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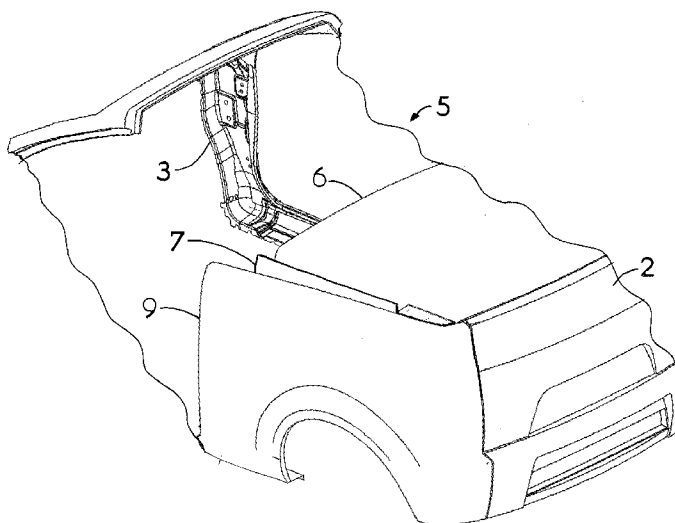
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(54) Title: A MOTOR VEHICLE



(57) Abstract: A motor vehicle (5) is disclosed having a roof structure comprised of a front roof member (6) and a rear member (4) which together form a cover for a passenger compartment (1) of the motor vehicle (5) when both of the roof members (4, 6) are in respective raised positions. When both of the roof members (4, 6) are lowered into stowed positions to form a convertible vehicle, a flap (7, 107) is deployed on each side of the motor vehicle (5) to bridge a gap between the stowed front roof member (6) and an upper edge of an outer rear panel (9).

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A Motor Vehicle

This invention relates to motor vehicles and in particular to a motor vehicle having a roof structure that
5 can be stowed away to form an open top vehicle.

It is known from, for example, French Patent Publication FR-2856014 and German Patent Publication DE-
19948746 to provide a motor vehicle having a roof structure
10 which can be stowed away to convert the motor vehicle into an open top vehicle.

It is a disadvantage of such prior art mechanisms that the roof is stowed in a luggage area of the motor vehicle
15 thereby reducing the space available for the transport of luggage when the roof is stowed. It is a further problem with this type of mechanism that it can only be used for motor vehicles having a separate luggage compartment and luggage compartment cover and is not suitable for use with a
20 hatchback type of vehicle.

It is an object of this invention to provide a motor vehicle in which the roof can be stowed without significantly reducing the volume of luggage that can be
25 carried and which is applicable to a hatchback vehicle.

According to a first aspect of the invention, there is provided a motor vehicle having front and rear roof members moveable between raised and stowed positions, and a moveable
30 flap located on each side of the motor vehicle to selectively bridge a longitudinally extending gap between the front roof member and an upper edge of a rear outer panel when the front roof member is in its stowed position, wherein each flap is moveable from a stowed position in
35 which it is positioned substantially vertically in a storage compartment when the front roof member is in its raised position, to a deployed position in which the flap is

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positioned substantially horizontally so as to bridge the gap when the front roof member is in the stowed position.

Each flap may be positioned in the stowed position when
5 the rear roof is in a raised position.

When the front and rear roof members are in respective raised positions, the front and rear roof members may form in combination a cover for a combined passenger and luggage
10 compartment of the motor vehicle.

The motor vehicle may have front and rear rows of seats and a front wall of the luggage compartment may be formed by the rear row of seats.
15

The rear roof member may be stowed in front of the rear row of seats.

Each flap may be pivotally connected to a support
20 member to allow the flap to rotate from the stowed position to the deployed position.

Each support member may be slidably connected to part of a body structure of the motor vehicle so as to permit the
25 support member to move between a raised position when the flap is in its deployed position and lowered position when the flap is in its stowed position.

The support member may be moveable between the lowered and raised positions by a cable connected to part of a
30 mechanism used to stow the front roof member.

The storage compartment for each flap may be defined by a cavity between the rear outer panel and a rear inner
35 panel.

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The storage compartment for each flap may be formed by a cavity between the outer rear panel and a cover panel pivotally connected to an outer surface of the rear outer panel.

5

The rear outer panel may have a recess formed therein which in combination with the cover panel forms the storage compartment.

10

Each flap may be pivotally connected to part of a body structure of the motor vehicle by two spaced apart U-shaped arms, each of which is pivotally connected at one end to the body structure of the motor vehicle and is fastened at an opposite end to the flap.

15

At least one of the two arms may contact the cover panel to move the cover panel away from the outer rear panel during movement of the flap from the stowed position to the deployed position.

20

At least one of the U-shaped arms may have a roller rotatably connected thereto for rolling contact with a corresponding rib formed on an inner surface of the cover panel to move the cover panel away from the outer rear panel during movement of the flap from the stowed position to the raised position.

25

Both of the arms may have a roller rotatably connected thereto for rolling contact with a respective rib on the cover panel.

30

Each flap may be moveable between its stowed and deployed positions by a cable connected at one end to one of the two U-shaped arms and at an opposite end to part of a mechanism used to stow the front roof member.

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According to a second aspect of the invention, there is provided a method for stowing a roof of a motor vehicle having a moveable front roof member, a moveable rear roof member and a moveable flap located on each side of the motor vehicle to selectively bridge a longitudinally extending gap between the front roof member and an upper edge of a rear outer panel when the front roof member is in a stowed position, the method comprising moving each flap from a stowed position in which it is positioned substantially vertically in a storage compartment when the front and rear roof members are in their respective raised positions towards a deployed position in which the flap is positioned substantially horizontally so as to bridge the gap when the front and rear roof members are moved from their respective raised position to their respective stowed positions.

Each flap may be slid upwards from the stowed position and then rotated to reach the deployed position.

Each flap may be moved upwards along an arc from the stowed position to the raised position.

The invention will now be described by way of example with reference to the accompanying drawing of which:-

Fig. 1 is a side view of a motor vehicle according to the vehicle showing front and rear roof members in raised positions;

Fig. 2 is a side view similar to Fig. 1 but showing the front and rear roof members in partially stowed positions;

Fig. 3 is a pictorial view of a rear portion of the motor vehicle shown in Figs. 1 and 2 showing the front roof member in its stowed position with a side filler flap partially deployed;

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Fig. 4 is a side view similar to Figs. 1 and 2 but showing the front and rear roof members in their fully stowed positions;

5

Fig. 5 is a pictorial view of the rear portion of the motor vehicle shown in Fig. 4 showing the front roof member in its stowed position with the side filler flap deployed;

10

Fig. 6 is a diagrammatic representation of an actuation mechanism for the flap shown in Figs. 3 and 5;

Fig. 7 is a pictorial view of the flap shown in Figs. 3 and 5 and an associated actuation mechanism in a stowed position;

15

Fig. 8 is a pictorial view of the flap shown in Figs. 3 and 5 and an associated actuation mechanism in a partially deployed position;

20

Fig. 9 is an enlarged end view in the direction of arrow Y on Fig. 8;

Fig. 10 is a pictorial view of the flap shown in Figs. 3 and 5 and an associated actuation mechanism in a deployed position;

25

Fig. 11 is an enlarged end view in the direction of arrow X on Fig. 10;

30

Fig. 12 is a pictorial view of a rear portion of a motor vehicle according to a second embodiment of the invention showing front and rear roof members in their raised positions;

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Fig. 13 is a pictorial view of the rear portion of the motor vehicle shown in Fig. 12 showing the front roof member in its stowed position with a side filler flap deployed;

5

Fig. 14 is a diagrammatic representation of an actuation mechanism for the flap shown in Fig. 13;

Fig. 15 is a pictorial view of the flap shown in Fig. 13 and an associated actuation mechanism in a stowed position;

Fig. 16 is a pictorial view of the flap shown in Fig. 13 and an associated actuation mechanism in a partially deployed position; and

Fig. 17 is a pictorial view of the flap shown in Fig. 13 and an associated actuation mechanism in the deployed position shown in Fig. 13.

20

With reference to Figs. 1 to 11 there is shown a first embodiment of a motor vehicle 5 according to the invention. The motor vehicle 5 has a body structure 3 including a pair of rear outer panels 9, one on each side of the motor vehicle 5, a drop down lower tailgate 2, a rear roof member or panel 4 and a front roof member or panel 6. The front and rear roof members 6 and 4 are moveable from raised positions, as shown in Fig. 1, where they form in combination a cover for a combined passenger and luggage compartment 1 to stowed positions, as shown in Figs. 4 and 5, where a two seat convertible vehicle is formed. Fig. 2 shows an intermediate position in which the front and rear roof members 6 and 4 are partially stowed.

To stow the two roof members 4 and 6, one of the two roof members 4 and 6 is firstly moved to disengage a rear edge of the front roof member 6 from a front edge of the

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rear roof member 4. This can be achieved by sliding the rear roof member 4 rearwardly, by providing an inclined shut face, such that the forwardly and downwardly rotating rear roof member 4 disengages from any seals through its normal motion or by lifting the front roof member 6. The rear roof member 4 is then rotated forwardly, moved forwardly and then lowered down such that it lies below a waistline of the motor vehicle 5 this can be achieved as distinct operations or simultaneous motion.

10

The motor vehicle 5 has two rows of seats located in the combined passenger and luggage compartment 1. There is a front row of seats including a seat for a driver of the motor vehicle 5 towards the front of the combined passenger and luggage compartment 1, and a rear row of seats which forms a front wall of the luggage compartment towards the rear of the combined passenger and luggage compartment 1. Such a vehicle is often referred to as a two box vehicle because there is no dividing wall between the luggage compartment and the passenger compartment, only a dividing wall between the passenger compartment and an engine compartment.

20

When the rear roof member 4 is in its stowed position, it lies between the front and rear row of seats and does not reduce the volume of the luggage area.

25

The front roof member 6 is moved at the same time as the rear roof member 4 from its raised position to its stowed position but the motions are phased such that the rear roof member 4 reaches its stowed position before the front roof member 6 reaches its stowed position.

30

When the front roof member 6 is in its stowed position it lies substantially horizontally across the rear of the motor vehicle 5 to form a cover for the luggage compartment of the motor vehicle 5. Access to the luggage compartment

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is still possible by opening the tailgate 2, and because the rear roof member 4 is stowed in front of the rear row of seats there is substantially no loss of luggage compartment volume.

