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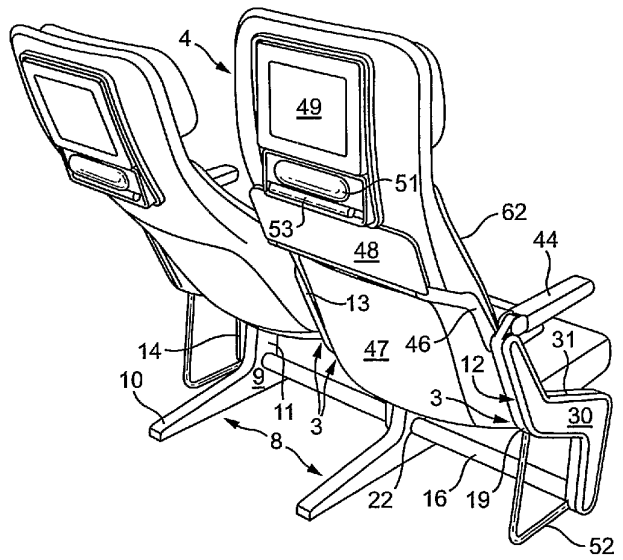
(54) Title: VEHICLE SEAT ASSEMBLY



(57) Abstract: A vehicle seat assembly for arranging in rows, such as for aircraft, has a compact construction to allow minimum seat pitch. The seat legs (8) have a low profile with support struts (16) being towards the front of the seat, the seats are convex or 'bucket' shaped, the recline actuating handle and storage pocket are located under the front of the seat, the backrest pivots (4) around the knee height for reclining movement, and the backrest is ergonomically shaped, having thin cushions (62) attached to the passenger side only.

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VEHICLE SEAT ASSEMBLY

This invention relates to a vehicle seat assembly, and in particular to vehicle seats to be arranged in rows of such seats in a vehicle such as an aircraft, and a support structure therefor.

The distance between rows of seats in an aircraft, or the seat pitch, has an impact on how many passengers may be accommodated in the aircraft cabin, and is therefore of great importance to airlines. Rows of seats are placed as close together as possible taking into account passenger comfort. The seats are sometimes also required to have an upright position and a reclined position to allow the passenger to rest.

Conventional economy class aircraft seats are relatively bulky. They are generally formed of structural seat members clad with plastic. This is then covered by relatively thick profiled seat cushions to form a comfortable seat shape. Seats are normally provided with a storage pocket on the rear of the backrest, tending to restrict knee-room. This situation is worsened by the reclining of the backrest also tending to impinge on the knee-room of the passenger behind.

Also, rows of the seats are commonly supported by transverse support struts under the seat pan at the front and rear thereof. The seat legs are slidably mounted on the struts, with an upright leg portion under the rear of the seat pan which tends to interfere with the foot space of the passenger behind.

Furthermore, conventionally armrests have been mounted at a position between the seats, commonly on a rail running laterally inside the backrests. This means it is not possible to stow them away completely, since when pivoted upwardly, the bulky armrest fouls the backrest and therefore is left somewhat

forward of the seat.

It is an object of the invention to alleviate these problems by providing a vehicle seat assembly comprising a vehicle seat and support structure, which seats may be arranged in rows with an optimal seat pitch.

According to one aspect of the present invention there is provided a support structure for supporting a plurality of seats side by side in a vehicle, the structure comprising at least a first elongate support strut for extending laterally of the seats, at least one seat leg assembly mounted to the strut, the leg assembly comprising: a foot portion arranged to be adjacent the floor of the vehicle for attaching the structure thereto; a seat support portion arranged to be adjacent the underside of the seat for attachment to the seat; and an intermediate portion extending between the seat support portion and the foot portion; wherein, in use, the support strut(s) and the intermediate portion of the or each leg assembly are arranged to be positioned under the front part only of each seat.

The foot portion is preferably elongate, extending in the fore-and-aft direction, so as to be attachable to a floor rail such as is commonly provided in aircraft. The intermediate portion and support strut(s) may for example be arranged to be positioned under the front half of the seat pan.

Thus the profile of the supporting legs of the seats can be very low (ie close to the floor) except at the front of the seat, so a passenger sitting behind may rest their feet under the seat with minimal interference from the support structure.

This is preferably achieved by providing two support struts both under the front part of the seat pan, one adjacent the foot portion of the leg assembly, and the other adjacent the seat support portion. Furthermore, the lower strut may be positioned rearwardly of the upper strut, to allow heel room or stowage space for

the passenger in the seat.

The leg assemblies may comprise first and second leg elements: the first element comprising the foot portion, and an upwardly extending portion mounted to the first and second support struts and forming part of the intermediate portion of the leg assembly; and the second element comprising the seat support portion, and a downwardly extending portion mounted to the first and second support struts and forming a further part of the intermediate portion of the leg assembly. Thus the second element may be in the form of a side plate or hanger bracket extending along the edge of each seat, and may be journalled to the seat pan and at least the lower part of the backrest. The seat pan and backrest may be movably connected to the hanger bracket, for example by means of cooperating sliders and runners, for allowing reclining movement of the seat. Alternatively the seat may be fixed in position in relation to the support structure.

With this arrangement, each seat is disposed between a pair of second leg elements. These elements are therefore separated by the width of a seat. Since the floor rails of aircraft are generally in fixed positions, the lateral positions of the first leg elements are determined by the rail positions. Therefore the first and second elements of the leg assemblies may be adjacent one another, or may be laterally spaced, depending on the seat width.

The invention also provides a seat assembly comprising such a support structure and at least one seat supported thereon, in which the seat comprises a seat pan and a backrest, and in which the rear of the seat pan and the rear of the backrest adjacent the seat pan have corresponding convex shapes when viewed from behind. This is made possible because there is no support strut at the rear of the seat pan, as was required by prior art structures. For example, the side edges

of the base of the backrest and the sides of the rear edge of the seat pan may be curved in the direction towards the front of the seat. This allows more knee-room for the passenger behind at the sides of the seat back.

Thus, the invention also provides a seat assembly comprising a support structure and a plurality of seats supported side by side thereon, the seats each comprising a seat pan and a backrest, the support structure comprising an elongate laterally extending support strut and at least one leg assembly mounted to the strut, in which the rear edge of the seat pan and the lower edge of the backrest are curved forwardly at the sides thereof, and in which the support strut is disposed forwardly of at least a part of the rear edge of the seat pan, such that a recess is formed at the sides of each seat to accommodate the knees of a passenger sitting behind.

Preferably, the support strut is positioned forwardly of the majority of or the whole of the rear edge of the seat pan in a position corresponding to the upright position of the seat.

This allows the pitch of the seats to be reduced since the knees of the rear passenger do not need to fit in behind the centre of the backrest and seat pan, and therefore larger passengers can position their knees in the recesses to the sides. With this arrangement, the support strut may be just forward of the end of the curve of the rear edge, where the side edge of adjacent seat pans meets. This position is preferably around at least 5 inches, and most preferably around 7 inches forward of the rearmost part of the backrest. There may be a further support strut further towards the front of the seat pan.

In another aspect, the invention provides a seat assembly for arranging in rows of such seat assemblies in a vehicle, the seat assembly comprising a seat

pan, a backrest, and a supporting structure for supporting the seat pan and backrest on the floor of the vehicle, the backrest being tiltable in relation to the supporting structure between a first upright position and a second reclined position about a pivot location on the supporting structure which is positioned above the base of the backrest.

Preferably, the pivot location is at a height at least approximately equal to the knee height of a passenger in the seat. Thus, when the backrest is in a reclined position, the problem of encroaching on the passenger's leg room is alleviated, since the part of the backrest at the height of the legs moves forwardly, further away from the passenger behind. Furthermore the high pivot minimises the intrusion of the backrest into the aft passenger space, in particular the passenger's head space.

A storage pocket for use by the passenger may also be included on the front of the leg assembly; that is, behind the passengers legs. This further reduces interference with passengers knee-room by the backrest of the seat in front.

Preferably, the seat includes means for locking the seat pan and backrest in selected relative positions, and comprising a manual actuating member for the locking means which is positioned beneath the front of the seat pan. For example, this may be a lever which the passenger activates by lifting it towards the seat to release the seat for movement. This arrangement avoids the need to provide a recline actuator in the armrest, as is conventional for aircraft seats. The armrest may therefore be of a simpler and less bulky construction.

This invention also provides a seat assembly comprising a plurality of seats arranged side by side, the seats each having a backrest and an armrest pivotable between a substantially upright stowed position and a substantially

horizontal use position, the pivot location being positioned forwardly of the backrest, or the backrest pivot. For example the armrest may be mounted on a flange extending forwardly from between the backrests. With this arrangement, the armrest can be stowed to lie substantially flat against the backrest or adjacent backrests. Since the armrest and backrest are arranged such that the armrest abuts the backrest in the stowed position thereof, the armrest may not extend behind the backrest. This eliminates the need for retaining tabs which are commonly provided on the sides of conventional backrests. Furthermore, it is easier to disassemble the armrest, for example for maintenance, since the pivot is accessible without dismantling the seat.

