carrier rail 40 is attached as will be described in greater detail below.

Referring to Figure 3, the seal carrier rail 40 comprises a first portion 41 located adjacent a first edge 42 of the seal carrier rail 40, and a second portion 43 located adjacent a second edge 44 of the seal carrier rail 40. The outer door panel skin 26 is attached to the first portion 41 of seal carrier rail 40 by a hemmed connection 48 (as shown in Figure 2) such that the outer door panel skin 26 is folded over the first edge 42 of the seal carrier rail 40. Together, the seal carrier rail 40 and the outer door panel skin 26 form the outer door panel 20.

Referring now to Figure 4, the waist rail 50 comprises a first portion 51 located adjacent a first edge 52 of the waist rail 50, and a second portion 53 located adjacent a second edge 54 of the waist rail 50. As best shown in Figure 2, in the assembled door 12 the seal carrier rail 40 of the outer door panel 20 is attached to the waist rail 50 of the inner structural frame 25. Because the outer door panel skin 26 is hemmed to the seal carrier rail 40 before the seal carrier rail 40 is attached to the waist rail 50, the location of the window frame 24 does not interfere with the hemming tool used to form the hemmed connection 48.

Figure 5 shows an isometric view of the waist seal 30. Referring to both Figure 2 and Figure 5, the waist seal 30 comprises an elongate support portion 31 bounded on an outer-side 28 (with reference to the outer door panel 20) by an elongate outer-side portion 33, and bounded on an inner-side 29 (with reference to the outer door panel 20) by an elongate inner-side portion 35. The outer-side portion 33 comprises a proximal end 32 which is contiguous with the outer-side 28 of the support portion 31, and a distal end 34 which is remote from the support portion 31. Similarly, the inner-side portion 35 comprises a proximal end 36 which is contiguous with the inner-side 29 of the support portion 31, and a distal end 37 which is remote

from the support portion 31. The inner-side portion 35 and the outer-side portion 33 each extend away from the opposing inner 29 and outer 28 sides of the support portion 31 such that together the inner-side portion 35, the outer-side portion 33, and the support portion 31 form a channel 38.

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As best shown in Figure 2, support portion 31 of the waist seal 30 is attached to the seal carrier rail 40 of the outer door panel 20. In this embodiment, the waist seal 30 comprises a plurality of self-fixing plug connectors 60 located on the exterior side 39 of the support portion 31.

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Referring once again to Figure 3, the seal carrier rail 40 comprises a plurality of apertures 45 which are each configured to receive one of the plurality of plug connectors 60. The plug connectors 60 are each configured so that they may readily pass through the respective apertures 45 on the seal carrier rail 40 in one direction, but not pass back through the apertures 45 as readily, or at all. Such plug connectors are well known in the art. The exterior side 39 of the support portion 31 may also be attached to the seal carrier rail 40 with an adhesive in addition to the plug connectors 60. As will be apparent to the person skilled in the art, any suitable method may be employed to attach the waist seal 30 to the seal carrier rail 40, some non-exhaustive examples of which are given below.

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The support portion 31 of the waist seal 30 is attached to the seal carrier rail 40 at a seal attachment portion 46. The seal attachment portion 46 is located adjacent the first portion 41 of the seal carrier rail and the plurality of apertures 45 are located in the seal attachment portion 46.

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The seal carrier rail 40 also comprises a mid-portion 47 located adjacent the seal attachment portion 46. As best shown in Figure 2, the mid portion 47 of the seal carrier rail 40 is attached to the first portion 51 of the waist rail 50 in the assembled door 12. In this embodiment, the seal carrier rail 40 is attached to the waist rail 50 by an adhesive. However, any other suitable method of attachment may be used, some non-exhaustive examples of which are given below.

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In this embodiment, the second portion 43 of the seal carrier rail 40 and the second portion 53 of the waist rail are connected to the outer door panel by anti-flutter material 70. However, in other embodiments only one, or neither, of the waist rail 50 and the seal carrier rail 40 are connected to the outer door panel by anti-flutter material 70.

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Referring once again to Figure 2, the inner-side portion 35 of the waist seal 30 comprises a sealing limb 61 which extends from a region proximate the inner-side edge 36 of the support

portion 31 towards the distal end 37 of the inner-side portion 35. A sealing lip 62 extends from the distal end 37 of the inner-side portion 35 towards the outer-side portion 33. Similarly, a sealing lip 63 extends from the distal end 34 (see Figure 5) of the outer-side portion 33 away from the inner-side portion 35.

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The waist seal 30 also comprises a second sealing limb 64 located adjacent to the inner-side portion 35 of the waist seal 30 external to the channel 38 formed by the support portion 31, the outer-side portion 33 and the inner-side portion 35. In use, the second sealing limb 64 supports the glass pane 22 when the glass pane 22 is located entirely within the vehicle door 112. The main function of the second sealing limb 64 is to support the glass pane 22 during door closing impact and to help prevent rattling.

