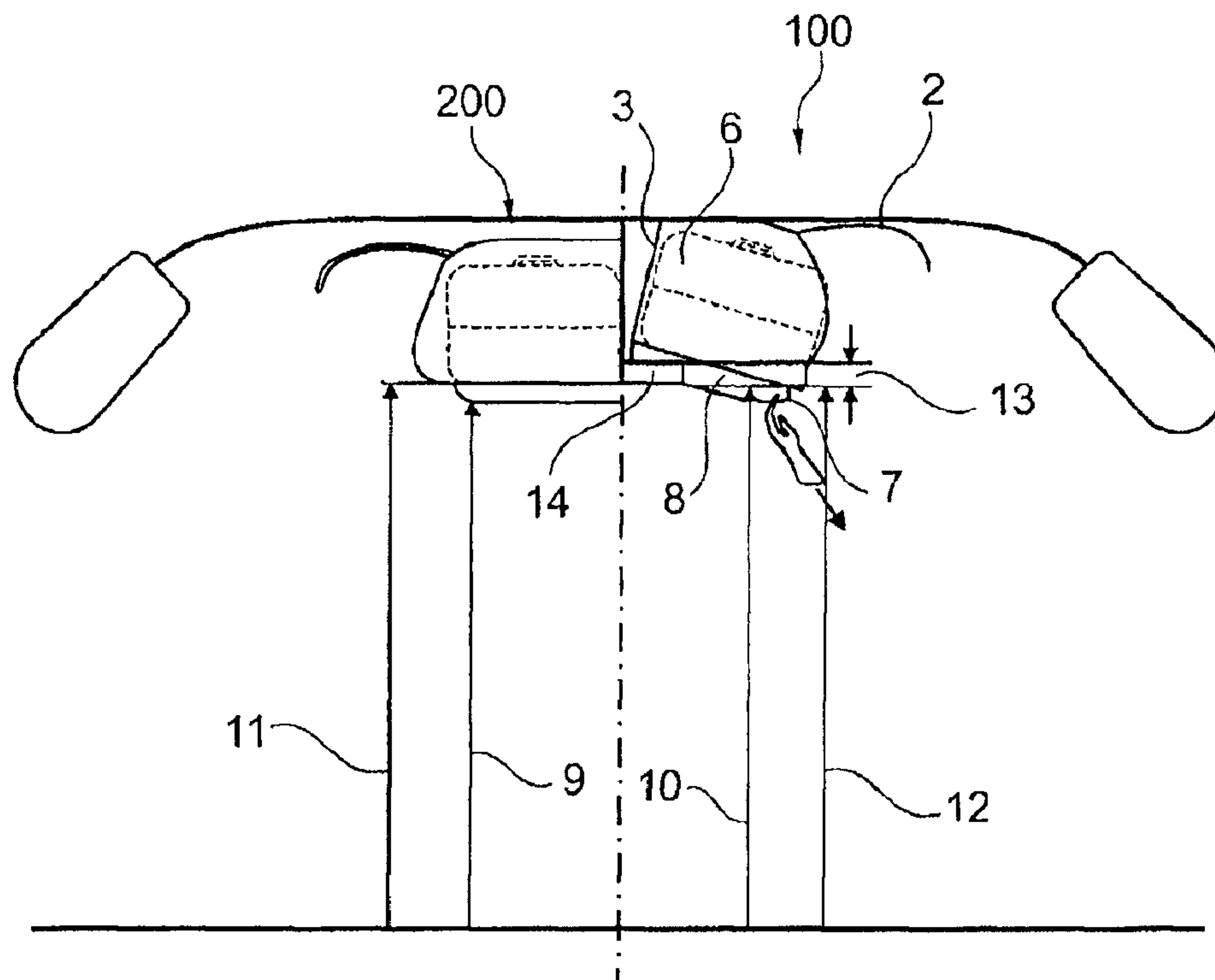




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(54) Title: AIRCRAFT LUGGAGE COMPARTMENT



(57) Abrégé/Abstract:

Rigidly installed luggage compartments are normally used today, the installation of which reflects a compromise between headroom and loading edge height. An exemplary embodiment of this invention describes a luggage compartment (100) for aircraft comprising a tilting floor (1), a flap (2) and a swiveling suspension device (8). The tilting floor (1) is designed for holding canyon baggage and the like, and can advantageously be locked in an initial state and tilted down for loading or unloading purposes, so that the effective loading edge height lies distinctly below the installation height.



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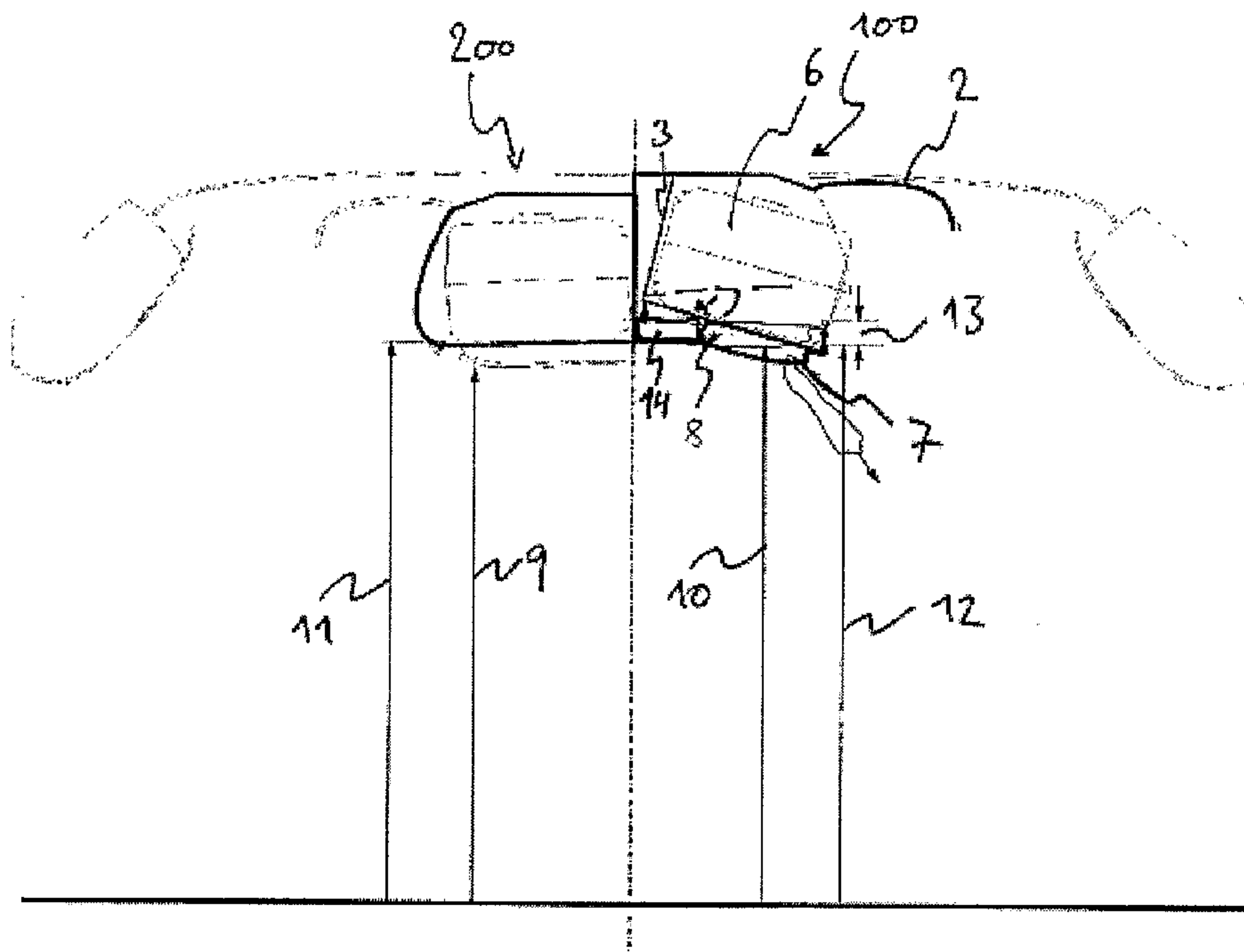
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(57) Abstract: Rigidly installed luggage compartments are normally used today, the installation of which reflects a compromise between headroom and loading edge height. An exemplary embodiment of this invention describes a luggage compartment (100) for aircraft comprising a tilting floor (1), a flap (2) and a swiveling suspension device (8). The tilting floor (1) is designed for holding canyon baggage and the like, and can advantageously be locked in an initial state and tilted down for loading or unloading purposes, so that the effective loading edge height lies distinctly below the installation height.

