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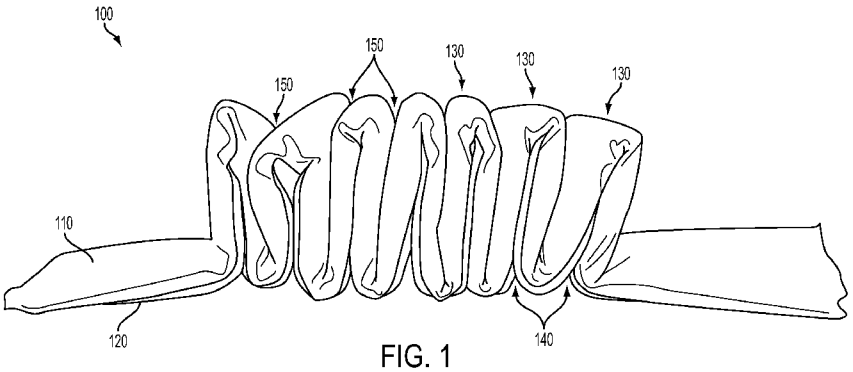

FIG. 1

(57) Abstract: A surgical instrument holder includes a strip of material that when permanently folded or fastened to itself creates at least one ridge for holding surgical instruments.

SURGICAL INSTRUMENT HOLDER AND RELATED METHODS

BACKGROUND

[0001] This application claims the full benefit of the filing date of U.S. Provisional Patent Applications 61/240,150, filed on September 4, 2009, and 61/339,917, filed March 11, 2010, which are both incorporated by reference for all purposes in their entireties as if fully set forth herein.

Field of the Invention

[0002] The present invention relates to surgical instrument holders and their methods of use.

Discussion of the Related Art

[0003] During surgical procedures, a surgical technician is responsible for organizing and transferring surgical instruments to a surgeon, as needed, enabling the surgeon to focus on the patient and their care. In order to carry out the job of a surgical technician efficiently and precisely and to minimize the time associated with a particular procedure, the surgical technician sets up the necessary surgical instruments and supplies prior to the surgery. The surgical technician assists the surgeon during a surgical procedure by handing instruments to the surgeon as needed. In order for the surgical technician to prepare well, he or she lays out or stands up instruments in an order that makes hand-off to the surgeon more efficient, thereby decreasing the surgeon's wait time and decreasing likelihood of harm to the surgeon, the technician or the patient from traumatic impact with the instrument.

[0004] In preparing for surgery, each surgical technician devises a temporary system for holding surgical instruments. Normally, surgical towels are rolled-up, folded and positioned on a Mayo Stand to hold the instruments for a particular surgery. Sometimes, before or during the surgery, the towel loses its positioning, and the instruments become scattered across the Mayo Stand. The scattering of the instruments leads to longer hand-off

times, increased wait times for surgeons and an increased risk of personal harm (i.e., accidental needle sticks or injury from sharps) due to the instruments not being held in place in an orderly fashion.

SUMMARY

[0005] Accordingly, the present invention is directed to surgical instrument holders and methods of using surgical instrument holders that substantially obviate one or more of the problems due to limitations and disadvantages of the related art.

[0006] An advantage of the present invention is to provide a surgical instrument holder that can both maintain a set shape throughout a surgical procedure or be reshaped during the procedure, as needed.

[0007] Another advantage of the present invention is to provide a reusable surgical instrument holder that may be sanitized in between surgeries.

[0008] Another advantage of the present invention is to provide a disposable surgical instrument holder that may be permanently fixed in a shape to hold surgical instruments.

[0009] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0010] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a surgical instrument holder includes a strip of material that when permanently folded or fastened to itself creates at least one ridge for holding surgical instruments.

[0011] In another aspect of the present invention, a plurality of the strips of material are fastened to each other extending the overall length of the device and the total number of ridges.

[0012] In another aspect of the present invention, one or more coatings are applied to the strip of material for reducing the force needed to place and remove the surgical instruments within the surgical instrument holder.

[0013] In another aspect of the present invention, one or more therapeutic agents are applied to the strip of material for reducing the growth of infectious organisms and maintaining the sterility of the surgical instruments.

[0014] In another aspect of the present invention, the one or more strips are made from a nonwoven lint free material.

[0015] In another aspect of the present invention, the one or more strips are made from a metallic material.

[0016] In another aspect of the present invention, the one or more strips are made from a fabric material.

[0017] In another aspect of the present invention, the one or more strips are made from a polymeric material.

