Title: IMPROVED WHEELCHAIR WITH TILTING SEAT

Abstract: A wheelchair has a reclining seat that has a back portion and a bottom portion. The wheelchair also has a frame, which has a lower portion onto which wheels are attached and a substantially vertical portion extending upwardly from the lower portion. The back of the seat is attached to the substantially vertical portion of the frame. The wheelchair has a first mode for normal seating in which the substantially horizontal lower portion supports the bottom portion of the seat. The seat also has a second, reclined mode in
which the seat is reclined backwardly relative to the normal position. The bottom and back portions of the seat and the substantially vertical portion of the frame are rotated together to tilt the seat into the reclined position. The lower portion of the seat is pivotally mounted on the lower portion of the frame, such that the lower portion of the frame remains substantially in place as the seat itself is tilted, and does not tilt with the seat. The seat may be removable from the frame, and the frame may be adapted to fold and/or collapse for compact storage. Alternative embodiments include features such as brackets that permit the seat back to slide relative to the back posts without the use of springs internal to the back posts. In another alternative embodiment, the seat is supported by members that rotate in conjunction with the back posts as the seat reclines.
IMPROVED WHEELCHAIR WITH TILTING SEAT

I. RELATED APPLICATIONS

This is a continuation-in-part of U.S. Patent Application No. 09/165,141, which was filed on October 1, 1998 and of U.S. Patent Application No. ______, which was filed on October 11, 1999 listing M. Melgarejo as the first inventor, listing attorney docket no. 310186-21, having a title of Improved Tilting Wheelchair at the top of page 1 of the specification, and being filed with the US Patent Office by attorney Scott R. Hansen via Express Mail on October 11, 1999, Express Mail Label No. EL189942460US, both of which applications are incorporated by reference herein.

II. BACKGROUND OF THE INVENTION

A. Field of the Invention

The present invention relates to wheelchairs and, more particularly, to wheelchairs in which the seat in which the user sits can be made to recline.

B. Prior Art

Wheelchairs are well known for providing persons of limited mobility with convenient means to get around. Two examples of wheelchairs are disclosed in U.S. Patent Nos. 4,078,817 and 5,127,709, among many others. The typical wheelchair has a seat that is fixed in position relative to the chair frame, in that to put the user in a reclined position, the entire wheelchair must be tipped and held at an angle. This arrangement is inconvenient in many circumstances. For example, therapists must sometimes put a patient at an angle during therapy. It is difficult if not impossible to maintain a patient in a reclined position for an extended period of time in the classic type of prior art wheelchair.

Fig. 1 illustrates the frame 10 of an alternative wheelchair design in which the seat can be made to recline. To recline the seat, the operator squeezes a hand-operated squeeze mechanism 11, which permits the entire seat-support substructure (including base frame members 12a,b and backposts 14a,b) to rotate with one another. The seat (not shown) then rotates along with the
seat-support substructure. A similar structure is disclosed in U.S. Patent No. 5,294,141, issued to Mentessi et al.

A drawback with the prior art design of Fig. 1 and the Mentessi patent is that the support substructure is relatively heavy, and it is difficult for the operator to tilt the seat back and forth. The frame is bulky and requires significant space for storage. A further drawback is that it is time consuming to manufacture the frames because they are welded.
III. SUMMARY OF INVENTION

The object of the present invention is to overcome one or more drawbacks present in the prior art.

In accordance with one aspect of the present invention, a wheelchair has a tiltable seat comprising a base frame comprising right and left base frame members. The wheelchair also includes a seat comprising a seat bottom and a seat back. A tiltable seat supporting frame has right and left back posts and right and left seat supporting members. The back posts are each interconnected with their respective seat supporting member. The tiltable seat supporting frame is pivotally mounted onto the base frame. The back posts each have a handle. The seat back is mounted onto the back posts and the seat bottom is mounted onto the seat supporting tubes. Right and left expandable lock mechanisms extending from a respective base frame member to a respective seat supporting member. The wheelchair frame includes the base frame and the tiltable seat supporting frame, the frame being laterally collapsible. A collapsible frame interconnects the right and left base frame members.

The collapsible frame comprises at least one cross member extending from one of the lower base frame members to the other of the upper base frame members. The cross member is pivotally mounted to a lower base frame member and an opposite upper base frame member.

