US009186053B2

(12) **United States Patent**
Viola

(10) **Patent No.: US 9,186,053 B2**
(45) **Date of Patent: Nov. 17, 2015**

(54) **METHODS OF USING LIGHT TO REPAIR HERNIA DEFECTS**

(71) Applicant: **Covidien LP**, Mansfield, MA (US)

(72) Inventor: **Frank J. Viola**, Sandy Hook, CT (US)

(73) Assignee: **Covidien LP**, Mansfield, MA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 293 days.

(21) Appl. No.: **13/860,695**

(22) Filed: **Apr. 11, 2013**

(65) **Prior Publication Data**

US 2013/0296657 A1 Nov. 7, 2013

Related U.S. Application Data

(60) Provisional application No. 61/641,974, filed on May 3, 2012.

(51) **Int. Cl.**

A61B 1/06	(2006.01)
A61B 17/00	(2006.01)
A61F 2/00	(2006.01)
A61B 19/00	(2006.01)

(52) **U.S. Cl.**

CPC ***A61B 1/06*** (2013.01); ***A61B 17/00234*** (2013.01); ***A61B 19/5202*** (2013.01); ***A61B 19/5212*** (2013.01); ***A61F 2/0063*** (2013.01); *A61B 2019/202* (2013.01); *A61B 2019/5206* (2013.01); *A61B 2019/5445* (2013.01); *A61F 2002/0072* (2013.01)

(58) **Field of Classification Search**

CPC A61B 1/07; A61B 1/00165; A61B 1/06; A61B 19/5202

USPC 600/2–343, 414–415, 424–429; 607/88, 607/90–93; 606/151, 153–155

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,272,204	A *	9/1966	Artandi et al.	606/151
3,376,869	A *	4/1968	Borysko	606/151
4,562,832	A *	1/1986	Wilder et al.	600/223
4,619,249	A *	10/1986	Landry	600/245
4,688,554	A *	8/1987	Habib	600/114
4,898,175	A	2/1990	Noguchi	
5,143,076	A	9/1992	Hardy et al.	
5,242,456	A *	9/1993	Nash et al.	606/142
5,269,753	A *	12/1993	Wilk	600/116
5,275,166	A *	1/1994	Vaitekunas et al.	600/439
5,280,788	A *	1/1994	Janes et al.	600/476
5,290,217	A *	3/1994	Campos	600/37
5,337,736	A *	8/1994	Reddy	600/217
5,353,786	A *	10/1994	Wilk	600/249
5,383,477	A *	1/1995	DeMatteis	128/898

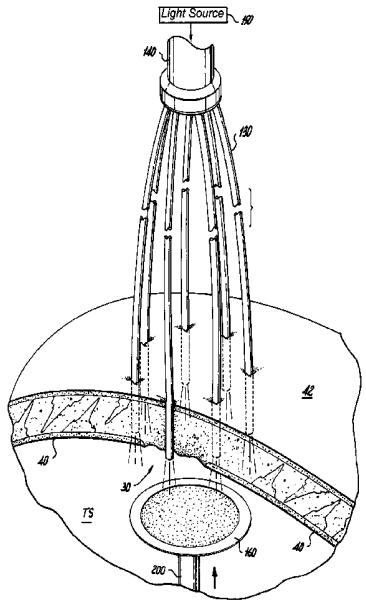
(Continued)

Primary Examiner — Eduardo C Robert
Assistant Examiner — Michelle C. Eckman

(57) **ABSTRACT**

A hernia repair method includes the step of identifying a hernia defect in a patient, the hernia defect having a size, a location, and a shape. The method involves positioning a dispensing instrument laparoscopically into the patient adjacent the hernia defect. According to one step, the method includes dispensing one or more light pipes from the dispensing instrument at predetermined locations. The method also involves advancing the one or more light pipes through the patient's skin. Another step includes coupling a light source to the one or more light pipes. The method also involves generating a pattern of light that indicates one or more of the size, the location, and the shape of the hernia defect. One step includes positioning a surgical patch adjacent the hernia defect in accordance with the pattern of light.

