

[54] AUTOMATIC SURGERY RETRACTOR

- [72] Inventor: Anthony Peronti, Morton Grove, Ill.
 [73] Assignee: Michael S. White, Chicago, Ill. a part interest
 [22] Filed: July 14, 1970
 [21] Appl. No.: 54,728

- [52] U.S. Cl. 128/20, 269/328
 [51] Int. Cl. A61b 17/02, A61g 13/00
 [58] Field of Search 128/20; 214/1 BC, 141; 46/40; 269/322, 328

References Cited

UNITED STATES PATENTS

- | | | | |
|-----------|---------|---------------------|------------|
| 1,615,284 | 1/1927 | Kennedy | 214/141 X |
| 1,747,799 | 2/1930 | Straus | 128/20 |
| 2,071,905 | 2/1937 | Smith | 46/40 X |
| 3,007,097 | 10/1961 | Shelley et al. | 214/1 BC X |
| 3,492,757 | 2/1970 | Balthazor | 46/40 |

OTHER PUBLICATIONS

"A New, Table-Supported, Self-Retaining Retractor"
 Marshall, Samuel F. et al., In Surgery, Vol. 54, No. 3, September 1963

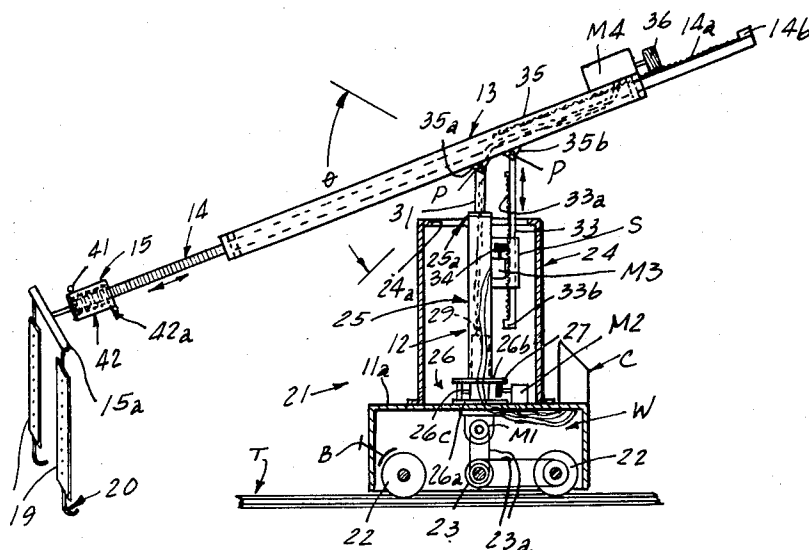
Primary Examiner—Channing L. Pace
 Attorney—Hill, Sherman, Meroni, Gross & Simpson

