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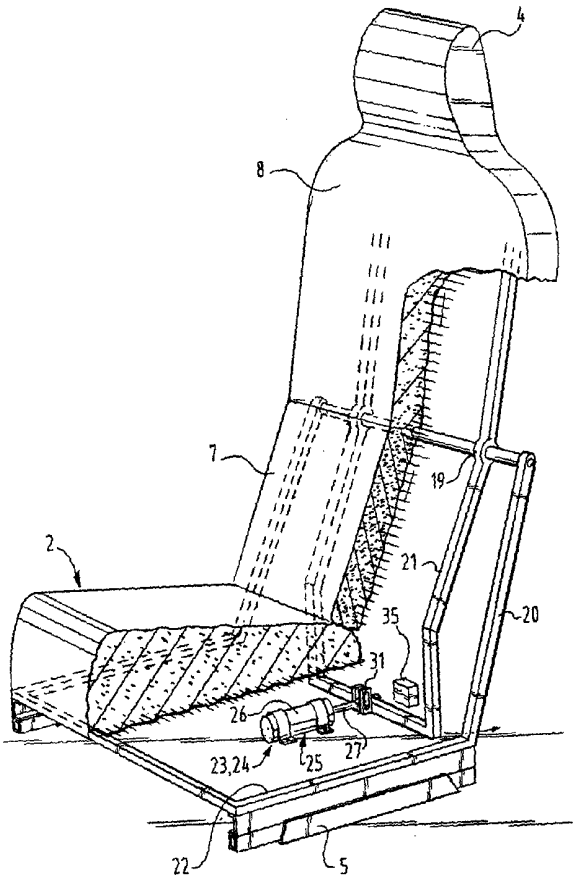

(57) Abstract: The invention relates to a vehicle seat which protects a passenger against the consequences of a rear-end collision, particularly against whiplash. Such a vehicle seat is provided with a seat part (2), an upright seat back (3) connected thereto and means for limiting a jerking movement of the seat back (3) under load. These jerk limiting means can be formed in that the seat back (3) has a rigidity which is variable in height direction. The rigidity of the seat back (3) in the vicinity of the seat part (2) is herein smaller than further from the seat part (2). The less rigid part can be movable, for instance pivotable, relative to the seat part. The jerk limiting means can also be formed in that the seat back (3) is pivotable on an axis located at a distance above the seat part (2). In both cases means can be present for fixing the pivotable parts in their rest position. There can also be means for damping the movement of these parts. These fixation and/or damping means can be adjustable, whereby the degree of damping can be adapted to the mass of the user. The invention also relates to a seat back and to fixation and/or damping means for application in a seat as described above.

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SEAT BACK WITH VARIABLE RIGIDITY FOR VEHICLE SEAT

The invention relates to a seat, particularly for application in a vehicle, provided with a seat part and an upright seat back connected thereto. Such a vehicle seat is generally known.

A problem which occurs in conventional vehicle seats is that they generally do not provide the passengers of a vehicle with sufficient protection in the case of a rear-end collision. In such accidents injury is hereby often caused to the neck and dorsal vertebrae, this being known by the name "whiplash". At the moment whiplash cannot be treated properly, and usually results in prolonged work disability, which entails high costs and much human suffering. Whiplash occurs as a result of high loads on the vertebra and the neck which are a consequence of the great accelerations which the different parts of the body of the passenger undergo at different times during a collision.

In the case of a collision the load generally travels within several tens of milliseconds from the point of first contact in the construction of the vehicle. In the case of a rear-end collision it takes on average about 20 ms before the force reaches the driver's seat. From that point in time it takes about another 20 ms before the force acts on the lower body and pelvis of the passenger, and then roughly another 10 to 30 ms before the upper body and the head of the passenger are also loaded. The total duration of the load on the body is then about 150 ms, wherein the highest values occur after 90 and up to 110 ms.

Owing to this progression of the propagation of the force in the body a lurching movement of the different parts of the body is generated, which results in rotations, lateral displacements and elongations in the spinal column. The cervical vertebrae in particular play

an important part here, as they only allow a limited rotation in rearward direction. Since the neck muscles cannot withstand the occurring forces, rotation, lateral displacement and elongation of the neck occur. This combination of movements of spinal column and neck eventually results in permanent injury in the form of whiplash.

The said movements of the different parts of the body are not cushioned in a conventional vehicle seat, or hardly so. In a conventional seat the seat back will bend rearward when it is loaded on the underside in the first instance by the pelvis of the passenger, which is the first part of the body to respond to the force of the collision. The seat back and the head support hereby move away from the upper body and the head of the passenger, and space is thus created for making said lurching movements when the force finally also acts on the upper body and head. The acceleration of the head in particular which herein occurs can reach a value of 20 to 30 g, which can result in an elongation of the cervical vertebrae of 2 to 15 cm. Such an elongation can be fatal, and will in any case result in permanent injury.

Proposals have already been made to limit the risk of whiplash by embodying a vehicle seat such that the space between the seat back and the body of the passenger remains limited. In EP-A-0 850 155 is thus described a vehicle seat, the seat back of which is slidable and tiltable relative to the seat part. During a rear-end collision the seat back can hereby execute an upward and forward directed pivoting movement round a virtual point of rotation which is situated in front of the seat back. The space between the seat back and the upper body and head is thus reduced in the first instance, and theoretically the lurching movement is therefore reduced. In the case of this seat the seat back is further connected to the seat part for pivotal adjustment in conventional manner, wherein a spring is tensioned between the seat back and the seat part. When the upper

body and head of the passenger are thus finally subjected to the load resulting from the collision and strike against the seat back, this latter pivots to the rear round the pivot axis counter to the force of the spring.

This known seat has a number of drawbacks. Owing to the upward directed component of the pivoting movement an upward directed force will thus be exerted on the upper body in the first instance, whereby the movement thereof is intensified instead of being damped. In addition, because the seat back eventually still pivots rearward round the pivot axis, the body will still be given space for the lurching movement.

The invention therefore has for its object to provide a vehicle seat which provides more protection against the occurrence of whiplash in the case of a rear-end collision. According to the invention this is achieved in such a seat by means for limiting a jerking movement of the seat back under load. By preventing the seat back from jerking further, no great distances occur between the upper body and head of the passenger on the one hand and the seat back with head support on the other, and great accelerations are thus avoided. Particularly the lurching movement of the body is thus limited or even wholly obviated.

In a first embodiment of the invention the jerk limiting means are formed in that the seat back has a rigidity variable in height direction. Differences in the load on the seat back owing to the user being pushed with force thereagainst can hereby be compensated, whereby the deformation of the seat back precisely follows the loads on the body of the user.

In this case the seat back preferably comprises at least two parts, and a part in the vicinity of the seat part is less rigid than a part further removed from the seat part. Through deformation of only the part in the vicinity of the seat part, which is the first part of the seat back which will be loaded by the pelvis of the user being pressed thereagainst, it is thus possible to

prevent the seat back being deformed as a whole and, as it were, bending away from the user. The distance between the head of the user and the seat back and/or head support mounted thereon would hereby increase, whereby the head would eventually strike against the head support at greater speed and therefore more force.

The less rigid part is advantageously movable relative to the seat part. The initial load of the pelvis sliding backward can thus be cushioned by co-displacement of the part of the seat back in the vicinity of the seat part. A structurally simple and properly operating seat is herein obtained when the less rigid part is connected pivotally to the rest of the seat back.

In another embodiment of the invention the jerk limiting means are formed in that the seat back is pivotable on an axis located at a distance above the seat part. Not only is the distance between the seat back and the upper body of the passenger thus prevented from increasing, but this distance is in fact even reduced, since the part of the seat back above the pivot axis moves toward the passenger. In this manner the successive movements of the different body parts can advantageously also be used to damp each other.

In order to give the seat a conventional form in the normal position of use, it is advantageously provided with means for fixing the less rigid part or the seat back in a rest position.

