Nov. 2, 1965 J. D. THACKREY 3,215,446

STAIR-CLIMBING WHEEL CHAIR

Filed Aug. 9, 1963 3 Sheets-Sheet 1

Fig. 1

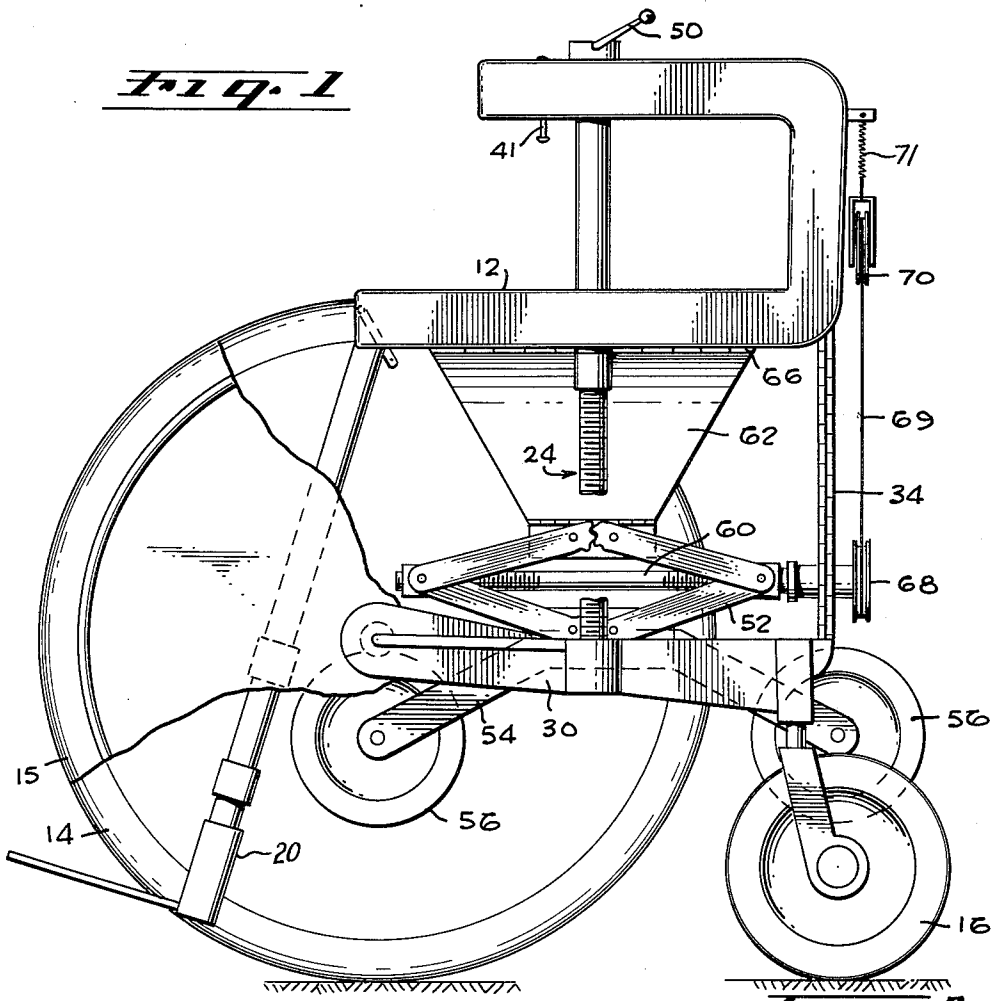


Fig. 1A

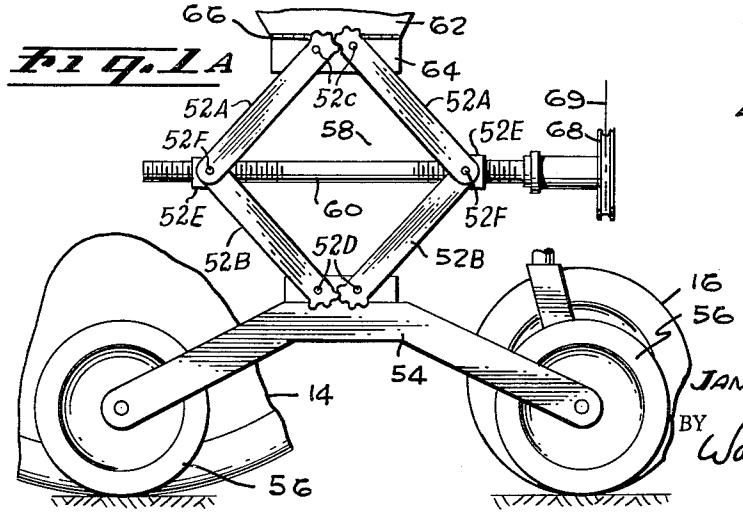
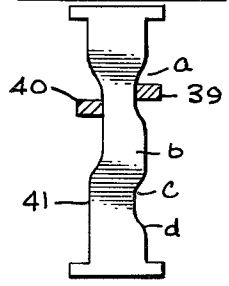