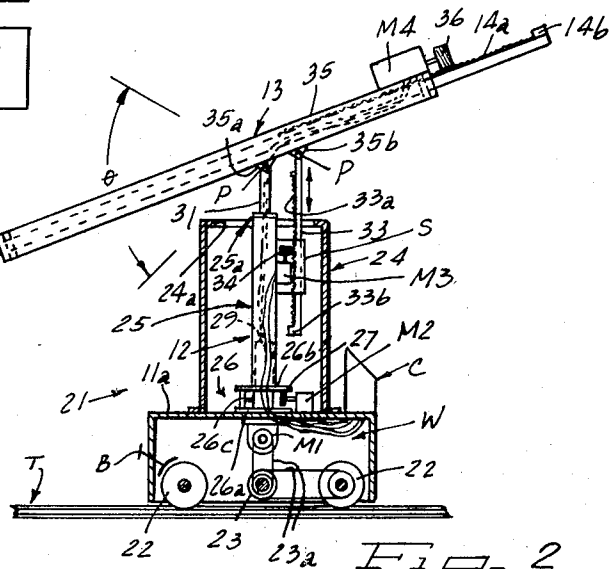
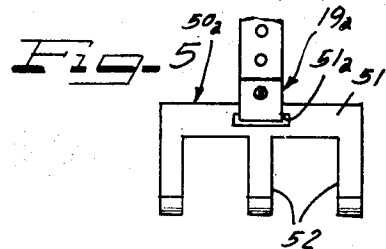
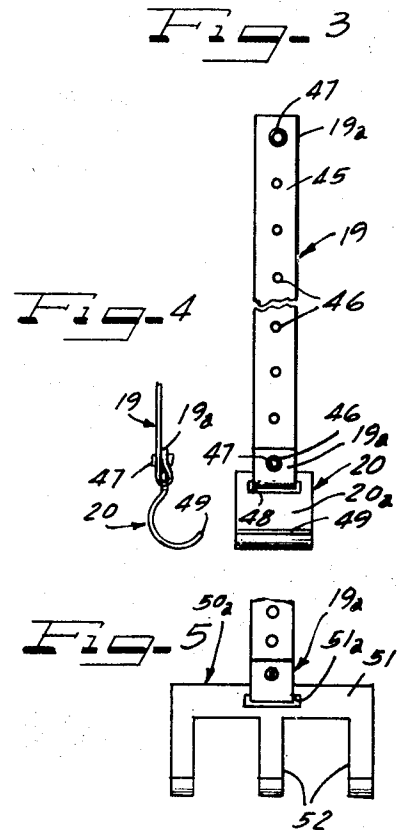
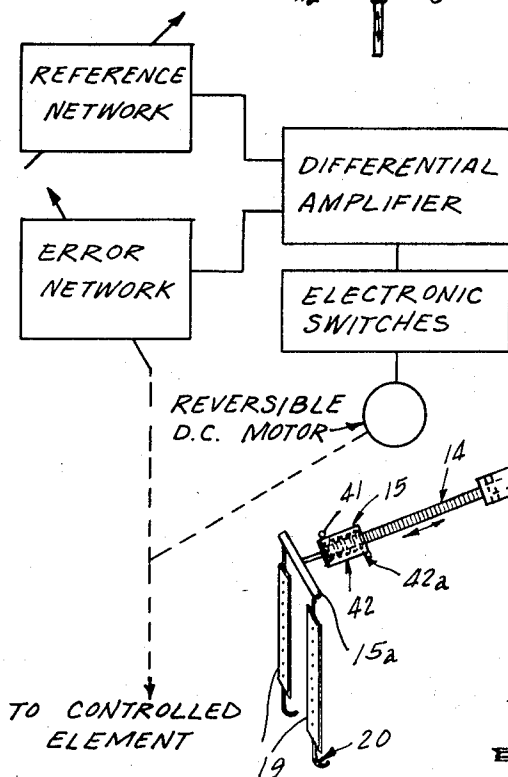
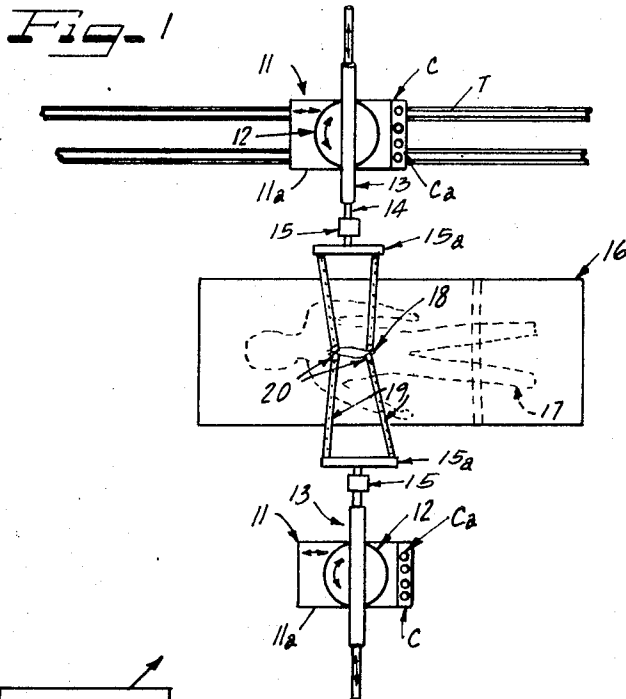
[57]

