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(54) Multifunctional wheelchair

(57) A wheelchair comprising at least two rear wheels, two front wheels, a support frame, a seat and a backrest, wherein a body supporting means, in particular the seat, comprises a supporting frame and a cushion arranged on a first side thereof, while the supporting frame has a peripheral edge which surrounds at least partly a central opening, a flap being connected through hinge means to a first side of the peripheral edge, which flap has a surface that is less than the surface of the opening, while setting means are arranged for setting the angle which the flap includes with the plane defined by at least a part of the peripheral edge of the supporting frame, the arrangement being such that the flap during use can at least partly extend within the opening and at least partly carries the cushion, with the cushion conforming in shape to the position of the flap.

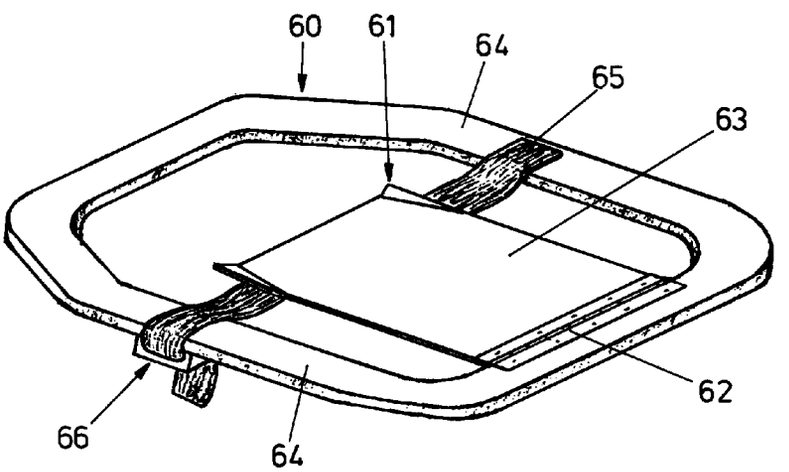

FIG.5

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Description

The present invention relates to a wheelchair of the type defined in the preamble of the main claim. Such a wheelchair is known from practice and is supplied by the firm of Revab, Silvolde, The Netherlands.

For the user, this known wheelchair has a number of drawbacks of an economic and ergonomic nature. In a configuration suitable for the intended user, the wheelchair is composed of a large number of parts. Where possible, standard parts are used, such as seats and backrests, frames, wheels, and the like. In general, individual adaptations to the wheelchair can only be effected to a limited degree and at high additional cost.

The seat of the known wheelchair consists of a foamed upholstered cushion mounted on, e.g., a board. As a result, the shape of the seat and the sitting position of the user is mainly determined by the composition of the seat cushion and the covering, the shape of the board, and the position of the seat relative to the rest of the wheelchair. For a heavier user, for example, the sitting position will therefore be different than for a lighter user. Moreover, only an average suitable sitting support can be obtained. For separate sitting supports, especially adapted seats will have to be made in single-piece production, which is expensive and time-consuming, and moreover, prevents the same seat being used for different users.

It is therefore a first object of the invention to provide a wheelchair having a seat that is easy to adapt to the individual user, economic in its production and enables an ergonomically suitable sitting position. To this end, a wheelchair according to the invention is characterized by the features of claim 1.

By means of the hinged flap the shape of the cushion can be adapted to the individual user. Thus, using a standard seat a suitable sitting support can be obtained for each user, while moreover adaptations are possible in a simple manner. If the same wheelchair (seat) must be made suitable for a next user, the shape of the seat can be simply adapted, so that a seat according to the invention has a prolonged service life. Also, a decrease of the resilience of the seat cushion can be compensated to some extent through changes in the position of the flap.

The backrest of the known wheelchair has a structure comparable to that of the seat and entails comparable drawbacks. Also, the backrest is not individually adjustable and production of an individualized backrest is expensive and time-consuming.

It is therefore a second object of the invention to provide a wheelchair having a backrest that is easy to adapt to the individual user, economically produced and enables an ergonomically suitable sitting position. To this end, a wheelchair according to the invention is characterized by the features of claim 4.

By means of the adjustable support straps, the form of the backrest can be individually determined and adapted, changes in the form being easy to perform.

In a very advantageous embodiment, a wheelchair according to the invention is characterized by the features of claims 5-8.

The length-adjustable support straps extending in approximately vertical direction and the length-adjustable lumbar strap, together with the adjustability of the points of attachment thereof along the support frame, provide optimum adjustability of the form of the backrest. Thus, by means of such a backrest an optimum back support can be obtained for each user. Even if the user has, e.g., a humpback or like deformity or certain spots which must hardly be loaded, if at all, or, conversely, need additional support, the backrest can be optimally adapted thereto. Particularly in combination with a sitting support as defined in claims 1 - 3 there is thus obtained a wheelchair capable of providing an excellent sitting support adjusted to the individual user without requiring considerable costs.

An important factor in obtaining an optimum sitting and use position in a wheelchair for each user is the position of the sitting support relative to the ground. A wrong positioning of seat and/or backrest relative to the ground results in a wrong sitting position and moreover renders the operation and use of the wheelchair more difficult. Individual adjustment thereof is therefore important, the more so as a wrong posture may lead to the user being undesirably loaded which may cause injuries and discomfort.

It is therefore a third object of the invention to provide a wheelchair of which the orientation and position of the seat and backrest relative to the ground are easily adjustable for the individual user, which wheelchair can be economically produced and used and enables an ergonomically suitable sitting and use position. To this end, a wheelchair is characterized according to the invention by the features according to claim 10.

By adjusting at least the front wheels of the wheelchair, the height and the angle at which the seat and backrest are arranged relative to the ground can be adapted.

In an advantageous embodiment a wheelchair is characterized according to the invention by the features according to claims 11-14.

By adjusting both the front and the rear wheels relative to the seat and the backrest, both the angle which the seat and backrest include with the ground and the height thereof above the ground can be adjusted individually, that is, independently of each other. Because upon height-adjustment of the wheels the wheel base changes correspondingly, there is always obtained an optimum adjustment of the wheel base to the height of the wheelchair and thus of the location of the center of gravity during use. If the center of gravity is located higher, the wheel base in a wheelchair according to this embodiment is greater than if the center of gravity is located lower, which has a stabilizing effect.

The known wheelchair has swiveling front wheels. A drawback of this known wheelchair is that the location of the wheel axle of each front wheel relative to the

swivel pin is fixed. As a result, the wheelchair has the same steering and riding behaviour. The position of the wheel axles relative to the swivel pins is therefore a compromise between optimum manoeuvrability, e.g. for use of the wheelchair indoors, and optimum stability and tracking, e.g. for use of the wheelchair for longer distances.

It is a fourth object of the invention to provide a wheelchair in which the position of the wheel axle relative to the swivel pin is adjustable. This object is achieved in a wheelchair according to the invention through the features according to claim 15.

Because the fork is pivotally connected via the second swiveling means with the first swiveling means, the position of the fork can be adapted to the individual user. At least two advantages can thus be obtained.

Firstly, if desired, the riding behaviour of the wheelchair can be influenced by the user. By positioning the wheel axle closer to the produced part of the first axis of rotation, a more direct steering is obtained; by increasing the distance between the wheel axle and the first axis of rotation, riding straight on with the wheelchair is facilitated, so that e.g. the use for longer distances becomes more agreeable. Secondly, in particular in a wheelchair according to one of claims 10 - 14, the advantage is obtained that upon adjustment of the front and/or rear wheels the position of the wheel axles can be corrected, so that the same steering behaviour is maintained or can be adjusted.

The known wheelchair has fixed dimensions and a limited number of sizes are available. Therefore, the same size of wheelchair is used for both tall and small users, which means that a user only very seldom has a wheelchair which suits him or her as to size. Changes to a wheelchair to adjust the dimensions are often not possible and at least expensive to perform. Moreover, such a wheelchair cannot readily be reused. In addition, such a necessary variety entails logistic and economic problems for at least the supplier.

It is therefore a fifth object of the invention to provide a wheelchair in which, using a limited number of standard parts, different wheelchairs can be obtained which are mutually different in one or a number of dimensions and can thus be easily adapted to the individual user, can be economically produced and used and enable an ergonomically suitable sitting and use posture. A wheelchair is then characterized by the features according to claim 17.