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As can be seen from Figure 5, when the waist seal 30 is not installed on a vehicle door 12, the sealing limb 61 is biased away from the outer-side portion 33 of the waist seal 30 such that the channel 38 formed by the support portion 31, the inner-side portion 35 and the outer-side portion 33 is substantially U-shaped, and the sealing lips 62, 63 do not touch. In contrast to this, as shown in Figure 2, when the waist seal 30 is installed on the vehicle door 12 and the glass pane 22 is at least partially received in the frame 24 (that is to say the window is closed or partially open), the sealing limb 61 is pushed towards the outer-portion 33 of the waist seal 30 by the glass pane 22 such that the sealing lips 62, 63 touch one another.

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Figure 6 shows an alternative waist seal and door assembly for a vehicle door 112. The vehicle door 12 is the same in all respects to the vehicle door 12 described above except for in the details as described below.

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In this embodiment the seal carrier rail 140 comprises a plurality of fixing elements 185 located on the mid-portion 147 of the seal carrier rail 140, and the waist rail 150 comprises a plurality of apertures 180 located in the first portion 151 of the waist rail 150. As shown in dashed outline, before the seal carrier rail 140 is attached to the waist rail 150, the fixing elements 185' project away from the mid-portion 146 of the seal carrier rail 140. To attach the seal carrier rail 140 to the waist rail 150, each fixing element 185' is passed through a respective aperture 180 in the waist rail 150. The fixing elements 185' are then folded into position 185 as shown in Figure 6. The fixing elements 185 are formed integrally with the material of the seal carrier rail 140. As will be clear to a person skilled in the art, a similar fixing arrangement could find the fixing elements 185 located on the waist rail 150 and the apertures 180 located in the seal carrier rail 140, or a combination of the two. Although not shown in Figure 6, an

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adhesive may optionally be used in addition to the fixing elements 185 in order to attach the seal carrier rail 140 to the waist rail 150.

Referring now to the waist seal 130 of Figure 6, in this embodiment the support portion 131 of the waist seal 130 comprises a plurality of apertures 165. Each aperture 165 is configured to receive a mechanical fixing 160 which passes through the aperture 165 in the waist seal 130 and through a corresponding aperture 145 in the seal attachment portion 146 of the seal carrier rail 140. Any suitable mechanical fixing 160 may be used such as a self-fixing plug or rivet. Although not shown in Figure 6, an adhesive may optionally be used in addition to the mechanical fixings 160 in order to attach the waist seal 130 to the seal carrier rail 140.

The waist seal 130 comprises a second sealing limb 164 located adjacent to the inner-side portion 135 of the waist seal 130 external to the channel 138 formed by the support portion 131, the outer-side portion 133 and the inner-side portion 135. In use, the second sealing limb 164 supports the glass pane 22 when the glass pane 22 is located entirely within the vehicle door 112. The second sealing limb 164 may also support the glass pane 22 when the window is closed or partially open.

The sealing lip 163 located at the distal end 134 of the outer-side portion 133 of the waist seal 130 shown in Figure 6 projects towards the inner-side portion 135. Nonetheless, because the sealing limb 161 is biased away from the outer-side portion 133, when the waist seal 130 is not installed on a vehicle door 112, the distal ends 137, 134 of the inner-side portion 135 and the outer-side portion 133 do not touch.

In both of the examples discussed above, the waist seals 30, 130 comprise inner-side 35, 135 and outer-side 33, 133 portions that do not touch one another when the waist seal 30, 130 is not installed on a vehicle door 12, 112 such that the channel 38, 138 formed by the support portion 31, 131, the inner-side portion 35, 135, and the outer-side portion 33, 133 form a substantially U-shaped channel. In an alternative embodiment, the waist seal 30, 130 may be formed such that the inner-side portion 35, 135 and the outer-side portion 33, 133 do touch one another when the seal is not installed on a vehicle door 12, 112. In such an embodiment, the inner-sealing limb 61, 161 may still be biased away from the outer-side portion 33, 133 such that it bears against the glass pane 22 when the window is closed or partially open. Alternatively, the inner-sealing limb 61, 161 may not be biased in any direction.

Two methods of attaching the waist seal 30, 130 to the seal carrier rail 40, 140 are described above. As will be clear to a person skilled in the art, the waist seal 30, 130 may be attached

to the seal carrier rail 40, 140 by any suitable method including adhesive only or any suitable mechanical fixing including, but not limited to integrally formed or separate: plugs, clips, bolts, tabs and rivets. In addition, the arrangement of mechanical fixings and apertures may be the inverse of that which is described above such that the mechanical fixings may be located on the seal carrier rail 40, 140 and the apertures located in the support portion 31, 131 of the waist seal 30, 130.

Similarly, two methods of attaching the seal carrier rail 40, 140 to the waist rail 50, 150 are described above. As will be clear to a person skilled in the art, the seal carrier rail 40, 140 may be attached to the waist rail 50, 150 by any suitable mechanical fixing including, but not limited to integrally formed or separate: plugs, clips, bolts, tabs and rivets. In addition, the arrangement of mechanical fixings and apertures may be the inverse of that which is described above such that the mechanical fixings may be located on the waist rail 50, 150 and the apertures located in the seal carrier rail 40, 140.

