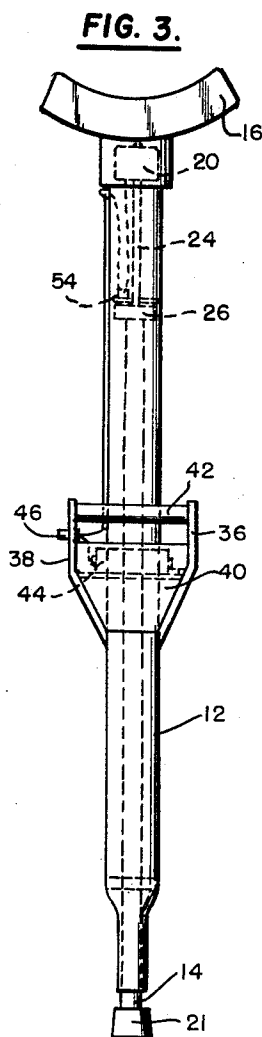
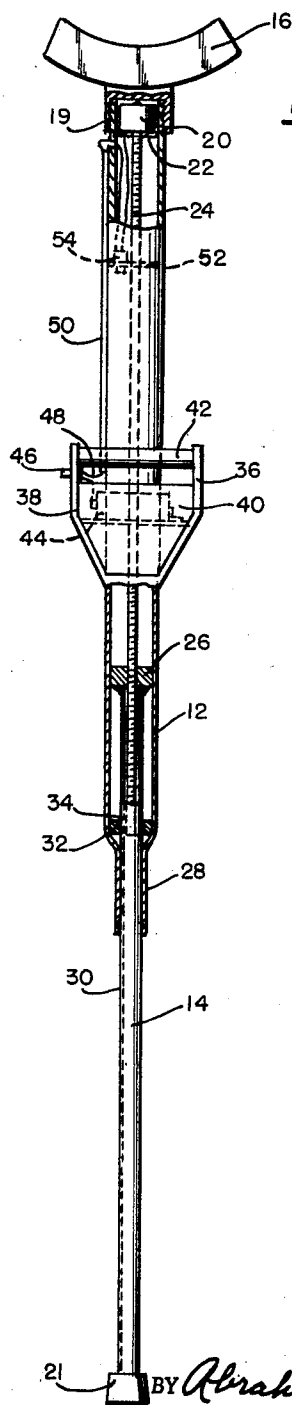
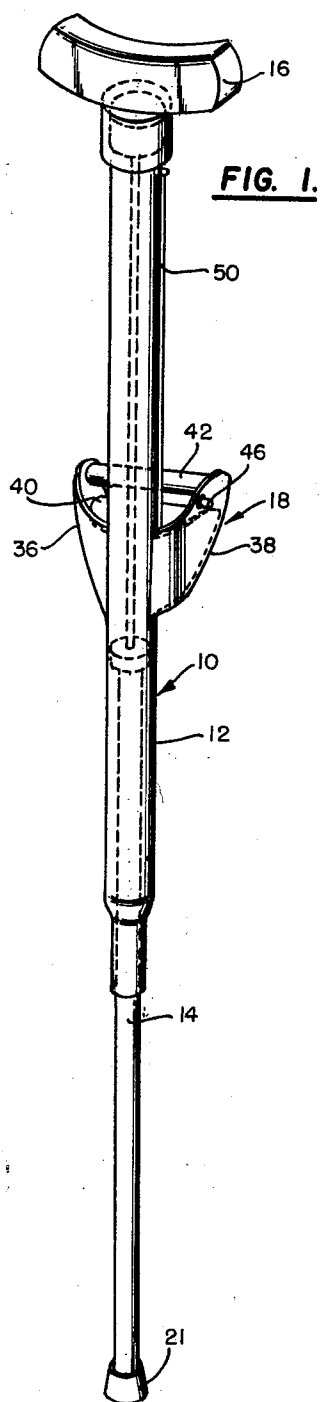


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G. R. FARNHAM  
POWER ACTUATED CRUTCH  
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1

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## POWER ACTUATED CRUTCH

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This invention relates to a power actuated, variable length crutch which may be extended or shortened under positive, electro-mechanical power to enable a handicapped person to use one or a pair of such crutches as power assist means in raising and lowering himself between generally reclining and erect positions.