In accordance with another aspect of the present invention, a wheelchair has a tiltable seat. The wheelchair has a base frame comprising right and left base frame members. A tiltable seat supporting frame comprising right and left back posts and right and left seat supporting members. The back posts are each releasably interconnected with their respective seat supporting member, the tiltable seat supporting frame being pivotally mounted onto the base frame. The back posts each have a handle, the seat back being mounted onto the back posts and the seat bottom being mounted onto the seat supporting tubes. The wheelchair has right and left expandable lock mechanisms, each extending from a respective base frame member to an adjacent seat supporting member. The wheelchair has a frame comprising the base frame and the tiltable seat supporting frame, the frame being laterally collapsible. The backposts are foldable onto the seat supporting tubes.
The wheelchair may have an in-use configuration in which the back posts are locked in a fixed relationship relative to the seat supporting tubes, and a folded configuration in which the back posts are unlocked from the seat supporting tubes and are folded forward onto the seat supporting frame.

In accordance with one specific embodiment, a wheelchair having a tiltable seat has a base frame comprising right and left lower base frame tubes and right and left upper base frame tubes. The wheelchair seat has a seat bottom and a seat back. The bottom of the seat is supported by a tiltable seat supporting frame. The tiltable seat supporting frame has right and left back posts and right and left seat supporting tubes. The tiltable seat supporting frame is pivotally mounted onto the base frame, the back posts each having a handle. The seat back is releasably mounted onto the back posts and the seat bottom is releasably mounted onto the seat supporting tubes. Releasable right and left locking bracket mechanisms interconnect the right and left back posts with right and left seat supporting tubes, respectively. Right and left releasable lock mechanisms, each having a retractable extension arm, extending from a respective upper base frame member to a respective seat supporting tube. The back post handle includes a release handle and a release cable extending from the release handle to the releasable lock mechanism.

The wheelchair has a frame comprising the base frame and the tiltable seat supporting frame, the frame being laterally collapsible and the backpost being foldable onto the seat supporting tube. The frame has an unfolded configuration in which the back posts are locked by the locking bracket mechanisms in a fixed relationship relative to the seat supporting tubes, and a folded configuration in which said backposts have been released from said locking bracket mechanisms and are folded forward onto the seat supporting frame. A collapsible frame interconnects the right and left base frame members, the collapsible frame comprising at least one cross member extending from one of the lower base frame members to the other of the upper base frame members. The cross member being pivotally mounted to the respective lower base frame and upper base frame members.

This embodiment may also have right and left tilt tube support brackets, which each extend between a respective upper base frame member and a tiltable chair supporting member.
Each of the brackets has a pin that extends through an upper base frame member such that upper base frame member is adapted to pivot about the pin.

The collapsible frame may also include first and second cross members, right and left upper cross-member mounting brackets hingedly mounted on respective right and left upper base frame tubes and right and left lower cross-member mounting brackets mounted on respective right and left lower base frame tubes. The first cross member extends from the mounting bracket on the right lower base frame member to the mounting bracket on the left upper base frame member. The second cross member extends from the mounting bracket on the left lower base frame member to the mounting bracket on the upper right base frame member.

The wheelchair frame may also be free of welds, and constructed with connectors so as to avoid the expense and time associated with welding.

A further embodiment of the present invention relates to a mechanism that permits the back of the seat to slide relative to the back posts as the seat is reclined. In this embodiment, the seat supporting frame is typically stationary, with the seat being pivotally mounted to the seat supporting frame. The seat then rotates backwardly as the user pulls back the back posts, with a seat back mounting bracket sliding relative to a back post as the seat reclines. The back posts may be fitted with plastic sheaths along which the seat back mounting brackets slide as the seat is inclined. The seat back mounting brackets may each include a roller that rolls along a back post as the seat is inclined, to smoothly accomplish the sliding function.

Many other objects and features of the invention will become apparent from a review of the Detailed Description below, from the drawings, and from the claims.

IV. BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a prior art wheelchair frame in which the entire seat frame rotates as a unit in order to recline the chair;

Fig. 2 is a perspective view of one embodiment of a wheelchair according to the present invention;