5

However, when the front roof member 6 is in its stowed position, a longitudinally extending gap is present along each longitudinal edge of the front roof member 6 because the width of the front roof member 6 is less than the width
10 of the motor vehicle body at its waistline.

In order to cover the longitudinally extending gaps, the motor vehicle 5 has two flaps 7, one on each side of the motor vehicle 5, which are deployed to cover the gaps when
15 the front roof 6 is stowed. The flaps 7 are stowed in respective storage compartments when the front roof member 6 is in its raised position.

With particular reference to Figs. 6 to 11, one of the
20 flaps 7 and an associated actuation mechanism is shown in greater detail.

The flap 7 is pivotally connected by means of a piano hinge 17 to a support member in the form of a carrier plate
25 18, which is attached at a lower end to a cable 11 used to actuate the flap 7.

The carrier plate 18 has a guide rail 24 attached thereto near to one side for sliding engagement with a U-shaped support 25 fastened to part of the body structure 3.
30 On an opposite side of the carrier plate 18 an outwardly extending finger 22 is formed as part of the carrier plate 18 for sliding engagement with a groove 21 formed in a second U-shaped support 20. An upper end of the second U-shaped support is formed into a curved guide 23 for the flap
35 7.

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As is shown in Fig. 6, the cable 11 is connected at an opposite end to a pulley 15 fastened to an arm 14 used to move the front roof member 6 between its respective raised and stowed positions. A second arm 13 is also connected to the front roof member 6 to control the motion of the front roof member 6 so as to ensure that it is substantially horizontally arranged when it is in its raised and stowed positions.

A spring 12 is positioned between the carrier plate 18 and the body structure 3 to bias the flap 7 into its stowed position, and the cable 11 is used to pull the carrier plate 18 upwards so as to move the flap 7 into its deployed position. That is to say, when the arm 14 moves in the direction of arrow "S" in Fig. 6 to move the front roof member 6 towards the stowed position, the cable 11 is wrapped around the pulley 15 thereby pulling the carrier plate 18 upwards against the action of the spring 12. A further spring (not shown) can be attached between the flap 7 and the carrier plate 18 to ensure that the flap 7 is moved into a horizontal position when it is deployed. When the front roof member 6 moves from its stowed position towards its raised position, the cable 11 is unwrapped from the pulley 15, thereby allowing the flap 7 to move to its stowed position due to the action of the spring 12.

As can be seen in Fig. 6, the flap 7 is stowed in a substantially vertical position in a storage compartment formed by a cavity defined between the rear outer panel 9 and a rear inner panel 8. This cavity is also used to stow a drop down side window 10 when the side window 10 is lowered.

Figs. 7, 8 and 10 show an alternative arrangement in which the cable 11 is connected directly to a lower edge of the carrier plate 18. In this case the carrier plate 18 is biased by one or more springs (not shown) so as to move the

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flap 7 to the deployed position, and is pulled back into the
stowage compartment when the front rccf member 6 moves
towards the raised position. The cable 11 in this case is
wrapped further around the pulley 15 when the front rccf
5 member 6 moves towards its raised position, and is unwrapped
from the pulley 15 when the front rccf member 6 moves
towards its stowed position. As before, a spring (not
shown) may be attached between the flap 7 and the carrier
plate 18 to bias the flap 7 towards its deployed orientation
10 of substantially 90 degrees to the carrier plate 18.

Although in both of the examples described above the
flap 7 is moved between its deployed and stowed positions by
a cable 11 connected to the front rccf stowage mechanism
15 this need not be the case and the flap 7 could be moved
independently by any other suitable means.

Each of the flaps 7 is arranged to be in its respective
stowed position whenever the front or rear rccf members 6
20 and 4 are in their respective raised positions and is only
moved to the deployed position when the front and rear rccf
members 6 and 4 are stowed.

It will be appreciated that the sequencing of the
25 movement of the flaps 7 need not be simultaneous with the
movement of the front rccf member 6 and that the flaps 7
could also be arranged to be deployed so that they are
already deployed when the front rccf member 6 reaches its
stowed position, or be deployed after the front rccf member
30 6 has reached its stowed position if independent actuation
of the flaps 7 is used.

Fig. 7 shows the flap 7 in its stowed position in which
the flap 7 is substantially vertically arranged.

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Figs. 8 and 9 show the flap 7 in a partially deployed
position with the flap 7 resting upon the curved guide 23.

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The curved guide 23 is used to control the rotation of the flap 7 as it transits between its stowed and deployed positions.

5 Figs. 10 and 11 show the flap 7 in its deployed position in which it is resting against the curved guide 23. The flap 7 is in this position substantially horizontally disposed and is arranged at approximately 90 degrees to the carrier plate 18.

10 With reference to Figs. 12 to 17, there is shown a second embodiment of the invention which differs from that previously described in that the flap 107 is not stowed between inner and outer panels of the motor vehicle 5 but in
15 a separate stowage compartment located outside the rear panel, and the flap 107 is not actuated by a sliding mechanism as previously described but by a rotating arm arrangement that moves the flap 107 through an arc.

20 With reference to Fig. 14 (which is diagrammatic and does not show in detail the actuation mechanism), the flap 107 is shown in its stowed position within a stowage compartment formed by a recess in the rear outer panel 9 and a moveable cover panel 150 pivotally connected at its lower
25 end to an outer surface of the rear outer panel 9. The cavity defined between the outer rear panel 9 and the inner rear panel 8 is not in this case occupied by the flap 107 or its actuating mechanism, and so there is more room for the drop down window 10 to be stowed in the cavity and, if
30 required, more room for reinforcement of the body structure to be added in the cavity.

As before, a cable 11 is connected at one end to the flap actuation mechanism and at an opposite end to the
35 pulley 15 fastened to the arm 14 used to move the front roof member 6 between its respective raised and stowed positions.

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As before, a spring 12 is used to bias the flap 107 into its stowed position, and the cable 11 is used to pull the flap 7 into its deployed position. That is to say, when the arm 14 moves in the direction of arrow "S" shown on Fig. 14 to move the front roof member 6 towards the stowed position, the cable 11 is wrapped around the pulley 15 thereby pulling the flap 107 upwards against the action of the spring 12.

The flap is connected to a first arm pivotable about the point "V" (corresponding to a pivot axis), and the cable 11 is attached to a second arm connected to the first arm so that the flap 107 is not slid up into position but is rotated into the deployed position along an arc defined by the geometry of the flap actuating mechanism.

Referring now to Figs. 15 to 17, which show the actuating mechanism for the flap 107 in greater detail, the flap 107 is connected along one of its two longitudinal edges to a cross bar 39 used to connect two spaced apart arms 35, 36 to the flap 107.

Each of the arms 35, 36 is U-shaped and is pivotally connected at one end to a respective bracket 51, 52 used to fasten the actuating mechanism to part of the body structure of the motor vehicle 5. The two arms 35, 36 are therefore able to pivot about a substantially horizontal pivot axis (corresponding to the point "V" on Fig. 14) extending between the two brackets 51, 52. At an opposite end to where it is pivotally connected to one of the brackets 51, 52, each arm 35, 36 is fastened to the cross bar 39.

One of the arms 36 has a curved extension 40 formed with a groove (not shown) in which the cable 11 is located. The cable 11 extends from the groove through an aperture (not shown) in the arm 36 and has a retainer cap 11A fitted

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to its free end, which is used to transfer force from the cable 11 into the arm 36 when the cable 11 is pulled.

Each of the arms 35, 36 has a respective roller 37, 38
5 attached thereto for engagement with a respective rik 33, 34 formed on an inner surface of the cover panel 150. Each of the riks 33, 34 forms a track along which the corresponding roller 37, 38 can roll.

10 The cover panel 150 has an aperture 60 formed in an upper surface to conform with one edge of the flap 107 and, when the flap 107 is in its deployed position, the flap 107 is located within the aperture 60. When the rear roof member 4 is in its raised position, at least a portion of
15 the rear roof member 4 overlies the aperture 60 and the upper surface of the cover panel 150 so that the cover panel 150 is held in a closed position while the rear roof member 4 is in its raised position. The cover panel 150 is
20 pivotally connected at a lower end by two arms 31, 32 each of which is hingedly connected to an outer surface of the outer rear panel 9.

As shown in Fig. 15, when the flap 107 is in its stowed position, the rollers 37, 38 are not in contact with the
25 riks 33, 34, and the cover panel 150 is in a closed position.

When the flap 107 is moved towards its deployed position, the rollers 37, 38 come into contact with the riks
30 33, 34 and open the cover panel 150 to allow the flap 107 to move up into its deployed position. At the position shown in Fig. 16, the cover panel 150 is fully open because the rollers 37, 38 are positioned at the maximum horizontal distance to the outside of the horizontal pivot axis of the
35 two arms 35, 36 between the pivot axis and the cover panel 150.

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When the flap 107 reaches its deployed position as shown in Fig. 17, the rollers 37, 38 have gone over-centre and the horizontal distance between the rollers 37, 38 and the pivot axis of the arms 35, 36 is less than the maximum horizontal distance, thereby allowing the cover panel 150 to move to its closed position.

Depending upon the design of the arms 35, 36, the rollers 37, 38 are now, as shown, lightly resting against the ribs 33, 34 or are spaced apart from the ribs 33, 34 so that no contact occurs between the ribs 33, 34 and the rollers 37, 38. One or more springs (not shown) is provided to bias the cover panel 150 towards its closed position, the cover panel 150 being opened when it is acted against by the rollers 37, 38.

It will be appreciated that when the flap 107 is moved from the deployed position to the stowed position, the cover panel 150 is opened to permit stowing of the flap 107 and then closed again before the rear roof member 4 reaches its raised position.

Although the flap 107 is described above as being moved between its deployed and stowed positions by a cable connected to the front roof stowage mechanism, this need not be the case, and the flap 107 could be moved independently by any other suitable means.

As before, each of the flaps 107 is arranged to be in its respective stowed position whenever the front or rear roof members 6 and 4 are in their respective raised positions, and are only moved to the deployed position when the front and rear roof members 6 and 4 are stowed.

