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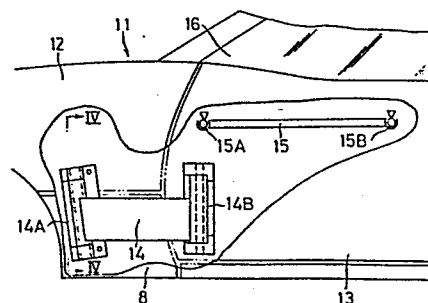
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54 Side door hinge mechanism in motor vehicle.

57 In a side door hinge mechanism in a motor vehicle, wherein a quadric crank chain comprises: a front rotary link (14) interconnecting two points which are disposed at the forward sides of a vehicle body (12) and a side door (13) as rotary centers out of four points including two points disposed on the vehicle body (12) and spaced apart from each other in the longitudinal direction of the vehicle body (12) and two points disposed on the side door (13) and spaced apart from each other in the longitudinal direction of the side door (13); a rear rotary link (15) interconnecting two points disposed at the rear sides as rotary centers; a portion between the two points on the vehicle body (12); and a portion between the two points on the side door (13); the rotary centers (14A, 14B) at opposite ends of one of the rotary links (14, 15) are arranged longitudinally in the vertical direction of the vehicle body (12) to form a rotary shaft (14A) inclined at least to one side so that the upper end portion of the side door (13) can be inclined outwardly in the widthwise direction of the vehicle body (12) when the side door (13) is opened, while, the rotary centers at opposite ends of the other of the rotary links (14, 15) are formed into ball joints (15A, 15B) having degrees of freedom also in the vertical direction of the side door (13).

FIG.3



1 Side door hinge mechanism in motor vehicle

This invention relates to improvements in a side door hinge mechanism in a motor vehicle through the utilization of a
5 quadric crank chain mechanism.

In most cases, the side door in a motor vehicle, e.g. passenger car has heretofore been installed in a manner to be rotatable about a hinge affixed to a vehicle body for
10 opening or closing. In order to allow an occupant of the motor vehicle to open or close the side door for getting on or off the motor vehicle, a door opening angle corresponding to the total length of the side door is required. At this time, when a space outwardly of the motor vehicle is small,
15 there are many cases where it is difficult for the occupant to get on or off the vehicle because the side door cannot be opened sufficiently.

In contrast thereto, there has been proposed a side door
20 hinge mechanism through the utilization of a quadric crank chain mechanism as shown in U.S. Patents Nos. 333,926 and 3,758,990, for example. Furthermore, as shown in Figs. 1 and 2, there has been contrived a side door hinge mechanism in a motor vehicle proposed by the present applicant in
25 Japanese Utility Model Application No. 74913/83, wherein a quadric crank chain comprises: a rotary link 4 interconnecting two points which are disposed at the forward sides of a vehicle body 2 of a motor vehicle 1 and a side door 3 as rotary centers 2A and 3A out of four
30 points including two points disposed on the vehicle body 2 and spaced apart from each other in the longitudinal direction of the vehicle body 2 and two points disposed on the side door 3 and spaced apart from each other in the longitudinal direction of the side door 3; a rotary link 5
35 interconnecting two points disposed at the rear sides as rotary centers 2B and 3B; a portion between the two rotary centers 2A and 2B on the vehicle body 2; and a portion between the two rotary centers 3A and 3B on the side door

1 3.

In the drawings, designated at 6 is a front pillar, 7 a front wheel and 8 a movable fender rotatable with the rotary link 4, respectively.

The side door hinge mechanism utilizing the quadric crank chain makes it possible for the occupant to reduce the necessary space outwardly of the motor vehicle while securing a space at his feet. In consequence, even when the space outwardly of the motor vehicle is small, the occupant can get on or off the motor vehicle by opening or closing the side door 3.