Preferably the armrest is shorter than conventional armrests; for example one third to one-half of the usual length. This is possible because, in accordance with the invention, there is no need to provide controls such as a recline button on the armrest. This contributes to the armrest being less intrusive in the passenger space, and alleviates the problem of restricted leg movement for larger passengers which can occur with conventional armrests.

The invention also comprises a seat assembly comprising a seat pan and backrest, the seat being movable between upright and reclined positions of the seat, by tilting movement of the seat pan and the backrest, in which the tilting movement of seat pan causes the front of the seat pan to move relatively upwardly, and the tilting movement of the backrest causes the top of the backrest to move relatively backwardly, and in which the angle of tilting travel of the backrest is equal to approximately 3.2 times the angle of tilting travel of the seat pan. This provides a comfortable 'cradled' position for the passenger.

As the rear of the seat pan moves downwardly in relation to the backrest, a

flange may be provided on the rear edge thereof which extends upwardly for covering any gap between the seat pan and the backrest.

The backrest may comprise a shaped rigid frame member and a shaped cushion member, the cushion member being applied to the front side only of the rigid frame member. Thus the frame member may be profiled to form the required backrest shape, and the cushion may have a simple thin profile. The shape of this rigid frame member is thus preferably an 'S' curve, corresponding to the natural curve of the spine. This arrangement provides a seat of a less bulky construction.

The seat pan may include a moveable element, movement of which causes adjustment of the thickness of the seat pan at a front portion thereof relative to the thickness of the seat pan at a rear portion thereof. Thus the passenger may effectively adjust the height of the lumbar support of the seat, for enhanced comfort. The passenger may also adjust the relative height at which the lower part of the thigh, or knee, is supported such that the legs may adopt an optimal position. For example a larger passenger may lower the knee height to place their legs comfortably. Conveniently, this may be done by the seat pan cushion including an airbag at the rear, and optionally also one at the front, which may be inflated or deflated by the passenger.

Alternatively, there may be resilient member such as a spring biased pivotal plate in the front of the seat, which biases it upwardly and pivots downwardly under the weight of a passenger's legs.

In order that the invention may be more readily understood, reference will now be made by way of example to the accompanying drawings in which:

Figure 1 is a perspective view from in front of a seat assembly comprising a pair of seats according to one embodiment of the present invention;

Figure 2 is a perspective view from behind of the seat assembly shown in Figure 1;

Figure 3 is a rear view from below of the support structure of the seat assembly;

Figure 4 is a side view of the seat assembly of Figure 1 showing upright and reclined positions of the seat;

Figure 5 is a partial side view of two rows of such seat assemblies with a person sitting in the rear row;

Figure 6 is a partial side view of the seat assembly showing the arm rest in different positions;

Figure 7 is a partial cross-sectional side view of the seat assembly showing airbags in the seat pan.

Figures 8a to 8c are a series of side views of a first element of a leg assembly according to various embodiments of the invention;

Figure 9 is a side view of the second element of the leg assembly of the seat of Figure 1; and

Figure 10 is a perspective view from behind of a seat assembly according to another embodiment of the invention;

Figure 11 is a further rear view from below of a support structure according to the invention;

Figure 12 is a perspective view from in front of a seat assembly comprising a row of seats according to another embodiment of the invention;

Figure 13 is a schematic side view showing an example of the dimensions of the seat assemblies with the support structure of Figures 1 to 9 and Figure 12 overlaid;

Figure 14 is a perspective view from behind of the seat assembly of Figure 12; and

Figure 15 is a schematic plan view of the seat pan of a seat according to the invention also showing a seat pan in the row behind.

Referring to Figures 1 and 2, the seat assembly comprises a pair of seats each including a seat pan 2 and a back rest 4, and a supporting structure 6 for supporting the seats on the vehicle floor. Aircraft seats are commonly mounted on rails extending fore and aft of the aircraft cabin floor (not shown). The support structure 6 includes a pair of leg assemblies 8. The leg assemblies 8 are substantially 'L' shaped, each including a first element 9 with a foot portion 10 having an elongate shape for attachment to the floor rail of an aircraft in a known manner. The elongate and substantially flat shape of the foot portion 10 reduces intrusion into the passenger foot space.

Referring to Figure 8, various possible profiles of the foot portion 10 are shown. Raising the profile allows a material of thinner cross-section to be used, and thus involves a weight saving, which is an important consideration in the field of aircraft seats. In Figure 8a, the foot portion has a depth of about 60 mm. In Figure 8b, the depth is about 90 mm, allowing a weight reduction as compared with the profile of Figure 8a of about 0.28 kg. If the depth is about 150 mm, as shown in Figure 8c, the weight of the first portion may be reduced by about 0.52 kg compared to that of Figure 8a. A preferred profile has a depth of about 100 mm.

Referring also to Figure 3, an upwardly extending portion 11 of the first element 9 extends from the front end thereof to form part of an upright intermediate portion of the leg assembly, which is positioned under the front part

of the seat pan 2.

A downwardly extending part 14 of a second element 12 forms a further part of the upright intermediate portion of the leg assembly. The second element 12 is in the form of a side plate or hanger bracket. The bracket 12 is generally of an elongate 'S' shape, having a middle part 15 extending along the side edge of the seat pan and an upper part 17 extending along the side edge of the lower part of the backrest, with a corner 19 therebetween. The middle and upper parts 15, 17 form a seat support portion of the bracket 12. The bracket 12 is journalled to the seat pan and backrest to allow reclining movement of the seat, as will be described below.

The leg assemblies 8 are mounted to upper and lower laterally extending support struts 16, 18. The upper strut 18 extends through upper mounting apertures 20 of each leg element 9, 12, respectively and the lower strut 16 extends through lower mounting apertures 22 thereof. The lower mounting aperture 22 of the first element 9 is adjacent the foot portion 10, and in the second element 12 it is adjacent the distal end of the downwardly extending part 14. The upper mounting apertures 20 are adjacent the seat support portion of the hanger bracket 12 at the underside of the seat pan, and adjacent the top end of the upwardly extending portion 11 of the first element 9.

With this arrangement, the lower support strut 16 may be positioned a little rearwardly of the upper strut 18. This has the advantage of allowing more heel room to the passenger in the seat. Alternatively the space can be used for stowage. For example, a storage pocket 50 may be mounted to the front of the leg assemblies (see Figure 4). This has the advantage of negating the need for a pocket on the seat back in front of the passenger, as is commonly provided in

aircraft, which interferes with knee room.

In one example, referring to Figure 9, the aperture 22 for the lower strut 16 is positioned about 205 mm below the aperture 20 for the upper strut 18, and the forward-most part of the lower aperture 22 is about 19.5 mm behind the forward-most part of the upper aperture 20.

Since there is no support strut under the rear edge of the seat pan, as is conventional, the rear edge may be convex in shape, and the lower edge of the backrest may have a corresponding convex shape. Thus a recess 3 is formed at each side of the rear of each seat for accommodating the aft passenger knees.

Referring also to Figure 14, it can be seen that, with the rear edge 100 of the seat pan extending forwardly of the seat 102 at the edges 104, the distance A between the back 106 of the seat and the rear edge 100 of the seat in front is significantly increased as compared to a traditional flat seat back 108.

Referring also to Figure 4, the brackets 12 extend along the edges of the seats both between the seats and at each end of the rows. At the end of each row the bracket 12 may be covered by a protective panel 30 having a peripheral bump strip 3. Also, a baggage bar 52 may extend from the corner 19 of the bracket 12 between the seat pan and backrest to the end of the downwardly extending portion 14, to retain any passenger baggage. An alternative position for the baggage bar would be for the upright portion to be inclined towards the corner of the bracket adjacent the upper support strut 18, as shown in Figure 10.

The seat assembly thus far described is suitable either as a fixed seat or as a reclinable seat. In this example a recline mechanism is shown. The upper end of each bracket 12 terminates adjacent a pivot location 32. The backrest 4 of each seat is mounted between two brackets 12 so as to be reclinable about the pivot

location 32. This location is positioned above the vehicle floor at a height intended substantially to coincide with or be just above the height of the knee 33 of a passenger 34 sitting in the seat with their feet resting on the floor (see also Figure 4). For example, the 95 centile middle of knee height of the adult population is about 542 mm, and thus the pivot height may be about 561 mm, but may be somewhat lower or higher. In this example the backrest pivots about a fixed point 32, but it may alternatively tilt about a pivot path in a similar manner to the seat pan, as described below. Where the backrest tilts about a path, the pivot location as defined above corresponds to the position where the backrest substantially moves neither forwardly nor rearwardly.

Furthermore, it can be seen that, due to the convex shape of the backrest, the pivot location may be positioned forwardly of the location on a seat with a conventional flat backrest.