It will be appreciated that the sequencing of the movement of the flaps 107 need not be simultaneous with the movement of the front roof member 6, and that the flaps 107

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could also be arranged to be deployed so that they are
already deployed when the front roof member 6 reaches its
stowed position, or be deployed after the front roof member
6 has reached its stowed position if independent actuation
5 of the flaps is provided.

Therefore in summary, a motor vehicle according to this
invention is transformable from a hatch back type motor
vehicle into a two seat type convertible vehicle with no
10 substantial reduction in luggage capacity by stowing a front
roof member such that it forms a cover for the luggage
compartment, and by providing a flap on each side of the
motor vehicle that bridge gaps between the stowed front roof
and rear outer panels of the motor vehicle. Each flap is
15 moved from a stowed position, in which it is positioned
substantially vertically in a storage compartment when the
front and rear roof members are in their respective raised
positions, towards a deployed position, in which the flap is
positioned substantially horizontally so as to bridge the
20 gap, when the front and rear roof members are moved from
their respective raised position to their respective stowed
positions.

It will be appreciated by those skilled in the art that
25 although the invention has been described by way of example
with reference to one or more embodiments, it is not limited
to the disclosed embodiments, and that modifications to the
disclosed embodiments or alternative embodiments could be
constructed without departing from the scope of the
30 invention.

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Claims

1. A motor vehicle (5) comprising front and rear roof members (6, 4) moveable between raised and stowed positions, and a moveable flap (7, 107) located on each side of the motor vehicle (5) to selectively bridge a longitudinally extending gap between the front roof member (6) and an upper edge of a rear outer panel (9) when the front roof member (6) is in its stowed position, wherein each flap (7, 107) is moveable from a stowed position in which it is positioned substantially vertically in a storage compartment when the front roof member (6) is in its raised position, to a deployed position in which the flap (7, 107) is positioned substantially horizontally so as to bridge the gap when the front roof member (6) is in its stowed position.

2. A motor vehicle (5) as claimed in claim 1, wherein each flap (7, 107) is positioned in the stowed position when the rear roof member (4) is in its raised position.

3. A motor vehicle (5) as claimed in claim 1 or 2, wherein, when the front and rear roof members (6, 4) are in respective raised positions, the front and rear roof members (6, 4) form in combination a cover for a combined passenger and luggage compartment (1) of the motor vehicle (5).

4. A motor vehicle (5) as claimed in claim 3, wherein the motor vehicle (5) has front and rear rows of seats, and a front wall of the luggage compartment is formed by the rear row of seats.

5. A motor vehicle (5) as claimed in claim 4, wherein the rear roof member (4) is stowed in front of the rear row of seats.

6. A motor vehicle (5) as claimed in any of claims 1 to 5, wherein each flap (7) is pivotally connected to a

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support member (18) to allow the flap (7) to rotate from the stowed position to the deployed position.

7. A motor vehicle (5) as claimed in claim 6, wherein
5 each support member (18) is slidably connected to part of a body structure (25, 20) of the motor vehicle so as to permit the support member (18) to move between a raised position when the flap (7) is in its deployed position, and lowered position when the flap (7) is in its stowed position.

10

8. A motor vehicle (5) as claimed in claim 7, wherein the support member (18) is moveable between the lowered and raised positions by a cable (11) connected to part (15) of a mechanism used to stow the front roof member (6).

15

9. A motor vehicle (5) as claimed in any of claims 1 to 8, wherein the storage compartment for each flap (7) is defined by a cavity between the rear outer panel (9) and a rear inner panel (8).

20

10. A motor vehicle (5) as claimed in any of claims 1 to 5, wherein the storage compartment for each flap (107) is formed between a recess in the outer rear panel (9) and a cover panel (150) pivotally connected to an outer surface of
25 the rear outer panel (9).

11. A motor vehicle (5) as claimed in claim 10, wherein each flap (107) is pivotally connected to part (51, 52) of a body structure of the motor vehicle (5) by two
30 spaced apart U-shaped arms (35, 36), each of which is pivotally connected at one end to the body structure of the motor vehicle (5) and is fastened at an opposite end to the flap (107).

12. A motor vehicle (5) as claimed in claim 11, wherein at least one of the two arms (35, 36) contacts the cover panel (150) to move the cover panel (150) away from

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the outer rear panel (9) during movement of the flap (107) from the stowed position to the deployed position.

13. A motor vehicle as claimed in claim 12, wherein at least one of the U-shaped arms (35, 36) has a roller (37, 38) rotatably connected thereto for rolling contact with a corresponding rib (33, 34) formed on an inner surface of the cover panel (150) to move the cover panel (150) away from the outer rear panel (9) during movement of the flap (107) from the stowed position to the raised position.

14. A motor vehicle as claimed in any of claims 11 to 13, wherein each flap (107) is moveable between its stowed and deployed positions by a cable (11) connected at one end to one of the two U-shaped arms (35, 36), and at an opposite end to part (15) of a mechanism used to stow the front roof member (6).

15. A method for stowing a roof of a motor vehicle (5) having a moveable front roof member (6), a moveable rear roof member (4) and a moveable flap (7, 107) located on each side of the motor vehicle (5) to selectively bridge a longitudinally extending gap between the front roof member (6) and an upper edge of a rear outer panel (9) when the front roof member (6) is in a stowed position, the method comprising moving each flap (7, 107) from a stowed position in which it is positioned substantially vertically in a storage compartment when the front and rear roof members (6, 4) are in their respective raised positions towards a deployed position in which the flap (7, 107) is positioned substantially horizontally so as to bridge the gap when the front and rear roof members (6, 4) are moved from their respective raised positions to their respective stowed positions.

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16. A method as claimed in claim 15, wherein each flap (7) is slid upwards from the stowed position and then rotated to reach the deployed position.

5 17. A method as claimed in claim 15, wherein each flap (107) is moved upwards along an arc from the stowed position to the raised position.

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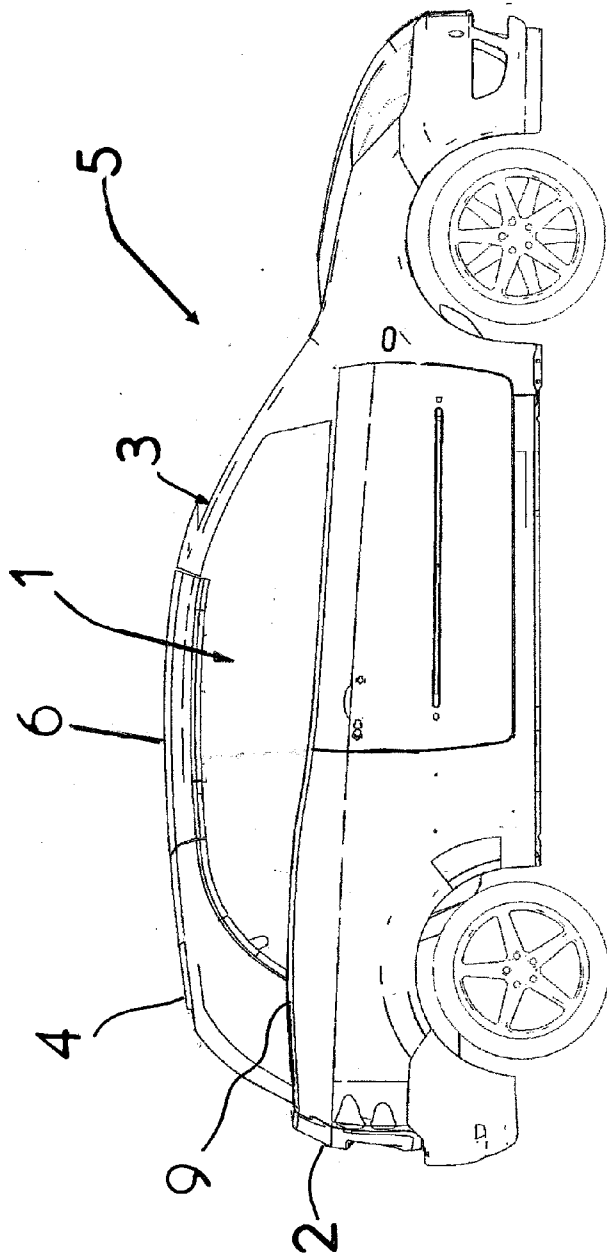


