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- (54) **HAND ASSISTED LAPAROSCOPIC DEVICE** 5,634,937 A 6/1997 Mollenauer et al.
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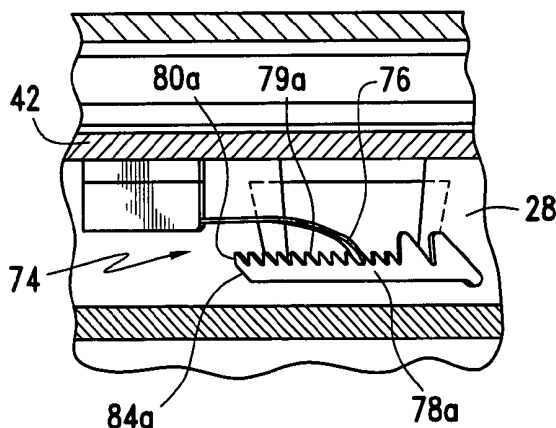
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(57) **ABSTRACT**

A seal assembly for permitting hand assisted laparoscopic procedures includes a seal cap having an iris seal positioned within a housing. The housing includes a lower seal ring having a track which supports an upper seal ring for relative rotational motion, wherein the iris seal is supported between the upper seal ring and the lower seal ring for rotation between an open orientation and a closed orientation. The seal assembly also includes a retractor extending from the seal cap.

15 Claims, 8 Drawing Sheets



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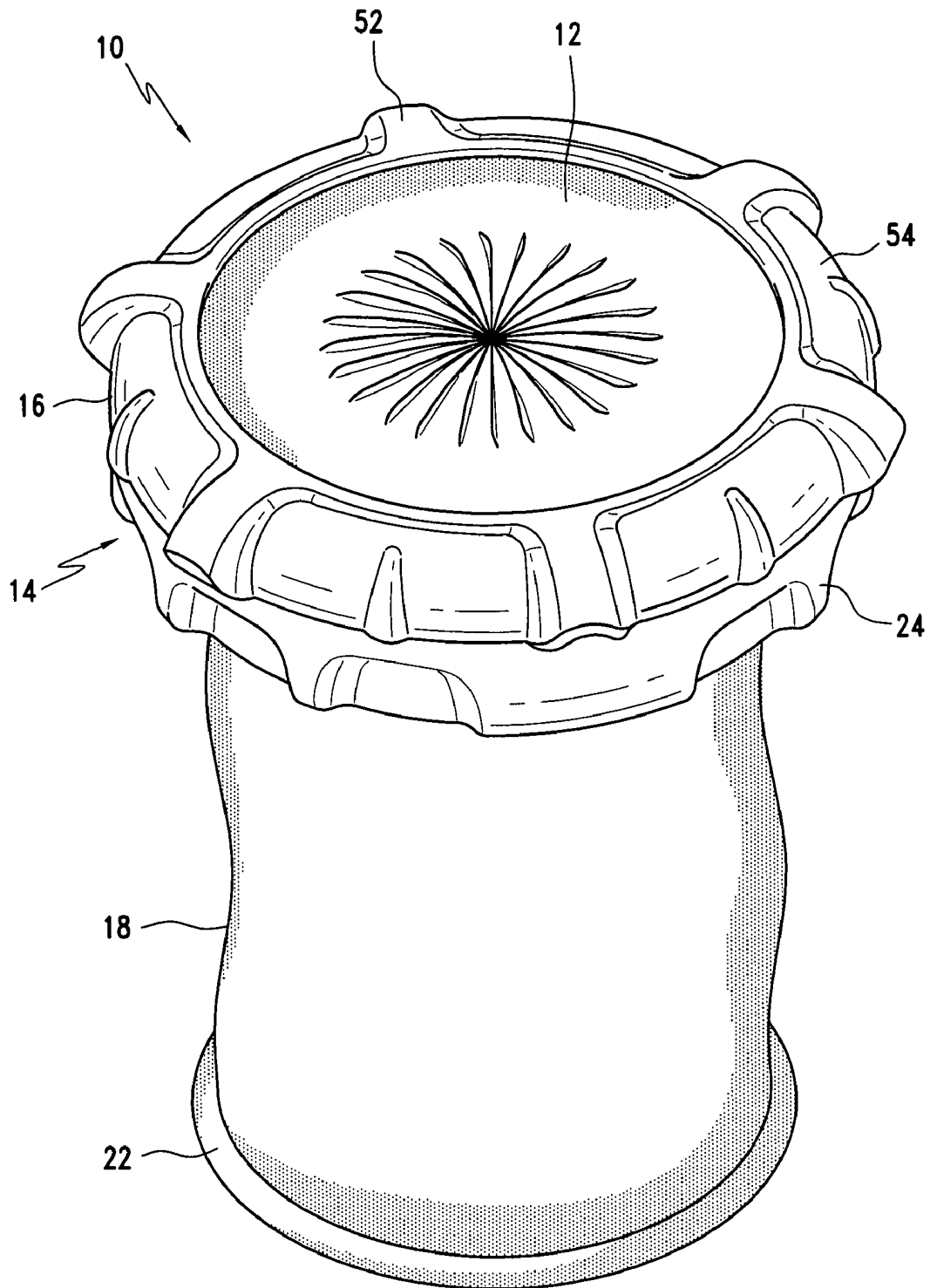