Fig. 5



INVENTOR.
JAMES D. THACKREY
BY Warren T. Jessup
ATTORNEY

Nov. 2, 1965 J. D. THACKREY 3,215,446

STAIR-CLIMBING WHEEL CHAIR

Filed Aug. 9, 1963 3 Sheets-Sheet 2

Fig. 2

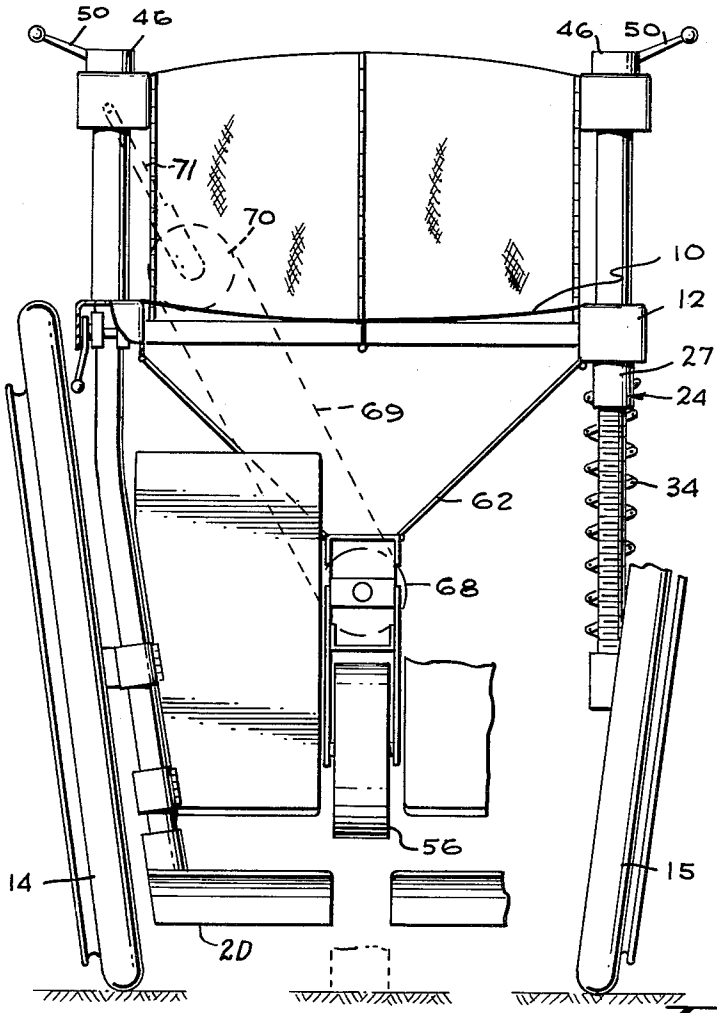


Fig. 4

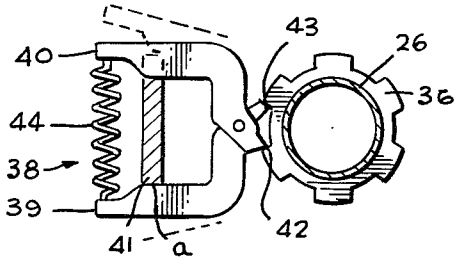
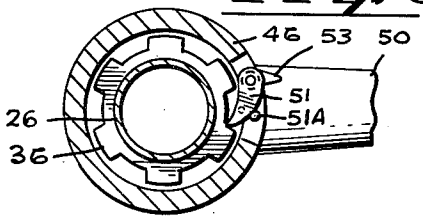


