

SEATING ARRANGEMENT, SEAT UNIT, TRAY TABLE AND SEATING SYSTEM

Field of invention

- 5 The present invention relates to seats and seating arrangements in or for a vehicle, particularly but not solely for an aircraft.

Background

- Seats onboard commercial passenger aircraft come in many different configurations.
10 Indeed, many aircraft carry a number of different types of seats. For example they may carry a number of business class seats, and usually a larger number of economy class seats.

 The standard price of a business class seat is higher than an economy class seat. This is primarily because a business class seat takes up much more floor space of the aircraft. Airlines may hence charge a premium for such seats.

- 15 Many business class seats now offer the ability for the seat to be reclined from a sedentary position to a fully lay flat position. In the lay flat position, the seat back, seat pan and for example an ottoman end up in a relationship with each other that presents a substantially flat surface. This allows a passenger to lie down and hence be more comfortable when resting or sleeping. WO 03/013903 (Virgin Atlantic Airways Ltd) shows such a seat. US
20 2007/0040434 also shows a seat that can achieve this. However such seats consume a large footprint onboard the aircraft in order to offer one passenger such comforts. This means that there is less passenger density in a business seat class section of an aircraft.

- The usual trade-off for airlines in offering passengers increased comfort is a reduction in passenger density. This is because comfort for a passenger is usually achieved by providing
25 more personal space onboard the aircraft for that passenger. This usually reduces the number of passengers that can be carried by an aircraft. This is the primary reason why airlines charge more for business class seats compared to economy class seat. It may be argued that a reduced payload (e.g. number of passengers and their luggage) may result in fuel savings. However, the mechanisms of business class seats are usually complex and expensive and heavy. This offsets
30 at least to some extent, any such fuel saving.

 Economy class seats on long-haul flights are known to be used in manner that can allow a passenger to lie down. The armrests between seats in a row of seats may be able to be folded out of the way. When lying down, only one passenger then occupies that entire row by

lying across all the seatpans of the seats in that row. This can usually only occur where the flight is not full as all the seats in that row may then be occupied by only one passenger.

Some airlines currently focus on trying to maximise an individual passengers comfort and personal space and also strive to isolate and insulate that passenger from other passengers as much as possible. Passengers are treated as individuals but on many flights, passengers
5 travel as a group of people such as a family. They may want to interact with each other and feel comfortable resting in close quarters to each other. Or they may at least want the options for such.

Making an individual seat less individualised and more communal is counterintuitive to
10 what the airline industry is currently trying to achieve. The seats do not allow for cooperation with each other. Indeed in business class, and in many other classes, cooperation is not a design factor because it usually means a loss of privacy.

Furthermore some groups of travelers may not be able to afford business class or cannot justify spending money on the price of business class tickets. For example where a
15 family is traveling with young children who do not benefit from the extra space offered in business class, the parents will find it harder to justify a business class ticket.

Whilst airlines are cautious about offering seats in a lower class on a basis that it may cannibalize the sale of seats in another class, there has been a significant amount of seat development work done to offer space and privacy and comfort and service for business class.
20 This has increased the separation of these qualities between business class and economy class because of the focus on business class seat development over economy class. There has generally been a lack of development in economy class seating to offer an increase in such qualities. Inflight entertainment systems, being an obvious exception to this.

Passenger seating technology in aircraft has necessarily developed as a separate
25 technical field to that in other modes of transportation due to the significant technical, cost and spacing restraints which are unique to aircraft applications.

It is therefore an object of the present invention to provide a seat and/or seating arrangement that is reconfigurable to offer a multifunctional zone that can promote shared use of a defined space by multiple passengers.

30 As used herein the term “and/or” means “and” or “or”, or both.

As used herein “(s)” following a noun means the plural and/or singular forms of the noun.

“contiguous” as used herein may be interpreted as being an abutting and contacting relationship or a non abutting relationship where a small but negligible gap may exist.

“window seat” as used herein denotes a seat of a row that is closest to the cabin wall adjacent the fuselage, whether there is physically a window adjacent that seat or not.

Brief description of the invention.

5 In a first aspect the present invention may broadly be said to be a passenger vehicle seat unit comprising:

 a row of a plurality of adjacent seats, each including a seat back, a seat pan and a leg rest supported by a support frame, the leg rest of each seat moveably mounted relative to the support frame in a manner to allow it to move between (a) a stored
10 condition and (b) a fully deployed condition where the seat pan and the leg rest are substantially coplanar, and

 wherein the leg rest and seat pan of each seat in the row can cooperate to define a reconfigurable horizontal support surface for at least one passenger.

 Preferably the leg rest and seat pan of each seat in the row can cooperate to define a
15 reconfigurable support surface for shared use by at least two passengers.

 Preferably the row comprises at least two adjacent seats and wherein the leg rest and seat pan of each seat in the row can cooperate to define a reconfigurable support surface for shared use by all of the at least two passengers assigned to the row.

 Preferably the row comprises three adjacent seats.

20 Preferably the row comprises four adjacent seats.

 Preferably the row comprises five adjacent seats.

 Preferably for each seat, the leg rest extends from adjacent the seat pan and in the seat facing direction when in the fully deployed condition.

 Preferably for each seat the leg rest is contiguous the seat pan when in the fully
25 deployed condition.

 Preferably for each seat, the leg rest extends from adjacent the seat pan and in a downward direction when in the stored condition.

 Preferably for each seat the leg rest is contiguous the seat pan when in the stored condition.

30 Preferably when in a fully deployed condition, the leg rest of adjacent seats are contiguous each other.

 Preferably when in a stored condition, the leg rest of adjacent seats are contiguous each other.

 Preferably all seats of the row are side by side and all face in the same direction.

Preferably the row includes three seats and wherein all the leg rests and seats pans of said three seats are able to be configured to

- i) define a horizontal passenger support surface that can assume each of a T-shape, L-shape and U-shape and I-shape when viewed in plan view, and
- 5 ii) allow all three leg rests, in their fully deployed condition, together with the seat pans to support at least one person in a reclined position.

Preferably the row includes four seats and wherein all the leg rests and seats pans said three seats are able to be configured to

- 10 i) define a horizontal passenger support surface that can assume each of a T-shape, L-shape and U-shape and I-shape when viewed in plan view, and
- ii) allow all four leg rests, in their fully deployed condition, together with the seat pans to support at least one person in a reclined position.

Preferably flanking each side of each seat in the row, is an armrest, the arm rest intermediate of two seats in the row being able to move between a usable position wherein it is positioned intermediate of the seatback and seat pan and a stowed position wherein it is not positioned intermediate of the seatback and seat pan.

Preferably in the stowed position each arm rest intermediate of two adjacent seats, is located in a cavity defined between the backrests of the two adjacent seats.

Preferably each leg rest can be moved and positioned independently of the other leg rests.

Preferably the seat pan of each seat can tilt (preferably in conjunction with a reclining of the back rest) independently of the seat pan of said adjacent seat(s).

A passenger vehicle seating unit as herein above defines, installed onboard a commercial passenger aircraft.

25 In a second aspect the present invention may broadly be said to be a passenger vehicle seat unit comprising:

a row of a plurality of adjacent seats supported by a support frame, each seat including a seat back, a seat pan and a leg rest and each seat facing in the same direction, the leg rest of each seat including a leg support surface and mounted relative to the seat frame in a manner to allow it to move between (a) a stored condition and (b) a fully deployed condition where the seat pan and the leg rest support surface are substantially coplanar, and

30 wherein the leg rest and seat pan of each seat in the row can cooperate to define a reconfigurable horizontal support surface for at least one passenger.

In a further aspect the present invention may broadly be said to be a passenger vehicle seat unit that comprises a row of three adjacent seats each supported by a support frame and each including a seat back, a seat pan and a leg rest, each leg rest movably mounted to said support frame and relative to the seat pan between a stowed condition and a deployed

5 condition, wherein all the leg rests and seats pans of said three seats are able to be configured to:

- i) define, for at least one person, a horizontal support surface that can assume each of a T-shape, L-shape and U-shape and I-shape when viewed in plan view, and
- ii) allow all three leg rests, in their fully deployed condition, together with the seat

10 pans to support at least one person in a reclined position.

In still a further aspect the present invention may be said to be a passenger vehicle seat unit that comprises a row of four adjacent seats each supported by a support frame and each including a seat back, a seat pan and a leg rest, each leg rest movably mounted to said support frame and relative to the seat pan between a stowed condition and a deployed condition,

15 wherein all the leg rests and seats pans of said four seats are able to be configured to

- i) define, for at least one person, a horizontal support surface that can assume each of a T-shape, L-shape and U-shape and I-shape when viewed in plan view, and
- ii) allow all four leg rests, in their fully deployed condition, together with the seat pans to support at least one person in a reclined position.

20 In a further aspect the present a passenger vehicle seating arrangement comprising:

- i) a first row of a plurality of adjacent seats,
- ii) a second row of a plurality of adjacent seats located adjacent, aligned and in a position advanced more in the vehicle to the first row of seats,

each seat comprising a seat pan, a seat back upwardly extending from the seat pan and a

25 leg rest, said leg rest mounted relative the seat pan to allow it to move between (a) a stored condition, and (b) a fully deployed condition where the seat pan and the leg rest cooperate to provide substantially horizontal passenger support.

Preferably the seat pan and the leg rest of all seats in said first row can cooperate to provide substantially horizontal passenger support to allow at least one passenger to recline or

30 lie and generally extend in a direction parallel to the row direction and occupy at least two seats of the row.

Preferably each leg rest can be moved and positioned independently of the other leg rests.

Preferably the seat pan of each seat unit can tilt (preferably in conjunction with a reclining of the back rest) independently of the seat pan of said adjacent seat(s).

In a further aspect the present invention may be said to be a passenger vehicle including a passenger vehicle seating arrangement as herein above described.

5 In a further aspect the present invention may be said to be a passenger vehicle seating unit as described above, installed onboard a commercial passenger aircraft.

In a further aspect the present invention may be said to be a passenger vehicle seating unit as described above installed in an economy class section of the aircraft.

10 In a further aspect the present invention may be said to be a seating arrangement for a passenger aircraft comprising a plurality of side by side and juxtaposed seats each facing in the same direct and aligned with each other forming a row of seats, each seat including a seat pan and a leg rest that can be moved relative to the seat pan between a stowed condition and a deployed, wherein in the deployed condition the leg rest and seat pan form a horizontal support surface, the leg rests of each seat in the row of seats able to be configured in at least
15 one of its deployed and stored condition to allow a passenger to assume (i) a sedentary position by sitting in a seat and (ii) at least one of a lounging style position and a reclined position, by occupation of at least two seats of the row.

Preferably two companion passengers can each assume (i) a sedentary position by sitting in a respective seat of said row and (ii) at least one of a lounging style position and a reclined
20 position by shared occupation of at least two seats of the row.

Preferably the seating arrangement is in an economy class section of an aircraft.

In even a further aspect the present invention may be said to be a passenger vehicle seating arrangement comprising:

25 a row of a plurality of juxtaposed seats, each seat including a seat back, a seat pan and a leg rest, the leg rest of each seat moveably mounted relative to the seat pan in a manner to allow it to move between a stored condition and an extended condition where the seat pan and the leg rest are substantially coplanar and wherein the leg rest and seat pan of adjacent seats in the row can cooperate to define a reconfigurable support surface for at least one passenger.

30 In even a further aspect the present invention may be said to be a passenger seating unit for an aircraft comprising:

a row of 3 juxtaposed seats, each seat including a seat back, a seat pan and a leg rest, the leg rest of each seat moveably mounted relative to the seat pan in a manner to

allow it to move between a stored condition and an extended condition where the leg rest is presented adjacent the seat pan to provide a support surface for a passenger.

In even a further aspect the present invention may be said to be a passenger seating unit for an aircraft comprising:

- 5 a row of 4 juxtaposed seats, each seat including a seat back, a seat pan and a leg rest, the leg rest of each seat moveably mounted relative to the seat pan in a manner to allow it to move between a stored condition and an extended condition where the leg rest is presented adjacent the seat pan to provide a support surface for a passenger.

This invention may also be said broadly to consist in the parts, elements and features
10 referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

- 15 Other aspects of the invention may become apparent from the following description which is given by way of example only and with reference to the accompanying drawings.

Brief description of the drawings

Preferred embodiments of the present invention are shown in the accompanying
20 drawings in which;

Figure 1a shows a front perspective view of a seating arrangement with individual seats of the front row positioned in various configurations;

Figure 1b shows a front view of a seat unit,

Figure 2 shows a back perspective view of a seating arrangement of figure 1a with
25 individual seats positioned in various configurations;

Figure 3 shows a top view of a seating arrangement of figure 1;

Figure 4a shows a side view of a seating arrangement of figure 1;

Figures 4b-g shows a plan schematic view of a row of 3 seats of different
configurations of leg rests relative to seat pans that can be achieved;

30 Figure 5a-5d shows a plan view of how a seating arrangement may be utilised for companion travellers, comprising two adults, to allow the creation of a communal/shared space;

Figure 6a-6d shows a plan view of how a seating arrangement may be utilised for companion travellers, comprising two adults and a child, to allow the creation of a communal/shared space;

5 Figure 6e-6h shows a plan view of how a seating arrangement may be utilised for companion travellers, comprising one adult and two children, to allow the creation of a communal/shared space;

Figure 7a and 7b shows a plan view of how a seating arrangement may be utilised for individual travellers, comprising two adult, to provide reconfigurable individual space;

10 Figure 7c and 7e shows a plan view of how a seating arrangement may be utilised for non-companion but associated travellers such as two business people to provide reconfigurable individual and shared space;

Figures 8-28 shows schematic plan views of seating arrangements in various configurations, including typical arrangements of passengers, illustrating the flexibility of the seating arrangement;

15 Figure 29 shows a top perspective view of a plurality of tray tables;

Figure 30 shows a top perspective view of a plurality of tray tables in another configuration;

Figure 31 shows a schematic plan view of part of an aircraft including a plurality of seat units in two columns of rows of seats each with three seats; and

20 Figure 32 shows a schematic plan view of an aircraft including a plurality of seat units in two columns of rows of seats with two seats abreast and with an intermediate column of four seats abreast.

Figure 33 shows a perspective view of part of a tray table,

25 Figure 34 shows a perspective view of part of a tray table as per figure 33 but in a different configuration

Figure 35 shows an aircraft that may carry the seat units and seating arrangement and onboard which the methods of the present invention may be performed;

Figure 36 shows a side view of the seat pan arrangement, leg rest arrangement and articulated coupling of a seat arrangement in a stowed condition;

30 Figure 37 shows a side view of the seat pan arrangement, leg rest arrangement and articulated coupling of a seat arrangement in a partially extended position; and

Figure 38 shows a side view of the seat pan arrangement, leg rest arrangement and articulated coupling of a seat arrangement in a fully extended position.

Detailed description of the invention.

With reference to the above drawings, in which similar features are generally indicated by similar numerals, there is shown a seating arrangement 100.

Figure 1 shows a seating arrangement 100 that can be implemented on board a commercial passenger aircraft 300. And preferably in its economy class section. The seating arrangement 100 consists of at least one and preferably at least two rows 5 of seats 6 that are positioned one behind the other. Each row of seats 5 includes at least 2 and preferably at least 3 adjacent seats 6. Each seat 6 in a row 5 includes a seat back 12, seat pan 10 and preferably also a leg rest 11. Each seat 6 can receive a passenger in a sedentary position. Each seat 10 defines an individual space in the row for a sedentary passenger to occupy. Such a passenger may occupy such a space and may utilise the seats backrest, seat pan and leg rest. They may also use the arm rests that may be presented on each side of the passenger. Arm rests 20 may be movable from an in use position where the arms of a passenger can rest on them, and a stowed position, where the arm rests generally are not located in the general space between 15 the seat pans and back rests. The arm rests may be removable, or may move down to be between seat pans of move back to be between back rests of the row of seats. For example the arm rests 20a may be moved to a stowed position where they extend substantially vertically and/or may be recessed within/or between the back rests of adjacent seats 6 in that row.