ABSTRACT

An automatic surgery retraction apparatus which is self-supporting away from an operating table or a patient and is selectively positionable along both. The apparatus includes a vertically extensible upright assembly mounted for rotation about a base member and a horizontally extensible boom assembly mounted for pivotal movement about the upright assembly. The upright and boom assemblies are provided with electronic precision servo-positioning systems allowing remote actuation thereof for precise and accurate positioning. The boom assembly is provided with one or more disposable strap members carrying retraction instruments, which may also be disposable.

12 Claims, 6 Drawing Figures





INVENTOR.

ANTHONY PERONTI

BY *Hill, Sherman, Perotti, Gross & Simpson* ATTORNEYS

AUTOMATIC SURGERY RETRACTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to surgical apparatus and more particularly to surgical retractor apparatus.

2. Prior Art

Various surgical retractor apparatuses are known. Certain of such known apparatuses simply comprise an instrument means for insertion into a patient and a handle means which must be continuously held at a given position by a suitably trained individual. These types of apparatuses have many disadvantages including the fact that they require a high degree of stamina by the individual utilizing them and necessitate the presence of a nonsurgeon individual at the operating table. Other known apparatuses comprise various framelike members which either attach to the operating table or to the patient and fixedly support an instrument means for insertion into the patient. Any and all adjustments for such apparatuses must be manually effected. These type of apparatuses also have many disadvantages including the fact that they are cumbersome, inefficient and require the surgeon or an assistant to effect the necessary adjustments as the operation progresses.

SUMMARY OF THE INVENTION

The invention provides an automatic surgery retractor apparatus which is self-supporting away from an operating table or a patient and is selectively and precisely positionable in respect to the patient and the operating table. Generally, the apparatus includes an extensible upright assembly rotatably mounted on a movable base member. In certain embodiments, a track means is provided along the floor of an operating room in working relation with the base member in guide the apparatus along a given path. In other embodiments, the base member is provided with lockable wheels or the like allowing the apparatus to be selectively moved to a given position and secured. An extensible boom assembly is pivotally attached to the upper portion of the upright assembly for angular movement along both the horizontal and vertical planes. One or more disposable strap members are attached to an end of the boom assembly and each strap member carries the desired retraction instrument for insertion into a patient during a particular operation. Suitable precision servo positioners, such as transistorized reversible electronic motors, are provided for the various members of the apparatus and which are energized by suitably positioned control panels.

Prior to the start of a particular operation, the apparatus of the invention is moved into a desired position away from the operating table and suitably secured to locked in place. The upright assembly is extended to an approximate desired height and the boom assembly is extended an approximate desired distance. The upright assembly is then rotated out of the way. The patient is then brought in and suitably positioned on the operating table and secured thereto as desired and the operation begun. At this time the disposable strap member is removed from a suitable sterilized container and attached to the boom assembly. The upright assembly is then rotated into a properly aligned position and suitable retraction instruments are attached to the strap members. Although the strap members and the retractor instruments can be preassembled and sterilized as a unit. The retractor instruments are then inserted into the operation incision and the boom assembly retracted sufficiently to maintain the desired degree of opening. During the course of the operation, the various members are precisely adjustable as desired from a remote control panel and the area around the operating table is free for the surgeon and his assistants who are actively involved in the operation. Various safety features, such as locks, brakes, alternative energy circuits, electrical insulator means, etc. can be provided as desired.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an essentially diagrammatical top view of an apparatus constructed and operated in accordance with the principles of the invention;

FIG. 2 is an elevational side view, partially broken away, of an embodiment of the apparatus of the invention;

FIG. 3 is a top view, partially broken, of an embodiment of the disposable strap member carrying an embodiment of a retraction instrument in accordance with the principles of the invention;

FIG. 4 is a partial side elevational view of the device illustrated at FIG. 3;

FIG. 5 is a partial top view of a disposable strap member carrying another embodiment of a retraction instrument in accordance with the principles of the invention; and

FIG. 6 is an essentially schematic diagram representing an embodiment of a control circuit utilized in the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Throughout the various Figures, like reference numerals will be utilized to refer to like parts.