Fig. 6



INVENTOR.
JAMES D. THACKREY
BY
Warren T. Jessup
ATTORNEY

Nov. 2, 1965 J. D. THACKREY 3,215,446

STAIR-CLIMBING WHEEL CHAIR

Filed Aug. 9, 1963 3 Sheets-Sheet 3

Fig. 3

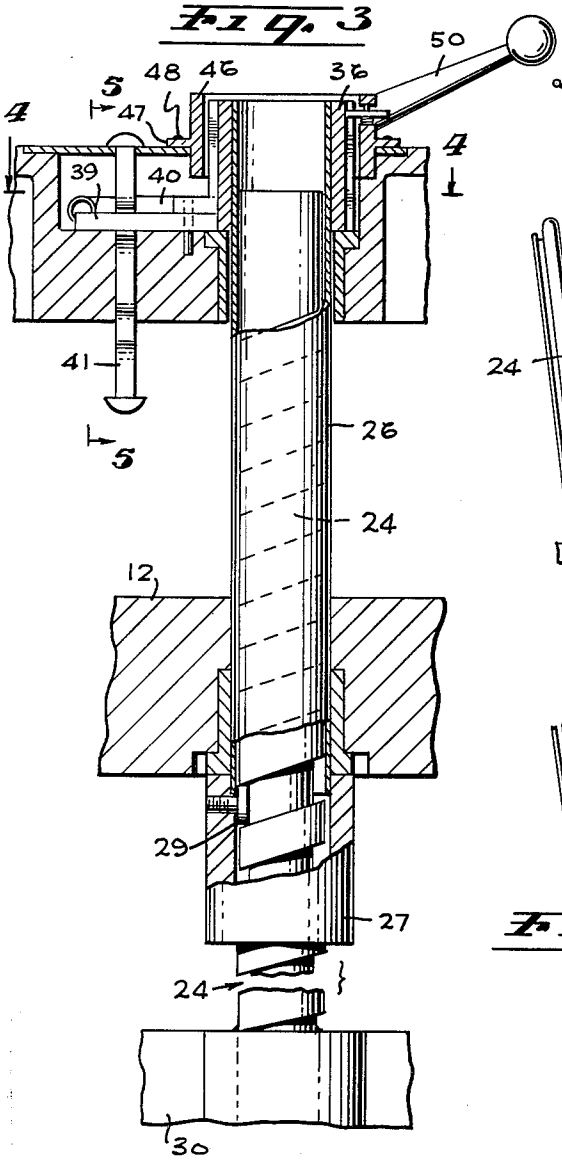


Fig. 7

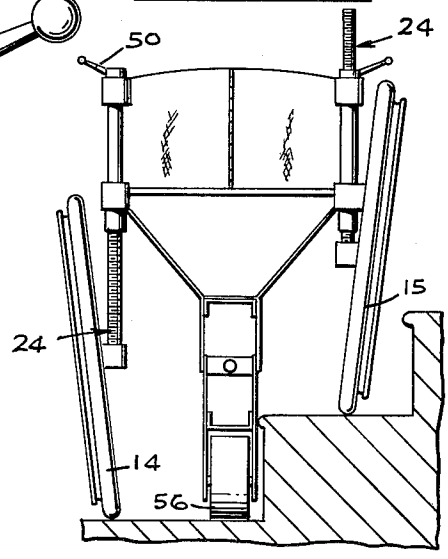


Fig. 8

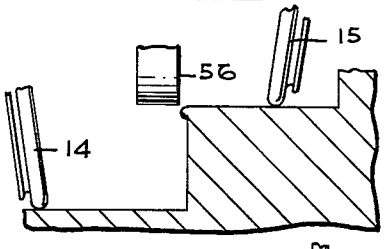


Fig. 9

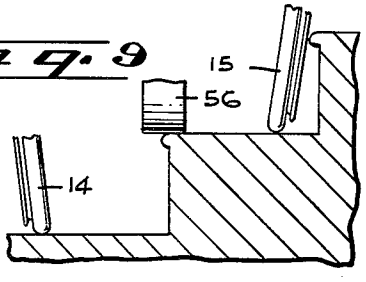


Fig. 10

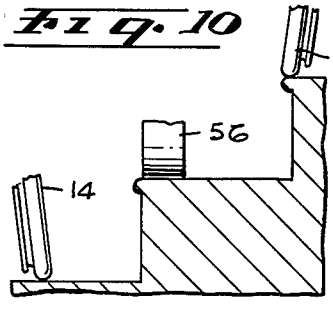
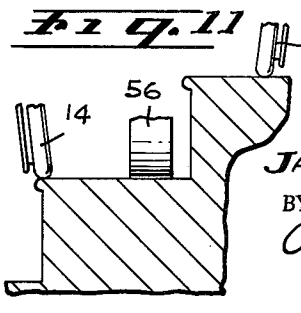


Fig. 11



INVENTOR.
JAMES D. THACKREY
BY
Warren T. Jessup
ATTORNEY

United States Patent Office 3,215,446 Patented Nov. 2, 1965

3,215,446

STAIR-CLIMBING WHEEL CHAIR

James D. Thackrey, 13852 Dall Lane, Santa Ana, Calif.

Filed Aug. 9, 1963, Ser. No. 301,026
6 Claims. (Cl. 280—5.28)

This invention relates in general to wheel chairs, and more particularly to a wheel chair adapted to be manipulated up a flight of stair treads, or over a curb, by an operator seated upon the chair.

A person confined to a wheel chair is also generally confined to floor and street level areas not set off by stairs, curbs, or similar sudden elevational changes. Ramps are required for even modest elevational changes.

The inability of such confined persons to propel themselves over abrupt changes in elevation is of extreme inconvenience to the confined one and his associates. Often an otherwise able-bodied person has lost the use of his legs. This type of person, when physically vigorous, will attempt to propel himself down, or even up over a small obstacle, and will attempt to do various things