FIG. 1

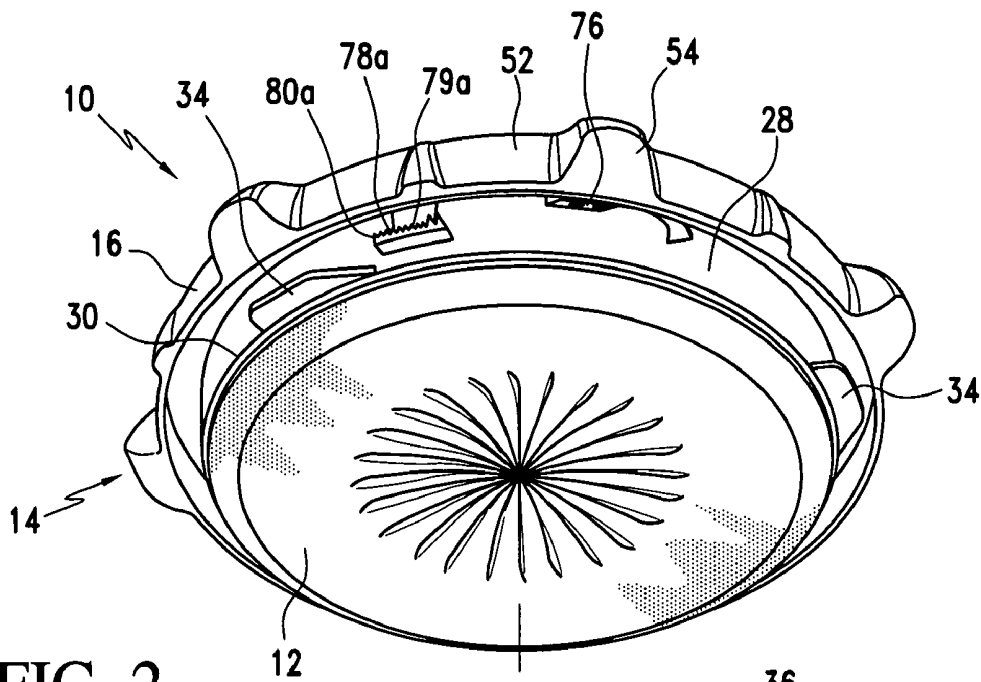


FIG. 2

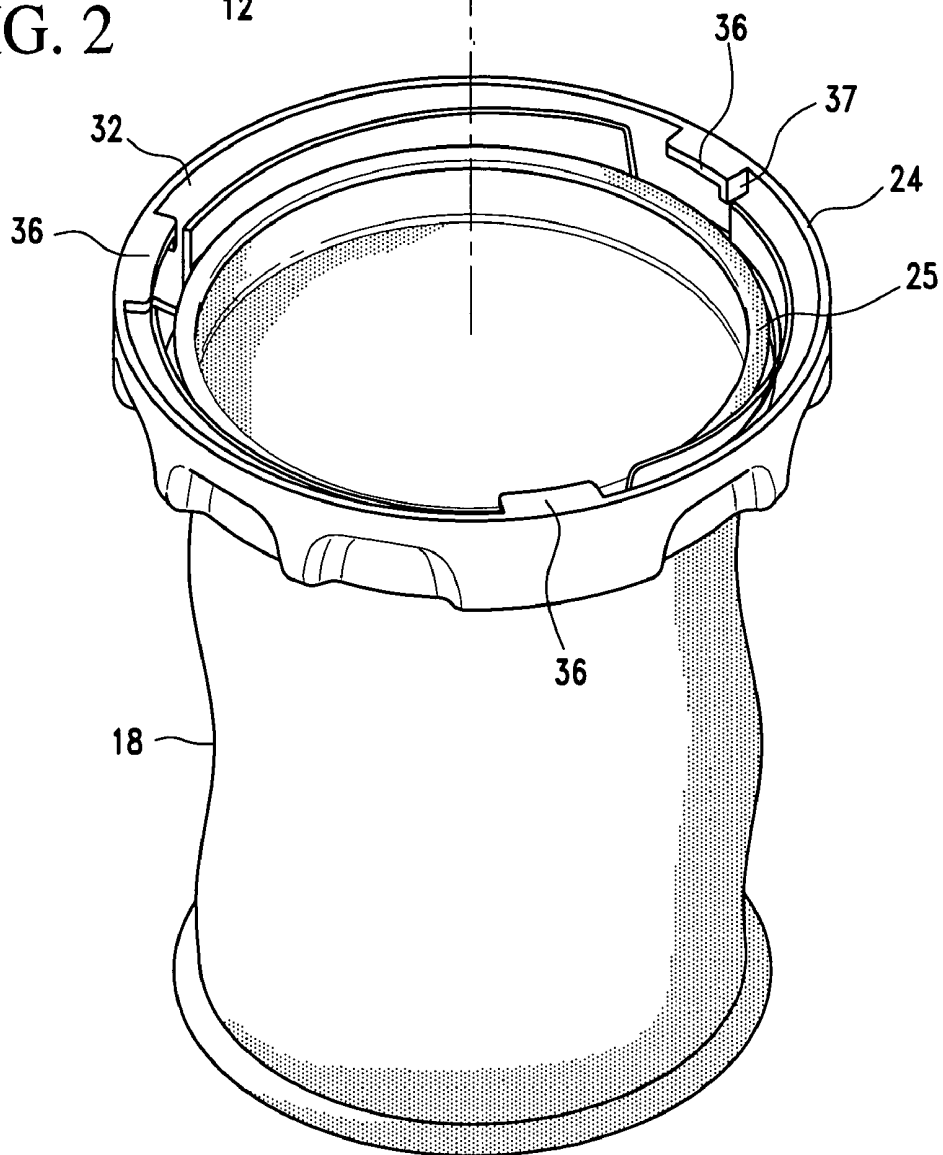
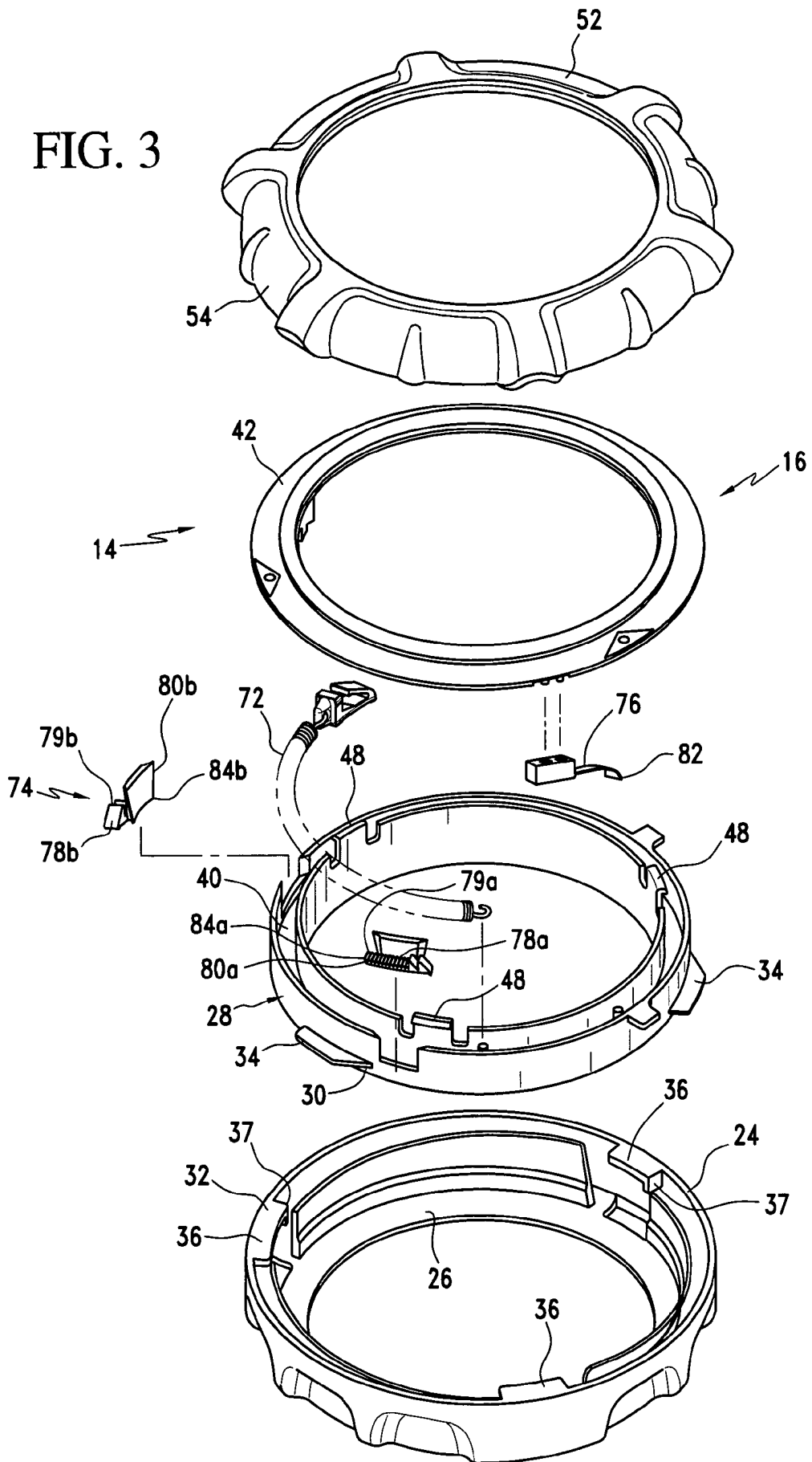