Fig. 3 is a side elevation view of the wheelchair of Fig. 2;
Fig. 4 is a front elevation view of the wheelchair of Fig. 2;  
Fig. 5 is a rear elevation view of the wheelchair of Fig. 2;  
Fig. 6 is a detail cut-away view illustrating a compression spring mechanism within a backpost;  
Fig. 7 illustrates a user squeezing the handles and reclining the seat and backrest together into a reclined position;  
Fig. 8 illustrates the wheelchair with the seat reclined;  
Fig. 9 is a perspective view of a second embodiment of the present invention, with the seat removed;  
Fig. 10 is a rear elevation of the wheelchair of Fig. 9;  
Fig. 11 is a front elevation of the wheelchair of Fig. 9;  
Fig. 12 is a detail view of Area 12 of Fig. 9;  
Fig. 13 is a detail view illustrating the seat mounted upon the frame;  
Fig. 14 is a rear elevation view illustrating the wheelchair in a partially folded configuration;  
Fig. 15 is a detail view of Area 15 of Fig. 9;  
Fig. 16 is a detail view illustrating the bracket of Fig. 15 having been rotated into a position to receive a backpost to place the wheelchair in a folded configuration;  
Fig. 17 illustrates an embodiment of the present invention in a fully folded configuration;  
Fig. 18 is a detail view taken at Area 18 of Fig. 11 illustrating a quick release mechanism for releasing the seat from the backposts;  
Fig. 19 is an alternative embodiment of the present invention;  
Fig. 20 is a detail view of Area 20-20 on Fig. 19;  
Fig. 21 is a detail view of the mechanism of Fig. 21 in an open configuration;  
Fig. 22 is a top view of the mechanism of Fig. 21 in the open configuration;  
Fig. 23 is a detail view of the seat hinge;  
Fig. 24 is detail view of Fig. 23 with the seat partially removed;  
Fig. 25 is a perspective view of an alternative embodiment of the present invention, in which a seat supporting frame rotates relative to the base frame as the seat is reclined;
Fig. 26 is a perspective view of the embodiment of Fig. 25 showing an attendant squeezing the release handles in preparation to recline the seat;

Fig. 27 is a perspective view showing the wheelchair in a reclined configuration;

Fig. 28 is a detail view of a back post;

Fig. 29 is a detail view showing the seat back releasably mounted to a back post;

Fig. 30 is a detail view showing a back post releasably interconnected with a seat supporting tube;

Fig. 31 is a detail view from another angle showing the back post interconnected with the seat supporting tilt tube;

Fig. 32 is a detail view of one side of the base frame and a seat supporting member;

Fig. 33 is a detail view showing a seat supporting tilt tube pivotally mounted by way of a bracket and pin to an upper base frame tube member;

Fig. 34 is a detail view of a tilt porter mechanism having an extendable arm, the mechanism interlocking an upper base frame tube with a seat supporting tilt tube, the extendable arm extending when the tilt porter mechanism is unlocked and as the seat supporting tilt tube is rotated upwardly;

Fig. 35 is a detail view of the weld-free frame, which is similar to a design disclosed in U.S. Patent Application No. 09/191,422, filed on November 12, 1998 and incorporated by reference herein;

Fig. 36 illustrates the embodiment of Fig. 25 with the removable seat having been removed from the wheelchair;

Fig. 37 is a detail view of the rotatable mounting bracket that interconnects a collapsible cross-frame member to an upper base frame tube;

Fig. 38 illustrates an attendant folding one of the back tubes down onto a seat supporting tube;

Fig. 39 illustrates the wheelchair frame in a fully collapsed and folded compact configuration;

Fig. 40 illustrates the bottom of the removable seat; and

Fig. 41 illustrates the back of the removable seat.
V. DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Considering now a particular preferred embodiment of the present invention, Figure 2 illustrates one illustrative example of a wheelchair having a reclining seat. The wheelchair 30 includes a seat 32 having an upper cushion 34 and a lower cushion 36. Figure 5 illustrates that the seat 32 also includes brackets 38A and 38B that interconnect the rear of upper cushion 34 with the bottom of lower cushion 36. The brackets 38A and 38B hold cushions 34 and 36 at a fixed angle relative to one another. Brackets 40A and 40B attach to the back of upper cushion 34 and interconnect with spring-loaded backposts 42A and 42B, respectively, to secure upper cushion 34 to the frame of the wheelchair. The lower seat cushion 36 rests upon upper base frame members 44A and 44B, respectively, when the seat is not reclined. However, the lower seat cushion is rotatably to the base frame members 44A and 44B and is free to rotate upwardly as illustrated in Figure 7.

The wheelchair also includes various features that are standard in the art such as relatively larger rear wheels 50A and 50B and relatively small front wheels 52A and 52B. Lower base frame members 54A and 54B are interconnected with upper base frame members 44A and 44B, respectively, by way of cross braces 56A and 56B. Push handles 58A and 58B, which may include a resilient material grip that is conventional in the art, are provided at the generally horizontally extending upper portions of backposts 42A and 42B, respectively.