The seat may be reclined by actuation of a lever 36 mounted underneath the front part of the seat pan 2. The seat pan 2 is mounted to the brackets 12 such that, upon reclining movement of the backrest 4, the seat pan 2 translates forwardly and tilts such that the front edge 38 moves upwardly slightly whilst the rear edge 40 moves downwardly. This may be achieved by a slider and runner arrangement, for example by machining the guide path 41 or runner for a slider (not shown) mounted to the edge of the seat pan 2, into the brackets 12, as shown in Figure 3. The angle of tilt α of the backrest is approximately 3.2 times the angle of tilt β of the seat pan. This provides a comfortable 'cradled' position for the passenger. With this arrangement, the seat pan 2 is additionally supported towards the front by a support ring 45 mounted on the upper strut 18 and bolted to the underside of the seat pan 2.

An example of an alternative mechanism is shown in Figure 11. When the actuator lever 36 is activated, a cable connected to release member 71 of a gas strut 72 unlocks the mechanism. If the passenger in the seat applies backward force to the backrest, the backrest tilts and the rear edge of the seat pan 2 is pushed forwardly by the lower end of the backrest moving forwards. The seat pan 2 movement is guided by a guide path 41 in the brackets 12 as already described in relation to Figure 3. A further guide member or cam 78 towards the front of the seat pan 2 helps to guide the front of the seat pan 2 upwardly throughout the recline movement. The cam 78 is fixed to a bracket 80 on the lower side of the seat pan 2. When the pan 2 moves forwardly, the cam 78 is caused to rotate on a fixed bar 82, pushing the bracket 80 upwardly. When the lever 36 is released, the mechanism is locked in position.

The seat pan 2 is connected to a pair of levers 74, 75, which in turn are connected to the gas strut 72. A spring 76 on the gas strut 72 urges the seat pan 2 back to the non-reclined position via the cam 74 when the actuator 36 once again is activated.

Also mounted at the pivot location 32 on each side of each seat is a table arm 46 extending backwardly such that each pair of arms 46 carries therebetween a table 48 at the other end thereof behind the seat (see Figure 2). The aft passenger may grip the table and pull it down into a substantially horizontal position for use. There may also be a screen 49 and a handset 51 having a coiled cord 53 provided on the upper part of the rear of each backrest for the use of the passenger sitting behind. A thin literature pocket, for example formed of a flat sheet of material, may also be provided on the lower part 47 the rear of the backrest, for example to contain a safety card. This may for example be a piece of

netting attached to the backrest at the sides and base. A further storage pocket 50 for passenger use may be mounted to the front of the leg assemblies. A life vest is also stored under the seat.

Referring also to Figure 6, the upper part of each bracket 12 includes forwardly angled flange 42 mounting an armrest 44. The armrest is pivotally mounted on the flange 42 for movement between a substantially horizontal position for use, and a stowed position substantially parallel to the adjacent backrest, whether the backrest is in the upright or the reclined position. Thus the armrest pivot point 43 (see Figure 9) is positioned forwardly of the backrest 4. This allows the armrest to be fully stowed, lying against the backrest, to allow passengers to move in and out of the seats. Since the armrest is not required to carry operating members such as a recline button, it may be of a simple construction and therefore less bulky. It may also be mounted by a simple pivot which is separate from the rest of the seat assembly and may easily be accessed. This armrest arrangement is suitable for a reclinable or non-reclinable seat.

Since the armrest lies against the backrest, it is prevented from extending behind it, and thus with reclinable seats, when the backrest moves from a relined to an upright position with the armrest stowed (ie parallel to the backrest), it will also push the armrest into an upright position. Thus there is no need for a tab extending from the backrest to abut with the armrest and prevent it extending behind the seat back, as is common in prior seat assemblies.

The seat back 4 and seat pan 2 each comprise rigid frame members 58 and 56 (not shown) respectively onto which corresponding shaped cushions 60, 62 and 64 are attached to form seat, back and head rest cushions respectively on the passenger bearing surfaces. For example, the cushions may be attached with hook

and loop or other such fasteners.

The backrest member is a rigid member which is shaped to provide the required ergonomic seat back profile. It therefore forms an 'S' curve corresponding to the natural curvature of the spine. Furthermore, the backrest member itself may be thin; for example not substantially exceeding about 30mm in thickness. Furthermore it is visually aesthetic, so that no cladding is required. Therefore the back and head rest cushions 62, 64 may be provided to the front side only of the backrest frame member, and can be of a simple thin profile, being less bulky than conventional seat cushion cover members. For example, the cushions may not substantially exceed 30mm or even 20mm in thickness. Other attachment means for the cushioning may be used, such as a thin fabric skirt wrapping around the seat back 4. Alternatively a thin cushioning layer may continue over the back surface of the backrest member 58. This may be thinner than the layer on the front.

The seat cushion 60 may include a pair of airbags 66, 68 mounted within the cushion at the front part and further to the rear respectively. The passenger may be provided with an actuator of a known type (not shown) for inflating or deflating each airbag. For example, they may be direct access airbags, which inflate upon actuation when passenger weight is removed, and may deflate upon actuation when weight is applied. Alternatively, a spring plate member may be provided in the front part of the seat to bias it upwardly, and be movable downwardly when pushed by the weight of the passenger's legs.

The passenger may thus adjust the height of the rear of the seat relative to the backrest, such that the position of the lumber support area of the backrest can be adjusted to suit the passenger. The angle of tilt of the seat part may also be

adjusted using the airbags 66, 68. Therefore a smaller passenger may lower the seat pan height and remove pressure under the thighs by deflating the airbags, and a taller passenger may more easily straighten the legs by creating an angled seat pan which is still supportive. This feature also facilitates reclining the seat pitch, since optimal leg position may be achieved by both short and tall passengers.

In the alternative embodiment shown in Figure 10, a footrest 70 is mounted adjacent the lower strut 10 for pivotable movement between a stowed position under the seat pan 2, and a use position as shown.

Referring to Figure 12, an alternative seat support structure is shown. In this embodiment, the structure comprises two support struts 84, 86 positioned one at the front and the other further rearwardly of the underside of the seat pan 2. The seat leg assembly comprises an elongate foot portion 88 for attaching to the aircraft floor rails. The seat pan 2 and backrest 4 are similar to those shown in Figures 1 to 9, and a seat support portion or bracket 90 supports the seat in a similar manner whilst being somewhat modified in shape. The intermediate leg portion comprises a forward upright member 92, extending from the front strut 84 to the front of the foot 88, and a rear member 94 extending from the rear strut 86 to the rear of the foot 88. The rear member 94 is curved inwardly towards the front strut 84 to reduce interference with passenger foot space. An arm 96 connects the front and rear leg portions together. The headrest cushions 98 in this example also each include an auxiliary cushion 99 for added comfort.

Referring also to Figure 14, it can be seen that the rear strut 86 is positioned adjacent and forwardly of the majority of the rear edge of the seat pan, so as still to provide a recess 95 at the sides of each seat for the aft passenger knees. Alternatively the rear strut 86 may be positioned forwardly of the whole of

the rear edge of the seat pan.

In Figure 13, the relative positions of various parts of the seat are shown by way of example, all of which are taken from the front foot attachment point 100. The drawing shows a first support structure 112 correspond to that of Figure 1, and overlays a second support structure 114 corresponding to that of Figure 12. It can been seen that the lumber region 102 of the backrest 2 is forward of the upper back region 104 (the two 'bends' of the 'S' curve) by a distance 108 which may be about 5 inches in the upright position. The height 110 of the backrest pivot from the floor is about 22.44 inches. It can be seen from this figure that the rear strut 86 of the second support structure 114 is sufficiently forward, by a distance 116, of the rear edge 106 of the seat pan 2 not to interfere significantly with the curved edges. In this example this distance is about 6.77 inches. Preferably it is at least about 3 or 4 inches.

CLAIMS

1. A seat assembly for a vehicle comprising a support structure and a plurality of seats supported side by side thereon for arranging in rows in the vehicle, the seats each comprising a seat pan and a backrest, and the support structure comprising at least one elongate laterally extending support strut and at least one leg assembly mounted to the strut, in which the rear edge of the seat pan and the lower edge of the backrest extend forwardly of the seat at the sides thereof, and in which the support structure adjacent the seat pan is disposed forwardly of the rear edge of the seat pan, such that a recess is formed at the sides of each seat for accommodating the knees of a passenger sitting in a row behind.

2. A seat assembly as claimed in claim 1, in which the support strut is disposed adjacent and forwardly of at least a portion of the rear edge of the seat pan.

3. A seat assembly as claimed in claim 1 or 2, in which a further support strut is disposed adjacent the front edge of the seat pan.

4. A seat assembly as claimed in claims 1 to 3, in which the backrest is tiltable in relation to the support structure between a first upright position and a second reclined position.

5. A seat assembly as claimed in claim 4, in which the backrest is tiltable

about a pivot location on the support structure which is arranged to be at a height from the floor of the vehicle which is at least approximately equal to the knee height of a passenger in the seat.

6. A seat assembly for arranging in rows of such seat assemblies in a vehicle, the seat assembly comprising a seat pan, a backrest, and a supporting structure for supporting the seat pan and backrest on the floor of the vehicle, the backrest being tiltable in relation to the support structure between a first upright position and a second reclined position about a pivot location on the support structure which is arranged to at a height from the floor of the vehicle which is at least approximately equal to the knee height of a passenger in the seat.

