

May 25, 1965

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MOVABLE AXLE ASSOCIATED THEREWITH

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2 Sheets-Sheet 1

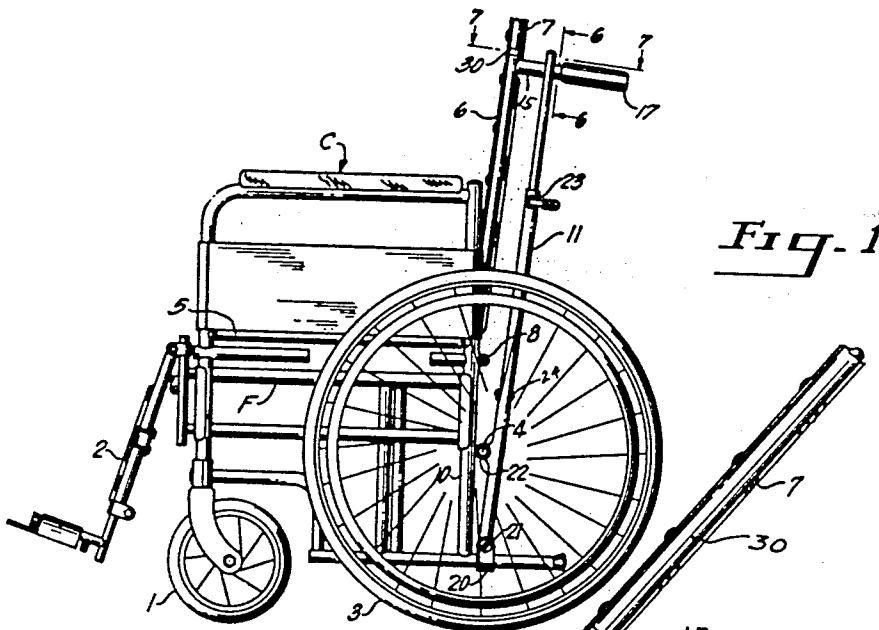


Fig. 1

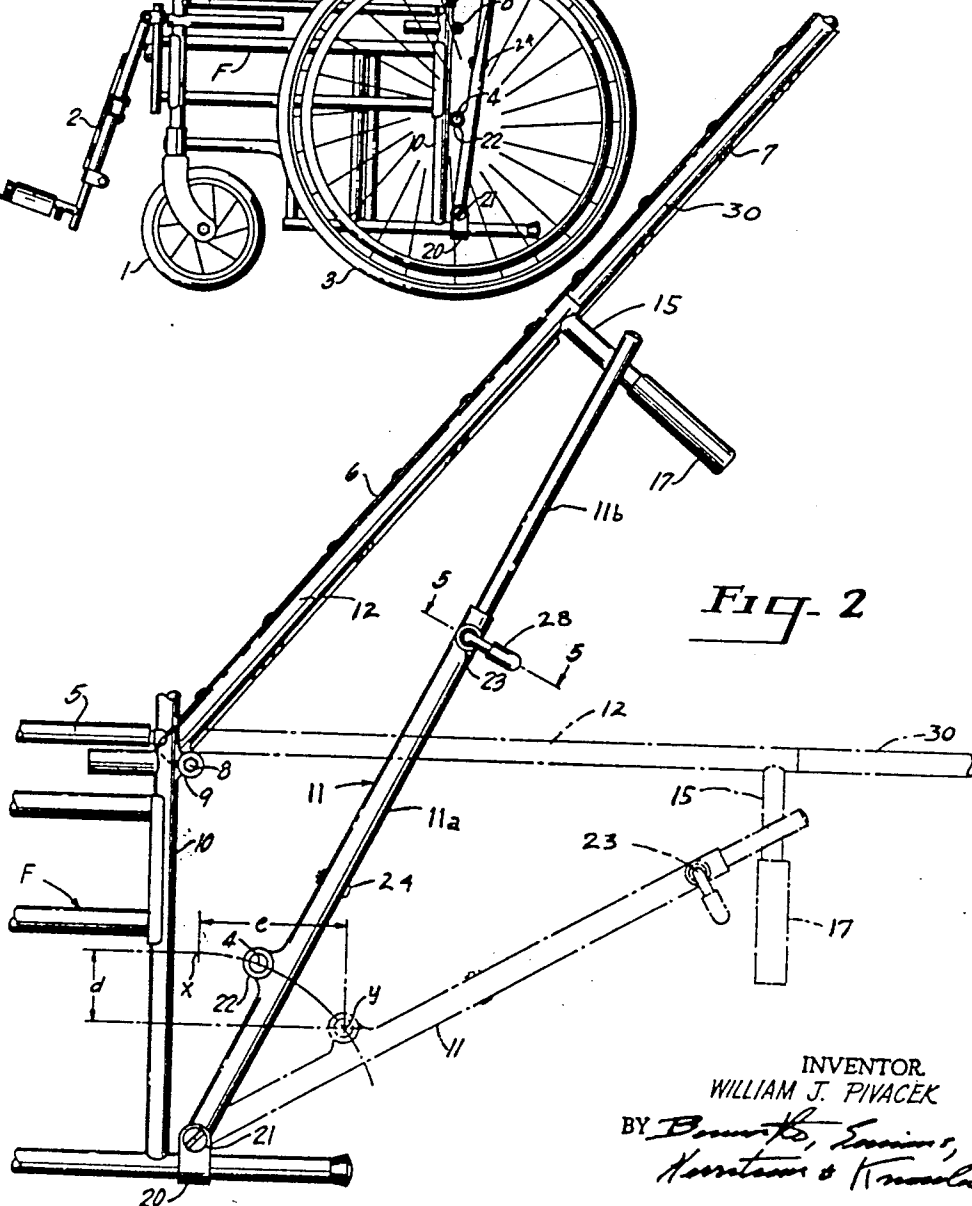


Fig. 2

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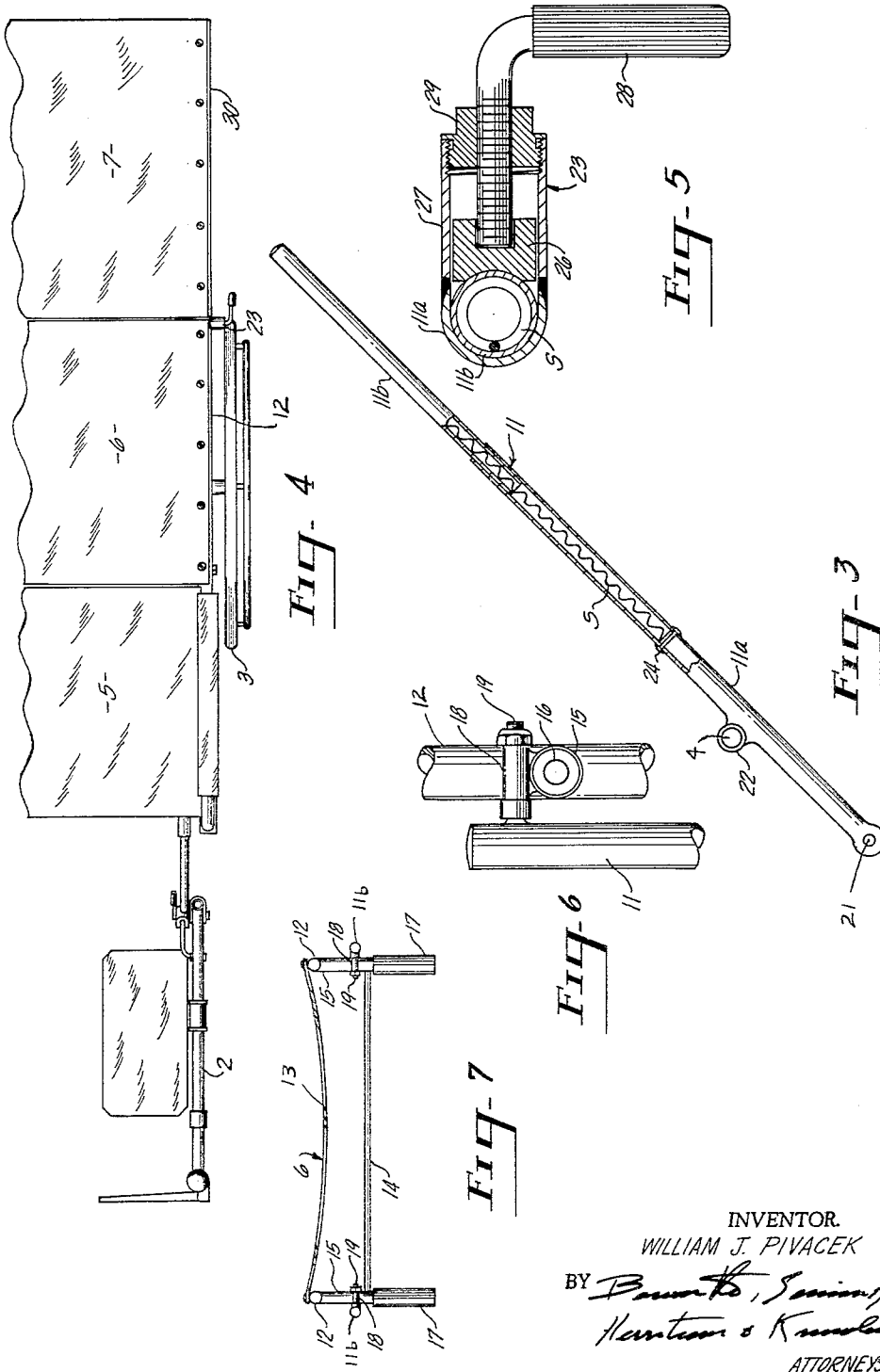
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WHEEL CHAIR WITH RECLINING BACKREST AND MOVABLE AXLE ASSOCIATED THEREWITH

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This invention relates to wheel chairs having adjustable reclining backrests, and more particularly to the equilibrium thereof and the wheeled support of such chairs against inadvertent tipping or overturning as the rearward inclination of the backrest and the occupant is increased and the center of gravity is shifted.