20 Claims, 9 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,433,721 A * 7/1995 Hooven et al. 606/143
5,456,720 A * 10/1995 Schultz et al. 623/23.64
5,517,997 A 5/1996 Fontenot
5,540,711 A * 7/1996 Kieturakis et al. 606/192
5,607,443 A * 3/1997 Kieturakis et al. 606/192
5,622,170 A 4/1997 Schulz
5,695,525 A * 12/1997 Mulhauser et al. 606/151
5,713,869 A * 2/1998 Morejon 604/174
5,730,756 A * 3/1998 Kieturakis et al. 606/190
5,772,680 A * 6/1998 Kieturakis et al. 606/190
5,807,387 A 9/1998 Druais
5,891,158 A 4/1999 Manwaring et al.
5,907,395 A 5/1999 Schulz et al.
5,972,007 A * 10/1999 Sheffield et al. 606/151
5,987,349 A 11/1999 Schulz
5,989,269 A * 11/1999 Vibe-Hansen et al. 606/151
6,004,337 A * 12/1999 Kieturakis et al. 606/190
6,041,249 A 3/2000 Regn
6,096,049 A 8/2000 McNeirney et al.
6,138,681 A 10/2000 Chen et al.
6,193,653 B1 * 2/2001 Evans et al. 600/210
6,251,110 B1 * 6/2001 Wampler 606/49
6,257,241 B1 * 7/2001 Wampler 128/898
6,286,514 B1 9/2001 Lemelson
6,287,344 B1 * 9/2001 Wampler et al. 623/23.72
6,293,282 B1 9/2001 Lemelson
6,317,616 B1 11/2001 Glossop
6,354,297 B1 * 3/2002 Eiseman 128/898
6,416,486 B1 * 7/2002 Wampler 601/2
6,442,409 B1 8/2002 Peyman
6,442,416 B1 8/2002 Schultz
6,447,527 B1 * 9/2002 Thompson et al. 606/174
6,540,764 B1 * 4/2003 Kieturakis et al. 606/190
6,569,172 B2 * 5/2003 Asculai et al. 606/151
6,587,702 B1 * 7/2003 Ruchti et al. 600/310
6,597,941 B2 7/2003 Fontenot et al.
6,694,164 B2 2/2004 Glossop
6,711,423 B2 3/2004 Colvin, Jr.
6,750,311 B1 * 6/2004 Van Antwerp et al. 528/77
6,873,867 B2 3/2005 Vilsmeier
6,978,166 B2 12/2005 Foley et al.
6,991,637 B2 * 1/2006 Crawley et al. 606/151
7,040,807 B2 5/2006 Scheuering
7,224,472 B2 5/2007 Bauch et al.
7,297,153 B2 * 11/2007 Kieturakis et al. 606/190
7,404,819 B1 * 7/2008 Darios et al. 606/151
7,450,783 B2 * 11/2008 Talapov et al. 382/286
7,728,868 B2 6/2010 Razzaque et al.
7,751,865 B2 7/2010 Jascob et al.
7,881,770 B2 2/2011 Melkent et al.
RE44,380 E * 7/2013 de la Torre et al. 604/256
8,617,157 B2 * 12/2013 Craig 606/41
RE44,790 E * 3/2014 de la Torre et al. 604/256
8,814,788 B2 * 8/2014 Gan 600/206
2002/0099279 A1 * 7/2002 Pfeiffer et al. 600/314
2004/0049251 A1 * 3/2004 Knowlton 607/101
2004/0064019 A1 * 4/2004 Chang et al. 600/180
2004/0204734 A1 * 10/2004 Wagner et al. 606/190
2004/0220516 A1 * 11/2004 Solomon et al. 604/66
2004/0236231 A1 * 11/2004 Knighton et al. 600/476
2005/0004576 A1 * 1/2005 Benderev 606/72
2005/0113798 A1 * 5/2005 Slater et al. 604/508
2005/0216040 A1 * 9/2005 Gertner et al. 606/151
2005/0216041 A1 * 9/2005 Okada et al. 606/151
2005/0277900 A1 * 12/2005 Klein et al. 604/318
2005/0288691 A1 12/2005 Leiboff
2005/0288706 A1 * 12/2005 Widomski et al. 606/213
2006/0069313 A1 * 3/2006 Couvillon et al. 600/179
2006/0270908 A1 * 11/2006 Luloh et al. 600/182
2006/0282105 A1 * 12/2006 Ford et al. 606/151
2007/0073160 A1 * 3/2007 Imam 600/476
2007/0088391 A1 * 4/2007 McAlexander et al. 606/232
2007/0185506 A1 * 8/2007 Jackson 606/151
2007/0260179 A1 * 11/2007 Sholev et al. 604/103
2007/0270890 A1 * 11/2007 Miller 606/151
2008/0033263 A1 * 2/2008 Marcinek et al. 600/322
2008/0058836 A1 3/2008 Moll et al.
2008/0065229 A1 * 3/2008 Adams 623/23.75
2008/0081945 A1 * 4/2008 Toso et al. 600/37
2008/0082078 A1 * 4/2008 Berlin 604/521
2008/0109015 A1 * 5/2008 Chu et al. 606/139
2008/0132753 A1 * 6/2008 Goddard 600/37
2008/0132917 A1 * 6/2008 Mueller 606/144
2008/0167546 A1 * 7/2008 Youmans et al. 600/407
2009/0105728 A1 * 4/2009 Noda et al. 606/139
2009/0171142 A1 * 7/2009 Chu 600/37
2009/0187181 A1 7/2009 Shadduck
2009/0192528 A1 * 7/2009 Higgins et al. 606/151
2009/0192530 A1 * 7/2009 Adzich et al. 606/151
2009/0210006 A1 * 8/2009 Cohen et al. 606/232
2009/0216253 A1 * 8/2009 Bell et al. 606/153
2009/0234370 A1 9/2009 Haras
2009/0234379 A1 * 9/2009 Rehnke 606/190
2010/0036393 A1 2/2010 Unsworth
2010/0042091 A1 2/2010 Shadduck
2010/0056928 A1 * 3/2010 Zuzak et al. 600/476
2010/0104608 A1 * 4/2010 Abuzaina et al. 424/400
2010/0145415 A1 * 6/2010 Dahm et al. 607/88
2010/0168763 A1 7/2010 Zhao et al.
2010/0191237 A1 7/2010 Shadduck
2010/0274282 A1 * 10/2010 Olson 606/228
2010/0280538 A1 * 11/2010 Perkins et al. 606/185
2010/0286473 A1 * 11/2010 Roberts 600/37
2010/0292724 A1 * 11/2010 Ravikumar et al. 606/185
2010/0298953 A1 11/2010 Holzman
2011/0009894 A1 1/2011 Forsell
2011/0009897 A1 1/2011 Forsell
2011/0032715 A1 * 2/2011 Beau et al. 362/459
2011/0040311 A1 2/2011 Levin et al.
2011/0077456 A1 * 3/2011 Drummond 600/30
2011/0077668 A1 * 3/2011 Gordon et al. 606/142
2011/0082442 A1 * 4/2011 Solovay et al. 604/524
2011/0098700 A1 * 4/2011 Tamai et al. 606/41
2011/0106113 A1 * 5/2011 Tavakkolizadeh et al. ... 606/151
2011/0112573 A1 * 5/2011 Bloom 606/213
2011/0130774 A1 * 6/2011 Criscuolo et al. 606/151
2011/0208215 A1 * 8/2011 Modesitt et al. 606/151
2011/0224704 A1 * 9/2011 Bailly et al. 606/151
2011/0276090 A1 * 11/2011 Berndt et al. 606/230
2011/0297161 A1 * 12/2011 Deitch 128/834
2011/0319915 A1 * 12/2011 Viola 606/151
2012/0004501 A1 * 1/2012 Beyer 600/37
2012/0041263 A1 * 2/2012 Sholev 600/118
2012/0071727 A1 * 3/2012 Hanson et al. 600/249
2012/0116423 A1 * 5/2012 Gleiman et al. 606/151
2012/0203273 A1 * 8/2012 Riskin et al. 606/213
2012/0209301 A1 * 8/2012 Bell et al. 606/151
2012/0209319 A1 * 8/2012 Bianco-Peled et al. 606/213
2012/0215073 A1 * 8/2012 Sherman et al. 600/249
2012/0232334 A1 * 9/2012 Bell et al. 600/37
2012/0253339 A1 * 10/2012 Rick et al. 606/33
2012/0289811 A1 * 11/2012 Viola et al. 600/407
2012/0303011 A1 * 11/2012 Schaeffer 606/16
2013/0041266 A1 * 2/2013 Rockrohr 600/473
2013/0085337 A1 * 4/2013 Hess et al. 600/157
2013/0096583 A1 * 4/2013 Mueller et al. 606/148
2013/0190558 A1 * 7/2013 Alexander et al. 600/37
2013/0190598 A1 * 7/2013 Sharonov et al. 600/409
2013/0218075 A1 * 8/2013 Gertz et al. 604/93.01
2013/0225936 A1 * 8/2013 Alexander et al. 600/235
2013/0226037 A1 * 8/2013 Pinto et al. 600/587
2013/0226156 A1 * 8/2013 Sharonov 606/1
2013/0253387 A1 * 9/2013 Bonutti et al. 601/46
2013/0296657 A1 * 11/2013 Viola 600/249
2013/0303845 A1 * 11/2013 Skula et al. 600/104
2014/0031665 A1 * 1/2014 Pinto et al. 600/407
2014/0100431 A1 * 4/2014 Curcillo 600/249
2014/0100604 A1 * 4/2014 Litvack et al. 606/213
2014/0155711 A1 * 6/2014 Mitchell et al. 600/309
2014/0187661 A1 * 7/2014 El Fray et al. 522/33
2014/0194806 A1 * 7/2014 Belhe et al. 604/8
2014/0213968 A1 * 7/2014 Vaccaro et al. 604/97.03
2014/0236222 A1 * 8/2014 Tegels 606/213
2014/0243872 A1 * 8/2014 Cordray 606/192

(56) **References Cited**

U.S. PATENT DOCUMENTS

2014/0257027	A1*	9/2014	Palmisano et al.	600/37
2014/0275775	A1*	9/2014	Jones et al.	600/109
2014/0276627	A1*	9/2014	Jenkins et al.	604/514
2014/0276996	A1*	9/2014	Sharonov	606/151
2014/0277043	A1*	9/2014	Jenkins et al.	606/170
2014/0309626	A1*	10/2014	Sargeant	606/14
2015/0005805	A1*	1/2015	Kesten et al.	606/196
2015/0018851	A1*	1/2015	Francois et al.	606/144
2015/0031990	A1*	1/2015	Boctor et al.	600/424
2015/0032135	A1*	1/2015	Gorman	606/151
2015/0039027	A1*	2/2015	Broom et al.	606/228
2015/0045818	A1*	2/2015	Kim et al.	606/151
2015/0051642	A1*	2/2015	Broom et al.	606/228
2015/0055094	A1*	2/2015	Boate et al.	351/206
2015/0066078	A1*	3/2015	Broom et al.	606/228
2015/0073445	A1*	3/2015	Griffin et al.	606/151
2015/0073473	A1*	3/2015	Broom et al.	606/228