[0018] In another aspect of the present invention, the one or more strips are sterilized using steam, ethylene oxide, hydrogen peroxide, gamma radiation, ebeam sterilization steam- flowing or pressurized, chemical agents (alcohol, phenol, heavy metals, ethylene oxide gas), high velocity electronic bombardment, or ultraviolet light radiation and combinations thereof.

[0019] In another aspect of the present invention, the one or more strips are capable of being re-sterilized after use.

[0020] In another aspect of the present invention, the one or more strips allow the surgical instrument being held to be identified.

[0021] In another aspect of the present invention, the one or more strips allow the distal end of the instrument being held to be visualized.

[0022] In another aspect of the present invention, a method of use for a surgical instrument holder includes the steps of: placing the surgical instrument holder in close proximity to a surgical procedure; placing surgical instruments in the surgical instrument holder such that the surgical instruments can be identified and easily removed, wherein a distal end of each instrument can be visualized to reduce the incidence of accidental exposure to blood borne pathogens; using the surgical instrument holder to facilitate a counting of all the surgical instruments; and disposing of the surgical instrument holder at the end of the surgical procedure.

[0023] In another aspect of the present invention, a method of use for a surgical instrument holder includes the steps of: placing the surgical instrument holder of claim 1 in close proximity to a surgical procedure; placing surgical instruments in the surgical instrument holder such that the surgical instruments can be identified and easily removed, wherein a distal end of each instrument can be visualized to reduce the incidence of accidental exposure to blood borne pathogens; using the surgical instrument holder to facilitate a counting of all the surgical instruments; and sterilizing the surgical instrument holder at the end of the surgical procedure for subsequent reuse.

[0024] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed but are non limiting of its scope.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention but are not limiting of the invention disclosed herein.

[0026] In the drawings:

[0027] FIG. 1 shows a side view of a surgical instrument holder of a first embodiment of the present invention in a fastened state.

[0028] FIG. 2 shows a top view of the surgical instrument holder of the first embodiment in a fastened state.

[0029] FIG. 3 shows a bottom view of the surgical instrument holder of the first embodiment in a fastened state.

[0030] FIG. 4 shows a bottom view of the surgical instrument holder of the first embodiment in an unfastened state.

[0031] FIG. 5 shows a closed up view of an end portion of the surgical instrument holder of the first embodiment in an unfastened state.

[0032] FIG. 6 shows an article used to fabricate the surgical instrument holder of the first embodiment.

[0033] FIG. 7 shows a surgical instrument holder of a second embodiment of the present invention in an unrolled state.

[0034] FIG. 8 shows a close up view of the surgical instrument holder of the second embodiment in a rolled state.

[0035] FIG. 9 shows a side perspective view of the surgical instrument holder of the second embodiment in a fastened state.

[0036] FIG. 10 shows a side perspective view of a surgical instrument holder of a third embodiment of the present invention in a fastened state.

[0037] FIG. 11 shows a side view of a surgical instrument holder of a fourth embodiment of the present invention.

[0038] FIG. 12 shows a bottom view of the surgical instrument holder of the fourth embodiment.

[0039] FIG. 13 shows a side view of a Mayo Stand.

[0040] FIGs. 14 and 15 show a top view of the Mayo Stand of FIG. 13.

[0041] FIGs. 16 and 17 show a surgical instrument holder according to an embodiment of the present invention holding surgical instruments on the Mayo Stand of FIG. 13.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

[0042] Reference will now be made in detail to embodiments of the present invention, examples of which is illustrated in the accompanying drawings.

[0043] The invention herein relates to all types of surgical procedure including but not limited to outpatient surgery, surgical suites, catheter labs, veterinary use and use in translational research applications.

[0044] The terms sterilization and re-sterilization are defined as methods by which a material and/or device are sterilized for use within a surgical field.

[0045] The term therapeutic agent is defied as a drug, biologic, derivates and analogs thereof or any substance which provides a beneficial and therapeutic effect.

[0046] The term fastener is defined as any means by which two things are joined whether temporarily or permanently. By way of an example, rivets, crimped material, heat sealed material, snaps, VELCRO and magnets are applicable to the present invention.

[0047] The term material includes but is not limited to polymer based materials, metals, non-woven and woven material, lint free materials, material impregnated or coated with one or more therapeutic agents.

[0048] The surgical instrument holder includes a pliable strip of material which when folded and fastened maintains at least one ridge or a plurality of ridges for holding surgical instruments. As such, a surgical technician may arrange instruments in spaces between adjacent ridges before a surgery and reposition instruments back to the spaces during the surgery.