The seat is preferably further provided with means for damping the (pivoting) movement of the less rigid part or the pivotable seat back, thereby preventing too great a load being exerted on the body of the user when the pivotable part or the pivotable seat back reaches the end of its movement. These damping means, into which the fixation means can advantageously be integrated, can for instance comprise a granular or particulate material. A suitable embodiment of such damping means on the basis of a particulate material is described in the earlier, as

yet unpublished Netherlands patent application 1016968 of applicant.

The fixation and/or damping means are however preferably of pneumatic or hydraulic character. These fixation and/or damping means are herein advantageously adjustable as a function of an anticipated load. By adjusting the damping on the basis of the anticipated mass inertia force of the user, the same optimal damping can in principle be realized for any user. This prevents for instance lighter passengers, generally women, undergoing an insufficiently damped movement and eventually being subjected to greater loads than heavier users.

The seat then preferably has means connected to the fixation and/or damping means for measuring a mass inertia force exerted thereon by the user and adjusting the fixation and/or damping means on the basis thereof. The required damping does not therefore have to be adjusted manually, but can be deduced automatically. In a structurally simple embodiment the measuring means are herein adapted to measure a mass generating the mass inertia force in the unloaded state, and comprise for instance at least one pressure sensor.

Measuring of the mass of the user and adjusting of the resistance force preferably takes place only once. During the first use, for instance during starting of a vehicle in which the damping device is arranged, the damping device can thus be adjusted to a desired value, which is then stored in random manner.

The fixation and/or damping means preferably comprise at least one housing which is at least partially filled with a fluid and which is connected to a supply and a discharge for the fluid, and said means can preferably be adjusted by adjusting the resistance in the fluid supply and/or discharge. A seat is thus obtained, the damping of which is very easy to regulate.

The mass-measuring means can otherwise be advantageously connected to the seat part of the seat.

The mass of the passenger can thus be measured in simple manner during normal use of the seat and be used to determine the anticipated mass inertia force in the case of a collision at a determined acceleration.

So as not to be dependent on failure of the fixation means to enable initiation of the damping action of the seat, this latter is preferably provided with controllable means for releasing the fixation means under load.

When the seat comprises a fluid damper, the fixation means preferably comprise a valve blocking the fluid supply and/or discharge, and the release means are adapted to open the valve in the case of loading. The release means can herein comprise at least one shock-sensitive switch, whereby a very rapid reaction is achieved.

The invention also relates to a seat back and to fixation and/or damping means for application in a seat as described above.

The invention is now elucidated on the basis of four embodiments, wherein reference is made to the annexed drawing, in which:

Fig. 1 is a schematic perspective view of a vehicle seat according to a first embodiment of the invention,

Fig. 2A to 2D are schematic cross-sections through the seat of fig. 1 at rest and during different phases of a rear-end collision,

Fig. 3 is a schematic perspective detail view of the seat back according to a second embodiment of the invention,

Fig. 4 is a schematic cross-section through a third embodiment of the seat back,

Fig. 5 is a partly cut-away perspective view of a seat with a seat back according to a fourth embodiment,

Fig. 6 and 7 show cross-sections through a damper applied in the embodiment according to fig. 5 in its rest position and its loaded position,

Fig. 8A-C show in side view a fifth embodiment of the seat according to the invention during different stages of the movement in the case of a rearward directed load by a mass inertia force,

Fig. 9 shows a circuit diagram of the damping means in the seat of fig. 8, and

Fig. 10 shows a circuit diagram of alternative damping means for use in such a seat.

A seat 1 (fig. 1) is formed by a seat part 2, a seat back 3 pivotally connected thereto and a head support 4 mounted on the upper side of the seat back. Seat 1 is mounted on the floor of a vehicle for sliding along rails 5. In the shown embodiment the seat 1 faces toward the direction of travel of the vehicle.

In order to protect a user 6 sitting in seat 1 as well as possible in the case of a rear-end collision (as seen in the direction of travel), seat 1 is adapted to limit further jerking of seat back 3 as much as possible. In the embodiment shown here this is achieved in that the rigidity of seat back 3 is not constant over the whole height thereof. Due to a locally lesser rigidity a local load resulting from a first contact of a part of the body of user 6 with the seat back can be cushioned by a local deformation of that part of seat back 3, without the remaining part of the seat back already being deformed or displaced.

In the shown embodiment the seat back is embodied in two parts 7 and 8, which are pivotally connected to each other by means of a lying hinge 9. The part 7 located in the vicinity of seat part 2 is herein only connected to the remaining part 8, while this part 8 of seat back 3 is connected to seat part 2 in conventional manner for pivoting on a lying axis 16. Each of these parts conventionally comprises a frame 10 respectively 11 to which a cushion body 12 respectively 13 is attached. Frames 10, 11 and cushions 12, 13 are covered with a suitable fabric or type of leather. Materials suitable for cushion bodies 12, 13 are conventional elastic foam

plastics as well as inherently damping plastic materials. Damping means 14 are arranged between the two parts 7, 8. These damping means 14, which are here formed by a granular or particulate material, hold the pivotable part 7 in the position as shown in fig. 2A during normal use, and thus also form the fixation means.

The action of the seat back 3 in the case of a rear-end collision is as follows. During the collision the seat 1 with user 6 thereon is accelerated in forward direction later than the surrounding construction of the vehicle as a result of the mass inertia. This delay generally amounts to about 20 ms, calculated from the start of the collision. Relative to the vehicle the seat 1 and user 6 are thus as it were accelerated in the opposite direction. This acceleration does not herein take place at the same moment at each point of seat 1 and the body of user 6. The seat part 2 of the seat will thus react first, whereby again about 20 ms later the lower body 15 of user 6 is also accelerated and pressed against the movable lower part 7 of seat back 3. This part 7 will hereby pivot rearward round axis 9 relative to the remaining part 8 of the seat back, wherein damping material 14 is compressed (fig. 2B). The remaining part 8 of seat back 3 herein remains in its position for the time being.

Only some time later (in practice in the order of 10 to 30 ms) will the upper body 17 and head 18 of the user also react, and strike against upper part 8 of seat back 3 (fig. 2C). Seat back 3 will hereby eventually be deformed or displaced in its entirety (fig. 2D). Since the deformation or displacement of the seat back only takes place with some delay relative to the moment of the first contact, the distance between the back, neck and head of user 6 on the one hand and seat back 3 and head support 4 on the other is prevented from being increased immediately. The body of user 6 could in that case develop a relatively high speed, whereby the load on the

body, and thereby the chance of the occurrence of whiplash, would also increase.

Instead of being embodied pivotally, the part 7 with lesser rigidity could also be movable in other manner. This part 7 could for instance be slidable substantially transversely of the plane of seat back 3 (fig. 3). The damping means 14 and fixation means could herein be formed by a number of combined spring/damper units 18 arranged spread over part 7.

The part 7 with lesser rigidity does not necessarily have to be movable relative to the rest of seat back 3. It is also conceivable for the cushion body 12 of this part 7 to simply take a less rigid form than cushion 13 of the remaining part 8 of seat back 3 (fig. 4). When cushion bodies 12, 13 are filled with a granular or particulate material, the chosen degree of filling of cushion 12 can be slightly lower than that of cushion 13. The degree of filling must however remain so high herein that the difference in rigidity is not perceptible in normal use, but only becomes noticeable at an extremely high load in the case of a rear-end collision.

In an embodiment of seat 1 which is recommended at this moment, not only the bottom part 7 but also the whole seat back 3 take a pivotal form. For this purpose the frame 21 of seat back 3 is connected by means of bearings 19 to a fixed frame part 20, which is mounted (optionally adjustably) on frame 22 of seat part 2 (fig. 5). Bearings 19 are once again arranged at roughly the same height as hinge 9 in the embodiment of fig. 1 and 2, i.e. roughly at the position of the lower thoracic and upper lumbar vertebrae of the user, so that the lower part 7 of the seat back is again movable in the same manner. The significant difference is however that in this embodiment there is not only ensured that the upper part 8 of seat back 3 does not jerk rearward, but that this part 8 is even moved actively forward.