* cited by examiner

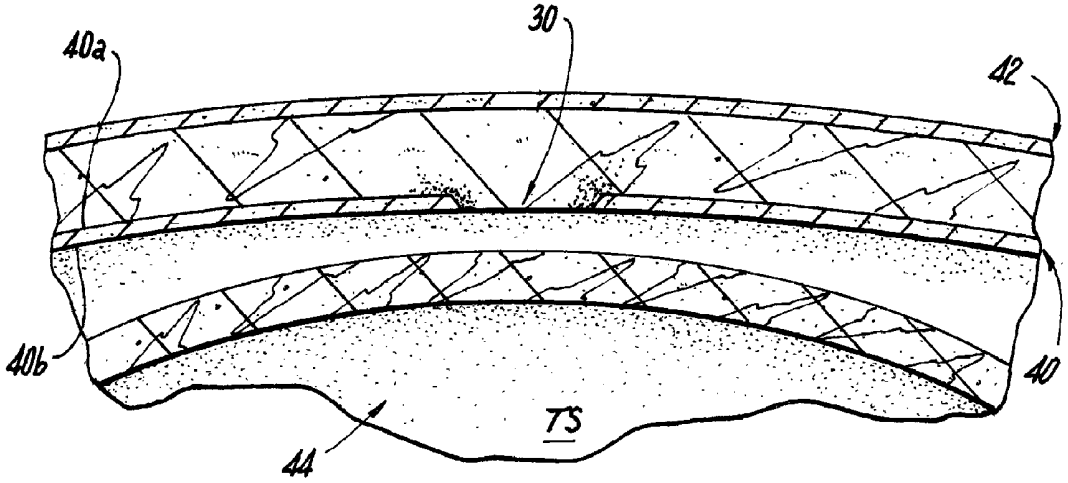


Fig. 1

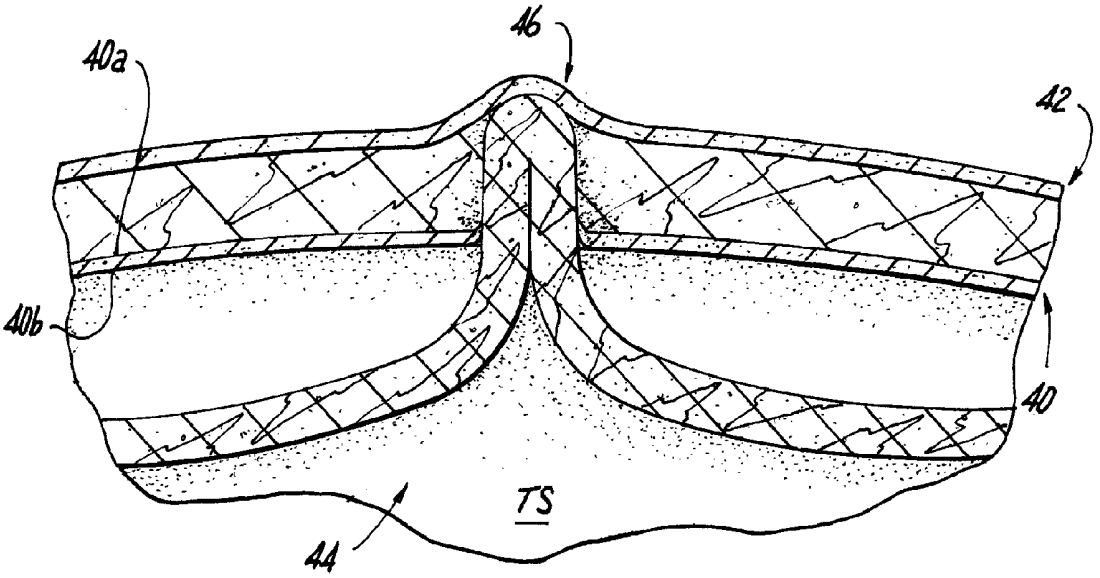
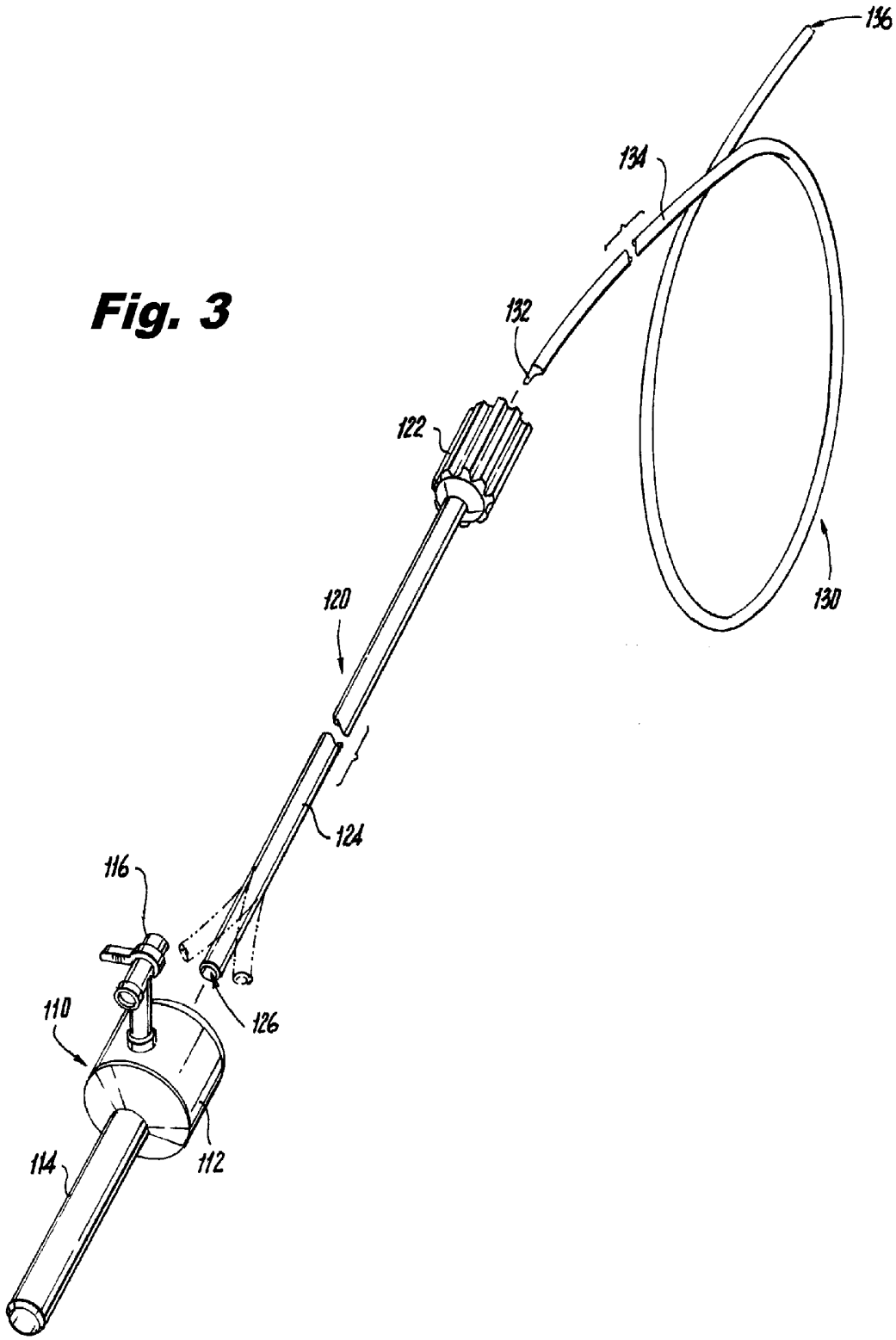