More particularly, this invention contemplates a crutch structure intended for use by invalids or handicapped persons desiring or requiring a form of mechanical assist for enabling them to controllably raise and lower themselves to and from generally reclining and erect positions, which crutch structure is still capable of performing in the manner of a normal crutch to assist the user in ordinary maneuvering.

The crutch of this invention generally comprises an elongated body assembly including at least a pair of telescoping body sections, an arm pit rest and hand hold means secured to the uppermost body section, a rotatable screw jack means interconnecting the body sections and adapted to cause them to move in telescoping relationship when the jack is actuated, and an electrical motor and battery power supply for the motor, both of the latter being contained within the crutch structure and being adapted to reversibly operate the screw jack means of the crutch under the control of the user. The controls for the crutch unit are contemplated as being placed as conveniently as possible upon the crutch, such as with the handhold assembly, whereby a user of the crutch may control the extension or contraction thereof by fingertip manipulations.

While the inventor is aware of the existence of various hydraulic stilt affairs of the type shown in U.S. Patent No. 2,351,145 issued to M. L. Pearson, it is clear that such stilts are intended to be used by healthy, agile persons experienced in handling such apparatus and not by invalids or handicapped persons who cannot stand upon such stilts, much less balance upon them and simultaneously manipulate the pump-like hydraulic jack systems used to actuate the stilts while the operator is standing and balancing upon them. The present invention is a crutch, not a stilt, and is intended to furnish infirm, handicapped people with a mechanical power assist means for raising themselves, and means for allowing themselves to be smoothly lowered at a controllable rate.

Accordingly, it is an object of this invention to provide a variable length, power actuated crutch that may be extended or contracted in length by a self-contained electro-mechanical system under the control of an invalid or handicapped person.

It is another object of this invention to provide, in a variable length crutch, a screw jack system operated by a battery supplied, reversible electrical motor contained within the crutch assembly, and manual fingertip means for controlling the operation of said motor and jack whereby the crutch may be varied in length under positive, electromechanical power to enable an invalid or handicapped person to controllably raise or lower himself.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

FIG. 1 is a perspective elevational view of a crutch embodiment of this invention in extended configuration;

2

FIG. 2 is a partial cutaway, front elevation view of the crutch of this invention showing the electrical motor unit and screw jack arrangement; and

FIG. 3 is a front elevational view of the crutch shown in FIGS. 1 and 2 in collapsed or fully shortened configuration.

Considering now in detail the preferred embodiment of the present invention which is shown in the drawings and looking initially at FIG. 1, a variable length crutch is shown comprising an elongated body 10 including upper and lower tubular telescoping body sections 12 and 14, respectively. Secured to the body section 12 is an armpit rest 16 and a hand hold assembly 18. The armpit rest 16 may be attached to the upper extremity of the upper body section 12 as by a threaded connection 19 seen in FIG. 2. A resilient ground engaging foot element 21 may be provided at the lower extremity of lower body section 14.

Disposed within the upper body section 12 is a reversible electrical motor means 20 best seen in FIG. 2. The electrical motor 20 may be supported upon a suitable internal fixture 22 within the body section 12 and is connected to a threaded shaft 24 constituting one part of a screw jack assembly. The threaded shaft 24 extends longitudinally downward within the body sections 12 and 14 and threadably engages a cooperating nut element 26 secured to the upper extremity of lower body section 14. The nut element 26 constitutes the other part of the screw jack assembly contained within the crutch assembly of this invention.

The lower crutch body section 14 fits in longitudinally slidable relationship within the lower portion 28 of upper body section 12. The lower section 14 is further provided with an antirotation groove or notch 30 which cooperates with a projection 34 of an antirotation fitting 32 secured within body section 12 to prevent relative relation between the body sections 12 and 14.