In this embodiment means 23 are also present for fixing the seat back 3 into a neutral position in normal

use, in addition to means 24 for damping the pivoting movement of the seat back. Fixation means 23 and damping means 24 are combined in a spring/damper combination 25, which is arranged between a bottom end of pivotable frame 21 and fixed frame 20. Spring/damper combination 25 here comprises a pneumatic damper formed by a cylinder 26 which is attached to fixed frame 20 and in which a piston 27 is movable, wherein piston 27 is urged to its neutral position by means of a fixation spring 28. The free end 29 of piston 27 is received in a slot 30 in a connecting block 31 fixed to frame 21.

Cylinder 26 is almost completely open at one end in order to ensure a rapid outward stroke of piston 27 and thereby a rapid reaction of seat back 3. The outward stroke is otherwise bounded by two stops 34, 35 in and outside spring/damper combination 25. On the opposite side the cylinder 26 is provided with a number of calibrated openings 32 which are closed by non-return valves 33. These valves 33 do not close the openings completely, so that air can also be pressed out of cylinder 26 during the return stroke of piston 27, be it that the resistance is then considerably higher, whereby this return movement is well damped.

In contrast to the foregoing embodiments, the whole movement of the seat back here therefore takes place round pivot axis 19, roughly halfway along seat back 3. No pivoting movement of seat back 3 takes place round the connecting line of seat back 3 and seat part 2.

In this embodiment the seat back 3 is likewise provided with two different cushion bodies 12, 13 with varying rigidity. Here however, the rigidity of the lower cushion body 12 is herein greater than that of the upper cushion body 13. On the one hand a rapid reaction of seat back 3 is thus ensured, since the movement of the pelvis of the passenger is properly transmitted by the relatively rigid cushion 12 to pivotable frame 21, while on the other hand the cushioning of the upper body and

head of the passenger takes place in properly damped manner in the softer cushion 13.

In yet another embodiment of the seat 101 according to the invention (fig. 8), not only is seat back 103 pivotable relative to the frame 120 connected to seat part frame 122, but the head support 104 is in turn also pivotable via a hinge 139 on the upper side of seat back 103. The underside of head support 104 is connected to the upper part of the upright part 120 of the fixed frame by means of a bounding element 140, for instance a cable, whereby the movements of head support 104 are bounded.

The pivotable seat back 103 is provided on its underside with an extension 131. This extension 131 is connected on one side to the fixed seat part frame 122 via a breaking pin 123, whereby the pivotable seat back 104 is fixed during normal use. In addition, the extension 131 is connected to damping means 124, which are in turn likewise connected to the fixed seat part frame 122. In the shown embodiment the damping means 124 comprise a piston-cylinder combination, the cylinder 126 of which is pivotally connected with one end 135 to the seat part frame 122, while the free end 137 of piston 127 is pivotally connected to extension 131.

The resistance force which is exerted by damping means 124 to absorb a mass inertia force is adjustable according to the invention as a function of this force of inertia. Connected for this purpose to damping means 124 are means 118 for measuring the mass inertia force and adjusting damping means 124 on the basis thereof. These measuring means can for instance be adapted to measure the weight G of the person sitting down on seat 101, since this weight is of course directly linked to the mass inertia force at a determined acceleration.

In the shown embodiment the measuring means 118 are of pneumatic nature, and comprise a pneumatic pressure sensor 151 which is arranged in seat part 102 and which is connected over a line 152 having therein a controllable valve 153 to a control input 154 of an

adjustable throttle valve 155. In the shown embodiment the valve 153 is connected controllably to ignition lock 169 of the vehicle in which seat 101 is mounted, for the purpose of determining and then storing the weight of a user at the start.

Adjustable throttle valve 155 is received in a line 156 which leads to one side 157 of cylinder 126. On the other side 158 the cylinder 126 is connected to a second line 159. Both lines 158, 159 are provided on their free end with inlet and outlet combinations 161, 162, which each comprise a relatively large inlet opening 163 closable by a return valve 164, and an adjustable calibrated outlet opening 132. The inlet and outlet combinations 161, 162 are also further provided with filters (not shown here), whereby dirtying of the damping means 124 is prevented and which also function as sound dampers.

In the shown embodiment the adjustable throttle valve 155 also has, in addition to the actual throttle 166, a bypass line 167 having therein a non-return valve 168. In this manner the throttle 166 influences the resistance force of the piston-cylinder combination in only one stroke direction of piston 127. Bypass line 167 can of course be omitted when it is desirable to influence the movement of piston 127 in both directions.

The operation of damping means 124 in vehicle seat 101 is now as follows. When a user sits in the seat 101, the pressure sensor 151, which can for instance comprise a membrane, is loaded, whereby a pressure proportional to the weight G of the user will result in the part of line 152 upstream of the momentarily still closed valve 153. If contact is now made, the valve 153 is then moved to its open position by ignition lock 169, whereby the pressure of sensor 151 becomes perceptible in the whole line 152, and throttle valve 155 is thus adjusted. When the vehicle is set into motion, ignition lock 169 closes valve 153, whereby the control pressure in line 152 and

thereby the adjustment of throttle valve 155 is thus stored during driving.

When seat 101 with the user therein is now subjected to a high forward acceleration, particularly in the case of a rear-end collision, the body of the user will not be able to follow the forward movement of seat 101 quickly enough as a result of the mass inertia, and will thus move rearward relative to seat 101. This movement begins roughly 20 ms after seat 101 is subjected to the acceleration, which in turn will be about 20 ms after the beginning of the collision. The pelvis of the user herein first comes into contact with the lower part of the seat back which is loaded by a force Fb. Because this force Fb engages below hinge point 119, the pivotable seat back 103 will pivot from its unloaded position (shown in fig. 8A and with dotted lines in fig. 8B) round this hinge point 119 such that the upper part moves forward with hinge 139 to the position shown with full lines. Here the upper body of the user is thus already pressed slightly into the cushion of the seat back. Pivotable head support 104 is also moved forward and in addition, as a result of this movement, pivots even further forward on hinge 139, from the position shown with dash-dot lines to an end position which is shown with full lines and which is determined by bounding element 140. Owing to this extra forward movement of head support 104 the head of the user can be cushioned in good time. These movements of seat back 103 and head support 104 have the further consequence that these parts come to stand practically upright, whereby the component of the acceleration along the surface of seat back 103 and head support 104 becomes practically zero or even negative. This is important with a view to limiting the lurching movement and avoiding elongation.

During the rearward pivoting movement of the lower part of the seat back the breaking pin 123 is broken and piston 127 of damping means 124 is drawn out of cylinder 126. Air is herein drawn into the side 157 of cylinder

126 via inlet and outlet combination 161, line 156 and throttle valve 155, while air is simultaneously driven out from the other side 158 of cylinder 126 via line 159 and inlet and outlet combination 162. The indrawn air flows through the relatively large inlet opening 164 and through valve 168 into bypass line 167, while the driven-out air escapes through the calibrated outlet opening 132. In the shown embodiment this opening is herein adjusted such that the outward stroke of the piston can take place in about 20 ms. The movement of the pelvis is thus damped.

In a second phase of the movement of the body of the user, the upper body (after about 10 ms) and the head (after about 30 ms) are also set into motion and strike against seat back 103 and head support 104 of seat 101. A rearward directed load Fr respectively Fh is herein exerted on these parts. In the first instance these loads are counteracted by the forward directed rotational force -Fb of the part of seat back 103 located above the pivot axis, whereby the movement of the upper body is therefore in fact damped by that of the pelvis. When the loads on the upper body and head become greater than the reactive force of the pelvis, both the head support 104 and the lower part of seat back 103 are again pivoted rearward on their pivot axes 139 respectively 119 (fig. 8C). The rearward pivoting movement of head support 104 is once again bounded by bounding element 140, thereby preventing the head of the user swinging backward, which could result in severe injury. The rearward pivoting movement of seat back 103 is now damped by damping means 124.