20 The armrest(s) 20a can pivot between the deployed position and a stowed position about a horizontal axis and when in the stowed position are substantially out of the way of passengers. In the preferred embodiment the stowed position may be in a cavity 22 formed between two adjacent seat backs 12.

The outer most arm rests 20b may or may not be movable. However, they may be 25 movable in a like manner to the arm rests 20a.

Each row preferably faces in a forward direction in relation to the body of the aircraft. In other words, the seat back 12 faces toward the front of the aircraft. Each row 5 preferably faces in the same direction. A column of plurality of rows can be defined in the aircraft, the column direction may be parallel to the seat facing direction. And may be parallel to the 30 elongate direction of the body of the aircraft.

The seats in each row are positioned adjacent each other. The seat pans are preferably able to assume a condition contiguous each other so that a bench or couch like sitting surface may be defined by the at least two seats. The back rests 12 of each seat 6 may recline from an upright more position to a reclined more position. This can be achieved independent of the

position of adjacent back rests. The seats may be individual seats each separately mounted to the floor track or tracks of the aircraft or may all be supported by one or more support frames mounted to the floor track or tracks of the aircraft.

5 Preferably each row has at least two adjacent seats, more preferably at least three seats or four adjacent seats.

 Preferably each seat includes a leg rest arrangement 111. The arrangement includes a leg rest 11 and a leg rest mechanism 112.

10 The leg rest can be moved between a stored position where it is located adjacent or proximate the front edge of a seat pan and extends downwardly therefrom and a fully deployed position where it is located adjacent a front edge of a seat pan and extends generally in a coplanar manner with the seat pan. It will be appreciated that surface contouring of the upper surface 17 of the seat pan and of the supporting surface 16 of the leg rest may exist. And that not the entire surface of the seat pan and the leg rest are strictly in a co-planar relationship, but may be close to it. In at least the fully deployed position, the leg rest is
15 contiguous the seat pan. A small but insignificant gap may exist. It may also be and preferably remain contiguous when in the stored and any intermediate position.

 The position of the leg rest relative to the seat pan can be independently controlled relative to the other leg rest of the other seats 6 in the row 5. Accordingly a passenger sitting in an individual seat can select a desired leg rest position.

20 With reference to the forward most row 5 shown in Figure 1, each seat 6 in that row shows its respective leg rest in a different position. Leg rest 11a is shown in a fully deployed position, leg rest 11b is shown in a partially deployed position and leg rest 11c is shown in a stored position.

25 In the fully deployed position as shown with reference to leg rest 11a, the supporting surface 16 cooperates with the respective seat pan to define a horizontal support zone 88. It is referred to as "horizontal" herein, though may not, or not always be perfectly horizontal in use as that may depend on the inclination of the aircraft. In essence, the horizontal support zone, in normal mode of use and when established, will offer a passenger support in a vertical direction.

30 With reference to Figures 3 and 4 it can be seen that the supporting surface 16 of a leg rest 11 may in its fully extended position also extend a substantial distance between the leading edge 19 of the seat pan, and a seat 6 (such as its back rest) of a row in front of the leading edge 19. In the preferred form, the leg rest 11 in its fully deployed position closes the gap between rows of seats. There may still be a slight gap but such is preferably insufficient for a

person to stand up in between rows on the floor X-X of the cabin of the aircraft as shown in figure 1b.

By providing a leg rest 11 for each seat 6 in a row that can be positioned independent of adjacent leg rests in the row, each passenger in that row can make a decision about the
5 desired leg rest position of the seat 6 that that passenger is sitting in.

Furthermore, the provision of such independent leg rests in a row 5 can allow for cooperation of leg rests of each row. For example, with reference to Figure 18, row 5a shows the leg rest of each seat moved to a fully deployed position. And the arm rests 20a may be moved to a stowed position. This allows for the creation of a sleeping surface that one or
10 more passengers can utilise. As can be seen a passenger in row 5a can lie in a general direction lateral to the forward/aft direction of the aircraft. Where the row is adjacent the side of the cabin interior, the armrest 12 a or 13b can also be moved out of the way. This can allow a passenger to recline against the cabin interior wall at that location, thereby creating even more space for that or each passenger in the row.

15 In the configuration where all leg rests in a row of seats are extended a single passenger may lie or recline more on the sleeping or resting surface so defined by at least two or more of the seat pans and associated extended leg rests. Multiple passengers such as an adult and a child may be able to share such a sleeping or resting surface. A child may also use the surface or part of the surface as a play area. The surface may also offer support to a
20 person preferring to sit in an upright position but with their legs extending substantially horizontally as for example as shown in row 5b in figure 17. Eg for use as a lounge.

It will be appreciated that in a reclined position of a person, a sleeping or resting surface defined by two adjacent seat pans and leg rests may be sufficient thereby allowing for a seat at one end of the row to have its leg rest in a non-fully deployed position such as in a
25 partially extended or stored position as shown with respect to row 5b of Figure 17. This is also shown with reference to row 5a shown in Figure 22. Likewise other seats in the row may have their leg rests in a non-fully deployed position.

Various combinations of leg rest positions of the leg rests 11 in a row can be achieved. For a row of 3 seats, some of the different combinations are shown in figures 4b-4g. With
30 reference to row 5a shown in Figure 27, seats 6 at the end of a row 5 may have their leg rests 11 in a stored position whereas the leg rest arrangement 11 of the intermediate seat(s) 6 may be fully extended. In a fully extended position a passenger in the intermediate seat arrangement may be able to sit up with their legs extending substantially horizontally. Alternatively where the person is of a smaller size, the person may be able to lie down. This

may be particularly beneficial for adult passengers travelling with babies or small children and can allow for babies or small children to rest more comfortably. Figures 5-7 show other configurations that can allow for the space between rows of seats to be customised by passengers depending on their needs and/or preferences.

- 5 The supporting surface 16 of each leg rest may be defined by a cushion. There may also be a life jacket compartment containing a life jacket that is incorporated in the leg rest and for access by a passenger at the supporting surface 16.

- The leg rest 11 is movable relative to the seat pan and the support frame of the seat by which it is supported in a pivoting manner between the stored and fully deployed positions.
- 10 The leg rest in such movement passes through a partially extended position (as shown in figure 1a). In the stored position, the leg rest 11 is stowed at least partially beneath the seat pan 10. In the partially extended position, it is envisaged that the support surface of the leg rest 11 will be in a range of between 30 and 60 degree to the vertical, and most preferably at about 45 degrees to the vertical and projecting downwardly and away from the seat pan.

- 15 Typically when an aircraft is about to land and/or take off and/or during taxi, the leg rest 11 may be required to be in its stored position. This provides a clear space between rows for evacuating passengers during an emergency. During taxi/take-off/landing the leg rest may need to be sufficiently restrained to prevent it from movement significant relative to the support structure under certain loads.

- 20 It is envisaged that the leg rest mechanism will be manually moved by a user or passenger preferably at least in part assisted by use of a hydrolock. An electric motor may be instead or also be used. Alternatively no such means for assistance may be provided .

- The leg rest is designed so that the leg rest does not require support from a seat in front, nor from the floor below. The leg rest is supported via the mechanism by the seat to which it is attached.
- 25

- Whilst herein reference is made to the leg rest and its primary function as being a leg rest to the passenger sitting on the seat pan with which the leg rest is associated, the leg rest may be used in a secondary function such as for allowing a passenger to sit on it or to lie on top of it. Preferably each leg rest can be moved and positioned independently of the other leg rests. Preferably the seat pan of each seat can tilt (preferably in conjunction with a reclining of the back rest) independently of the seat pan of said adjacent seat(s).
- 30

 A further embodiment of the invention may include at least one tray table 80 that is mounted to the rear of a seat back 12. It provides a surface for an associated passenger seated

behind the seat back 12 to use. The tray table 80 can be deployed for use or stowed out of the way when not required. It also has various partially deployed states.

The table comprises a primary table top 82 and a segmented secondary table top 85 comprising multiple extension panels 84 which can be moved to increase or decrease the
5 usable surface area of the tray table 80.

The primary table top 82 is pivotally mounted by an arm 86 or pair of arms 86 that are affixed to the seat, such as to the seat back. The arms define a horizontal pivot axis that mounts the primary table top to be rotational between a stowed position where it is located adjacent and substantially parallel to the seat back and a deployed position for use. The arms
10 may themselves be pivotally mounted to the seatback.

It is envisaged that primary table top 82 may be slidably mounted to the base panel 87 as shown in the middle arrangement of figure 30. Alternatively there may be no such base panel 87. And the primary table top may be directly connected to the arms 86.

The primary table top carries the segmented secondary table to. This may comprise of
15 two adjacent extension panels 84 that may be pivotally mounted to the primary table top 82 . In a preferred embodiment as shown in figures 29 and 30, two pivotally mounted extension panels 84 are pivoted or hinged from the edge of the primary table top 82 closest to the passenger. The two pivotally mounted extension panels 84 are pivotable between a first position in which they are folded together on top of the primary table top 82 such that their
20 major faces are in face to face contact with each other, and a second position, in which either one or both of the pivotally mounted extension panels 84, can be pivoted or hinged from a folded position into a deployed position such that the total table top surface is increased toward the passenger together with the primary table top 82.

Alternatively the pivotally mounted extension panels 84 could hinge from any edge of
25 the primary table top.

The preferred edge of the primary table top that may be utilised is the edge that is perpendicular to the seat facing direction. The primary table top is preferably quadrilateral in shape. And preferably rectangular. The extension panels are preferably also rectangular in shape and each include an edge that can be positioned contiguous the others, such as when
30 both extension panels are fully deployed or both are fully in their stored condition.

In the preferred embodiment two or more tray tables 80 for a row of seats can act in concert to provide various table arrangements for the passengers in the row of seats. It is envisaged that the various available configurations of the tray tables may be used in combination with the many available configurations of the seats as a seating system 500 to

provide a high degree of flexibility and usability for passengers of various sizes and groupings, as shown in figures 8-28.

For example, a tray table arrangement for the middle of a row of 3 seats may be fully deployed, the leg rest of that seat being in the stored position to allow a passenger in that seat to be sedentary. Passengers in the adjacent seats may sit on the fully extended leg rests of their respective seats to allow them to sit in a more communal manner with the passenger in the middle seat and utilise the tray table arrangement in desired manner. This can help facilitate more comfortable or desirable interactivity between passengers in a row.

Partially deployed tray table arrangements and tray table arrangements of variable configuration can also help with passenger accessibility and usability of their seating environment.

As shown in figure 31, it is envisaged that an aircraft may include columns (when viewed in plan) of seat units, with the seat units arranged in rows in each column. As an example, the seat units could be arranged in rows of three as two columns separated by an aisle. The rows of each column may align or may be off-set from each other. The rows of each column may have row pitch set at the same pitch or at different pitch. Indeed the pitch between rows in a column, may not be consistent.

Preferably all seats in a row face in a forward direction. The seat facing direction of each seat in a row, and preferably all seats in all rows is perpendicular to the longitudinal direction of the aircraft. Preferably the rows are parallel to each other.

Preferably all seats in the row are no more advanced in the plane compared to other seats in row. Eg the row direction is perpendicular to the longitudinal direction of the aircraft.

Preferably the seats do not rotate about any vertical axis. Eg the seat facing direction remains stationary (ie it does not rotate). And preferably the seat frame is stationary.

In another embodiment for a larger plane, and as shown in figure 32, it is envisaged that two columns of seat units arranged side by side with three-abreast seats in each row of at least one or both columns could be separated by another column of seats with an aisle on each side. The separating column of seats need not be the currently claimed seat units, but may be any known seats. The seats of the present invention lend themselves particularly well for the row being positioned adjacent the interior side wall of the aircraft, where the seats can be arranged to allow a passenger to lean against the cabin wall and thereby create even more space in the row. A person can more conveniently lean against the sidewall of the aircraft when the armrest outboard most is positioned out of the way.

The seat pan of each seat preferably includes an individual seat cushion for each seat. A gap exists between cushions of adjacent seats to allow a seat belt webbing to extend from the seat frame between adjacent cushions. The individual cushions may each and separately be removable. The seat pan of each seat may also tilt independently of the seat pan of adjacent
5 seat(s) in the row. A seat tilt mechanism may be provided so that the angle of incline (in a fore-aft direction) of the cushion may be varied. This mechanism may be tied to the recline mechanism of the back rest of the seat. Eg, as the back rest moves, the seat pan may move.

Referring now to figures 36-38, each seat arrangement 200 comprises a seat back 12; a seat pan arrangement 10; a leg rest arrangement 11 and an articulated coupling.

10 The seat back 12 is configured to be independently moveable between a more upright position and a more reclined position.

The seat pan arrangement 10 includes a seat pan cushion 60 supported at least in part by a seat pan frame 62, and defines a supporting surface 17. The seat pan frame 62 is pivotally mounted to a fixed structural member (not shown) relative the aircraft about a seat
15 pan pivoting axis 64.

The seat pan arrangement 10 is configured to be moveable between a substantially horizontal position (as shown in figures 36 and 38), and a reclined position in which the seat pan arrangement slopes upwardly towards the front of the seat pan arrangement 10. It is also envisaged that in alternative embodiments, the seat pan arrangement could also move to an
20 inclined position in which the seat pan arrangement slopes downwardly towards the front of the seat pan arrangement 10.

The leg rest arrangement 11 is substantially planar in a preferred embodiment, but it is envisaged that it could include formations or contouring on it. The leg rest arrangement 11 includes a leg rest frame 42 and a leg rest cushion 44 defining a supporting surface 16.

25 The leg rest arrangement 11 is articulated to pivot about a leg rest pivot axis 15 to be movable between a stored position (as shown in figure 36) and a fully extended position (as shown in figure 7), and passing through a partially extended position (as shown in figure 37). In the stored position, the leg rest arrangement 11 is stowed at least partially beneath the seat pan arrangement 10. In the fully extended position, the leg rest arrangement 11 extends
30 substantially outwardly from the seat pan arrangement 10 to sit co-planar with the seat pan arrangement 10. In the partially extended position, it is envisaged that the plane of the leg rest arrangement 11 will be aligned in a range of between 30 and 60 degree to the vertical, and most preferably at about 45 degrees to the vertical.

The leg rest arrangement 11 and the seat pan arrangement 10 are coupled to each other via an articulated coupling 30. As will be explained in greater detail below, movement of at least one of the seat pan arrangement 10 or the leg rest arrangement 11 causes or can cause movement of the other of the seat pan arrangement 10 and the leg rest arrangement 11.

5 The articulated coupling 30 includes a coupling pivoting member 32, which is pivotable about a horizontal pivot axis 34. The coupling pivoting member 32 is coupled to the leg rest arrangement by a first sliding mechanism 36. The first sliding mechanism 36 includes a first lug 38 which is slidably received into and is reciprocally movable along a complementary first slot formation 40.

10 In a preferred embodiment, the first lug 38 extends from the leg rest frame 42, and is received into the first slot formation 40 in the coupling pivoting member 32. However, it is envisaged that other alternative mechanisms may be utilised to drive angular movement of the leg rest arrangement 11 about the leg rest pivot axis 15. In one embodiment, the leg rest pivot axis 15 and the coupling pivot axis 34 of the coupling pivoting member 32 may be coaxial. In
15 yet another embodiment, the coupling pivoting member 32 may be joined with the leg rest arrangement 11.

As shown in figures 36-38, pivoting movement of the leg rest arrangement 11 about the leg rest pivot axis 15 causes pivoting movement of the coupling pivoting member 32 about the coupling pivot axis 34. Since the leg rest pivot axis 15 and the coupling pivot axis
20 34 are not coaxial in figures 5-7, the first lug 38 will slide within in the first slot formation 40.

The coupling pivoting member 32 is further coupled to the seat pan arrangement 10 by a second sliding mechanism 50. The second sliding mechanism 50 includes a second lug 52 which extends from the coupling pivoting member 32, and is configured and dimensioned to be received into and slidably move along a complementary second slot formation 54 in the
25 seat pan frame 62. In this way, pivoting movement of the coupling pivoting member 32 about the coupling pivot axis 34 causes sliding movement of the second lug 52 in the second slot formation 54.