FIG. 3



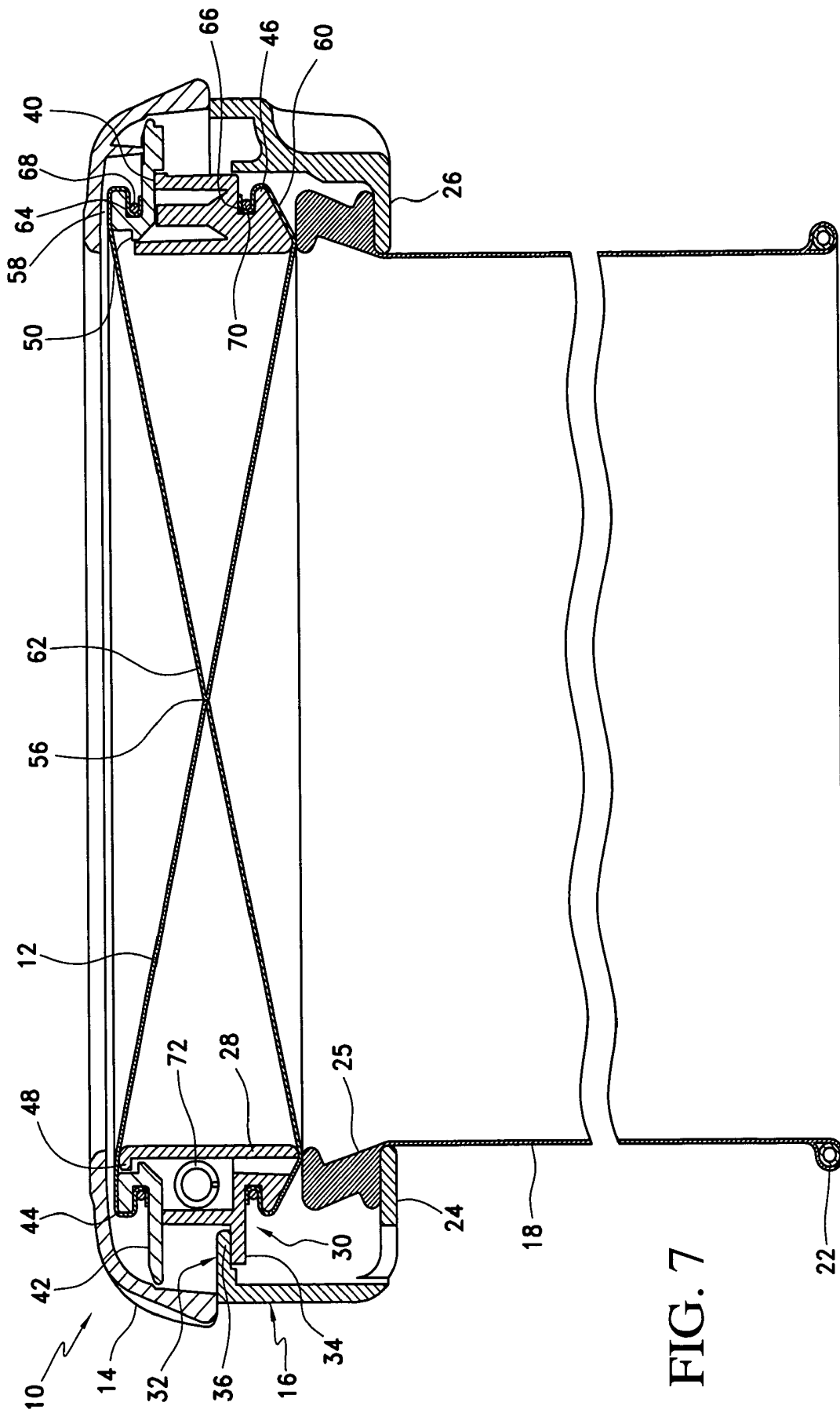


FIG. 7

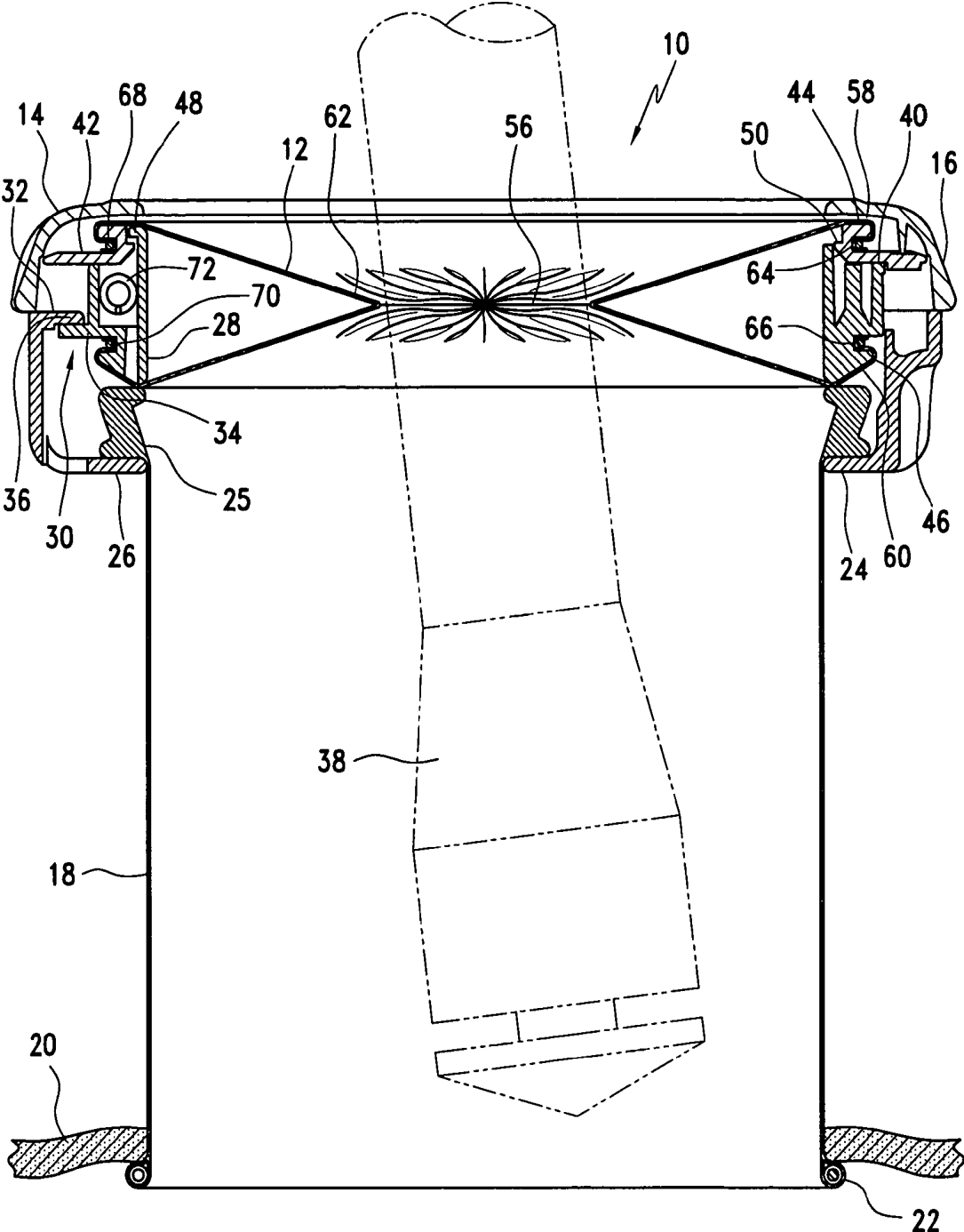


FIG. 8

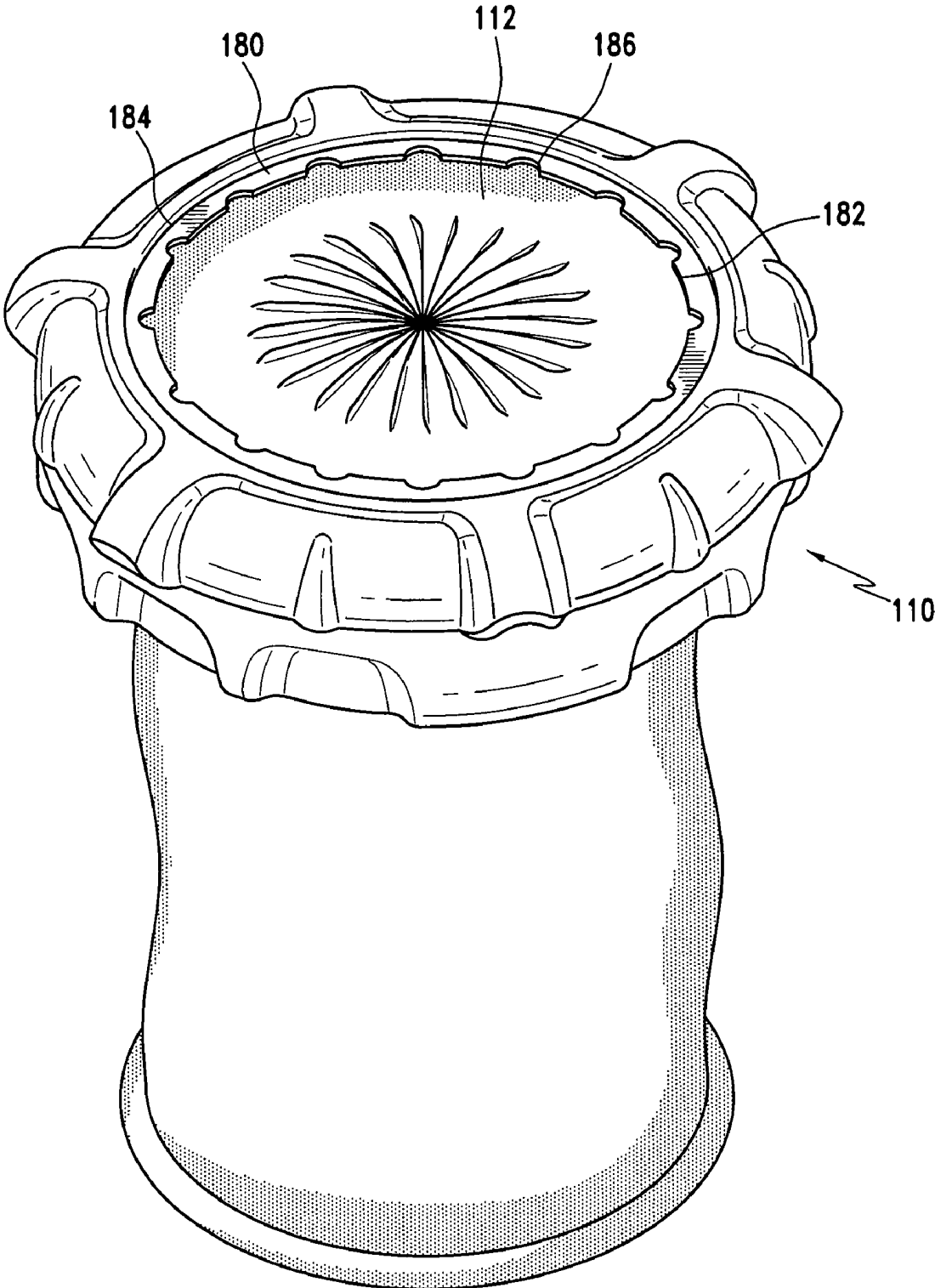


FIG. 12

HAND ASSISTED LAPAROSCOPIC DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to laparoscopic devices. In particular, the invention relates to a laparoscopic seal assembly permitting the use of hands in assisting during laparoscopic procedures.