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Aircraft Luggage Compartment

This invention relates to luggage compartments for aircraft. In particular, this
5 invention relates to a luggage compartment for an aircraft, an aircraft comprising
such a luggage compartment, the use of a luggage compartment in an aircraft, and a
method for loading baggage in a luggage compartment.

Luggage compartments in aircraft are used for stowing and keeping carryon baggage,
10 clothing and the like. The luggage compartments are located to the left and right of
the aisle at or slightly above passenger head level. Since the luggage compartments
cannot be suspended so high as to make smaller individuals no longer able to stow
baggage in the luggage compartment, larger individuals most often find it impossible
to stand up straight under such a luggage compartment.

15

It is an object of the present invention is to provide for improved baggage stowage in
aircraft.

According to an exemplary embodiment of this invention, a luggage compartment
20 for aircraft is provided, the luggage compartment comprising a tilting floor, a flap
and a pivoted suspension device, wherein the flap has an open and closed position,
and wherein the tilting floor is adapted to rotate around the suspension device from
an initial position into a loading position with the flap in the open position.

25 This configuration of the luggage compartment may ensure that the luggage
compartment can be suspended high enough that even large individuals can stand up
straight underneath it on the one hand, while also providing for a lower stowing edge
height on the other hand, so that smaller individuals can load the luggage
compartment without exertion. This is enabled by a tilting mechanism that enables
30 the luggage compartment to be fixed high enough horizontally in its initial position,
and tilt in its loading position, so that the front edge of the tilting floor is tilted down,

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also enabling smaller people to conveniently stow items away. The tilting floor and suspension device may only be turned if the flap is in the open position. This means that the tilting floor cannot tilt with the flap closed. As a result, the tilting floor is fixed securely in its initial position during normal flight operation, and can only be
5 tilted down accordingly after the flap has been opened.

According to another exemplary embodiment of the present invention, the luggage compartment comprises a first locking device, wherein the first locking device can be used to prevent the tilting floor from turning around the suspension device, and
10 wherein the first locking device can be released to allow the tilting floor to turn around the suspension device.

This may make it possible to ensure that a tilting motion of the floor only takes place once the user has actuated the first locking device.
15

In another exemplary embodiment of this invention, the first locking device can be locked into the initial position automatically by turning the tilting floor.

This may ensure that, once the tilting floor has been turned into its initial position, it
20 is automatically locked there, so that it can no longer be moved unless the user manually releases it. As a result, undesired tilting of the tilting floor can be prevented.

In another exemplary embodiment of this invention, the luggage compartment has a
25 second locking device, wherein the flap can be held in the closed position by the second locking device, and wherein the second locking device can be released, making it possible to open the flap.

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This advantageous makes it impossible to unintentionally open the flap.

In another exemplary embodiment of this invention, the luggage compartment also comprises a coupling device for coupling the first locking device with the second
5 locking device, wherein the coupling device is adapted in such a way that the first locking device can only be released once the second locking device has been released, and wherein the coupling device is further designed in such a way that the second locking device can only be closed once the first locking device has been closed.

10

This may ensure that the tilting floor can only be tilted for loading or unloading the luggage compartment after the flap has been opened. The tilting floor cannot be tilted before the flap is opened, thereby preventing the tilting floor from tilting and the flap then opening, for example, which can cause the carryon baggage to accidentally fall
15 out of the luggage compartment. In addition, the coupling means makes it possible to lock the flap only once the tilting floor has been flipped back into its initial position. This ensures that users always first flip back the tilting floor before closing the flap. This can also help avoid the risk of an accident owing to falling carryon baggage.

20 In another exemplary embodiment of this invention, the coupling device comprises a handle, wherein the handle has a first position, a second position and a third position, which can be assumed one after the other. The first position here corresponds to the handle in the resting position. The second position involves releasing the second locking device of the flap, so that the flap can be opened, and the third position
25 involves releasing the first locking device, so that the luggage compartment can be turned around the suspension device.

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Therefore, the first and second locking devices may be released one after the other using the same handle in the correct sequence. The user pulls on the handle, and as soon as the handle is in the second position, the flap is unlocked. As soon as the handle has then moved from the second position into the third position, the tilting
5 floor is released, and can turn around its suspension axis.

In another exemplary embodiment of this invention, the suspension device is situated near a line that runs vertically through the center of gravity of the luggage compartment in the initial position, so that only a slight torque is required for turning
10 the tilting floor.

This represents a very significant advantage, in that only slight forces must be exerted in order to turn the tilting floor (with any carryon baggage therein). Force enhancing means or elevated exertion by the user are not required.

15

In another exemplary embodiment of this invention, the suspension device encompasses a rotational axis, wherein the tilting floor has a first lateral wall and a second lateral wall, and wherein the rotational axis rigidly joins the first and second lateral wall, so that the forward and reverse forces, e.g., those produced by aircraft
20 accelerations, can be absorbed by the combination of first lateral wall, second lateral wall and rotational axis.

Coupling both lateral walls via the rotational axis may provide for a stable combination, which can also absorb strong acceleration forces, e.g., of the kind that
25 may arise during a crash.

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In another exemplary embodiment of this invention, the luggage compartment also has a spring arrangement, wherein a minimum threshold force, which is necessary for turning the tilting floor, can be set via the spring arrangement.

- 5 The spring arrangement may make it possible to set a force that the user must exert to move the tilting floor out of its initial position, for example. In this case, the spring arrangement can dampen or provide support.

- Another exemplary embodiment of this invention provides for a simple and reliable
10 method with which the luggage compartment may be actuated on board an aircraft. The method here comprises the release of a second locking device for opening a flap of the luggage compartment, the release of a first locking device for turning a tilting floor of the luggage compartment from an initial position into a loading position, the loading of baggage into the luggage compartment, the application of a threshold
15 force to turn the tilting floor back into the initial position, the closing of the first locking device for locking the tilting floor, the closing of the flap, and the closing of the second locking device for locking the flap.

- Therefore, the method according to the invention may make it possible to load or
20 even unload the luggage compartment while the floor still remains horizontally locked upon actuation of the second locking device for opening the flap. Only when a second locking device is additionally actuated can the tilting floor be turned into the desired loading/unloading position. The corresponding loading/unloading position of the front edge of the tilting floor is here located under the initial position owing to
25 the rotation. This simplifies the loading process. The tilting floor can then be turned back, whereupon the flap can only be closed and locked after the initial position has been reached.

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Additional exemplary embodiments of this invention are described in the claims and subclaims.

Preferred exemplary embodiments of this invention will be described below, drawing
5 reference to the figures.

Fig. 1 shows a diagrammatic view of a luggage compartment for an aircraft according to an exemplary embodiment of the present invention.

10 Fig. 2 shows a diagrammatic cross sectional view of a luggage compartment arrangement.

Fig. 3 shows a diagrammatic cross sectional view of a luggage compartment arrangement in an aircraft fuselage.

15

Fig. 4a-4b show diagrammatic cross sectional views of a luggage compartment according to an exemplary embodiment of the present invention.

20 Fig. 5 shows a diagrammatic partial view of a luggage compartment with a recess on a side panel.

Fig. 6 shows a diagrammatic view of the actuation principle for the first and second locking devices with coupling means.

25 Fig. 7 shows a schematic representation of a luggage compartment according to another exemplary embodiment of the present invention.

Fig. 8 shows the embodiment of Fig. 7 in another state of use.

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The same reference numbers for identical or similar elements are used in the following figure description.