Fig. 1

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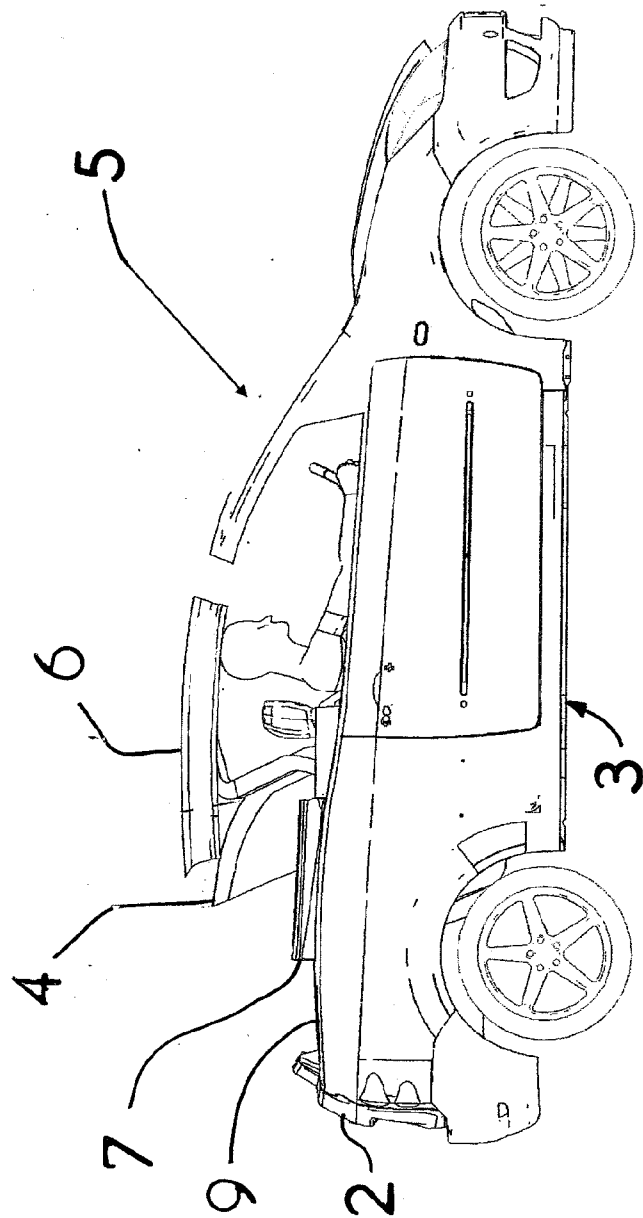
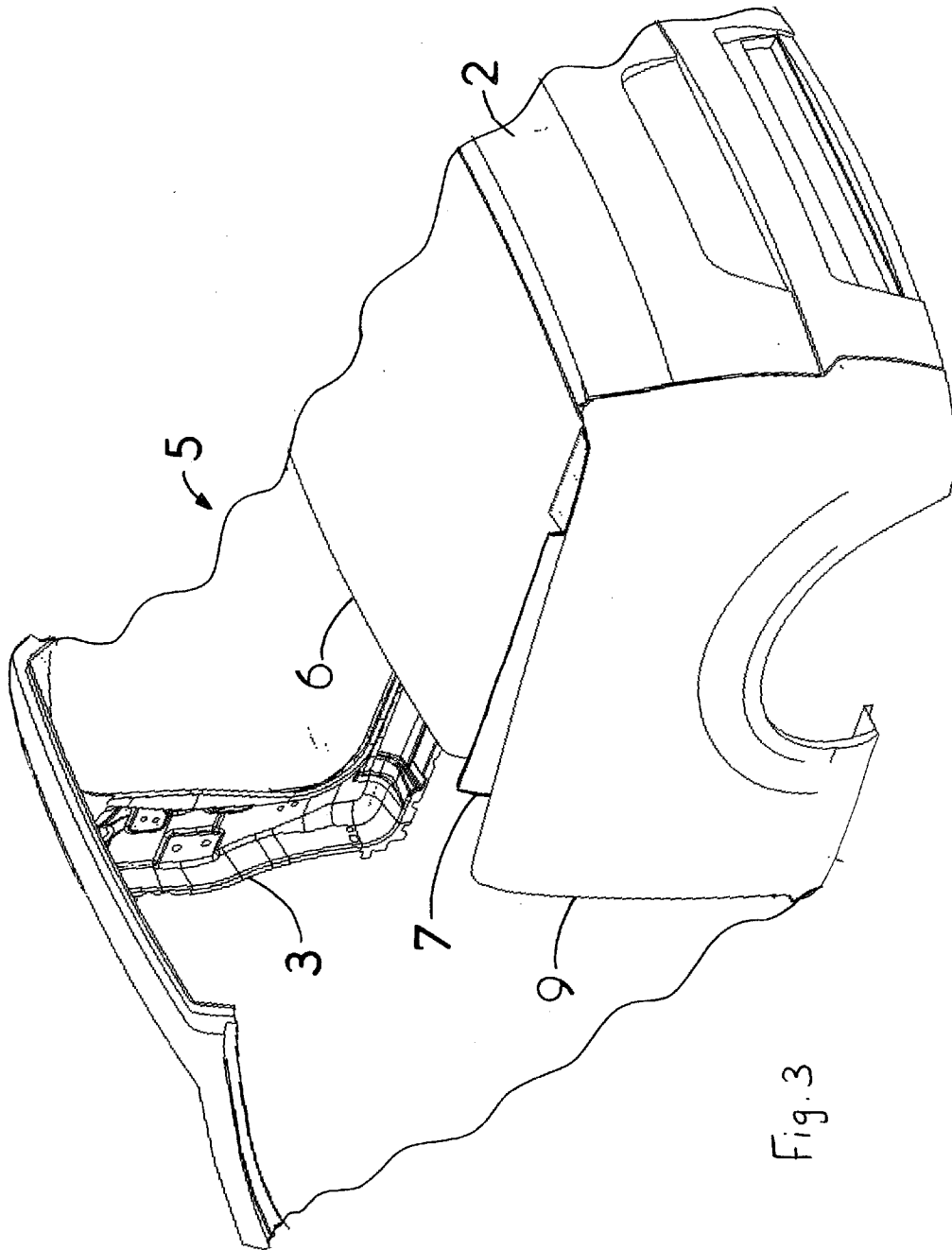


Fig. 2

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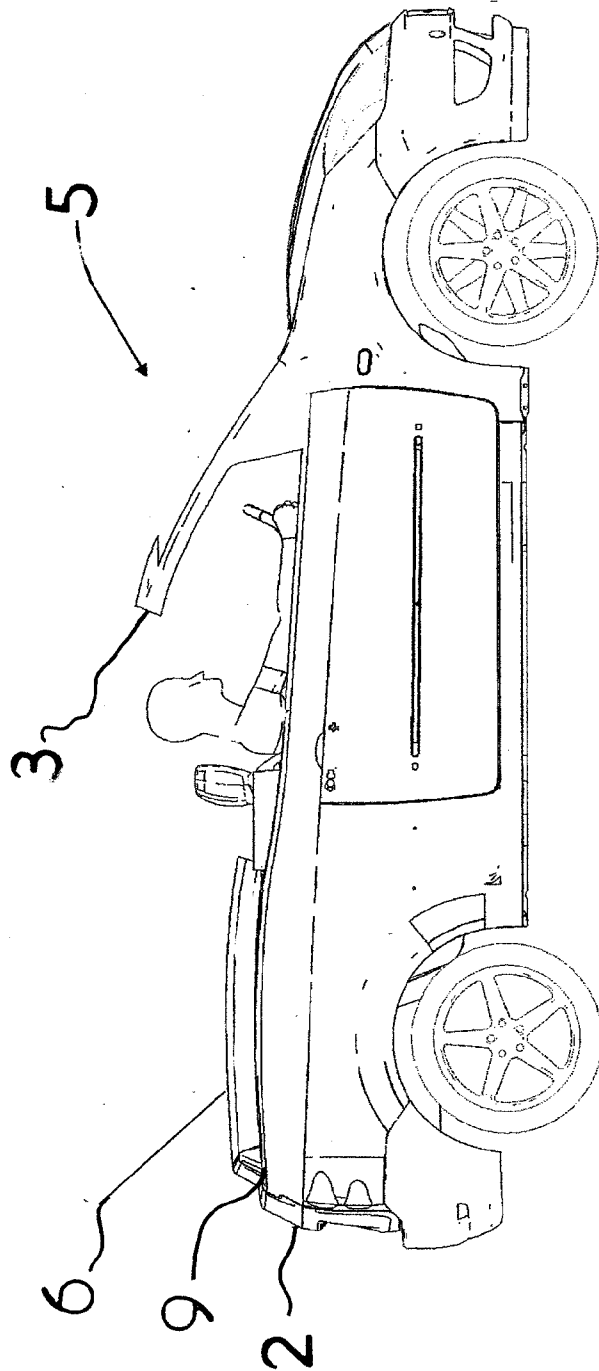