The wheelchair may also be provided with flip canopy support posts 60A and 60B that are rotatably mounted onto the upper portion of the backposts 42A and 42B, respectively. The canopy support members are normally placed in the configuration illustrated in Figure 2 in which no canopy extends over the seat 32. However, as illustrated in Figure 3, the flip canopy support post may be rotated upwardly to extend above the seat 32. A canopy (not shown) may be extended between canopy supports 60A and 60B to provide shade to the user in sunny, outdoor conditions. The feature of the canopy above the wheelchair seat is conventional in the wheelchair art. Alternatively, in certain embodiments of a wheelchair according to the present invention, supports 60A and 60B may be adjusted downwardly on the respective backposts 42A, B to become adjustable locking flip back armrests that may be locked into a horizontal configuration to support the arms of the person in the wheelchair.
A unique feature of one preferred embodiment of the present invention relates to the manner in which the seat can be tilted backwards in order to put the user in a reclined position. As will be recalled from Fig. 1, reclining wheelchairs are designed such that the entire supporting frame that supports the seat rotates upwardly with the lower seat cushion as the seat reclines.

In the preferred embodiment of the present invention, the base frame members 44A and 44B do not rotate with the lower seat cushion 36 as the seat is reclined. Rather, the lower seat cushion 36 tilts upwardly independently of the position of the base frame members 44A and 44B, which are generally fixed into a set position. As Figure 8 illustrates, the backposts 42A and 42B recline backwardly in conjunction with rear seat cushion 34 as the seat reclines. In particular, the backposts 42A and 42B are rotatably interconnected with the lower portion of the wheelchair frame by means of bracket assemblies 62A and 62B.

As illustrated in Figure 6 and in Figure 3, for example, a bolt 64B extends from bracket 40B and through 66B and 68B in backposts 42B. The bolt is secured to the outside of the member 42B by means of a standard bolt head and washer arrangement or, alternatively and preferably, by a knob that the user can tighten or untighten as desired. Such a knob is illustrated in Figure 2, for example, as member 70B.

Referring in particular to Figure 6, a compression spring 72B is provided within backpost 42B. The compression spring is held into place by means of one or more roll pins (not shown). As the seat 32 reclines backwardly, the bolt 64B slides down the slots 66B and 68B respectively, thereby compressing compression springs 72B. A similar compression spring 72A and associated bolt is provided within structural member 42A. As the bolt 64B travels downwardly in the slots 66B and 68B, the compression spring 72B is compressed. These compression springs 72A and 72B perform at least two functions. One function is to ease the rate of recline as the chair is being put into the reclining position. The compression springs 72A and 72B serve to make the reclining motion somewhat more gentle than if there was no compression spring within the structural members 42. Methods of mounting compression springs within a tube are known in the art such as, for example, mounting roll pins within the tube at one or both ends of the compression spring.

Another function of the compression springs 72A and 72B is to assist the operator in returning the seat to the non-reclined position of Figure 2, for example, from the reclined
position of Fig. 8. There will typically be someone sitting in the seat 32 when the chair is being rotated from the reclined position back to the non-reclined position, and the weight of the user can make it somewhat difficult to rotate the seat. However, the compression springs 72A and 72B apply an upward pressure on the respective bolts 64A and 64B, thereby assisting the user in rotating the seat back from the reclined to the non-reclined position.

As Figure 7 illustrates, as the chair 32 reclines, the members 42A and 42B move in parallel with rear cushion 34 while the lower cushion 36 rotates upwardly and independently of the base frame members 44A and 44B. The lower cushion is supported by two support rods 73A and 73B (Fig. 3) that are mounted on the underside of the lower cushion. The support rods are removably mounted in a sleeve, and rotate within the sleeve as the chair reclines. The cushion 34 and the lower cushion 36 are held at a fixed angle relative to one another such that they rotate in unison. It should be noted that, as illustrated in Figure 5, the two cushions 34 and 36 can be adjusted to be closer or farther from one another simply by adjusting the bracket 38A and 38B. Similarly, the position of the upper cushion 34 can be adjusted relative to the structural members 42A and 42B by adjusting the position of the brackets 40A and 40B. The brackets are typically attached to the back of the seat by way of screws or bolts that can be secured by any means known in the art.

Figures 9-16 illustrate a second embodiment of the present invention. Fig. 9 is a perspective view of a second embodiment of a wheelchair according to the present invention, with the seat removed. Generally speaking, the parts of the wheelchair are numbered in a manner consistent with Figs. 2-8, with an additional 100 added to each reference numeral. The wheelchair has independently movable backposts 142a and b. The backposts are loaded with compression springs 172a and b (Fig. 10), which are held in place within the tubes with roll pins (not shown). Movable plastic sleeves 188a and b are mounted on the backposts 142a and b. The plastic sleeves are movable up and down on the respective backposts, such that as a plastic sleeve is moved downwardly, the respective compression spring compresses.

As in the embodiment of Figs. 2-8, the base frame includes cross braces 156a and 156b extending between upper and lower base frame members. The cross braces are fixedly but rotatably attached to the lower base frame members, and are attached to the upper base frame
members by rotating armatures that permit the cross braces to separate from the upper base frame as the chair is folded.