It will thus be readily apparent that actuation of the screw jack shaft 24 by means of electrical motor 20 will cause the lower body section 14 to telescope into or out of the upper body section 12 by reason of the engagement of shaft 24 with nut means 26, the direction of telescoping being dependent upon the direction of rotation of shaft 24. The electrical motor which has been used by the present inventor for the power actuated crutch is that which is furnished by the Black and Decker Manufacturing Company of Towson, Maryland, the motor being housed in a physically cylindrically-formed package which is approximately  $3\frac{3}{16}$ " long and has an outer diameter of approximately  $1\frac{3}{4}$ ", and, combined with a small battery the motor has sufficient lifting capacity for the present use. It is to be understood that while a simple threaded nut 26 has been illustrated as a component of the screw jack assembly within the present crutch structure, any suitable means known to the art involving screw jacks may be used in this connection including well-known ball nut assemblies cooperating with a helically grooved shaft. Likewise, other configurations of rotatably actuated screw jacks may be used in the crutch of this invention in place of the simple threaded shaft and fixed nut means illustrated without departing from the concept and scope of this invention.

It will be obvious to one skilled in the art that the motor and jack assembly 20, 24, 26 will be of sufficient capacity to raise a design load. This can be accomplished with a relatively small power package incorporating modern electro-mechanical actuator techniques including the extensive use of friction minimizing elements such as ball-nut assemblies just mentioned, and suitable gearing for providing necessary torque for extending and shortening the crutch. Such small size, electro mechanical screw shaft actuators are typical in the

3

aircraft art, for example, as shown in Patent No. 2,283,476 to Warbel and Patent No. 2,307,317 to Konig. It is to be understood that the simple motor, shaft and nut 20, 24 and 26 is exemplary only and not intended to suggest that this is the only type of jack assembly contemplated within the scope of this invention which is essentially a power operated, variable length crutch.

The hand hold assembly 18 includes a pair of side flanges 36, 38 secured to the body section 12. A cover plate 40 encloses a space between the flanges 36, 38 and a cross bar 42 serves as a hand hold means for a crutch user. Disposed within the space between the flanges 36, 38 is a suitable battery means 44 which serves as an electrical power supply for the motor 20.

A manual, fingertip motor control switch means 46 is provided adjacent the cross bar 42 on one of the flanges 38 of the hand hold assembly. Suitable wiring 48 connects the battery 44, the control switch 46, and the motor 20. A conduit 50 may be provided for enclosing the wiring along the exterior of the body section 12, although any suitable means may be used as guide and securing means for the wiring between the switch 46 and the motor 20.

A suitable upper motion limit or stop means 52, as seen in FIG. 2, is provided within upper body section 12 and serves to prevent movement of the nut 26 and lower body section 14 past this point. A suitable limit switch 54 in FIG. 2 is also provided at this point to automatically cut off energization of electrical motor 20 when the upper limit of travel of nut 26 has been reached. The antirotation fitting 32 may function as a lower limit stop for nut element 26 and lower body section 14. A suitable limit switch (not shown) similar to limit switch 54 may be provided also at this lower point if desired.

In operation, manual fingertip manipulation of the control switch 46 controls energization of motor 20 which in turn actuates the screw jack shaft 24 in either desired direction to cause the lower section 14 to telescope inwardly or outwardly with respect to upper section 12. When motor 20 is not operating, the relative positions of section 12 and 14 remain fixed, since the relationship of the threads on shaft 24 and nut 26 are such that axial forces acting on body section 14 will not cause rotation of shaft 24; that is, the motion of the screw jack is not "reversible" in the sense that axial forces may be transferred into rotary motion.

Thus, by means of the crutch of this invention, used in pairs, or possibly even singly, a handicapped person desiring or requiring the normal use of a crutch, also has at his disposal a completely self-contained power assist unit which he may use to raise and lower himself between relatively reclined and erect positions. While a battery means 44 has been shown within the crutch structure it is possible that a suitable electrical outlet means (not shown) could be provided upon the crutch body, along with suitable circuitry, whereby an external power supply could be utilized to furnish electrical energy for the motor 20 of the crutch.

Having thus defined the invention, what is claimed is as follows:

1. A variable length crutch for handicapped persons comprising an elongated body assembly having a pair of tubular load-bearing telescoping sections, an armpit rest disposed above said telescoping sections and supported thereby, hand hold means attached to one of said telescoping sections and located below said armpit rest, internal screw jack means connected between said telescoping sections for varying the length of said body assembly by causing said sections to telescope relative to each other, electrical motive means carried by said crutch for actuating said screw jack means, and means to control the electrical motive means.

2. A crutch as recited in claim 1 including a battery

4

power supply carried by said crutch supplying electrical energy to said electric motive means.