- 5 Fig. 1 shows a first perspective, diagrammatic view of a luggage compartment according to an exemplary embodiment of this invention. As evident from Fig. 1, the luggage compartment 100 according to the invention has a tilting floor 1 with a first lateral wall 4 and a second lateral wall 5. The two lateral walls 4, 5 are rigidly joined by way of a rotational axis (not shown on Fig. 1), which is located in the floor 1, for
10 example. The rotational axis is part of a suspension device 8, which is designed for turning the tilting floor 1, and consequently pivoted (e.g., in corresponding side panels). The rotational axis rigidly joins the first and second lateral wall, thereby yielding a stable structure that is able to withstand strong forward and reverse accelerations of the kind that might arise when an aircraft crashes, for example.
- 15 Given a strong braking effect, for example, corresponding forces conveyed by the carryon baggage 6 to the second lateral wall 5 can here be partially deflected to the first lateral wall 4 via the rotational axis. This results in an elevated stability for the luggage compartment.
- 20 Furthermore, the luggage compartment according to the invention encompasses a flap 2, which, as shown on Fig. 1, can assume an open position. The flap 2 can also assume a closed position, in which it can be locked. The tilting floor 1 can be turned from an initial position after opening the flap 2 into a loading/unloading position (as shown on Fig. 1). In this loading position, carryon baggage can be comfortably
25 loaded and unloaded, since the loading edge (front side) of the tilting floor is lowered.

- 8 -

The tilting floor 1 also comprises a rear wall 3, which limits the luggage compartment from below.

Fig. 2 shows a diagrammatic cross sectional view of a luggage compartment arrangement. Reference number 200 here denotes a conventional luggage compartment, while reference number 100 denotes a luggage compartment according to this invention.

A luggage rack in a wide-bodied aircraft is determined by three criteria, specifically a defined stowage volume, an installation height (headroom/standing height) and a loading edge height.

As may be seen from Fig. 2, the standing height or headroom 10 in the luggage compartment 100 with the tilting floor according to the invention is increased relative to the headroom 9 for the known luggage compartment 200. The increased headroom measures 6 to 10 cm, for example, but can also be higher (e.g., depending on the maximum tilting angle α). This also allows taller people to stand under the luggage compartment without hunching over. This increases passenger comfort significantly.

20

In addition, the loading edge height 12 of the tilting floor luggage compartment arrangement 10 according to the invention is reduced in the invention relative to the loading edge height 11 of the conventional luggage compartment 200. The reduction can here measure several centimeters depending on the position of the bearing arrangement 8 the installation height of the luggage compartment 100 and the maximum tilting angle α .

25

- 9 -

According to an exemplary embodiment of the present invention, the loading edge height 12 does not wander upward regardless of the elevated suspension of the luggage compartment, but rather (as compared with the conventional solution 200) even migrates downward, as denoted by reference number 13. This further enables a comfortable loading.

Actuating the lock 7 initially opens the flap 2, while the floor still remains horizontally locked. Only when the lock 7 is again actuated and given a downward pulling motion does the floor tilt into the desired loading/unloading position.

10

After loading is complete, the floor is manually pressed up over a dead center (threshold force). This threshold force can be generated, for example, by having a portion of the loading weight lie behind the fulcrum, but can also be provided by means of a dampening spring. For example, a spring arrangement (not shown on Fig. 2) can be provided for heavy carryon baggage to support a rotating motion of the tilting floor. Further, the spring arrangement can be used to set a minimum required threshold force for turning the tilting floor (dead center).

15

The flap can only be closed once the tilting floor has returned to the automatically locked initial position. This can simultaneously serve as a safety check, since a closed flap tells the flight personnel that the tilting floor is correctly locked.

20

Provided as an example is a coupling means that couples a first locking device for locking the tilting floor with a second locking device for locking the flap. The coupling means can involve a toothed belt linkage between the two locking mechanisms, so that the first locking device can only be released once the second locking device has been released. In addition, the coupling means can be designed in

25

- 10 -

such a way that the second locking device can only be closed once the first locking device has been closed.

It should be noted, that the locking device for locking the floor and the locking
5 device for locking the flap may not be coupled. For example, the locking device for locking the flap may be adapted as a normal locking mechanism for the flap. When the locking mechanism has been released and the flap is opened, the other locking device (for the tilting floor) may be laid open, since the flap has moved away from the other locking device. Then, the other locking device (for the tilting floor) may be
10 released in order to allow the tilting floor to turn around the suspension device.

In an exemplary embodiment according to this invention, the first locking device can be locked automatically by turning the tilting floor into the initial position. For example, this can be done using a snapping mechanism or the like, which
15 automatically snaps into a corresponding counterpart once the initial position has been reached, thereby locking the tilting floor. If the tilting floor is then locked, the coupling means release the second locking device (for the flap 2).

The coupling means here encompass a handle or tongue 7, for example, which can
20 assume three different sequential positions. The first position is here the resting position. Actuating the handle makes it possible to bring the handle into a second position, which releases the second locking device of the flap 2. Further moving the handle 7 then brings the handle into a third position, which releases the first locking device of the tilting floor, so that the tilting floor can now be turned into its loading
25 position.

The turning motion of the tilting floor can be supported or dampened via corresponding pneumatic springs, for example. Naturally, however, other spring

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mechanisms may be used, such as rubber springs or spiral springs. Also possible are friction mechanisms, which dampen the turning motion. The pneumatic springs (or another corresponding spring or dampening means) can be used to support the rotational process of the tilting element, but also for dampening it. Further, the spring means can be adjustable, so that the threshold force can be set correspondingly, and hence is independent of the loaded status of the luggage compartment, for example.

As evident from Fig. 2, suspending the luggage compartment as described in the invention created a free space 14 that can be used, for example, for a passenger service unit channel (PSU channel).

Fig. 3 shows a diagrammatic cross sectional view of a luggage compartment arrangement in an aircraft fuselage. As evident from Fig. 3, the swivel-mounted tilting floor arrangement can be comfortably flipped down for loading or unloading carryon baggage. This increases passenger comfort, for example, by increasing the headroom under the flipped-up luggage compartments.

Fig. 4a-4b show diagrammatic cross sectional views of a luggage compartment arrangement according to an exemplary embodiment of this invention. As evident from Fig. 4a, the luggage compartment 100 with tilting floor according to the invention has a rotating suspension device 8, which defines a rotational axis of the luggage compartment 100. The center of gravity of the luggage compartment 100 symbolized in its initial position by the continuous lines on Fig. 4a is marked with reference number 41. As evident from Fig. 4a, the center of gravity 41 is laterally shifted to the left relative to the line 43 via the fulcrum 8. As a result, the tilting floor is in a stable position, since the lateral shift in the center of gravity 41 away from the horizontal line 43 causes a torque to act counterclockwise on the tilting floor or

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luggage compartment 100, which presses the luggage compartment 100 against a fixed stop 46.

- As may be seen from Fig. 4b, the center of gravity 41 of the luggage compartment 100 in the loading position (shown after having opened the flap 2 and turning the tilting floor or luggage compartment 100 from the initial position on Fig. 4a) is situated in the end position (see Fig. 4b) shifted laterally to the right relative to the horizontal axis 43 via the fulcrum 8. As a result, the tilting floor is in a stable position even in this position, since the torque acts on it clockwise, thereby pressing the tilting floor against the fixed stop 45. Given the relative proximity of the center of gravity to the horizontal axis 43, only a relatively low force is ever necessary for the rotational motion. Mechanically complex and heavy dampening means or force enhancing means can hence be largely omitted.
- Fig. 5 shows a diagrammatic partial view of a luggage compartment with a recess 51 on a side panel 50. As evident from Fig. 5, this prevents the fingers of a user from being jammed when snapping in the tilting floor 1. The risk of injury is minimized as a result.
- In order to load or unload the luggage compartment according to the invention, a locking device is first released to disengage the flap 2 of the luggage compartment. This makes it possible to open the flap 2. After the flap has been opened, a second locking device is released, allowing the tilting floor 1 of the luggage compartment to be tilted from an initial position into a loading position. The first and second locking device are here joined with a handle 7 via a coupling means, wherein the coupling means is designed in such a way that the first locking device can only be released once the second locking device has been released, and that the second locking device can only be locked once the first locking device has been closed. After the tilting

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floor has arrived at the loading or unloading position, the baggage can be pushed into or taken out of the luggage compartment. A threshold force must then be exerted to turn the tilting floor back to the initial position. When the initial position has been assumed, the first locking device automatically latches to lock the tilting floor, and
5 the flap can be closed. After the flap 2 is closed, the flap 2 is automatically locked by a second locking mechanism.