The adjustability of the frame of the wheelchair in both width and length affords the possibility to each individual user to obtain optimum dimensions of the frame of the wheelchair, while use can be made of always substantially the same standard parts.

In a first further elaboration, such a wheelchair is characterized by the features according to claim 18. Thus, any length of the frame is obtainable, while only the coupling pieces to be included between the sections are different from each other.

In a second further elaboration, such a wheelchair is characterized by the features according to claim 19. Since the connecting frame is width-adjustable, a variety of wheelchair widths can be obtained with the same standard connecting frame.

A wheelchair according to the invention is moreover preferably characterized by the features according to claim 20. Thus, transport and storage can be easily carried out, while yet a stable and form-retaining, easily operated wheelchair is obtained.

When the known wheelchair is used in a stepping manner, there is a risk that when a foot is being moved under the seat, the foot or the back of the leg comes into contact with a frame part, in particular a connecting part thereof. This is inconvenient, increases the risk of injuries and moreover reduces the convenience of use, because less large stepping paces can be made.

It is therefore a sixth object of the invention to provide a wheelchair which can be easily and safely used through stepping, in an ergonomically sound manner. Thus a wheelchair according to the invention is characterized by the features according to claim 21.

Other advantageous embodiments of a wheelchair according to the invention are given in the other claims and the specification.

In elucidation of the invention, an exemplary embodiment of a wheelchair will be described with reference to the drawings, in which:

Fig. 1 is a side view of a wheelchair according to the invention in a first position with a rear wheel removed;
Fig. 2 is a side view of the wheelchair shown in Fig. 1 in a second position;
Fig. 3 is a rear view of a wheelchair according to Figs. 1 and 2;
Fig. 4 is a diagrammatic perspective view of a connecting frame of the wheelchair;
Fig. 5 is a perspective view of a seat with the seat cushion removed;
Fig. 6 is a cross-sectional side view of a seat and backrest, with mounted cushions;
Fig. 7 is a rear view of a backrest, with back cushion removed;
Fig. 8 is a top plan view of a backrest as shown in Fig. 7, with back cushion placed;
Fig. 9 is a front view in partial cross-section of a suspension of a front wheel; and
Fig. 10 is a side view of the suspension shown in Fig. 9.

A wheelchair as shown in Figs. 1-3 comprises a support frame 1 built up from a number of tubular sections, whose construction will be explained below in more detail, a pair of large rear wheels 2, a pair of small front wheels 3 mounted for swiveling movement, a seat 4 and a backrest 5, foot rests 6, and handles 7.

The support frame 1 comprises two approximately identical parts 8 spaced apart and approximately parallel to each other. Each frame part 8 comprises two seat

tubes 9a, 9b which in the position shown in Fig. 1 extend approximately horizontally and approximately parallel to each other. The upper seat tube 9a continues at the rear side via an upwardly directed first bend 10. To this first bend 10 connects, for instance, an armrest (Figs. 1-3). Attached adjacent the bend 10 via a set of toothed rings 100 is a back tube 11, which extends behind or laterally of the backrest 5 and is capable of including an angle with the vertical, preferably in such a manner that the back tube 11, viewed in the direction of travel, is inclined backwards slightly. The angle of the back tubes 11 is adjustable by means of the toothed rings 100. At the top the back tube 11 is connected with a handle 7 extending rearwards. At the front the upper seat tube 9a continues via a downwardly directed second bend 13 into a foot rest tube 14. The foot rest tube 14 includes an angle with the vertical, in such a manner that the lower end of the foot rest tube 14 is disposed forward of the second bend 13. Adjacent its lower end the foot rest tube 14 is provided with a collapsible foot rest 6 which is freely suspended above the ground.

Near the first bend 10 a wheel frame 16 is mounted on the upper seat tube. The wheel frame 16 comprises two support bars 17 extending approximately parallel to each other and downwards at right angles to the upper seat tube 9a, which support bars 17 are interconnected at the lower end by a cross-latch 18. The support bars are provided at regular intervals with fixing holes 19 through which a wheel plate 20 can be fixed. The wheel plate 20 has a central opening 12 in which a rear wheel 2 is mounted. The lower seat tube 9b extends in rearward direction from the foot rest tube 14 as far as the support bars 17.

The seat tubes 9, an armrest, if present, the foot rest tube 14 and the wheel frame 16 of each frame part 8 are substantially disposed in one plane, which extends approximately vertically. The wheel plate 20 is shaped in such a manner that the rear wheel 2 includes an angle with the vertical plane mentioned, in such a manner that the distance between the two wheel plates 20 adjacent the ground is greater than is the distance at the upper end. Thus the stability of the wheelchair is increased.

The frame parts 8 are interconnected by a connecting frame 21 (Figs. 3 and 4) which is so designed that the wheelchair is collapsible. The connecting frame 21 comprises two upper connecting bars 22, one on the side proximal to the front of the wheelchair and one near the back, and one lower connecting bar 23, near the back, approximately straight under the rear upper connecting bar 22. Each connecting bar 22, 23 consists substantially of two approximately identical connecting frame halves 24 which in mirrored position are hingedly connected in a central hinge point 25 adjacent the vertical median plane of the wheelchair. The end of each connecting frame half 24 remote from the central hinge point 25 is connected with a frame half 8 in a frame hinge point 26. The hinges of the central hinge points 25 and frame hinge points 26 are parallel to each other and to the longitudinal direction of the wheelchair, in such a manner that upon upward movement of the central hinge points 25 relative to the frame hinge points 26 the latter are drawn towards each other. In this manner, the frame halves 8 can be moved towards each other, so that the width of the wheelchair is reduced considerably.

The upper and lower central hinge points 25 located adjacent the rear of the wheelchair are interconnected through a guide bar 27 which in a central area thereof is provided with a guide slot 28. At some distance from the lower central hinge point 25 each lower connecting frame half 24 is provided with an auxiliary hinge point 29 in which a hooked link 30 is pivotally mounted. The ends of the links 30 remote from the connecting frame halves 24 are connected through the guide slot 28 by means of a coupling bolt 31 for mutual hinging movement. Through this arrangement of the guide bar 27 and links 30 it is ensured that the two frame halves 8 remain parallel to each other in each position of the central hinge point 25. Moreover, as a result, the freedom of movement of the central hinge points 25 in vertical direction is limited. If the coupling bolt 31 is disposed at the upper end of the guide slot 28, the connecting frame 21 has the maximum width, if the coupling bolt 31 is disposed at the lower end of the guide slot 28, the connecting frame 21, and hence the wheelchair, has the minimum width. The guide bar 27 therefore prevents buckling of the connecting frame 21.

The upper connecting bars 22 are interconnected by three longitudinal bars 32. The central longitudinal bar connects the upper central hinge points 25 and extends in line with the hinges thereof. The wheelchair can be substantially folded up by pulling this longitudinal bar 32 upwards. Through the longitudinal bars 32, the connecting frame acquires sufficient stiffness in horizontal direction as well.

Each connecting frame half 24 is made up of an outer tube 34 which is connected with a central hinge point 25 and an inner tube 35, which is slidable within the outer tube 34 with a proper fit and is connected with a frame hinge point 26. By means of, for instance, a set bolt (not shown), the inner tube 35 can be secured in different positions displaced lengthwise with respect to the outer tube 34, through holes in the respective parts. As a result, the maximum width of the connecting frame 21 can be simply adapted to individual desires and prescriptions of users.

Each frame half 8 is made up of a front section 36 and a rear section 37. To that end, the seat tubes 9a, 9b are divided near the centre. In one of the sections 36, 37, within each of the seat tube halves, a guide stub 38 is arranged which has an outside cross section substantially corresponding with the inside cross section of the respective seat tube 9a, 9b. The other section can be slid over these two tube stubs 38, in such a manner that the length of the seat tubes 9a, 9b can thereby be changed. By means of set bolts 39, the two sections 36, 37 can be secured on the tube stubs 38 in the desired position through holes in the respective parts, so that

the desired length of the wheelchair can be set. Between the facing ends of the sections 36, 37 a filling tube 15 can be arranged around the tube stubs 38 with a proper fit, in such a manner that, in any case visually, the seat tubes 9a, 9b are continuous.

By means of the connecting frame 21 and the guide stubs 38 it is therefore possible to adapt both the width and the length of the wheelchair to the needs of the user.