Further, sliding movement of the second lug 52 in the second slot formation 54 causes pivoting movement of the seat pan arrangement 10 about the seat pan pivoting axis 64, since
30 the lug 52 acts as a cam follower and the second slot formation 54 acts as a cam. It is envisaged that many equivalent mechanical mechanisms may be used to transmit angular drive between the leg rest arrangement 11, and the seat pan arrangement 10.

It should be noted that the second slot formation 54 is curved in nature and extends downwardly at each end. This is because the seat pan arrangement 10 is required to be in its

horizontal position when the leg rest arrangement 11 at least is in its fully extended position and preferably is at both opposed limits of its pivotal movement. This is in order for the seat pan arrangement 10 to form a substantially coplanar surface with the substantially planar leg rest arrangement 11 when the leg rest arrangement 11 is in its fully extended position, thereby
5 defining a larger size bed for a passenger to sleep on than would have been the case without the leg rest arrangement 11.

Further, typically when an aircraft is about to land and/or take off, both the leg rest arrangement 11 may be required to be in its stored position, and the seat pan arrangement may be required to be in its horizontal position.

10 In the embodiments shown, the curvature of the second slot formation 54 is such that the greatest angle of recline of the seat pan arrangement 10 will occur when the plane of the leg rest arrangement 11 is between 30 and 60 degrees to the vertical, and preferably at about 45 degrees to the vertical.

It will be appreciated that while the embodiments shown in the figures show the seat
15 pan arrangement 10 being directly coupled to the leg rest arrangement 11, it is envisaged that in alternative embodiments, the seat pan arrangement 10 may be decoupled and moved independently of the leg rest arrangement 11. In this way, the seat pan arrangement 10 can be moved to its reclined or inclined position when the leg rest arrangement 11 is in either its stored position, or in its fully extended position.

20 It is envisaged that in one embodiment, the coupling pivoting member 32 may be configured and adapted to be pivoted about its coupling pivot axis 34 by at least one electric motor (not shown), thereby mechanising movement of the seat pan arrangement 10 and leg rest arrangement 11. However, for the purposes of airline seating, where weight is a critical factor, it is envisaged that the articulated coupling 30 will be manually moved by a user or
25 passenger exerting a force for example to the leg rest arrangement 11 directly or via a handle 70 located towards an edge of the leg rest arrangement 11. Or by use of a hydrolock.

The seat 6 further includes a locking mechanism (not shown) for locking in selected positions one or more selected from the seat pan arrangement 10, the leg rest arrangement 11, the articulated coupling 30, and the coupling pivoting member 32. It is envisaged that the
30 locking mechanism could operate by way of a positive mechanical lock, or a friction lock, or the like. It is envisaged that locking of the locking mechanism may occur passively (ie purely by virtue of the position of the leg rest), and unlocking actively (eg by a person).

Since the seat pan arrangement 10, the leg rest arrangement 11, the articulated coupling 30, and the coupling pivoting member 32 are coupled to each other, preventing

movement of one of these will in effect lock the position of the rest of them, unless one or more of these is independently decoupled from the others as described.

It is envisaged that the locking mechanism could lock the one or more of the seat pan arrangement 10, the leg rest arrangement 11, the articulated coupling 30, and the coupling
5 pivoting member 32 at predetermined positions (for example at its extremes of movement, and/or when the leg rest arrangement is at 45 degrees to the vertical) or allow locking of the leg rest arrangement 11 in variable positions.

It is envisaged that the seats are provided in an economy class section of an aircraft.

The accommodation space that can be created by the present invention provides a
10 flexible and multifunctional space that can promote shared use of a defined space by multiple passengers. The space can be configured to treat passengers not as individuals but rather as groups of people such as a couple, a family of three, two business partners, 3 children and so on yet also cater for an individual traveler. And for that individual passenger offer more and multi functional space. Such as when for example the aircraft is not flying at full capacity or
15 full class capacity.

To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any
20 sense limiting.

Claims:

1. A passenger vehicle seat unit comprising:
a row of a plurality of adjacent seats, each including a seat back, a seat pan and a
5 leg rest supported by a support frame, the leg rest of each seat moveably mounted
relative to the support frame in a manner to allow it to move between (a) a stored
condition and (b) a fully deployed condition where the seat pan and the leg rest are
substantially coplanar, and
wherein the leg rest and seat pan of each seat in the row can cooperate to define
10 a reconfigurable horizontal support surface for at least one passenger.
2. A passenger vehicle seat unit as claimed in claim 1 wherein the leg rest and seat pan of
each seat in the row can cooperate to define a reconfigurable support surface for shared use
by at least two passengers.
3. A passenger vehicle seat unit as claimed in claim 1 or claim 2 wherein the row comprises
15 at least two adjacent seats and wherein the leg rest and seat pan of each seat in the row can
cooperate to define a reconfigurable support surface for shared use by all of the at least two
passengers assigned to the row.
4. A passenger vehicle seat unit as claimed in claim 3 wherein the row comprises three
adjacent seats.
- 20 5. A passenger vehicle seat unit as claimed in claim 3 wherein the row comprises four
adjacent seats.
6. A passenger vehicle seat unit as claimed in claim 3 wherein the row comprises five
adjacent seats.
7. A passenger vehicle seat unit as claimed in any one of claims 1 to 6 wherein for each
25 seat, the leg rest extends from adjacent the seat pan and in the seat facing direction when in
the fully deployed condition.
8. A passenger vehicle seat unit as claimed in claim 7 wherein for each seat the leg rest is
contiguous the seat pan when in the fully deployed condition.
9. A passenger vehicle seat unit as claimed in any one of claims 1 to 8 wherein for each
30 seat, the leg rest extends from adjacent the seat pan and in a downward direction when in the
stored condition.
10. A passenger vehicle seat unit as claimed in claim 9 wherein for each seat the leg rest is
contiguous the seat pan when in the stored condition.

11. A passenger vehicle seat unit as claimed in any one of claims 1 to 10 wherein when in a fully deployed condition, the leg rest of adjacent seats are contiguous each other.
12. A passenger vehicle seat unit as claimed in any one of claims 1 to 11 wherein when in a stored condition, the leg rest of adjacent seats are contiguous each other.
- 5 13. A passenger vehicle seat unit as claimed in any one of claims 1 to 12 wherein all seats of the row are side by side and all face in the same direction.
14. A passenger vehicle seat unit as claimed in claim 1 wherein the row includes three seats and wherein all the leg rests and seats pans of said three seats are able to be configured to
- 10 i) define a horizontal passenger support surface that can assume each of a T-shape, L-shape and U-shape and I-shape when viewed in plan view, and
- ii) allow all three leg rests, in their fully deployed condition, together with the seat pans to support at least one person in a reclined position.
15. A passenger vehicle seat unit as claimed in claim 1 wherein the row includes four seats and wherein all the leg rests and seats pans said three seats are able to be configured to
- 15 i) define a horizontal passenger support surface that can assume each of a T-shape, L-shape and U-shape and I-shape when viewed in plan view, and
- ii) allow all four leg rests, in their fully deployed condition, together with the seat pans to support at least one person in a reclined position.
16. A passenger vehicle seat unit as claimed in any one of claims 1 to 15 wherein flanking
- 20 each side of each seat in the row, is an armrest, the arm rest intermediate of two seats in the row being able to move between a usable position wherein it is positioned intermediate of the seatback and seat pan and a stowed position wherein it is not positioned intermediate of the seatback and seat pan.
17. A passenger vehicle seat unit as claimed in claim 16 wherein in the stowed position each
- 25 arm rest intermediate of two adjacent seats, is located in a cavity defined between the backrests of the two adjacent seats.
18. A passenger vehicle seating unit as claim in any one of the preceding claims wherein each leg rest can be moved and positioned independently of the other leg rests.
19. A passenger vehicle seating unit as claimed in any one of the preceding claims wherein
- 30 the seat pan of each seat can tilt (preferably in conjunction with a reclining of the back rest) independently of the seat pan of said adjacent seat(s).
20. A passenger vehicle seating unit as claimed in any one of claims 1 to 19 installed onboard a commercial passenger aircraft.