2. Description of the Prior Art

During laparoscopic procedures, it is often desirable for the surgeon to place his or her hand within the patient in a manner manipulating the instruments positioned within the patient. When this occurs, it is desirable to separate the external environment from the internal portion of the patient. For example, when hand assisted laparoscopic procedures are performed within the abdominal cavity, it is desirable to perform hand exchanges with minimal loss of abdominal insufflation. As such, a need exists for skin mountable seals permitting hand assisted laparoscopic procedures without fear that the abdominal pressure will be compromised. The present invention provides such an apparatus.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a seal assembly for permitting hand assisted laparoscopic procedures. The seal assembly includes a seal cap having an iris seal positioned within a housing. The housing includes a lower seal ring having a track which supports an upper seal ring for relative rotational motion, wherein the iris seal is supported between the upper seal ring and the lower seal ring for rotation between an open orientation and a closed orientation. The seal assembly also attaches to a retractor extending from the seal cap.

It is also an object of the present invention to provide a seal assembly wherein the housing further connects to an attachment ring detachably secured to the lower seal ring for permitting selective attachment of the retractor by positioning it between the attachment ring and the lower seal ring.

It is also another object of the present invention to provide a seal assembly wherein the lower seal ring includes at least one outwardly extending flange shaped and dimensioned for seating within at least one inwardly facing recess formed along the attachment ring.

It is also a further object of the present invention to provide a seal assembly where an upper end of the iris seal is connected to the upper seal ring and a lower end of the iris seal is connected to the lower seal ring.

It is another object of the present invention to provide a seal assembly including an ergonomic cover member secured to the upper seal ring, wherein the ergonomic cover member includes a contoured outer surface providing for improved handling and twisting of the upper seal ring for opening and closing the iris seal.

It is a further object of the present invention to provide a seal assembly wherein the iris seal is constructed in a folded configuration spanning the upper seal ring and the lower seal ring.

It is still a further object of the present invention to provide a seal assembly wherein the iris seal is composed of a rubber like material.

It is yet another object of the present invention to provide a seal assembly including a contoured ring secured to the upper seal ring, the contoured ring including an inner circumference formed with a series of recesses shaped and dimensioned for receiving fingers of a user.

It is also an object of the present invention to provide a seal assembly including a spring biasing the upper seal ring relative to the lower seal ring.

It is another object of the present invention to provide a seal assembly including a ratchet mechanism controlling motion of the upper seal ring relative to the lower seal ring.

Other objects and advantages of the present invention will become apparent from the following detailed description when viewed in conjunction with the accompanying drawings, which set forth certain embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the present hand assisted laparoscopic seal assembly.

FIG. 2 is a perspective view of the hand assisted laparoscopic seal assembly with the attachment ring and retractor disengaged from the seal cap.

FIG. 3 is an exploded view of the seal cap of the present seal assembly.

FIGS. 4, 5 and 6 are partial sectional top views showing actuation of the present hand assisted laparoscopic seal assembly respectively between a closed position, a partially opened orientation for hand insertion and a fully opened orientation for viewing and insertion of larger instruments or specimen extraction.

FIG. 7 is cross sectional view taken along the line 7-7 in FIG. 4.

FIG. 8 is cross sectional view taken along the line 8-8 in FIG. 6 with an instrument shown in phantom.

FIGS. 9, 10 and 11 are detailed views of the ratchet mechanism in accordance with the present invention.

FIG. 12 is a perspective view of a hand assisted laparoscopic seal assembly in accordance with an alternate embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The detailed embodiments of the present invention are disclosed herein. It should be understood, however, that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, the details disclosed herein are not to be interpreted as limiting, but merely as the basis for teaching one skilled in the art how to make and/or use the invention.

Referring to FIGS. 1 to 11, a seal assembly 10 for permitting hand assisted laparoscopic procedures is disclosed. The seal assembly 10 generally employs an iris seal cap 14 and retractor 18 to ensure abdominal pressure is not compromised during hand exchanges while hand assisted laparoscopic procedures are performed. As such, and in accordance with a preferred embodiment of the present invention, the seal assembly 10 includes an iris seal 12 housed within a seal cap 14. The iris seal 12 creates a gas tight barrier around the surgeon's wrist or surgical instrument when inserted through the seal assembly 10 and also creates a gas tight barrier between the interior abdominal space and the external environment when a hand is not inserted through the seal assembly 10.

Referring to the various figures, the seal cap 14 includes an iris seal 12 positioned within a housing 16. The housing 16 is made of soft textured material such as SANTOPRENE, or other like materials and supports the iris seal 12 in a concentric manner.

As with prior hand assisted laparoscopic seal assemblies, the housing 16 of the present seal assembly 10 is secured to

the abdominal wall **20** of an individual patient by first creating an incision and positioning the retractor **18** and the seal cap **14** above the incision. Thereafter, the retractor **18**, which will eventually be coupled to the seal cap **14**, is inserted into the body cavity with the abdominal wall **20** therebetween. As such, the seal cap **14** is securely connected and supported on the outside of the abdominal wall **20** with the retractor **18** resiliently holding the abdominal wall **20** therebetween.

More particularly, the surgical site is prepared in accordance with conventional standard hospital procedures, making sure the skin is clean and dry. Thereafter, a template is placed over the incision site and an incision line is marked upon the template using a sterile skin marker. As those skilled in the art will appreciate, the glove size dictates the size of the incision. For example, if the surgeon's glove size is 7, a 6.5 to 7.0 cm incision is usually appropriate. Thereafter, an incision is made along the marked incision line. The incision size is thereafter verified by inserting the surgeon's hand into the abdomen prior to attaching the present seal assembly **10**. If the incision is too small, the incision is extended as required on each end to maintain the central position of the incision relative to the placement of the present seal assembly **10**. Thereafter, the lower retractor ring **22** of the retractor **18** is inserted through the incision. Using one's fingers, the retractor **18** is seated evenly under the peritoneum and the area is swept to ensure the lower retractor ring **22** is not lying between tissue layers. Thereafter, the seal cap **14** is attached to the retractor **18** via an attachment ring **24**, which may be rigid but is not limited to a specific material, and adjustments are made to ensure the seal assembly **10** is secured with the patient's abdomen maintaining pneumo. As those skilled in the art will certainly appreciate, the retractor may be a fixed length or adjustable length retractor. In either case the retractor **18** must fit the abdominal wall thickness to maintain stability and pneumo. As briefly discussed above, the present seal assembly **10** is provided with an attachment ring **24** that is detachable from the remaining portions of the housing **16** for permitting selective attachment of the retractor **18** to the present seal cap **14**. It is further contemplated, the attachment ring **24** can facilitate other accessory cap attachments, such as instrument port cap. In particular, the upper end **25** of the retractor **18** is seated within a ledge **26** formed in the attachment ring **24** (best seen in FIG. 3). Thereafter, the attachment ring **24** is secured to the lower seal ring **28** such that the retractor **18** is captured between the attachment ring **24** and the lower seal ring **28**.