Adjacent the front of the wheelchair, the upper 9a and lower seat tube 9b are connected through a front wheel tube 40 which includes an angle with the vertical, which angle in the embodiment shown is slightly smaller than the angle between the foot support tube 14 and the vertical. Slidably received within each front wheel tube 40 is a sliding piece 41, which can be secured in different displaced positions, as appears from Figs. 1 and 2, where two positions are shown. The sliding piece 41 comprises a first part 42 which can extend within the front wheel tube 40, and a second part 43 which includes an angle with the first part, which angle corresponds approximately with the angle which the front wheel tube includes with the vertical. In the embodiment shown, these angles are about 66°. Accordingly, in assembled condition, the second part 43 of the sliding piece 41 extends downwards approximately at right angles to the seat tubes 9a, 9b.

Each front wheel 3 is mounted in a fork 44 which is provided at the top thereof with a swivel point 45. During operation, the swivel point defines a vertical axis of rotation D, with the arms 46 of the fork including an angle with the vertical. Accordingly, the axle 47 of the front wheel, viewed in horizontal direction, is not located straight under the swivel point 45 but slightly to the side thereof. The angle which the fork 44 includes with the vertical and the length of the fork 44 determine the horizontal distance between the swivel point and the axle 47, and hence the steering behaviour of the wheelchair. If this distance is small, the wheelchair becomes unstable in its steering behaviour; if the distance is large, the wheelchair is difficult to steer to negotiate a bend. Moreover, it is important that the axis of rotation D is oriented as vertically as possible because this makes steering lighter and moreover prevents wear.

Given the same position of the rear wheels 2 relative to the wheel frames 16, upon length adjustment of the sliding pieces 41 within the front wheel tubes 40, the position of the wheelchair will change. When the sliding piece 41 is slid out, the wheelchair will tilt backwards, and when slid in, forwards. Thus, for instance the angle of inclination of the seat and the backrest can be set, which can have, for instance, ergonomic advantages. In case of such a tilt, the axis of rotation D of the front wheels would likewise tilt, which is disadvantageous, as described. Therefore, a tilting mechanism 48 is provided on the second part 43 of the sliding piece 41, which mechanism allows the axis of rotation D to be brought into a vertical position again upon sliding movement of the sliding piece 41.

The tilting mechanism 48 is arranged on the side of the swivel point 45 remote from the fork 44. Each tilting mechanism 48 comprises a leg 49 which adjacent a first end is pivotally connected with the second part 43 of the sliding piece 41 through a tilting pin 50 extending horizontally and at right angles to the direction of travel of the wheelchair. The opposite, second end of the leg is connected to the swivel point 45. Thus, by pivoting the leg 49 about the tilting pin 50 the orientation of the axis of rotation D can be adjusted. For the purpose of pivoting and securing the leg, an eccentric 51 is included between the tilting pin 50 and the swivel point 45.

The eccentric 51 comprises a rotary pin 53 of a relatively large cross section and with a head 54 of greater cross section, which pin extends through an opening in the second part 43 of the sliding piece 41. The head 54 of the rotary pin 53 abuts against a first side 55 of the second part 43 remote from the leg 49. The end of the rotary pin 53 opposite the head 54 is approximately flush with the second side 56 of the second part 43 of the sliding piece 41, remote from the first side 55 of the second part 43. In the rotary pin 54 a hole has been drilled, located eccentrically, parallel to the longitudinal axis of the rotary pin 54, through which hole extends a bolt 57. This bolt 57 has its head 58 abutting against the outside of the head 54 of the rotary pin 53. The threaded opposite end extends through a fitting slot 52 in the leg 49. At the end of the leg 49 remote from the sliding piece 41, a nut 58 has been screwed onto the bolt 57. Upon rotation of the rotary pin 53, the bolt 57 moves along around the axis of rotation of the rotary pin 53 and through the slot 52. As a result, the leg 49 is pivoted around the tilting pin 50 located at a distance from the bolt 57 and the axis of rotation of the rotary pin 53, so that the angle which the axis of rotation D includes with the vertical can be simply adjusted. Upon adjustment of the angle (preferably to 0° with the vertical), the nut 58 and the bolt 57 can be screwed tight one within the other, to thereby fix the position.

By means of the wheel plate 20, the height of the axle of each rear wheel 2 can be adjusted relative to the wheel frame 16. To that end, the fixing bolts must be taken from the fixing holes 19 and secured again in other desired fixing holes 19. This also influences the inclination of the wheelchair, while the inclination and/or the position of the axes of rotation D can optionally be adjusted in the manner described in the foregoing. Accordingly, by means of, mainly, the wheel plates 20, the wheel frames 16, the sliding pieces 41 and the front wheel tubes 40, it is possible to adjust the angle of inclination as well as the height of the wheelchair in a simple manner, while the orientation of the axes of rotation D of the front wheel forks 44 can be adjusted thereto by means of the eccentrics, which is of importance for the front wheels to track.

Because the front wheel tube 40, viewed in the direction of travel, tilts backwards, an advantage is gained in that upon a height adjustment of the wheelchair, the length of the wheel base changes as well. If

the front wheel is set "higher", that is, if the sliding piece 41 is slid out further, the wheel base becomes longer. Accordingly, a wheelchair set "higher" becomes more stable, which is beneficial to the safety of the user.

The preferably detachable seat 4 comprises a seat edge 60 supported by the upper seat tubes 9a, which edge 60 leaves clear a central opening 61. Mounted on the forward portion of the seat edge 60 is a hinge 62 by means of which a flap 63 is mounted for tilting movement within the opening 61 in the seat edge. Adjacent the side remote from the hinge 62, the flap 63 is supported by a support strap 65 attached to the longitudinal sides 64 of the seat edge 61. This support strap 65 can be of slightly elastic construction and is length-adjustable, for instance by means of a clasp 66. If the support strap 65 has a minimum length, which means that it extends across the opening approximately in horizontal direction, the flap 63 is disposed approximately horizontally above the opening 61. If the length of the support strap 65 is increased, it will sag, so that the flap 64 will tilt within the opening 61. In other words, by means of the support strap 65, the angle of inclination α of the flap 64 can be set.

Placed on the seat edge 60, the flap 64 and the support strap 65 is a seat cushion 67, consisting, for instance, of a first layer of foam 68 of a relatively high density and a second layer of foam 69 of a relatively low density, arranged on the first layer 68. When using the wheelchair, a user will sit on the seat cushion 67, whereby the layers of foam will be compressed slightly. If the support strap 65 is fully tightened, the flap 64 is approximately flush with the seat edge 60 and the user does not in effect experience any seat angle other than the angle that exists due to the angle of inclination of the wheelchair. If the support strap 65 is set less tight, the seat cushion will sag slightly along with the flap 64. As a result, a relatively greater angle of inclination of the seat is obtained. By making the support strap slightly elastic, additionally the spring and absorbing capacity of the wheelchair is influenced advantageously for the user. The use of the flap 64 and support strap 65 provides in a simple and economic manner for an increase of the ergonomic value of the wheelchair and moreover of the convenience in use and operation. The seat is comfortable and simple in use. It is noted that the flap 64 can also be designed in other ways, for instance as a number of straps extending between the front of the seat edge 60 and the support strap 65.

The backrest 5 is provided with a backrest edge 70 which is mounted against the back tubes 11. Tensioned between the top 71 and bottom 72 of the backrest edge 70 are a number of straps 73, two in the exemplary embodiment shown. Each strap is length-adjustable by means of a strap tensioner 74, and moreover preferably made up of a first, elastic part 75 and a second, non-elastic part 76. By means of the strap tensioners 74, the straps 73 can be adjusted in length in a manner similar to the support strap 65 of the seat 4, so that the degree of bending thereof upon loading can be set. The elastic first part 75 here provides for more comfort. Arranged against the backrest edge 70 is a back cushion 77 which has a structure comparable to the seat cushion 67. Because two straps 73 are arranged approximately parallel to each other, with each of the straps being individually length-adjustable, it is possible to control the compression of the left half and right half of the backrest 5 separately, so that the shape and deformation of the back cushion 77 can be set individually and at any time for each user. For instance for people with deviantly shaped back portions and/or a higher risk of bed sores (decubitus), this is particularly advantageous because an optimum pressure distribution can be provided for. It is noted that the seat 4 too can, if desired, be comparably provided with two or more straps instead of, or in addition to, the flap 64.