Fig. 2

Fig. 3



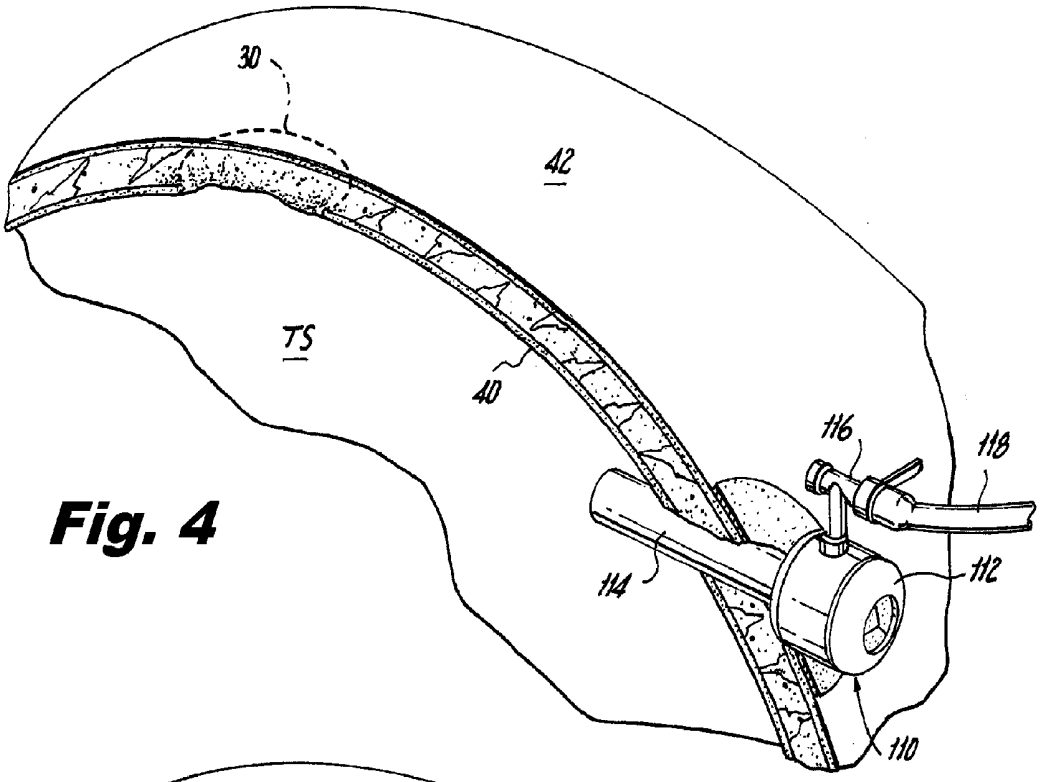


Fig. 4

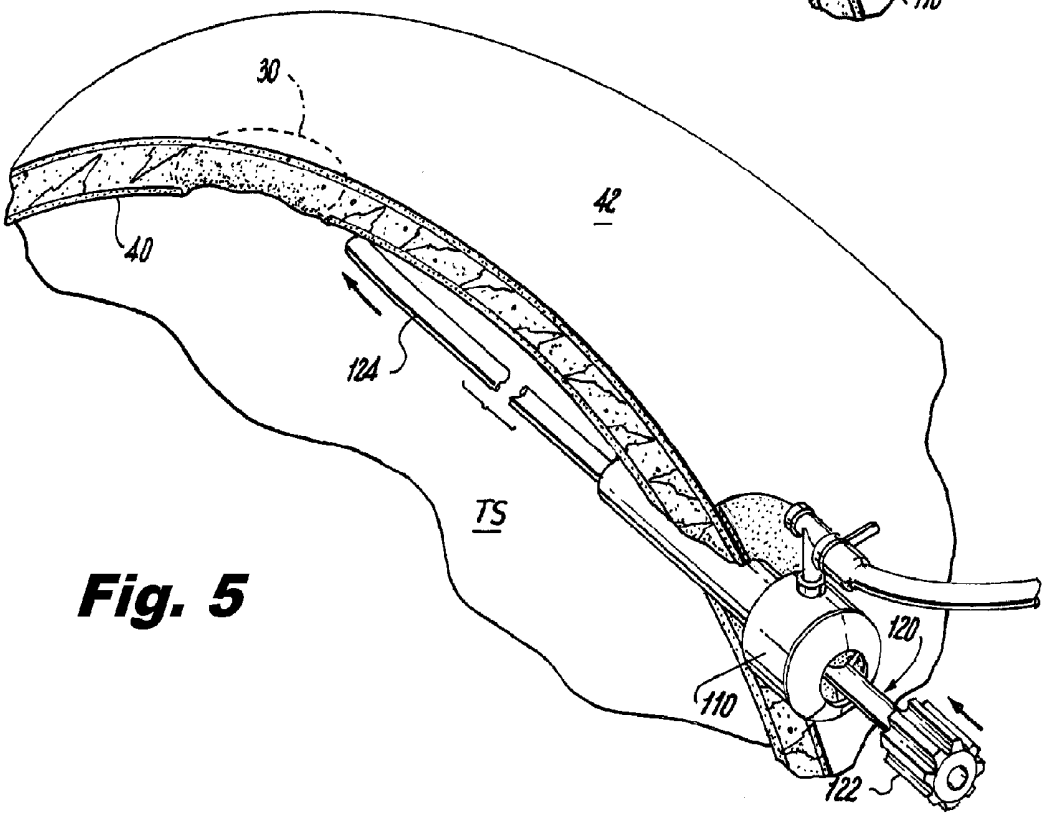


Fig. 5

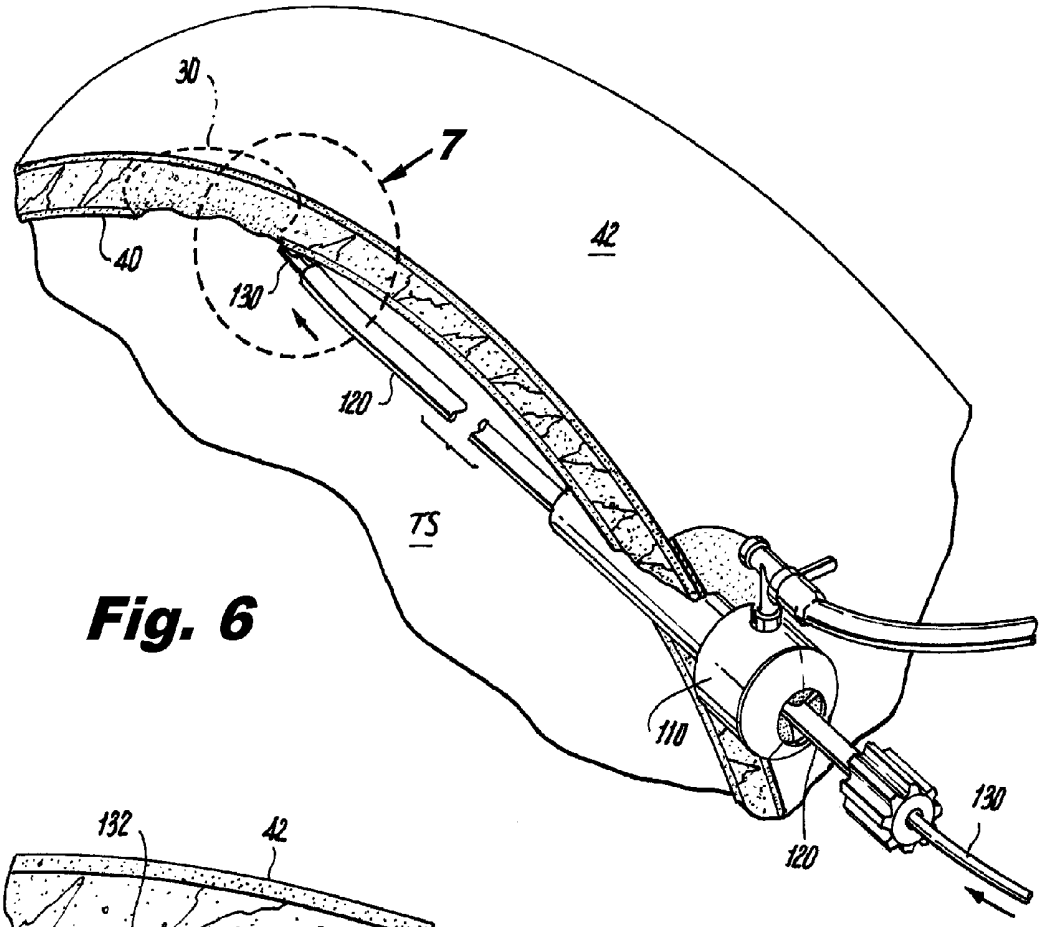


Fig. 6

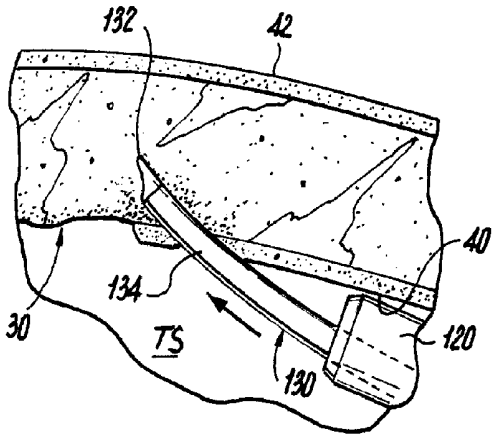