As shown in FIG. 1, a plurality of apparatus embodiments 11 constructed in accordance with the invention are simultaneously usable in a given operation to maintain an incision in a desired open position. Each of the apparatus 11 is positioned away from an operating table 16 a suitable distance whereby the surgeon and his assistants have essentially free and adequate access to all portions of the table 16 and/or a patient 17. Track means T are provided and are suitably recessed into the floor as a safety feature and to provide a guide path along the edge of the table 16. As illustrated, only one side of the operating table has a track means T while the other side is without any predetermined guide path. The guide path provided by the track T is here illustrated as a straight line, however, the path may be curved as desired.

Each of the apparatus 11 has a movable base member 11a adapted to support the various other apparatus members thereon. A suitable means, such as wheels or ball bearings, are provided along the bottom of the base members 11a for selective movement of the apparatus along a given path. Of course, track means may be provided for all of the apparatus or may be dispensed with, however, it has been noted that track means provide a more positive guiding means allowing better positioning of the apparatus. A control panel C is mounted along one end portion of the base member 11a and has a plurality of control knobs or the like Ca for selective energization and adjustment of the apparatus. When desired, the control panel C may be positioned remote from the apparatus 11, such as at an end of the operating table 16 and, a suitable single control panel may be provided for a plurality of apparatuses as desired.

A vertically telescoping or extensible (i.e., axially movable) upright assembly 12 is fixedly attached to the base member 11a and mounted for rotation or angular movement about its longitudinal or vertical central axis for angular positioning in respect to the base member 11a as desired. Safety means (not shown) are provided to maintain the upright assembly in a given position, both as to its angular and axial positions.

A horizontally telescoping or extensible (i.e., axially movable) boom assembly 13 is fixedly attached to an upper end of the upright assembly 12 in a pivotal manner so as to allow the boom assembly 13 to pivot about its point of attachment. The boom assembly 13 includes and is provided with a selectively extensible arm member 14. Safety means (not shown) are provided for positively maintaining the boom assembly 13 in a given position, both as to its angular and axial position. A safety attachment means 15 is fixedly attached to an outer end of arm member 14 and a plurality of disposable strap members 19 are selectively secured to the attachment means 15 via a yoke member 15a.

The disposable strap members 19 are provided with suitable retraction instruments 20 for insertion into an incision 18. As

will be appreciated, a variety of retractor instruments are known and any particular type of retractor instrument is readily attachable to the disposable strap means 19. For most general operations where relatively simple incisions are sufficient, a standardized retraction instrument, such as a curved blade member, is provided as a unit with a disposable strap member, and in accordance with the invention such a unit is disposable thereby materially simplifying sterilization problems. Preferably, the strap members 19 are composed of a suitable synthetic resin material, such as a polyester material (i.e., Mylar, a registered trademark of E. I. duPont de Nemours & Co., for a polyester film material) suitably treated, as by molecular orientation or by perforation or the like, to exhibit selectively limited tensile strength. The strap members 19 may also be composed of a suitable fabric or a combination of fabric and resin material so as to be economically disposable and easily sterilized as required. In instances where the retractor instrument is formed as a unit with the strap members so as to be disposable therewith, it may be composed of a suitable synthetic resin material, such as a nylon or polycarbonate material.

As shown, the retractor instruments 20 are inserted into the incision 18 and the arm members 13 are retracted by actuation of their respective means for accurately and speedily positioning the members so as to provide a desired amount of tension on the strap members 19 and maintain an opening at the incision. As the operation progresses, the position of the retractors can be moved as desired and the position of the various units 11a, 12, 13 and 14 can also be precisely adjusted by selective energization of their respective precision servo-positioning means.