In an alternative embodiment, not shown, the or each strap 73 is laterally displaceable as well, in such a manner that the distance between each strap and the peripheral edges or the other straps, if any, can be adjusted. As a result, the shape of the supporting surface can be controlled even better.

In order to afford the user even more comfort and support, the backrest 5 further comprises an adjustable lumbar support 78, which is formed by a lumbar strap 80, extending between the sides 79 of the backrest edge 70 and crossing the straps 73, and which is likewise provided with a strap tensioner 74. The lumbar strap 80 is attached to the sides 79 through bolts and two sliding nuts received in sliding rails 81. Each of the ends of the lumbar strap 80 is adjustable along the relevant sliding rail 81 and can be secured in any position. As a result, it is possible both to displace the lumbar strap straight along the surface of the backrest 5, up and down, and to have it include an angle with the horizontal. In other words, for a user the lumbar strap 80, and hence the lumbar support 78, can be set higher and lower, simultaneously on the left and right side, as well as individually on either side, so that the lumbar support can be adapted to the individual user. Accordingly, in combination with the straps 73 which are adjustable in vertical direction, it is possible through the lumbar support 78 to adapt the shape of the back cushion 77 to the individual user in an ideal manner, which is advantageous in particular for users with a deviant geometry of the back.

The sides 79 of the backrest edge 70 are slightly bent forwards for the purpose of augmenting the lateral support for the user, so that the backrest 5 is tub-shaped to some extent. The seat 4 can similarly be of tub-shaped design.

A wheelchair according to the invention can be used as follows.

Two frame parts 8 are assembled from a front 36 and rear section 37, with a filling tube being fitted between the sections 36, 37 over the relevant guide stubs 38 for the purpose of adjusting the length of the frame parts 8, depending on the intended user of the wheelchair. Then a connecting frame 21 is assembled,

whose desired width is set by means of the outer tubes 34 and inner tubes 35, again depending on the intended user. This connecting frame 21 is assembled together with the frame parts 8 for forming the support frame 1.

On opposite sides of the support frame 1, a wheel plate 20 is mounted on the relevant wheel frame 16 at a height depending on the intended user. Then in each wheel plate 20 a standard size rear wheel 2 is mounted. These wheels may be provided with driving hoops.

In each front wheel tube 40 a sliding piece 41 is mounted, on which a standard front wheel 3 is pivotally mounted. The eccentric 51 is positioned in the sliding piece 41. The sliding piece 41 is adjusted in height through displacement thereof within the front wheel tube 40, in such a manner that a desired angle of the support frame 1 is obtained. This desired angle will depend, for instance, on the intended user. Thereupon, in the manner described in the foregoing, by means of the eccentric 51 the position of the fork 44 which mounts the front wheel 3 is adjusted in such a manner that the axis of rotation D extends approximately in vertical direction, whereafter the eccentric 51 is fixed by means of the set bolt 57 and associated nut. Thus a fully individually adapted wheelchair undercarriage is obtained.

On the seat tubes 9 a seat 4 is mounted, with the length of the or each support strap 65 being adjusted in such a manner that a suitable, convenient sitting angle for the intended user is obtained. In a comparable manner, a backrest 5 is mounted against the back tubes 11, and the straps 73 and the lumbar support 78 thereof are suitably set, in such a manner that the shape of the backrest 5 is optimal for the intended user. Further, the wheelchair can be provided, for instance, with armrests and a headrest and like accessories. In this way, a fully individually adapted wheelchair is obtained, which is made up of standard parts, which is favourable both from an economic and from an ergonomic point of view.

During use of the wheelchair by the user, it can be driven by rotation of the rear wheels, for instance by means of the hoops. It is also possible, however, to ride the wheelchair by stepping. When so used, this wheelchair has an advantage over known wheelchairs in that the support frame does not impede such stepping movement. This can be understood as follows.

During stepping, at least one of the feet and a part of the associated leg of the user come under the seat. Owing to the fact that the connecting frame 21 of a wheelchair according to the invention has only one rear lower connecting bar, the space under the seat adjacent the front of the wheelchair, and hence in the area where the or each foot and associated leg of the user will extend intermittently during the stepping movement, is free of obstacles. As a result, the user experiences no hindrance from the support frame during stepping. It is noted that it is naturally also possible to drive the wheelchair in other ways, for instance by means of a motor, by pushing or through lever drive.

For the purpose of transporting the wheelchair, it can be collapsed. To that end, the seat and backrest are removed or at least swung clear, whereafter the central longitudinal bar 32 is gripped and pulled up. As a result, the two frame parts 8 are moved towards each other and the wheelchair is rendered easy to transport. For the purpose of making the wheelchair ready for use from this position, the reverse procedure is followed. The wheelchair is preferred to be self-locking in the service position.

In an alternative embodiment, not shown, the angle of the front wheel forks is adjustable during use as well, for instance by means of a lever, while the axis of rotation D is maintained approximately vertical. As a result, during use, a switch can be made from an "indoor position" in which the wheelchair can be properly manoeuvred in that the front wheel fork extends approximately vertically and an "outdoor position" in which the fork includes an angle with the vertical, so that the wheelchair tracks right. To that end, use can be made of the eccentric described, or an additional, second swivel point can be included, with an axis of rotation approximately parallel to the wheel axle and located between the eccentric and the wheel axle. The invention is not in any way limited to the embodiments shown and described. Many modifications thereof are possible. For instance, the frame parts can be constructed differently, for instance wholly or partly from plate parts, the wheel frames can be of different design, and the foot support tube and the front wheel tube can be combined. Further, for instance the seat and backrest can be of integrated design and the wheelchair can be made of rigid, that is, non-collapsible design. Different tilting mechanisms and height adjustment means can be used for the front wheels, for instance screw unions. These and many other variations are understood to fall within the scope of the invention.

Claims

1. A wheelchair comprising at least two rear wheels, two front wheels, a support frame, a seat and a backrest, characterized in that a body supporting means, in particular the seat, comprises a supporting frame and a cushion arranged on a first side thereof, while the supporting frame has a peripheral edge which surrounds at least partly a central opening, a flap being connected with a first side of the peripheral edge through hinge means, which flap has a surface that is less than the surface of the opening, while setting means are arranged for setting the angle which the flap includes with the plane defined by at least a part of the peripheral edge of the supporting frame, the arrangement being such that the flap during use can at least partly extend within the opening and at least partly carries the cushion, with the cushion conforming in shape to the position of the flap.

2. A wheelchair according to claim 1, characterized in that the setting means comprise at least one sup-

port strap, which support strap connects two opposite second sides of the peripheral edge, extends approximately parallel to the first side of the peripheral edge, spaced from the hinge means, supports the flap at least partly and is length-adjustable by means of adjusting means, in such a manner that the position of the flap is settable through length-adjustment of the support strap.

3. A wheelchair according to claim 1 or 2, characterized in that the setting means comprise at least one support strap, which support strap connects two opposite second sides of the peripheral edge, extends approximately parallel to the first side of the peripheral edge, spaced from the hinge means, supports the flap at least partly and is at least partly elastic.

4. A wheelchair comprising at least two rear wheels, two front wheels, a support frame, a seat and a backrest, optionally according to any one of the preceding claims, characterized in that a body supporting means, in particular the backrest, comprises a supporting frame and a cushion arranged on a first side thereof, while the supporting frame has a peripheral edge which surrounds at least partly a central opening, while at least one support strap is provided between two opposite sides of the peripheral edge, with the length of the or each support strap being adjustable, in such a manner that during use the cushion is at least partly supported by the or each strap and conforms thereto in shape.

5. A wheelchair according to claim 4, characterized in that at least two first support straps are provided, which extend in spaced relation and during use between two opposite, approximately horizontally extending first sides of the peripheral edge, with the length of each first support strap being settable independently of the length of the or each other support strap.

6. A wheelchair according to claim 4 or 5, characterized in that at least one first support strap has adjacent the peripheral edge at least one point of attachment which is displaceable along the plane defined by the peripheral edge in a direction approximately at right angles to the longitudinal direction of the relevant first support strap.

7. A wheelchair according to claims 4-6, characterized in that the or a support strap extends between two second sides of the peripheral edge during use approximately in horizontal direction as a lumbar strap, which is length-adjustable.

8. A wheelchair according to claim 7, characterized in that the or each support strap to be referred to as lumbar strap has adjacent each relevant second side a point of attachment adjustable in the longitudinal direction of that second side, at least substantially at right angles to the longitudinal direction of the lumbar strap.