Selective attachment and detachment of the attachment ring **24** from the lower seal ring **28** is achieved through the provision of interlocking engagement structures formed along the lower surface **30** of the lower seal ring **28** and the upper surface **32** of the attachment ring **24**. In particular, the lower seal ring **28** is formed with a plurality of outwardly extending flanges **34** that are shaped and dimensioned for seating within inwardly facing recesses **36** formed along the attachment ring **24**. As such, one need only twist the outwardly extending flanges **34** into the inwardly extending recesses **36** to securely couple the attachment ring **24** to the lower seal ring **28**, and ultimately to the remainder of the housing **16** of the seal cap **14**. Rotation is controlled by providing the recesses **36** with a wall **37** that stops rotation of the lower seal ring **28** relative to the attachment ring **24**. The wall **37** is positioned on the side of the recess **36** that is in the same rotational direction as the direction to open the iris seal **12** (and in accordance with a preferred embodiment, clockwise). When it is desired to detach the attachment ring **24** from the lower seal ring **28**, one need only turn the lower seal ring **28** in the opposite direction, that is, counter-clockwise in

accordance with a preferred embodiment, with slight pressure to overcome the frictional interference between the outwardly extending flanges **34** of the lower seal ring **28** and the inwardly directed recesses **36** of the attachment ring **24** such that the flanges **34** and recesses **36** are unseated in a manner permitting separation of the attachment ring **24** and the lower seal ring **28**. It will be understood by those skilled in the art that the disconnect torque must be greater than the rotational torque of the iris seal. Although the present invention discloses a bayonet type of connection, many other techniques can be applied without departing from the spirit of the present invention, for example, axial snaps or latches may be employed. Also, although the retractor is disclosed as being detachably secured to the seal cap **14**, it may be fixedly secured thereto without departing from the spirit of the present invention.

In accordance with a preferred embodiment, the iris seal **12** is a rotatable seal which selectively opens to permit passage of a surgeon's hand therethrough and automatically closes in a manner creating a gas tight barrier between the interior abdominal space and the external environment whether or not a hand or instrument **38** is inserted through the seal assembly **10**. In particular, the housing **16** in which the iris seal **12** is supported includes a lower seal ring **28** having a track **40** which supports an upper seal ring **42** for relative rotational motion in a manner discussed below in greater detail.

As will be discussed below in greater detail, the upper end **44** of the iris seal **12** is permanently connected to the upper seal ring **42**. The lower end **46** of the iris seal **12** is permanently connected to the lower seal ring **28**. The upper seal ring **42** and the lower seal ring **28** are connected together for relative rotational movement in a manner allowing for opening and closing of the iris seal **12**. In accordance with a preferred embodiment, the upper seal ring **42** and the lower seal ring **28** are connected by at least three snap tabs **48** located on the lower seal ring **28** that are shaped and dimensioned to engage a recess **50** along the inner edge of the upper seal ring **42**.

An ergonomic cover member **52** is secured to the upper seal ring **42**. The ergonomic cover member **52** includes a contoured outer surface **54** providing for improved handling and twisting of the upper seal ring **42** for opening and closing the iris seal **12** in accordance with the present invention. In accordance with a preferred embodiment, the ergonomic cover member **52** is a separate component fixedly secured to the upper seal ring **42** such that rotational force applied to the ergonomic cover member **52** is transmitted on to the upper seal ring **42** for opening and closing of the iris seal **12**. However, and as those skilled in the art will certainly appreciate, the ergonomic cover member **52** could be integrally formed with the upper seal ring **42**, while still remaining within the spirit of the present invention.

Referring to FIGS. 4, 5, 6, 7 and 8, as discussed below in greater detail, the iris seal **12** is secured between the upper seal ring **42** and the lower seal ring **28**. The upper seal ring **42** is supported within a track **40** of the lower seal ring **28** in a manner facilitating rotational movement between the upper seal ring **42** and the lower seal ring **28**. In this way, the rotational movement of the upper seal ring **42** relative to the lower seal ring **28** is utilized to control the opening and closing of the iris seal **12** for one-hand insertion of a hand through the present seal assembly **10**.

The iris seal **12** is mounted between the upper seal ring **42** and the lower seal ring **28** such that upon rotation of the upper seal ring **42** in a predetermined direction, the central access opening **56** of the iris seal **12** will open providing a surgeon with an access opening **56** for passage of his hand there-

through. Automatically the upper seal ring **42**, and ultimately, the iris seal **12** will rotate in the reverse direction, the access opening **56** will close securely about the wrist of the surgeon or instrument. That is, the upper seal ring **42** and the iris seal **12** are moved between open orientations (see FIGS. **5**, **6** and **8**) in which an access opening **56** is created within the iris seal **12** and a closed orientation (see FIGS. **4** and **7**) in which the iris seal **12** is either wrapped about the wrist of a user with his or her hand inserted therein or substantially fully closed when the iris seal **12** is not in use.

Opening and closing of the iris seal **12** is achieved by constructing the iris seal **12** in a folded configuration spanning the upper seal ring **42** and the lower seal ring **28** in a substantially taut configuration. As such, rotation of the upper seal ring **42** in a first direction will result in an increase of tension along the iris seal **12** in a manner drawing the fold outwardly opening the central access opening **56** in the iris seal **12**.

In accordance with the preferred embodiment, the iris seal **12** is composed of a rubber like member. The rubber like member is constructed in the shape of a cylindrical section with the upper and lower sections **58**, **60** thereof having a wider diameter than the central section **62** (thereby offering a generally I-shaped cross-section as shown in FIGS. **7** and **8** when assembled). As will be appreciated based upon the following disclosure, the construction of the rubber like member creates a substantially planar iris seal **12** which is closed or opened when the upper seal ring **42** and the lower seal ring **28** are relatively rotated in opposite directions.