FIG. 2 illustrates an embodiment 21 of the apparatus constructed in accordance with the principles of the invention. A base member 11a is mounted on a plurality of wheels 22. As diagrammatically indicated at B, a brake-locking mechanism is provided in working relationship with the wheels 22. The base member is formed into a suitably sized cabinet and the upper free surface thereof may be utilized as a work area for carrying surgical instruments and the like. A control panel C is mounted at one end of the cabinetlike member 11a along a portion thereof and has suitable control devices (not shown) for remotely and selectively energizing the various power means of the apparatus. A suitable power source (not shown) is provided in working relation to control panel C so as to provide energy to the various drive means of the apparatus.

A reversible drive means M1, such as a reversible DC electrical motor, is mounted interiorly of the base member 11a. The drive means M1 is provided with suitable energization circuit (best seen in FIG. 6) interconnected to a communication means, such as electrical wires W, so as to provide an energy flow path between the drive means M1 and the control panel C and to a suitable power source (not shown). A speed-control device 23 is mounted in working relation with the drive means M1 and with one of the wheels 22. A plurality of belts 23a or the like are provided to transmit the power from the motor means M1 to the speed control device 23 and then to the wheels 22.

A suitable recessed track means T is provided on the operating room floor and disposed along a desired guide path. The wheels 22 engage the track in a working relation and are positively guided thereby along the desired guide path.

An upright cover member 24 is centrally mounted onto the upper outside surface of the base member 11a in a fixed manner. An opening 24a is provided along the upper surface of cover member 24.

A rotatably supported collar assembly 26 is mounted interiorly of the cover member 24 and on top of the base member 11a. The support collar assembly 26 includes a rigid low baseplate 26a directly attached to the base member 11a and an upper angularly movable support plate 26b. The support plate 26b is provided with a central through opening (not shown). A rotatable means 26c, such as a wheel, separates the plate 26a and 26b and allows the support plate 26b to rotate

relative to the lower plate 26a. The lower surface of the support plate 26b is provided with an engagement surface, such as a suitably geared track, along the peripheral edges thereof for positively driving the plate 26b in a rotary motion. A suitable drive means M2, such as a reversible DC electronic motor, is mounted on the base member 11a in working relationship to the collar assembly 26. A spur gear 27 or the like is mounted on the output shaft of the drive means M2 so as to engage the gear track or the like with the support plate 26b. In this manner, the plate 26b is selectively rotated about the vertical axis to any desired angular position. As will be appreciated, the drive means M2 is also provided with a suitable energization circuit and with suitable communication means for interconnecting the circuit with the control panel C.

The upright assembly 12 comprises an outer rotatable column member 25 which is mounted on the upper surface of the support plate 26b so as to be generally concentric with the through opening in the plate 26b. The outer column member 25 is hollow along its lower portion so as to define a lower receiving chamber. The upper end of the outside column member 25 is closed, as by a cap means 25a and a rod member 31 is rigidly secured thereto. The outer column member 25 is angularly positionable as desired and rotates with the support plate 26b.

An inner stub member 29 is mounted centrally within the receiving chamber (i.e., the lower portion) of outer column member 25 and passes through the opening in plate 26b for direct attachment with the plate 26a. The stub member 29 is fixedly attached and provides an anchoring means between the base member 11a and the upright assembly 12. Suitable bearing means are provided between the outer walls of stub member 29 and the bottom of the through opening of plate 26b so as to allow relative movement therebetween.

A support bracket S is rigidly mounted along the outer surface of the column member 25 so as to support a drive means M3 along an outer side surface of column member 25. The support means S extends beyond the drive means M3 so as to provide a guide support for an axially movable rod member 33. If desired, a plurality of support means may be provided. The drive means M3 is a reversible DC synchronized electronic motor provided with a suitable energization circuit and with communicating means, such as wires W interconnecting the circuit with the control panel C. A motion translation device 34, such as worm gear or the like, is mounted on the output shaft of the drive means M3 as shown.