During the rearward movement of seat back 103 the piston 127 is pressed back into cylinder 126, whereby on the one side 158 air is drawn in via inlet and outlet combination 162, while on the other side 157 the air is driven out by piston 127 via line 156, throttle valve 155 and inlet and outlet combination 161. The indrawn air once again flows through the relatively large inlet opening 164, while the driven out air can now not flow

through bypass line 167 but is forced through throttle 166, the resistance of which is adjusted as a function of the weight of the user. Because the resistance is thus proportional to the weight of the user, the deceleration of the body will be substantially the same for each user. This deceleration can thus be set to a value by a suitable choice of the adjustment of throttle 166 such that injury, in particular whiplash, is prevented.

In yet another embodiment (fig. 10), the measuring means 218 are electrically connected to damping means 224. Measuring means 218 once again comprise a pressure sensor 251 in the form of a membrane, which is connected to a pressure difference meter 273. This pressure difference meter 273 is connected to a central processing unit 274 with a memory and a control block 275 for an adjusting motor 276. Central processing unit 274 is permanently powered, for instance by a battery 277 of the vehicle 271 in which the seat is arranged. Adjusting motor 276 is connected to the adjustable throttle 266 of throttle valve 255.

In this embodiment two damping cylinders 226 are present, each comprising a piston 227 with continuous rod. Both piston rods are connected to the movable part of seat back 203. Both cylinders 226 form a closed system, with combined supply and discharge lines 256, 259 for the fluid present therein.

Further received in fluid line 259 is a controllable blocking valve 223 whereby the flow of fluid through lines 256, 259 is prevented under normal conditions, and the movable part of seat back 203 is thus fixed. This blocking valve 223 is embodied as an electromagnetic valve loaded by a spring 278, and is connected to a circuit 270 which extends from front to rear through vehicle 271. Shock-sensitive switches 272 are arranged in this circuit 270 on the front and rear side of vehicle 271.

Central processing unit 274 is adapted to carry out a zero value measurement or taring when a door of vehicle

271 is opened. In this taring the pressure on membrane 251 is measured and stored in the memory of central processing unit 274. When a passenger has then sat down on the seat, a new measurement is performed. This preferably takes place as soon as vehicle 271 begins to move, since it is then in any case certain that the passenger is sitting wholly in the seat, and a correct measurement can thus be performed. Sensors in the drive line can for instance be used for this purpose. The difference between the two measured values of the pressure forms a measure for the weight of the passenger, which can be used to adjust the damping force of cylinders 226, by further opening or closing throttle valve 255.

Although the invention is elucidated above on the basis of a number of embodiments, it will be apparent that it is not limited thereto, but can be varied in many ways within the scope of the appended claims. The seat back could thus consist of more than two separate parts, whereby the progression of the displacement of the body of the user could be followed even more precisely. In addition, the position of the hinge connection between the two parts could be chosen at a different height than is shown here. Instead of a purely pivoting movement of the seat back, a sliding movement along a curved path could also be envisaged, whereby a part of the seat back still moves rearward and another part thereof moves forward.

Instead of pneumatically operating damping means, a choice could be made for hydraulic or even mechanical damping, for instance such as described in NL 1016968. In addition, the pressure sensor(s) could be arranged at positions other than in the seat part, for instance in the frame of the seat or even under the seat, in the seat rail or vehicle base, while it is also conceivable for a user to adjust the damping by entering his weight. It is even not inconceivable for a separate damper to be wholly

omitted, and to suffice with the mutual damping of the different successive movements of the body parts.

The scope of the invention is therefore defined solely by the claims.

CLAIMS

1. Seat, particularly for application in a vehicle, provided with a seat part and an upright seat back connected thereto, **characterized by** means for limiting a jerking movement of the seat back under load.

2. Seat as claimed in claim 1, **characterized in that** the jerk limiting means are formed in that the seat back has a rigidity which is variable in height direction.

3. Seat as claimed in claim 2, **characterized in that** the seat back comprises at least two parts, and a part in the vicinity of the seat part is less rigid than a part further removed from the seat part.

4. Seat as claimed in claim 3, **characterized in that** the less rigid part is movable relative to the seat part.

5. Seat as claimed in claim 4, **characterized in that** the less rigid part is connected pivotally to the rest of the seat back.

6. Seat as claimed in claim 1, **characterized in that** the jerk limiting means are formed in that the seat back is pivotable on an axis located at a distance above the seat part.

7. Seat as claimed in any of the claims 4-6, **characterized by** means for fixing the less rigid part or the seat back in a rest position.

8. Seat as claimed in any of the claims 4-7, **characterized by** means for damping the (pivoting) movement of the less rigid part or the seat back.

9. Seat as claimed in claim 8, **characterized in that** the fixation means are integrated with the damping means.

10. Seat as claimed in any of the claims 7-9, **characterized in that** the fixation and/or damping means comprise a granular or particulate material.

11. Seat as claimed in any of the claims 7-9, **characterized in that** the fixation and/or damping means are of pneumatic or hydraulic character.

12. Seat as claimed in any of the claims 7-11, **characterized in that** the fixation and/or damping means are adjustable as a function of an anticipated load.

13. Seat as claimed in claim 12, **characterized by** means connected to the fixation and/or damping means for measuring a mass inertia force exerted thereon and adjusting the fixation and/or damping means on the basis thereof.

14. Seat as claimed in claim 13, **characterized in that** the measuring means are adapted to measure a mass generating the mass inertia force in the unloaded state.

15. Seat as claimed in claim 14, **characterized in that** the measuring means comprise at least one pressure sensor.

16. Seat as claimed in claim 14 or 15, **characterized in that** measurement of the mass and adjustment of the resistance force take place only once.

17. Seat as claimed in any of the claims 12-16, **characterized in that** the fixation and/or damping means comprise at least one housing which is at least partially filled with a fluid and which is connected to a supply and a discharge for the fluid, and can be adjusted by adjusting the resistance in the fluid supply and/or discharge.

18. Seat as claimed in any of the claims 14-16, **characterized in that** the mass-measuring means are connected to the seat part.

19. Seat as claimed in claims 12-18, **characterized by** controllable means for releasing the fixation means under load.

20. Seat as claimed in claims 17 and 19, **characterized in that** the fixation means comprise a valve blocking the fluid supply and/or discharge, and the release means are adapted to open the valve in the case of loading.

21. Seat as claimed in claim 19 or 20, **characterized in that** the release means comprise at least one shock-sensitive switch.