The locking mechanisms of the embodiments of Figs. 2-8 and Figs. 9-13 are very similar and will be explained with reference to both embodiments. Returning to Figure 2, the wheelchair is provided with handle bar squeeze mechanisms, 72A and 72B, which are connected to cables 74A and 74B, respectively, which are in turn connected to mechanical locks 76A and 76B. The squeeze handle system operates analogously to hand brakes on a bicycle. Mechanical locks 76A and 76B can be of the type known as "Mechlock," which are known in the art. When the user squeezes the hand squeeze unit 72A and 72B, the wires 74A, 74B are pulled and the mechanical locks 76A and 76B are released. The user can then move the backposts 42A and 42B backwards and forwards to put the chair in a reclined position, to return the chair to the normal position from a reclined position, or to hold the unit into the configuration of Figure 13 when the seat has been removed.

However, when the user has not squeezed the hand squeeze units 72A, 72B the backposts 42A and 42B are locked into place. Consequently, the user can sit in a particular position on the chair without fear that the chair will rotate forwardly or backwardly when not intended. The system further permits the operator to tilt the chair to the extent desired, and to tilt and lock the chair to any tilt position. Arrangements other than the mechanical lock and hand squeezed system illustrated in Figure 2 may be employed.

The mechanical lock is illustrated in greater detail in Fig. 12, which illustrates the second embodiment of the present invention. The lock 176a includes a movable housing 200a that is free to move along rod 202a when the user squeezes the respective squeeze lever 172a. Squeezing the squeeze lever 172a compresses compression spring 204a, which in turn releases the lock. As the user then pulls back on the backpost 142a while continuing to squeeze the squeeze lever 172a, the housing 200a of the lock is forced downwardly along the rod 202a. The seat rotates backwardly with the backpost 142a (assuming that the user reclines backpost 142b simultaneously). To lock the seat into position, the user releases the squeeze lever, which then causes the mechanical lock 172a to lock in place on the rod 202a.

Figure 13 illustrates how the seat is rotatably mounted onto the base frame of the wheelchair. Two cylindrical tubes 210a and b are attached to the underside of the seat. The
cylindrical tubes are removably mounted onto female receptacles on sleeves 212a, b. The
cylindrical tubes 210a and b are free to rotate within the sleeves 212a, b, such that the angle of
the seat can be adjusted back and forth. The receptacles on sleeves 212a, b are generally open,
such that the seat can be lifted off of the sleeves when the user pulls up on the seat.

The sleeves are themselves mounted on a pivoting bracket, which can be locked into
place or can be rotated 90 degrees. Fig. 15 illustrates one arrangement in which the sleeve 212b
is locked into a position for mounting the seat onto the base frame. Fig. 16 illustrates the same
sleeve 212b having been rotated 90 degrees for the purpose of accepting the backpost 142b. The
diameter of the backpost 142b is selected such that the backpost 142b can snap into the sleeve
212b in order to hold the backpost 142b into a folded position, and can be snapped out of the
sleeve 212b for normal use of the wheelchair. The sleeve 212b is locked into position by use of a
spring-loaded pin, as is conventional in the art.

Another inventive feature of the preferred embodiment of the present invention relates to
folding the frame into a compact configuration that is easy to store. Figure 10 illustrates the
frame itself after the chair has been removed. The chair is mounted onto the backposts 142a,b by
way of a hook/sleeve combination. In particular, referring to Fig. 18, the hook bracket 220b fits
onto the outer surface of a plastic sleeve 188b. The hook bracket is held in place by means of a
quick release handle 222b. To release the seat from engagement with the backpost 142b, the user
rotates the handle 142b in a clockwise direction until the handle no longer holds the hook in
place. An identical arrangement is provided on the opposing side of the seat, employing
backposts 142a, quick release handle 222a, and a sleeve 188a (not shown). The hook
bracket/quick release handle arrangement permits the chair to be removed from the wheelchair
frame so that the frame can be folded.

The frame is provided with a flexible handle strap 180 having ends that are attached to
the wheelchair frame. The handle 180 is typically made of a flexible non-stretch material such as
3/4 inch width nylon. As Figure 11 illustrates, the cross braces 156A and 156B are rotatably
attached to lower base frame members 154A and 154B respectively, which are mounted on
rotating brackets 182A and 182B, respectively. The members 156A and 156B are rotatably
connected to the horizontal portions of base frame members 144A and 144B respectively, by
means of rotating armatures 184A and 184B, respectively. As the user pulls up on the handle
180, the cross-members 156a,b lift up off the members 144A and 144B as the armatures 184A and 184B rotate upwardly. Similarly, the lower brackets 182A and 182B rotate to allow the cross braces 156A and 156B to rotate into a generally vertical configuration. As the user continues to pull on handle 180, the frame collapses horizontally as Figure 12 illustrates. To fold the wheelchair into an even more compact configuration, the user can further rotate the vertically extending members 142A and 142B into the configuration of Figure 13. The wheelchair is then in a highly compact configuration for storage or transport, as illustrated in Fig. 17, which relates in particular to the embodiment of Figs. 2-8 but generally to both embodiments described herein.