According to an exemplary embodiment of this invention, there are two stable states in which no restoring force acts. The first state is shown on Fig. 4a, in which the
10 acting force actually works counterclockwise, which would cause the tilting element to turn up further if no stop element 46 were provided. The second stable position is shown on Fig. 4b, in which the force acts on the tilting element clockwise, so that a tilting motion would continue if a second stop element 45 were not to halt this tilting motion. Therefore, a stable state is also shown on Fig. 4b.

15

Torsion dampeners can also be used as the spring arrangement.

Gaps between the inner lateral walls can be covered by a profile. A gap on the rear side of the luggage compartment can be covered by a movable panel (e.g., see 15 on
20 Fig. 1). The luggage compartment can be unlocked by means of a handle or slide-out tongue, wherein the door is unlocked by about 30% after the tongue is withdrawn, for example, and the tilting floor is unlocked by another 30% while continuing to withdraw the tongue. For example, the handle can be designed as a handrail, which the user can use to pull down the tilting floor after withdrawn 60%. This handrail can
25 take up the entire width of the luggage compartment, for example. The handrail can advantageously encompass a seat or seat row number, which is legible from the both with the tilting floor flipped up or down. Typical forces needed to open or tilt the tilting floor can measure 200 Newtons, for example.

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Fig. 6 shows a diagrammatic view of the actuating principle for the first and second locking devices with coupling means. As discernible from Fig. 6a, both the first locking device 62 located on the lateral walls of the luggage compartment and the second locking device 61 located on the flap 2 of the luggage compartment are closed in the initial state. The two locking devices 61, 62 are coupled together via a coupling means 63 comprising the handle 7. The door 2 is unlocked by actuating the handle 7 (shifting from the first position shown on Fig. 6a into the second position shown on Fig. 6b). Fig. 6c shows how the handle, and hence the coupling means, is moved into the third position via the two locking devices 61, 62, in which the first locking device 62 opens on both sides of the luggage compartment, so that the tilting floor 1 can now be tilted. This is depicted on Fig. 6d, in which the handle and the coupling means have been moved further down into a fourth position, as a result of which the tilting floor 1 is turned around the suspension device 8 and tilted downward.

Fig. 7 and Fig. 8 show an other exemplary embodiment of the present invention. The luggage compartment further comprises a frame member 701 or holder which is rotatably attached to the tilting floor and adapted for preventing a piece of luggage to slip out of the compartment when the floor is tilted. For that reason, the frame 701 follows the tilting movement of the floor after the flap is opened, thereby holding back the luggage, as depicted in Fig. 7. As may be seen from Fig. 8, the frame member 701 may be rotated upwards in order to access the luggage or to load/unload the compartment. It should be noted the other mechanisms for fixing and/or moving the frame may be used, such as, for example, a sliding mechanism which allows the frame member 701 to be moved upwards when the luggage as to be accessed.

- 15 -

The invention is not limited in its implementation to the preferred embodiments shown on the figures. Rather, a plurality of variants is conceivable, which make use of the described solution and principle according to the invention, even given embodiments with a fundamentally different configuration.

5

In addition, it must be noted that “comprising” does not exclude any other elements or steps, and “one” or “a” do not exclude a plurality. Further, let it be noted that features or steps that have been described with reference to one of the above exemplary embodiments can also be used in combination with other features or steps of other exemplary embodiments described above. Reference numbers in the claims are not to be regarded as limiting.

10

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A luggage compartment for an aircraft, comprises:
 - a tilting floor;
 - a flap having an open position and a closed position; and
 - a suspension device;wherein the tilting floor is coupled to the suspension device such that the tilting floor is capable of rotating on the suspension device around a suspension axis from an initial position to a loading position, when the flap is in the open position.
2. The luggage compartment according to claim 1, further comprising:
 - a first locking device having a locked position and an unlocked position wherein the first locking device locks the tilting floor in the initial position and prevents the tilting floor from rotating on the suspension device, when the first locking device is in the locked position, and the tilting floor is released to allow the tilting floor to rotate on the suspension device, when the first locking device is in the unlocked position.
3. The luggage compartment according to claim 2, wherein the locked position of the first locking device is automatically engaged by rotating the tilting floor to the initial position.
4. The luggage compartment according to claim 3, further comprising:
 - a second locking device wherein the flap is latched in the closed position by the second locking device in a latched position and is released to allow the flap to move to the open position, when the second locking device has been released.
5. The luggage compartment according to claim 4, further comprising:
 - a coupling device coupling the first locking device with the second locking device;
 - such that the first locking device is releasable only when the second locking device has been released, and
 - the flap and the second locking device are capable of returning to the latched position only when the first locking device is in the locked position.
6. The luggage compartment according to claim 5,

wherein the coupling device comprises a handle and the handle has a first position, a second position and a third position, such that the first position is the latched position of the coupling device and the flap, and moving the handle to the second position releases the flap from the latched position such that the flap may be moved to the open position and the third position releases the first locking device from the locked position, such that the tilting floor is rotatable on the suspension device and the handle moves from the first position to the second position to the third position in sequence.

7. The luggage compartment according to claim 1,
wherein the suspension device is positioned with respect to an imaginary line that runs vertically through the center of gravity of the luggage compartment when the tilting floor is in the initial position, such that the tilting floor is rotatable on the suspension device using only a slight torque applied to the tilting floor, a slight torque being defined in the range of torques that a normal passenger could apply using a single finger without use of any other bias torque.
8. The luggage compartment according to claim 1,
wherein the suspension device comprises a rotational axis; and
the tilting floor comprises a first lateral wall and a second lateral wall;
wherein the rotational axis rigidly joins the first lateral wall and second lateral wall, such that forward forces and reverse forces produced during aircraft accelerations are absorbed by the first lateral wall, the second lateral wall and the rotational axis.
9. The luggage compartment according to claim 1, further comprising:
a spring arrangement wherein the spring arrangement is coupled to the tilting floor and the suspension device such that the spring arrangement exerts a minimum threshold force required for rotating the tilting floor.
10. The luggage compartment according to claim 1, further comprising:
a frame member coupled to a structure of the luggage compartment such that the frame member prevents luggage stored in the luggage compartment from sliding out of the luggage compartment when the tilting floor is in the loading position.
11. An aircraft comprising a luggage compartment according to claim 1.
12. A method for actuating a luggage compartment on board an aircraft, comprising:

releasing a second locking device for opening a flap of the luggage compartment;
releasing a first locking device for rotating a tilting floor of the luggage compartment around a suspension axis from an initial position into a loading position;
loading of baggage into the luggage compartment;
applying a threshold force for rotating the tilting floor back into the initial position;
closing the first locking device for locking the tilting floor;
closing the flap; and
latching the second locking device and the flap such that the flap closes the luggage compartment.

13. The method according to claim 12, wherein the first locking device and the second locking device are coupled and the step of releasing the first locking device is prevented until after the step of releasing the second locking device is completed; and the step of latching the second locking device is prevented until after the step of closing the first locking device has been completed.