[0049] In a fastened state, the surgical instrument holder contains at least one ridge but may be preferably between about 6 to about 12 inches in length, more preferably about 10 inches in length, and may be preferably between about 1 to about 3 inches in width, more preferably about 2 inches in width. The holder may preferably include between 5 to 10 ridges, more preferably 6-8 ridges and more preferably 7 ridges. The thickness of the pliable strip may preferably be between about 0.001 to about 1/2 inch in thickness. In one non-limiting embodiment the thickness is about 1/4 inch in thickness. However, the dimensions of the holder may vary from the above-described ranges, and the number of ridges may be increased or decreased according to preference. Preferably, the length of the device is less than a width of a Mayo Stand upon which the surgical instrument holder may be placed.

[0050] Furthermore, the surgical instrument holder may be fastened to a table supporting the holder or fastened to the holder itself. For example, adhesive material may be added to the holder to ensure that the surgical instrument holder remains at one location during surgery.

[0051] In one non-limiting embodiment one or more surgical holders may be fastened together resulting in a longer surgical holder.

[0052] In some embodiments, the surgical instrument holder may be reusable. The reusable surgical instrument holder may be reversibly fastened together to maintain the plurality of ridges. For example, the holder may include snap fasteners connecting one ridge to an adjacent ridge. The snap fasteners may include male-female pairs, wherein a male snap fastener is positioned on one ridge and a female snap fastener is positioned on an adjacent ridge. Preferably, the snap fasteners may be made of a material that can withstand sterilization of the surgical instrument holder. For example, the snap fasteners may be formed of stainless steel.

[0053] The material of the pliable strip of the reusable holder may be made of any material that may be sanitized. After surgery the reusable holder may be sterilized prior to reuse in another surgery. The type of material used may include cotton or denim, for example. Any fabric that is weaved, pressed, knitted or felted using natural or synthetic fibers, for example, may potentially be used for the holder.

[0054] The material of the reusable surgical instrument holder may be selected from materials known to be lint free, thus avoiding lint contamination of the surgical instruments to be held. The material may be selected from materials that avoid catching onto surgical instruments as well for the same reason. Also, therapeutic agents may be added to the material of the surgical instrument holder.

[0055] In one non-limiting embodiment, the therapeutic agent comprises the impregnation of the material with silver ions to guard against infection.

[0056] In other embodiments, the surgical instrument holder may be disposable. For the disposable holder, the holder may be made out of disposable material approved for use during surgery. In place of fasteners, the disposable holder may be fixed in a permanent position for maintaining the plurality of ridges. After use during the surgery, the disposable holder may be destroyed along with other medical waste.

[0057] FIGs. 1-6 shows a surgical instrument holder of a first embodiment of the present invention.

[0058] As shown in FIGs. 1 and 2, the surgical instrument holder 100 includes a top strip surface 110 and a bottom strip surface 120. The top and bottom strip surfaces may be one unitary structure or may be separate strips of fabric. A filling material or additional strips of fabric may be included in between the top and bottom strips of fabric.

[0059] The surgical instrument holder 100 further includes ridges 130. The ridge 130 may be formed by folding the surgical instrument holder 100. The surgical instrument holder 100 further includes ridge fasteners 140 on the bottom strip surface 120 for fastening together adjacent ridges. Preferably the ridge fasteners 140 are reversible fasteners, such as snap fasteners, so that the surgical instrument holder 100 may be unfolded. In between adjacent ridges 130 are spaces 150 in which surgical instruments may be placed.

[0060] As shown in FIG. 3, the ridge fasteners 140 hold together lower portions of adjacent ridges 130.

[0061] As shown in FIGs. 4 and 5, the bottom strip surface 120 includes a plurality of male ridge fasteners 140a and a plurality of female ridge fasteners 140b, which are strategically spaced apart from each other to form and maintain ridges 130. As shown in FIG. 4, male ridge fastener 140a corresponds to female ridge fastener 140b, so that when the male ridge fastener 140a and the female ridge fastener 140b are fastened together, the portion of the surgical instrument holder between the ridge fasteners folds together to form a ridge. The height of the ridge is approximately equal to half the distance between the male ridge fastener 140a and the female ridge fastener 140b.

[0062] A third ridge fastener is positioned on the other side of the female ridge fastener 140b. This third ridge fastener corresponds to a fourth ridge fastener, so that when

the third and fourth ridge fasteners are fastened together, the portion of the surgical instrument holder between the third and fourth ridge fasteners folds together to form a ridge.