Fig. 7

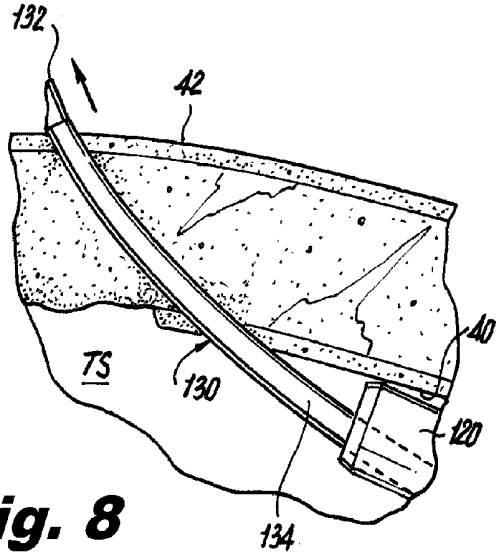


Fig. 8

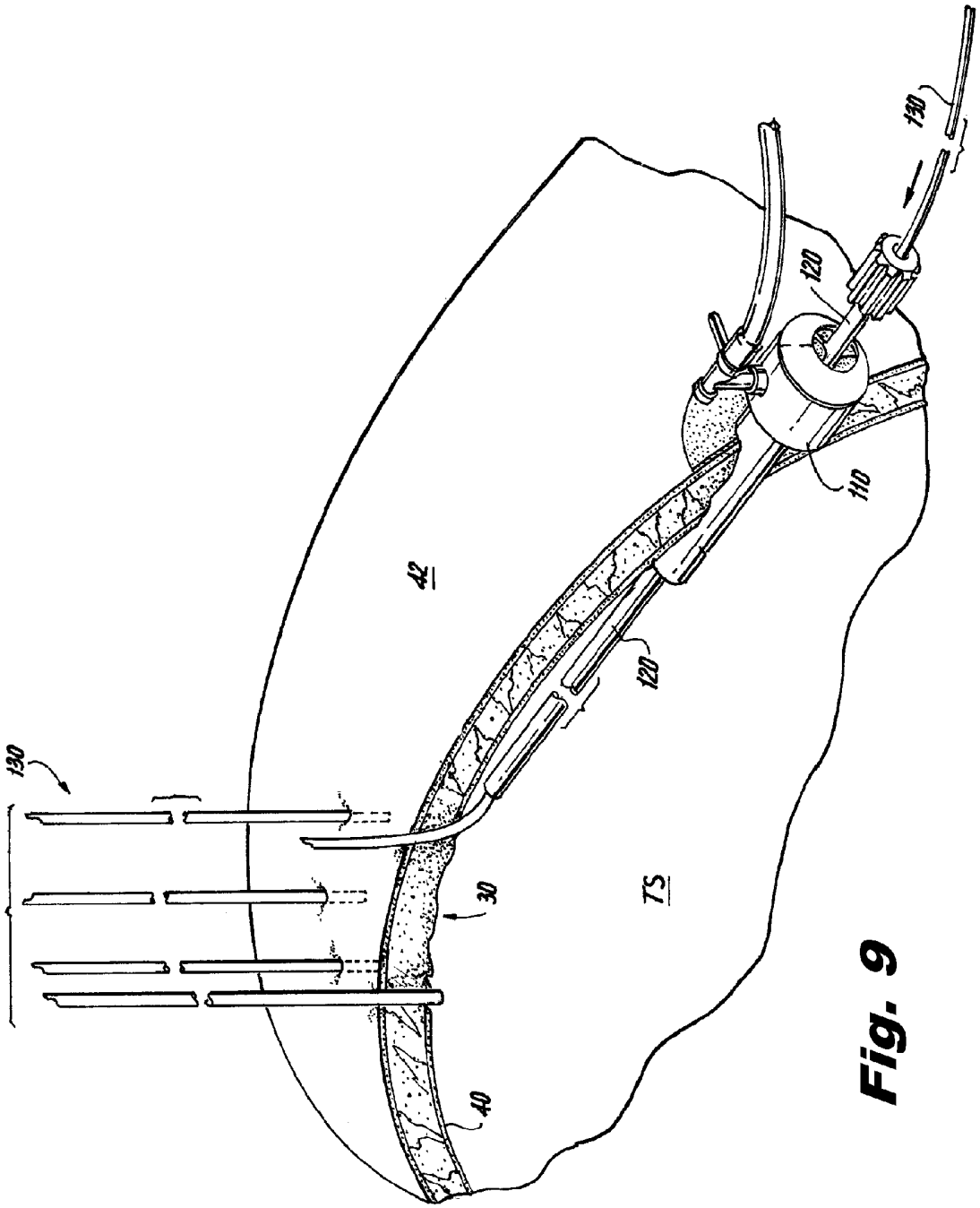


Fig. 9

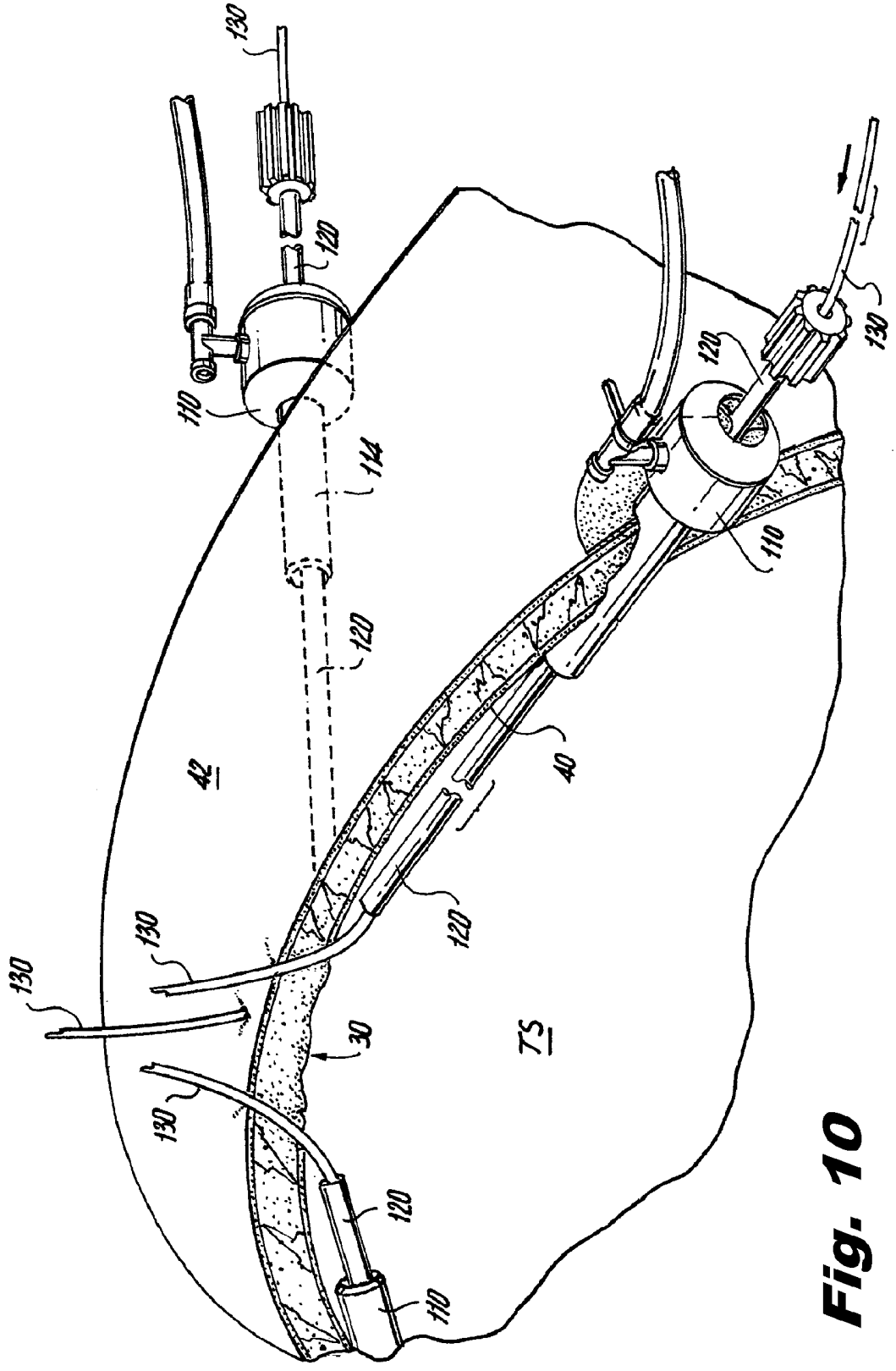
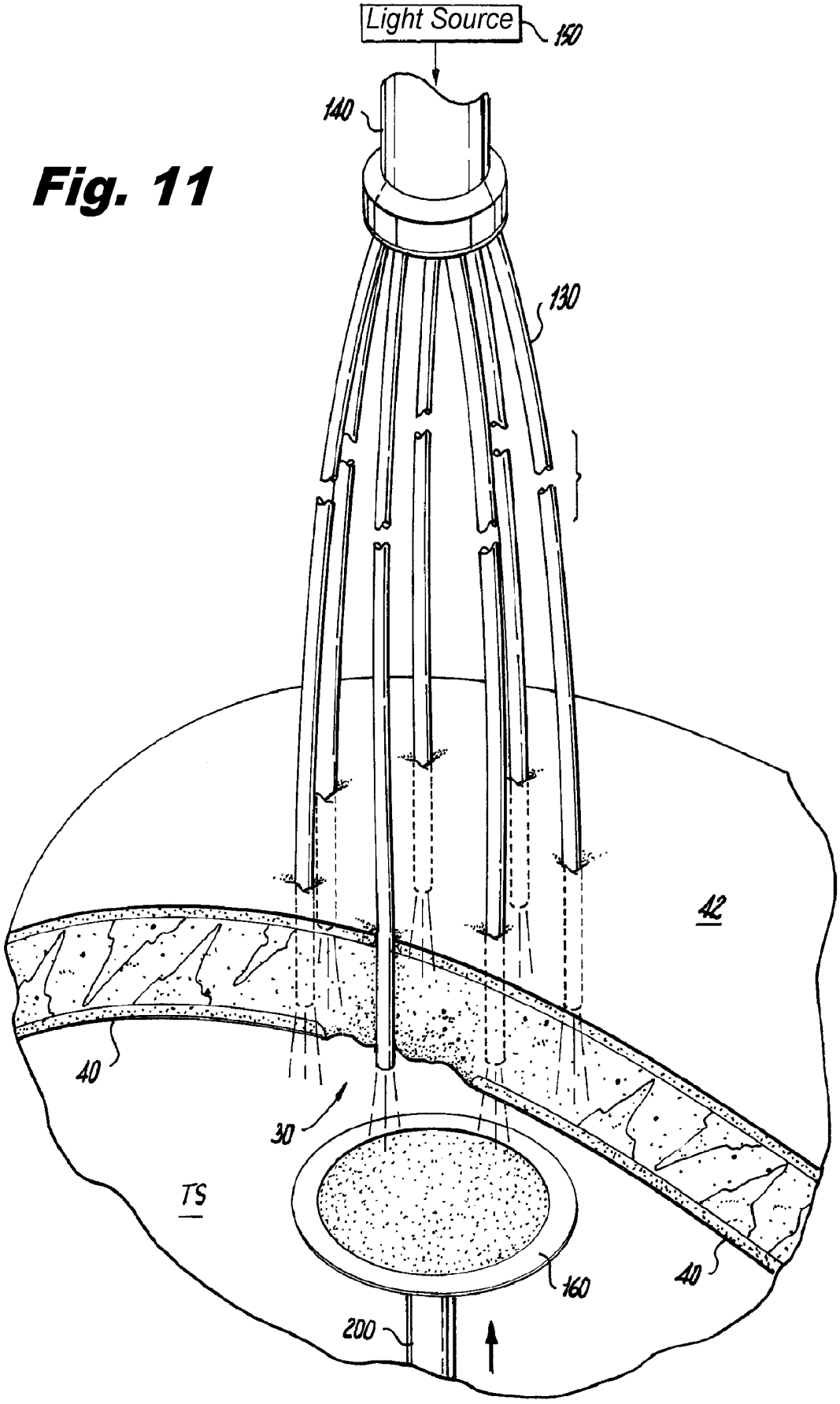