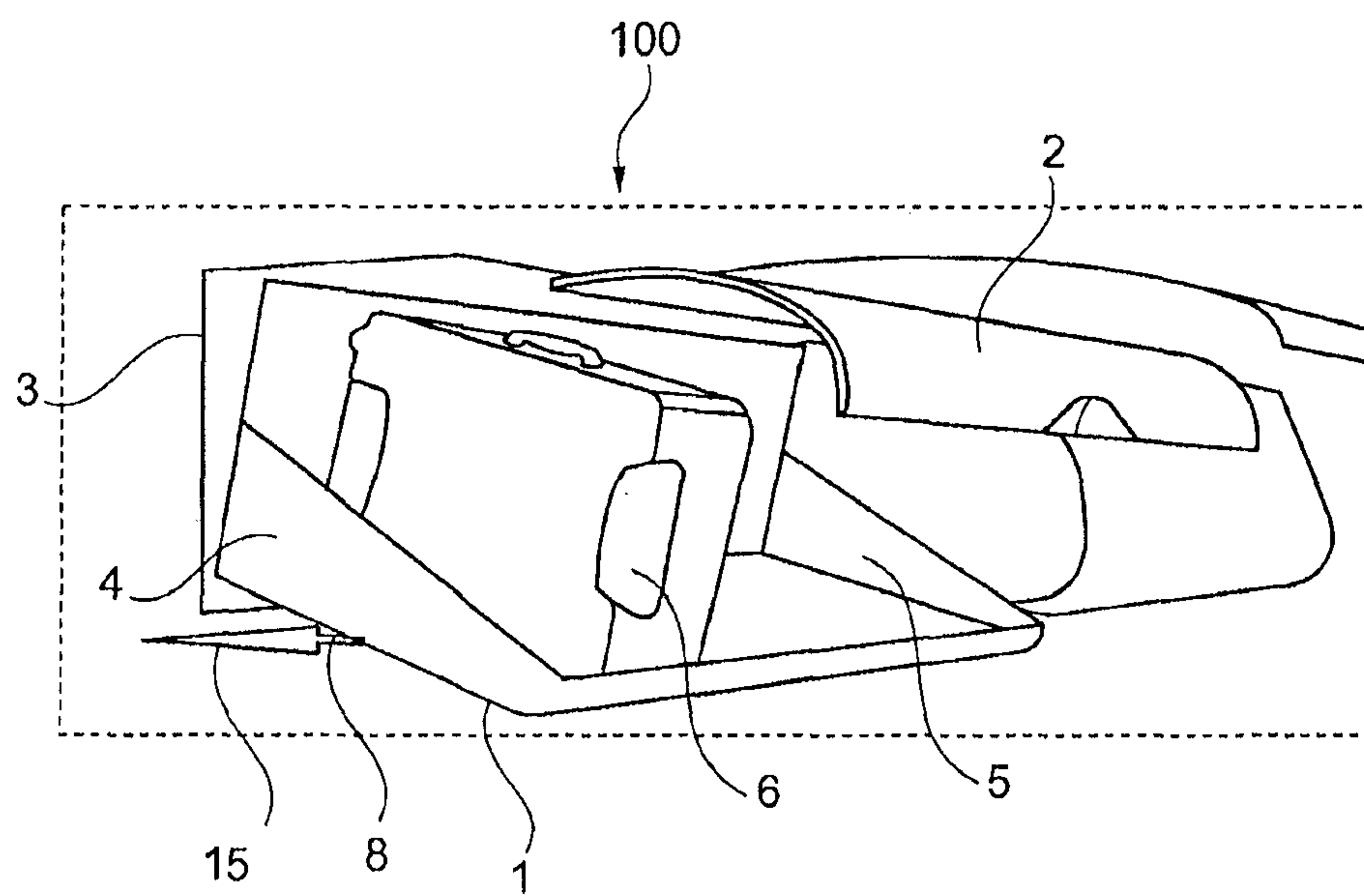


Fig. 1

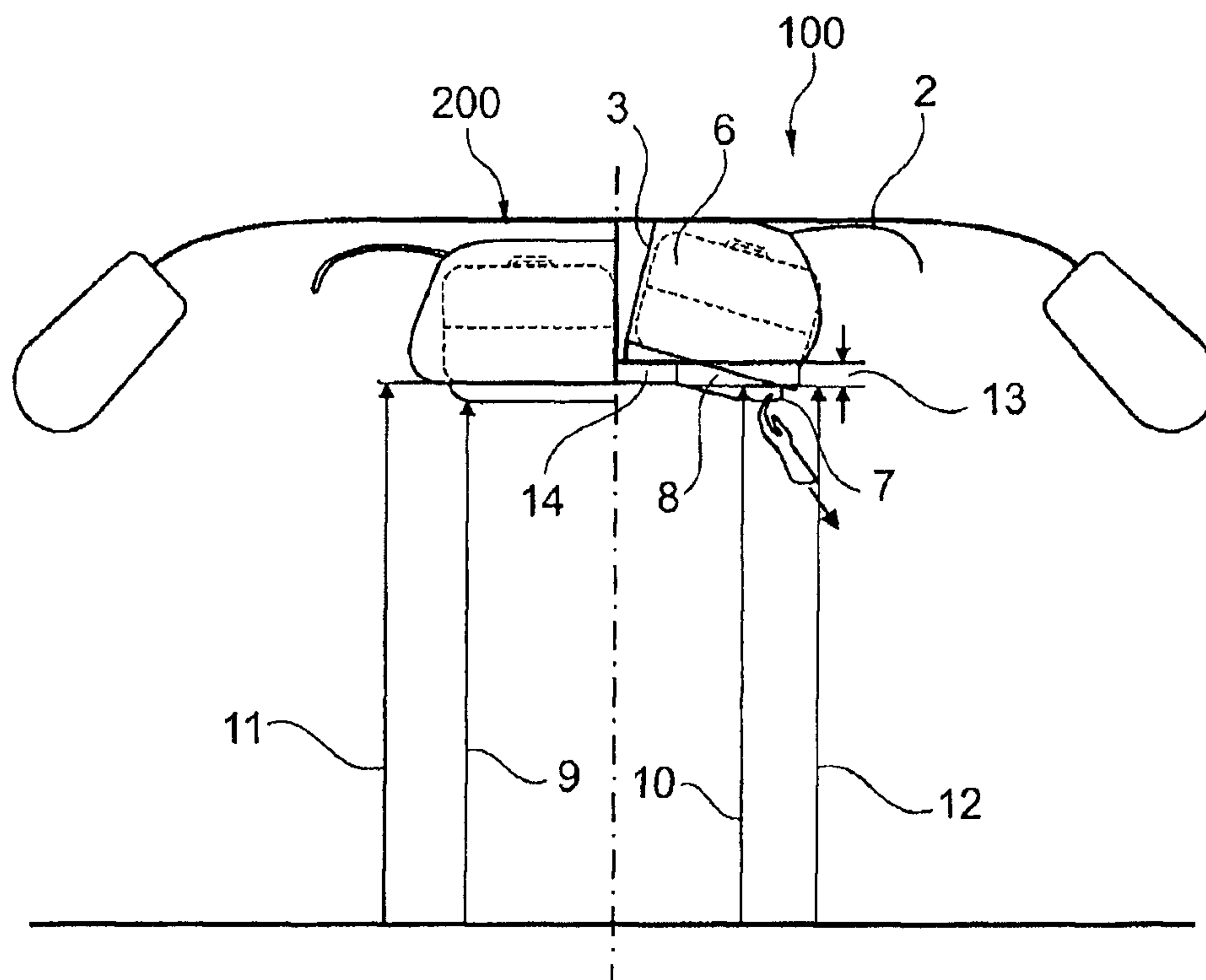


Fig. 2