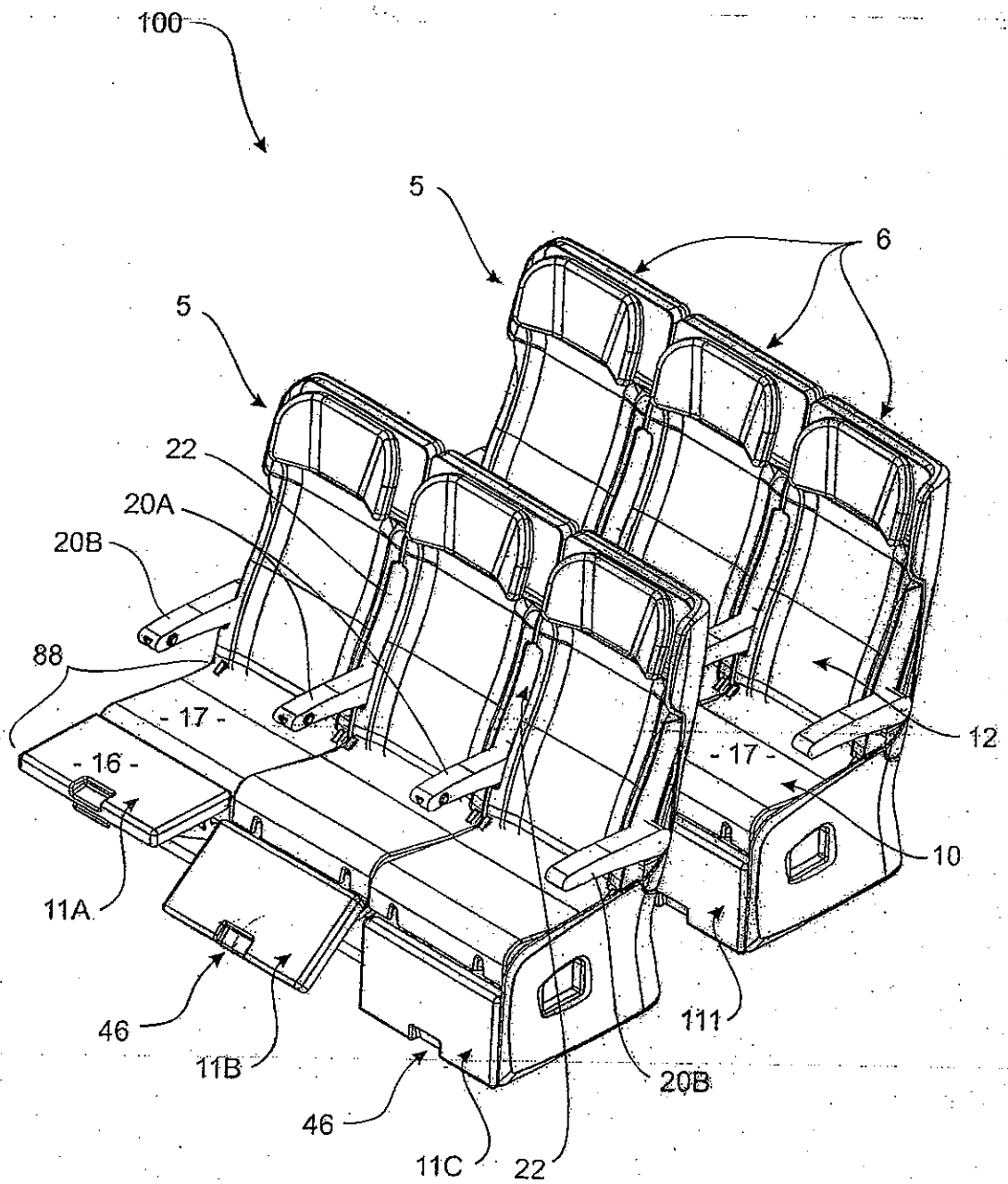


FIG. 1a

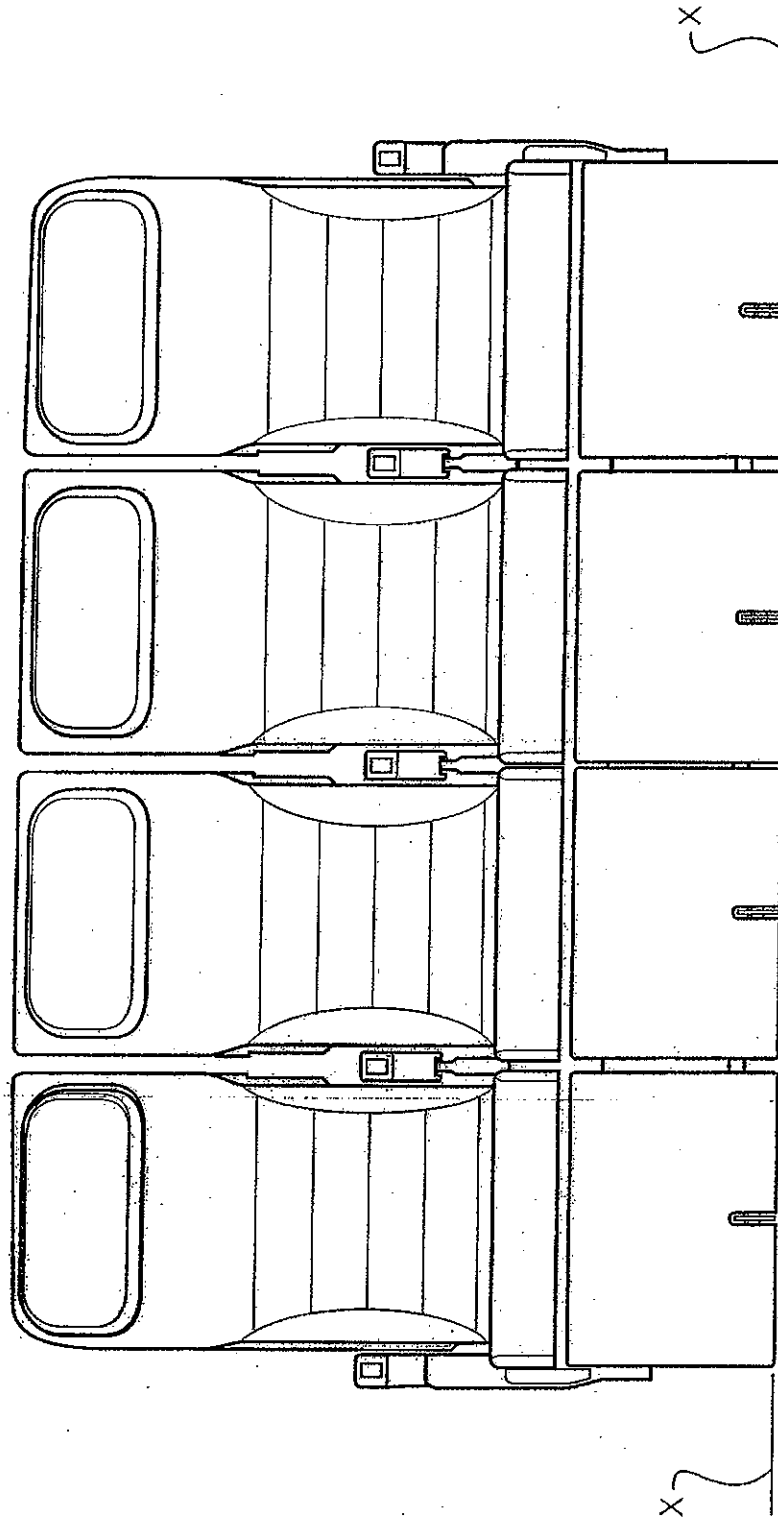


FIG. 1b

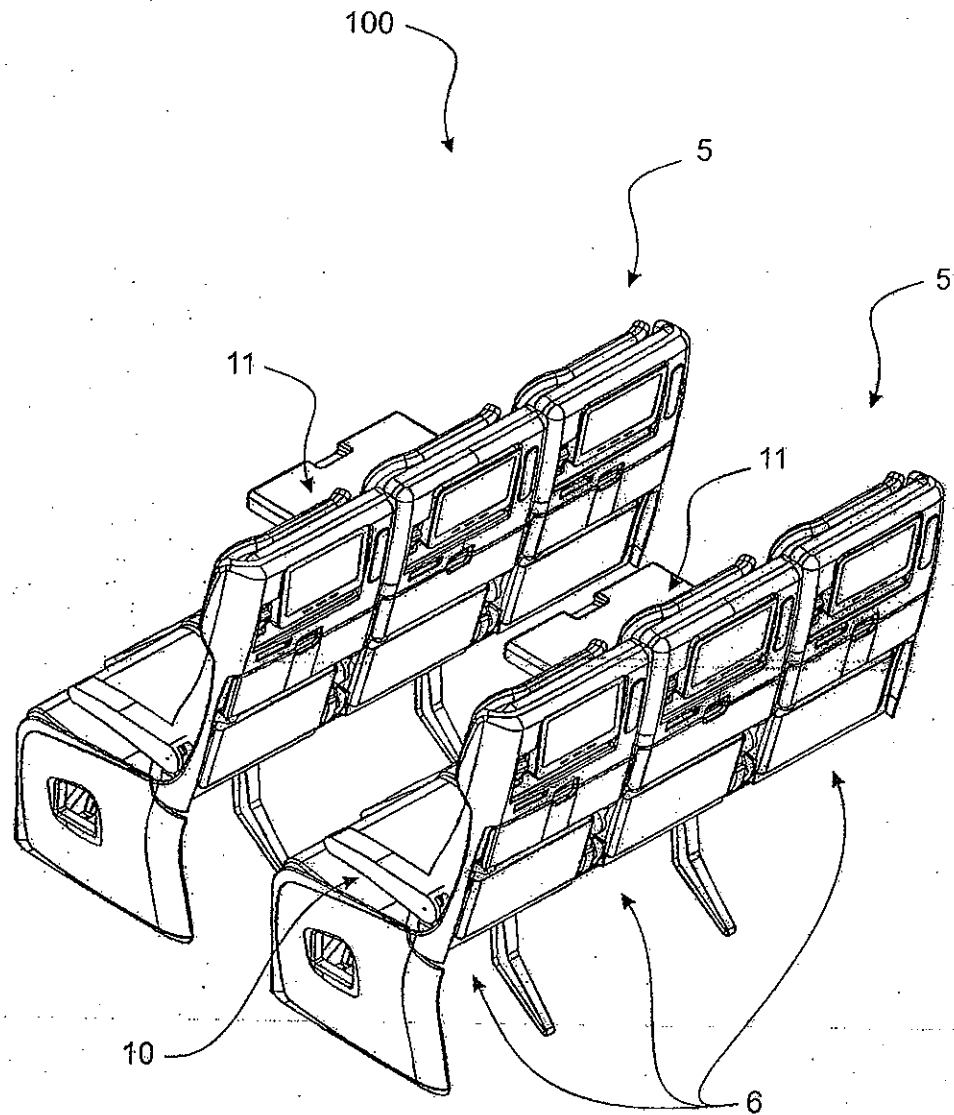


FIG. 2

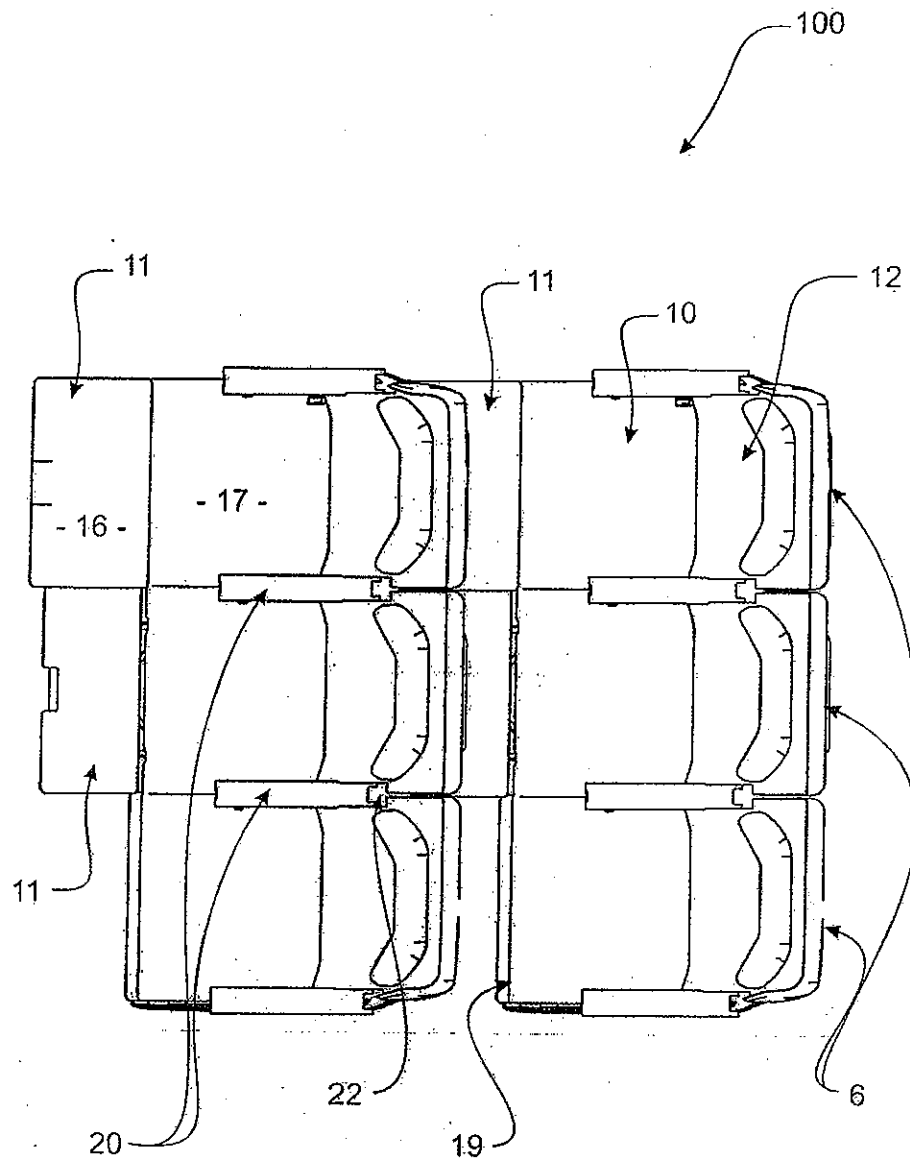


FIG. 3

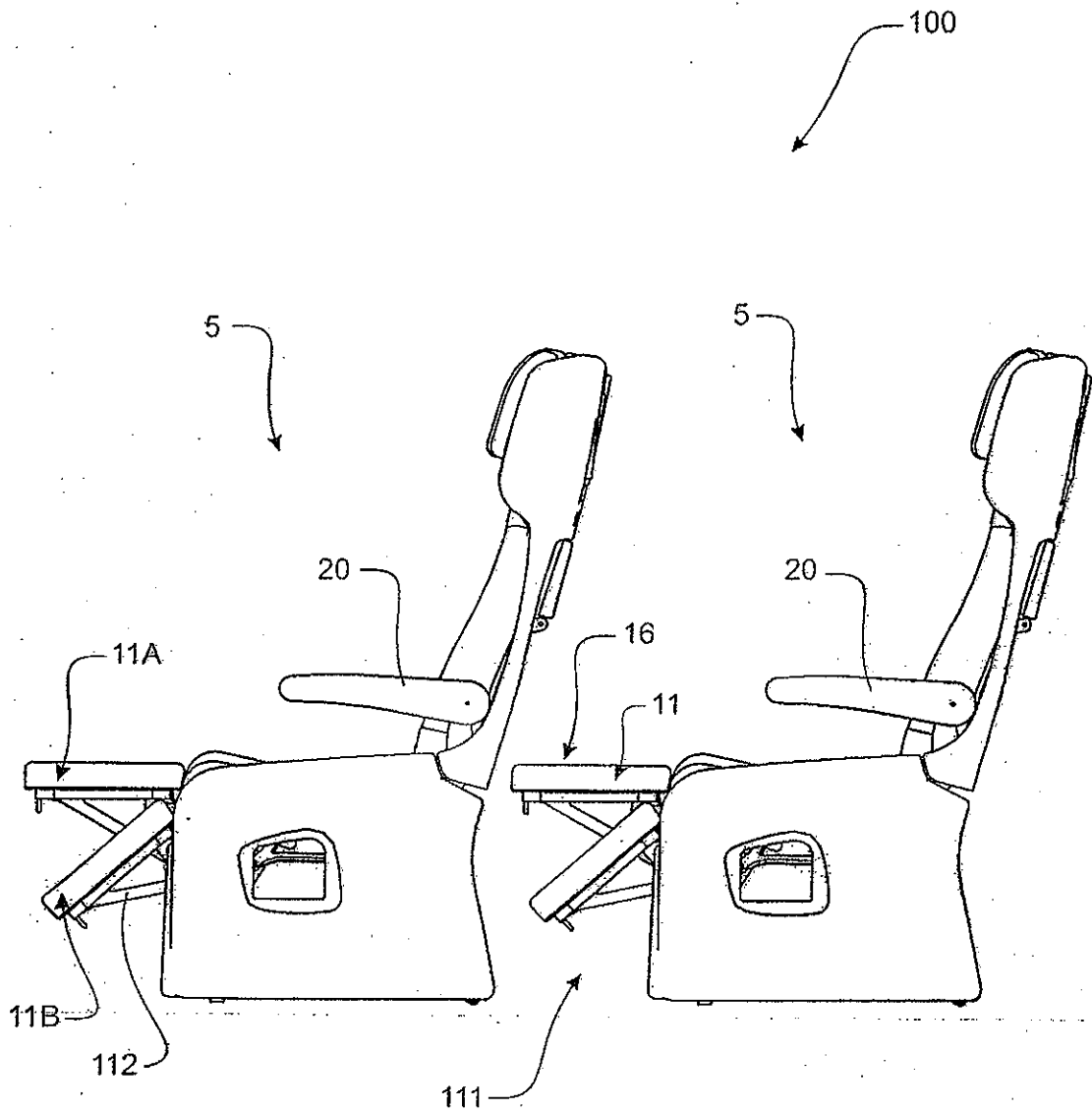


FIG. 4a

6-23

FIG. 4b

		- 17 -
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FIG. 4c

		- 17 -

FIG. 4d

		- 16 -
		- 17 -

FIG. 4e

	- 16 -	
		- 17 -

FIG. 4f

- 16 -		
		- 17 -

FIG. 4g

		- 16 -
		- 17 -

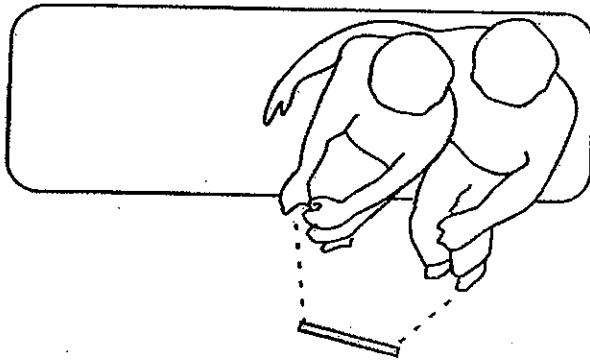


FIG. 5a

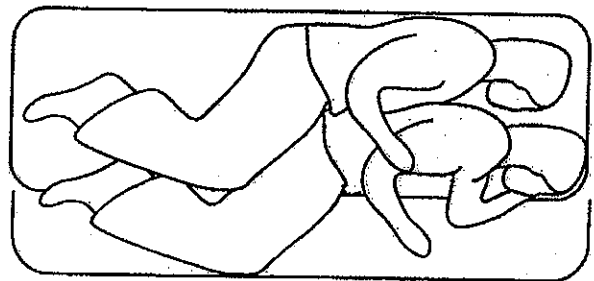


FIG. 5b