7. A seat assembly as claimed in claims 5 or 6 in which the pivot location is arranged to be at a height which is approximately equal to at least the 95th centile of middle knee heights of the adult population.

8. A seat assembly as claimed in claim 5, 6 or 7, in which the pivot location is arranged to be at a height from the floor between about 542 and about 591mm.

9. A seat assembly as claimed in claim 8, in which the pivot location is arranged to be at a height of between 569 and 591mm.

10. A seat assembly as claimed in claim 9, in which the pivot location is arranged to be at a height of approximately 580mm.

11. A seat assembly as claimed in any one of claims 4 to 10, in which the seat pan is movable with the backrest between a first position corresponding to the first position of the backrest, and a second position corresponding to the second position of the backrest, in which in the second position the seat pan is translated forwardly in relation to the support structure.

12. A seat assembly as claimed in claims 4 to 11, in which the pivot location is positioned forwardly of at least a part of the front surface of the backrest.

13. A seat assembly as claimed in claims 4 to 12, in which the seat pan is movable with the backrest between a first position corresponding to the first position of the backrest, and a second position corresponding to the second position of the backrest, in which in the second position the seat pan is translated forwardly in relation to the support structure and is tilted by the front of the seat pan moving relatively upwardly, and in which the angle of tilting travel of the backrest is between about 2.5 and 3.9 times the angle of tilting travel of the seat pan.

14. A seat assembly comprising a seat pan and backrest, the seat being movable between upright and reclined positions of the seat, by tilting movement of the seat pan and the backrest, in which the tilting movement of seat pan causes the front of the seat pan to move upwardly and the rear of the seat pan to move downwardly, and the tilting movement of the backrest causes the top of the

backrest to move backwardly and the bottom of the backrest to move forwardly, and in which the angle of tilting travel of the backrest is between 2.5 and 3.9 times the angle of tilting travel of the seat pan.

15. A seat assembly as claimed in claim 13 or 14, in which the angle of tilting travel of the backrest is between about 3.0 and 3.4 times the angle of tilting travel of the seat pan.

16. A seat assembly as claimed in claim 15, in which angle of tilting travel of the backrest is equal to approximately 3.2 times the angle of tilting travel of the seat pan.

17. A seat assembly as claimed in any one of claims 4 to 16, comprising locking means for locking the seat pan and backrest in selected relative positions, and comprising a manual actuating member for the locking means which is positioned beneath the front of the seat pan.

18. A seat assembly as claimed in any one of claims 4 to 17, in which the rear edge of the seat pan includes a flange extending upwardly adjacent the lower edge of the backrest so for substantially preventing a gap between the seat pan and the backrest.

19. A seat assembly as claimed in any preceding claim, comprising an armrest pivotable between a substantially upright stowed position and a substantially

horizontal use position, the pivot location being positioned forwardly of the backrest.

20. A seat assembly comprising a plurality of seats arranged side by side, the seats each having a backrest, and an armrest pivotable between a substantially upright stowed position and a substantially horizontal use position, the armrest pivot location being positioned forwardly of the backrest.

21. A seat assembly as claimed in claim 19 or 20, in which the armrest is less than 12 inches long, and preferably less than 10 inches long.

22. A seat assembly as claimed in claim 19 or 20 or 21, in which, in the upright stowed position, the armrest abuts the front of the backrest such that the armrest is prevented from extending behind the backrest.

23. A seat assembly as claimed in claims 19 to 22, in which the backrest is pivotable about a backrest pivot location, and the armrest pivot location is positioned forwardly of the backrest pivot location.

24. A seat assembly as claimed in any preceding claim having a seat pan and a backrest, the backrest being movable between upright and reclined position, and the seat pan member including a moveable element, movement of which causes adjustment of the thickness of the seat pan member at a front portion thereof relative to the thickness of the seat pan at a rear portion thereof.

25. A seat assembly as claimed in claim 24, in which the seat pan comprises a cushion, and the movable element comprises an airbag, movement thereof being effected by inflation or deflation of the airbag.

26. A seat assembly as claimed in claim 24, in which the movable element comprises two airbags, one being positioned in the front of the seat cushion and the other being positioned in the rear of seat cushion.

27. A seat assembly as claimed in claim 24, in which the movable element comprises a resilient member mounted in the front part of the seat and arranged to be movable by the weight of a passenger's legs.

28. A seat assembly as claimed in any preceding claim, in which the backrest comprises a shaped rigid frame member and a resilient cushion member, the cushion member being applied to the front side only of the rigid frame member.

29. A seat assembly as claimed in claim 28, in which the cushion member is covered by an upholstery layer which extends around the edge of the backrest for attaching the cushion member to the backrest

30. A seat assembly as claimed in any preceding claim, in which the backrest comprises a shaped rigid frame member and a resilient cushion member, and in which the thickness of the cushion member does not exceed 30mm over a substantial portion thereof.

31. A seat assembly as claimed in any preceding claim in which backrest comprises a shaped rigid frame member and a resilient cushion member, and in which the thickness of the cushion member is substantially constant over the front surface of the backrest.

32. A seat assembly as claimed in claims 28 to 31, in which the thickness of the backrest member does not exceed 30mm over a substantial portion thereof.

33. A seat assembly as claimed in any preceding claim, in which the backrest is provided on the rear surface thereof with a pocket for use by the aft passenger, the pocket comprising a flexible flat sheet.

34. A support structure for a seating assembly as claimed in any preceding claim, comprising at least a first elongate support strut for extending laterally of the seats, and at least one seat leg assembly mounted to the strut, the leg assembly comprising: a foot portion arranged to be adjacent the floor of the vehicle for attaching the structure thereto; a seat support portion arranged to be adjacent the underside of the seat for attachment to the seat; and an intermediate portion extending between the seat support portion and the foot portion; wherein, in use, the support strut(s) and the intermediate portion of the or each leg assembly are arranged to be positioned under the front part only of each seat.

35. A support structure for supporting a plurality of seats side by side in a

vehicle, the structure comprising at least a first elongate support strut for extending laterally of the seats, and at least one seat leg assembly mounted to the strut, the leg assembly comprising: a foot portion arranged to be adjacent the floor of the vehicle for attaching the structure thereto; a seat support portion arranged to be adjacent the underside of the seat for attachment to the seat; and an intermediate portion extending between the seat support portion and the foot portion; wherein, in use, the support strut(s) and the intermediate portion of the or each leg assembly are arranged to be positioned under the front part only of each seat.

36. A support structure as claimed in claim 34 or 35 comprising at least two leg assemblies.

37. A support structure as claimed in claim 34, 35 or 36, in which the or each foot portion is elongate and comprises attachment means for attaching the leg assembly to corresponding elongate rails provided on the floor of the vehicle.

38. A support structure as claimed in claim 34 to 37, comprising first and second support struts, in which the first support strut is mounted at or adjacent the foot portion of the or each leg assembly, and the second support strut is mounted at or adjacent the seat support portion thereof.

39. A support structure as claimed in claim 38, in which the first support strut is positioned rearwardly of the second support strut.

40. A support structure as claimed in claim 39 in which the or each leg assembly comprises first and second elements: the first element comprising the foot portion, and an upwardly extending portion mounted to the first and second support struts and forming part of the intermediate portion of the leg assembly; and the second element comprising the seat support portion, and a downwardly extending portion mounted to the first and second support struts and forming a further part of the intermediate portion of the leg assembly.

41. A support structure as claimed in claim 40, in which the first element of the or each leg assembly is laterally spaced from the second element thereof.

42. A support structure as claimed in claim 39 or 40, in which the seat support portion of the second element is arranged to extend along at least a part of the side edge of the seat pan and the backrest.

43. A support structure as claimed in any one of claims 34 to 42, in which the leg assembly is provided on the front thereof with a storage pocket for use by a passenger.