Fig. 4

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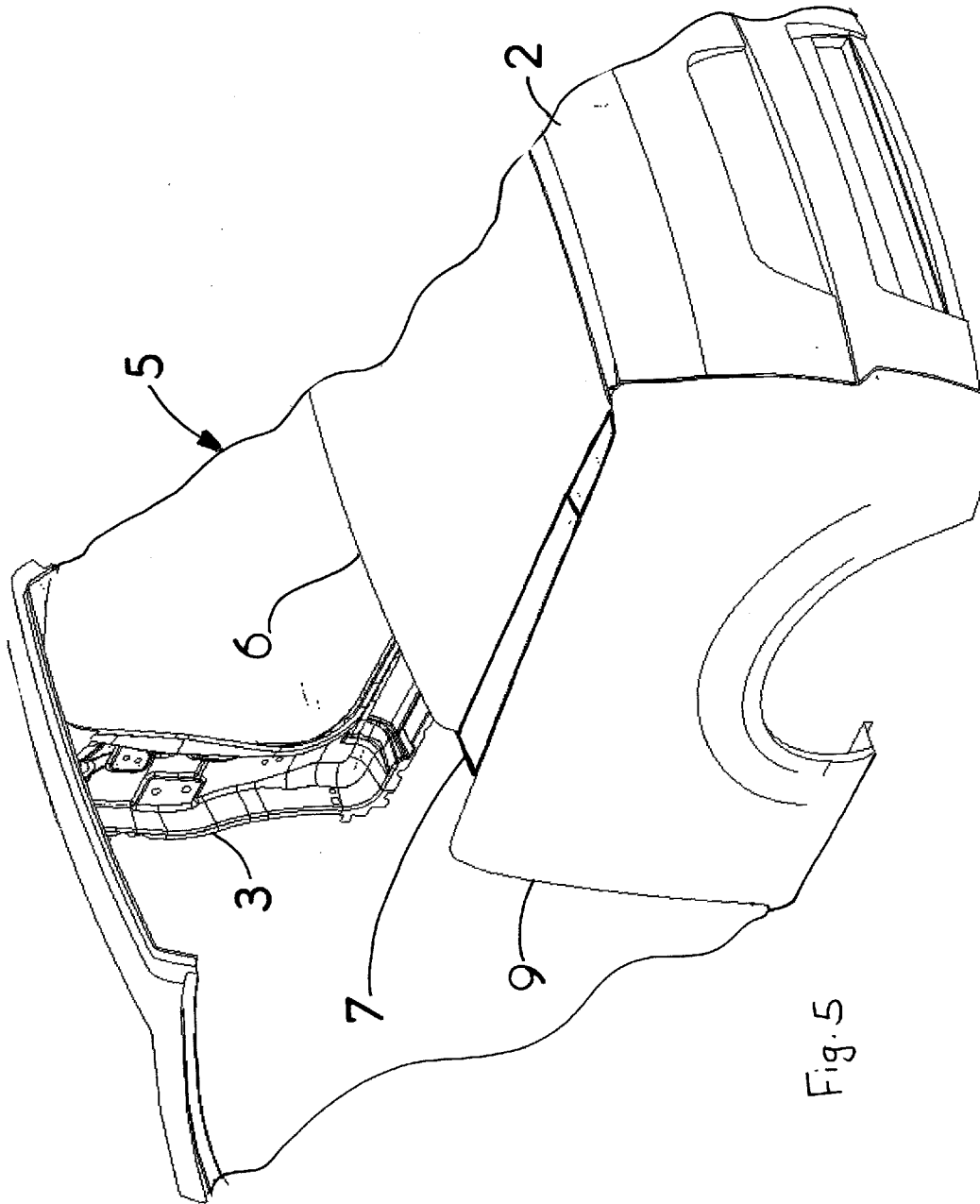
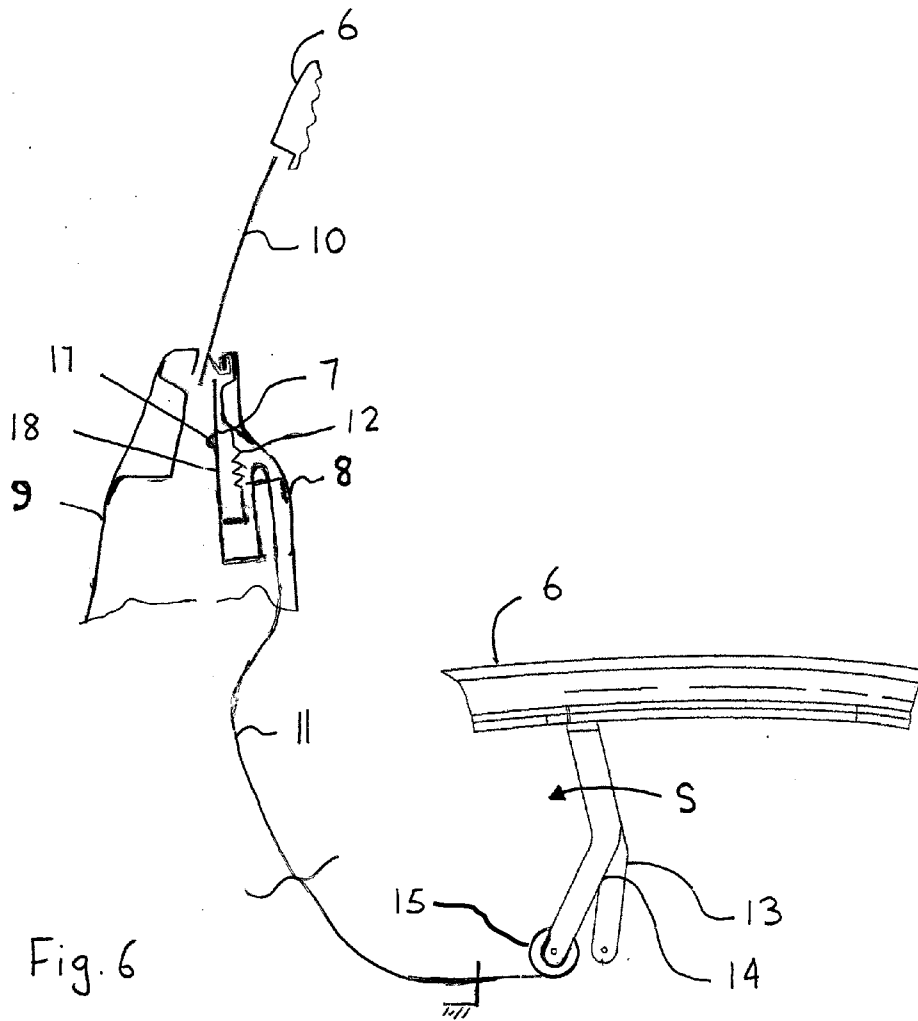
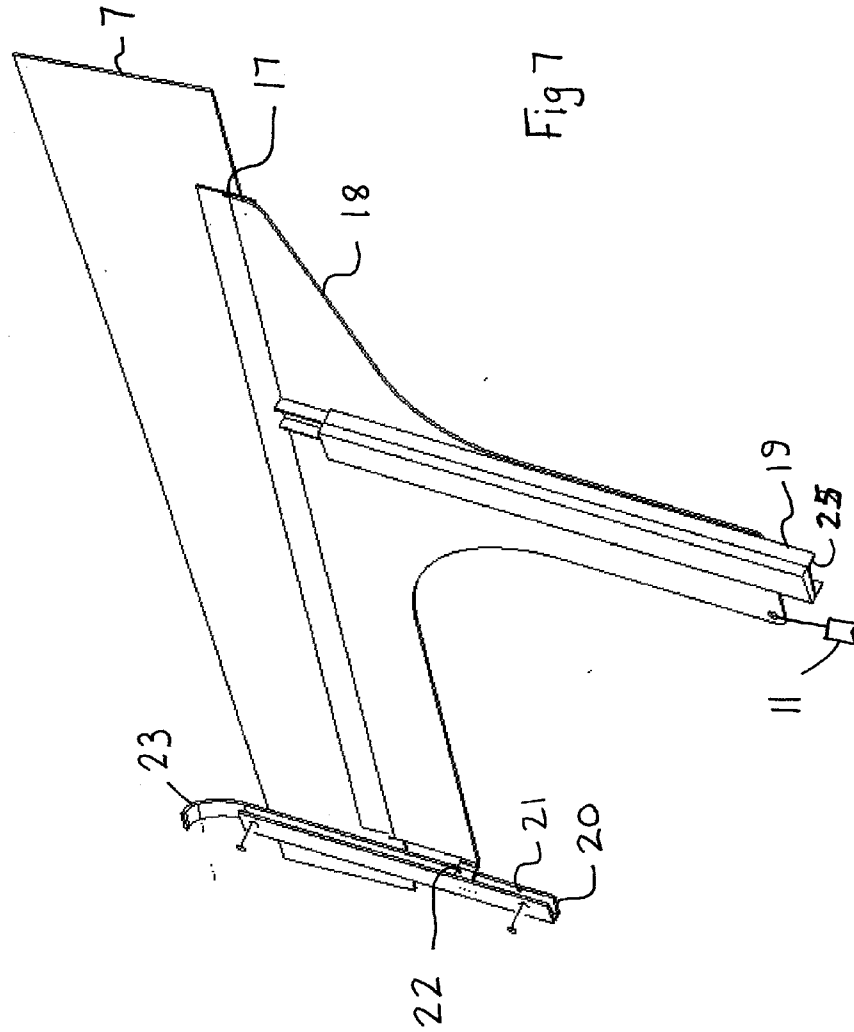