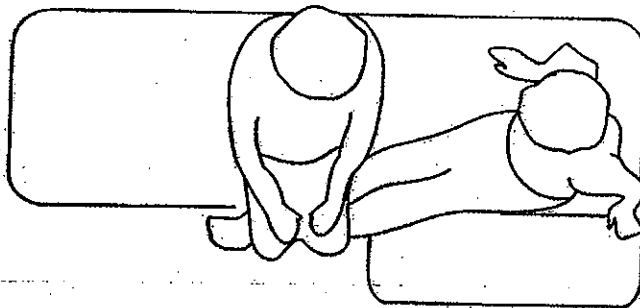


FIG. 5c

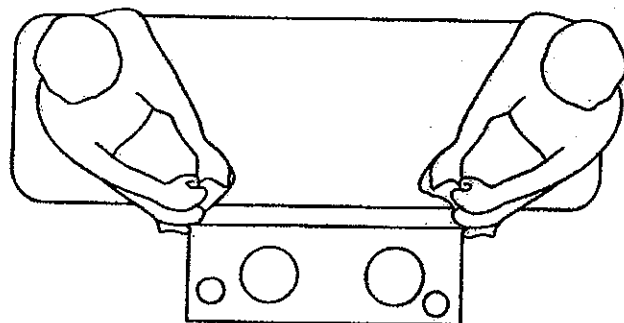


FIG. 5d

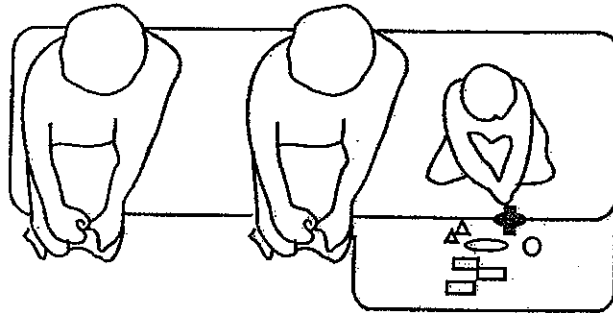


FIG. 6a

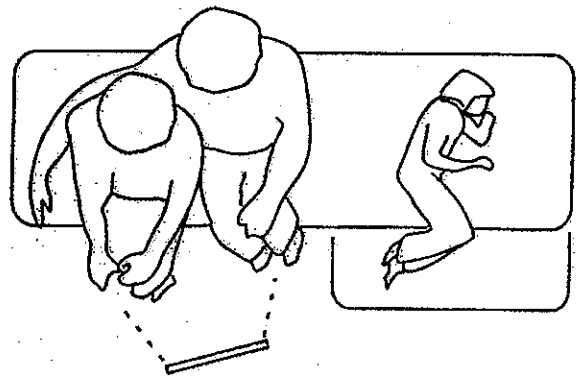


FIG. 6b

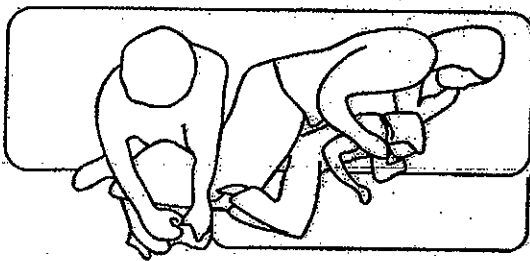


FIG. 6c

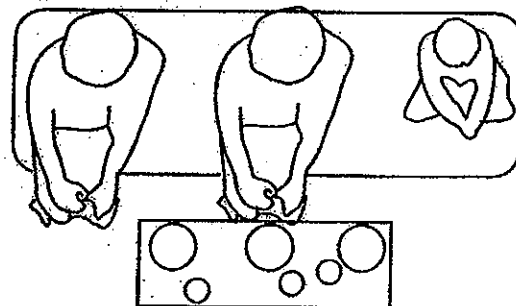


FIG. 6d

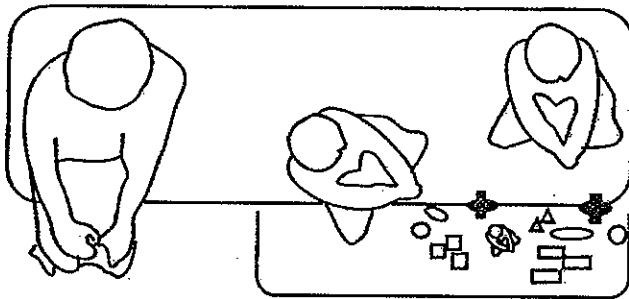


FIG. 6e

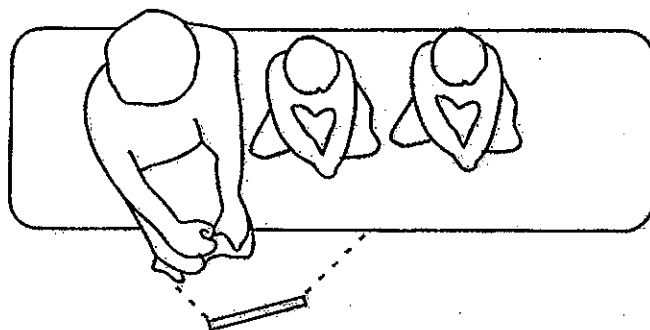


FIG. 6f

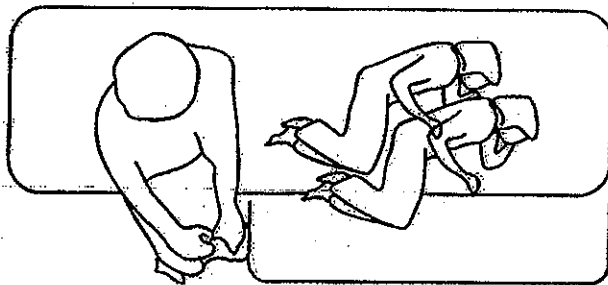


FIG. 6g

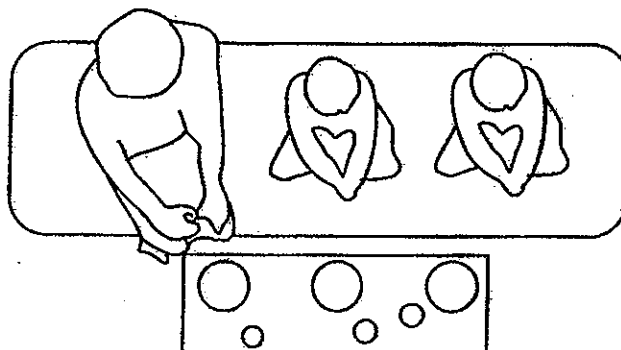


FIG. 6h

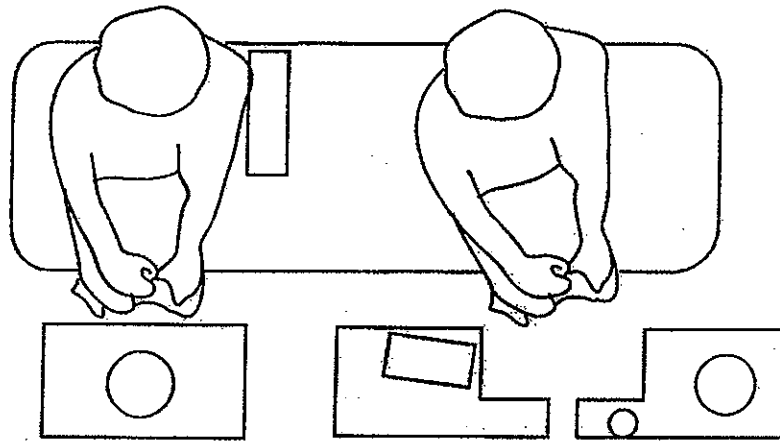


FIG. 7a

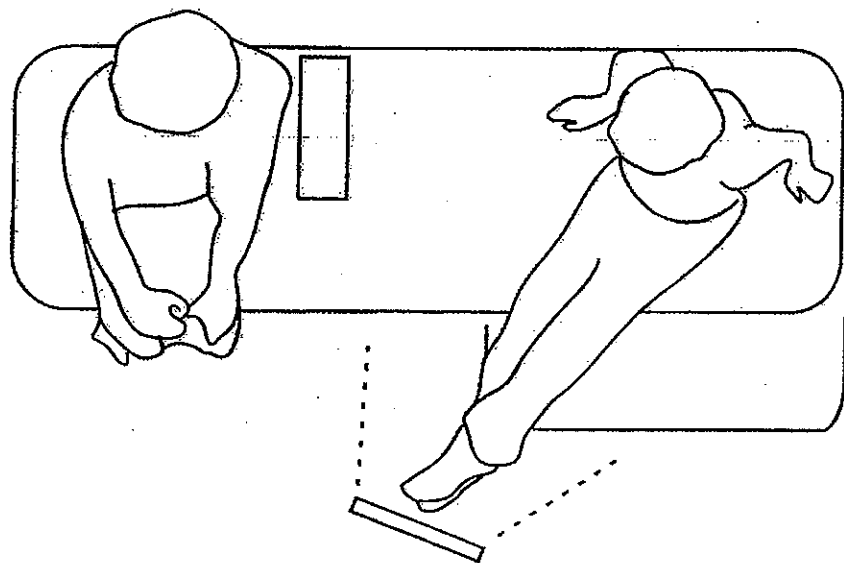