3. A crutch as recited in claim 1 wherein said control means are manual.

4. A variable length crutch for handicapped persons comprising an elongated, tubular body means including a pair of body sections axially slidable relative to each other; an arm pit rest and a hand hold assembly secured to one of said body sections, a screw jack means disposed within said body means, one end of said screw jack means being secured to one of said body sections, the other end of said screw jack means being secured to the other of said body sections whereby said body sections may be made to slide axially relative to each other when said screw jack means is actuated to thereby vary the overall length of said body means; reversible electrical motive means disposed within said body means for actuating said screw jack in either direction; battery means for energizing said electrical motive means; and manual control means carried by said body means whereby the energization and direction of operation of said electrical motive means may be manually controlled by a crutch user desiring to vary the length of said crutch, said body sections being otherwise fixed against sliding relative to each other when said screw jack is not being actuated.

5. A variable length crutch for handicapped persons comprising an elongated body means including telescoped upper and lower body sections, said body sections being longitudinally slidable with respect to each other, an arm pit rest and a hand hold means carried by the uppermost one of said body sections; a screw jack assembly for causing said body sections to telescope inwardly or outwardly relative to one another when actuated for varying the length of said crutch, said screw jack assembly being carried internally within said crutch and comprising a threaded shaft extending longitudinally along the axis of said crutch, said shaft being rotatably mounted to the uppermost one of said body sections of said crutch but being fixed against axial displacement relative thereto, and cooperating nut means threadably engaging said shaft, said nut means being secured to the lowermost one of said body sections and being fixed against movement relative thereto whereby when said shaft is rotated within said nut said body sections are caused to longitudinally slide relative to one another; and electrical motive means carried by said crutch adapted to rotate said threaded shaft to actuate said screw jack for varying the length of said crutch.

6. A variable length crutch for handicapped persons comprising an elongated body means including telescoped upper and lower body sections, said body sections being longitudinally slidable with respect to each other, an arm pit rest and a hand hold means carried by the uppermost one of said body sections; a screw jack assembly for causing said body sections to telescope inwardly or outwardly relative to one another when actuated for varying the length of said crutch, said screw jack assembly being carried internally within said crutch and comprising a threaded shaft extending longitudinally along the axis of said crutch, said shaft being rotatably mounted to the uppermost one of said body sections of said crutch but being fixed against axial displacement relative thereto, and cooperating nut means threadably engaging said shaft, said nut means being secured to the lowermost one of said body sections and being fixed against movement relative thereto whereby when said shaft is rotated within said nut said body sections are caused to longitudinally slide relative to one another; electrical motive means carried by said crutch adapted to rotate said threaded shaft to actuate said screw jack for varying the length of said crutch; and a battery power supply means carried by said crutch for supplying electrical energy to said electrical motive means.

7. The crutch of claim 6 wherein said electrical motor means comprises a reversible electrical motor, and where-

5

in said motor is directly connected to said threaded shaft of said screw jack assembly.

8. A variable length crutch for handicapped persons comprising an elongated body means including telescoped upper and lower body sections, said body sections being longitudinally slidable with respect to each other, an arm pit rest and a hand hold means carried by the uppermost one of said body sections; and screw jack assembly for causing said body sections to telescope inwardly or outwardly relative to one another when actuated for varying the length of said crutch; said screw jack assembly being carried internally within said crutch and comprising a threaded shaft extending longitudinally along the axis of said crutch, said shaft being rotatably mounted to the uppermost one of said body sections of said crutch but being fixed against axial displacement relative thereto, and co-operating nut means threadably engaging said shaft, said nut means being secured to the lowermost one of said body sections and being fixed against movement relative thereto whereby when said shaft is rotated within said nut said body sections are caused to telescope inwardly or outwardly relative to one another; electrical motive means carried by said crutch adapted to rotate said threaded shaft to actuate said screw jack for varying the length of

6

said crutch; a battery power supply means carried by said crutch for supplying electrical energy to said electrical motive means; and manual control means for regulating the energization and direction of operation of said electrical motive means, said manual control means being disposed adjacent said hand hold means and being adapted for fingertip operation whereby a crutch user desiring to vary the length of said crutch body means may regulate the operation of said electrical motive means by fingertip manipulation, and whereby said crutch may be used by a handicapped person as a power assist in raising and lowering himself between generally reclined and erect positions.

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