In accordance with a preferred embodiment, the rubber like member is formed from a thin film having a thickness around 0.010" to 0.013" and made from a material having elasticity, such as, natural rubber, synthetic rubber, poly vinyl chloride, silicon and a variety of elastomers (for example, urethane, polyisoprene, silicone). As briefly mentioned above, the rubber like member is tapered cylindrical and includes a central access opening **56** having a predetermined cross sectional area at the central section **62** thereof. The rubber like member is shaped such that the diameter of the opening decreases in the direction from the upper and lower sections to the central section **62** of the rubber like member. Furthermore, the upper and lower ends **44**, **46** of the iris seal **12**, which are fitted into the grooves **64**, **66** of the upper seal ring **42** and the lower seal ring **28** and held therein with o-rings **68**, **70**, allow for detachment from the upper seal ring **42** and the lower seal ring **28**. In accordance with a preferred embodiment, the o-rings are integrated into the iris seal, minimizing components and material cost. Because of such detachable structure of the rubber like member, it can be easily replaced by a fresh member when the used rubber like member is broken or worn. This technique would be useful for reusable devices.

Referring to FIGS. **4**, **5**, **6**, **7** and **8**, a plan view and a sectional view are presented, showing the iris seal **12** in its respective closed and open states. FIGS. **6** and **8** show the iris seal **12** in a fully opened orientation for viewing within the cavity or insertion of an instrument or hand therethrough, while FIG. **5** shows a partially opened orientation sufficient for passing a hand therethrough when sealing thereabout is desired.

This open state is created when the upper seal ring **42** is rotated at a predetermined angle, for example, 15 degrees, from the closed state of the iris seal **12**, and the access opening **56** is created.

In accordance with an alternate embodiment, and with reference to FIG. **12**, improved access to the movement of the upper seal ring, and ultimately, the iris seal **112**, is achieved by the provision of a contoured ring **180** secured to the upper

surface of the upper seal ring. The contoured ring **180** is substantially annular and includes an inner circumference **182** and an outer circumference **184**. The outer circumference **184** is substantially smooth and conforms to the profile of the upper seal ring. However, the inner circumference **182** is formed with a series of recesses **186** shaped and dimensioned for receiving the fingers of a medical practitioner attempting to use the present seal assembly **110**. In particular, the recesses **186** are shaped and dimensioned such that an individual wishing to use the present seal assembly **110** may seat his or her fingers therein and rotate the contoured ring, and the upper seal ring to which the contoured ring **180** is rigidly attached, and ultimately the iris seal **112** with only one hand. While the iris seal **112** is in its open orientation, the user may simply slip his or her hand through the iris seal **112** and proceed with the surgical procedure with minimal loss of insufflation. This feature allows the physician's other hand to be free and undisturbed, allowing the surgeon to maintain his procedural focus and position with the free hand during hand exchanges.

In accordance with a preferred embodiment, the upper seal ring **42** is biased relative to the lower seal ring **28** by a spring **72** to immediately return to the closed orientation upon rotation of the upper seal ring **42** relative to the lower seal ring **28** to its open orientation with subsequent release thereof. As such, the surgeon may rotate the upper seal ring **42** relative to the lower seal ring **28** through engagement of the contoured surface of the ergonomic cover member **52**, the contoured ring **180** (in accordance with the embodiment shown with reference to FIG. **12**) or the iris seal **12** to move the iris seal **12** from its closed orientation to an open orientation opening the access opening **56** for passage of his or her hand therethrough. Once his or her hand is passed therethrough, the upper seal ring **42**, ergonomic cover member **52**, contoured ring **180** and/or the iris seal **12** are released allowing the action of the spring **72** to move the upper seal ring **42** and the iris seal **12** back toward the closed orientation.

As some surgeons may want to maintain an open position using the auto-closing device, a ratchet mechanism **74** has been developed wherein the surgeon has control over the spring biased action moving the upper seal ring **42** relative to the lower seal ring **28** and iris seal **12** from its open orientation to its closed orientation. Although a ratchet system is disclosed in accordance with a preferred embodiment of the present invention, those skilled in the art will appreciate that a seal assembly without a ratchet assembly could also be practiced within the spirit of the present invention.

In accordance with a preferred embodiment, and with reference to FIGS. **3** to **11**, the upper seal ring **42** is seated within the track **40** of the lower seal ring **28** with the spring **72** biasing the upper seal ring **42** relative to the lower seal ring **28** for movement relative thereto opening the access opening **56**. However, a ratchet mechanism **74** is positioned between the upper seal ring **42** and the lower seal ring **28**. The ratchet mechanism **74** includes a ratchet arm **76** secured to the upper seal ring **42** which is oriented to engage upwardly facing first and second ratchet surfaces **78a**, **78b** composed of a plurality of ratchet teeth **79a**, **79b** on the lower seal ring **28** which functions to hold the upper seal ring **42** relative to the lower seal ring **28** as it is moved to an open orientation. In practice, the ratchet arm **76** is shaped and dimensioned to engage the teeth **79a**, **79b** of the ratchet surfaces **78a**, **78b** when rotated in a first direction (for example, and in accordance with a preferred embodiment, clockwise rotation when viewed from above). However, once the upper seal ring **42** is rotated such that the ratchet arm **76** moves beyond the rear end **80a**, **80b** of the ratchet surfaces **78a**, **78b**, the ratchet arm **76** is free to

move under the ratchet surfaces **78a**, **78b** as the upper surface ring **42** is rotated in a second direction opposite the first direction.

This is achieved by providing the ratchet arm **76** with a tapered distal end **82** which is biased by a similar tapered surface **84a**, **84b** on the respective rear end **80a**, **80b** of the ratchet surfaces **78a**, **78b** to ride under the ratchet surfaces **78a**, **78b** as the upper seal ring **42** is rotated relative to the lower seal ring **28** in a second direction. However, when the upper seal ring **42** is rotated in a first direction, the distal end **82** of the ratchet arm **76** is biased to ride over the upper surface of the ratchet surfaces **78a**, **78b** such that it engages the various teeth **79a**, **79b** to control movement of the upper seal ring **42** relative to the lower seal ring **28**.