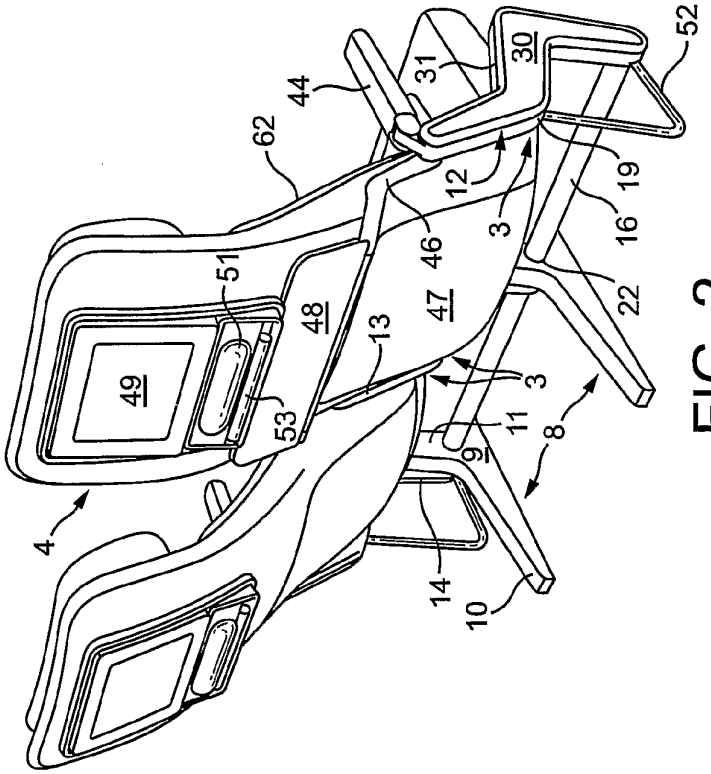
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FIG. 2

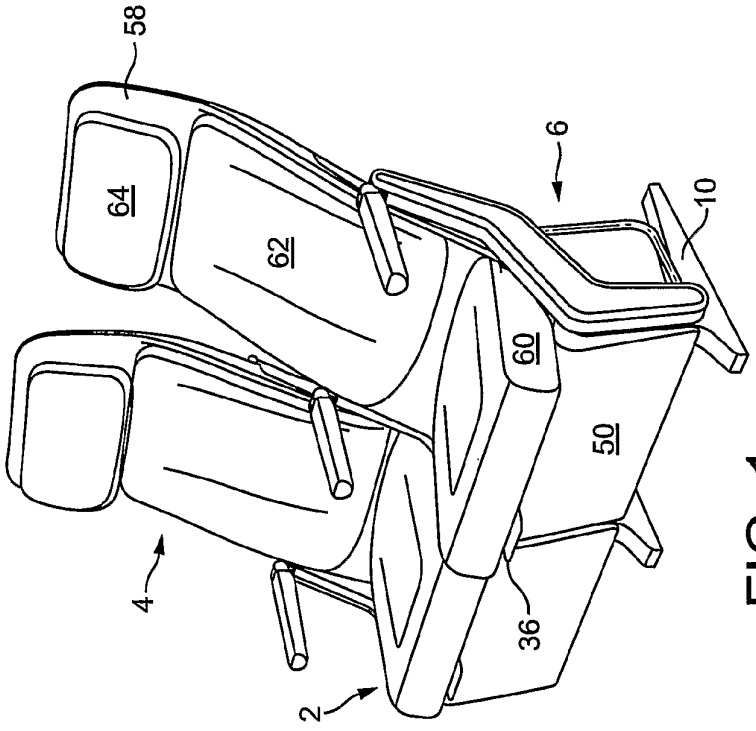
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FIG. 1