9. A wheelchair according to any one of claims 2-8, characterized in that at least a number of the support straps are made at least partly of elastic material.

10. A wheelchair comprising at least two rear wheels, two front wheels, a support frame, a seat and a backrest, optionally according to any one of the preceding claims, characterized in that the support frame, viewed in the direction of travel of the wheelchair, is provided, adjacent the front, with adjusting means for adjusting the distance between the seat and the axis of rotation of the front wheels, measured in at least vertical direction.

11. A wheelchair according to claim 10, characterized in that the adjusting means comprise on opposite sides of the wheelchair a front wheel tube, while a sliding piece is arranged for sliding movement within or around the front wheel tube with a proper fit and is securable in different lengthwise spaced positions, while each sliding piece carries a front wheel, the arrangement being such that through adjustment of the front wheels the height of the support frame, sitting surface and the backrest and/or the angle of inclination thereof relative to the ground can be set.

12. A wheelchair according to claim 10 or 11, characterized in that the support frame, viewed in the direction of travel of the wheelchair, comprises on opposite sides thereof a wheel frame on which a rear wheel is mountable, the wheel frame comprising a series of fixing means above each other, while the position in substantially vertical direction of the relevant wheel relative to the wheel frame is adjustable through a suitable choice of the fixing means to be used, the arrangement being such that through adjustment of the rear wheels the height of the support frame, sitting surface and the backrest and/or the angle of inclination thereof relative to the ground can be set.

13. A wheelchair according to claim 12, characterized in that the wheel frame comprises two substantially parallel tubular, bar or plate members each provided with a series of holes preferably provided at regular intervals, with each rear wheel being mounted on a wheel plate which, by means of fastening means such as bolts, can be fastened through at least one hole in each tubular, bar or plate member.

14. A wheelchair according to any one of claims 10-13,

characterized in that the adjusting means for the front and/or rear wheels are arranged such that upon adjustment of the front and/or rear wheels in a vertical direction to a greater height, the distance between the axes of rotation of the front and rear wheels increases, and decreases upon adjustment to a lesser height.

15. A wheelchair comprising at least two rear wheels, two front wheels, a support frame, a seat and a backrest, optionally according to any one of the preceding claims, characterized in that each front wheel, by way of a wheel axle, is received in a fork which via first and second swiveling means is connected with the support frame, while the first swiveling means define a first axis or rotation crossing the wheel axle substantially at right angles and the second swiveling means define a second axis of rotation extending substantially parallel to the wheel axle, spaced therefrom, while the second swiveling means are arranged for swiveling the fork about the second axis of rotation for adjusting the position of the wheel axle relative to the first axis of rotation.

16. A wheelchair according to claim 15, characterized in that the second swiveling means comprise an eccentric, spaced from the second axis of rotation.

17. A wheelchair comprising at least two rear wheels, two front wheels, a support frame, a seat and a backrest, optionally according to any one of the preceding claims, characterized in that the support frame is so designed that at least the length and the width thereof are settable.

18. A wheelchair according to claim 17, characterized in that the support frame comprises two substantially equal frame halves, with each frame half consisting of a front and a rear section, which sections are adapted to be coupled through coupling pieces, which coupling pieces define the mutual distance between the sections of the relevant frame halves and hence the length of the frame halves.

19. A wheelchair according to claim 17 or 18, characterized in that the two frame halves are interconnected by a connecting frame comprising adjusting means for adjusting the width thereof.

20. A wheelchair according to claim 19 or 20, characterized in that the connecting frame is collapsible in substantially vertical direction, in such a manner that the two frame halves are movable towards each other into an approximately vertical position.

21. A wheelchair comprising at least two rear wheels, two front wheels, a support frame, a seat and a backrest, optionally according to any one of the preceding claims, characterized in that the support frame comprises two substantially equal frame halves which, viewed in the direction of travel, are connected adjacent the rear by means of a connecting frame, while adjacent the front of the wheelchair the space under the seat is free, at least the space in which a user seated in the wheelchair moves his or her leg or legs during use in order to contact the ground under the seat.