As for dimensions, those skilled in the art will recognize that chairs of the embodiment illustrated may be made in any of the variety of sizes for a variety of different users. For example, small chairs may be made for children, while much larger chairs may be made for adults. Consequently, the specific dimensions of any one embodiment will depend upon the size of the intended end user. Those skilled in the art will also recognize that the various structural components must have sufficient dimension and material strength characteristics so as to make the chair structurally sound. The specific dimensions and material strength characteristics of the wheelchair are not specifically an inventive feature of the present invention, and those skilled in the art will know how to employ structurally sound members to make a safe wheelchair.

The foregoing has described a presently preferred embodiment of the invention, as well as alternative embodiments. However, it should be understood that the scope of the invention is not limited to what is described in the Detailed Description. Numerous variations may be employed within the scope of the invention. For example, the back posts can be connected directly to the seat rather than to the base frame.

Considering additional variations on the invention, Figures 19-24 illustrate an alternative embodiment in which the rear of the seat slides relative to the back posts as the seat is reclined backwardly. This removes the need to use springs that are internal to the back posts. Referring to Fig. 19, a plastic back tilt sleeve 300 encompasses a portion of each respective back post. A back tilt “u” clamp 302 that is interconnected with seat back 304 is engaged about the tilt sleeve 300. When the seat is reclined, the bracket slides relative to the tilt sleeve 300. The tilt sleeve can be formed from PVC, or from another durable plastic or other durable and lightweight material.
Fig. 20 illustrates the arrangement in more detail. The “u” clamp has a roller 308 that rolls relative to the plastic sheath 300 as the seat is reclined. The “u” clamp also has an arm 306 that engages with a rotating back tilt arm 310. Arm 306 of the “u” clamp 302 includes a detent 311, while arm 310 includes a detent 312. The detent 312 is adapted to engage with detent 311 when arm 310 is rotated downwardly. A locking member 313, also referred to as a back tilt locking block, is slidably mounted on arm 306 to selectively lock the arm 310 into place, as in Fig. 20.

The rotating arm 310 rotates about a 10/32” by 5/8” BHCS member 314 that extends through arm 310 and into the adjoining portion of the “u” clamp 302. As seen in Fig. 22, the “u” clamp 302 is itself mounted to an L-shaped bracket 316, which is mounted to the back of the seat 304.

Fig. 23 illustrates a generally tubular mounting member 322 that is rotatably mounted onto a seat-supporting portion of the frame. The tubular member 322 extends from and is attached to the underside of seat bottom 324. Mounting member 322 engages with a compatibly-shaped receiving member 326, which is mounted on seat-supporting frame member 328. A locker arm 330 rotates to selectively maintain the tubular member 322 in the receiving member 326, as in Fig. 23. The seat can be removed from the seat-supporting frame when the locker arm 330 is rotated into an unlocked position, as in Fig. 24.

In accordance another embodiment that Figures 25-41 illustrate, a wheelchair has a tiltable seat 500. The seat includes a seat back 502 and a seat bottom 504. A base frame 506 includes right and left lower base frame tubes 508 and right and left upper base frame tubes 510. The bottom of the seat is supported by a tiltable seat supporting frame 512. The tiltable seat supporting frame 512 has right and left back posts 514 and right and left seat supporting tubes 516.

The tiltable seat supporting frame 512 is pivotally mounted onto the base frame 506. Referring to Fig. 33, a tilt tube support bracket 518 extends from the upper base frame tube to a pivot point 520 on the seat supporting tilt tube. A pin extends through the bracket 518 and the
tilt tube 516, such that the tilt tube 516 rotates about the pin as the seat reclines. Figure 34 illustrates the tilt tube having been rotated about the pivot pin into a reclined position.