Inasmuch as the health and comfort of the user of a wheel chair is often enhanced by sitting in a reclining position and/or by altering his position from and between sitting upright to lying supine, chairs with reclining backrests have been sought and variously provided. All such prior chairs, however, have had grave limitations: full rearward inclination of the backrest was risked only at the expense of inordinately increased wheel base of the chair with all the inconvenience and awkwardness thereof, or the inclination was so limited that no increase in wheel base was necessary to maintain the stability and safety of the chair, or safety and stability was risked to provide desirable inclination with the hope that an attendant or divine providence would prevent calamity befalling the occupant. The undesirability and/or hazard of each of these alternatives has been long understood and miserably endured, but heretofore no solution has come forth that has promoted the art, in spite of the want and need therefor.

My first object is to solve the problem stated above, and provide a wheel chair in which the backrest may be adjustably and selectively positioned, and safely used and enjoyed, by any occupant, patient and/or attendant, without risk or hazard, and without sacrifice of compactness, convenience and maneuverability of the chair.

A more specific object of my invention is to provide a wheel chair with a reclining backrest wherein the wheelbase is automatically changed with the need therefor as the inclination of the backrest and the shifting of the center of gravity of the chair and its load requires.

Another object is to provide a wheel chair with a reclining backrest so interconnected with the axles of the wheels adjacent and subadjacent thereto that the wheels will always be moved safely rearwardly of the rearwardly moving center of gravity of the chair and occupant as the backrest is inclined rearwardly.