However, as seen in the passenger cars and the like in recent years, for the shape of outer surface of the vehicle body, such a style is adopted that a door glass portion is considerably inclined and curved upwardly and inwardly in the widthwise direction of the vehicle body. Because of this, even when the vehicle body is provided with the side door hinge mechanism utilizing the aforesaid quadric crank chain, such disadvantages have been presented that, when the occupant gets on or off the motor vehicle, the upper end portion of a door frame of the side door or the upper portion of a door glass interferes with the occupant, so that satisfactory performance of getting on or off the vehicle cannot be secured.

To obviate these disadvantages, there has been proposed such a construction of the vehicle body that door hinges are held by a pair of horizontally disposed upper and lower rotary shafts, which can displace the door upwardly and outwardly at the beginning stage of door opening operation, as in U.S. Patent No. 3,166,783 for example. In this case, the door opening or closing operation is difficult to carry out, the operation imparts an unnatural feel to the occupant, the construction comes to be complicated, and the operation becomes further difficult to carry out when the

1 aforesaid construction is applied to the aforesaid door
having the door glass considerably inclined and curved, and
the door is pushingly opened upwardly and outwardly to an
extent where the upper portion of the door does not
5 interfere with the occupant.

Furthermore, as disclosed in U.S. Patent 3,275,370, there
has been proposed an invention, according to which, one of
rotary shafts provided at opposite ends of a link
10 interconnecting a vehicle body and a door is inclined with
respect to the other through the utilization of a slider
link mechanism, so that the door can be inclined outwardly
when the door is opened. However, the slider mechanism is
not applicable to the side door, and further, from the
15 viewpoint of construction, there is a limit to the value of
inclination of the door outwardly when the door is opened.

Furthermore, as described in U.S. Patent 3,095,600 a door
hinging arrangement for vehicle bodies has been proposed in
20 which the door will swing outwardly and upwardly when
moving from a closed to an open position by the utilization
of a first and a second hinge arms, in each of which a
rotary shaft on the vehicle body is inclined and a rotary
shaft on the door has a ball joint, and a control arm
25 connected at opposite ends thereof to be vehicle body and
the door through ball joints.

This door hinging arrangement, utilizing the three arms,
presents such disadvantages that the construction is
30 complicated, a space for receiving the arms becomes
excessively large when the door is closed, and the vehicle
weight is increased.

It is therefor the primary object of the present invention
35 is to provide a side door hinge mechanism in a motor
vehicle, in which, even when such a side door is adopted
that the upper end portion of a door frame or a door glass
thereof is curved or inclined inwardly in the widthwise

1 direction of the vehicle body, an upper body of an occupant
does not interfere with the upper portion of door when the
occupant gets on or off the vehicle, so that satisfactory
performance of getting on or off the vehicle can be
5 secured.

Further, another object of the present invention is to
provide a side door hinge mechanism in a motor vehicle,
utilizing a quadric crank chain mechanism capable of easily
10 opening or closing the door and simplified in construction.

Furthermore, the present invention has as its object to
provide a side door hinge mechanism in a motor vehicle,
which presents advantages that the construction is simple,
15 a space for receiving the arms is small when the door is
closed, and the weight is small.

To the above end, the present invention contemplates that,
in a side door hinge mechanism in a motor vehicle wherein a
20 quadric crank chain comprises: a front rotary link
interconnecting two points which are disposed at the
forward sides of a vehicle body and a side door as rotary
centers out of four points including two points disposed on
the vehicle body and spaced apart from each other in the
25 longitudinal direction of the vehicle body and two points
disposed on the side door and spaced apart from each other
in the longitudinal direction of the side door; a rear
rotary link interconnecting two points disposed at the rear
sides as rotary centers; a portion between the two points
30 on the vehicle body; and a portion between the two points
on the side door; the rotary centers at opposite ends of
one of the aforesaid rotary links are arranged
longitudinally in the vertical direction of the vehicle
body to form a rotary shaft inclined at least to one side
35 so that the upper end portion of the side door can be
inclined outwardly in the widthwise direction of the
vehicle body when the side door is opened, while, the
rotary centers at opposite ends of the other of the

1 aforesaid rotary links are formed into ball joints having
degrees of freedom in the vertical direction of the side
door, whereby, when the door is opened, the upper end,
portion of the door is continuously inclined outwardly in
5 the widthwise direction of the vehicle body, so that the
upper portion of the door does not interfere with the upper
body of the occupant when the occupant gets on or off the
vehicle.