As described in the previous embodiments, the back posts each having a handle with a release lever 522 mounted thereon. To recline the seat, the attendant 524 first squeezes the release levers (Fig. 26) to tighten respective release cables 526 (Fig. 28). The release cables 526 extend from the levers to mechanical locking mechanisms 528 (Figs. 27, 33 and 34) of the sort that are conventional in the art. When the cables are tightened, the mechanical locking mechanisms 528 are disengaged, and the seat is free to rotate into a reclined position, or from a reclined position to a non-reclined position, as desired. Each mechanical locking mechanism has an extendible and retractable arm 530 that extends when the mechanical locking mechanism is disengaged and the attendant is reclining the seat (Fig. 34). The arm retracts when the mechanical locking mechanism is disengaged and the attendant rotates the seat forward (Fig. 33). When the seat is in the desired position, the attendant releases the levers to again engage the mechanical locking mechanisms. The seat is then fixed into position. Figures 26 and 27 illustrate how an attendant puts the seat into a reclined position.

Considering the mechanical locking mechanism in more detail, and referring to Fig. 34, right and left releasable lock mechanisms are mounted on a respective upper base frame member 510 and extend to a respective seat supporting tube 516. In particular, the extendable arm 530 is mounted to the seat supporting tilt tube 516. Consequently, the arm 530 extends when the seat supporting tube 516 reclines, and retracts when the seat supporting tube 516 reclines. This particular embodiment of a locking mechanism serves to maintain the relative positions of the seat supporting tube and the upper base frame tube, and to interconnect the seat supporting structure with the base frame.

The seat back is releasably mounted onto the back posts and the seat bottom is releasably mounted onto the seat supporting tubes. The seat of the present embodiment has different mounting brackets than the seat illustrated in Fig. 18 in conjunction with another embodiment of the invention. Figures 40 and 41 illustrate the mounting brackets on the bottom 504 and rear 502 of the seat, respectively. The brackets are mounted onto seat mounting mechanisms such as illustrated in Fig. 34 with reference numeral 532. The attendant tightens the bracket against the
seat by rotating the screw-type handle of the mechanism. Figure 29 illustrates the seat back mounted onto a seat mounting bracket 532, with the handle having been rotated to secure the seat in place.

Figures 30 and 31 illustrate that releasable right and left locking bracket mechanisms 534 interconnect the right and left back posts 514 with right and left seat supporting tubes 516, respectively. Each locking bracket mechanism includes a spring biased back post release lever 536 that extends from its respective back post 514. The base of the lever is mounted within the post, as is a compression spring that biases the lever downwardly. The portion of the lever 536 that extends from the back post has a step, which serves as a locking surface. The post locking system also includes a release lever locking bracket 538 that is mounted on and extends from the seat supporting tilt tube 516. As Fig. 30 illustrates, the step of the release lever 536 abuts a surface of the release lever locking bracket 538, to lock the back post 514 into position relative to the seat supporting tilt tube 516. To unlock the back post 514 from the seat supporting tilt tube 516, the user lifts the release lever 536 to overcome the bias force of the compression spring, and rotates the back post 514 forward, as Fig. 38 illustrates. The back post 514 is mounted with a pin onto the seat supporting tilt tube 516, thereby allowing the back post 514 to rotate back and forth relative to the tube 516 when the locking bracket mechanism 534 is disengaged.

The frame 540 of this particular embodiment comprises the base frame 506 and the tiltable seat supporting frame 512. The frame is laterally collapsible and the backpost is foldable onto the seat supporting tube. The mechanisms for laterally collapsing and folding the backposts have already been described in detail above in connection with the first-described embodiment of the invention. To summarize, the frame 540 has an unfolded configuration in which the back posts are locked by the locking bracket mechanisms in a fixed relationship relative to the seat supporting tubes (Fig. 1). The frame 540 also has a folded configuration in which the backposts have been released from the locking bracket mechanisms and are folded forward onto the seat supporting frame (Fig. 39).

A collapsible cross-frame interconnects the right and left base frame members to make the wheelchair frame collapsible, in the manner previously described in conjunction with Fig. 14. The collapsible frame has at least one cross member extending from one of the lower base frame
members to the opposite upper base frame member. The cross member is pivotally mounted to the respective lower base frame and upper base frame members. The collapsible frame may also include first and second cross members, right and left upper cross-member mounting brackets hingedly mounted on respective right and left upper base frame tubes and right and left lower cross-member mounting brackets mounted on respective right and left lower base frame tubes. The first cross member extends from the mounting bracket on the right lower base frame member to the mounting bracket on the left upper base frame member. The second cross member extends from the mounting bracket on the left lower base frame member to the mounting bracket on the upper right base frame member.

The preferred embodiments of the wheelchair frames according to the present invention are free of welds. The weld-free frame technology is discussed in detail in co-pending U.S. Patent Application No. 09/191,422, filed on November 12, 1998 and incorporated by reference herein. The weld-free design generally results in a more durable, less costly to produce, and lighter weight design than designs found in the prior art.

