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(71) Applicant *(for all designated States except US)*: **DEXTERITY SURGICAL, INC.** [US/US]; Suite 700, 1495 Hembree Road, Roswell, GA 30076 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **FEILER, Frederick, C., Jr.** [US/US]; 925 Tanworth Drive, Raleigh, NC 27615 (US). **FADEM, Kalford, C.** [US/US]; 2111A Defoors Ferry Road, Atlanta, GA 30318 (US).

(74) Agents: **KITA, Stanley, B.__** et al.; Howson and Howson, Spring House Corporate Center, P.O. Box 457, Spring House, PA 19477 (US).

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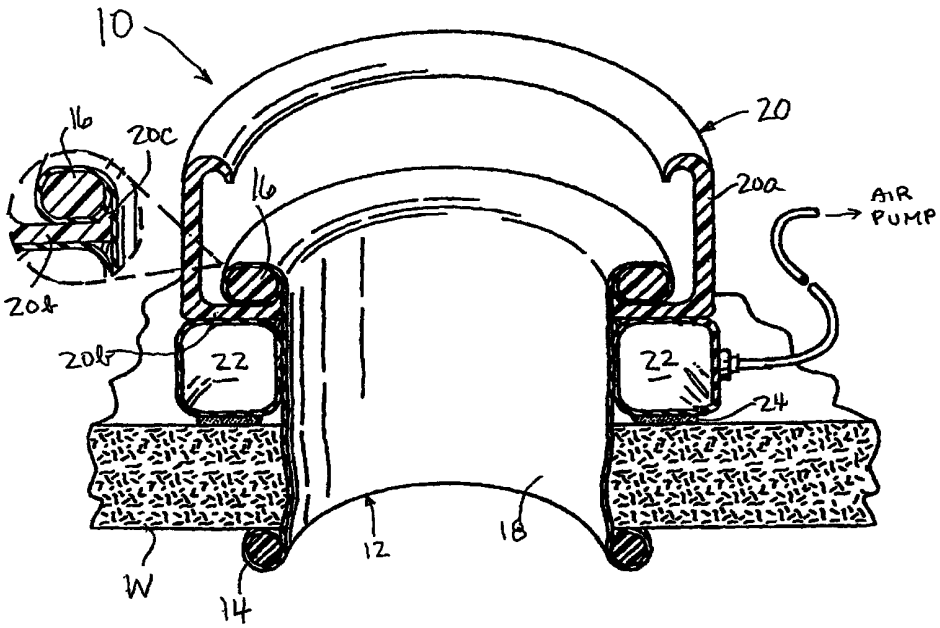
(54) Title: ADJUSTABLE SURGICAL WOUND PROTECTOR AND RETRACTOR



(57) Abstract: An adjustable surgical wound retractor (10) having outer and inner resilient rings (14, 16) connected together by a flexible sleeve (18). The outer ring (14) may be rolled down onto the sleeve (18) for coarse adjustment of the sleeve (18) length suitable for initial installation in an incision. A lifter (20) interposed between the outer surface around the incision and the outer ring (14) provides a fine adjustment. The lifter (20) may be actuated pneumatically or mechanically.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ADJUSTABLE SURGICAL WOUND PROTECTOR AND RETRACTOR

FIELD OF THE INVENTION

The present invention relates generally to improvements in surgical wound protectors and retractors, and more particularly to a surgical wound protector and retractor which can be precisely adjusted to accommodate different thicknesses of incision walls.

BACKGROUND OF THE INVENTION

Minimal laparoscopic surgery has become a method of surgery preferred both by patients and surgeons because there is less trauma associated with large incisions and the healing time is significantly shorter. Laparoscopic instruments are inserted through puncture wounds into the body cavity and externally manipulated while viewing images within the cavity on a TV monitor. A modified form of laparoscopy, referred to as hand-assisted minimal invasive surgery, allows one hand to be inserted within the cavity through an additional small muscle-splitting incision. The advantages to this are that it affords a bio-physical feedback through the hand as the instruments are manipulated, and enables the surgeon to palpate internal organs during the operation. The size of the incision is just sufficient to allow the surgeon's hand to pass into the cavity.

An incrementally adjustable wound protector such as disclosed in U.S. Patent 5,524,644 to Berwyn M. Crook is installed in the incision and acts as a barrier against bacteria or harmful contaminants from the surgeon's hand, instruments or foreign matter during surgery which may otherwise contact the incision wall. The wound retractor comprises a pliable sleeve of thin material impervious to such contaminants. The sleeve is secured at opposite ends around inner and outer pre-formed resilient O-rings. The O-rings are sized to engage the inner and outer edges of the incision and the sleeve length must exceed the thickness of the incision wall. The inner ring is inserted through the incision and spreads into contact with the inner edge of the incision. The outer ring is then turned outwardly about its circular axis onto the outer

end of the sleeve until the sleeve is contiguous with the incision. Each complete turn of the outer O-ring takes up an increment of the sleeve length.