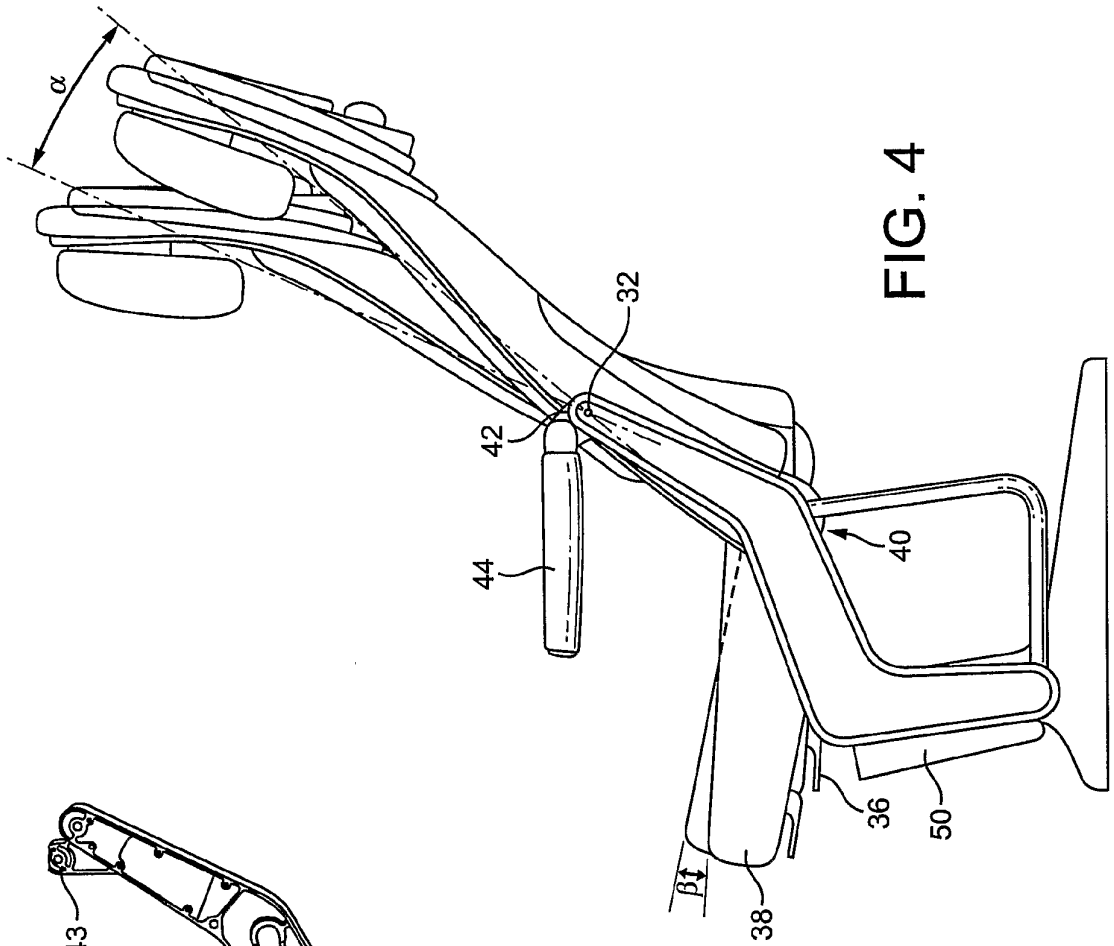

FIG. 4

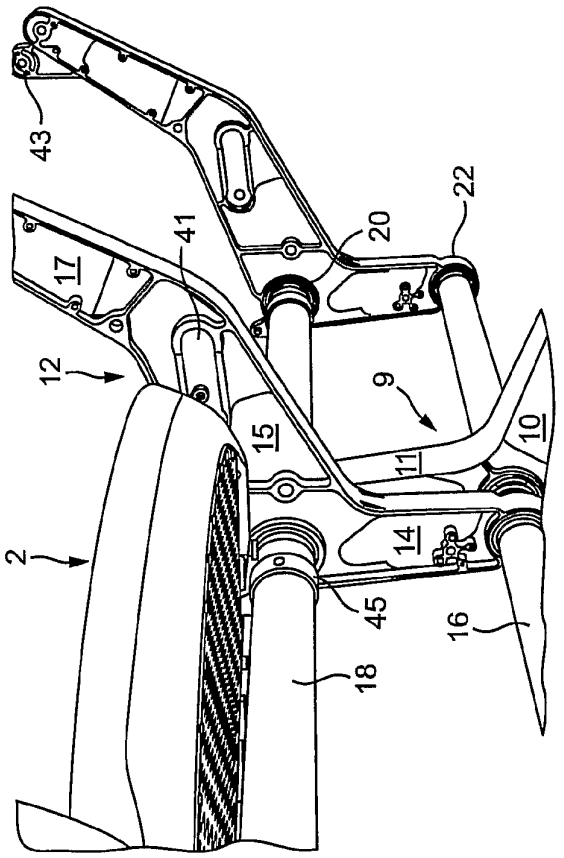

FIG. 3

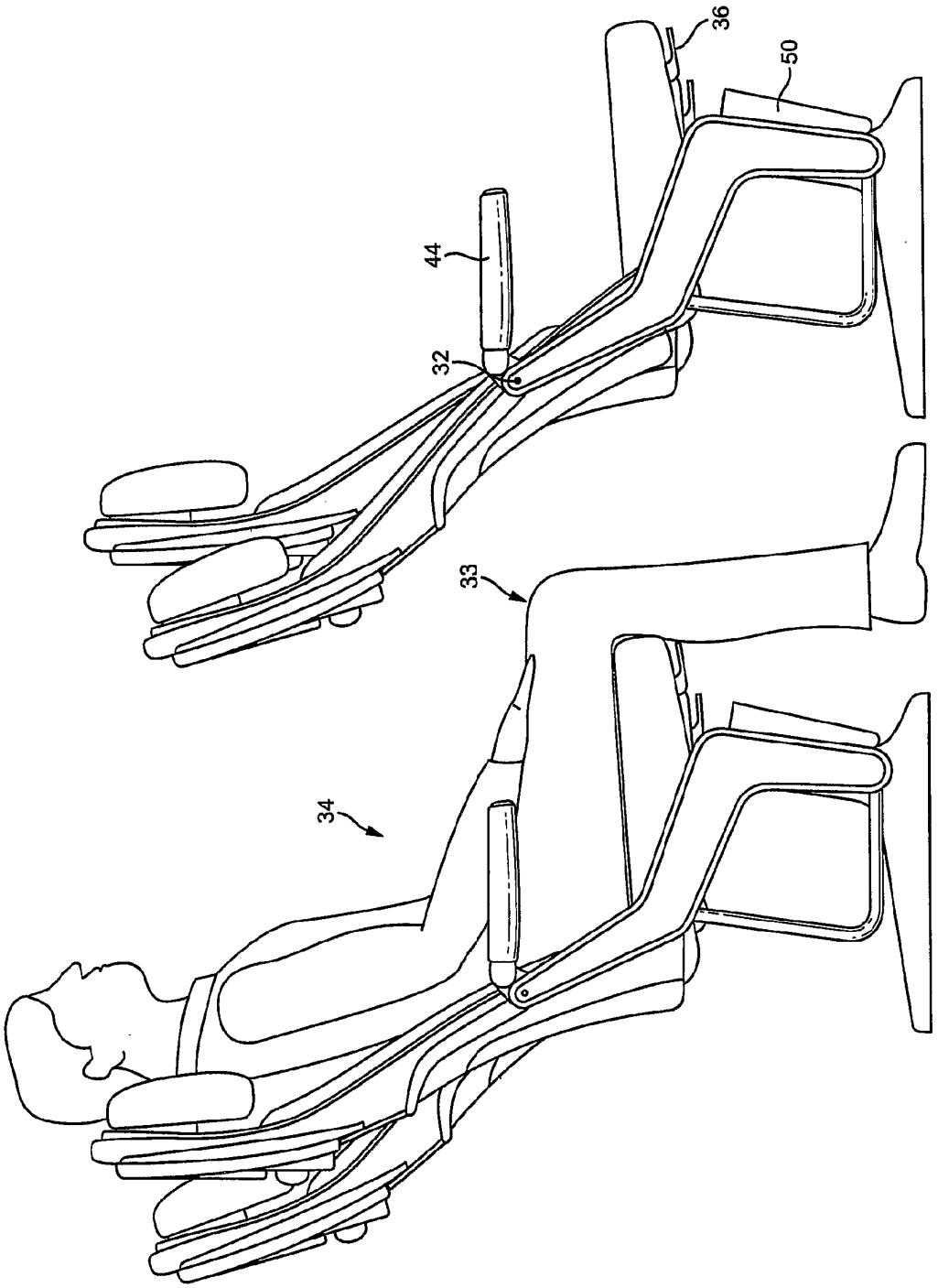

FIG. 5

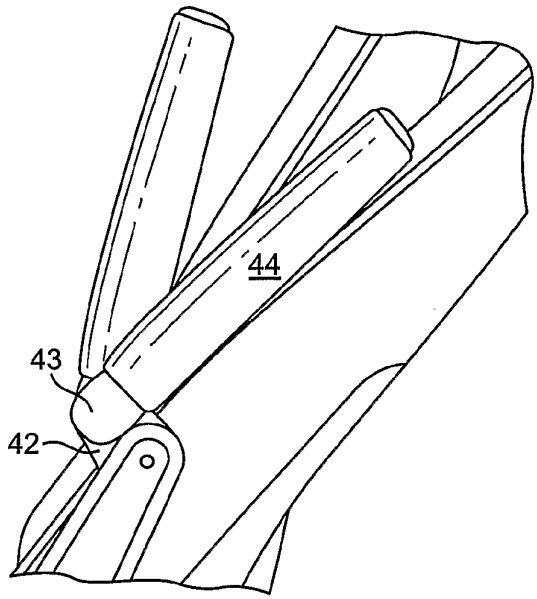

FIG. 6

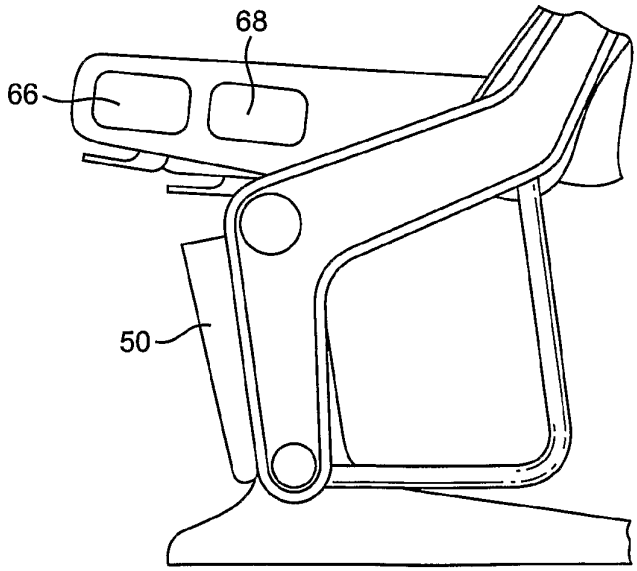

FIG. 7