The axially movable rod member 33 is pivotally attached, as at P to the horizontal boom assembly 13 and extends downwardly therefrom in a working relationship with the motion translation device 34. The rod member 33 is provided with a rack means 33a along one surface thereof for engagement with the device 34 whereby energization of the drive means M3 drives the rod member 33 in an up-and-down motion as desired. A safety retaining means 33b is provided along the lower end of rod member 33 to insure that no disengagement occurs. A further safety feature includes the fact that positive mechanical engagement between the drive means and the rod member is continuously maintained during all operations positions so that no slippage or the like can occur.

The horizontal boom assembly 13 includes an outer sleeve member 35 and an inner axially movable arm member 14. The sleeve member 35 is provided with a pair of projecting ear members 34a and 34b for attachment with the rod members 31 and 33 of the upright assembly 12 so as to provide pivot points P of attachment allowing the horizontal boom assembly 13 to pivot in a vertical plane about the upright assembly 12. As shown, the horizontal boom assembly is free to rotate through an angle θ of about 60° to 80°, however, by appropriately shaping cover member 24 greater angular movement is possible as desired.

Inner arm member 14 is mounted in a linearly movable manner within the sleeve member 35 so as to be extensible and retractible therein as desired. The arm member 14 is provided with a rack means 14a to engage with a motion transla-

tion device 36 such as a worm gear, to effect the desired extension or retraction. A safety retaining tab 14b is secured to the outer end of arm member 14 to prevent the arm member from being disengaged with the motion translation device 36.

A servo-positioning means M4 is mounted along one end of the sleeve member 35 and is provided with a suitable energization circuit and appropriate communicating means interconnecting the drive means M4 with the control panel C. It will be noted that the communication means between the various means M1, M2, M3 and M4 are shown as passing internally of the structural members. This type of arrangement is convenient to avoid entanglement of the wires. The means M4 is provided with a motion translation device 36, such as a worm gear or the like directly connected to its output shaft and arranged to engage or mesh with rack means 14a of arm member 14.

A safety attachment means 15 is secured to the nondriven end, or the securing end, i.e., the end not in engagement with means M4, of arm member 14. The attachment means 15 include a warning means 41, such as a self-energizing light (i.e., containing an appropriate sized dry cell battery positioned remote from the arm member 14) for selective actuation and indicating an excess pressure being applied. Attachment means 15 is formed into the shape of a hollow cylinder. An internally mounted tensioning means 42 is mounted, such as a helical spring or the like within attachment means 15 and includes a means 42a of adjusting the tension thereof as desired. The tension means 42 is provided with conventional contact points to complete the circuit of warning device 41 as it is moved to a given position.

A yoke member 15a is directly attached to the tensioning means 42 whereby any tension on the yoke means 15a is directly transmitted to the tensioning means 42. The yoke means 15a may comprise a transversely extended barlike member with a dimension sufficient for carrying a plurality of disposable strap means. As shown, a plurality of strap means 19 may be directly attached to the yoke member 15a in a substantially uniformly spaced manner. The disposable strap means 19 are provided with suitable retraction instruments 20 for use in a particular operation.

As best seen at FIG. 3, the disposable strap 19 comprises an elongated narrow band of material 45, such as a synthetic resin, a fabric, or a combination thereof. Preferably, the material 45 is selected to have limited tensile strength and is provided with means 46, such as perforations, positively providing such limited tensile strength. This additional safety feature is to further insure that only limited tension will be applied to the incision. The perforations 46 are uniformly spaced along the length of the disposable strap member 19 and also functions as an adjustment means of lengthening or shortening the strap 19. At both ends of disposable strap member 19 are provided a pair of postlike projections 47 for insertion and mating with the perforations 46 so as to provide approximate length adjustability for the strap members 19. In this manner, the perforations 46 serve a dual function of providing desired tensile strength characteristics to the strap member 19 and providing a means, along with posts 47, of adjusting the length of the strap member 19. Further, as shown, the perforation means 46 and post means 47 also serve as an extremely efficient means of fastening retractor instruments 20 to the strap member 19.

The retraction instrument 20 may comprise a body portion 20a having a suitable recess 48 along one edge thereof of a sufficient size to receive the strap member 19 therethrough as shown. The other end of the retraction instrument 20 is adapted to function as a blade portion 49. Such blade portion may be integrally formed with the body 20a or may be separately attached as desired.