22. Seat back evidently intended for application in a seat as claimed in any of the foregoing claims.

23. Fixation and/or damping means evidently intended for application in a seat as claimed in any of the claims 7-21.

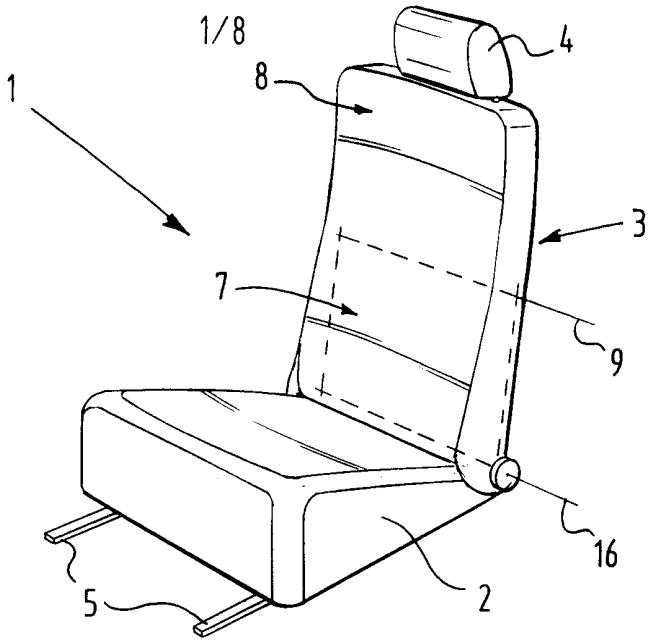


FIG. 1

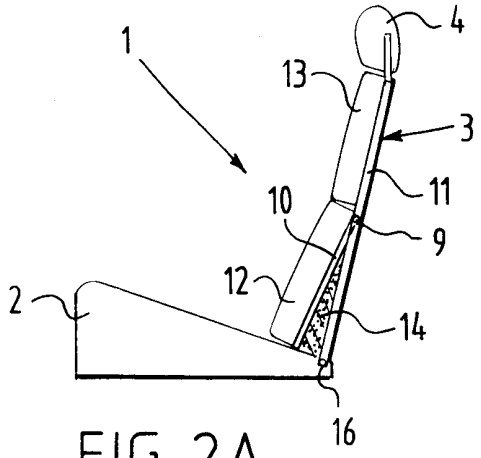


FIG. 2A

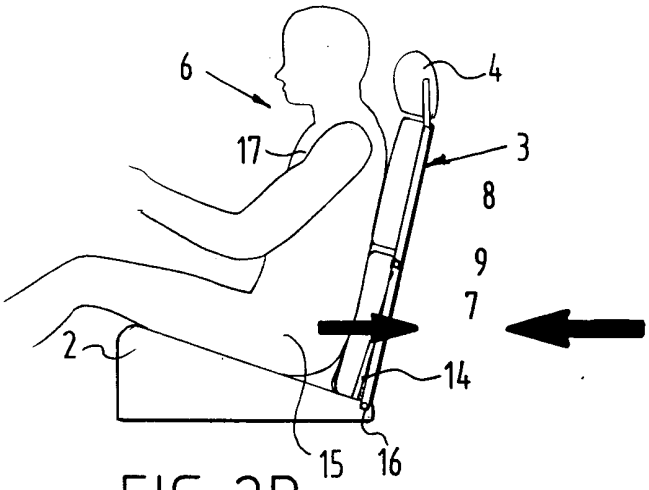


FIG. 2B

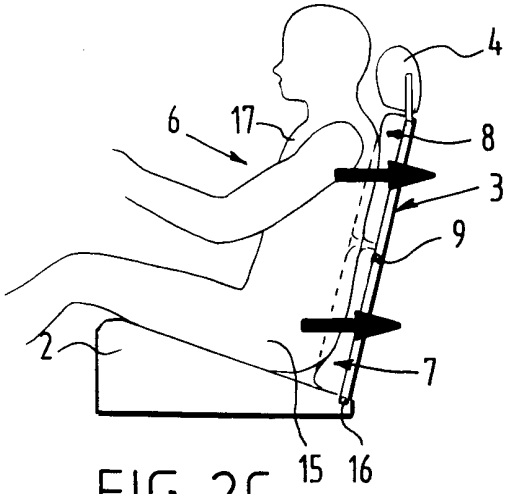


FIG. 2C

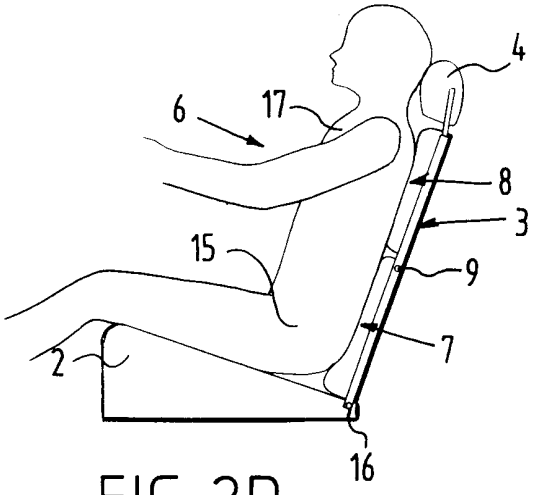
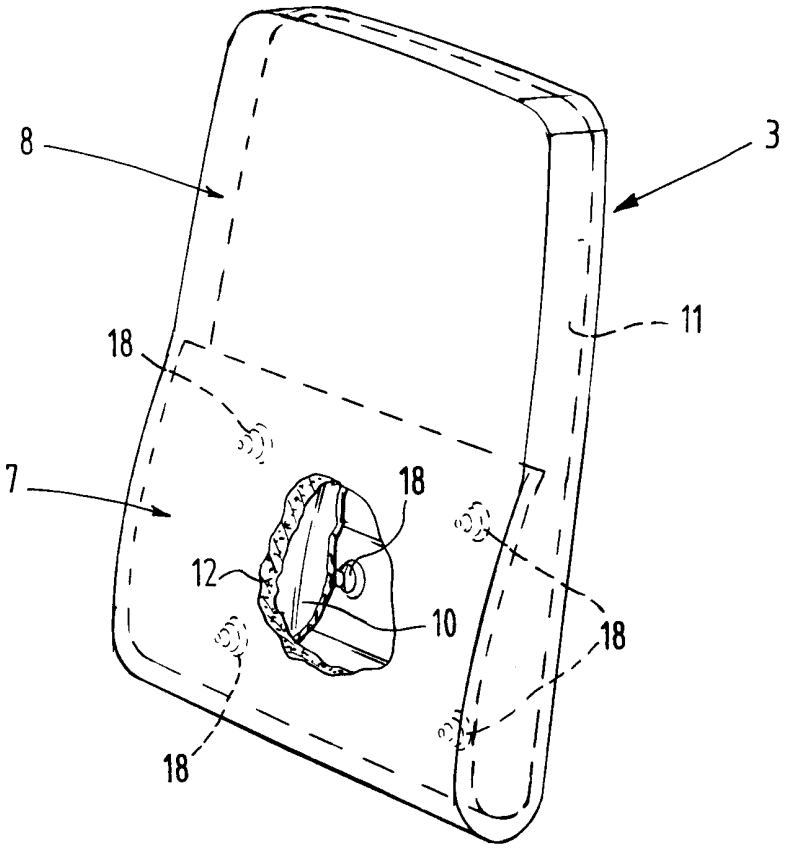