FIG. 7b

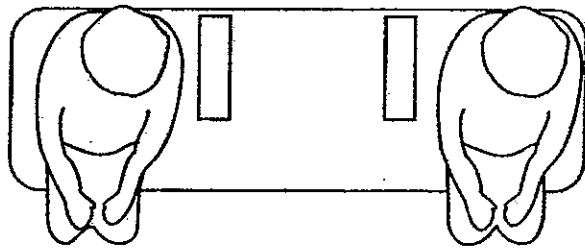


FIG. 7c

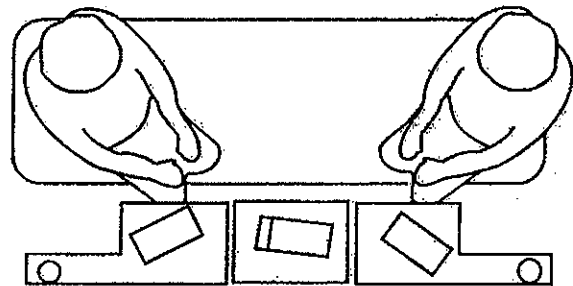


FIG. 7d

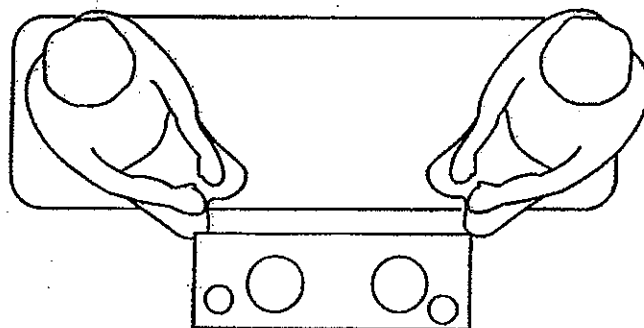


FIG. 7e

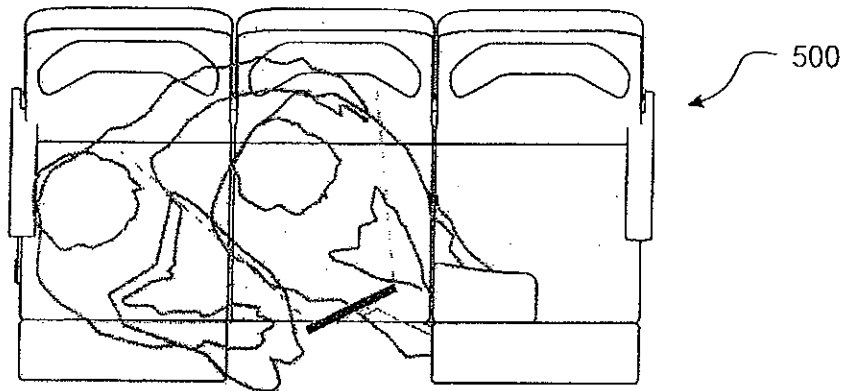


FIG. 8

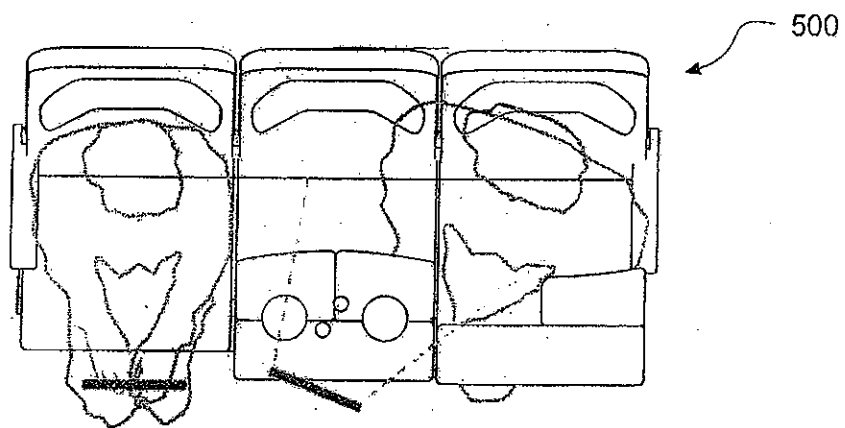


FIG. 9

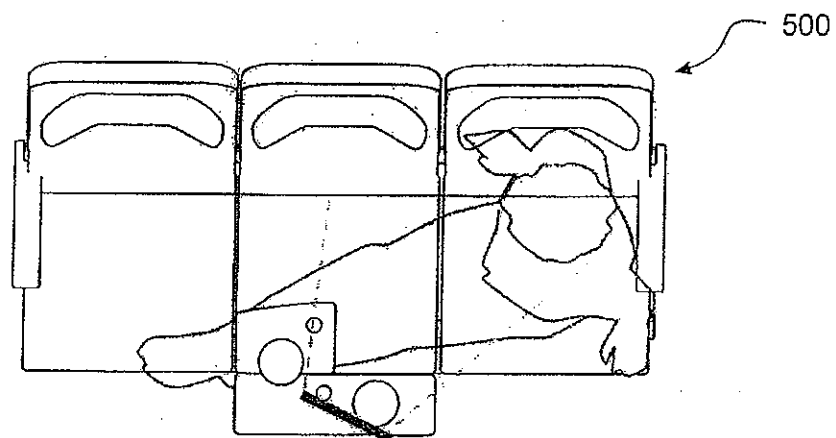


FIG. 10

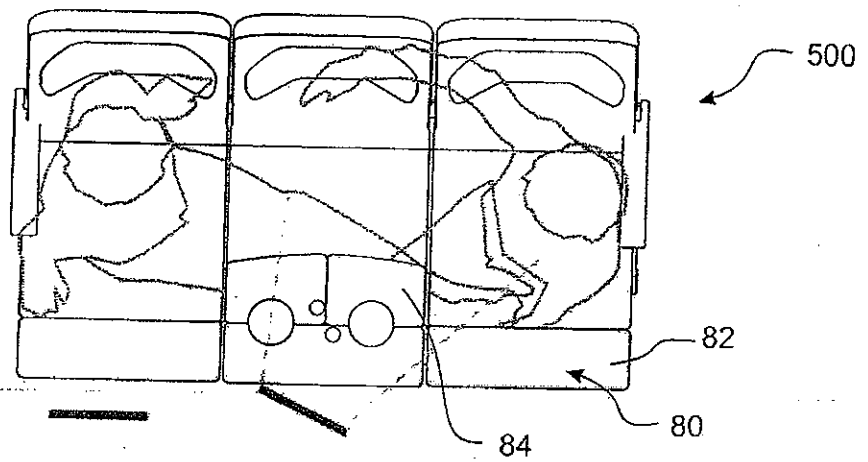


FIG. 11

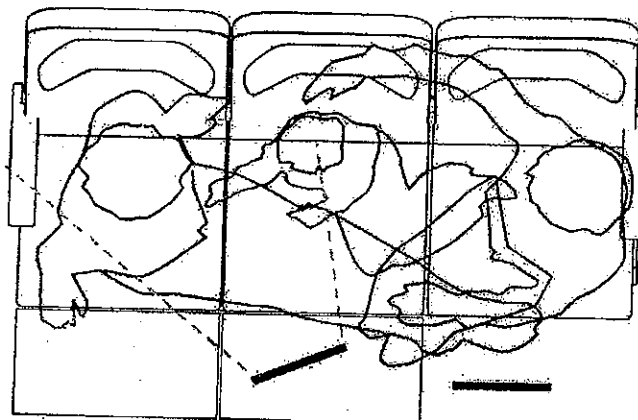


FIG. 12

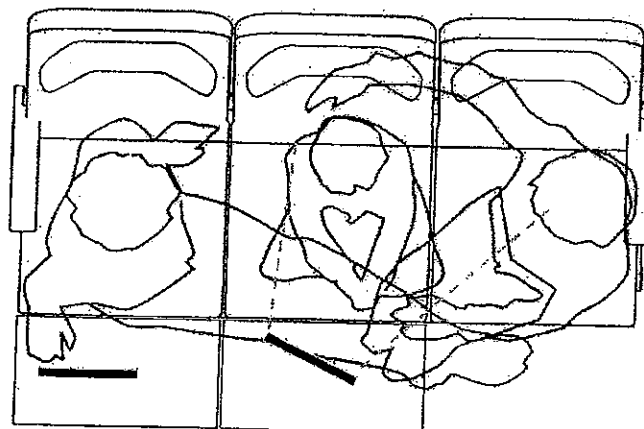


FIG. 13

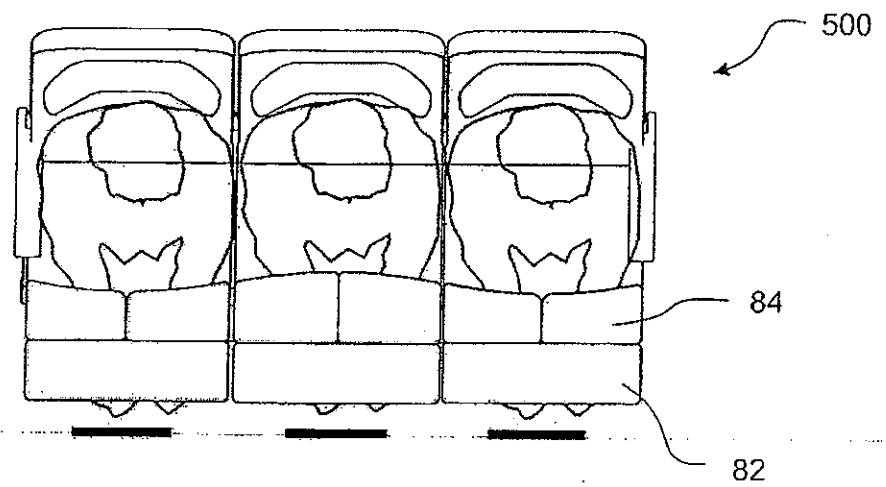


FIG. 14

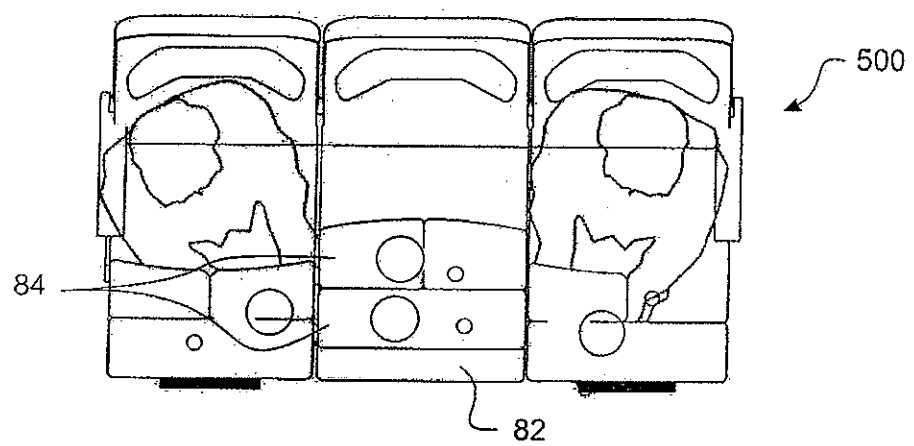


FIG. 15