[0063] In FIG. 4, the male and female ridge fasteners alternate along the length of the surgical instrument holder 100. However, it is not necessary that the male and female ridge fasteners alternate. Also, it is not necessary that the ridge fasteners are male and female. For example, instead of male and female snap fasteners the ridge fasteners may include straps to tie together adjacent ridges, buttons, hooks and eyes, a heat sealed or crimped configuration or VELCRO fasteners, or any other means that can fasten ridges into place. The use of snaps rather than other types of fasteners may reduce preparation time.

[0064] FIG. 5 shows a close up view of an end portion of the surgical instrument holder 100 and a male snap fastener 140a. Also, FIG. 5 shows a first serge line 160 along the length of the holder 100 and a second serge line 170.

[0065] As shown in FIG. 6, the surgical instrument holder 100 may be formed of a piece of fabric having male ridge fasteners 140a and female ridge fasteners 140b positioned along an edge of the piece of fabric. The piece of fabric may be rolled or folded into a shape of a strip so that the strip includes a plurality of layers of the piece of fabric. Then, in this embodiment, the edge of the piece of fabric adjacent to the ridge fasteners 140 may be serged along the length of the strip along the first serge line 160 shown in FIG. 5, and the end of the strip may be serged along the second serge line 170 shown in FIG. 5.

[0066] FIGs. 7-9 show a surgical instrument holder of a second embodiment of the present invention.

[0067] FIG. 7 shows the surgical instrument holder 200 in an unrolled state. The surgical instrument holder 200 includes an inside surface 202 and an outside surface 204. A plurality of ridge fasteners 240 are positioned along an edge of the surgical instrument holder 200. Like the first embodiment, male ridge fasteners 240a and female ridge fasteners 240b

are positioned along an edge of the surgical instrument holder 200 to form and maintain a plurality of ridges 230 after the holder 200 is rolled or folded into a shape of a strip.

[0068] However, the surgical instrument holder 200 of the second embodiment may further include edge fasteners 245, such as male edge fastener 245a and female edge fastener 245b. The edge fasteners 245 are positioned such that when the surgical instrument holder 200 is rolled or folded into the shape of a strip, the edge fasteners 245 are positioned to fasten the ends of the edge portion of the surgical instrument holder 200 to the remainder of the surgical instrument holder. In this manner, the surgical instrument holder may be reversibly held in the strip shape and unfolded or unrolled for easy sanitation. The edge fasteners 245a and 245 b shown in FIG. 7 are spaced a distance apart equal to approximately twice the width of the rolled or folded strip or more accurately, the edge fasteners 245 are spaced a distance equal to the circumference of a cross-section of the strip.

[0069] Furthermore, as shown in FIG. 7 and the close-up view in FIG. 8, in the case of snap fasteners, while the male snap fastener 240a and female snap fastener 240b face away from the strip so that they may connect to each other, the male edge fasteners 245a and female edge fasteners 245b face in an opposite direction so that each end of the holder 200 may be fastened. In other words, as shown in FIG. 7, edge fasteners 245 and ridge fasteners 240 are positioned towards opposite sides 202 and 204 of the holder 200.

[0070] The edge fasteners 245 may be the same or different than the ridge fasteners 240. Also, it is not necessary that the edge fasteners are male and female. For example, instead of male and female snap fasteners, the edge fasteners may include straps, VELCRO, magnets or combinations thereof to tie together.

[0071] FIG. 9 shows a side perspective view of the surgical instrument holder of the second embodiment in a state where the ridge fasteners 240 are fastened together. Similar to the first embodiment, the holder 200 includes a top surface 210, a plurality of ridges 230, a

plurality of fasteners 240 for maintaining the ridges 230 and spaces 250 in between the ridges 230 for holding surgical instrument.

[0072] FIG. 10 shows a side perspective view of a surgical instrument holder of a third embodiment of the present invention in a fastened state.

[0073] The surgical instrument holder 300 includes a top surface 310 and a bottom surface 320, which together form a shape of a strip. As shown, the surgical instrument holder 300 is folded to form a plurality of ridges 330, which are fastened together by a plurality of fasteners 340. Spaces 350 are formed between the ridges 330 for holding surgical instruments.

[0074] In the third embodiment, the top surface 310 and the bottom surface 320 may be formed of separate strips of material which are connected together. For example, as shown in FIG. 10, the top surface 310 is connected to the bottom surface 320 by a first serge line 360 at a end of the strip, a second serge line 370 along a length of a first side of the strip and a third serge line along a length of a second side of the strip. Although not clearly shown, the holder 300 may include a fourth serge line at an end of the strip opposite the first serge line 360.