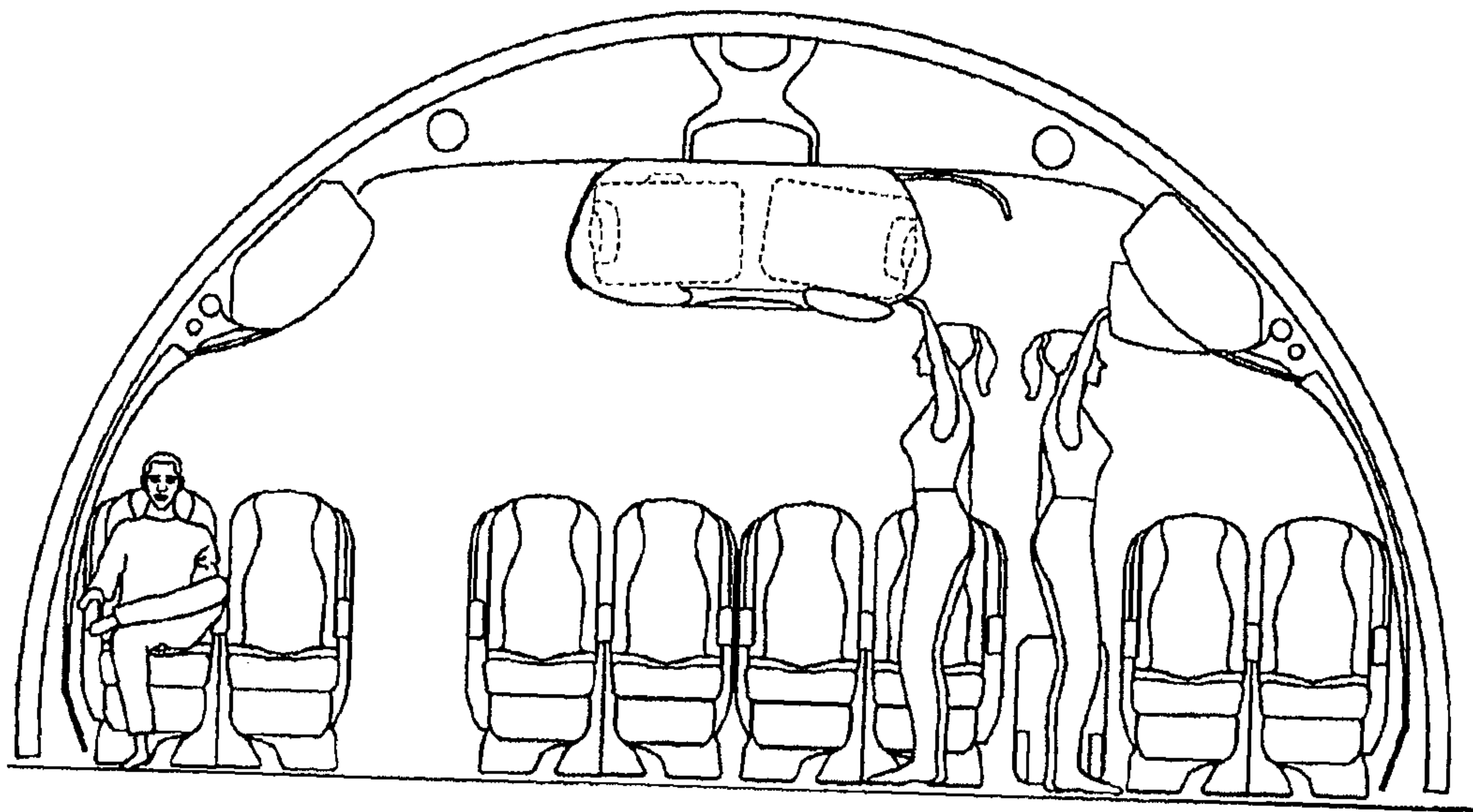


Fig. 3

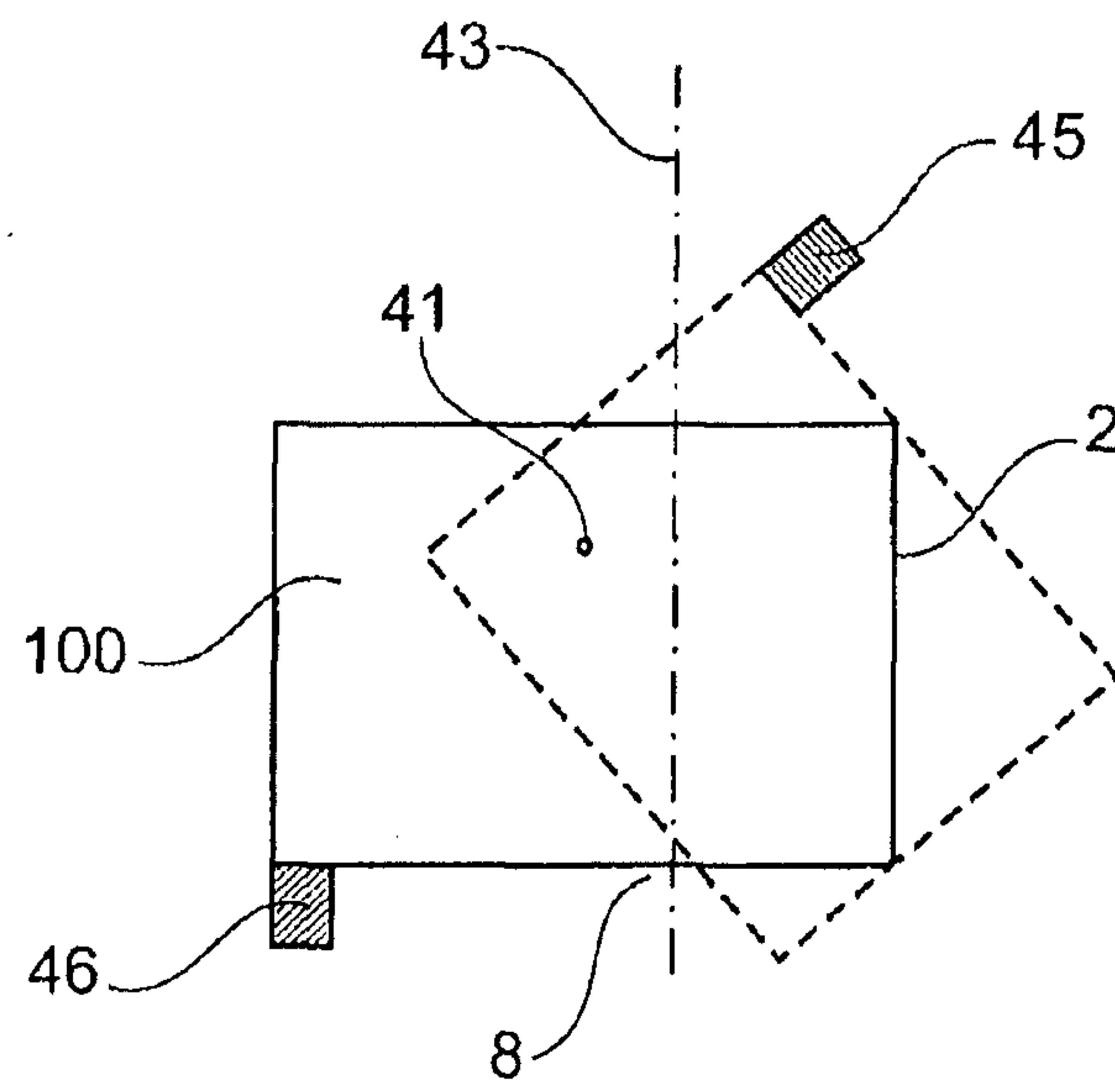


Fig. 4a

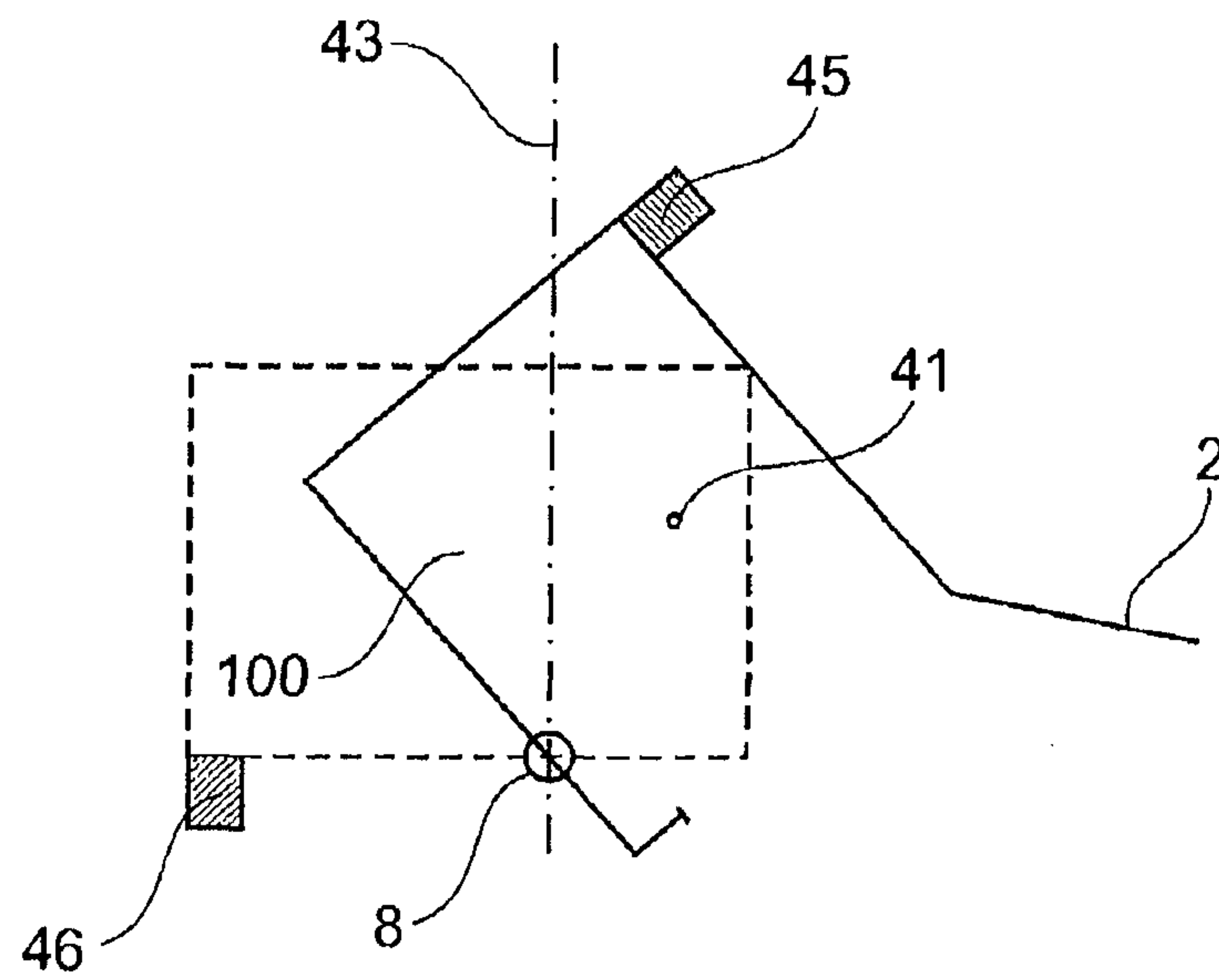