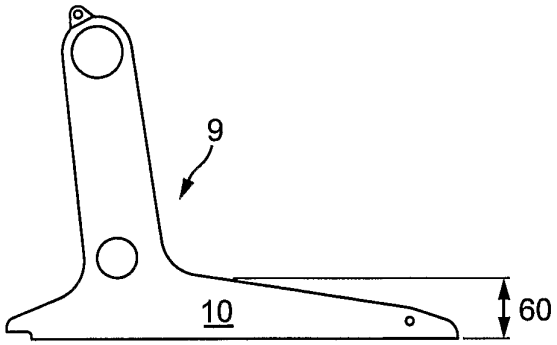

FIG. 8A

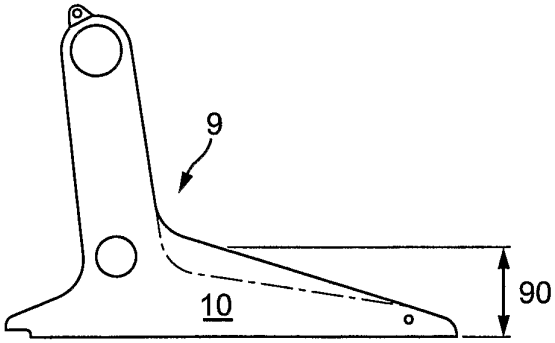

FIG. 8B

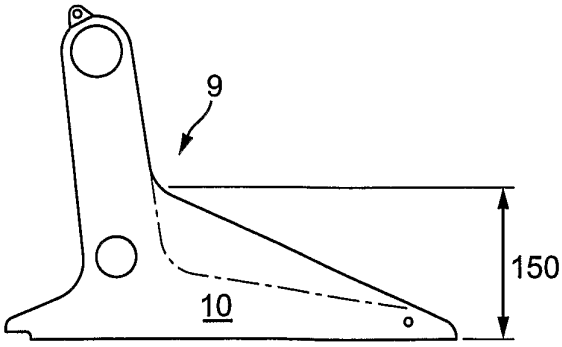

FIG. 8C

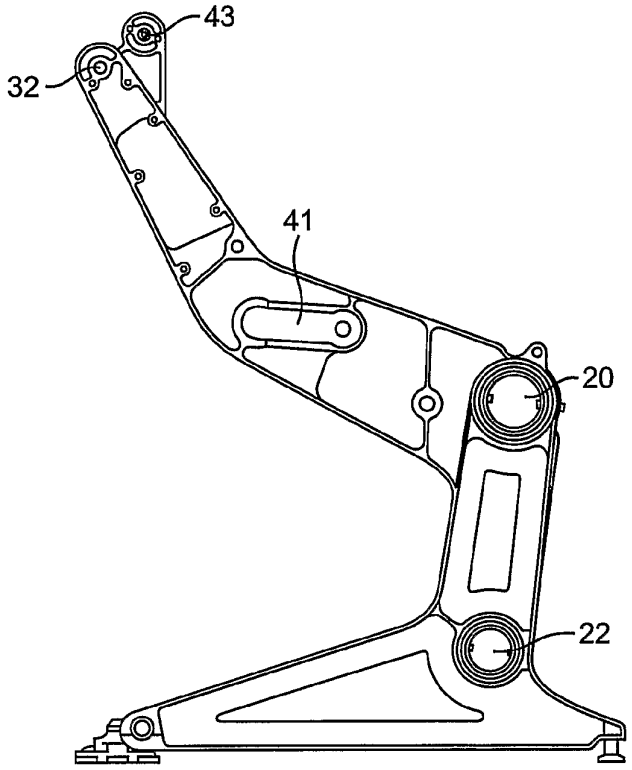

FIG. 9

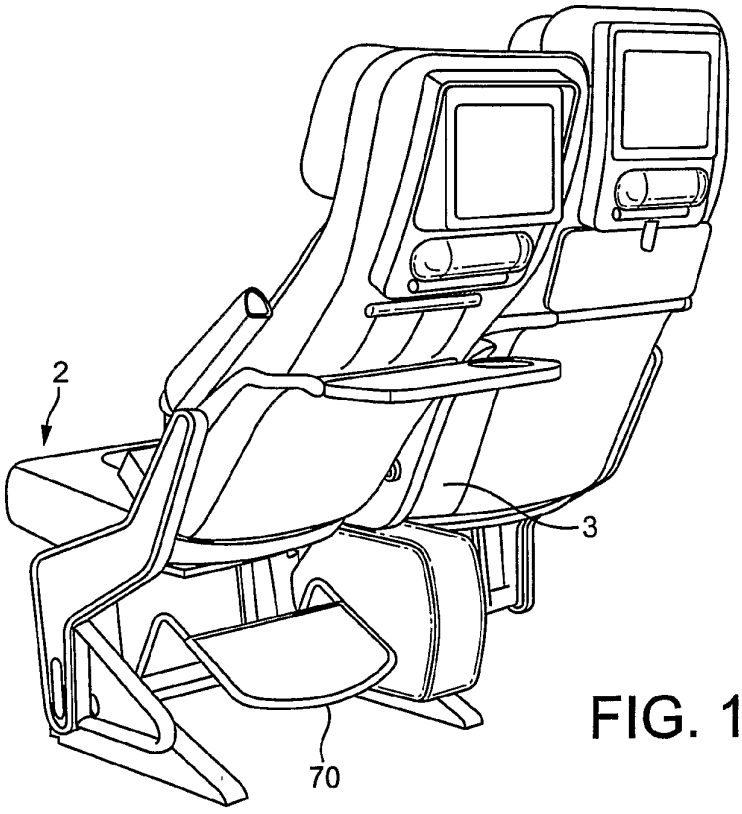

FIG. 10