130
120
110
144
120
42
40
130
130
120
30
75
130
120
110
120
110
130

Fig. 10

Fig. 11



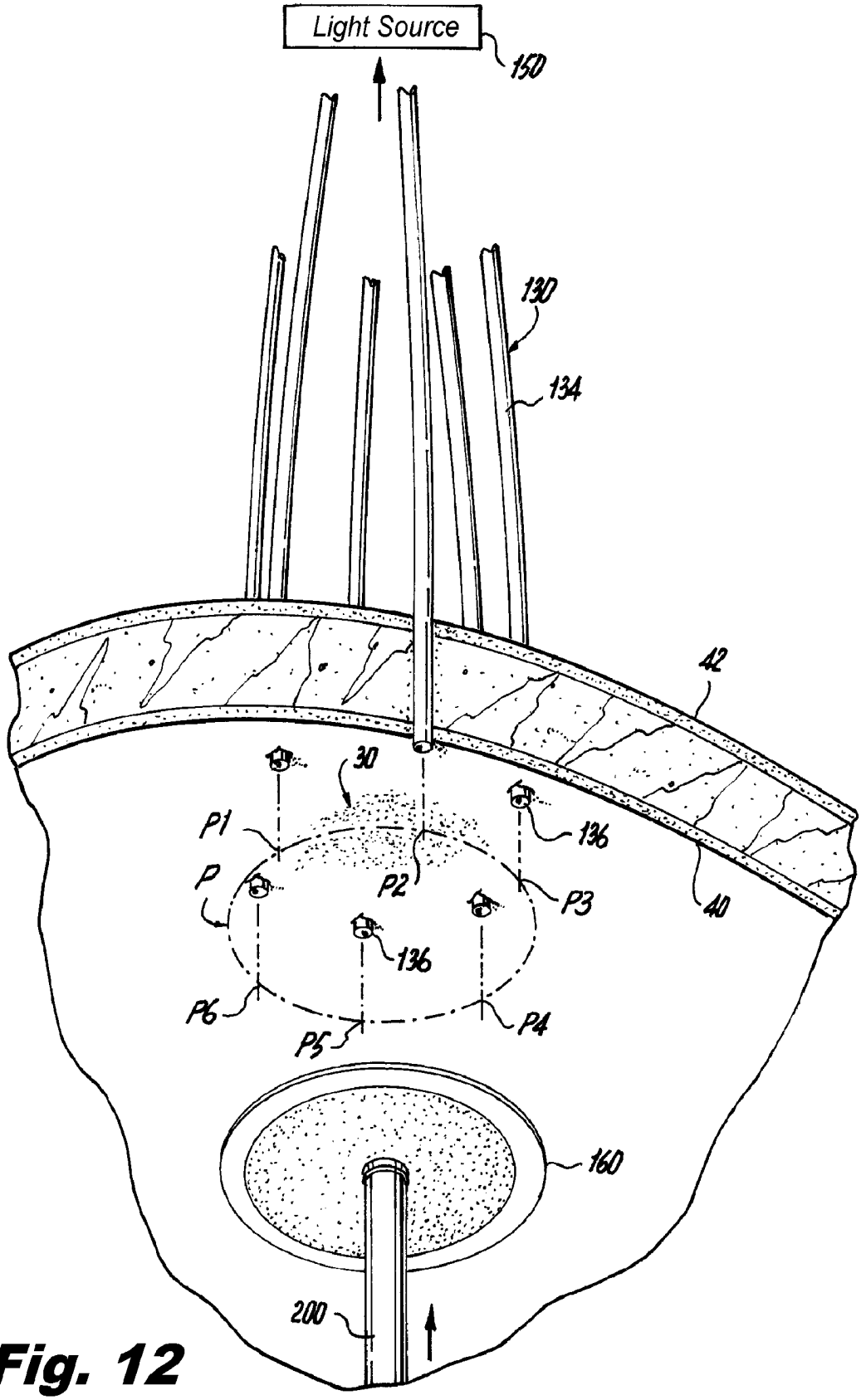
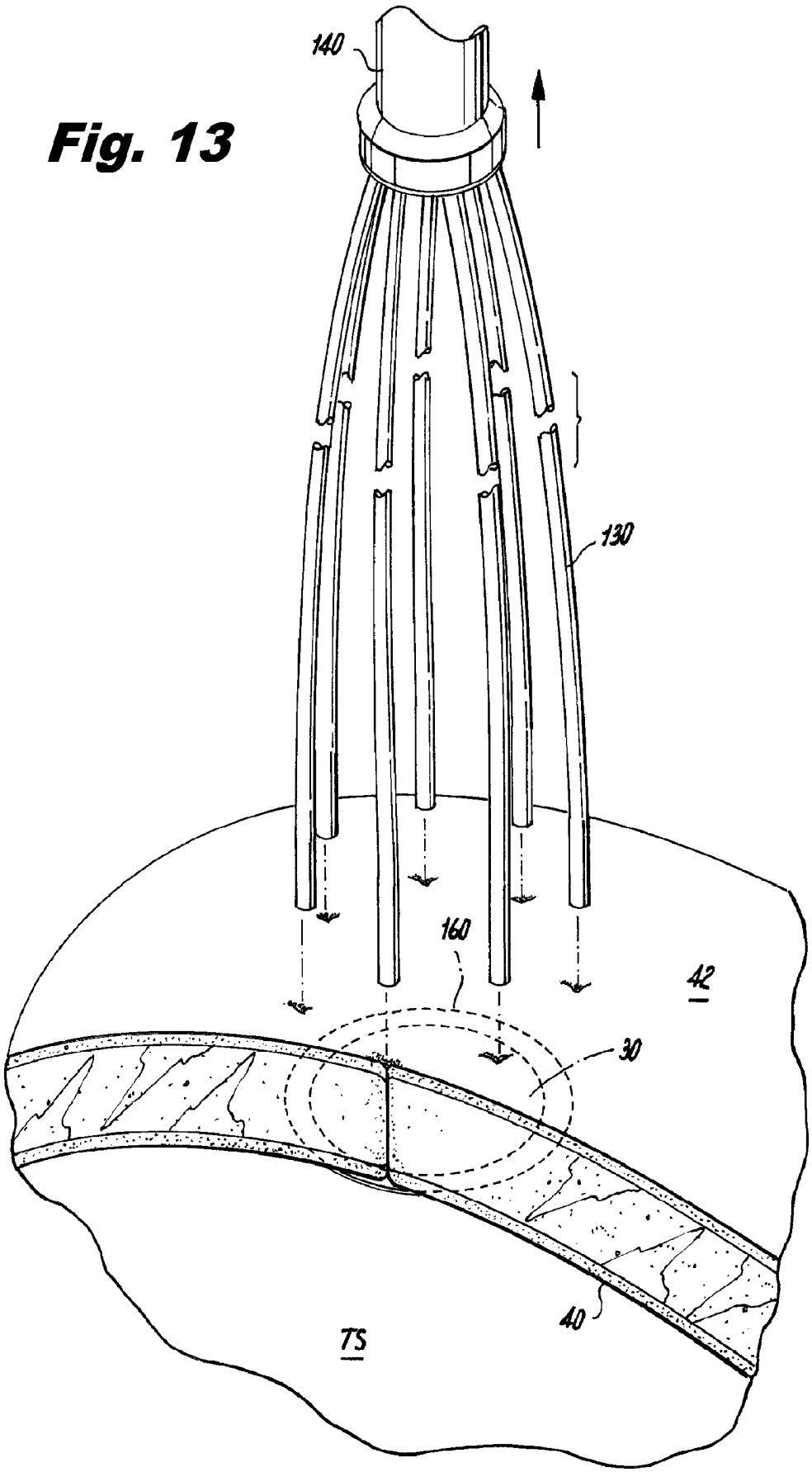

Light Source
150
130
134
42
30
P1
P
P2
P3
136
40
136
P6
P5
P4
160
200

Fig. 12

Fig. 13



METHODS OF USING LIGHT TO REPAIR HERNIA DEFECTS

CROSS REFERENCE TO RELATED APPLICATION

The present application claims the benefit of and priority to U.S. Provisional Application Ser. No. 61/641,974, filed on May 3, 2012, the entire contents of which are incorporated herein by reference.

BACKGROUND

1. Technical Field

The present disclosure relates to hernia repair methods. More particularly, the present disclosure relates to methods for positioning a surgical patch to a tissue site of a hernia using light.

2. Description of Related Art

A hernia is a protrusion of a tissue, structure, or part of an organ through injured muscle tissue or an injured membrane by which the tissue, structure, or organ is normally contained. Some examples of hernias include: abdominal hernias, diaphragmatic hernias and hiatal hernias (for example, paraesophageal hernia of the stomach), pelvic hernias, for example, obturator hernia, anal hernias, hernias of the nucleus pulposus of the intervertebral discs, intracranial hernias, and Spigelian hernias.

Hernias may be surgically repaired, and are principally repaired by pushing back, or "reducing", the herniated tissue, and then reinforcing the defect in injured muscle tissue (an operation called herniorrhaphy). Modern muscle reinforcement techniques involve placement of a surgical patch, such as a surgical mesh, near the injured tissue or defect to support the defect. The surgical patch is either placed over the defect (anterior repair) or under the defect (posterior repair).