15

CLAIMS

1. An assembly for a vehicle framed door, the assembly comprising:
an outer door panel skin;
5 a waist rail; and
a seal carrier rail,
wherein the seal carrier rail is attached to the waist rail, and wherein the outer door
panel skin is attached to a portion of the seal carrier rail,
wherein:
10 the seal carrier rail comprises:
a first portion located adjacent a first edge of the seal carrier rail, and a second portion
located adjacent a second edge of the seal carrier rail, the outer door panel skin being attached
to the first portion of the seal carrier rail by a hemmed connection such that the outer door
panel skin is folded over the first edge of the seal carrier rail;
15 a seal attachment portion located adjacent the first portion of the seal carrier rail, and
wherein:
the waist rail comprises a first portion located adjacent a first edge of the waist rail,
and a second portion located adjacent a second edge of the waist rail;
the seal carrier rail is attached to the waist rail such that the first portion of the seal
20 carrier rail extends beyond the first edge of the waist rail, and the second portion of the waist
rail extends beyond the second edge of the seal carrier rail; and
the second portion of the waist rail is connected to the outer door panel skin.
2. An assembly as claimed in any preceding claim, wherein the seal attachment portion
25 comprises a plurality of apertures for receiving mechanical fixings.
3. An assembly as claimed in any preceding claim wherein the seal carrier rail
comprises a mid-portion located adjacent the seal attachment portion, wherein the mid-portion
of the seal carrier rail is attached to the first portion of the waist rail.
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4. An assembly as claimed in claim 3, wherein the seal carrier rail comprises a plurality
of fixing elements located on the mid-portion of the seal carrier rail, and wherein the waist rail
comprises a plurality of apertures located in the first portion of the waist rail, wherein at least
some of the fixing elements of the seal carrier rail pass through at least some of the apertures
35 in the waist rail.

11 01 24

5. An assembly as claimed in any preceding claim, wherein the second portion of the seal carrier rail is connected to the outer door panel skin.
- 5 6. A vehicle framed door seal assembly comprising:
a vehicle framed door assembly in accordance with any one of claims 1 to 5; and
a waist seal comprising:
an elongate support portion;
an elongate inner-side portion; and
10 an elongate outer-side portion,
wherein the elongate inner-side portion and the elongate outer-side portion each comprise a proximal end connected to the elongate support portion and a distal end remote from the elongate support portion, wherein the elongate inner-side portion and the elongate outer-side portion each extend away from opposing sides of the elongate support portion such
15 that together the elongate inner-side portion, the elongate outer-side portion and the elongate support portion form a channel, wherein the elongate support portion is attached to the seal support rail of the vehicle door assembly.
- 20 7. A vehicle framed door seal assembly as claimed in claim 6, wherein the elongate support portion of the waist seal comprises a plurality of apertures, wherein the waist seal is attached to the seal carrier rail by a plurality of mechanical fixings which pass through the apertures in the elongate support portion.
- 25 8. A vehicle framed door seal assembly as claimed in claim 7, wherein the elongate support portion of the waist seal comprises a plurality of mechanical fixings, wherein the waist seal is attached to the seal carrier rail by the plurality of mechanical fixings.
- 30 9. A vehicle framed door seal assembly as claimed in claim 8, wherein the plurality of mechanical fixings are integrally formed with the waist seal.
- 35 10. A vehicle door comprising a vehicle framed door seal assembly in accordance with any one of claims 6 to 9.
11. A vehicle door as claimed in claim 10, wherein the waist seal is located within the door in normal use.
12. A vehicle comprising a vehicle door in accordance with claim 10 or claim 11.

13. A method of assembling a vehicle framed door, the method comprising:
attaching an outer door panel skin to a seal carrier rail; and
attaching the seal carrier rail to a waist rail,
5 wherein the outer door panel skin is attached to the seal carrier rail before the seal carrier rail is attached to the waist rail.
14. A method as claimed in claim 13, wherein the outer door panel skin is attached to the seal carrier rail by a hemmed connection.
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15. A method as claimed in claim 13 or claim 14, comprising attaching a waist seal to the seal carrier rail.
16. A method as claimed in claim 15, wherein the waist seal comprises:
15 an elongate support portion;
an elongate inner-side portion; and
an elongate outer-side portion,
wherein the elongate inner-side portion and the elongate outer-side portion each
comprise a proximal end connected to the elongate support portion and a distal end remote
20 from the elongate support portion, wherein the elongate inner-side portion and the elongate outer-side portion each extend away from opposing sides of the elongate support portion such that together the elongate inner-side portion, the elongate outer-side portion and the elongate support portion form a channel, wherein the elongate support portion is configured for attachment to the seal carrier rail.
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17. A method as claimed in claim 16, wherein the waist seal is attached to the seal carrier rail by a plurality of mechanical fixtures each of which passes through a respective aperture in the support portion of the waist seal.
- 30 18. A method as claimed in claim 16, wherein the waist seal is attached to the seal carrier rail by a plurality of mechanical fixtures each of which passes through a respective aperture in the seal carrier rail.
- 35 19. A method as claimed in claim 18, wherein the mechanical fixtures are integrally formed with the waist seal.