Fig. 4b

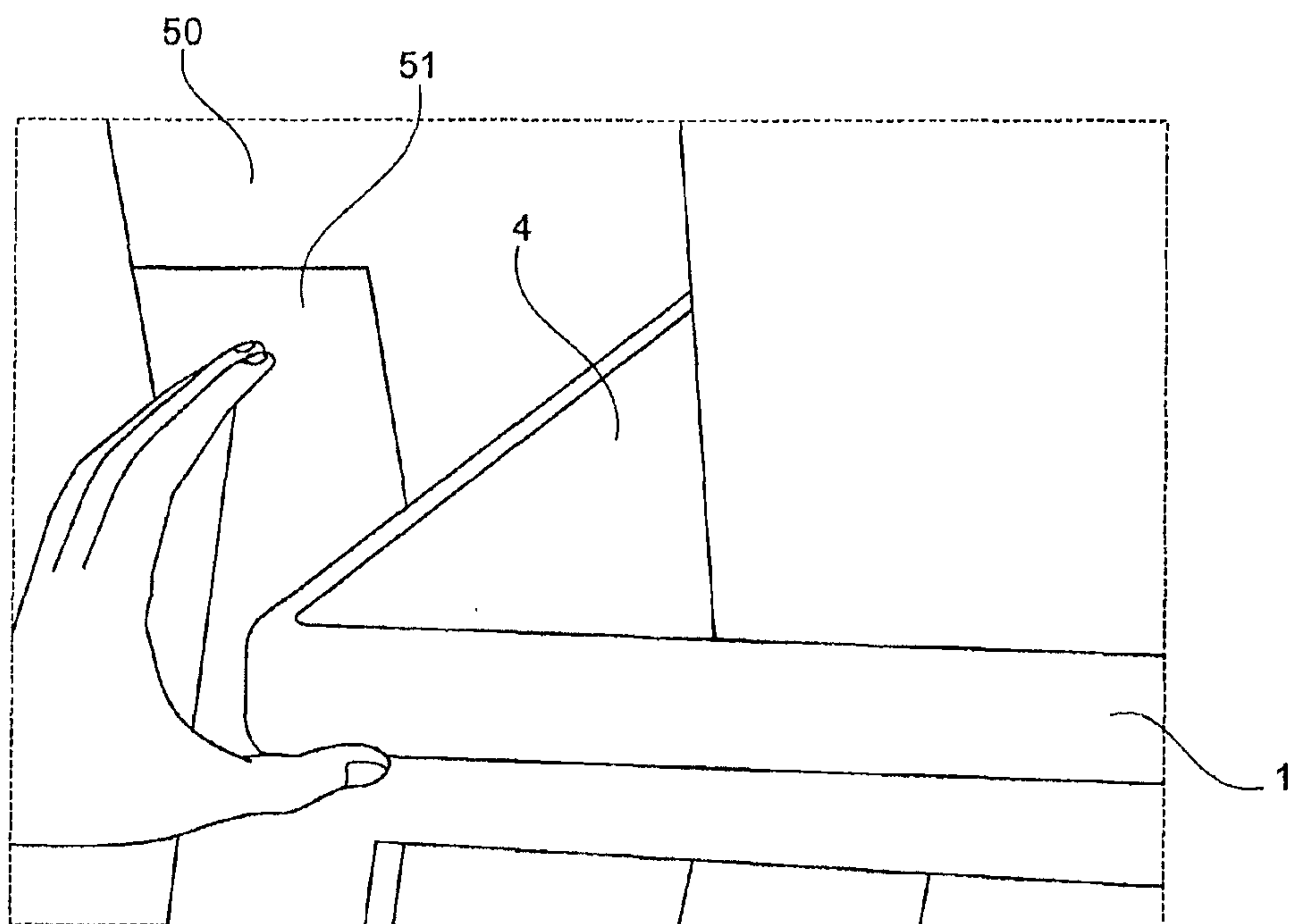


Fig. 5

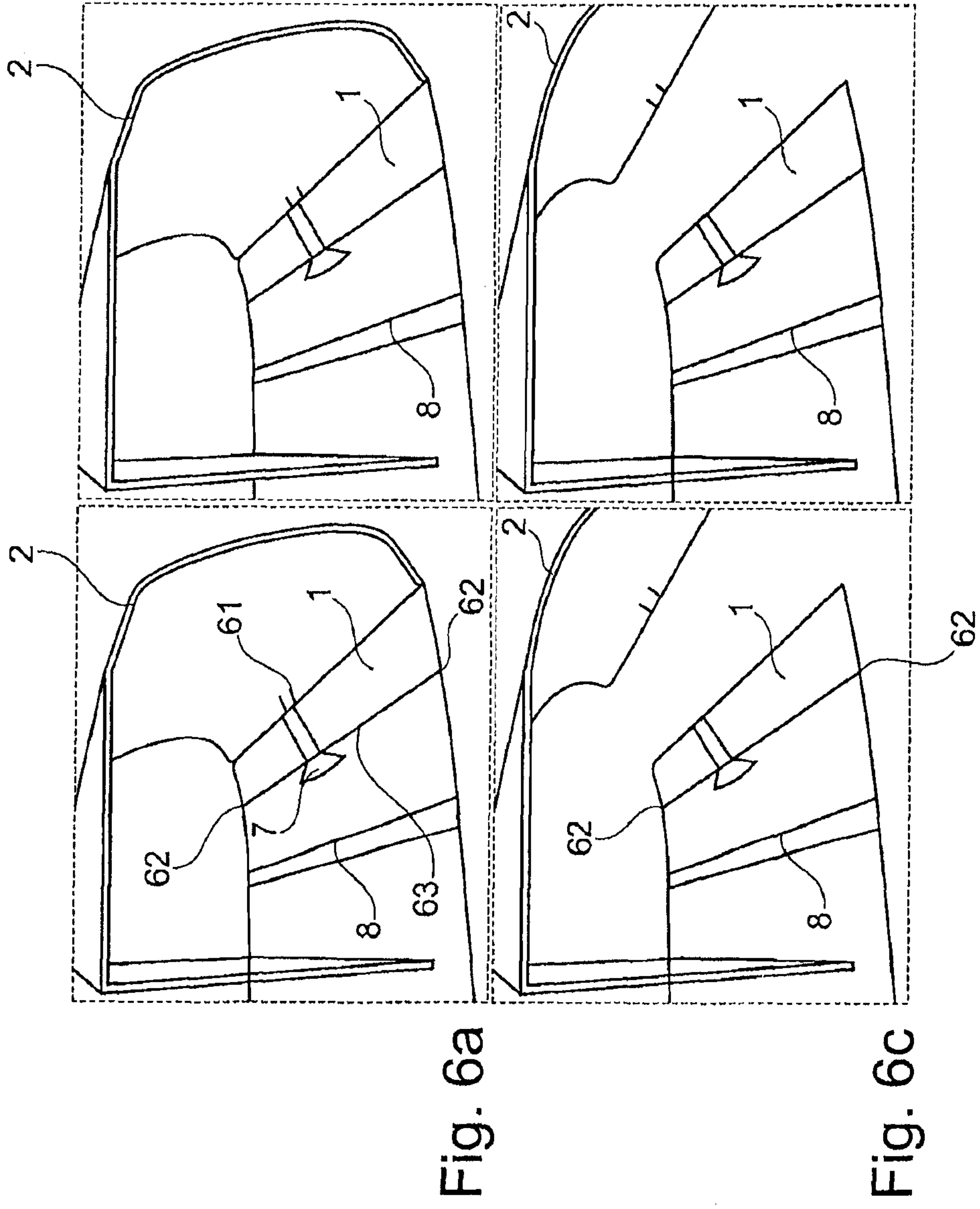


Fig. 6b

Fig. 6d