FIG. 5 illustrates another embodiment 50 of a retraction instrument. The embodiment 50 comprises a main body portion 51 having a plurality of blade portions 52 dependent therefrom so as to provide a somewhat wider area of contact with an incision. The body 51 is provided with a suitable

recess 51a for receiving a disposable strap member 19 as explained hereinbefore.

In certain instances, it is desirable to form the retraction instruments, such as the embodiments 20 or 50, of a suitably economical material so as to allow them to be disposable with the strap member 19. In such instances, the retractor instruments may be formed of suitably rigid synthetic resin material, such as polycarbonate resins or polymeric amide resins, i.e., nylon. Further, suitably shaped disposable retractor instruments may be formed as a unit with the disposable strap members 19 and in which instance the strap member may be directly attached, such as by heat-sealing to itself, thereby obviating the necessity of the previously discussed post member 47 at the ends and the previously discussed yoke member 15a may be provided with suitable attachment means, such as hooks or the like, which are directly insertable into the perforations 46 of the strap member 19.

FIG. 6 illustrates, in schematic form, an energization circuit suitable for use with the various servo-positioning means, i.e., M1, M2, M3 and M4, utilized in the instant apparatus. Various precision control circuits are known, such as disclosed in U.S. Pat. No. 2,846,630 or in U.S. Pat. No. 3,513,370, both of which patents are incorporated herein by reference, and can be incorporated into a suitable motor means to allow precise and speedy positioning of a member driven by such motor means.

Briefly described, the energization circuit shown can include a small reversible DC motor for accurately positioning a shaft, an electronic switching system for controlling deenergization of the reversible DC motor, and a differential amplifier system for controlling the operation of the electronic switches. The differential amplifier system comprises a reference network and an error network, each comprising two stages of amplification connected across a single source of supply. The differential outputs of the networks are used to control the output of a driver-amplifier which, in turn, selectively controls the operation of the two electronic switches to control the energization of the reversible DC motor. Preferably, the electronic switches comprises a PNP-type transistor and an NPN-type transistor having interconnected emitters, and each having a base connected to a common point in the differential amplifier network. When the conductivity of the driver-amplifier is increased by the differential output, one of the transistor switches becomes conductive and the motor is energized in one direction. When the conductivity of the driver-amplifier is decreased, the other transistor switch becomes conductive and the motor is energized in the other direction. In either case, the motor will always drive an element in the error network until such time as the reference and error networks are balanced and then the motor is again deenergized. This type of transistorized servo-positioner systems is extremely accurate and fast thereby allowing precisely fine adjustment of the various driven elements.

As indicated before, suitable electrical insulators may be positioned between those elements in contact with the patient and/or are in relative proximity to contact by operating personnel to insure that no short circuits or the like occur. As will be appreciated, the disposable strap member 19 is an insulator member which completely isolates the electrical system of the apparatus from the patient. Also, suitable disposed parallel energization circuits can be provided to avoid dangers of nonoperability of the main circuits and, as is common with most electronic surgery equipment, an alternate power source can also be provided in working relation to the energization circuits whereby continuous operation of the retraction apparatus is insured.

In summation, it will be seen that the invention provides a surgical retraction device for use away from an operating table, comprising, a movable support means selectively positionable along the operating table, an upright assembly mounted on said support means for selective rotation about said vertical axis, a boom assembly mounted for selective pivotal movement about said upright assembly and including

an axially movable arm member having a securing end, at least one disposable strap member attached to said securing end of the arm member and having a free end, a retraction instrument attached to said free end of the strap member, and means for speedily and precisely positioning at least the arm member.

Certain changes and modifications in the practice of the present invention can readily be made without substantially departing from the intended spirit and scope of the invention. Therefore, it is to be fully understood that the invention is not to be limited or in any way restricted to the preferred embodiments thereof which are set forth in the foregoing description and specification; rather, its scope and spirit is to be construed and interpreted in light of the appended claims.