FIG. 2D



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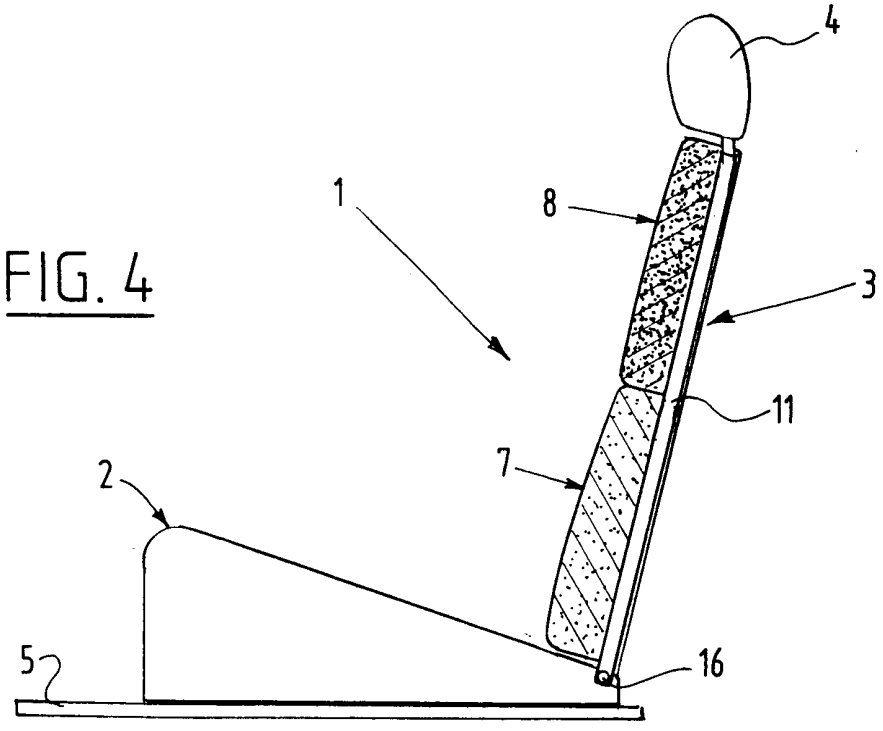
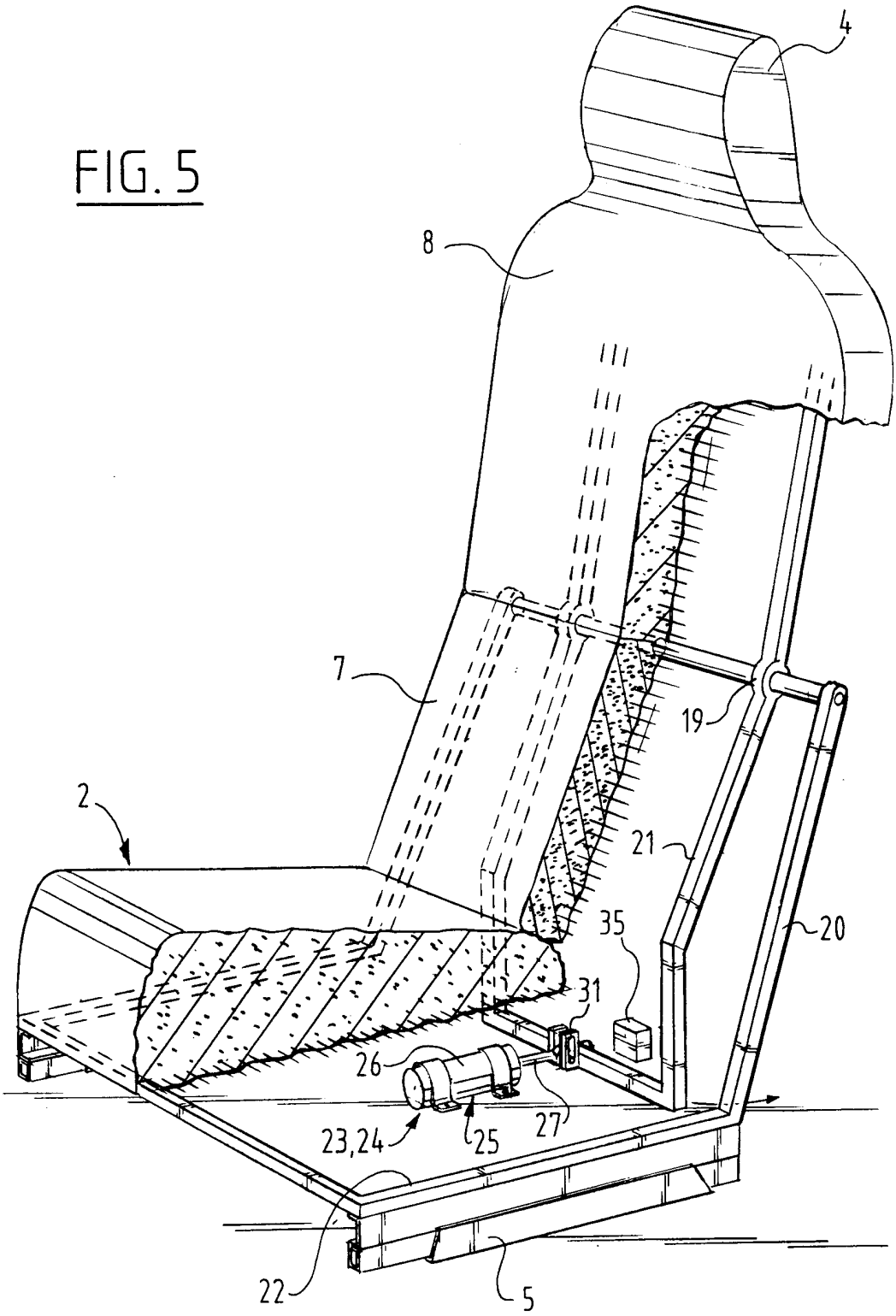
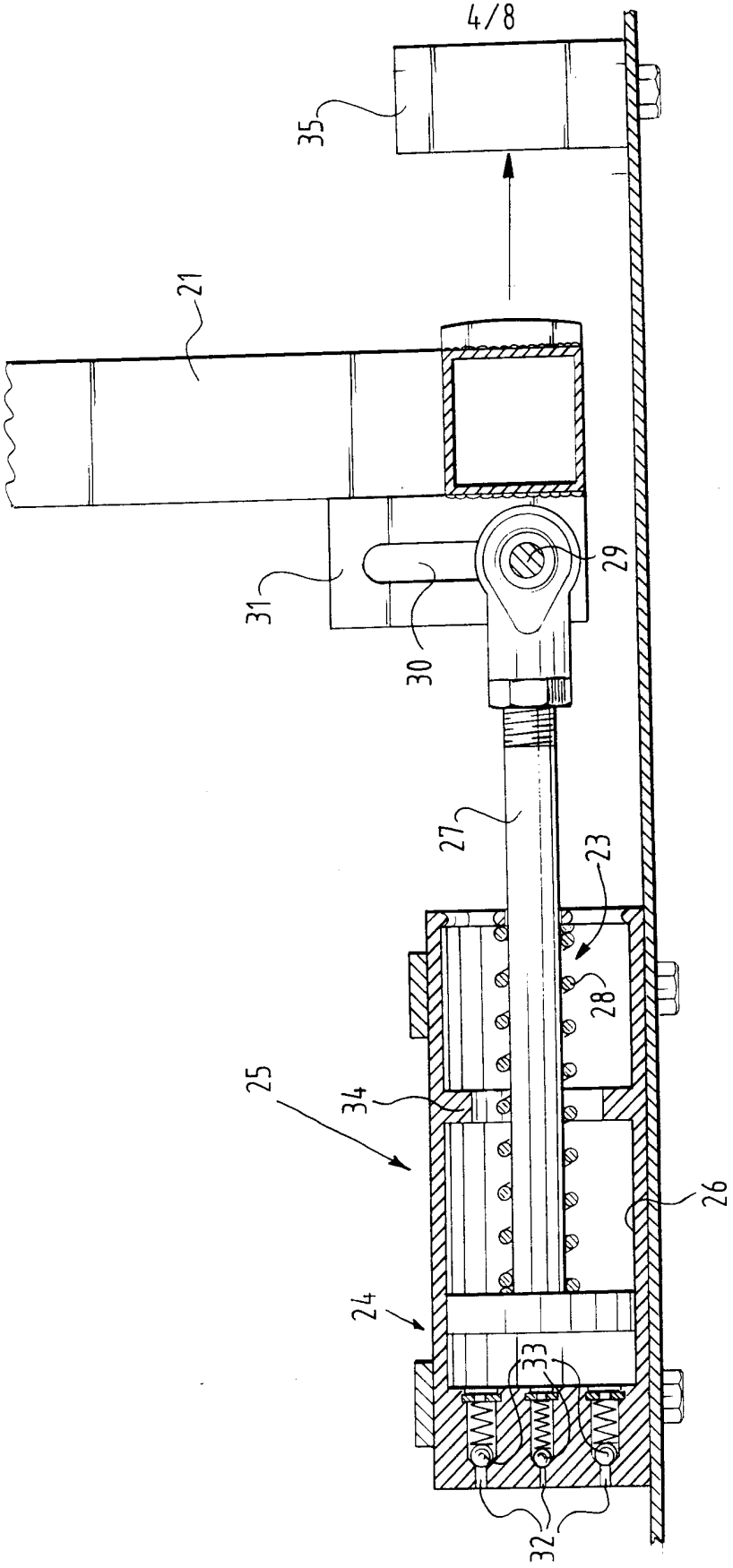