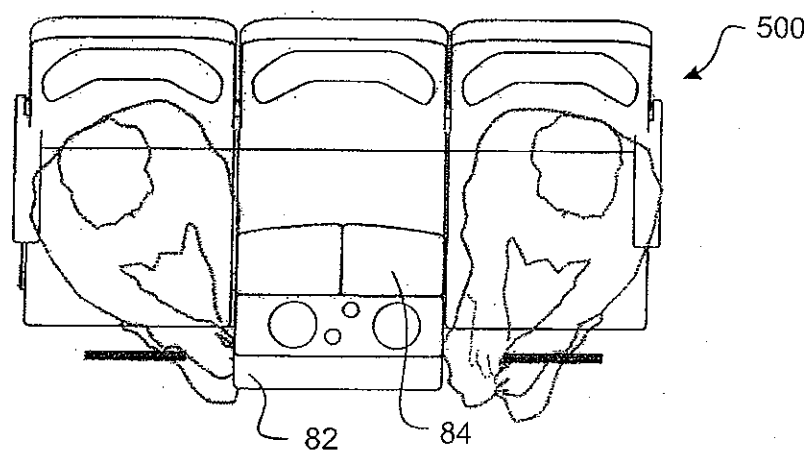


FIG. 16

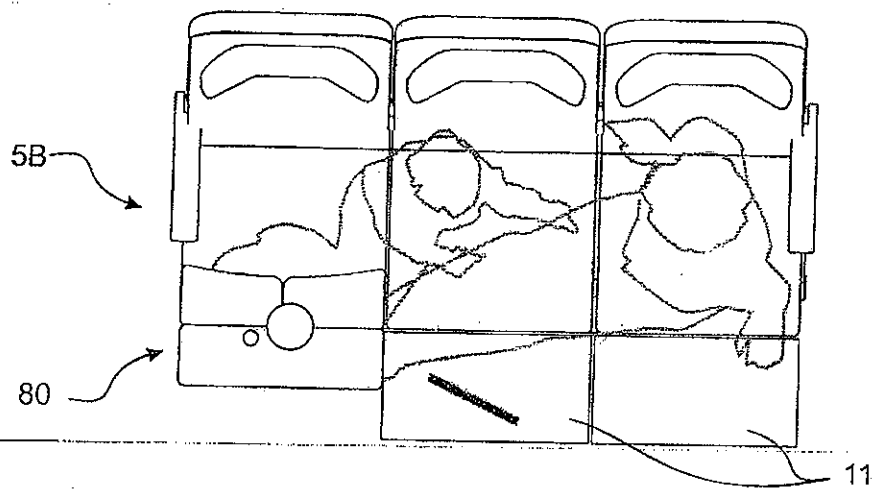


FIG. 17

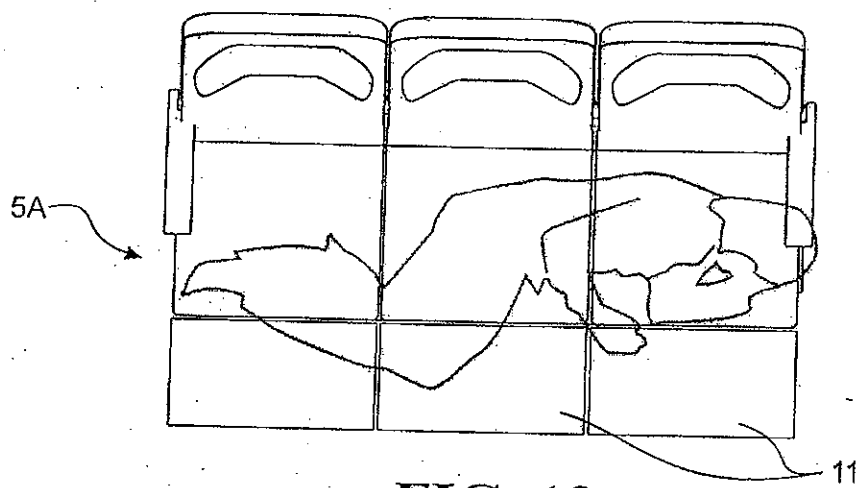


FIG. 18

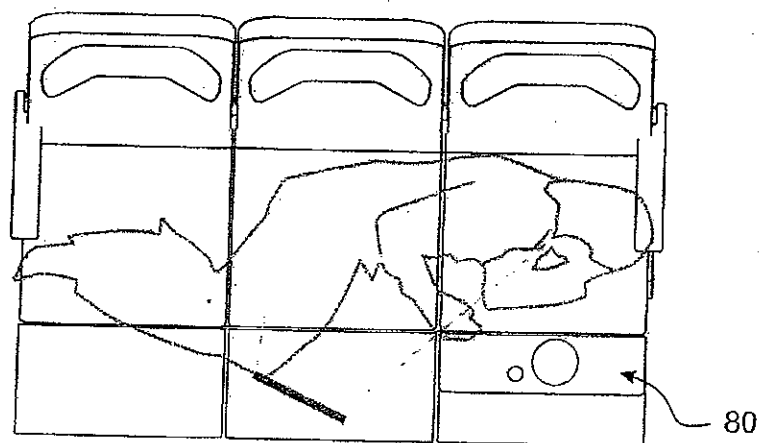


FIG. 19

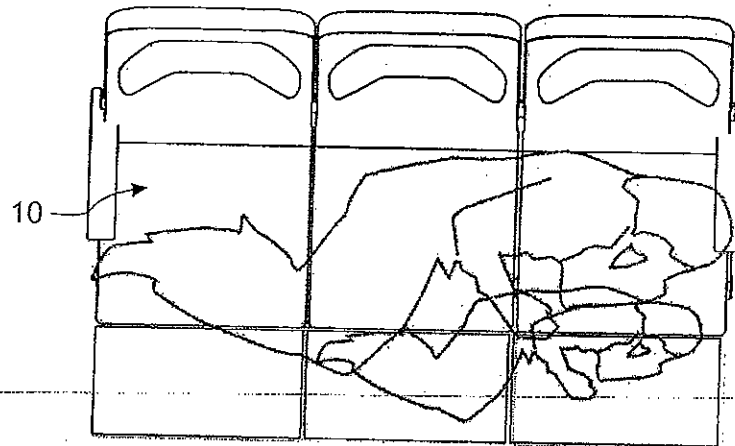


FIG. 20

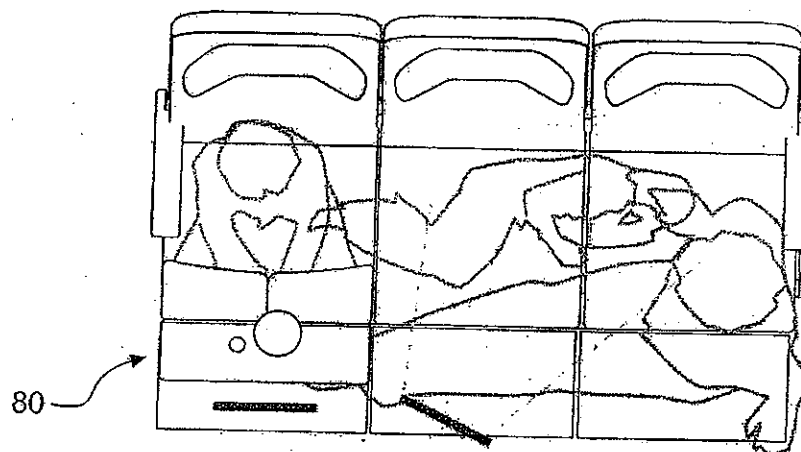


FIG. 21

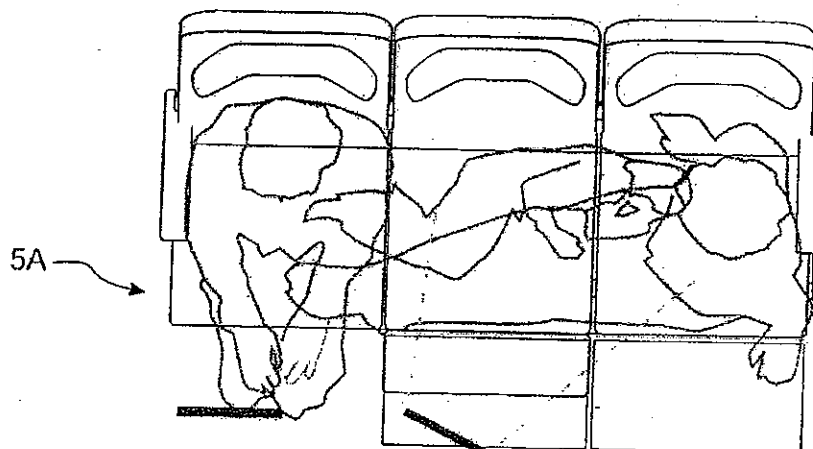


FIG. 22

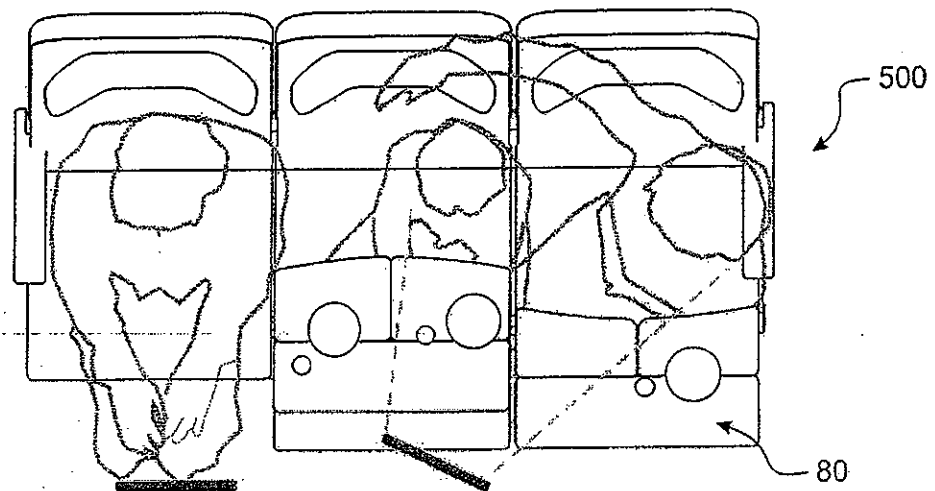


FIG. 23

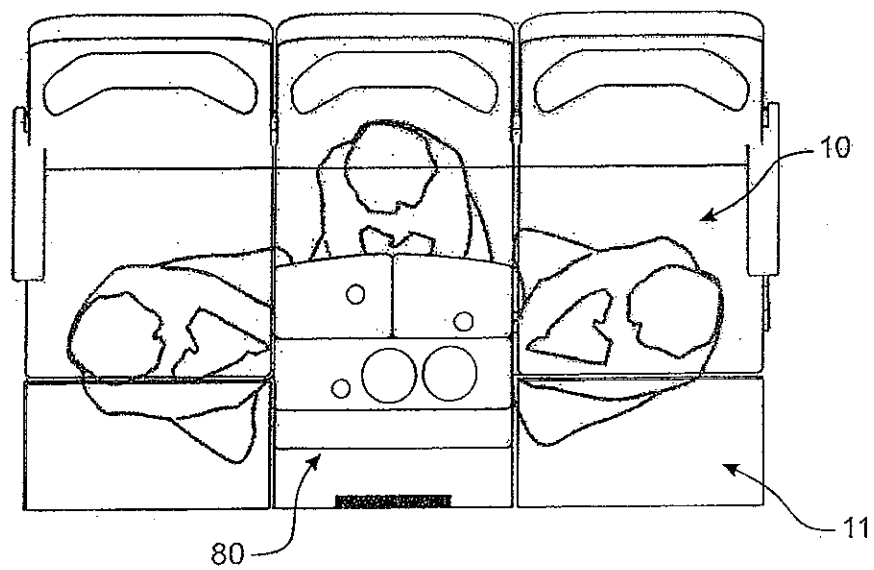


FIG. 24

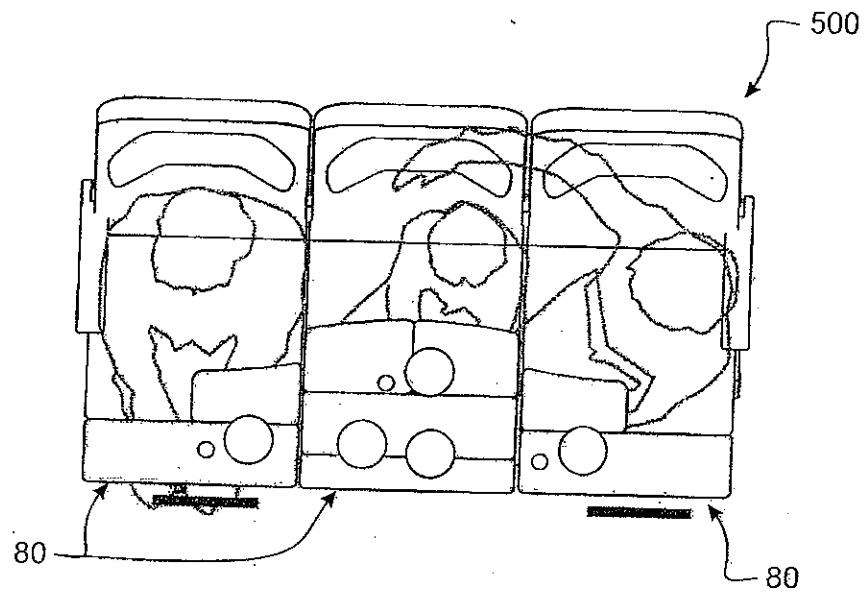


FIG. 25

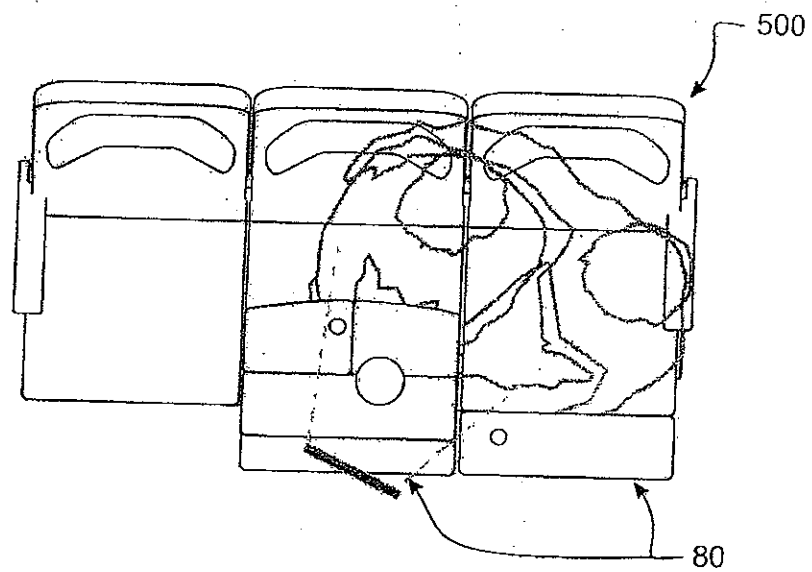


FIG. 26

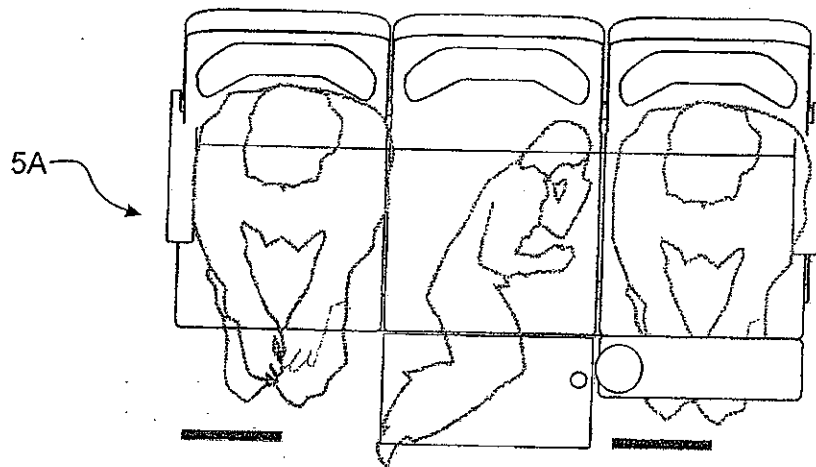