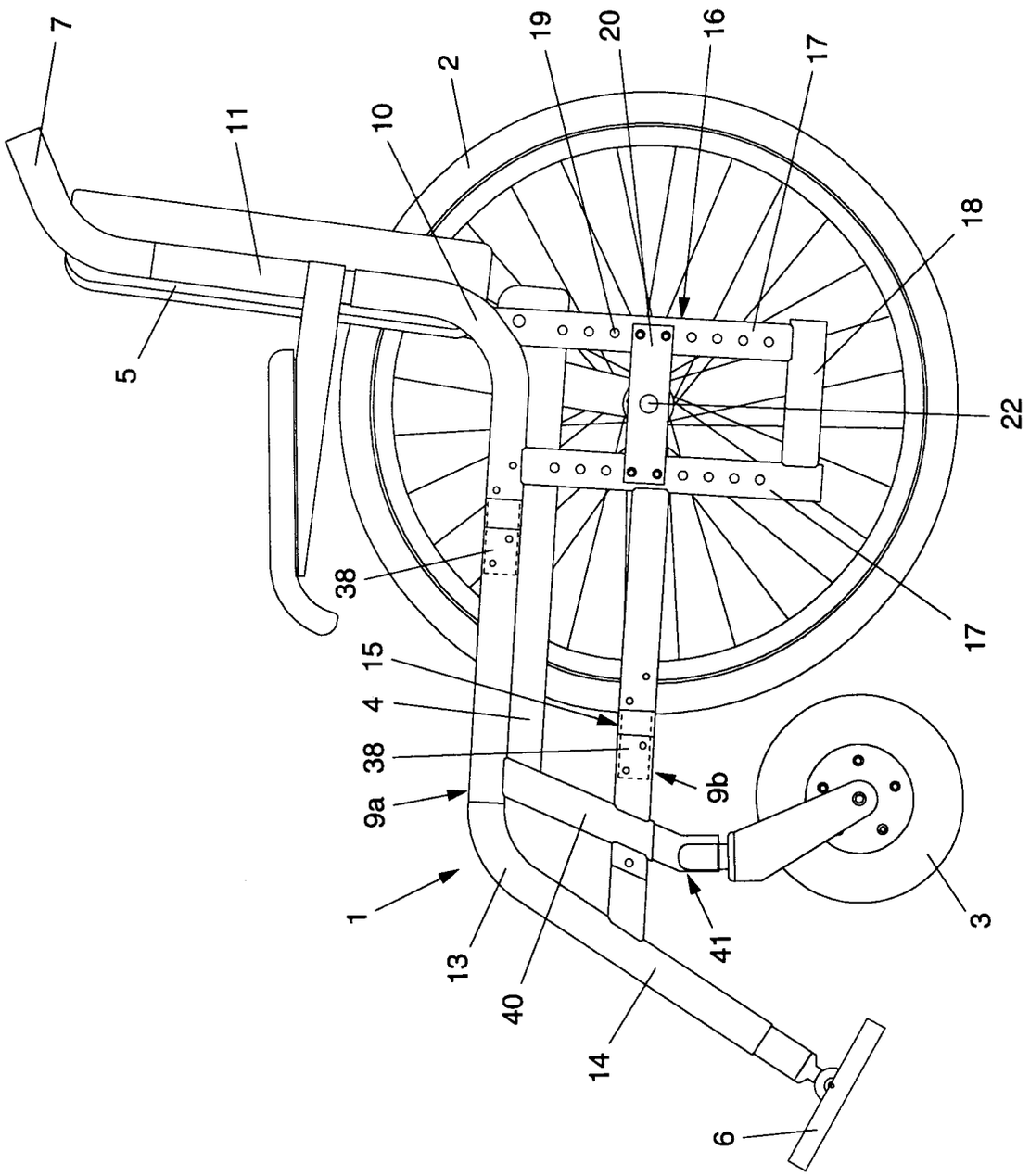

FIG. 1

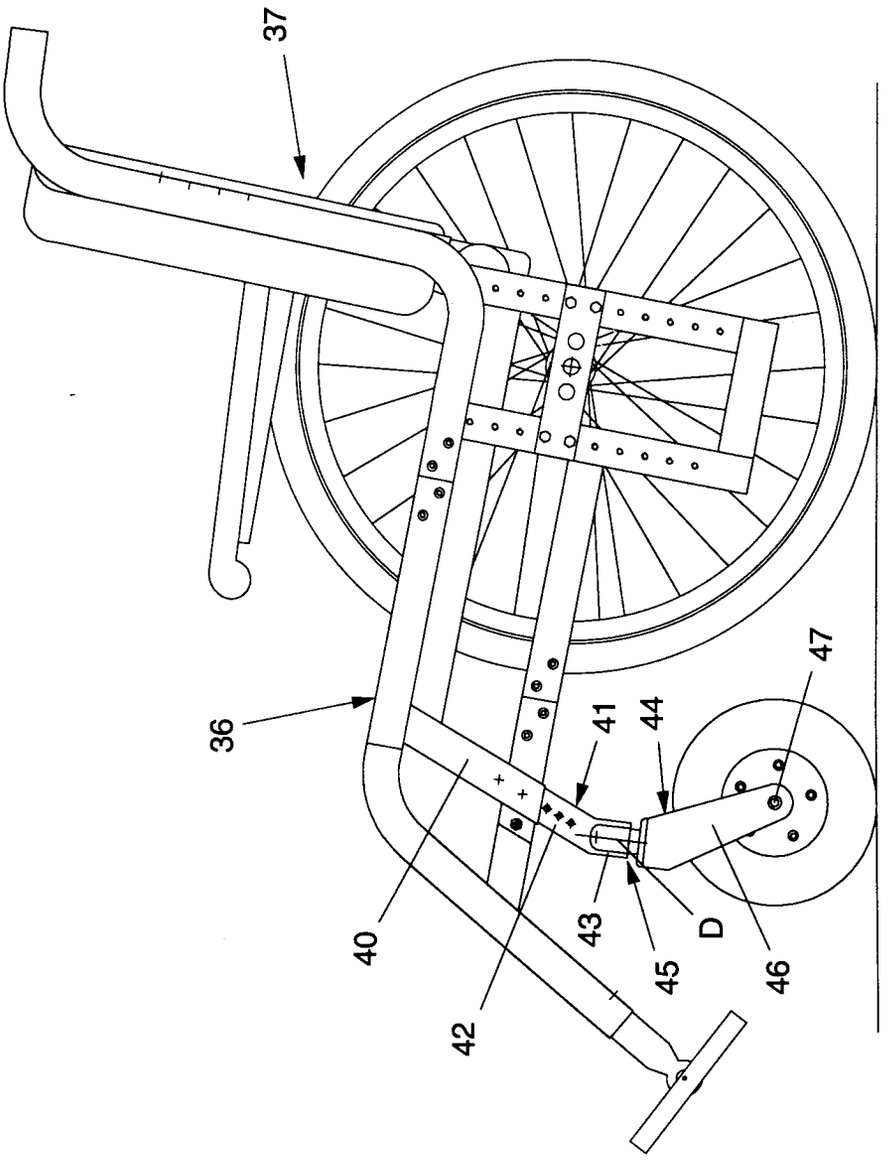

FIG. 2

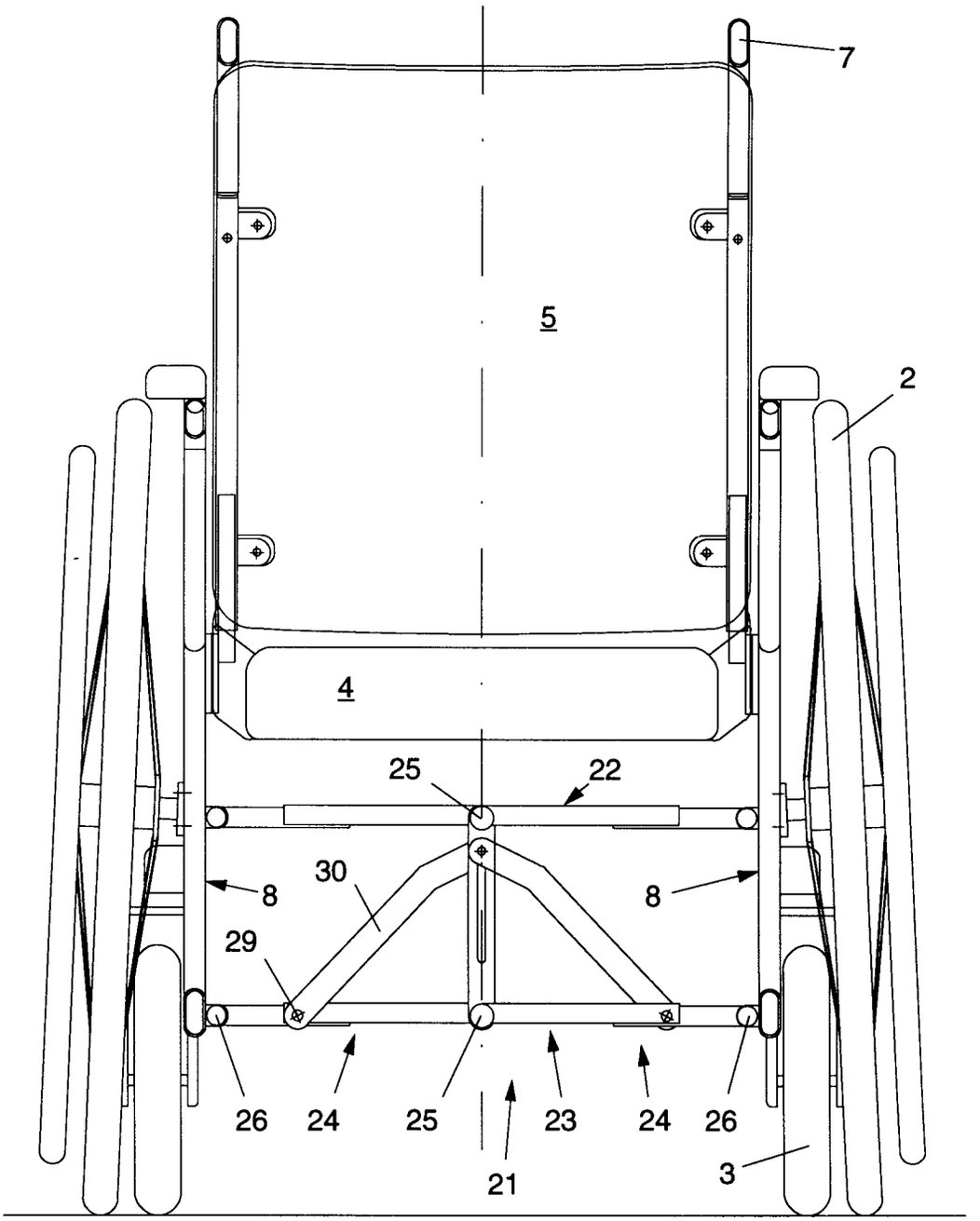

FIG. 3

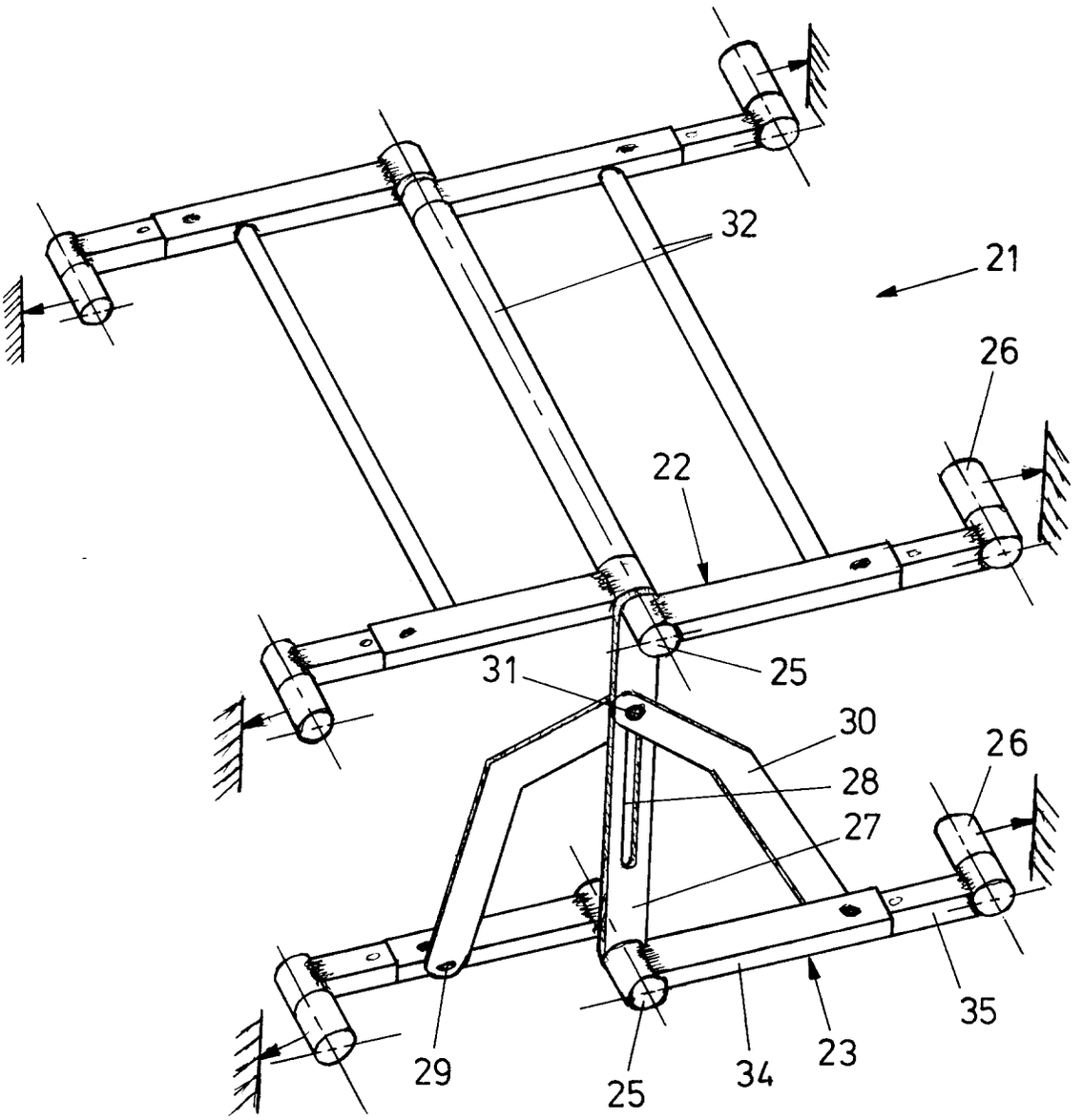

FIG. 4

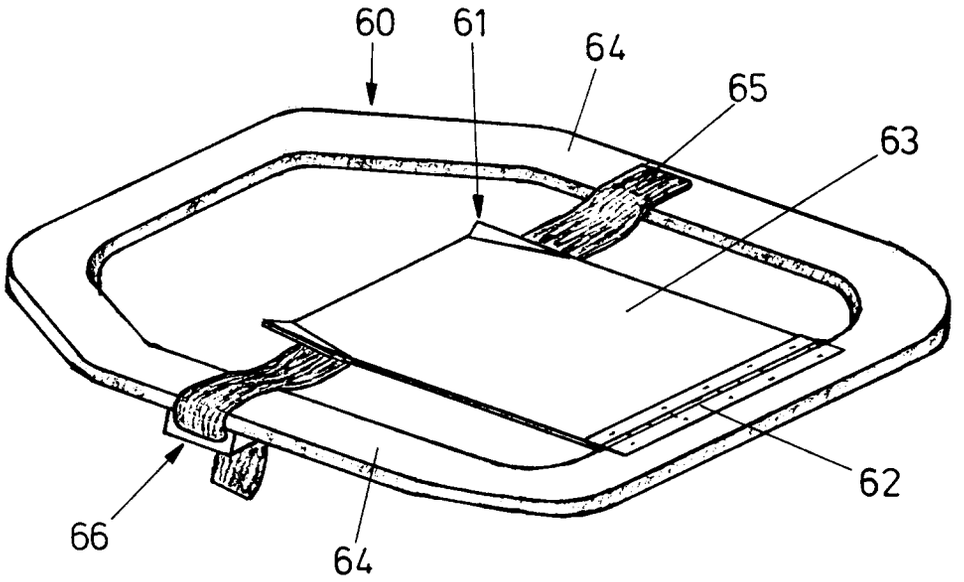

FIG.5

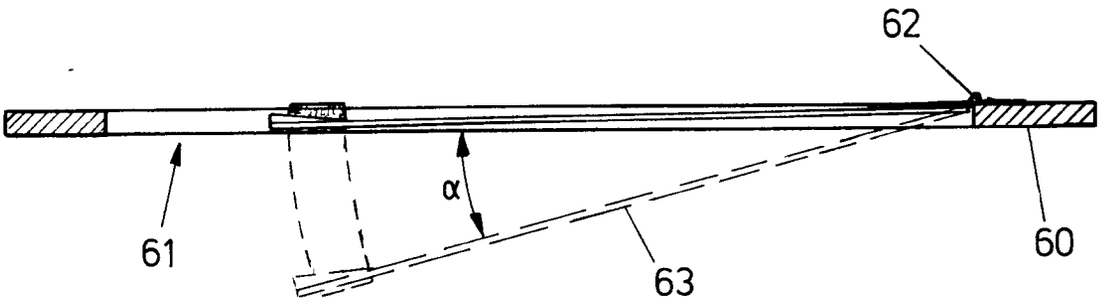

FIG.6A

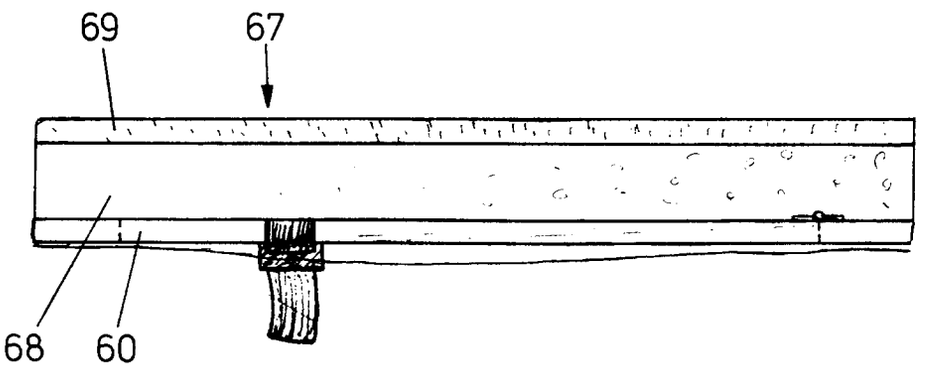

FIG.6B

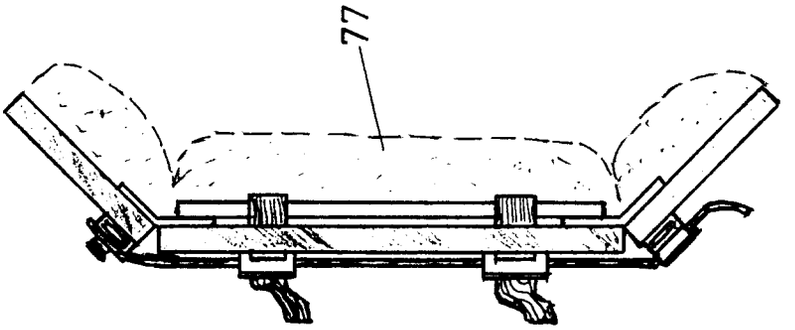

FIG.8

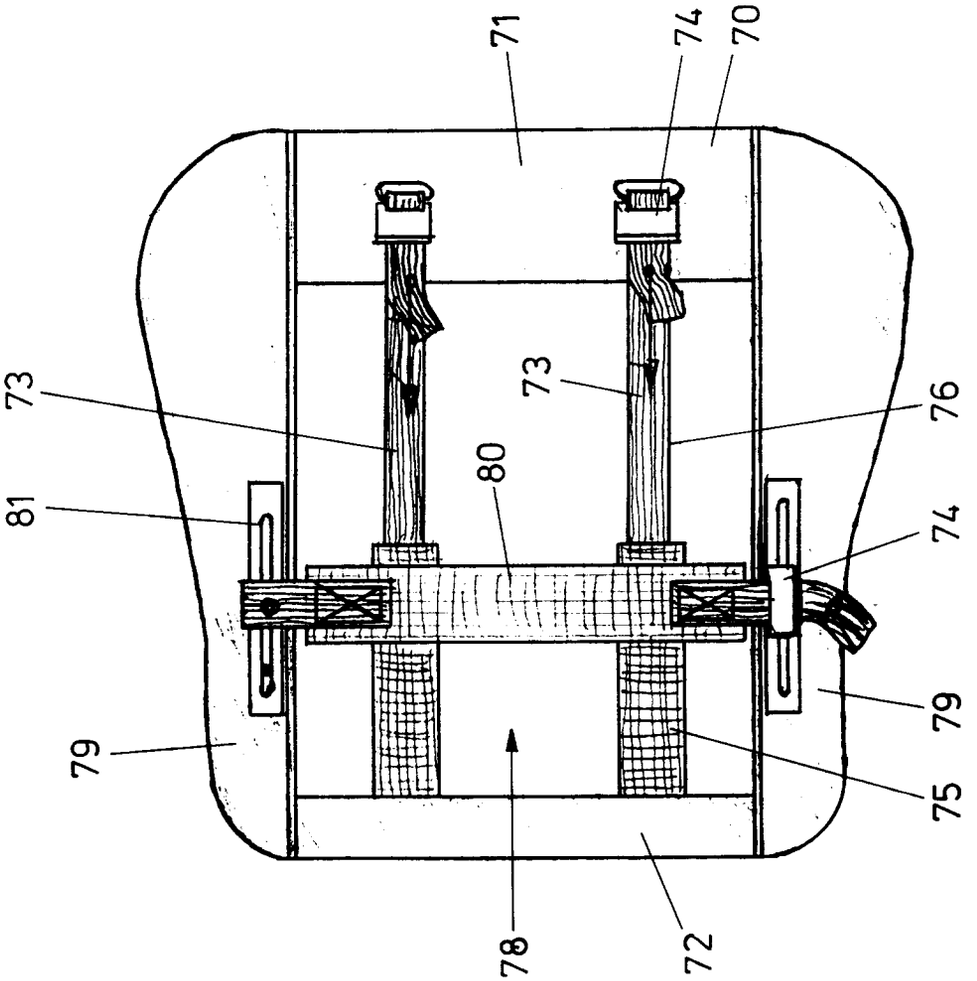

FIG.7

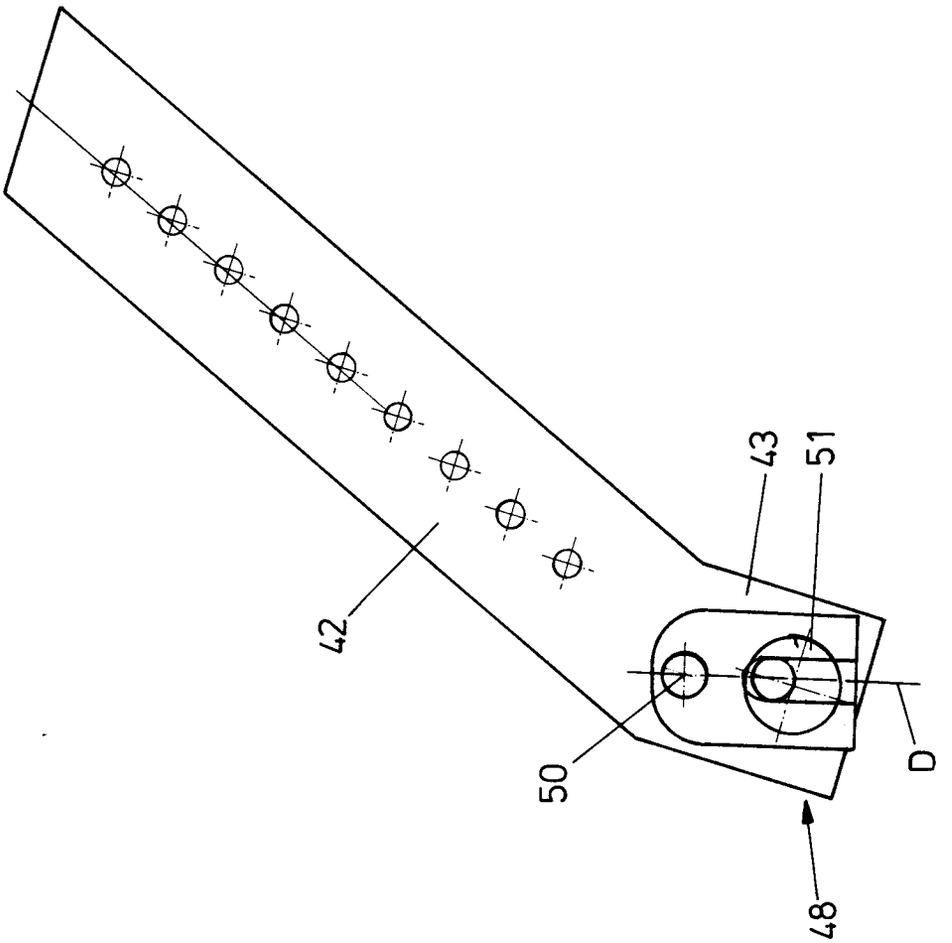