10 To the above end, the present invention contemplates that,
out of the aforesaid pair of rotary shafts, the rotary
shaft on the vehicle body is disposed with the upper
portion thereof inclined forwardly of the vehicle body and
outwardly in the widthwise direction of the vehicle body,
15 and the rotary shaft on the side door is disposed in the
vertical direction.

To the above end, the present invention contemplates that
both the aforesaid pair of rotary shafts are disposed with
20 the upper portions thereof inclined forwardly of the
vehicle body.

To the above end, the present invention contemplates that,
out of the aforesaid pair of rotary shafts, the rotary
25 shaft on the vehicle body is disposed in the vertical
direction, and the rotary shaft on the door is disposed
with the upper portion thereof inclined outwardly of the
vehicle body and inwardly in the widthwise direction of the
vehicle body.

30

To the above end, the present invention contemplates that
in a side door hinge mechanism in a motor vehicle, one of
said rotary links is made to be the rotary link having two
rotary centers disposed at the forward sides of said
35 vehicle body and said side door, made broad in the
direction of the rotary shaft so as to support most of the
load of said side door, and the other of said rotary links
is made to be a control arm for controlling the opening or

1 closing of said door.

To the above end, the present invention contemplates that
in a side door hinge mechanism in a motor vehicle, the
5 rotary center on the vehicle body of said rotary link
having two points at the forward sides of said vehicle body
and said side door as the rotary centers is disposed
outwardly of a front wheel and inwardly of a lower front
fender, and a portion of said lower front fender, which
10 would otherwise interfere with said rotary link, is formed
into a divided movable fender rotatable with said rotary
link.

Fig. 1 is a schematic side view showing the side door hinge
15 mechanism in a motor vehicle, proposed by the present
applicant in another application;

Fig. 2 is a schematic plan sectional view showing a moving
path of the side door when the side door is opened or
20 closed with the side door hinge mechanism being utilized;

Fig. 3 is a schematic side view showing an embodiment of
the side door hinge mechanism in a motor vehicle according
to the present invention;

25

Fig. 4 is a schematic front sectional view taken along the
line IV-IV in Fig. 3;

Fig. 5 is a schematic plan view showing the moving path of
30 the above embodiment when the side door is opened or
closed; and

Figs. 6 and 7 are schematic plan view similar to Fig. 5,
showing second and a third embodiments of the present
35 invention.

Description will hereunder be given of an embodiment of the
present invention with reference to the drawings. As shown

1 in Figs. 3 to 5, according to the present embodiment, in a
side door hinge mechanism in a motor vehicle, wherein a
quadric crank chain comprises: a front rotary link 14
interconnecting two points which are disposed at the
5 forward sides of a vehicle body 12 and a side door 13 as
rotary centers out of four points including two points
disposed on the vehicle body 12 of a motor vehicle 11 and
spaced apart from each other in the longitudinal direction
of the vehicle body 12 and two points disposed on the side
10 door 13 and spaced apart from each other in the
longitudinal direction of the side door 13; a rear rotary
link 15 interconnecting two points disposed at the rear
sides as rotary centers; a portion between the two rotary
centers on the vehicle body 12; and a portion between the
15 two rotary centers on the side door 13; the rotary centers
at the opposite ends of one 14 of the rotary links are
formed into rotary shafts 14A and 14B both being elongate
in the vertical direction of the vehicle body, the forward
rotary shaft 14A is inclined forwardly of the vehicle body
20 12 and outwardly in the widthwise direction of the vehicle
body so that the upper end portions of the door can be
inclined outwardly in the widthwise direction of the
vehicle body when the side door 13 is opened and the rotary
centers at the opposite ends of the other rotary link 15
25 are formed into ball joints 15A and 15B both having degrees
of freedom also in the vertical direction of the side door
13.