A variety of different fixation devices are used to anchor the surgical patch to the tissue. For example, a needled suture may be passed through or around the tissue near the defect to hold the surgical patch in a position which spans the injured tissue. In other examples, staples, tacks, clips and pins are also known to be passed through or around the tissue near the defect to anchor the surgical patch in a position which spans the injured tissue.

When applying a surgical patch during minimally invasive surgery, it is imperative that the surgeon know the precise location, size and shape of the hernia defect in order to properly place the surgical patch. However, since the bounds of the hernia defect are generally internal, visibility is often limited and placement of the surgical patch can be cumbersome. Thus, a continuing need still exits to provide a means for facilitating the effectiveness of the placement of surgical patches used to surgically repair hernias.

SUMMARY

Accordingly, a hernia repair method includes the step of identifying a hernia defect in a patient, the hernia defect having a size, a location, and a shape. The method involves positioning a dispensing instrument laparoscopically into the patient adjacent the hernia defect.

According to one step, the method includes dispensing one or more light pipes from the dispensing instrument at predetermined locations. The light pipes may be fiber optic. The method may include the step of positioning the dispensing instrument adjacent a corner or an extreme of the hernia defect prior to dispensing the one or more light pipes.

The method also involves advancing the one or more light pipes through the patient's skin. The method may further include piercing the patient's skin with that one or more light pipes. The method may further comprise the step of advancing the one or more light pipes to a position immediately adjacent the hernia defect after advancing the one or more light pipes through the patient's skin.

The method may include the step of bundling a plurality of light pipes. Another step includes coupling a light source to the one or more light pipes. The method also involves generating a pattern of light that indicates one or more of the size, the location, and the shape of the hernia defect. The method further includes the step of forming an outline of the hernia defect, in vivo, with the pattern of light being formed from the positioning of the plurality of light pipes at the predetermined locations.

One step includes positioning a surgical patch adjacent the hernia defect in accordance with the pattern of light. According to one step, the method involves generating a pattern of light that can be visualized, ex vivo, through the surgical patch when the surgical patch is positioned over the hernia defect in vivo. According to one step, the method involves removing the one or more light pipes from the patient after positioning the surgical patch adjacent the hernia defect.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features, and advantages of the present disclosure will become more apparent in light of the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. **1** is a cross-sectional view illustrating a tear in an abdominal wall;

FIG. **2** is a cross-sectional view illustrating a ventral hernia;

FIG. **3** is a perspective view of a hernia repair system in accordance with the present disclosure;

FIGS. **4-8** are progressive views illustrating a deployment of a light pipe of the hernia repair system of FIG. **3** into tissue;

FIG. **9** is perspective view of a plurality of light pipes disposed in tissue after being deployed from the hernia repair system of FIG. **3**;

FIG. **10** is a perspective view of another embodiment of a hernia repair system deploying a plurality of light pipes in tissue in accordance with the present disclosure; and

FIGS. **11-13** are progressive views illustrating a surgical patch being positioned adjacent a hernia defect with the aid of a plurality of light pipes in accordance with the present disclosure.

DETAILED DESCRIPTION

The present disclosure relates to methods for surgeries such as transluminal and/or endoluminal placement of a surgical patch at a surgical site. As used herein the term "surgical patch" is used to refer to any type of patch for use in surgical procedures, such as, for example, meshes that can be attached to the abdominal wall. Although described herein with reference to a hernia surgical patch, the methods of the disclosure may be used in any surgical repair.

In the drawings and in the description that follows, the term "proximal," as is traditional, will refer to an end of a device that is closer to the user, while the term "distal" will refer to the end of the device that is farther from the user.

Referring now in specific detail to the drawings, in which like numbers identify similar or identical elements, FIG. **1** illustrates a hernia that may involve a defect **30** such as a tear in the abdominal wall **40**. The abdominal wall **40** is defined by

an external side **40***a* and an internal side **40***b*. A surface tissue **42**, which covers the external side **40***a* of abdominal wall **40**, may or may not be immediately affected by this defect **30**. An internal organ **44** located below the internal side **40***b* of the abdominal wall **40** may not protrude until some form of exertion or use of the muscle located at the abdominal wall **40** forces the internal organ **44** into the defect **30**. Depending on the size and location of the defect **30**, exertion may not be needed to cause the organ to protrude. As shown in FIG. **2**, a hernia occurs when an internal organ **44** protrudes into the defect **30** of abdominal wall **40**. Oftentimes the protrusion creates a bulge **46** in the surface tissue **42**.

As depicted in FIG. **3**, a hernia repair system **100** includes an access port **110**, a dispensing instrument **120**, and one or more light pipes **130**.

The access port **110** includes a seal assembly **112** at a proximal end and cannula **114** at a distal end. The seal assembly **112** accommodates the dispensing instrument **120** in a substantially sealed relationship. The seal assembly **112** includes an insufflation valve **116** to selectively permit the passage of insufflation fluids therethrough to create a working space in an underlying tissue site.

The dispensing instrument **120** includes an actuation assembly **122** at a proximal end and a shaft **124** at a distal end. The shaft **124** extends from the actuation assembly **122**. The shaft **124** defines a lumen **126** therethrough to accommodate the one or more light pipes **130**. The shaft **124** is movable via the actuation assembly **122** to dispense the one or more light pipes **130** at predetermined locations within a patient. In particular, as illustrated in FIG. **3**, the distal end of the shaft **124** may be rotatable, pivotable, and/or articulable to orient the distal end of the shaft **124** in a particular orientation relative to the hernia defect **30**.

Each light pipe **130** includes a distal tip **132**, which may be sharpened to pierce tissue, and an elongated member **134**. The elongated member **134** may define a lumen **136** therethrough to permit the passage of light therethrough when coupled to a light source **150** (see FIG. **11**). Alternatively, the elongated member **134** may include any suitable electrical and/or mechanical and/or chemical components configured to emit light from the distal end of the elongated member **134** (e.g., like a flashlight). The elongated member **134** may be rigid or flexible. The light pipes **130** may be fiber optic.

In use, a hernia defect **30** is identified in a patient. As can be appreciated, each hernia defect **30** has a particular size, location, and shape and therefore proper placement of a surgical patch **160** during minimally invasive surgery is facilitated when a practitioner can ascertain the size, location, and shape from an ex vivo location. Thus, in order to be able to perceive the hernia defect **30** from an ex vivo location, the practitioner inserts the access port **110**, namely the cannula **114** into tissue adjacent the hernia defect **30** (see FIG. **4**). With continued reference to FIGS. **4-5**, the underlying tissue site "TS" may be insufflated when the insufflation valve **116** is coupled to an insufflation source **118** to create a working space. In this respect, the practitioner may then laparoscopically advance the dispensing instrument **120** into the patient adjacent the hernia defect **30** to facilitate placement of one or more light pipes **30** in position about the hernia defect **30**, which is best depicted in FIG. **5**. As depicted in FIG. **10**, any number of access ports **110** and/or dispensing instruments **120** may be used to position the one or more light pipes **130** in tissue. In some modes of operation, the practitioner may even directly laparoscopically advance the one or more light pipes **30** through the access port **110** or directly laparoscopically advance the one or more light pipes **30** through an incision (without the access port **110**) by virtue of the sharpened distal tip **132**, where appropriate.

Turning now to FIGS. **6-9**, one or more light pipes **130** may then be dispensed from the dispensing instrument **120** at predetermined locations about the hernia defect **30** to create a pattern about the defect **30** that is commensurate with the size, location, orientation and/or shape of the defect **30**. For example, the dispensing instrument **120** may be positioned adjacent one or more corners and/or extremes of the hernia defect **30** prior to dispensing the one or more light pipes **130** to generate the pattern. The one or more light pipes **130** can then be dispensed with sufficient force to pierce and advance through the patient's skin, e.g. surface tissue **42**. The one or more light pipes **130** may include sharpened tips **132** to further facilitate the penetration of the patient's skin. After the ends, e.g., the sharpened tips **132** are positioned so that they extend externally, the one or more light pipes **130** may be advanced to a position immediately adjacent the hernia defect **30** or the abdominal wall **40**. In this respect, the one or more light pipes **130** may be pulled proximally through the pierced skin until they are positioned snug against the hernia defect **30** or the abdominal wall **40**, depending upon the desired position.

Once in the snug position, the one or more light pipes **130** are most suitably configured in the pattern. The pattern may extend along the defect **30** and/or along an area immediately adjacent the defect **30**. The pattern may have any suitable geometry, size, etc. for facilitating the placement of a surgical patch **160** adjacent the defect **30**.

As illustrated in FIGS. **11-13**, when the one or more light pipes **130** are coupled to a light source **150** or are otherwise adapted to emit light (e.g., selectively via a switch coupled to the one or more light pipes or autonomously by fluorescent chemicals or the like), one or more points of light are formed about the defect **30** corresponding to the pattern to indicate the size, location, orientation and/or shape of the defect **30**.