In accordance with a preferred embodiment of the present invention, first and second ratchet surfaces **78a**, **78b** are provided. The first ratchet surface **78a** engages the ratchet arm **76** when the upper and lower seal rings **42**, **28** are oriented to provide a relatively small opening in the iris seal **12** through which a medical practitioner may pass his or her hand to gain access to a body cavity. The configuration is especially suited to single hand interactions where a user may rotate the upper seal ring **42** relative to the lower seal ring **28** with the same hand which is to be passed through the present seal assembly **10**. In particular, and as a result of the ratchet mechanism **74**, a user may, for example, use his or her left hand to rotate the upper seal ring **42** relative to the lower seal ring **28** in a manner slightly or partially opening the iris seal **12** as shown in FIG. **5**. When in this position, the audible click sound and slight resistance produced as the ratchet arm **76** moves over the first ratchet surface **78a** will provide the user with an indication a stopping position has been reached. At this point, the user may release the upper seal ring **42** without fear that the iris seal **12** will snap back to its closed orientation. Rather, the ratchet mechanism **74** holds the upper and lower seal rings **42**, **28** relative to each other, allowing the user to slip his or her hand through the opening in the iris seal **12**. As the user pushes his or her hand through the iris seal **12**, the outward force causes a slight rotation of the upper seal ring **42** relative to the lower seal ring **28** in a manner disengaging the ratchet arm **76** from the first ratchet surface **78a**, and allowing the upper seal ring **42** to rotate relative to the lower seal ring **28** under the bias of the spring **72** to move the iris seal **12** back to its closed orientation, securely wrapping it about the user's wrist/forearm. As such, when the user must pull his or her arm from the seal assembly **10**, the iris seal **12** will automatically close sealing the body cavity from the external environment.

The second ratchet surface **78b** allows the seal assembly **10** to be locked in a larger open configuration allowing for more complete access to the body cavity. As those skilled in the art will certainly appreciate, it is at times desirable to provide a large access opening to the body cavity. As such, the present seal assembly **10** is provided with a second ratchet surface **78b** providing for locking of the upper seal ring **42** and the lower seal ring **28** relative to each other when the iris seal **12** is more fully opened as shown in FIG. **6**. As with the first ratchet surface **78a**, the second ratchet surface **78b** engages the ratchet arm **76** when the upper and lower seal rings **42**, **28** are oriented in a particular orientation providing, in this case, a relatively large opening in the iris seal **12**. A user rotates the upper seal ring **42** relative to the lower seal ring **28** to create an opening in the iris seal **12** beyond the small opening as shown in FIG. **5**. Once the first ratchet surface **78a** is passed (as indicated by the first series of audible clicks), the audible clicking sound produced as the ratchet arm **76** moves over the second ratchet surface **78b** will provide the user with an indication a stopping position has been reached. At this point,

the user may release the upper seal ring **42** without fear that the iris seal **12** will close, and proceed to utilize the large opening for access to the body cavity in a desired manner. When the user no longer requires this access, he or she may simply rotate the upper seal ring **42** relative to the lower seal ring **28** in a first direction slightly opening the iris seal **12**, at which point the ratchet arm **76** will disengage from the second ratchet surface **78b** and allow the upper seal ring **42** to rotate relative to the lower seal ring **28** under the bias of the spring **72** to move the iris seal **12** back to its closed orientation.

While the preferred embodiments have been shown and described, it will be understood that there is no intent to limit the invention by such disclosure, but rather, is intended to cover all modifications and alternate constructions falling within the spirit and scope of the invention.

The invention claimed is:

1. A seal assembly for permitting hand assisted laparoscopic procedures, comprising:

a seal cap including a seal positioned within a housing, the housing including a lower seal ring having a track which supports an upper seal ring for relative rotational motion, wherein the seal is supported between the upper seal ring and the lower seal ring for rotation between an open orientation and a closed orientation;

a spring biasing the upper seal ring relative to the lower seal ring; and

a ratchet mechanism controlling motion of the upper seal ring relative to the lower seal ring the ratchet mechanism includes a ratchet arm oriented to engage a ratchet surface composed of a plurality of ratchet teeth, the ratchet arm being shaped and dimensioned to engage the ratchet teeth of the ratchet surface when rotated in a first direction until the ratchet arm moves beyond a rear end of the ratchet surface, where the ratchet arm is free to move past the ratchet surfaces and rotate in a second direction opposite the first direction.

2. The seal assembly according to claim 1, further including a retractor extending from the seal cap.

3. The seal assembly according to claim 2, wherein the housing further includes an attachment ring detachably secured to the lower seal ring for permitting selective attachment of the retractor by positioning it between the attachment ring and the lower seal ring.

4. The seal assembly according to claim 3, wherein the lower seal ring includes at least one outwardly extending flange shaped and dimensioned for seating within at least one inwardly facing recess formed along the attachment ring.

5. The seal assembly according to claim 1, where an upper end of the seal is connected to the upper seal ring and a lower end of the iris seal is connected to the lower seal ring.

6. The seal assembly according to claim 1, further including an ergonomic cover member secured to the upper seal ring, wherein the ergonomic cover member includes a contoured outer surface providing for improved handling and twisting of the upper seal ring for opening and closing the seal.

7. The seal assembly according to claim 1, wherein the seal is an iris seal.

8. The seal assembly according to claim 7, wherein the iris seal is constructed in a folded configuration spanning the upper seal ring and the lower seal ring.

9. The seal assembly according to claim 7, wherein the iris seal is composed of a rubber like member.

10. The seal assembly according to claim 1, further including a contoured ring secured to the upper seal ring, the con-

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toured ring including an inner circumference formed with a series of recesses shaped and dimensioned for receiving fingers of a user.

11. The seal assembly according to claim 1, wherein the ratchet arm is shaped and dimensioned to engage the ratchet surface when the upper seal ring is rotated relative to the lower seal ring in the first direction and rides under the ratchet surface when the upper seal ring is rotated relative to the lower seal ring in the second direction.

12. The seal assembly according to claim 11, wherein the ratchet arm includes a tapered distal end shaped and dimensioned to ride under the ratchet surface as the upper seal ring

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is rotated relative to the lower seal ring in the second direction.

13. The seal assembly according to claim 1, wherein the ratchet arm is secured to the upper seal ring and the ratchet surface is on the lower seal ring.

14. The seal assembly according to claim 13, further including first and second ratchet surfaces on the lower seal ring.

15. The seal assembly according to claim 1, further including first and second ratchet surfaces.

* * * * *

专利名称(译)	手助腹腔镜设备		
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摘要(译)

一种用于允许手辅助腹腔镜手术的密封组件包括密封帽，该密封帽具有位于壳体內的虹膜密封件。壳体包括具有轨道的下密封环，该轨道支撑上密封环以进行相对旋转运动，其中虹膜密封件支撑在上密封环和下密封环之间，用于在打开方向和闭合方向之间旋转。密封组件还包括从密封帽延伸的牵开器。