FIG. 4

FIG. 5





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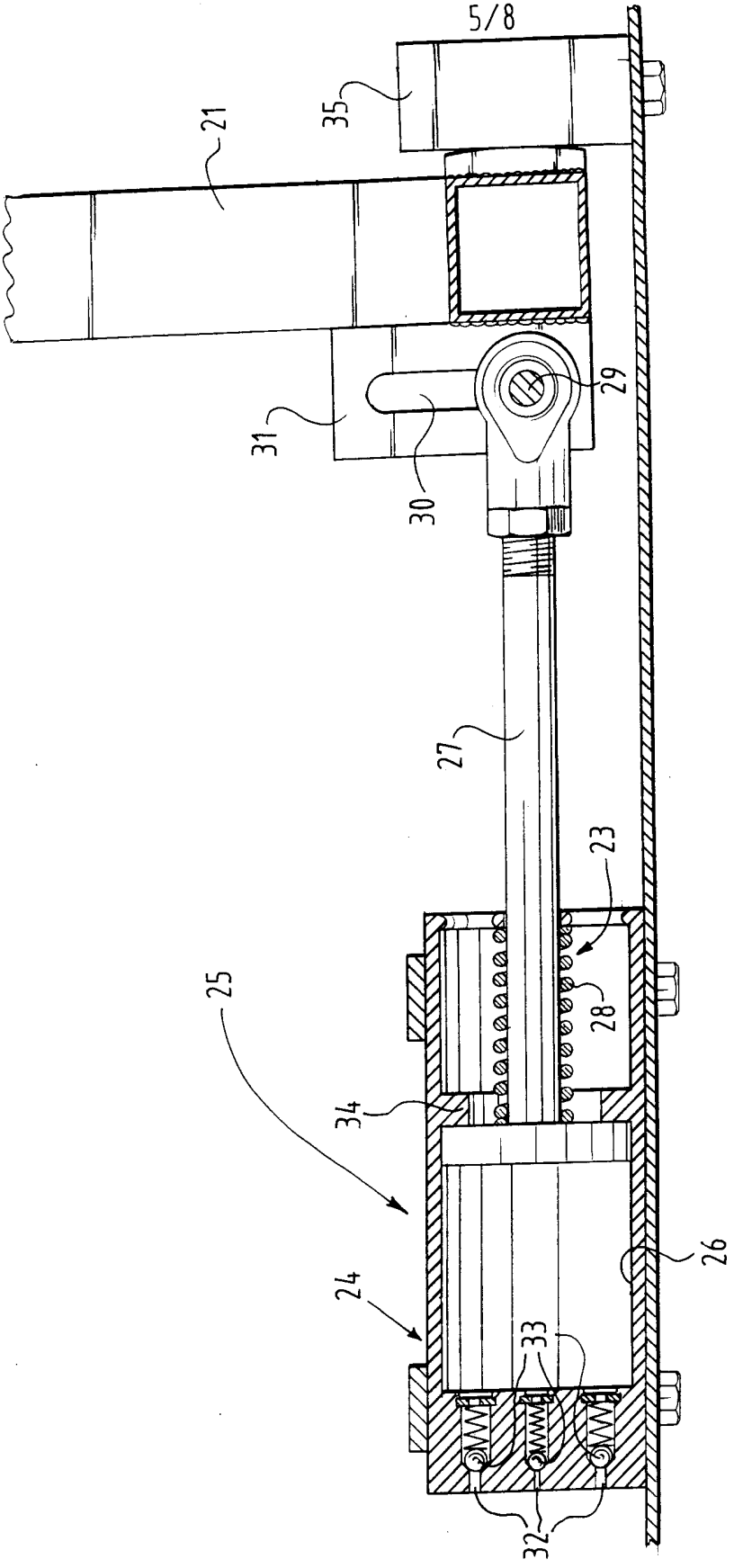