Fig. 5

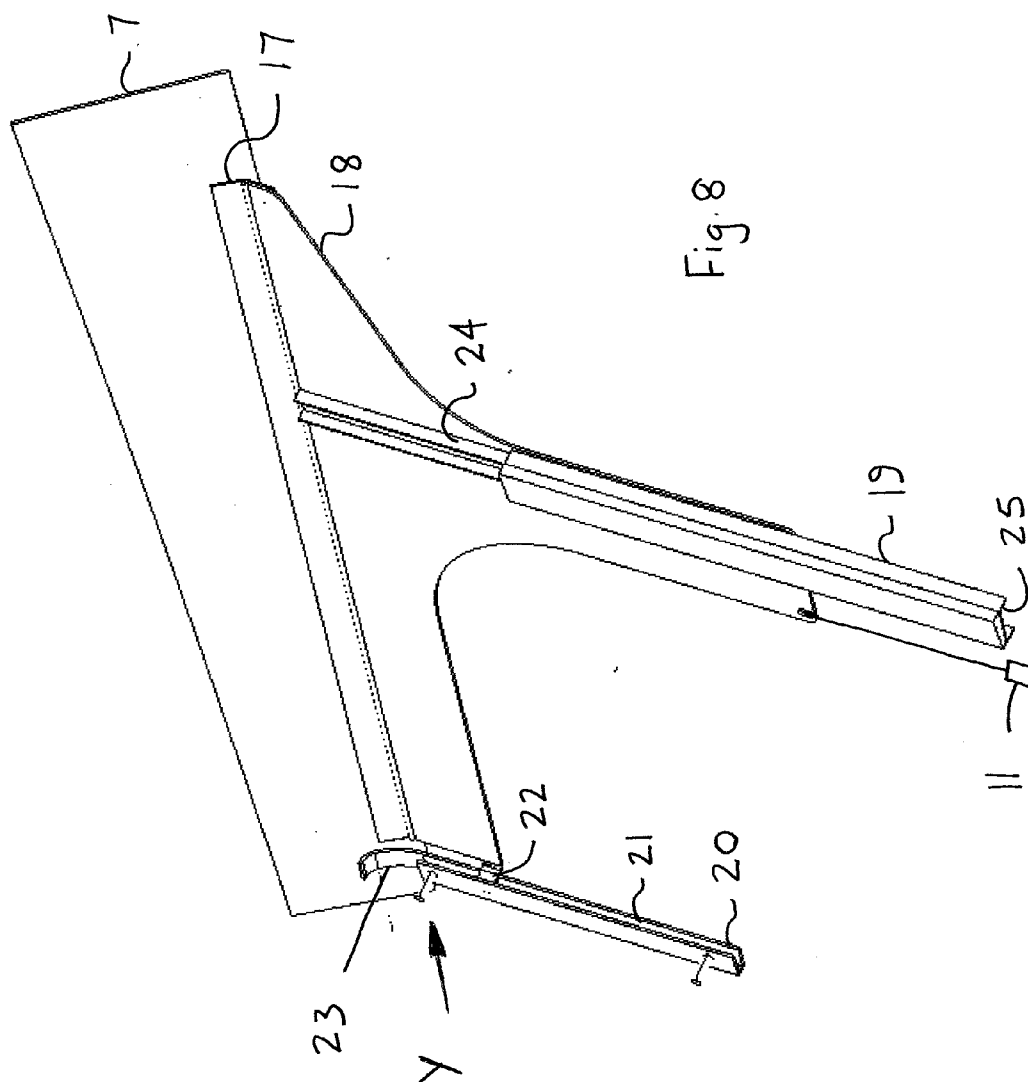
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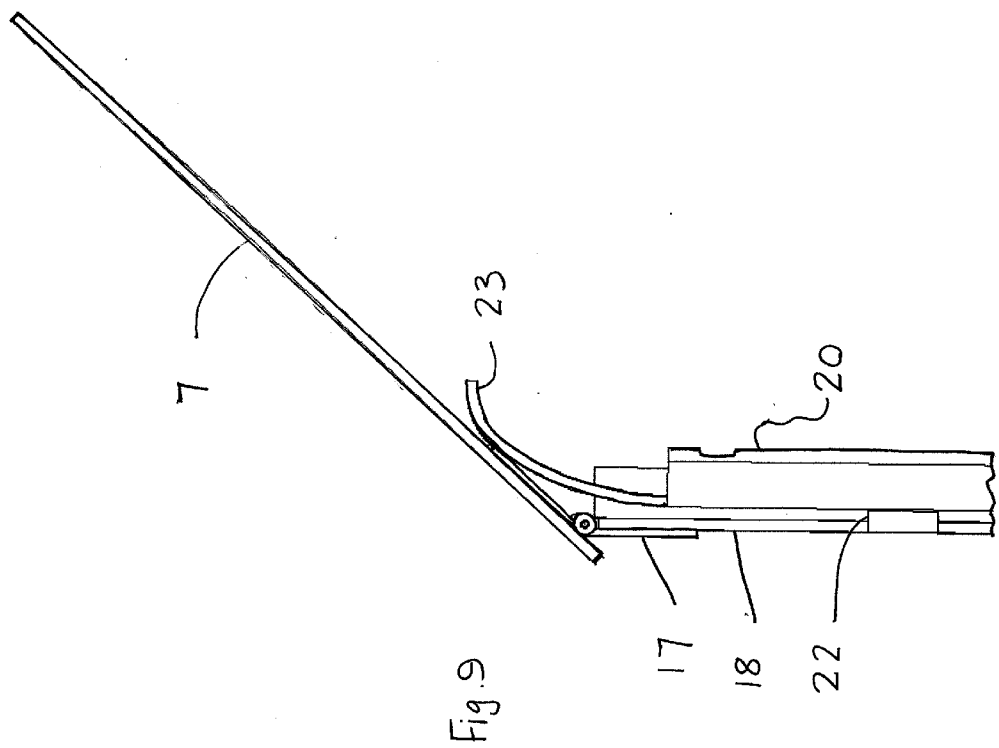
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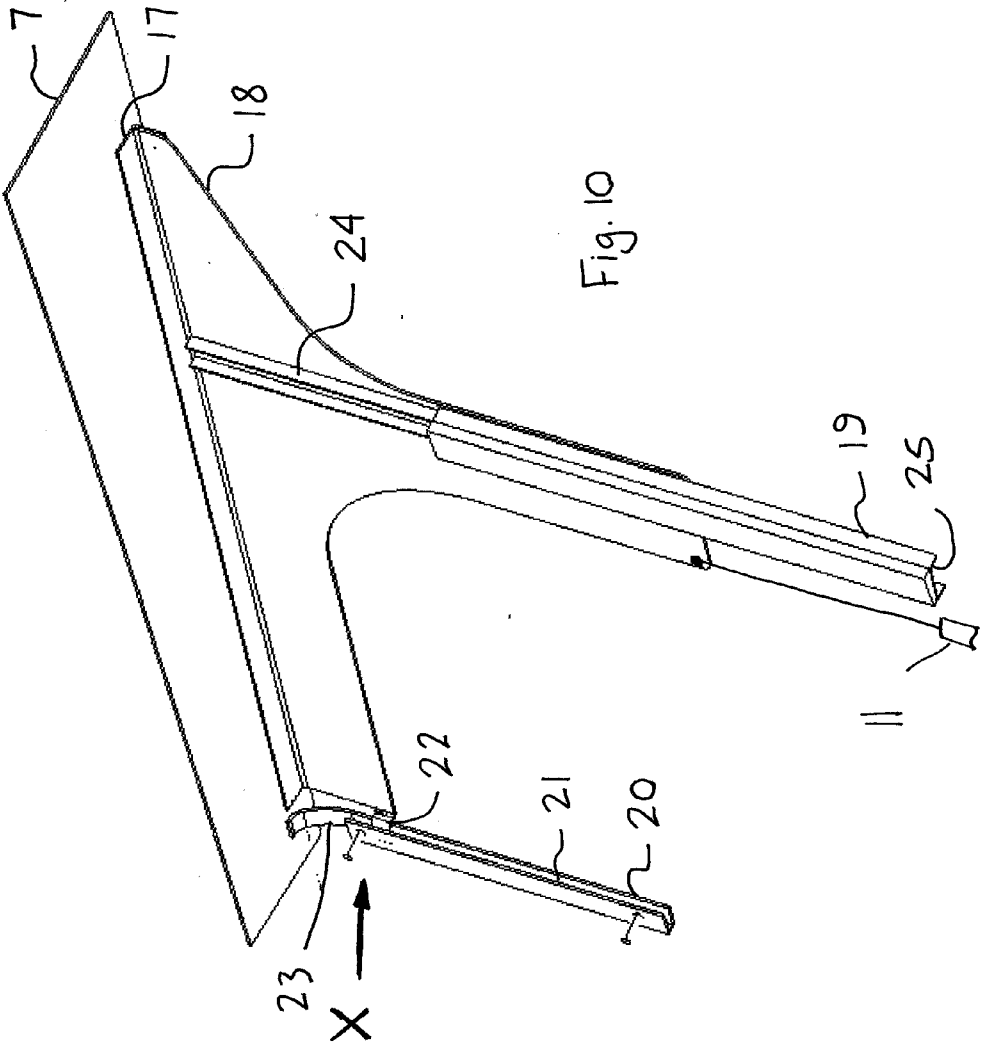
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