APPARATUS FOR CONTROLLING THE ATTITUDE OF A KNEE JOINT DURING SURGERY

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References Cited

UNITED STATES PATENTS

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3,612,509 10/1971 Boston.................. 269/328
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2,764,459 9/1956 McDonald................ 269/325

ABSTRACT

Apparatus for controlling the attitude of a knee joint includes a housing secured to the center section of an operating table; the housing supports the upper portion of a leg being operated on. An elongated support for the lower portion of the leg is pivotally mounted on the housing. Reversible drive means pivot the support through a vertical plane to flex and extend the knee joint. First control means operate the reversible drive means and second control means deactivate the reversible drive means at predetermined limit positions.

6 Claims, 4 Drawing Figures
APPROPRIAT AN ATTITUDE OF A KNEE JOINT DURING SURGERY

BACKGROUND OF THE INVENTION

This invention relates to apparatus for positioning selected portions of the body of a patient during surgery to expedite a contemplated surgical procedure. More particularly, this invention relates to apparatus for controlling the flexion and extension of a knee joint during surgery.

During the course of surgery on the knee joint, particularly in the case of orthopedic and rheumatological procedures, it is often necessary for the operating surgeon to flex or extend the joint to several attitudes. Heretofore, such change of position has been accomplished manually by the surgeon and/or his assistants. Manual manipulation, although ultimately workable, requires the surgeon either to put down his implements to use his own hands or to rely upon inexact verbal commands to his assistants. Accordingly, the necessity for such manual manipulation of the joint is disadvantageous in that it may inordinately lengthen the duration of the surgical procedure, cause interruption of the surgeon's concentration, or result in relatively inexact positioning of the joint at critical stages of the procedure.

Adjustable examination and operating tables of the type disclosed in U.S. Pat. Nos. 2,764,459 and 2,895,775 are complex, expensive and fail to provide a solution to the problem of precisely locating and adjusting the position of a portion of the body of a patient in different attitudes during the course of surgery.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Apparatus of the present invention includes a housing 10 which is secured at one end to the center section 11a of a conventional operating table 11 which includes three separate sections: a head section (not shown), which may be selectively inclined at any desired angle with respect to the center section 11a, and a foot section 11b which is also selectively inclined with respect to the center section 11a. As shown best in FIG. 2, when the present apparatus is secured to a conventional operating table, the foot section 11b is lowered out of the way and the present apparatus, in effect, acts as the foot section of the table.

Referring again to FIG. 2, an upper surface 12 of the housing 10 is substantially coplanar with an upper surface 14 of the center section 11a of operating table 11 in order to support the upper portion of the leg being operated on. A U-shaped mounting portion 15 of the housing 10 enables the housing to be removably mounted on support bar 16 which extends transversely across the center section 11a of the operating table 11 as shown in FIG. 1. The support bar 16 is secured at either end to holders 17, 18 which are, in turn, fixedly secured to the center section 11a by clamps 19, 21, respectively, or other suitable means.

An elongated support 22 for the lower portion of the leg to be operated on is mounted on an opposite end of the housing 10 for rotation in a vertical plane. The lower leg support 22 is fixedly secured by clamps 23, 24 to a first shaft 25 which is rotatably mounted on the housing 10. The lower leg support 22 may be provided with raised sides 26 to better retain the lower leg in position during an operation.

Reversible drive means to pivot the lower leg support 22 either upwardly or downwardly through its vertical plane of rotation include a reversible electric motor 27 mounted in the housing 10 and having a drive gear 28 secured to its output shaft 29. A driven sector gear 31 is secured to the first shaft 25 and is meshed with the drive gear 28.

A first control means for operating the drive means includes a foot switch 33 which is electrically connected by conventional circuitry to the motor 27 by an electrical conduit 34. The foot switch 33 may be selectively operated by a surgeon during the course of an operation to drive the motor 27 in either direction. It is also contemplated that the rate of rotation as well as the direction may be controlled in this manner.