Accordingly, the present invention is not limited precisely to the arrangements as shown in the drawings and as described in detail hereinabove.
VI. CLAIMS

What is claimed is:

1. A wheelchair having a tiltable seat comprising:

   a base frame comprising right and left lower base frame tubes and right and left upper
   base frame tubes;

   a seat comprising a seat bottom and a seat back;

   a tiltable seat supporting frame comprising right and left back posts and right and left seat
   supporting tubes, said tiltable seat supporting frame being pivotally mounted onto said base
   frame, said back posts each having a handle, said seat back being releasably mounted onto said
   back posts and said seat bottom being releasably mounted onto said seat supporting tubes;

   releasable right and left locking bracket mechanisms which interconnect said right and
   left back posts with said right and left seat supporting tubes, respectively;

   right and left releasable lock mechanisms, each having a retractable extension arm, each
   said lock mechanism extending from a respective upper base frame member to a respective seat
   supporting tube;

   said back post handle comprising a release handle and a release cable extending from said
   release handle to said releasable lock mechanism;

   said wheelchair comprising a frame comprising said base frame and said tiltable seat
   supporting frame, said frame being laterally collapsible and said backpost being foldable onto
   said seat supporting tube, said frame having an unfolded configuration in which said back posts
   are locked by said locking bracket mechanisms in a fixed relationship relative to said seat
   supporting tubes, and a folded configuration in which said backposts have been released from
   said locking bracket mechanisms and are folded forward onto said seat supporting frame; and

   a collapsible frame interconnecting said right and left base frame members, said
   collapsible frame comprising at least one cross member extending from one of said lower base
frame members to the other of said upper base frame members, said cross member being pivotally mounted to each of said lower base frame and upper base frame members.

2. A wheelchair as defined in claim 1, further comprising right and left tilt tube support brackets each extending between a respective upper base frame member and a tiltable chair supporting member, wherein each said bracket has pin that extends through an upper base frame member such that upper base frame member is adapted to pivot about said pin.

3. A wheelchair as defined in claim 1, wherein said collapsible frame comprises first and second cross members, right and left upper cross-member mounting brackets hingedly mounted on respective right and left upper base frame tubes and right and left lower cross-member mounting brackets mounted on respective right and left lower base frame tubes, said first cross member extending from said mounting bracket on said right lower base frame member to said mounting bracket on said left upper base frame member and said second cross member extending from said mounting bracket on said left lower base frame member to said mounting bracket on said upper right base frame member.

4. A wheelchair as defined in claim 1, wherein said wheelchair frame is free of welds.

5. A wheelchair having a tiltable seat comprising:

a base frame comprising right and left base frame members;

a seat comprising a seat bottom and a seat back;

a tiltable seat supporting frame comprising right and left back posts and right and left seat supporting members, said back posts each being interconnected with its respective seat supporting member, said tiltable seat supporting frame being pivotally mounted onto said base
frame, said back posts each having a handle, said seat back being mounted onto said back posts and said seat bottom being mounted onto said seat supporting tubes;

right and left expandable lock mechanisms, each said lock mechanism extending from a respective base frame member to a respective seat supporting member;

5 said wheelchair comprising a frame comprising said base frame and said tiltable seat supporting frame, said frame being laterally collapsible; and

a collapsible frame interconnecting said right and left base frame members.

6. A wheelchair as defined in claim 4, wherein said collapsible frame comprises at least one cross member extending from one of said lower base frame members to the other of said upper base frame members, said cross member being pivotally mounted to each of said lower base frame and upper base frame members.

7. A wheelchair having a tiltable seat comprising:

15 a base frame comprising right and left base frame members;

a seat comprising a seat bottom and a seat back;

a tiltable seat supporting frame comprising right and left back posts and right and left seat supporting members, said back posts each being releasably interconnected with its respective seat supporting member, said tiltable seat supporting frame being pivotally mounted onto said base frame, said back posts each having a handle, said seat back being mounted onto said back posts and said seat bottom being mounted onto said seat supporting tubes;

right and left expandable lock mechanisms, each said lock mechanism extending from a respective base frame member to a respective seat supporting member;
said wheelchair comprising a frame comprising said base frame and said tiltable seat supporting frame, said frame being laterally collapsible; and

said backposts being foldable onto said seat supporting tubes.

8. A wheelchair as defined in claim 7 wherein said wheelchair has an in-use configuration in which said back posts are locked in a fixed relationship relative to said seat supporting tubes, and a folded configuration in which said backposts are unlocked from said seat supporting tubes and are folded forward onto said seat supporting frame.
FIG. 9
FIG. 11