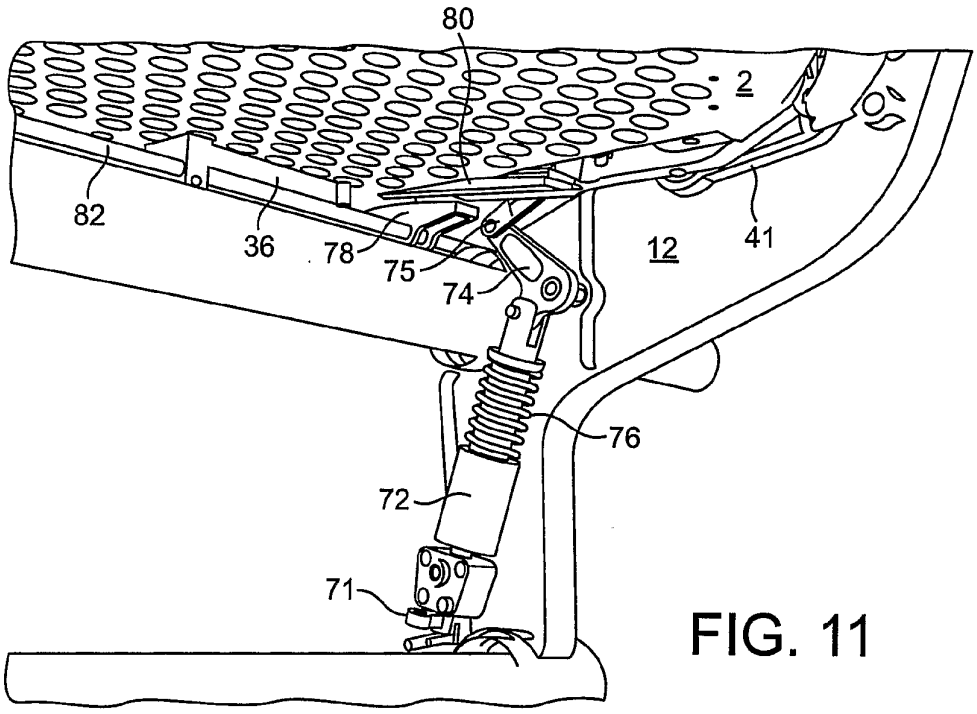

FIG. 11

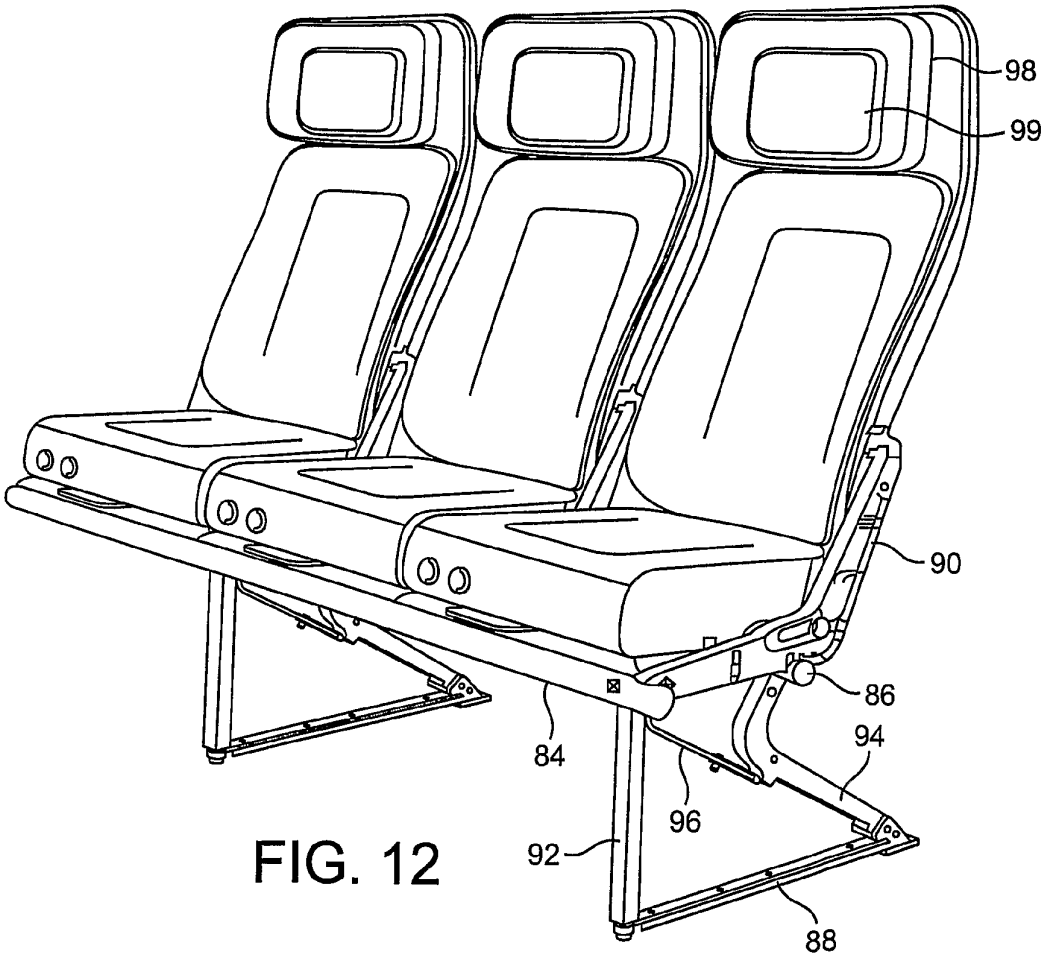

FIG. 12

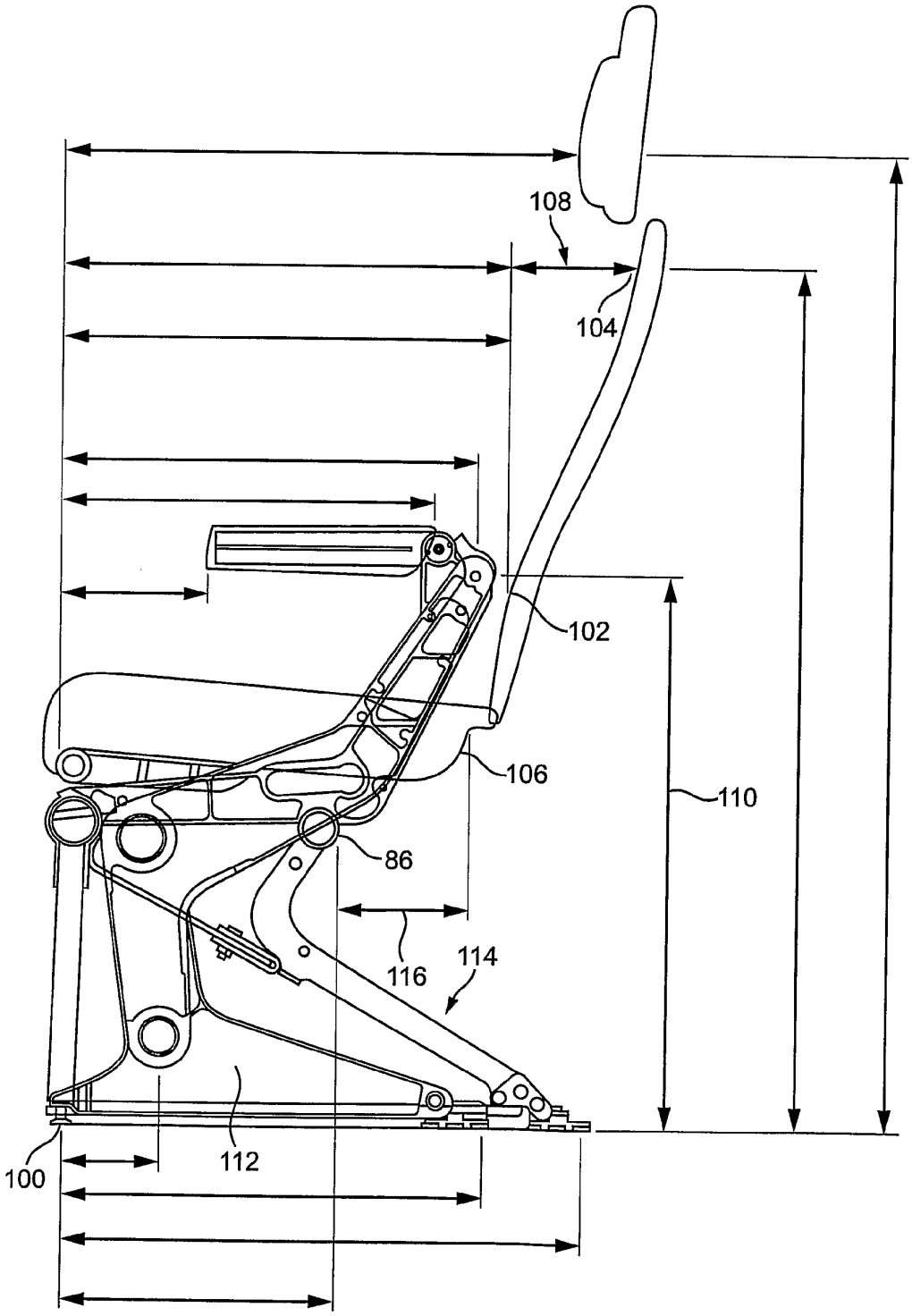

FIG. 13

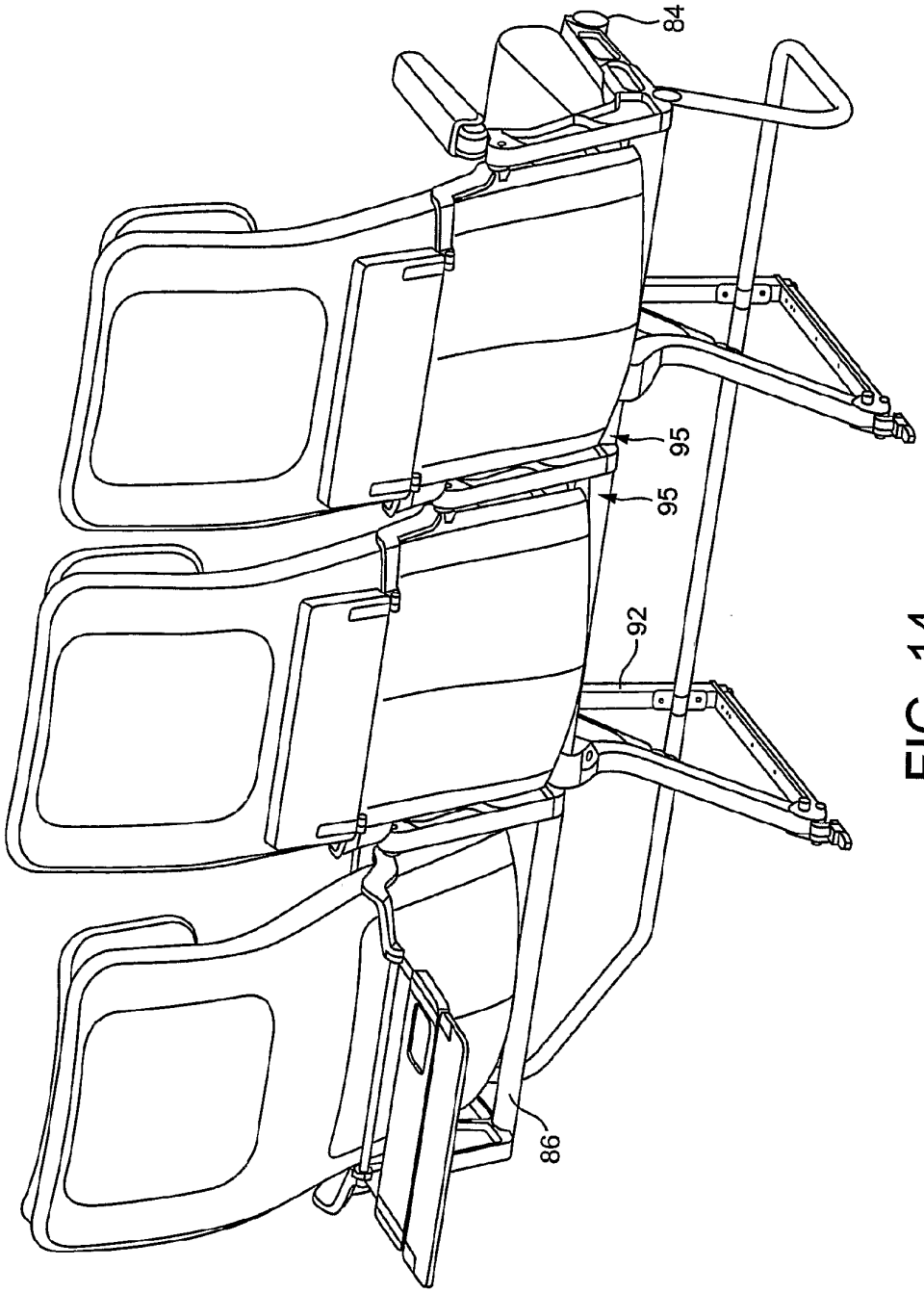

FIG. 14

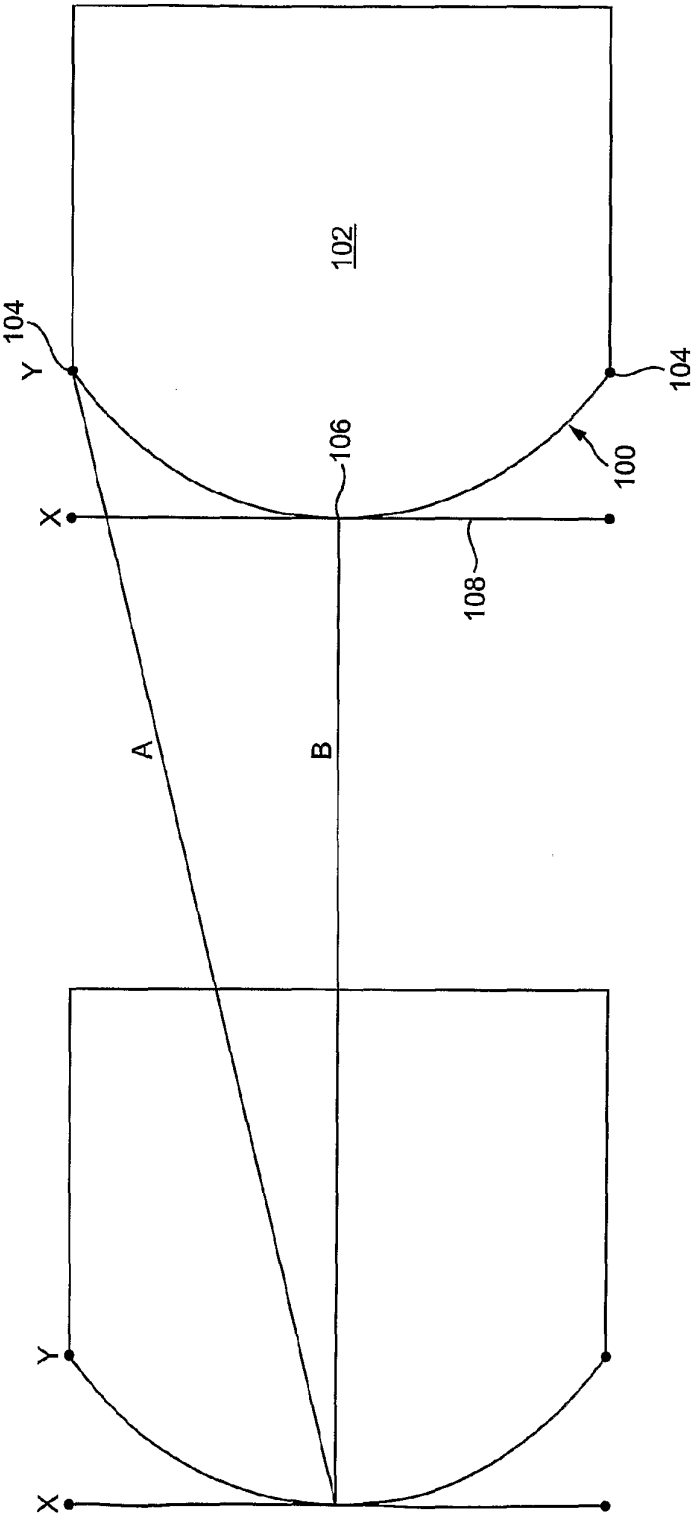

FIG. 15