Since the outer O-ring can stabilize only at complete turns, one coarse incremental adjustment is possible per turn. Consequently, a final installation may be either too loose or over tightened. Fine adjustment for a proper fit is not possible.

OBJECTS OF THE INVENTION

Accordingly, it is an object of the present invention to provide a novel and improved adjustable wound protector and retractor which is capable of being precisely adjusted to fit incisions of different wall thicknesses.

Another object of the invention is to provide an adjustable wound protector and retractor which is suitable for use with an extracorporeal enclosure under conditions of insufflation of the body cavity.

Still another object of the invention is to provide an adjustable wound protector and retractor which is of relatively simple design, inexpensive to manufacture, and easy to use.

SUMMARY OF THE INVENTION

These and other objects and novel features of the invention are accomplished with an adjustable wound retractor having outer and inner resilient rings connected together by a flexible sleeve. The outer ring may be rolled down onto the sleeve for coarse adjustment of the sleeve length suitable for initial installation in an incision. A lifter interposed between the outer surface around the incision and the outer ring provides a fine adjustment. The lifter may be actuated pneumatically or mechanically.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects, novel features and advantages of the invention will become more apparent from the following description when taken in conjunction with the accompanying drawings wherein:

FIG. 1 is an isometric view in cross-section of one embodiment of an adjustable wound protector and retractor pneumatically operated according to the invention;

FIG. 2 is a view like FIG. 1 of another embodiment of an adjustable wound protector and retractor mechanically operated according to the invention;

FIG. 3 is a more detailed view in cross-section of a portion of the protector and retractor of FIG. 2; and

FIG. 4 is a view like FIG. 3 of an alternate design of a portion of the protector and retractor of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings wherein like reference characters denote like or corresponding parts throughout the several views, FIG. 1 shows an adjustable wound protector and retractor indicated generally by the numeral 10 according to the invention. A retractor 12 is installed in a small muscle-splitting incision in a patient's anterior abdominal wall W to permit a surgeon's hand to be extended into the abdominal cavity. Retractor 12 includes a pair of resilient inner and outer O-rings 14 and 16 connected to opposite ends of an impermeable pliable sleeve 18. Inner O-ring 14 engages the inner edge of the incision wall with a portion of sleeve 18 extending above the surface of the abdomen wall for rolling down on itself around outer O-ring 16 for a coarse adjustment. A suitable retractor for this purpose is disclosed in U.S. Patent 5,524,544 supra.

A lifter assembly 20 comprises a cylindrical section 20a and a flat ring section 20b extending from the lower end which engages the bottom side of outer O-ring 16 and any sleeve wound thereon. The inner perimeter of ring 20b terminates in a continuous raised lip 20c. O-ring 16 and lip 20c are sized to form an interference fit requiring outer O-ring 16 to be snapped over the lip 20c onto shelf section 20b where it is maintained in slight tension. Lifter 20 further includes a toroidal balloon 22 affixed around the underside of shelf section 20b and preferably sealingly attached by an adhesive 24 to the exposed surface of the abdominal wall W. An air pump (not shown) inflates balloon 22 in infinite increments to lift O-ring 16 until O-ring 14 is

snug against the inner edge of the incision and sleeve 18 is contiguous with the incision wall W. The upper end of cylinder section 20a may be formed to sealingly attach to an extracorporeal enclosure when the surgical procedure requires insufflating the body cavity. A suitable enclosure for this purpose is disclosed in U.S. Patent 5,853,395 to Berwyn M. Crook, et al.

The ease with which the protector and retractor can be installed should be readily apparent. Preferably, lifter 20 is affixed by adhesive 24 to the exposed surface around the incision. Retractor 12 is then inserted by squeezing inner O-ring 20 into an oblong shape and reinserting it lengthwise through the incision and letting it expand around the inner edge. The outer O-ring 16 is gripped by the thumb and fingers and turned outwardly to roll sleeve 18 incrementally onto O-ring 16 until the sleeve 18 is drawn into close contact with the sides of the incision. O-ring 16 and the sleeve portion of 18 wound thereon are snapped over lip 20c onto shelf section 20b where they are retained under slight tension. Finally, balloon 22 is manually inflated from an air pump (not shown). A sealed enclosure may be attached around the upper end of lifter 20 if the cavity is to be sufflated.