which a more infirm person might not be tempted to do. Such otherwise able-bodied person might be tempted to dangerous practices in his effort to climb or descend such obstacles as most porch steps. Accordingly, it is an object of this invention to provide a wheel chair structure which will enable the person confined therein to manipulate the chair up or down a reasonable flight of stairs or similar elevational discrepancies. It is a further object of this invention to enable provisions for folding to be readily combined with a basic structure.

In accordance with these and other objects which will become apparent hereinafter, a preferred form of the present invention is disclosed in the accompanying drawings wherein:

FIGURE 1 is a side elevation, with parts broken away for clarity of illustration, of a chair embodying the features of the present invention;

FIGURE 1A is a detail illustration of the power jack structure of FIGURE 1;

FIGURE 2 is a front view of the wheel chair of FIGURE 1 with parts broken away for clarity of illustration;

FIGURE 3 is a detail illustration of a wheel supporting jack screw;

FIGURE 4 is a descriptive illustration of a detent and pawl arrangement as if taken along the lines 4—4 of FIGURE 3;

FIGURE 5 is a detail illustration of the pawl control cam shown in FIGURE 4, taken as if viewed from position 5—5 of FIGURE 3;

FIGURE 6 is a descriptive illustration of a drive ratchet structure located on the top of the jack shaft as shown in FIGURE 3; and

FIGURES 7 through 11 are operating illustrations.