Another object is to provide movable wheeled support for a chair with a reclining backrest which not only changes its wheelbase automatically to preserve the stability of the chair against horizontal changes of the center of gravity of the chair and occupant, but also tends to maintain that center of gravity at a substantially constant, or increased, elevation throughout its horizontal motion as the backrest is increasingly inclined, and correspondingly to employ the weight of the patient in aid of, or without hinderance to raising the chair and occupant to upright position. It is an object of my invention to reduce, or substantially eliminate, the effort required by the occupant and/or attendant to change the inclination of the backrest of my chair with the weight of the occupant upon it.

These and other objects and advantages of my invention will more fully and at large appear in the following description of a preferred form thereof, reference being had to the accompanying drawings, in which:

FIGURE 1 is a side elevation of a wheel chair em-

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bodying my invention, lacking part of the upper extension of the backrest.

FIGURE 2 is a fragmentary side elevation of the rearward part of the chair of FIGURE 1 with the backrest inclined from the position of FIGURE 1 and with the rear wheels removed for convenience of illustration, and with a second reclined position of the backrest shown in dotted lines.

FIGURE 3 is a partially cut-away elevation and longitudinal section of one of the adjustable telescoping struts on my chair.

FIGURE 4 is a fragmentary plain view of approximately one longitudinal half of my chair with the backrest fully reclined and a legrest fully raised.

FIGURE 5 is an enlarged sectional view of the clamp for the strut of FIGURE 2, taken on the line 5—5 in FIGURE 2.

FIGURE 6 is an enlarged detail of the upper pivotal connection between the adjustable strut and the backrest near the attendant's handle, taken on the line 6—6 of FIGURE 1, and

FIGURE 7 is a transverse section taken on the line 7—7 of FIGURE 1 through the upper end of the backrest just above, and showing the attendant's handles and spreader.

My invention is conveniently illustrated in the environment of the wheel chair disclosed in the prior U.S. patent for the joint invention of William C. Shea and me, No. 3,072,437, wherein the legrest at the front of the chair may complete the support of the inclined or supine occupant of the chair embodying my present invention as suggested in FIGURES 1 and 4 herein. The invention of our prior patent had its office and function at and about the front of an invalid chair, such as the conventional folding wheel chair therein otherwise illustrated. My present invention in the form herein illustrated and described, has its office and function at the rear of the same or same type of, chair.

In FIGURE 1 the chair C, preferably of the folding type, has substantially duplicate essentially tubular metallic side frames F each having front, caster wheels 1, swingable legrests 2, according to my said prior invention with William C. Shea, large, rear, driving wheels 3 mounted on axles with horizontal axes 4, a seat 5, see also FIGURE 4, an adjustably inclinable backrest 6, and a removable extension of the backrest comprising a headrest 7. The backrest 6 and headrest 7 together are pivotally supported on transverse axes 8 disposed behind and slightly below the rearward end of the seat 5, for swinging motion from approximately the vertical to the horizontal, see also FIGURES 2 and 4. The axes 8 are borne in brackets 9, secured to the rear vertical posts 10 of the side frames F. Right and left telescoping struts 11 are pivotally connected at their lower ends on axes 21 borne and carried in bearing brackets 20 secured, preferably adjustably, on the bottom rails of the side frames F, FIGURE 2. The struts 11 carry the wheel axles 4 in bearing brackets 22 spaced from the lower ends of the struts, and are pivotally connected on axes 19 at their upper ends to the upper part of the backrest. Adjustable hand clamps 23, see also FIGURE 5, permit or secure the telescopic extension or retraction of, and/or relation between, the telescopic halves of the struts 11 whereby to position and support the backrest at any desired inclination, cf. FIGURES 1, 2 and 4.