In the present embodiment, the rotary shaft 14A of the
30 front rotary link 14 on the vehicle body, for supporting
the forward and portion of the side door 13 is installed in
a manner to be inclined outwardly in the widthwise
direction of the vehicle body and forwardly, whereby, when
the side door 13 is opened, then the upper portion of the
35 side door 13 comes to be inclined outwardly as the side
door 13 as a whole is increased in the opening degree as
shown in Fig. 5. Then, a movable fender 8 is rotated in
unison with the rotary link 14, whereby the rear portion

1 thereof is opened outwardly of the vehicle body.

At this time, the opposite ends of the rotary link 15 are formed into the ball joints 15A and 15B, whereby, even if a height in the vertical direction between the both ball joints 15A and 15B is varied as the side door 13 is opened, the variation in height is easily followed, so that the opening degree of the side door 13 can be controlled.

10 In consequence, the upper portion of the side door 13 is inclined outwardly in the widthwise direction of the vehicle body at the fully opened state of the side door 13, whereby, even if a door glass 16 or a door frame, not shown, is considerably inclined or curved inwardly in the widthwise direction of the vehicle body at the fully closed state of the door, the side door 13 is relieved outwardly at the fully opened state thereof, so that the door does not interfere with the upper body of the occupant when he gets on or off the vehicle.

20 Additionally, in the above embodiment, the rotary shaft 14A of one 14 of the rotary links on the body is inclined outwardly in the widthwise direction of the vehicle body and forwardly, whereby the upper portion of the side door 13 is outwardly inclined when the door is opened. However, the present invention need not necessarily be limited to this, and is applicable to any embodiment in which the upper portion of the side door 13 can be inclined outwardly when the side door 13 is opened.

30 In consequence, both the rotary shafts 14A and 14B disposed at the apposite ends of the rotary link 14 may be inclined forwardly of the vehicle body for example.

35 Fig. 6 shows a moving path of the side door 13 when the door is opened or closed in the above case.

Furthermore, the rotary shaft 14A of the rotary link 14 on

1 the vehicle body may be disposed in the vertical direction
and the upper portion of the rotary shaft 14B on the side
door 13 may be inclined rearwardly of the vehicle body and
inwardly in the widthwise direction of the vehicle body.

5

Fig. 7 shows a moving path of the side door 13 when the
door is opened or closed in the above case.

Furthermore, in the above embodiment, the rotary shaft in
10 the front rotary link 14 is inclined and the opposite ends
of the rear rotary link 15 are formed into the ball joints,
however, this arrangement may be reversed. Additionally,
the rotary link 14 is elongated in the vertical direction,
supports most of the load of the side door 13, while, the
15 rotary link 15 controls the moving path of the side door
13. However, this arrangement may be reversed. Further,
the load of the side door 13 may be supported by members
other than the rotary links 14 and 15.

20 With the above-described arrangements according to the
present invention, the upper portion of the side door may
be inclined outwardly in the widthwise direction of the
vehicle body when the door is opened, so that, even when
the upper portion of the side door is curved or inclined
25 inwardly in the widthwise direction of the vehicle body,
the side door may avoid interfering with the upper body of
the occupant when he gets on or off the vehicle, thereby
offering such an outstanding advantage that the performance
of getting on or off the vehicle by the occupant can be
30 improved.

1 Claims:

1. A side door hinge mechanism in a motor vehicle, wherein a quadric crank chain comprises: a front rotary link (14)
5 interconnecting two points which are disposed at the forward sides of a vehicle body (12) and a side door (13) as rotary centers out of four points including two points disposed on the vehicle body (12) and spaced apart from each other in the longitudinal direction of the vehicle
10 body (12) and two points disposed on the side door (13) and spaced apart from each other in the longitudinal direction of the side door (13); a rear rotary link (15) interconnecting two points disposed at the rear sides as rotary centers; a portion between said two points on the
15 vehicle body (12); and a portion between said two points on the side door (13); the rotary centers at opposite ends of one of said rotary links (14, 15) are arranged longitudinally in the vertical direction of the vehicle body (12) to form a rotary shaft (14A) inclined at least to
20 one side so that the upper end portion of the side door (13) can be inclined outwardly in the widthwise direction of the vehicle body (12) when said side door (13) is opened, while, the rotary centers at opposite ends of the other of said rotary links (14, 15) are formed into ball
25 joints (15A, 15B) having degrees of freedom also in the vertical direction of said side door (13).