The drawings illustrate a preferred embodiment of the invention for the purpose of setting forth the concepts of the invention, and may be modified as needed to suit individual design.

Referring then to FIGURE 2, a seating portion of the chair is indicated by reference character **10**. The seating portion is defined by a C frame **12** as best seen in FIGURE 1. The back rest **13** is made of two rigid sheets joined by a vertical hinge in order to provide rigidity in the chair and yet maintain collapsibility.

As best seen in FIGURE 2, the seating portion is made mobile by a carriage system including two laterally opposed main support wheels **14** and **15**, together with rear caster wheels **16**. The large wheels **14** and **15** are illustrated in an inclined or toed-in condition in order to make the chair more adaptable to narrow sair treads, and preferably the wheels are of disk rather than wire construction because a disk wheel has a concave configuration

which will enable the wheel to nest better with the superstructure of the seating portion, when the wheel is in its maximum elevated position with respect to that seat.

Leg rests **20** and similar portions of the chair have been broken away to reveal the location of first and second laterally opposed jack screws **24**, each carried within a tube **26**, which tubes are journaled on the C frame **12**. At the bottom end of each tube **26**, as best shown in FIGURE 3, is a nut **27** which is journaled in the frame **12** and secured to the tube **26** for rotation therewith. Each jack screw **24** extends upwardly through the tube **26**, and is engaged by nut **27**. In the preferred embodiment shown in FIGURE 3, nut **27** consists of a smooth bore cylindrical sleeve having a cam follower **29** on its inner diameter.

A beam **30** is carried on the end of the jack screw **24**. See FIGURE 1. The wheel **14** and one of the wheels **16** are carried at one side of the chair by one such beam **30**, and the wheel **15** and the other wheel **16** are carried by the opposite beam **30**. Thus, the relative elevational position of the wheels may be individually controlled on each side of the chair by elevational movement of the associated jack screw **24**. A lazy tongs anti-sway arrangement **34** is carried between the beam **30** and the frame **12** in order to prevent rotational movement of the beam **30** and jack screw **24** about the jack screw axis. Being thus prevented from rotating on its axis, the jack screw **24** may only extend or retract. As best seen in FIGURE 3, it is necessary that the tube **26** rotate in order to permit vertical shifting of jack screw **24**, beam **30**, and wheels **14**, **15**, and **16**.

For the purposes of this invention, the beam **30** with the wheels carried thereby, must be free to change elevational relationships with respect to the seating portion **10** without material interference, or alternatively to be locked into a selective relative elevational position, according to the will of the operator. Refer to FIGURE 4. In order to accomplish this intended result, the top of tube **26** is provided with a splined member **36**. This member **36** provides a plurality of alternate ridge and recess areas as shown in the FIGURE 4. A pawl and cam system **38** is then provided to control the direction in which the tube **26** is free to rotate, if at all. Hence, by reason of the interfit of the cam follower wheel **29** in the spiral groove of jack screw **24**, control of rotation of tubes **26** will control the elevational movement of the beam **30**. The system **38** includes pawls **39** and **40**, and a cam rod **41** to determine the relative pivotal position of these pawls. Note that pawl **40** has a catch end **42** and pawl **39** has a catch end **43** adapted to catch into a recess area of top part **36** and abut a splined area. Thus, for example, if the catch **43** is positioned within a recess, but the catch **42** is rotated to the position indicated in dotted outline, then the tube **26** is confined to clockwise rotation. If the catch ends are reversed in situation, then the tube **26** can only rotate in a counterclockwise direction. Hence, when both pawl ends are engaged as illustrated in full lines of FIGURE 4, the spline top **36** of the tube **26** is locked against all movement and hence it is not possible to elevate or lower the beam **30** with respect to the seat portion **10**. A spring **44** tends to move the pawls into the lock position.