FIG. 27

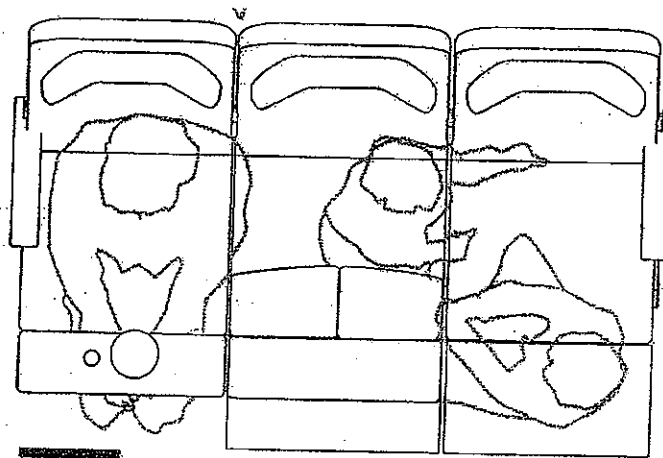


FIG. 28

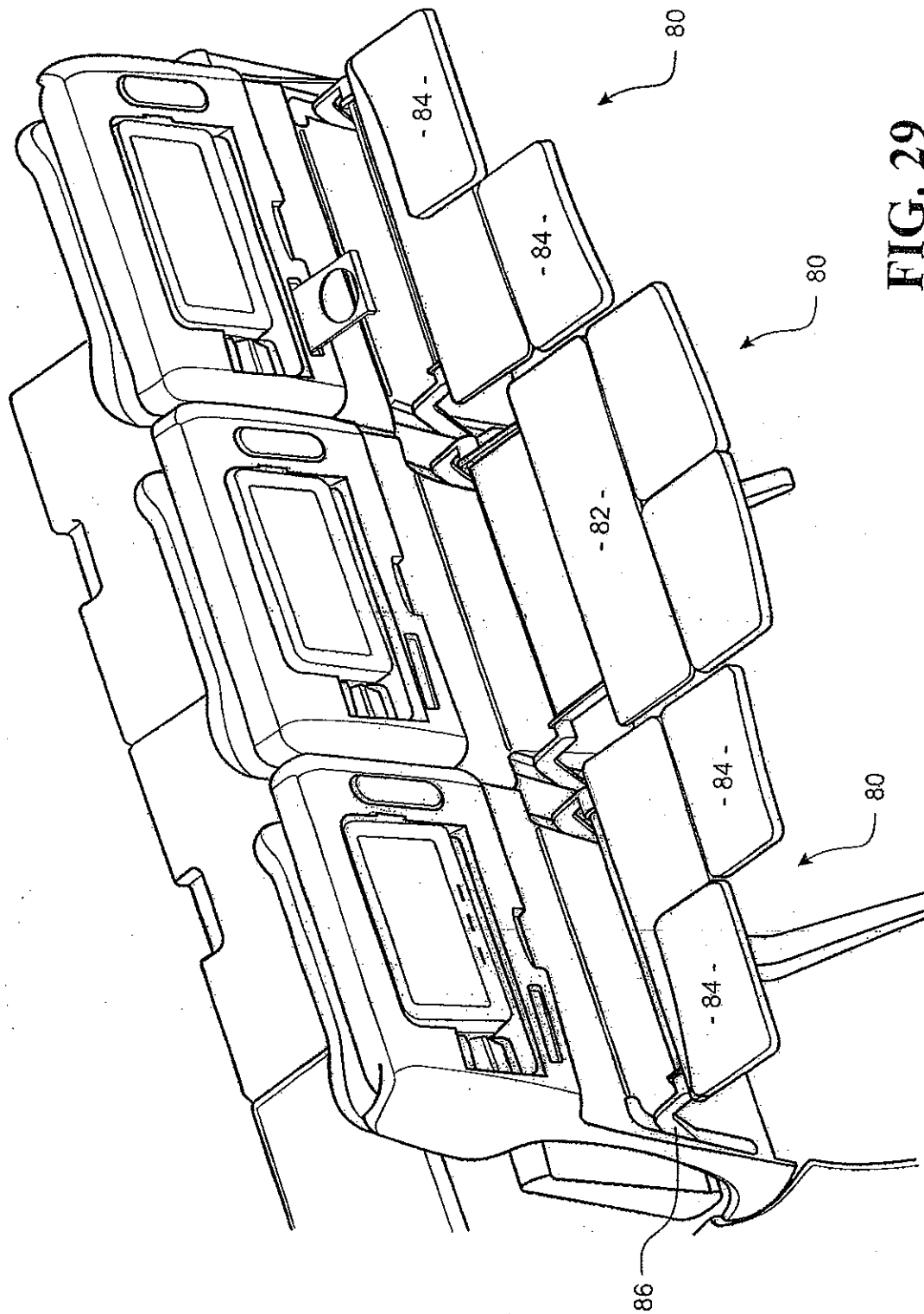


FIG. 29

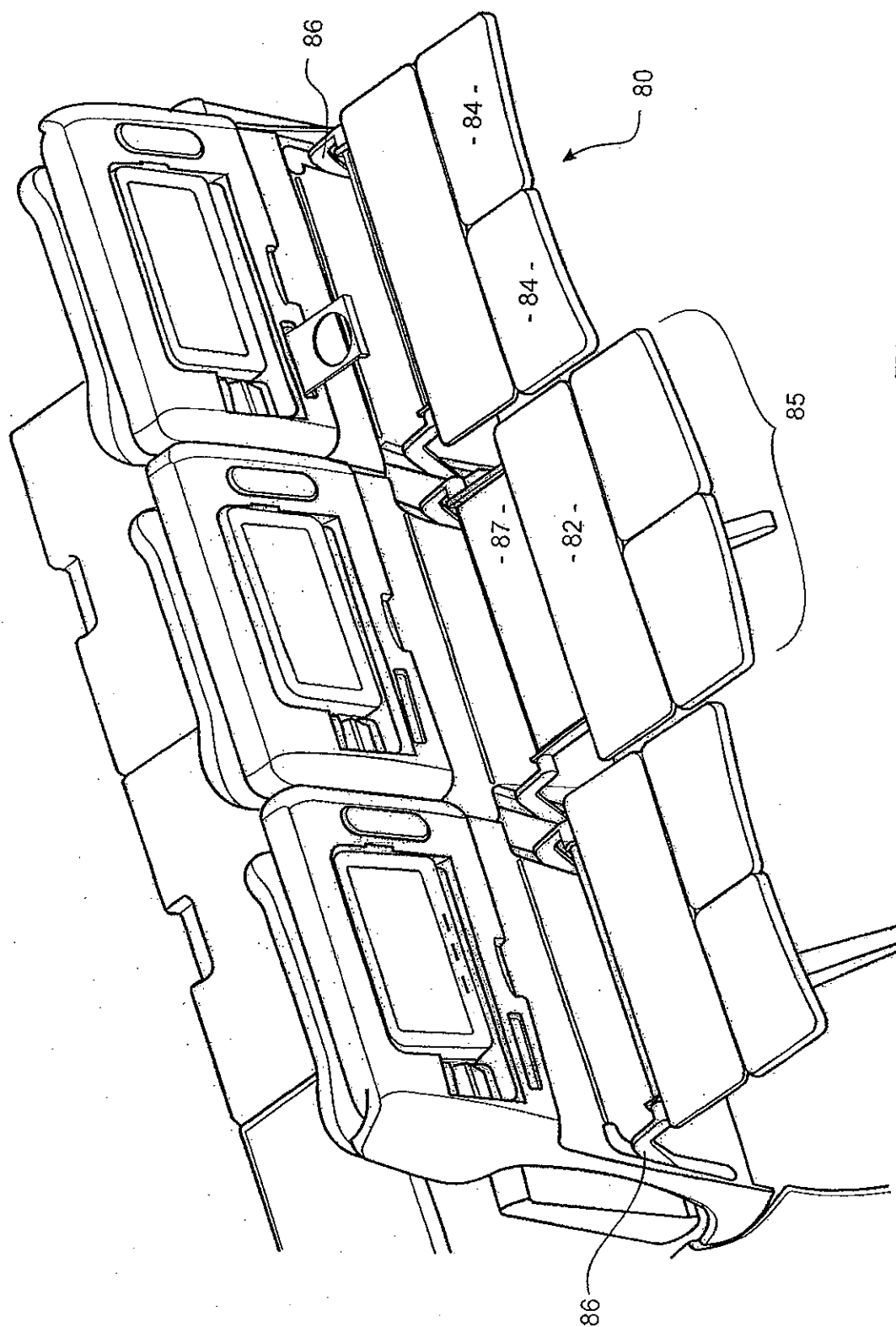


FIG. 30

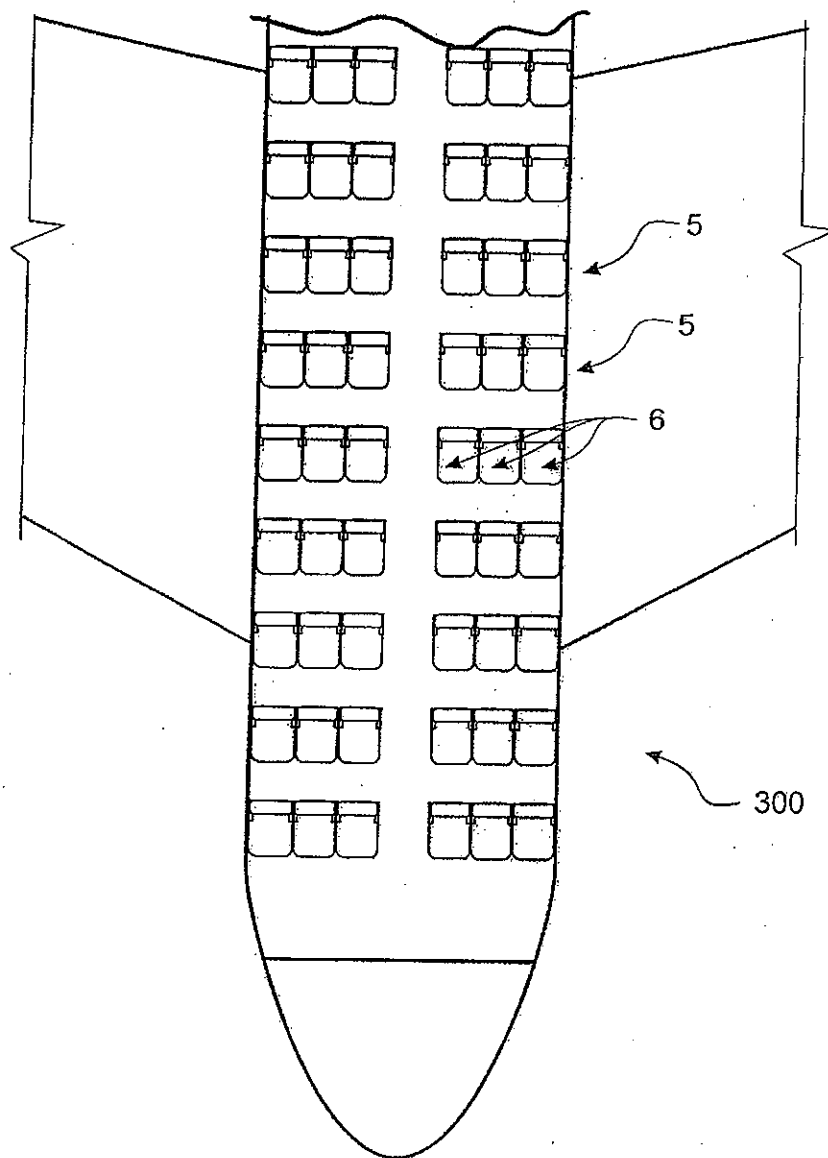


FIG. 31

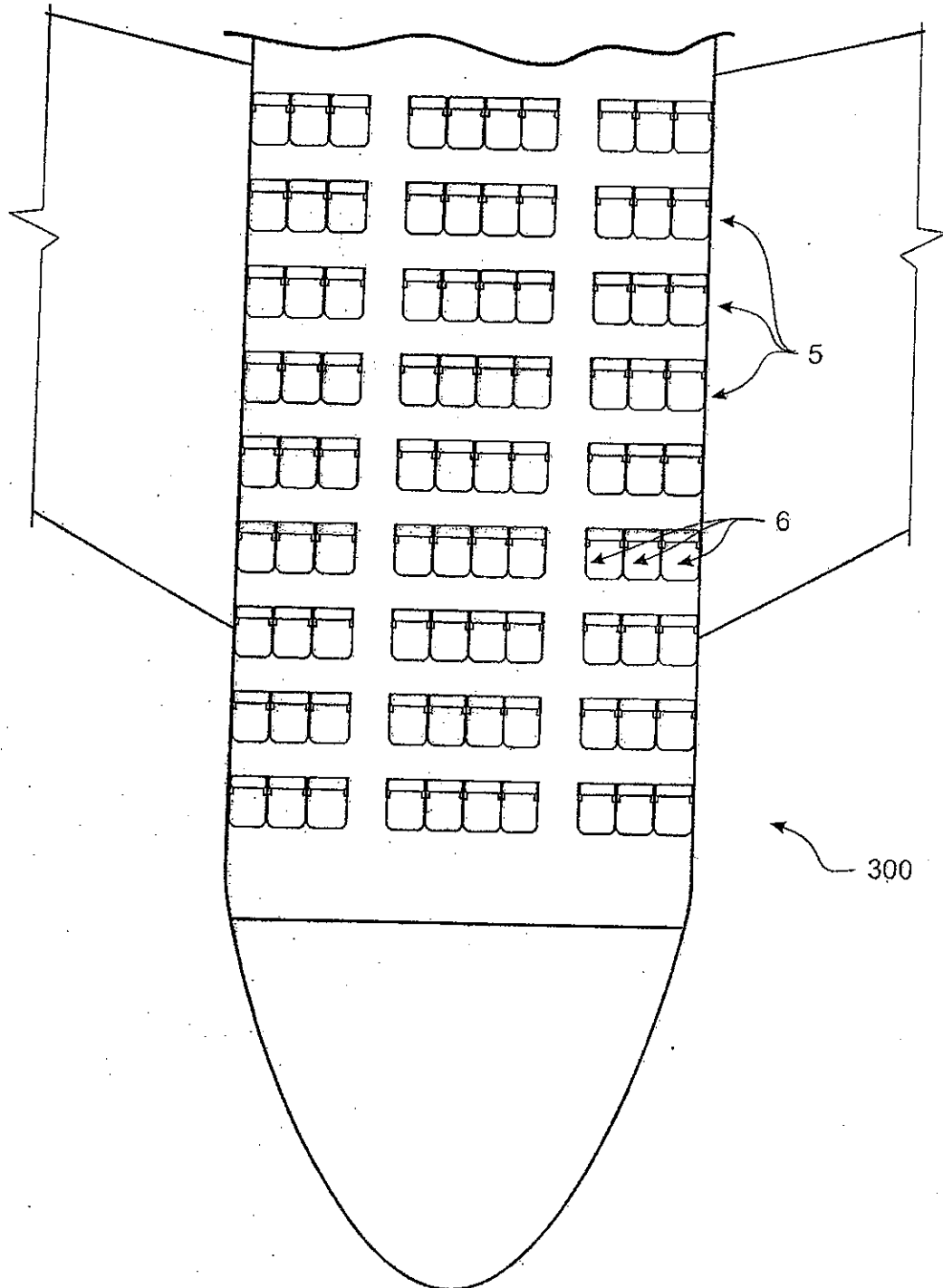


FIG. 32

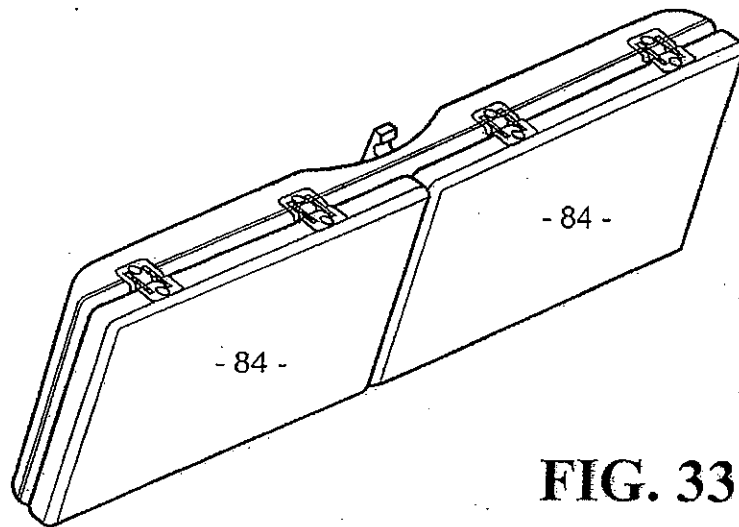


FIG. 33

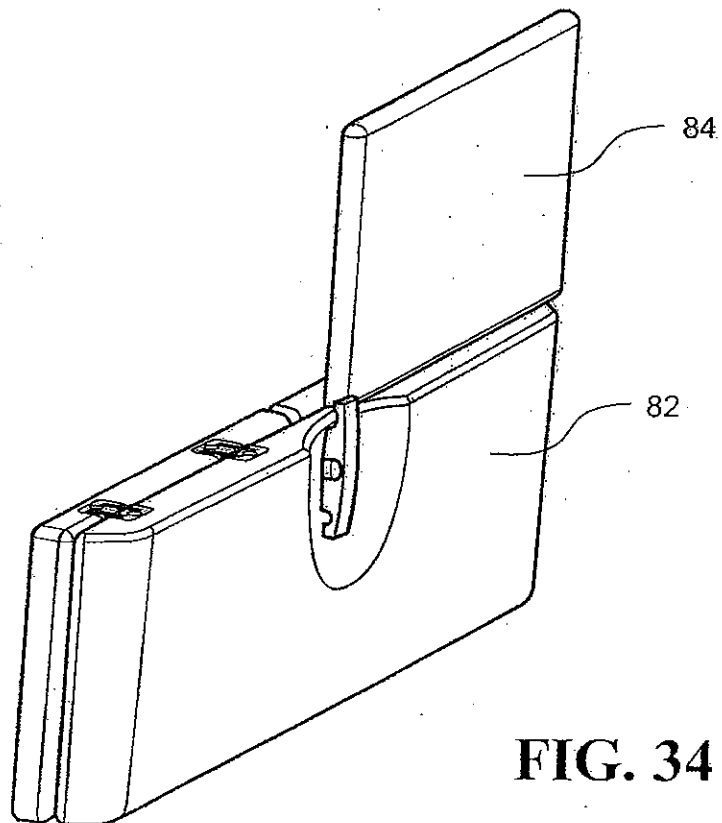


FIG. 34

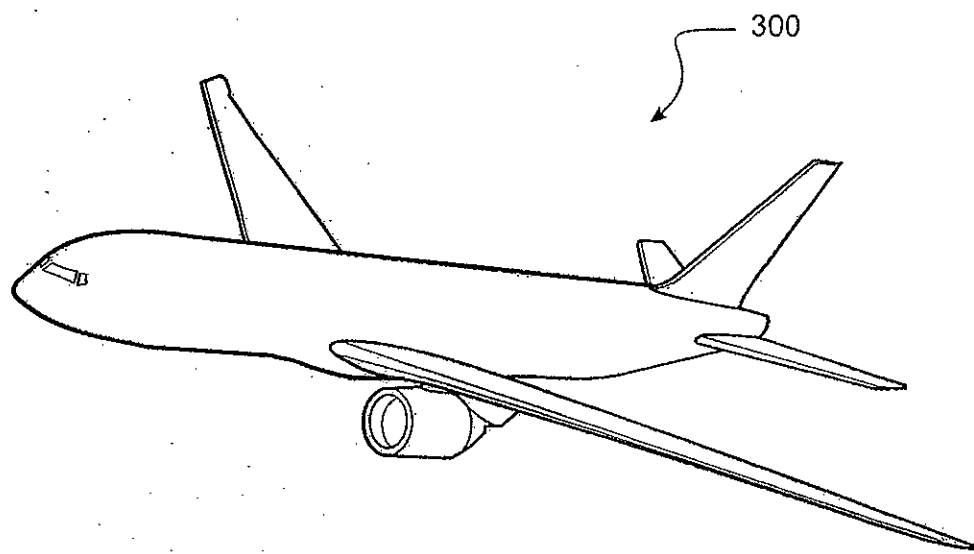
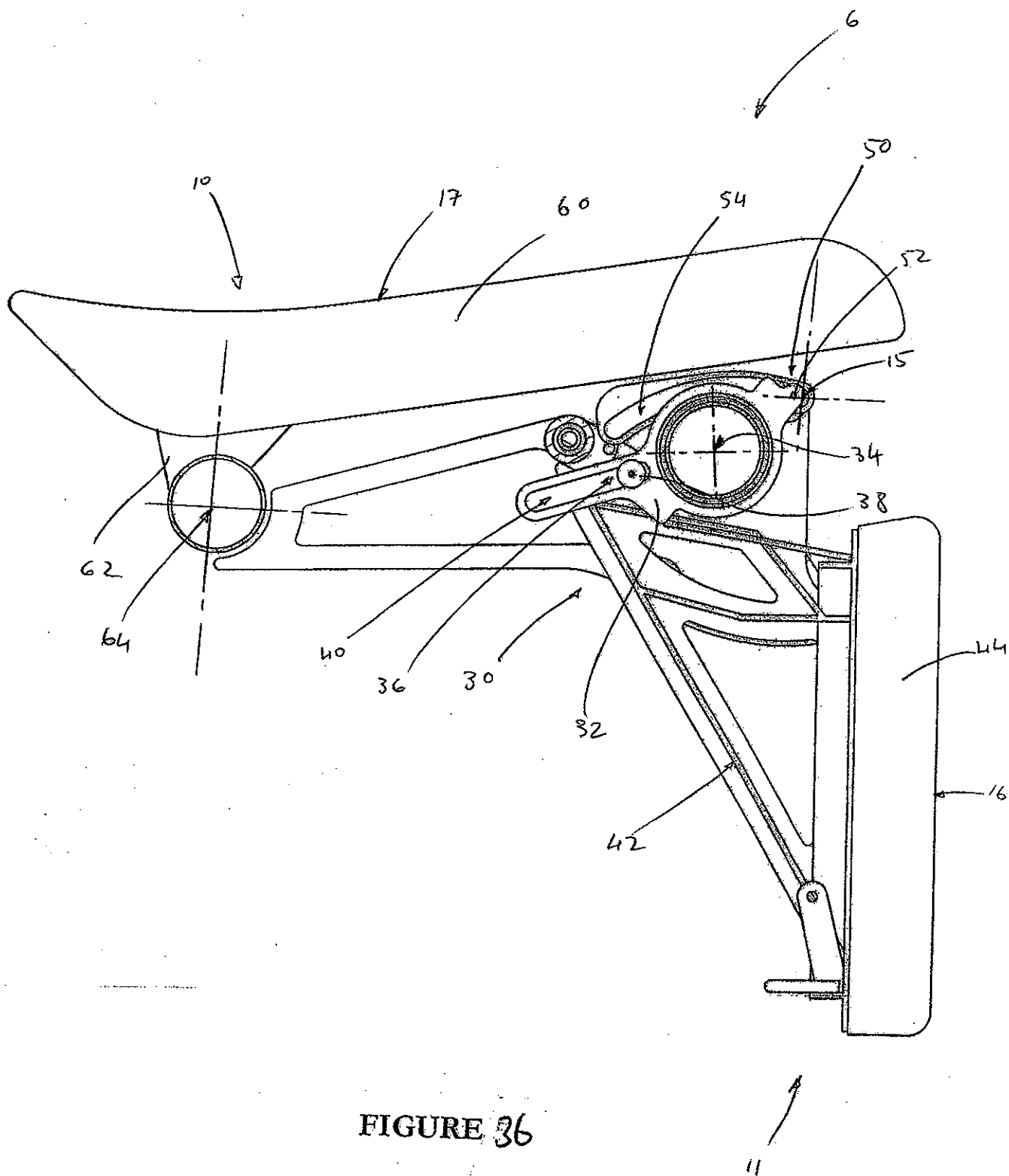


FIG. 30



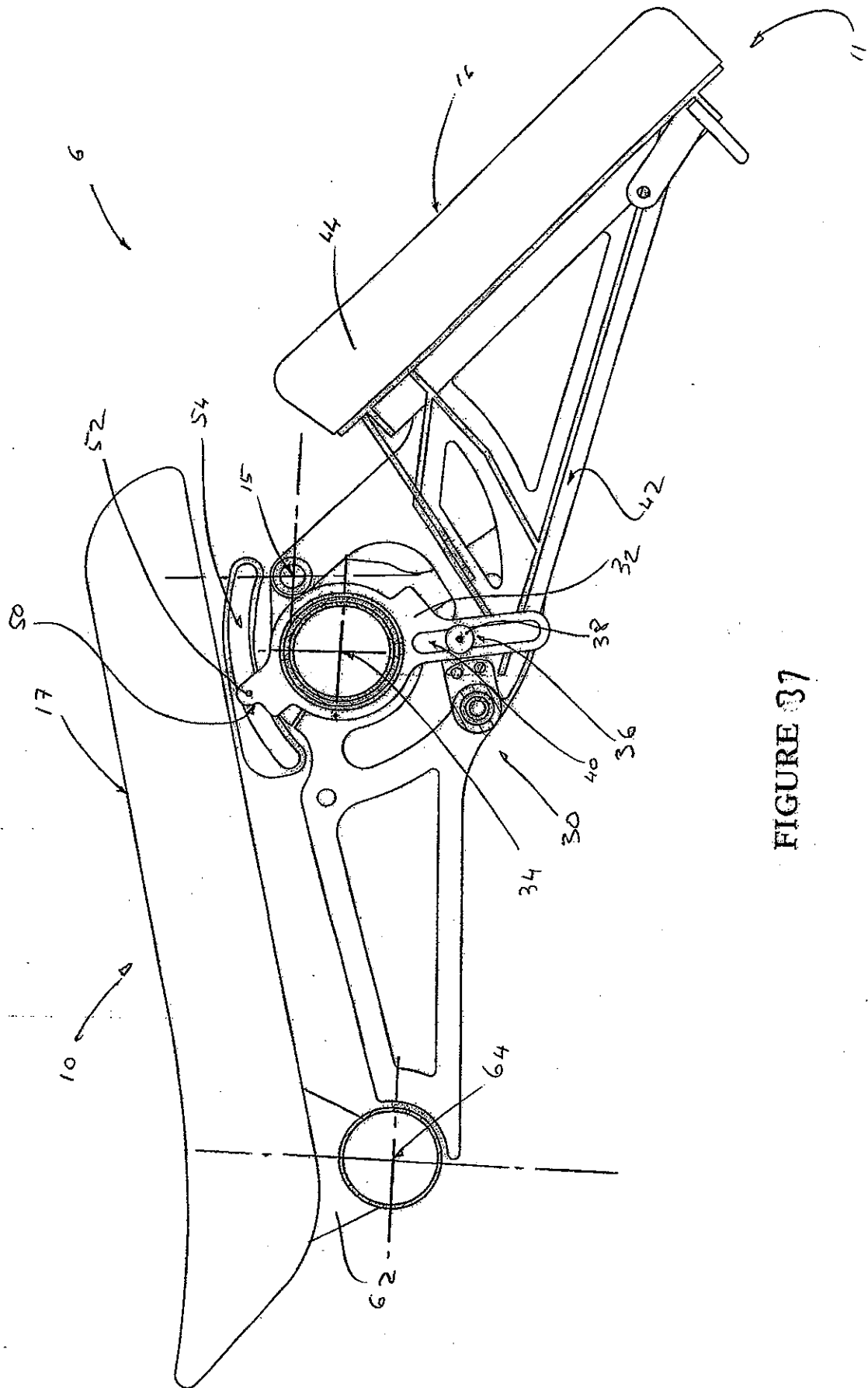


FIGURE 37

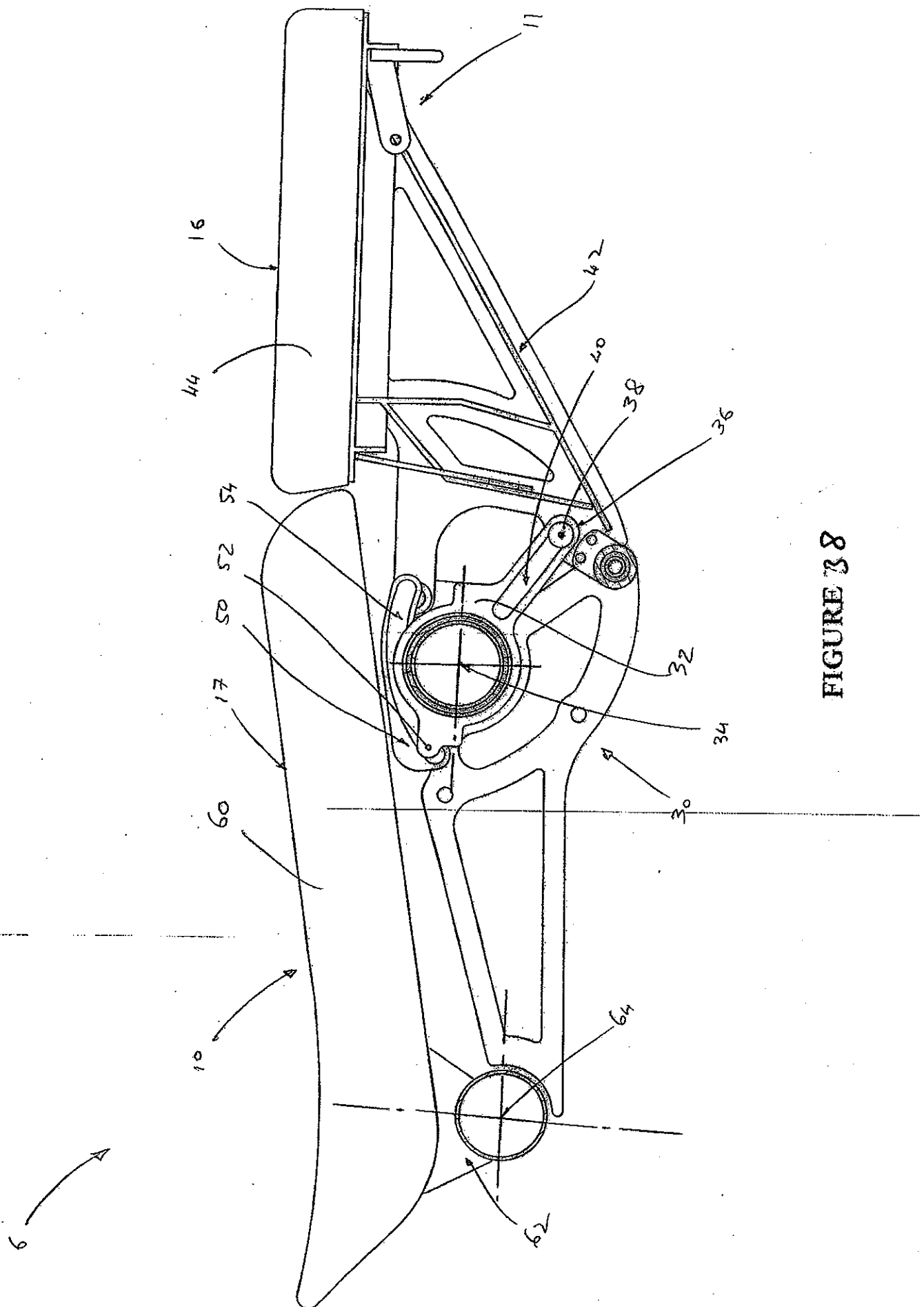


FIGURE 38