With reference to FIG. **11**, when there is a plurality of light pipes **130**, the plurality may be bundled together via a bundling member **140**. The light source **150** may then be coupled to the one or more light pipes **130**, either individually, collectively, or by groups of light pipes **130**. The bundling member **140** may include a light source **150**. As depicted in FIG. **12**, the light source **150** generates the pattern of light "P" via points of light P1, P2, P3, P4, P5, P6, etc. that indicate the size, the location, the orientation and/or the shape of the hernia defect **30**. In this regard, the light emitted from the light source **150** will form an outline of the hernia defect **30**, in vivo, so as to be viewable ex vivo so that the surgical patch **160** may be positioned adjacent the hernia defect **30** with any suitable instrument **200** (e.g., a grasper) in accordance with the outline/pattern of light. As can be appreciated, when the surgical patch **160** is positioned in vivo over the hernia defect **30**, the generated pattern of light can be visualized, ex vivo, through the surgical patch **110** and the tissue. After the surgical patch **160** is placed in a desired position adjacent the hernia defect **30**, the surgical patch **160** may be secured to the defect **30** by any suitable means (e.g., glue, tack, staple, suture, etc.) and the one or more light pipes **130** may then be removed from the patient either individually, collectively, or by groups of light pipes **130** (see FIG. **13**).

The presently disclosed surgical patch may be any type of patch for use in surgical repair and suitable for use in situ. The surgical patch may be any suitable shape (i.e., circular, non-circular, etc.) and may include one or more layers. The sur-

gical patch may be made of multiple fibers, or may be made of a single fiber. The fibers may be a monofilament or multifilament.

The fibers forming the presently disclosed patch may be made from a natural material or a synthetic material. The fibers may be biodegradable or non-biodegradable. Any combination of natural, synthetic, bioadegradable and non-biodegradable materials may be used to form the fibers. The term "biodegradable" as used herein is defined to include both bioabsorbable and bioresorbable materials. By biodegradable, it is meant that the materials decompose, or lose structural integrity under body conditions (e.g. enzymatic degradation or hydrolysis) or are broken down (physically or chemically) under physiologic conditions in the body such that the degradation products are excretable or absorbable by the body.

The surgical patch of the present disclosure may be formed using any method suitable to forming patch structures, including but not limited to knitting, weaving, non-woven techniques, and the like. Suitable techniques for making the surgical patch are within the purview of those skilled in the art.

The surgical patch may be any shape or size suitable for covering the herniated area and securing the patch to surrounding tissue. The surgical patch may be preformed to a certain size, such as, for example, a 9 cm diameter round patch or 50 cm×50 cm square patch. In embodiments, the surgical patch may be cut to a particular size and shape as needed.

In addition, the surgical patch of the present disclosure may be rolled, folded, or otherwise oriented so that the surgical patch forms a shape more suitable for placement adjacent a hernia defect.

While several embodiments of the disclosure have been shown in the drawings, it is not intended that the disclosure be limited thereto, as it is intended that the disclosure be as broad in scope as the art will allow and that the specification be read likewise. Therefore, the above description should not be construed as limiting, but merely as exemplifications of particular embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended hereto.

What is claimed is:

1. A hernia repair method, comprising:

identifying a hernia defect in a patient, the hernia defect having a size, a location, and a shape;

positioning a dispensing instrument laparoscopically into the patient adjacent the hernia defect;

dispensing leading and trailing ends of a first light pipe from a leading end of the dispensing instrument at a predetermined location within the patient to separate the first light pipe from the dispensing instrument;

advancing the leading end of the first light pipe through the patient's skin;

coupling a light source to the leading end of the first light pipe;

generating a pattern of light with the first light pipe that indicates at least one of: the size, the location, or the shape of the hernia defect; and

positioning a surgical patch adjacent the hernia defect in accordance with the pattern of light.

2. The hernia repair method of claim **1**, further comprising positioning the dispensing instrument adjacent a corner or a periphery of the hernia defect prior to dispensing the first light pipe.

3. The hernia repair method of claim **1**, further comprising advancing the trailing end of the first light pipe to a position immediately adjacent the hernia defect after advancing the leading end of the first light pipe through the patient's skin.

4. The hernia repair method of claim **1**, further comprising dispensing a second light pipe from the dispensing instrument.

5. The hernia repair method of claim **4**, further comprising bundling the first and second light pipes.

6. The hernia repair method of claim **1**, further comprising generating the pattern of light so that the pattern of light can be visualized, ex vivo, through the surgical patch when the surgical patch is positioned over the hernia defect in vivo.

7. The hernia repair method of claim **1**, wherein the first light pipe is a fiber optic light pipe.

8. The hernia repair method of claim **1**, further comprising removing the first light pipe from the patient after positioning the surgical patch adjacent the hernia defect.

9. The hernia repair method of claim **1**, wherein coupling the light source to the leading end of the first light pipe includes transmitting light from the light source from the leading end of the first light pipe to the trailing end of the first light pipe so that light can exit from the trailing end of the first light pipe into the patient.

10. A hernia repair method, comprising:

identifying a hernia defect in a patient, the hernia defect having a size, a location, and a shape;

positioning a dispensing instrument laparoscopically into the patient adjacent the hernia defect;

dispensing leading and trailing ends of a first light pipe from a leading end of the dispensing instrument at a predetermined location within the patient to separate the first light pipe from the dispensing instrument;

piercing the patient's skin with the leading end of the first light pipe to cut through the patient's skin from an internal surface of the patient's skin to an external surface of the patient's skin, the leading end of the first light pipe being sharpened;

advancing the leading end of the first light pipe through the patient's skin;

coupling a light source to the leading end of the first light pipe;

generating a pattern of light with the first light pipe that indicates at least one of: the size, the location, or the shape of the hernia defect; and

positioning a surgical patch adjacent the hernia defect in accordance with the pattern of light.

11. The hernia repair method of claim **10**, further comprising maintaining the trailing end of the first light pipe positioned within the patient after the leading end of the first light pipe is pierced through the internal and external surfaces of the patient's skin and positioned externally of the patient.

12. The hernia repair method of claim **10**, further comprising positioning the dispensing instrument adjacent a corner or a periphery of the hernia defect prior to dispensing the first light pipe.

13. The hernia repair method of claim **10**, further comprising advancing the trailing end of the first light pipe to a position immediately adjacent the hernia defect after advancing the leading end of the first light pipe through the patient's skin.

14. The hernia repair method of claim **10**, further comprising dispensing a second light pipe from the dispensing instrument.

15. The hernia repair method of claim **14**, further comprising generating the pattern of light with the first and second light pipes and positioning the first and second light pipes at predetermined locations within the patient to form an outline of the hernia defect in vivo.

16. The hernia repair method of claim 14, further comprising bundling the first and second light pipes.

17. The hernia repair method of claim 10, further comprising generating the pattern of light so that the pattern of light can be visualized, ex vivo, through the surgical patch when the surgical patch is positioned over the hernia defect in vivo.

18. The hernia repair method of claim 10, wherein the first light pipe is a fiber optic light pipe.

19. The hernia repair method of claim 10, further comprising removing the first light pipe from the patient after positioning the surgical patch adjacent the hernia defect.

20. The hernia repair method of claim 10, wherein coupling the light source to the leading end of the first light pipe includes transmitting light from the light source from the leading end of the first light pipe to the trailing end of the first light pipe so that light can exit from the trailing end of the first light pipe into the patient.

* * * * *

专利名称(译)	用光修复疝缺损的方法		
公开(公告)号	US9186053	公开(公告)日	2015-11-17
申请号	US13/860695	申请日	2013-04-11
[标]申请(专利权)人(译)	柯惠有限合伙公司		
申请(专利权)人(译)	COVIDIEN LP		
当前申请(专利权)人(译)	COVIDIEN LP		
[标]发明人	VIOLA FRANK J		
发明人	VIOLA, FRANK J.		
IPC分类号	A61B1/06 A61B17/00 A61F2/00 A61B19/00		
CPC分类号	A61B1/06 A61B17/00234 A61B19/5202 A61B19/5212 A61F2/0063 A61B2019/202 A61B2019/5206 A61B2019/5445 A61F2002/0072 A61B90/13 A61B90/30 A61B90/361 A61B2090/306 A61B2090/3945		
优先权	61/641974 2012-05-03 US		
其他公开文献	US20130296657A1		
外部链接	Espacenet USPTO		

摘要(译)

疝气修复方法包括识别患者的疝气缺陷的步骤，疝气缺陷具有大小，位置和形状。该方法涉及将腹腔镜下的分配仪器定位在邻近疝缺损的患者体内。根据一个步骤，该方法包括在预定位置从分配仪器分配一个或多个光管。该方法还涉及使一个或多个光管前进穿过患者的皮肤。另一步骤包括将光源耦合到一个或多个光管。该方法还涉及产生指示疝缺陷的大小，位置和形状中的一个或多个的光图案。一个步骤包括根据光的图案将手术贴片定位在疝缺损附近。