Note that the cam **41** is elongated and has a plurality of cam indents formed in the shank thereof. See FIGURE 5 of the drawing. These indents determine the relative pivotal position of the pawls **39** and **40**. In the closed locking position shown in full outline in FIGURE 4, the pawls are moved to their closest relative position, and hence are positioned within opposed recesses shown at the vertical section *a* in FIGURE 5. The cam **41** is shiftable vertically by the operator to select the particular desired rotative position. If the cam **41** is elevated to the next operative position, that is the position indicated by section

marked *b* in FIGURE 5, only pawl **40** will be in a recess notch, and pawl **39** will be pivoted to the dotted outline position shown in FIGURE 4. Hence, the tube **26** will be released to rotate counterclockwise, but will not rotate clockwise. If cam **41** is moved to the section *c*, just the opposite condition prevails, and if elevated completely to the section marked *d* of FIGURE 5, the pawls will be separated the maximum amount, and hence neither of the catches **42** or **43** will be engaged into the splined top **36**, and the tube **26** will be free to move without restraint in either direction. This will then permit the wheel carrying beam **30** to elevate or lower without restraint.

On occasion it is desired that the operator be permitted to drive the beam **30** in an elevational direction by mechanical advantage force means, whereas in most instances the operator will simply grasp the wheel **14** or **15** being elevated and lift it manually. In order to provide the force drive device, a cap **46** is provided over the end of the splined top **36** shown best in FIGURE 3. The cap is provided with a central opening in order that jack screw **24** may extend up through the cap as shown in FIGURE 7 for example. The cap is provided with a flange **47** and is held to the frame **12** by means of pins **48**. The flange is provided with arcuate slots for the pins **48** in order that the cap **46** may be pivoted back and forth. A handle **50** is secured to the cap and enables a drive force to be applied to the cap **46**. Refer to FIGURE 6 of the drawing. A pawl **51** is provided in the cap to engage the splines of the member **36**, and exert a driving force from the handle **50** to the tube **26**. A male detent **51A** is provided with a recessed detent in the pawl **51** to enable the pawl **51** to be moved by contact of a thumb tab **53**, into position where the detents are engaged and hence lock the pawl out of operative position.

FIGURES 1 and 1A jointly illustrate the action of a jack leverage system **58** which carries a beam **54** on which wheels **56** are journaled. This jack leverage system **58** is a substantially conventional mechanical advantage device having eight link members **52A** and **52B**, a screw **60** and two link spreader channels **64**.

Link members **52A** are pivotally attached to channels **64** by means of pivots **52C**, and members **52B** are pivotally attached to beam **54** by pivots **52D**.

Two internally threaded collars **52E** are threaded upon screw **60**, and the four ends of levers **52A** and **52B** are secured thereto, as shown, by pivots **52F**.

The leverage system **58** is carried centrally of the chair between the jack screws **24** by means of two sheet arms **62**. Arms **62** are attached to C frame **12** and link spreader channels **64** by hinges **66**. Hence, the arms **62** may collapse with the chair without affecting the attachment of the leverage system **58**.

A sprocket **68** carried at the end of screw **60** is rotatably driven by means of a chain **69** which is carried by an idler wheel **70** located behind the seating portion as best shown in FIGURE 1 of the drawings. Idler wheel **70** is mounted by a spring **71** in order that chain may move with the travel of the sprocket **68**, and also keep the chain taut when the chair is changed from a folded to a service condition and vice versa. From this structure, it will be seen that the operator may operate the chain **69** by reaching behind the chair. Thus, the operator is able to elevate or lower the wheels **56** and upon contact of the wheels **56** with a support surface the entire chair may be elevated by this powerful elevator jack system.

A structure has thus been described, which enables the series of operational functions shown in the FIGURES 7 through 11. This series of illustrations will show the maneuver up a stair tread, and the reverse movement will be understood from this illustration.