FIG.10

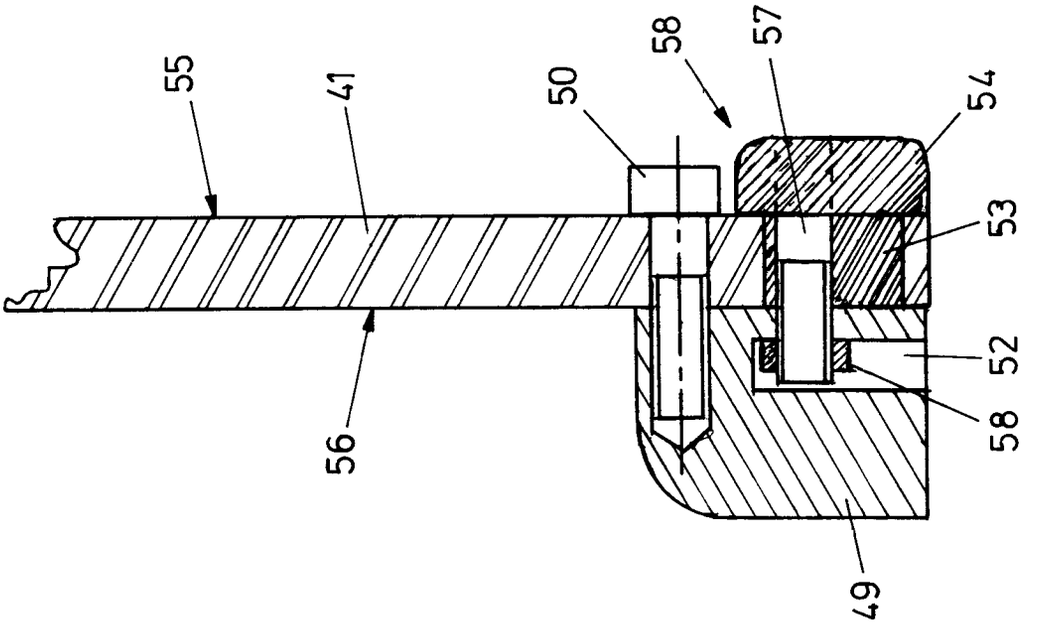

FIG.9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 20 2513

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-5 437 497 (HUTSON) 1 August 1995 * column 3, line 65 - column 4, line 29; figures * ---	1,2	A61G5/00 A61G5/12
A	US-A-5 445 433 (MEDISOL U.S.A.INC.) 29 August 1995 * column 4, line 15 - line 37; figures 2,5,6A * ---	4	
A	US-A-3 464 754 (GOTTFRIED) 2 September 1969 * the whole document * ---	1-4	
A	US-A-4 813 693 (INVACARE CORP.) 21 March 1989 * the whole document * ---	10,12, 13,15, 17,19-21	
A	WO-A-91 07936 (MARSHALL) 13 June 1991 * the whole document * ---	10, 12-15, 17-19	TECHNICAL FIELDS SEARCHED (Int.Cl.6) A61G
A	US-A-4 730 842 (WHEEL RING,INC.) 15 March 1988 * abstract; figures * ---	1	
A	DE-U-89 14 424 (MEYRA) 25 January 1990 * figures * -----	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 December 1996	Baert, F

CATEGORY OF CITED DOCUMENTS

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