The backrest 6 conveniently and preferably comprises a pair of rigid, tubular, right and left, side members 12, see also FIGURE 7, pivotally connected to the rear posts 10 on axes 8 at their lower ends, as mentioned above, and a central flexible, fabric, occupant-supporting panel 13 secured at and along its right to left lateral edges to the members 12, and also a detachable spreader 14 to

keep the members 12 parallel and properly spaced other than when the chair is, and is to be folded. Short rearwardly disposed extensions 15 integrally connected to the members 12, have integrally and rearwardly disposed, tapped holes 16, FIGURE 6, to threadably receive male threads on the reduced forward ends, not shown, of handles 17 which also pass through the ends of the spreader 14 for the simultaneous attachment, or detachment, of the handles and spreader to the extensions 15. Each of the extensions 15 carry bearing brackets 18, FIGURES 6 and 7, for the pivotal support of pivot pins or axes 19 which are carried by and extend laterally inward from, and near the upper ends of, the struts 11.

Each of the struts 11, FIGURE 3, comprises a greater lower tube 11a and a lesser upper tube 11b interfitted in close sliding telescoping relation and preferably jointly embracing a spiral coil spring S which is compressed and compressible between the closed upper end of the tube 11b and a conventional transverse stop pin and washer combination 24 by virtue of which the strut has a forcible yielding tendency to elongate from its minimum length shown in dotted lines in FIGURE 2 to or toward its greater or greatest lengths shown in full lines in FIGURES 2 and 1 respectively. I prefer to provide a plurality of diametrically aligned, longitudinally spaced holes in the tube 11a for selectively positioning the pin of the combination 24 to facilitate adjustment of the compressed stress of the spring S as may be desired. The hand clamps 23, FIGURE 5, serve, among other things, to secure the struts 11 at desired lengths against the efforts of the springs S to elongate the same. Each clamp comprises a block 26 frictionally engageable with the inner tube 11b and movable in a T extension 27 of the outer tube 11a by an angled handle 28, the threaded shank of which screws through the nut 29 fixedly secured in the end of the extension.

The headrest 7 is substantially a replica of the backrest and comprises an extension thereof, preferably freely detachable therefrom with the lower ends of its tubular side members 30 having a snug telescopic fit of limited length within the open upper ends of the side members 12 of the backrest whereby to act as rigid continuations thereof as shown in FIGURES 2 and 4.

In operation the chair C may first be assumed to be "unfolded," FIGURE 1, and in operative condition and occupied by a person, not shown, sitting upright with the backrest most upright as in FIGURE 1, i.e. with the bearing brackets 22 for the wheel axes (and axles) 4 making contact with the rear uprights 10 of the frame F as shown in FIGURE 1, and with the axes 4 in their uppermost and foremost position x as shown on the dotted arc x-y stuck from the center 21 in FIGURE 2. To incline the backrest (and occupant) rearwardly to the full-line position of FIGURE 2, for instance, the clamps 23 are loosened to permit the struts 11 to be shortened telescopically and the springs S to be compressed as the backrest is rotated rearwardly about the axes 8 as urged by the occupant directly upon the backrest and/or by an attendant grasping the handles 17 or the headrest 6 or backrest 7. When the desired inclination, as in full lines in FIGURE 2, is obtained the same may be secured by the clamps 23.

The inclination of the backrest is accompanied and facilitated by the rearward swinging of the struts 11 about their lower pivot points and axes 21 on the frame F with, however, the rearward and downward movement of the wheel axes 4 along the arc x-y. This motion of the struts 11 carries the wheels rearwardly relative to the frame and seat of the chair about as far as the center of gravity of the occupant and backrest (and headrest) has moved rearwardly whereby to preserve the equilibrium and stability of the chair. Additionally, the rearward part of the chair along with the upper legs and lower body portions of the occupant have been lifted upwardly relative to the surface on which the chair is resting by

about the amount the axes 4 have moved downwardly on the arc x-y, all with a small swinging motion of the chair counterclockwise, as viewed in FIGURE 1, about the front wheels as a center, lowering the occupant's feet and lower legs whilst also the head, shoulders and upper torso of the occupant have been lowered with the increased rearward inclination of the backrest and headrest.