FIG. 2 represents a mechanical embodiment of an adjustable wound protector and retractor 10a according to the invention having wound retractor 12 installed in an incision in the manner shown in FIG. 1. A lifter assembly 30 includes a base 32 surrounding retractor 12 and defines a cylindrical section 32a extending upward from a flat ring section 32b which is sealingly secured around the incision by adhesive 24. Lifter assembly 30 further includes retractor support 34 defined by a cylindrical section 34a extending upward from a shelf section 34b. Cylindrical section 32a is axially slidable in section 32a of base 32. As best seen in FIG. 3, the facing surfaces of cylinders 32a and 34a have annular rows of facing sawteeth 38 which permit support 34 to be racheted upward from base 32 to apply additional tension to sleeve 18 in a manner similar to the pneumatic actuation in the embodiment of FIG. 1.

FIG. 4 is an alternate configuration of the interface between base 32 and retractor support 34. An O-ring 40 secured around the circumference of cylindrical section 34a selectively engages one of a plurality of circumferential grooves 42 on the

inner surface of cylindrical section 32a as support 34 is raised from base 32. It should be noted that the spacing of the sawteeth and the grooves may be made close in order to obtain maximum fine adjustment, whereas the balloon lifter has virtually infinite number of positions.

Some of the many advantages and novel features of the invention should now be readily apparent. For example, an adjustable surgical wound protector and retractor is provided which can be used for a large range of incision wall thicknesses, the sleeve length of the wound retractor can be later adjusted for a precise fitting, and it may be used in conjunction with an extracorporeal enclosure. The protector and retractor can also be easily installed.

It will be understood, of course, that various changes in the details, materials, steps and arrangement of parts which have been described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art without departing from the scope of the invention as expressed in the appended claims.

CLAIMS:

1. An adjustable surgical wound protector and retractor (10, 10a) for installation in an incision in a cavity wall (W) comprising, in combination:

an elongate pliable sleeve (18) open at each end and of a length exceeding the wall thickness,

a resilient inner O-ring (14) secured around one of said ends and pre-formed to overlap the inner edge of the incision;

a resilient outer O-ring (16) secured around the other of said ends and pre-formed to overlap the outer edge of said incision, said outer ring (16) being formed to roll said sleeve (18) onto said outer ring (16) to shorten the sleeve (18) in coarse increments; and

a lifting means (20, 30) interposed between said outer sleeve and the external surface around the incision for tightening said sleeve (18) in fine increments of motions.

2. An adjustable surgical wound protector and retractor (10) according to claim 1, wherein said lifting means (20) is pneumatically operated.

3. An adjustable surgical wound protector and retractor (10a) according to claim 1, wherein said lifting means (30) is mechanically operated.