2. A side door hinge mechanism in a motor vehicle as set forth in claim 1, wherein out of said pair of rotary shafts
30 (14A, 14B), said rotary shaft (14A) on the vehicle body (12) is disposed with the upper portion thereof inclined forwardly and outwardly in the widthwise direction of the vehicle body (12) and said rotary shaft (14B) on the side door (13) is disposed in the vertical direction.

35

3. A side door hinge mechanism in a motor vehicle as set forth in claim 1, wherein both the upper portions of said pair of rotary shafts (14A, 14B) are inclined forwardly of

1 the vehicle body (12).

4. A side door hinge mechanism in a motor vehicle as set forth in claim 1, wherein out of said pair of rotary shafts
5 (14A, 14B), said rotary shaft on the vehicle body (12) is disposed in the vertical direction and said rotary shaft (14B) on the side door (13) is disposed with the upper portion thereof inclined outwardly of the vehicle body (12) and inwardly in the widthwise direction of the vehicle body
10 (12).

5. A side door hinge mechanism in a motor vehicle as set forth in claim 1, 2, 3 or 4, wherein one (14) of said rotary links (14, 15) is made to be the rotary link having
15 two rotary centers disposed at the forward sides of said vehicle body (12) and said side door (13), made broad in the direction of the rotary shaft (14A, 14B) so as to support most of the load of said side door (13), and the other (15) of said rotary links (14, 15) is made to be a
20 control arm for controlling the opening or closing of said side door (13).

6. A side door hinge mechanism in a motor vehicle as set forth in one of claims 1 to 5, wherein the rotary center
25 (14A) on the vehicle body (12) of said rotary link (14) having two points at the forward sides of said vehicle body (12) and said side door (13) as the rotary centers is disposed outwardly of a front wheel (7) and inwardly of a lower front fender, and a portion of said lower front
30 fender, which would otherwise interfere with said rotary link (14), is formed into a divided movable fender (8) rotatable with said rotary link (14).