Similarly when the backrest and headrest have been inclined to the position shown in dotted lines in FIGURE 2, a practical maximum and nearly horizontal and comfortably supine position, the axes 4, and the rear wheels 3, will have moved rearwardly the distance e to the position y on the arc x-y, and the rearward part of the chair with the backrest and headrest will have been raised the distance d, swinging the chair counterclockwise about the front wheels 1 as described above, and lowering the footrest a little. The rearward motion e will be as great as the rearward movement of the center of gravity of the chair and occupant, or at least ample to preserve the stability of the chair, and prevent inadvertent backward tipping thereof. Again the middle of the occupant's body will have been raised while the ends are lowered, all relative to the surface supporting the chair, assuming in this illustration that the position of the legrest 2 relative to the chair, and the occupant's feet and lower legs resting thereupon, is not changed. In the fully reclined position shown in dotted lines in FIGURE 2, and with the parts located and proportioned about as shown, and with the occupant within the average, normal middle range of height and weight, the net resolution of lifting the middle of the occupant and lowering his head and foot ends will in most instances be to raise the center of gravity of the occupant and chair, as I prefer, and provide that much kinetic energy tending to swing the occupant, backrest and headrest up toward the upright sitting position in FIGURE 1. Supplementing this force, as I presently prefer, is the compression of the spring S, also tending to restore the chair and occupant to upright sitting position.

It will be understood and appreciated that the geometric relationship between the parts which effect the reclining of the backrest and the support thereof may be altered advantageously without departing from my teaching and the essential mode of operation of my invention. For example, the pin and washer combination 24 may be disposed higher or lower in the strut 11 so that the strut more or less vigorously tends to raise the backrest from an inclined to a more upright position as might be desirable from the point of view of an attendant, nurse, occupant, or patient, especially if the patient were proportioned to have relatively greater weight in the upper parts of his body than in the middle. Similarly, the disposition of the pivot point 21 at the bottom end of the strut 11 may conveniently be moved fore and aft within reasonable limits by changing the position of the bracket 20 on the lower rail of the frame F whereby to modify, among other things, the relation of the vertical distance d to the horizontal distance e that will accompany the change in the inclination of the backrest. Those skilled in the art will also appreciate that endless variations in different specific amounts and characteristics of movements may be had by raising and lowering the pivot points 21 and/or altering the relative locations of the axes and pivot points 21, 4, 8 and 18; all as the same may or should be accompanied by changes in the size of the rear wheels 3 of the chair. Among these geometrical speculations, I have found it presently prudent to stay within the preferred form herein illustrated and described, including the disposition of the axes and axes 3 for the lower end of the backrest sufficiently below the level of the seat of the chair and rearwardly of the rearward end of the seat of the chair to preserve a comfortable support for the occupant by and between the seat and the backrest throughout all the

variable positions of the latter relative to the former.

In the foregoing description of my invention, I have avoided describing any action of the legrest merely to conclude the description of the backrest before describing the coaction therewith of the footrest.

Frequently the occupant, or the patient occupying a wheel chair, may alter the position of one or both legrests from time to time to enhance his comfort, especially if his foot or feet and/or lower leg or legs have been injured or impaired. When, however, a chair is provided with an adjustable reclining backrest, it not only adds to the occupant's comfort to raise the legrests at about the same time that the backrest is lowered, but it may become a matter of discomfort if the legrests are not raised when the backrest has been much lowered, or lowered to a supine position for the occupant. As suggested in FIGURE 4, the footrests 2, only the left one being shown, have been raised to a substantially horizontal position to accompany the full, substantially horizontal reclination of the backrest and headrest to support the patient from head to foot in supine comfort. By the employment of the legrest having horizontal sliding motion, as taught in the prior patent for the invention of William Shea and me, the occupant of the chair does not have to change his seat to accompany a change in position of his foot and leg, but should his greater or lesser inclination with the movement of the backrest of the chair tend to move his foot, leg or knee horizontally, the legrest of our prior patent will also accommodate this action fully and comfortably, and therefore enhance the enjoyment of my present invention.