Two procedures which the operator would follow are first described. First, as the seat is elevated using the leverage system **58** and wheels **56**, the operator will normally keep the wheel **14** or **15** or both in contact with the supporting surface to improve balance and control of the wheel chair. Secondly, the lateral movement necessary to progress between positions is accomplished by rolling the chair forward and back at a slight angle to the stair riser. For this purpose, wheels **14** and **15** are always used whether they are bearing weight or not. When only one wheel can be used, the operator must allow for the curvature of the wheel chair's path caused by the offset traction force.

The chair is caused to approach the first tread of the stair as close as possible, whereupon the operator operates the leverage system **58** by manipulating jack chain **69** to lower the wheels **56** and thus shift support from the coaction of wheels **14** and **15** to a coaction of the wheels **56**, and for example, wheel **14**. Then, the operator places the cam **41** into position to allow the wheel **15** to be elevated without restraint, whereupon the operator lifts the wheel by grasping it and pulling upwardly. When the wheel is lifted above the elevation of the first stair tread, the chair is then moved until the wheel **15** will drop down upon the first tread. Thereupon the cam **41** is moved to lock the tube **26** against further rotation and the chair is now provided in such condition that it will be able to support the seat portion upon the wheels **14** and **15**, but on two different elevational surfaces. See FIGURE 7.

Thereafter, the operator, by manipulating the chain **69**, causes the wheels **56** to elevate to a position slightly higher than the elevation of the first stair tread. See FIGURE 8 of the drawing.

Thereafter, the wheel chair is manipulated to a position wherein the wheels **56** are over the first stair tread, and thereupon the wheels **56** are driven downwardly by again manipulating chain **69**, to contact the stair tread. The wheels are at this time in the position shown in FIGURE 9. For steps with a tread as narrow as that shown in the figures, wheel **15** must now be raised. At this time, the cam **41** associated with wheel **15** is moved to release the detent holding the screw and the wheel **15** is lifted to the second stair tread, as shown in FIGURE 10, whereas the wheel **14** remains on the original elevation, and the wheels **56** are supported on the first stair tread. See FIGURE 10. When this condition is achieved, the wheel **14** is released and elevated to the height of the first stair tread and the chair is manpulated on the wheels **56** and the wheel **15**, to the position shown in FIGURE 11, whereupon the chair has now achieved a support position upon two treads above the original support surface.

During these movements, the operator may sit in the normal position, or he may obtain greater assurance against unbalance of the chair on its supporting wheels by leaning sidewise, thereby centering the weight which must be supported on the wheels which provide the support.

The process will now be understood, and may be repeated in like manner for the number of steps to be traversed.

In the foregoing description the chair was brought to the step and one wheel elevated. This requires the central supporting jack mechanism to have an excursion limit relatively near to the seat of the chair. Such device normally does not have a great range of useful leverage. For the purpose of this invention it should have a range exceeding the normal stair step height, and an excursion limit of approximately one inch lower than a normal main wheel position.

Another mode of operation employing essentially the same structure is to employ a central jack leverage system having an excursion limitation farther from the seat portion of the chair. Then the seat portion is first elevated a distance corresponding to slightly more than the riser height. As the chair is brought to the step, it rests on six wheels. Thereafter one of the running wheel carriages is elevated to a position on the first step, and then the central wheel mechanism is elevated to also approximately that same height in order to obtain a position upon the step. See FIGURE 9. The operational sequence remains unchanged, but the occupant's weight is lifted before FIG. 7

or in FIG. 11, rather than in FIGS. 9, 10, or 11, as was originally described.

This mode of operation and slight structural change is within the description given above.

While the instant invention has been shown and described herein in what is conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention which is therefore not to be limited to the details disclosed herein but is to be afforded the full scope of the claims.

I claim:

1. A wheel chair, comprising:

a seat portion;

first and second opposed and laterally positioned carriage system means, each said carriage system means being a wheel truck unit;

elevator means connecting each carriage system means to an adjacent side of said seat portion for causing the seat portion to move elevationally with respect to said carriage system means, or the seat portion to remain stationary and the carriage system means to move elevationally relative to the carriage system means, and means for locking said carriage system means in any position selected; and

separate elevating means between said first and second carriage system means operable to support and/or elevate said seat portion independently of any action of said systems, or in conjunction with either or both.