FIG.1

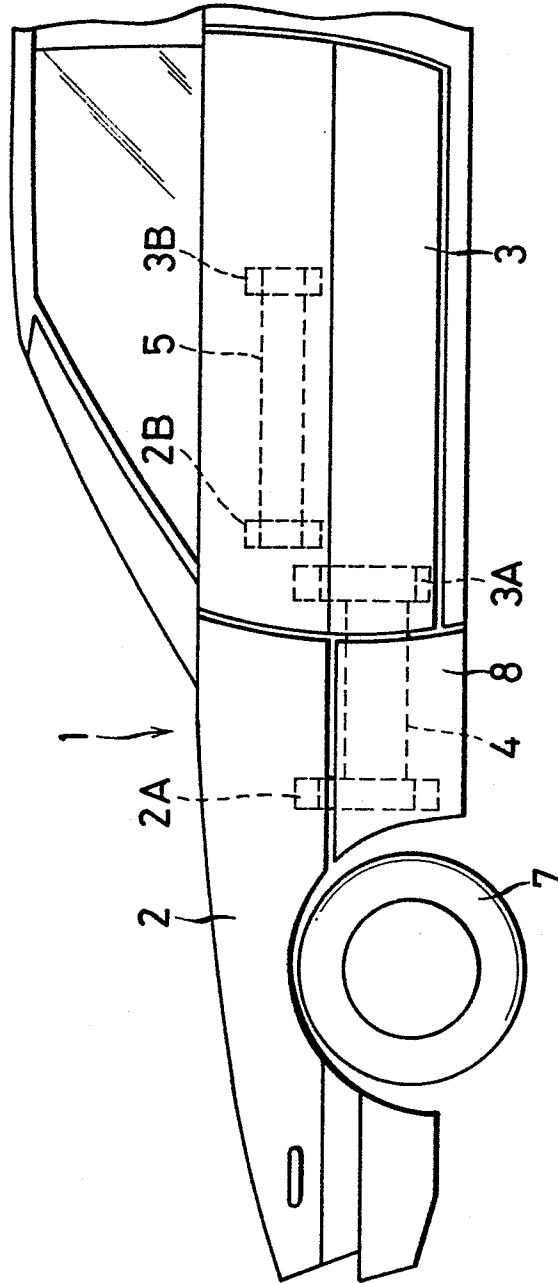


FIG. 2

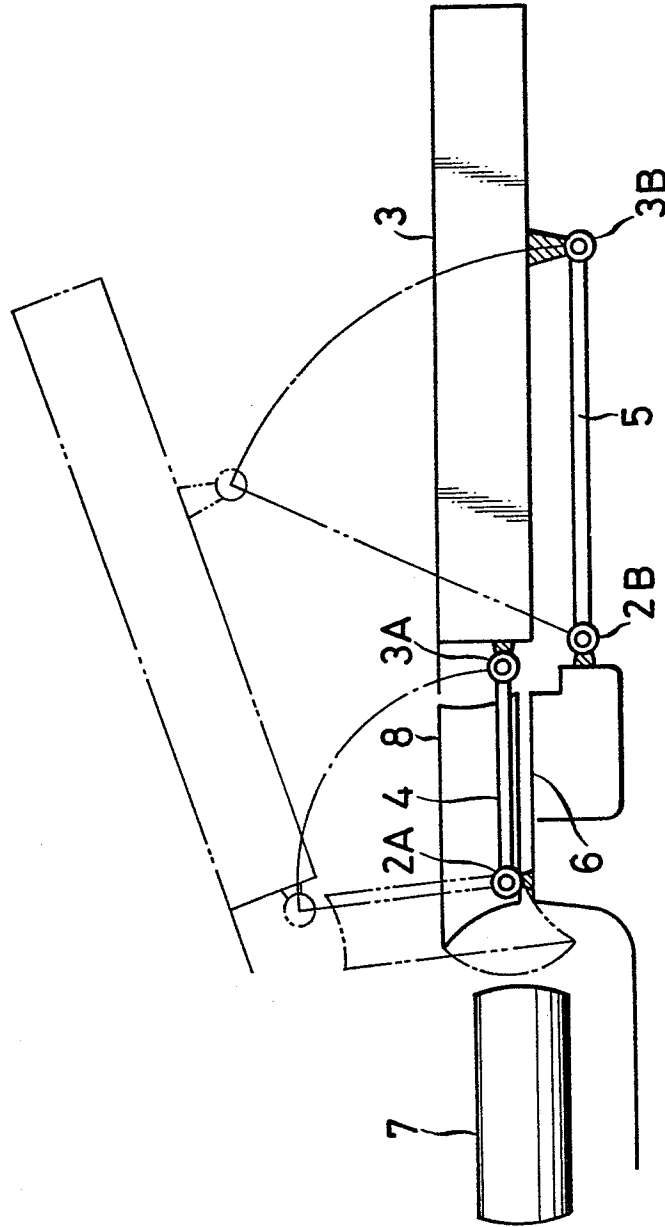