While I have hereinabove described a preferred form and embodiment of my invention, changes and improvements therein and thereupon will occur to those skilled in the art who come to understand and enjoy the same without departing from the precepts and principles thereof wherefore I do not want to be confined in the scope and effect of my patent to the form of my invention herein specifically illustrated and described, nor in any other way inconsistent with the progress by which the art has been promoted by my invention.

I claim:

1. A wheel chair comprising a frame, a seat, a reclinable backrest pivotally connected to the frame adjacent the rearward end of the seat for swinging motion about a transverse axis extending across the back of the chair, a pair of wheels having movable axles parallel with said axis and disposed subjacent said backrest, and a pair of struts having their upper ends proximate said backrest and having their lower ends pivotally connected to said frame for swinging movement about aligned axes below and parallel with said transverse axis, each of said struts carrying one of said wheel axles between said upper and lower ends thereof, and means for swinging said struts, backrest and axles together.

2. The chair of claim 1 wherein said struts are longitudinally extensible and pivotally connected to said backrest.

3. The chair of claim 2 wherein said aligned axes are carried by said frame below said wheel axles, and said wheel axles are moved rearwardly as said backrest is inclined rearwardly.

4. The chair of claim 3 wherein the said rearward movement of said wheel axles includes a vertical component raising the chair when the backrest is reclined.

5. The chair of claim 4 with a legrest on the front of the chair which is movable forwardly as it is swung upwardly and influences the center of gravity of the chair and occupant to move forwardly when the occupant achieves an entirely supine position.

6. The chair of claim 1 wherein said aligned axes are disposed substantially below said wheel axles when

the backrest is substantially upright and said wheel axles are moved rearwardly and downwardly relative to the chair as said backrest is inclined rearwardly.

7. The chair of claim 1 wherein said struts are pivotally connected to said backrest at their upper ends, and wherein a rigid portion of the chair between the axes upon which said struts and said backrest are respectively mounted comprises the base of a triangle of which the said backrest and struts comprise the sides, one of said sides being changeable in length, and means for releasably securing said side against change in length.

8. The chair of claim 7 with spring means associated with said side of changeable length and stressed to bias said backrest toward an upright position.

9. The chair of claim 8 wherein the said rearward movement of said wheel axles includes a vertical component raising the chair relative to said wheels when said backrest is inclined.

10. The chair of claim 1 wherein the said movement of said wheel axles includes movement rearwardly and downwardly relative to the chair and raising and seat of the chair when the backrest is swung rearwardly, and said chair also comprising means exerting a force supplementing gravity tending to lower said seat and bias said backrest toward upright position.

11. A wheel chair comprising a frame, a seat, a reclinable backrest pivotally connected to the rearward part of the frame adjacent the rearward end of the seat for swinging motion about a transverse axis extending across the back of the chair, a pair of wheels having movable axles parallel with said axis and disposed subjacent said backrest, and a pair of struts having their upper ends proximate said backrest and having their lower ends pivotally connected to said frame for swinging movement about aligned axes below and parallel with said transverse axis, each of said struts carrying one of said wheel axles between said upper and lower ends thereof and above said aligned axes when said backrest is in an upright position, and means for swinging said struts, backrest and axles together and swinging said axles rearwardly and downwardly relative to the rearward part of said frame whereby to raise said seat and said axis when said backrest is inclined rearwardly.

12. The wheel chair of claim 11 wherein said wheels stand higher than said seat and said aligned axes are located nearer to the bottoms of the wheels than to said wheel axles when the backrest is in said upright position.

13. The chair of claim 11 with means for selectively locking said backrest in desired positions, and wheel axles under the influence of gravity tending to stand vertically above the said aligned strut axes and said struts and said backrest tending to rise vertically upright above their axes of pivotal connection with said frame when said locking means are released.

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