I claim as my invention:

1. In combination, a surgical operating table and a surgical retraction device for use therewith, said surgical retraction device comprising a movable support means selectively positionable along the operating table, an upright assembly rotatably mounted on said support means for selective rotation about a longitudinal axis thereof, a boom assembly pivotally mounted on said upright assembly for selective pivotal movement about said upright member, said boom assembly including a longitudinally movable arm member having a securing end, at least one disposable strap member attached to said securing end and having a free end, a retraction instrument attached to said free end of the strap member and means for speedily and precisely controlling the position of at least the arm member.

2. A surgical retraction device as defined in claim 1 wherein the means for speedily and precisely positioning includes a transistorized precision servo positioner including a reversible DC motor coupled in working relation to said arm member.

3. A surgical retraction device as defined in claim 2 wherein the movable support member, the upright assembly and the arm member are all connected in a working relation to the precision servo positioner, said positioner being adapted to be actuated from a remote position.

4. A surgical retraction device as defined in claim 1 wherein the support means is provided with lockable wheel members for selectively moving the support means along a path, and track means are provided recessed into a floor along said path for positively guiding said wheel members along said path.

5. A surgical retraction device as defined in claim 1 wherein the disposable strap member is composed of a synthetic resin material having a predetermined tensile strength.

6. A surgical retraction device as defined in claim 5 wherein the disposable strap member and the retraction instrument comprise a single sterilizable and disposable unit.

7. A surgical retraction device as defined in claim 5 wherein the disposable strap member is provided with a plurality of substantially uniformly spaced perforations along the length thereof and a means adjacent the ends thereof for mating with one of said perforations for approximate adjustment of the length thereof.

8. A surgical retraction device as defined in claim 1 wherein an attachment means is fixedly secured to the securing end of the arm member, said attachment means having an adjustable tensioning means and a warning means in working relation

therewith, said tensioning means having one end fixedly attached to said attachment means and the other end being free to move in response to tension on the strap member, said warning means being actuated by contact with said tensioning means.

9. A surgical retraction device as defined in claim 1 wherein a plurality of strap members are attached and uniformly spaced along the securing end of the arm member.

10. In combination, a surgical operating table and a surgical retraction device for use therewith, said surgical retraction device comprising,

a support member adapted for selective movement along a floor so as to be selectively positioned along the operating table,

an upright assembly rotatably mounted on said support member for selective angular positioning in respect to said support member, and upright assembly including a linearly movable rod member and a precision servo-positioning means for selectively and accurately moving said rod member along the vertical axis of said upright assembly,

a boom assembly pivotally attached to an upper portion of said upright assembly for selective angular positioning thereof in respect to the vertical axis of said upright assembly, said boom assembly including a linearly movable arm member and a precision servo-positioning means for selectively and precisely moving said arm member along a longitudinal axis of said boom assembly,

said precision servo-positioning means being adapted for actuation from a remote position, an attachment means fixedly secured to an end of said arm member, said attachment means having an adjustable tension means and a warning means in working relation therewith, said tension means having one end fixedly attached to said attachment means and the other end thereof free to move in response to tension, said warning means being fixed on said attachment means remote from said arm member and being actuated by contact with said tension means, a yoke member fixedly attached to said other end of the tensioning means and having a portion thereof extending transversely to said arm member,

a plurality of disposable strap members attached along said transversely extending portion of the yoke member in a spaced manner from each other, said strap members being composed of a synthetic resin material having a predetermined tensile strength, and

a plurality of retraction instruments each individually attached to a free end of a strap member of said plurality of strap members for insertion into a surgical incision.

11. A surgical retraction device as defined in claim 1 wherein the upright assembly is selectively movable along the longitudinal axis thereof.

12. A surgical retraction device as defined in claim 11 wherein the upright assembly includes a vertical standard rotatably mounted on the support means and an auxiliary rod member supported on said vertical standard and linearly movable along the longitudinal axis of said upright assembly for selectively positioning the boom assembly.

* * * * *

60

65

70

75