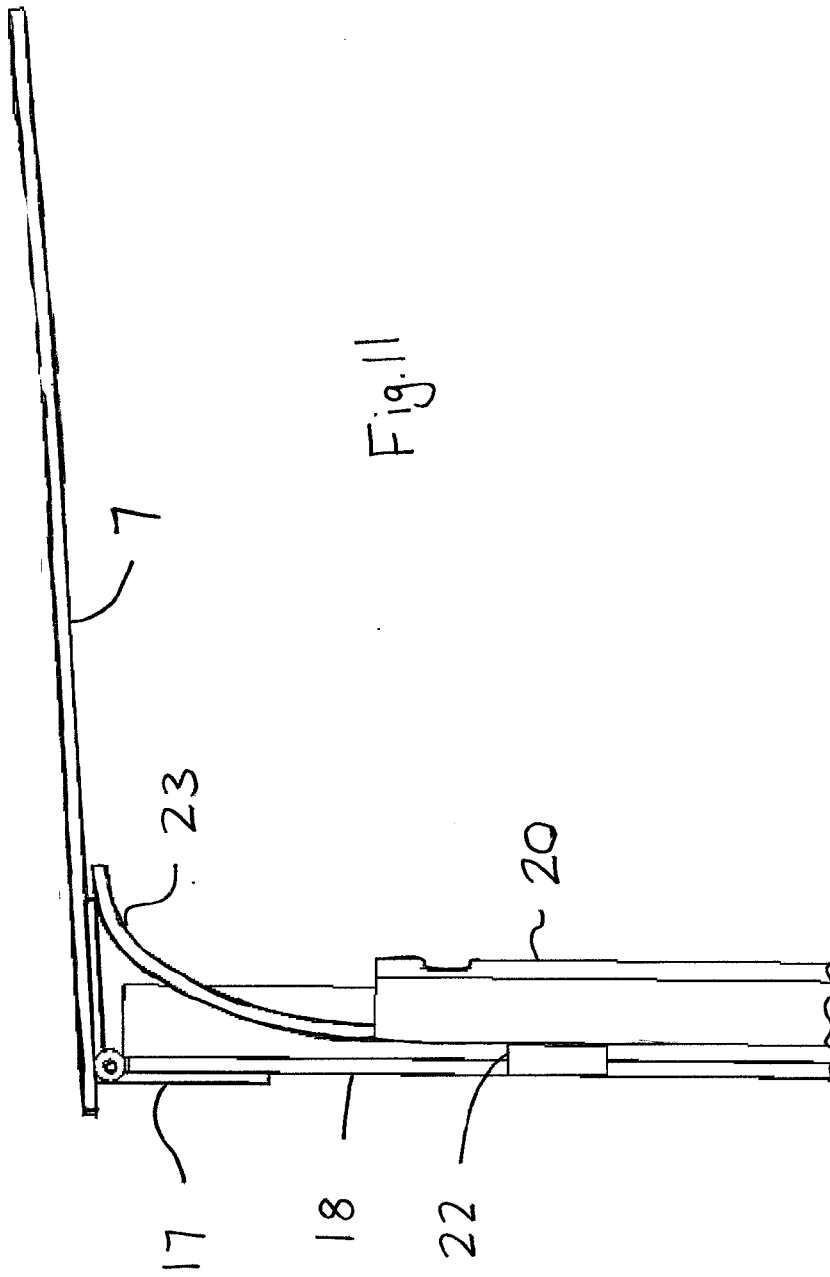
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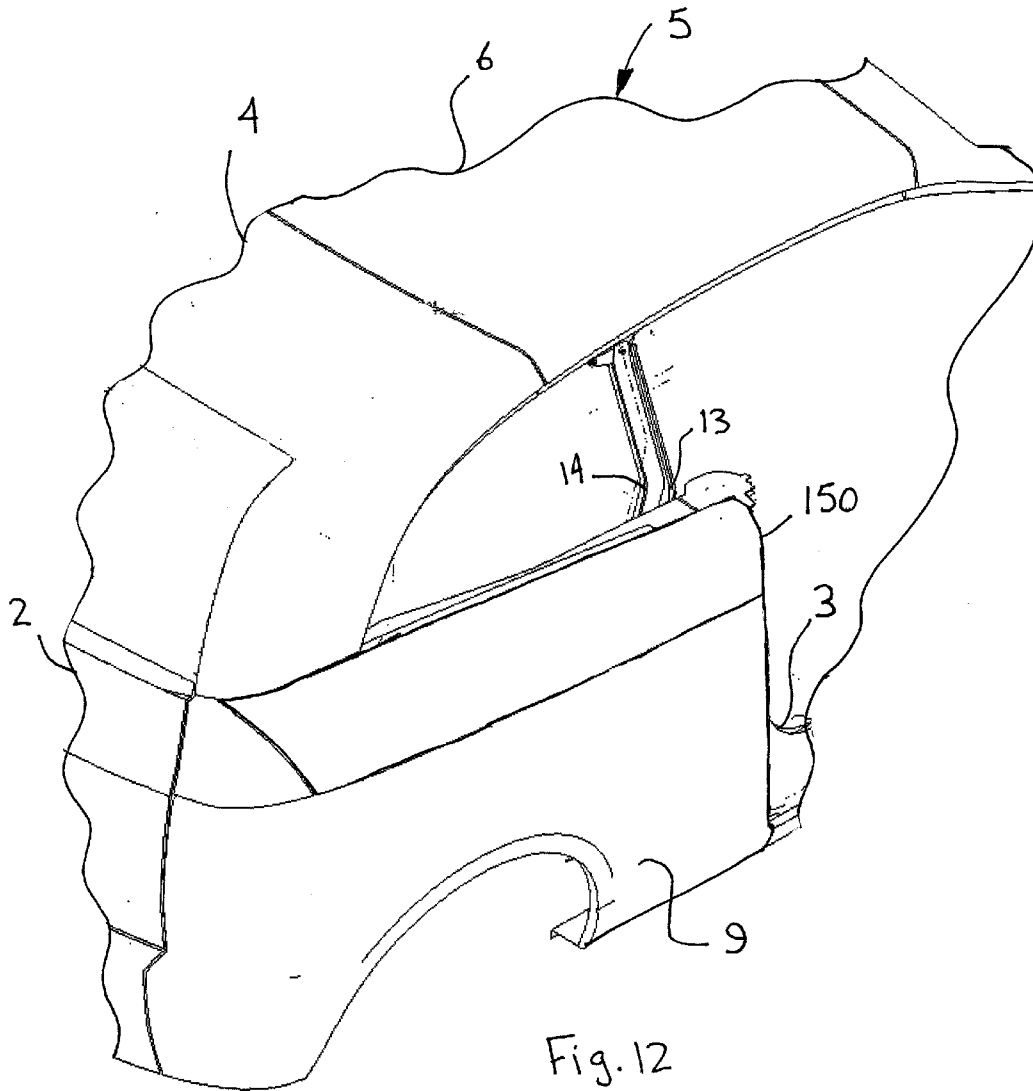
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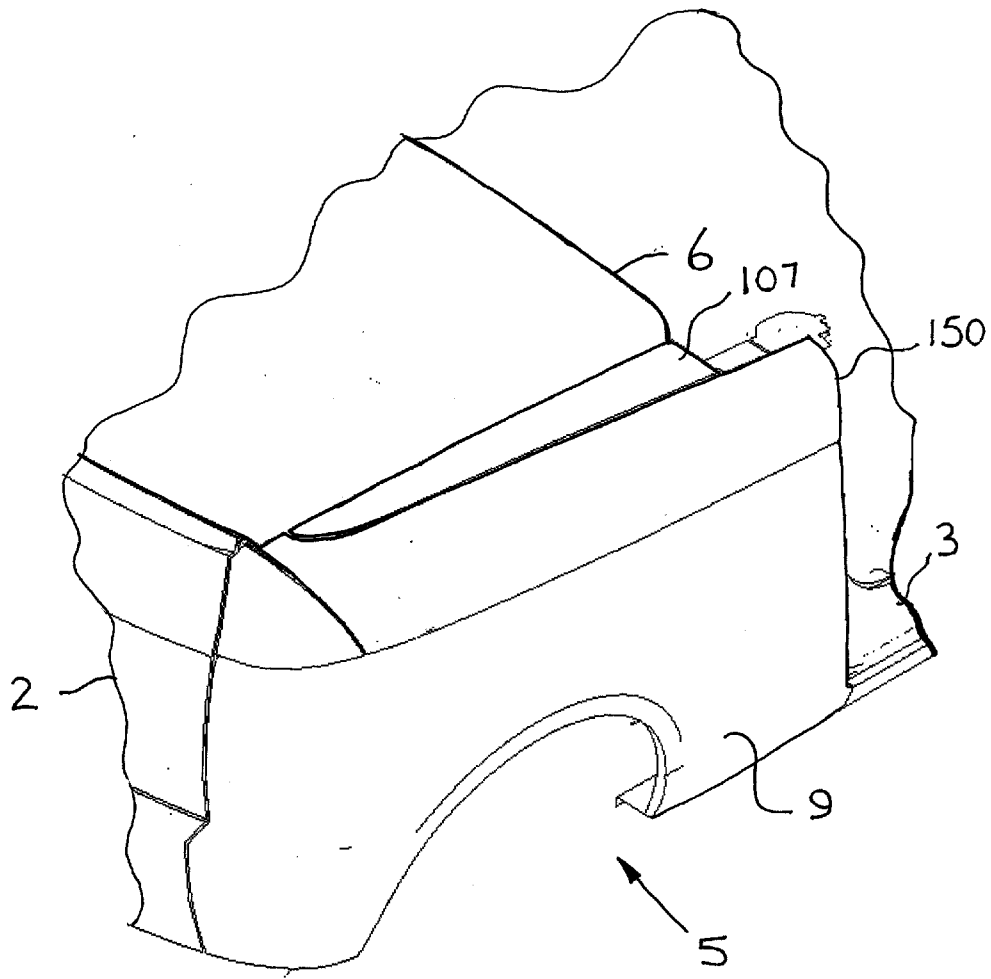
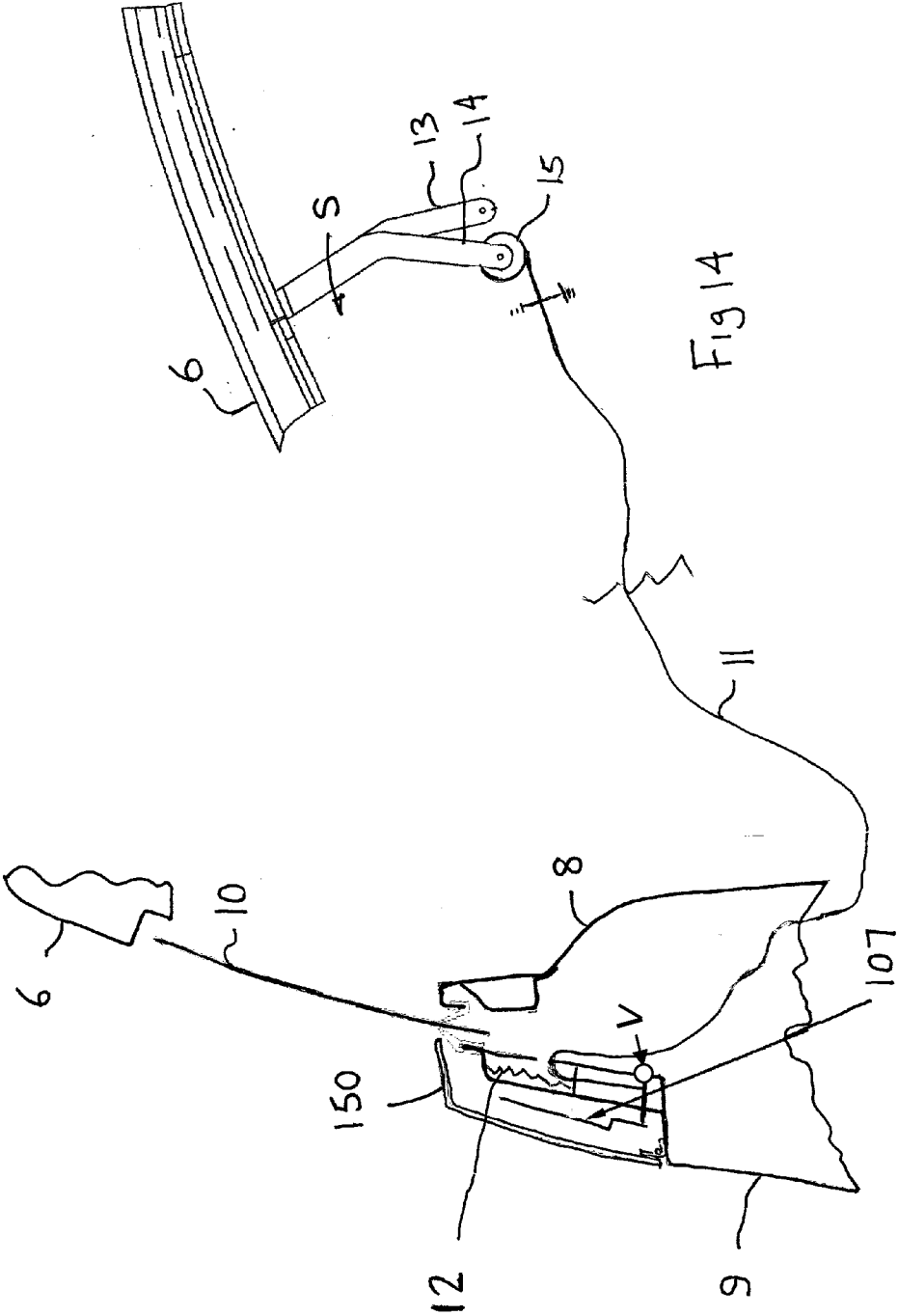