2. A wheel chair, comprising:

a seat portion;

first and second opposed and laterally positioned carriage system means, each said carriage system means being a wheel truck unit;

elevator means connecting each carriage system means to an adjacent side of said seat portion for causing the seat portion to move elevationally with respect to said carriage system means, or the seat portion to remain stationary and the carriage system means to move elevationally relative to the carriage system means, and means for locking said carriage system means in any position selected; and

elevating means separate from said system means in the form of a carriage base jack system located under the seating portion between the said first and second carriage system means; and having power means operable under the control of a person seated in the seat portion to move the jack system vertically between a first station position near the seat portion and a second station position a distance farther from the seat portion, said elevating means thereby adapted to exert an elevating force upon contact with a support surface to give stability to the seating portion by operating in conjunction with either one of the carriage systems alone or independently of either carriage system.

3. In the wheel chair defined in claim **2**, said elevating means having a tread width such that reasonable stability may be obtained by support upon the elevational means alone independent of any other outrigger support means.

4. A wheel chair, comprising:

a seat portion;

first and second opposed and laterally positioned beams each having a large support wheel and a small caster wheel in a forward and rearward relative position, a vertically extending screw carried centrally of the beam;

for each such screw there is provided a nut journaled on the seat portion and having a cam follower engaging with said screw such that the nut may be allowed to rotate freely for elevational positioning of the screw and the beams carried thereby, or the nut may be locked against rotation for maintaining the beam and wheels in a selected elevational position relative to the seat portion, whereby both beams may remain elevationally stationary and the seat portion elevated, or the seat portion may remain stationary and either one or both of said beams may move vertically; and

separate elevating means operable to support and/or elevate said seat portion independently of any action of said beams or in conjunction with either or both.

5. A wheel chair, comprising:

a seat portion;

first and second opposed and laterally opposed positioned beams each having a large support wheel and a small caster wheel in a forward and rearward relative position, a vertically extending screw carried centrally of the beam;

for each such screw there is provided a nut journaled on the seat portion and having a cam follower engaging with said screw such that the nut may be allowed to rotate freely for elevational positioning of the screw and the beams carried thereby, or the nut may be locked against rotation for maintaining the beam and wheels in a selected elevational position relative to the seat portion, whereby both beams with the wheels carried thereby may remain elevationally stationary and the seat portion elevated, or the seat portion may remain stationary and either one or both of said beams may move vertically; and

elevating means in the form of a carriage base jack system located under the seating portion between the said first and second beams; and

having power means operable under the control of a person seated in the seat portion to move the jack system vertically between a first station position near the seat portion and a second station position a distance farther from the seat portion, said elevating means thereby adapted to exert an elevating force upon contact with a support surface to give stability to the seating portion by operating in conjunction with either one of the beams alone or independently of either beam.

6. A stair climbing wheel chair, comprising:

a seating portion;

a first and second support carriage system, each said system having a main support wheel and a caster wheel, said systems related to provide two laterally opposed main support wheels and two caster wheels;

mounting means supporting said seating portion upon said carriage wheels:

first and second laterally opposed jack screws, each carried by said seating portion and having one of said support carriage systems carried at the end thereof; means adapting said jack screws to function under the control of an operator to:

elevate said wheel carried thereby freely by externally applied force between an extreme lower and top position and to lock in desired locations therebetween,

mechanical advantage force means to elevate said shafts between said lower and top positions and to lock in any desired location therebetween; and

lifting wheel means carried by said seating portion located between said support wheels, and elevator jack means operable by a person seated in said seating portion to elevate said seating portion.

References Cited by the Examiner

UNITED STATES PATENTS

468,022	2/92	Bray	280—5.28
3,127,188	3/64	Greub	280—5.22
3,169,596	2/65	Wright	180—7

BENJAMIN HERSH, *Primary Examiner.*

LEO FRIAGLIA, *Examiner.*