FIG. 4

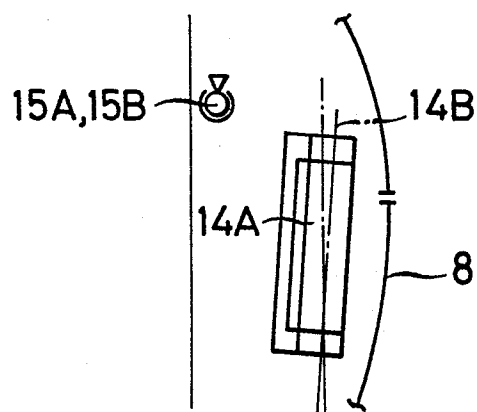


FIG.5

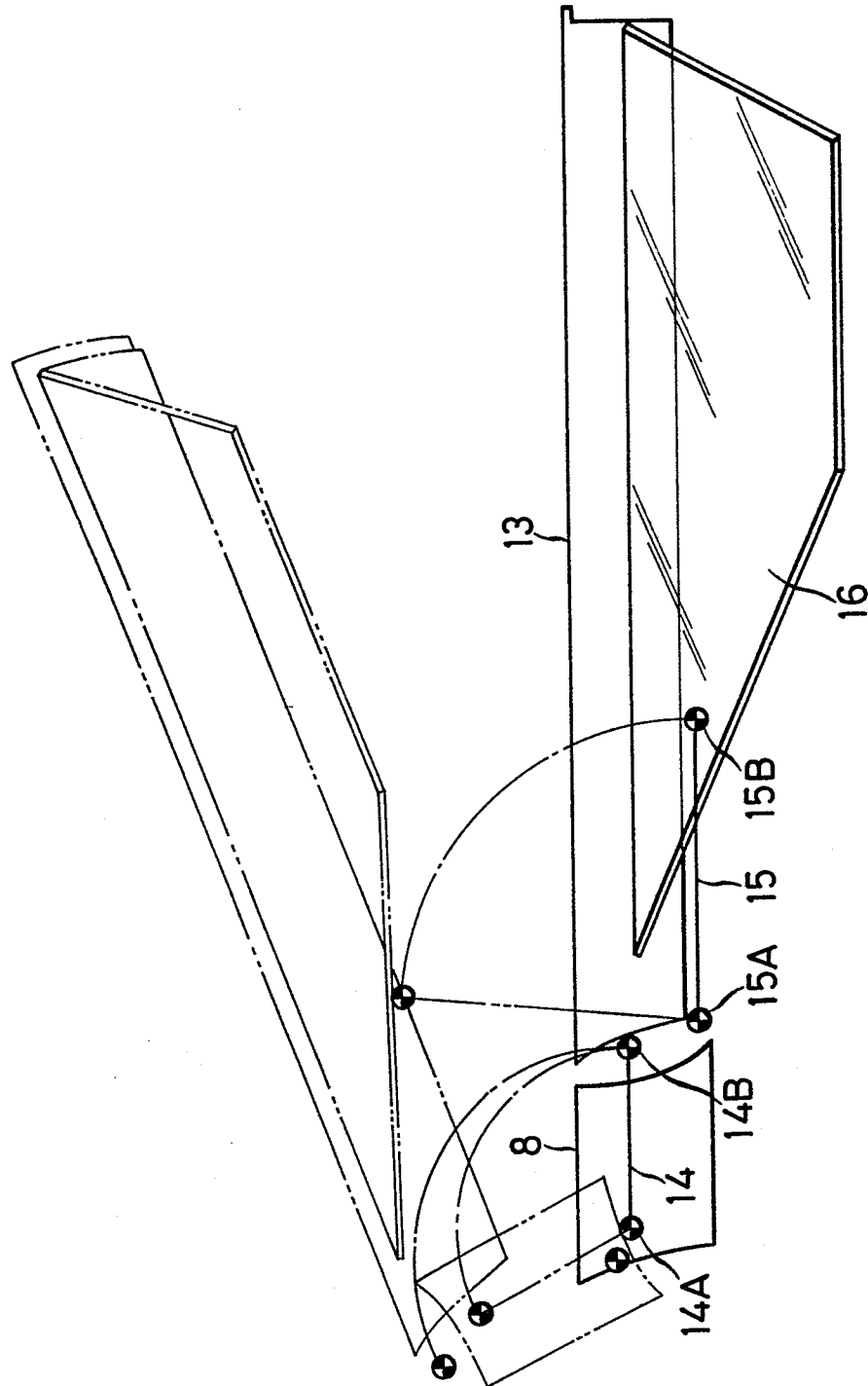


FIG.6

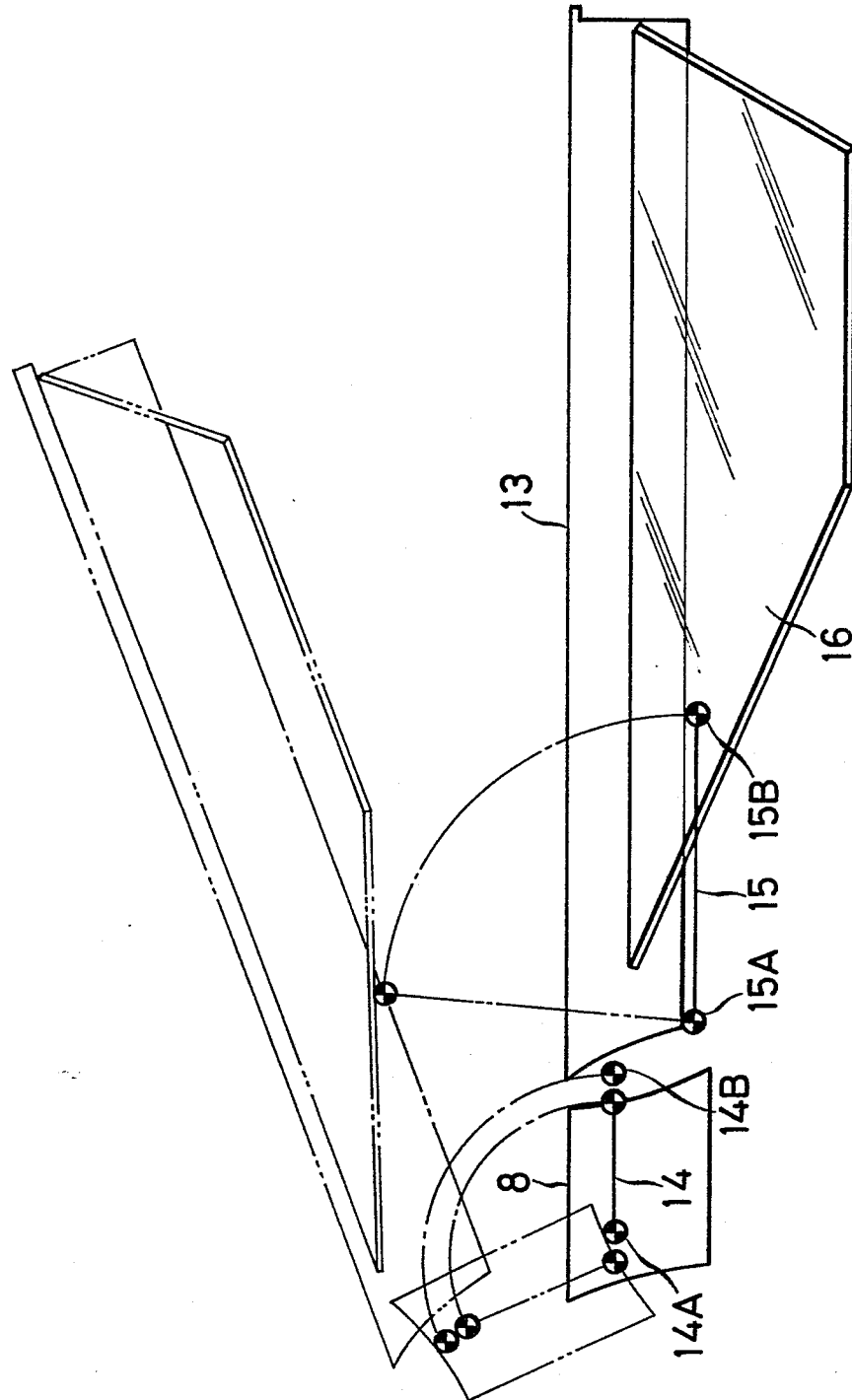


FIG. 7