FIG. 7

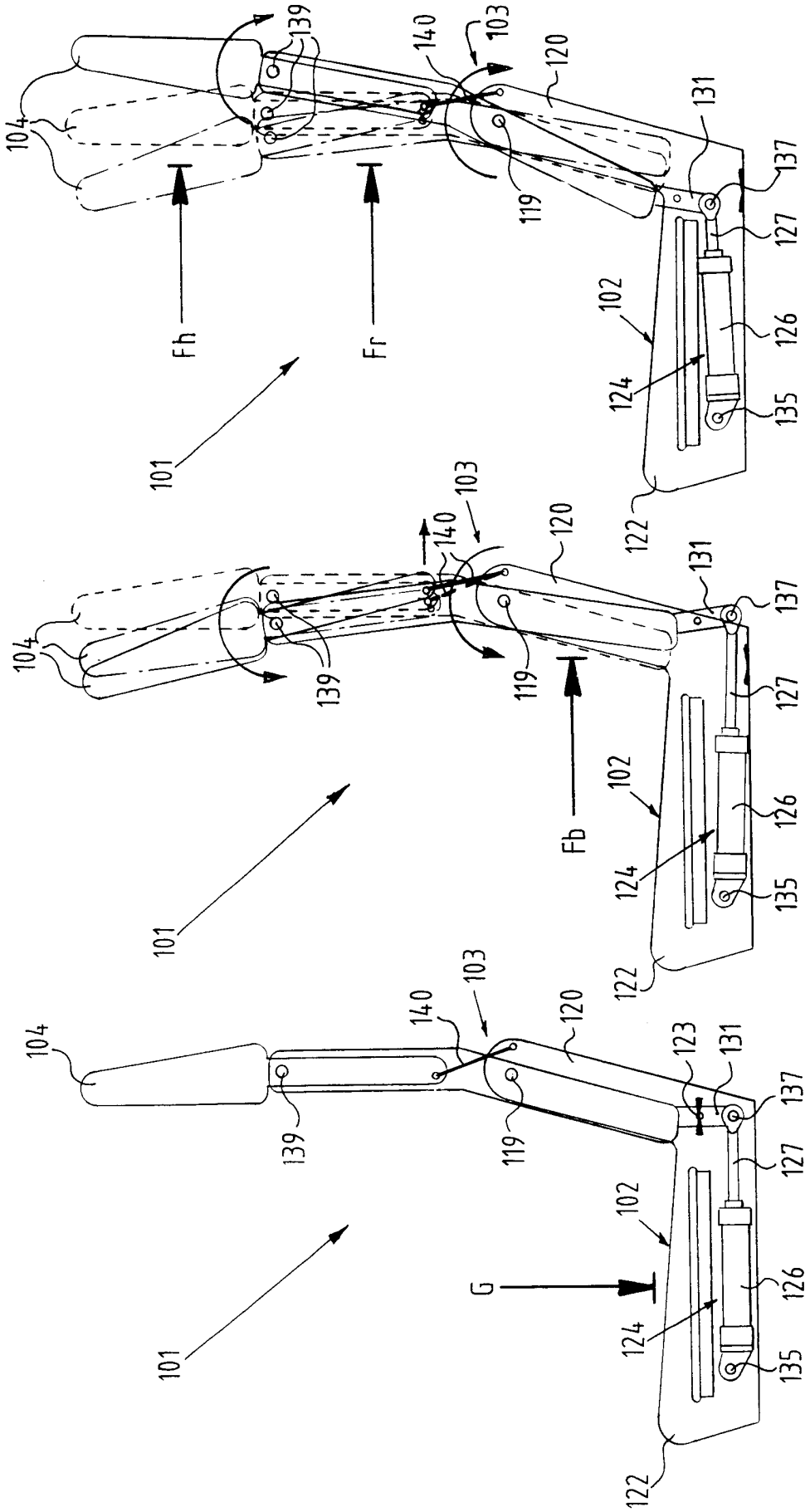

FIG. 8A

FIG. 8B

FIG. 8C

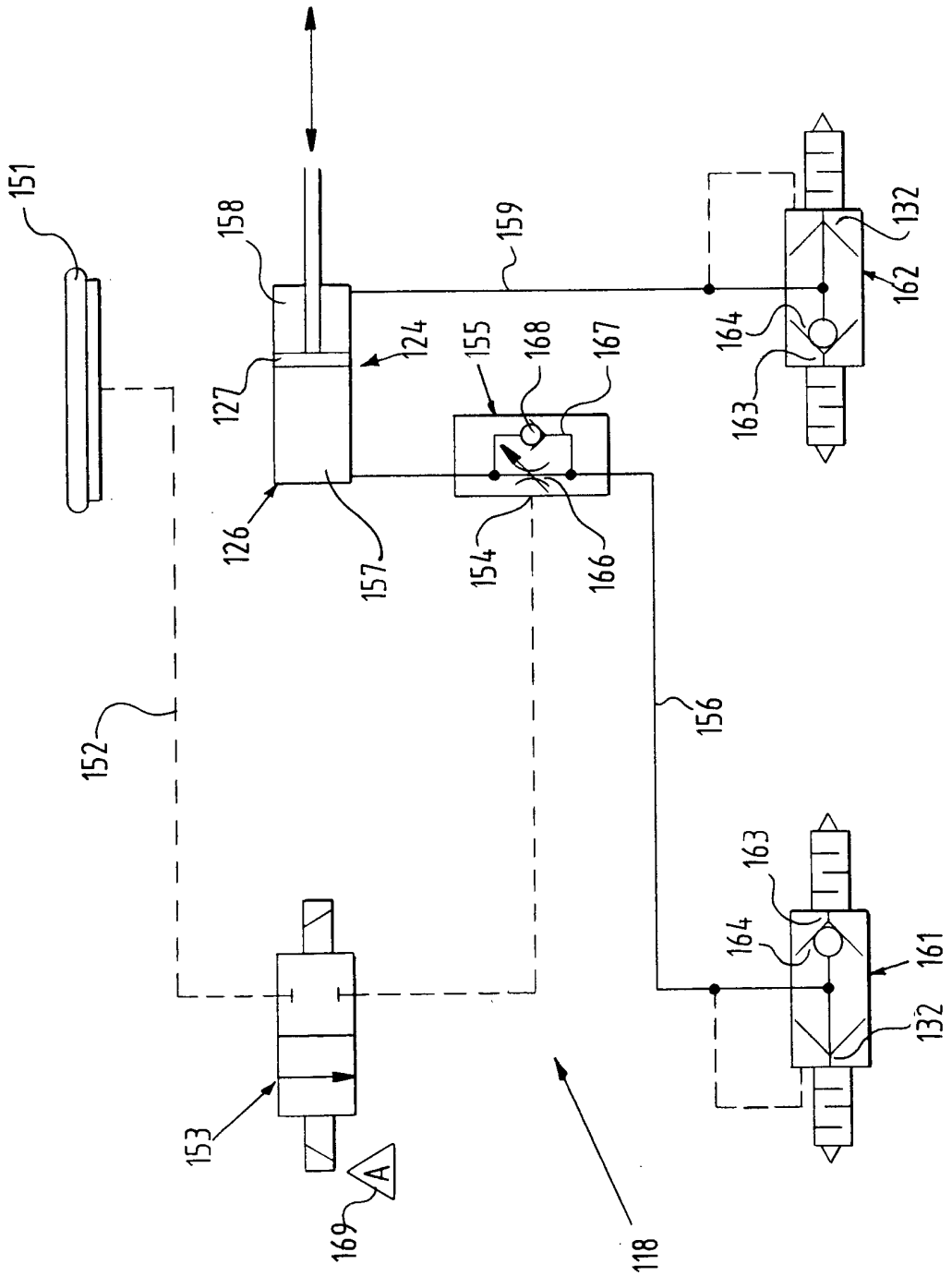
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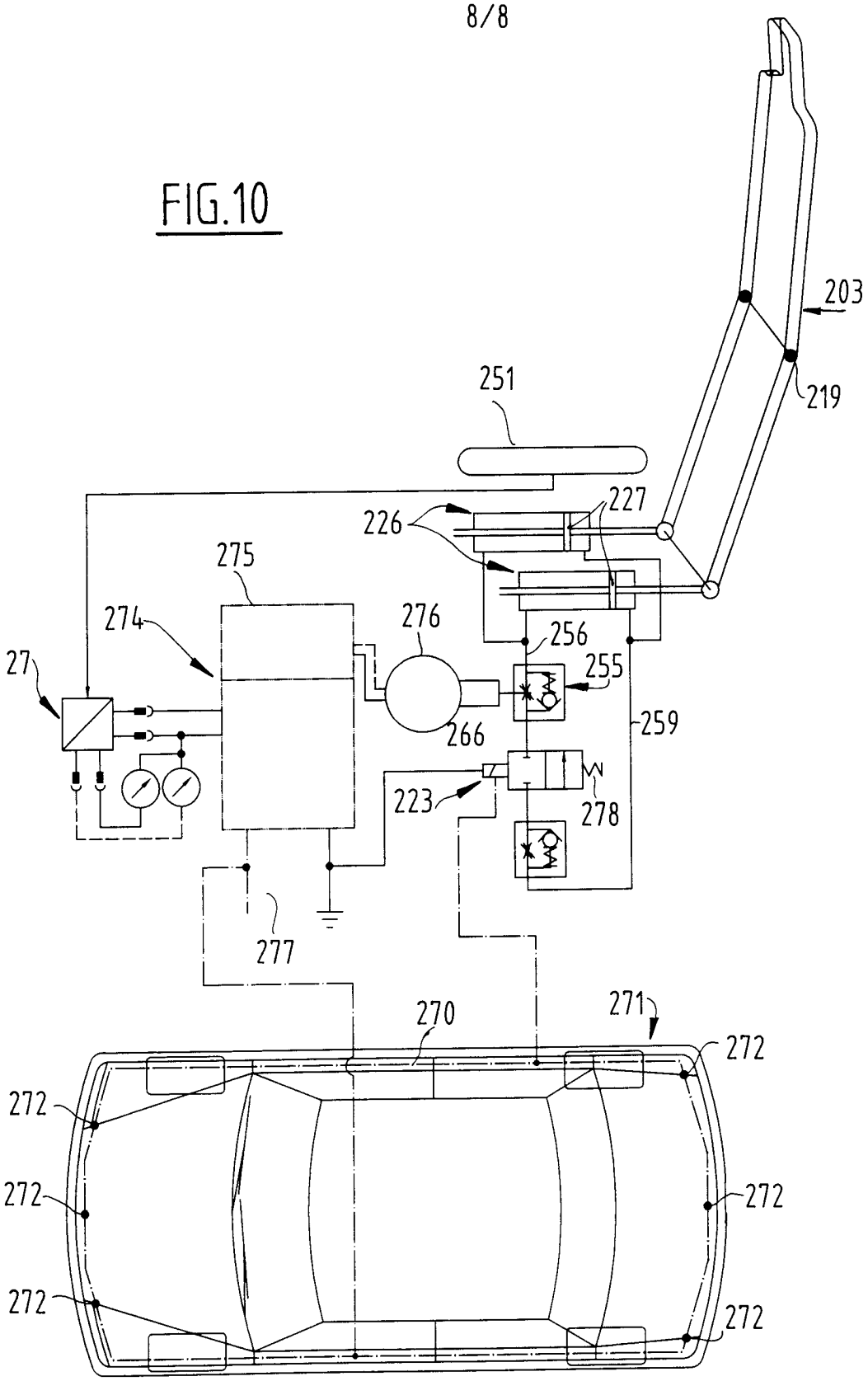
FIG. 9

FIG.10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INTERNATIONAL SEARCH REPORT

Intern .nal Application No
PCT/NL 01/00074

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60N2/64 B60N2/42

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)
IPC 7 B60N

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, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 43142 A (LENZ THOMAS ;LTG SAFE CONTROL AUTOMOTIVE AB (SE)) 20 November 1997 (1997-11-20) the whole document	1,22,23
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A	WO 99 47379 A (LINDBERG MATS ;ACCRA TEKNIK AB (SE); BERGLUND GOERAN (SE); SUNDGRE) 23 September 1999 (1999-09-23)	

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 June 2001	05/07/2001

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

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PCT/NL 01/00074

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A	GB 2 283 163 A (AUTOLIV DEV) 3 May 1995 (1995-05-03) ---	
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