To prevent abnormal flexion or extension of the knee joint, a second control means are provided for deactivating the drive means at predetermined limit positions. Specifically, the second control means prevent the lower leg support from being pivoted either upwardly above the horizontal plane or downwardly more than about 110° from the horizontal plane. The second control means of the present embodiment include first and second microswitches 36, 37 which are mounted in the housing 10 adjacent the driven gear 31 as shown best in FIG. 2. The microswitches 36, 37 are electrically connected by conventional circuitry to the motor 27 to cut off power to the motor 27 when either of the predetermined limit positions are reached. First and second microswitch actuators 38, 39 are mounted on the leg support 22.
an inside surface of the driven gear 31 and are positioned to activate the respective microswitches 36, 37 when the predetermined limit positions have been reached.

Electrical power is provided through a conduit 41 which includes a connector (not shown) suitable for engagement with a conventional wall socket. Power switch means 42 includes an indicator lamp which operates only when power is flowing to the motor 27. A fuse 43 is also provided as a safety feature.

Referring particularly to FIGS. 1 and 3, the present apparatus further includes a second support 50 for the leg not being operated on which has a U-shaped mounting portion 51 that enables the second leg support 50 to be removably and rotatably mounted on the support bar 16 alongside the housing 10. The relative positions of the housing 10 and the second leg support 50 are interchangeable depending in each instance upon whether the right or left leg of a patient is to be operated upon.

First and second brackets 52, 53 are secured to and extend downwardly from opposite longitudinal marginal edges of the second leg support 50. A cross-plate 54 is secured to and disposed between the brackets 52, 53 and has a centrally located threaded opening 55 therein. A threaded rod 57 is received in the opening 55 and extends axially from either side of the crossplate 54. A handwheel 58 is secured to one end of the rod 57 and a leveling pad 59 is secured to the other end of the rod 57. In the present embodiment, the leveling pad 59 abuts the foot section 11b of the operating table 11 which has been lowered out of the way. The position of the second leg support 50 with respect to the operating table 11 is determined in each case by rotating the handwheel 58 to vary selectively the length of the rod 57 between the cross-plate 54 and the leveling pad 59.

I claim:

1. Apparatus for controlling flexion and extension of a knee joint during surgery comprising a housing secured at one end to and extending from the center section of an operating table, an upper surface of the housing being substantially coplanar with the upper surface of the operating table to support the upper portion of the leg being operated on; an elongated support for the lower portion of the leg being operated on mounted on an opposite end of the housing for rotation in a vertical plane the lower leg support being fixedly secured to a first shaft which is rotatably mounted on the housing; reversible drive means mounted in the housing for pivoting the lower leg support through the vertical plane to flex and extend the knee joint, the reversible drive means including a motor mounted in the housing, a drive gear secured to an output shaft of the motor, and a driven gear secured to the first shaft and meshing with the drive gear to pivot the lower leg support when the motor is activated; first control means for operating the drive means; and, second control means for deactivating the drive means at predetermined limit positions.

2. Apparatus according to claim 1 wherein the first control means includes a foot-operated switch for selectively operating the motor in first and second directions.

3. Apparatus according to claim 1 wherein the second control means include first and second microswitches mounted on the housing adjacent a driven gear and first and second microswitch actuator means mounted on the driven gear, the actuators being adapted to operate the respective microswitches to deactivate the drive means when the lower leg support is rotated to the predetermined limit positions.

4. Apparatus according to claim 1 wherein the housing is removably mounted on a support bar extending transversely across the center section of the operating table and being secured to holders at either end, the holders being fixedly secured to the center section of the operating table.

5. Apparatus according to claim 4 further including a second support for the leg not being operated on pivotally secured to the support bar adjacent the housing and extending from the center section of the operating table, the housing and the second leg support being interchangeably positioned on the support bar, the respective positions of the housing and the second leg support being determined in each instance by the particular leg to be operated on.

6. Apparatus according to claim 5 wherein the second leg support further includes first and second brackets secured to and extending downwardly from opposite longitudinal marginal edges of the second leg support, a cross-plate secured to and disposed between the brackets and having a threaded opening therein, a threaded rod receivable in the cross-plate opening and extending axially from either side of the cross-plate, a handwheel secured to one end of the rod and a leveling pad secured to the opposite end of the rod and abutting the foot section of the operating table, the handwheel being rotatable to vary selectively the length of the rod between the cross-plate and the leveling pad, determining the position of the leg support with respect to the operating table.

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