Fig. 13



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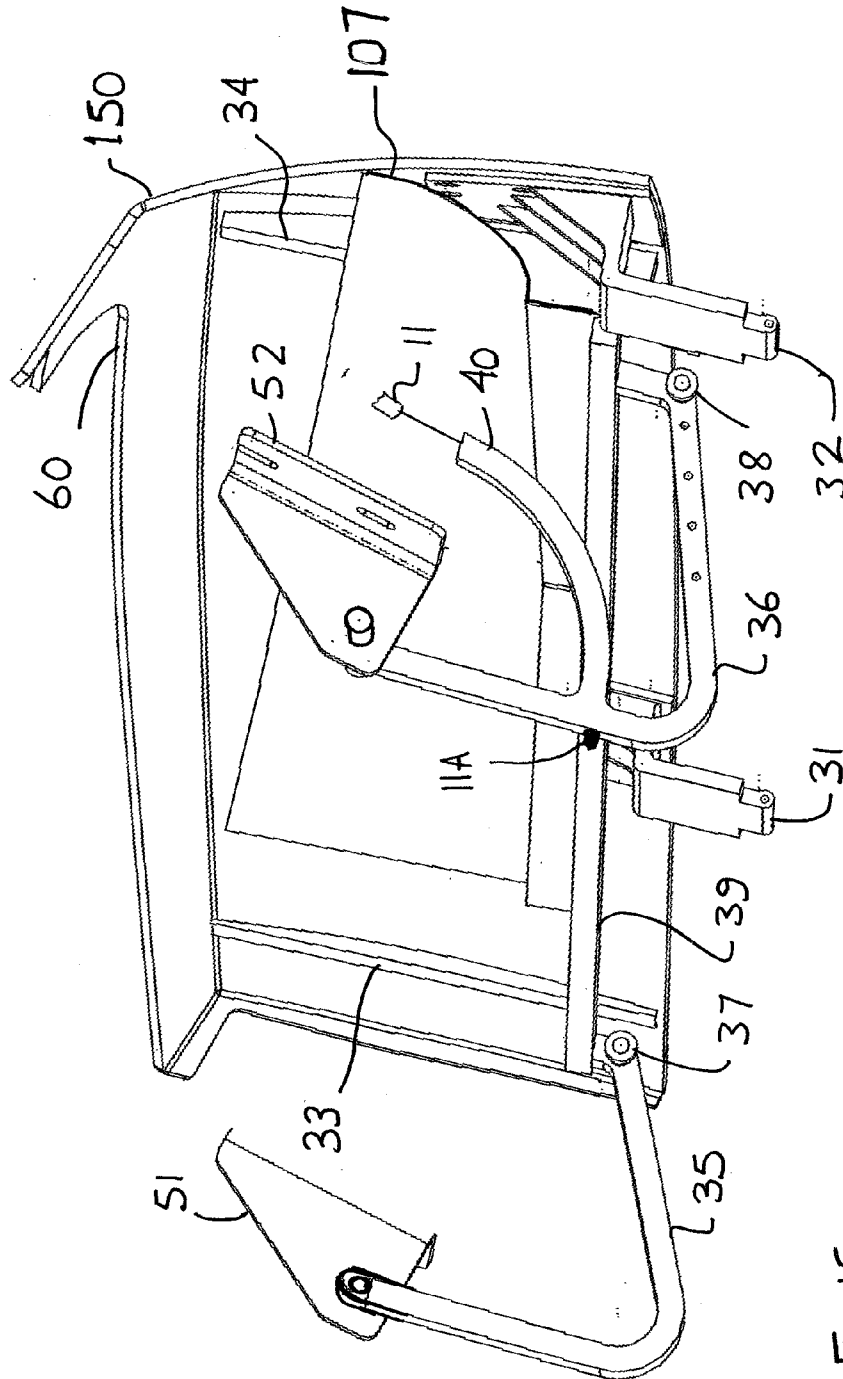


Fig. 15

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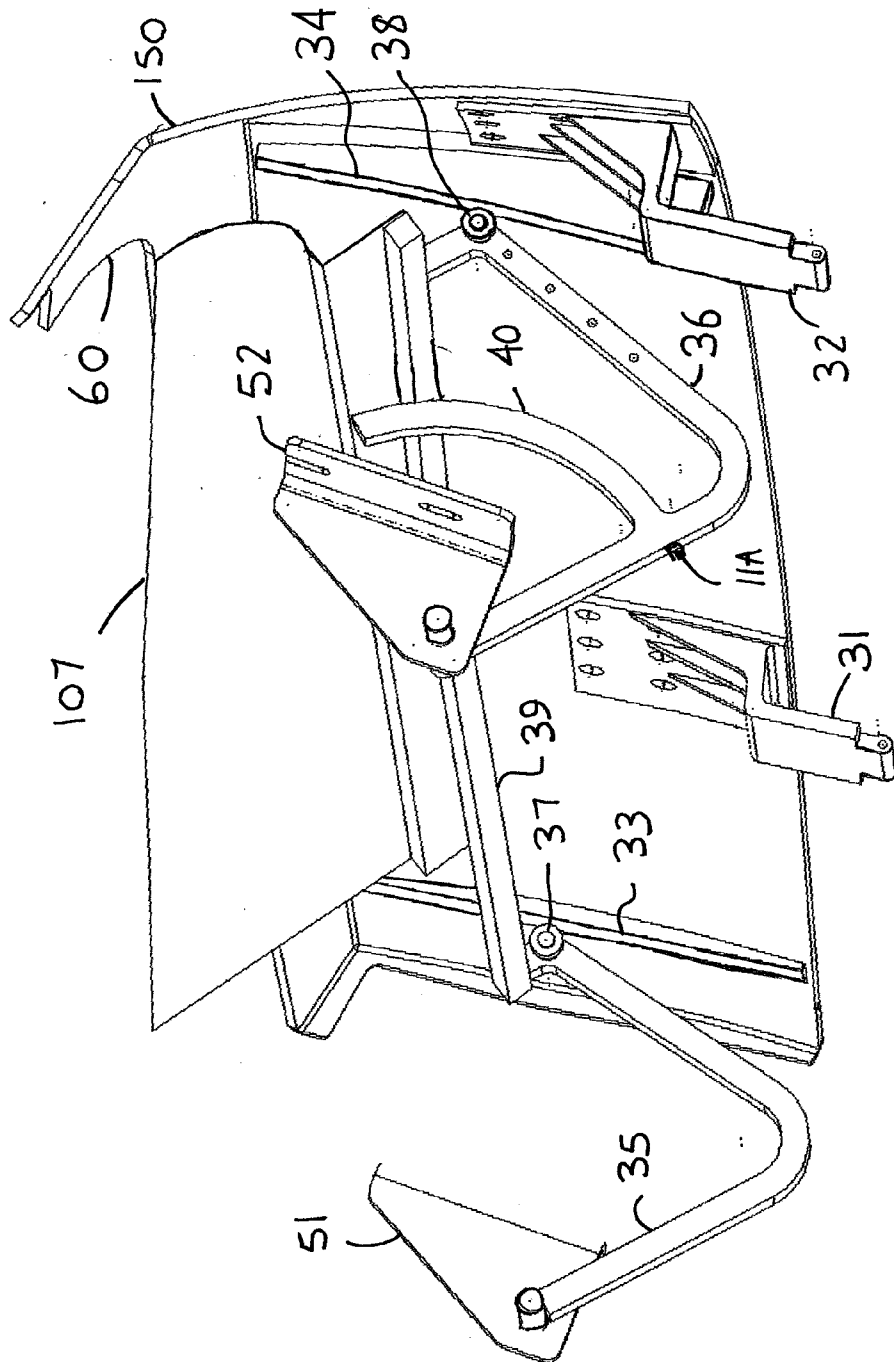


Fig. 16

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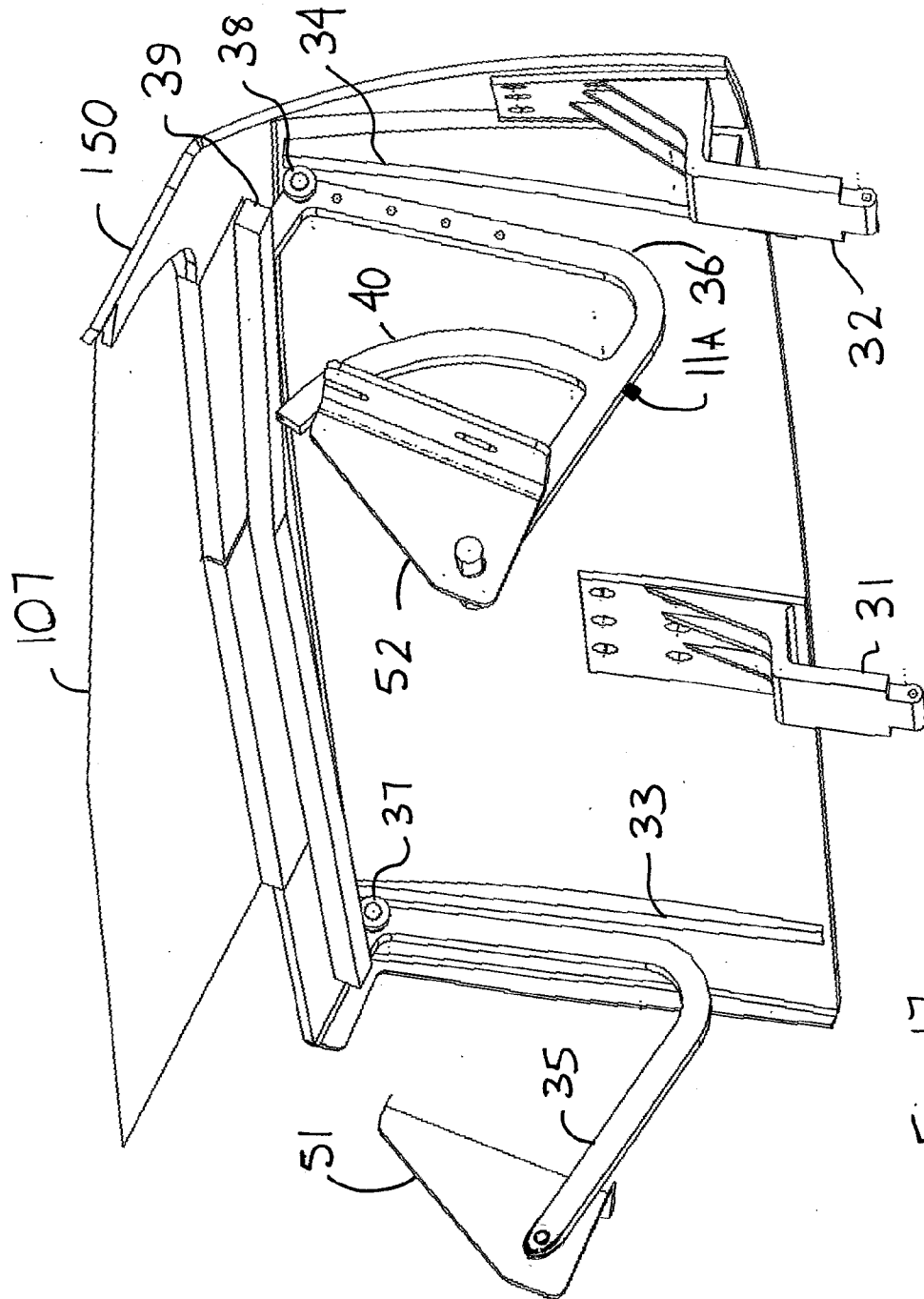


Fig. 17

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/050113

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60J7/14 B60J7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B60J B60P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ See patent family annex.

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Date of the actual completion of the international search

27 June 2007

Date of mailing of the international search report

05/07/2007

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INTERNATIONAL SEARCH REPORT

International application No

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