Fig. 6a

Fig. 6c

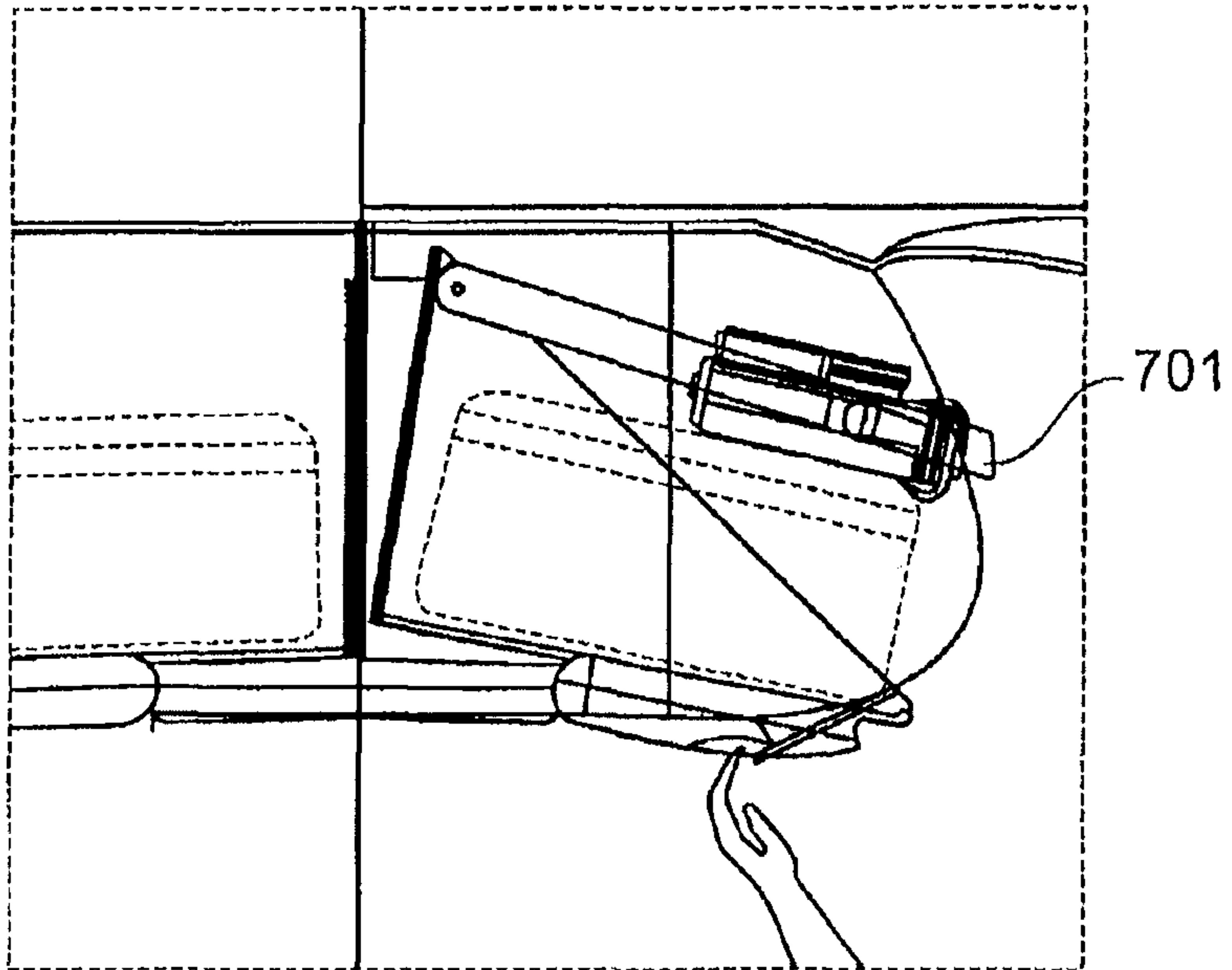


Fig. 7

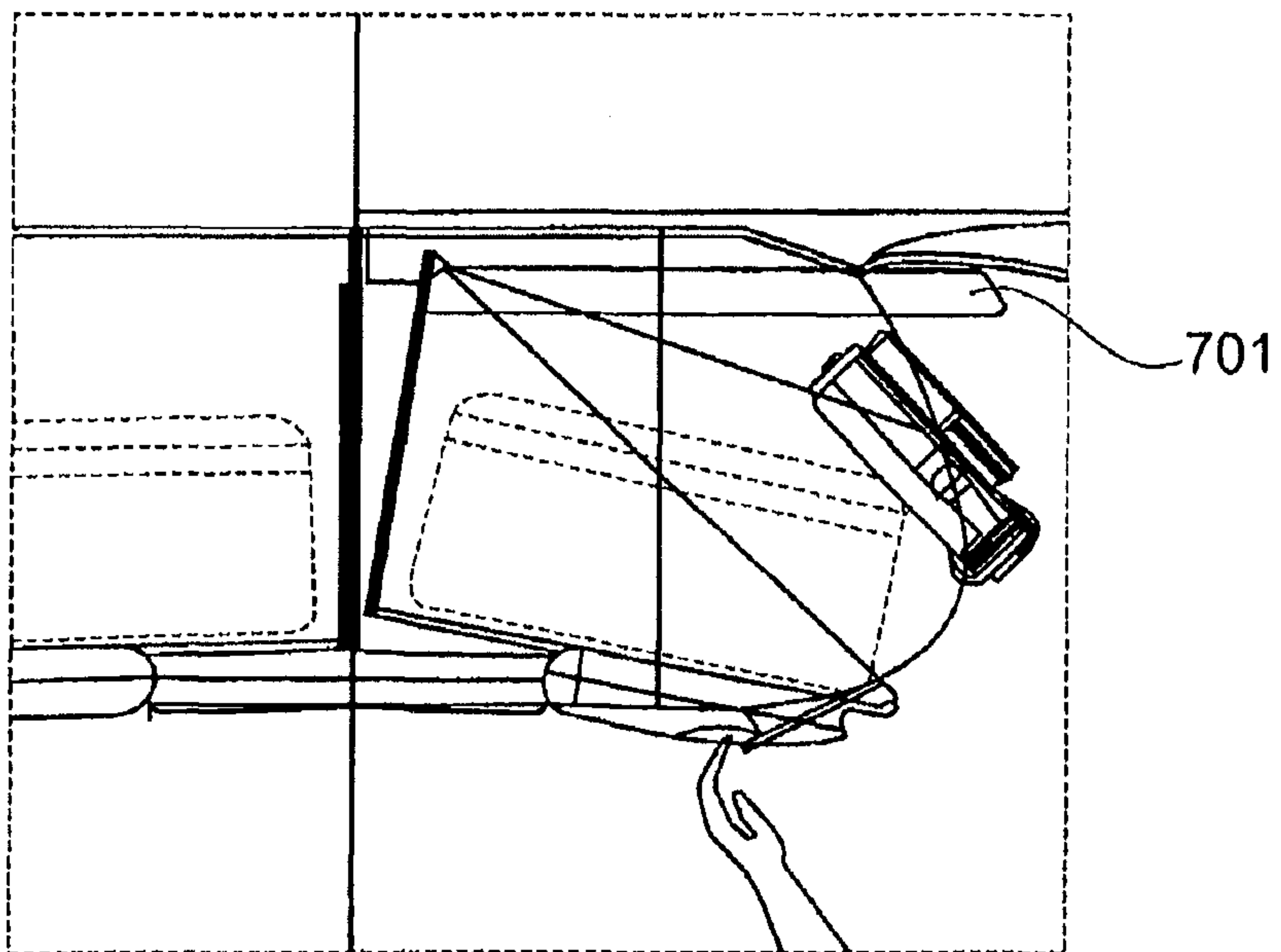


Fig. 8