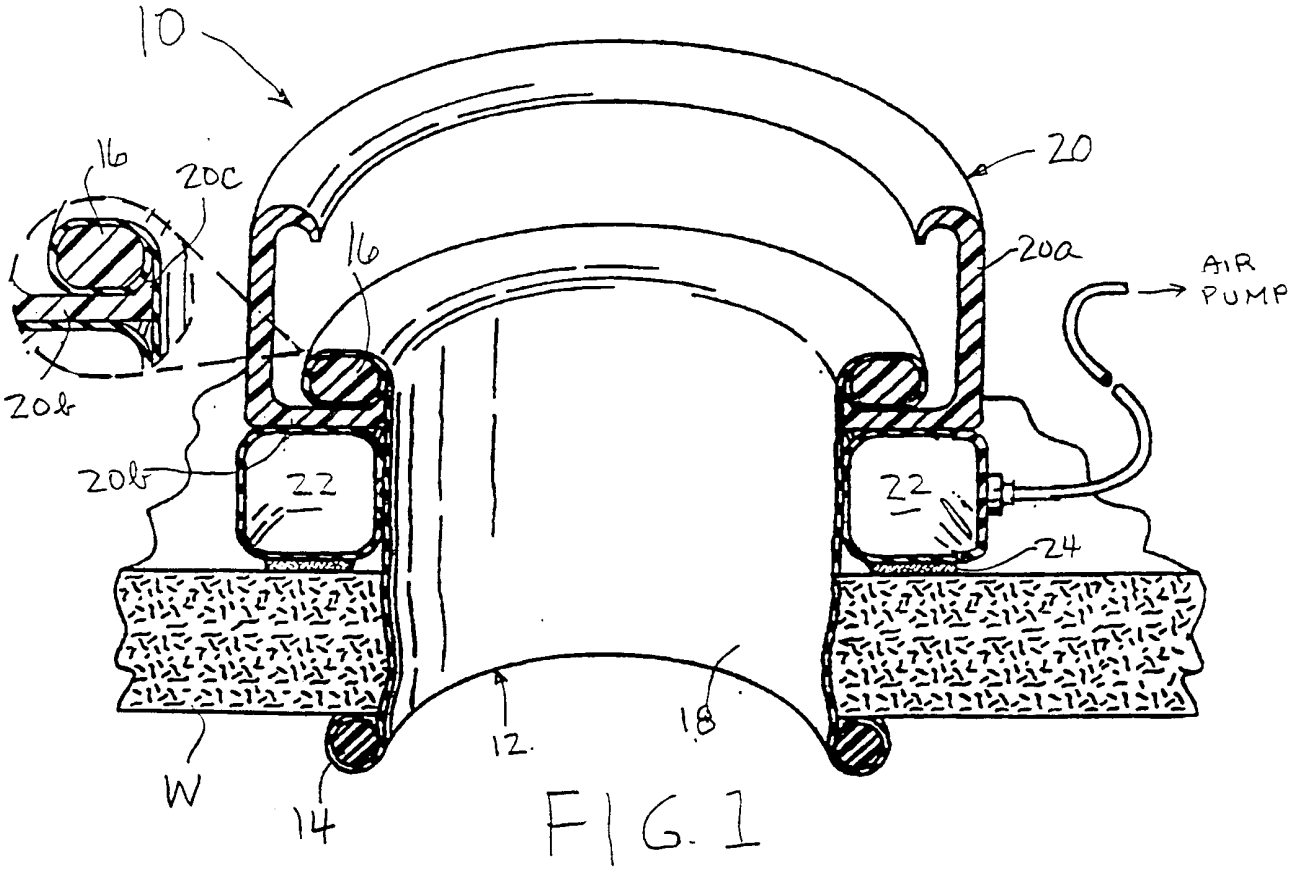

FIG. 1

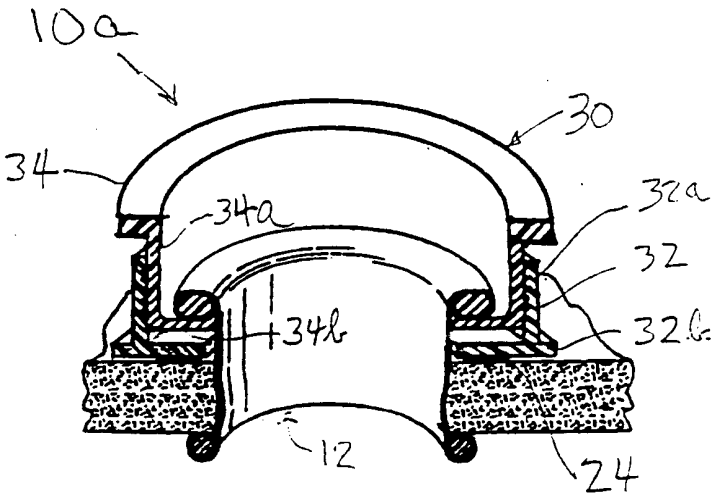

FIG. 2

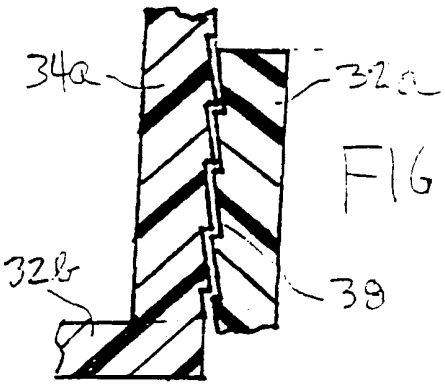

FIG 3

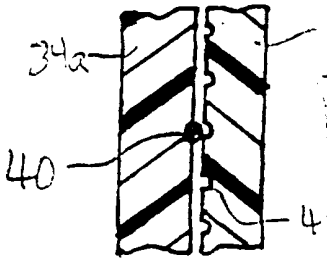

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/34578

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :A61B 17/00
US CL :606/207

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 606/207, 206, 205, 220, 235, 207; 128/850

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,159,921 A (HOOVER) 3 November 1992, see complete document.	1-3
A	US 5,906,577 A (BEANE, et al) 25 May 1999, see complete document.	1-3
A, P	US 6,033,426 A (KAJI) 7 March 2000, see complete document.	1-3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer EDUARDO C. ROBERT Telephone No. (703) 305-7333

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