[0075] Furthermore, additional filler material may be included between the top and bottom surfaces. For example, the additional filler material may include additional strips of material. In one aspect, the additional filler may include an interface material between the top and bottom surfaces, and the fasteners 340 may be attached to the interface material.

[0076] FIGs. 11 and 12 shows a surgical instrument holder of a fourth embodiment of the present invention.

[0077] The surgical instrument holder 400 includes a top surface 410 and a bottom surface 420, a plurality of ridges 430 and spaces 450 between the ridges 430 for holding a plurality of surgical instruments. In one aspect, the surgical instrument holder may

be formed of a single strip of material having the desired thickness without folding or rolling. In another aspect, the surgical instrument holder may be formed of a single piece of material folded to form a strip or multiple pieces combined together to form a strip. As shown in FIGS. 11 and 12, the holder 400 is formed of a single piece of material folded in a shape of a strip and serge along it length at serge line 470 and serged at ends by serge line 460.

[0078] In the fourth embodiment, the surgical instrument holder 400 is irreversibly fastened together at fastening positions 440 to form and maintain the ridges 430. In one aspect, the ridges are fastened together by sewing, crimping or by heating means as well as, VELCRO, adhesives, or any means that fasten ridges into place.

[0079] As such, the surgical instrument holder 400 may not be unfolded without ripping or destroying the fastening means or the strip. As such, the holder 400 is fixed in a permanent position and ready for use in surgery. Also, since the holder 400 may not be unfolded, sterilization may not be practical. Accordingly, it may be desirable to manufacture the holder 400 from disposal materials approved for use in surgery.

[0080] FIGs. 13-15 shows a side view of a conventional Mayo Stand. FIGs. 16 and 17 show a surgical instrument holder according to an embodiment of the present invention holding surgical instruments on the Mayo Stand.

[0081] As shown in FIGs. 14 and 15, the Mayo Stand shown has a length of approximately 17 inches and a width of approximately 11 inches. The surgical instrument holder may preferably have a length less than the width of a Mayo Stand upon which the surgical instrument holder is to be placed.

[0082] As shown in FIG. 16 and 17, the surgical instrument holder according to embodiments of the present invention may hold a variety of surgical instruments in an organized manner. Since the one or more ridges of the surgical instrument holder are reliably

maintained, the surgical instrument may be positioned and repositioned into the holder in an easy and safe manner for continued use during surgery.

[0083] The surgical instrument holder may be manufactured according to the following method or any other method.

[0084] For a reusable device, a cloth may be cut to approximately 16 x 37 inch dimensions. Snap fasteners may be secured to a side of the cloth approximately 1 ½ inch from a long edge. The first and second snaps may be positioned approximately 3 ½ inches apart and the third snap may be positioned approximately 1 inch from the second snap. The fourth snap may be positioned approximately 3 ½ inches from the third snap. In total the holder may include seven pairs of snaps to form seven ridges, for example. Additionally, the above identified distance between the first and second snaps may be increased or decreased. Increasing the distance increases the height of the resulting ridge, and decreasing the distance decreases the height of the resulting ridge. The above identified distance between the second snap and third snap may be increased or decreased. Increasing the distance increases the distance between adjacent ridges and decreasing the distance decreases the distance between adjacent ridges. Furthermore, the number of pairs of snaps may be altered, thereby decreasing or increasing the number of resulting ridges. Alternately, the holder may include ties or VELCRO or any means that fasten ridges together. Then, the cloth is folded until the material is in approximately a 2 inch strip. Then, the long edge may be secured next to the snaps by serging or another manner of securing, and the ends of the strip may be secured by serging or another manner of securing.

[0085] Alternately, the cloth may be cut to 6-8 strips approximately 2 inch by 37 inch in size. After snap fasteners are secured, the strips may be secured together around the perimeter of the strip.

[0086] A disposable holder may be made in a similar manner to the reusable holder or by other means. For example, the disposable holder may include a single strip folded into a strip or a plurality of strips combined into a strip. In this case, the strip may be permanently fixed into the strip shape by pressing using a heating device if the material is plastic in nature or is susceptible to be fixed by heating means. Also, the ridges of the disposable device may also be permanently fixed together by a heating means.

[0087] Although the above-described holder has been described for holding surgical instruments, the holder could be used to hold objects other than surgical instruments and could be used in non-surgical contexts.

[0088] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A surgical instrument holder comprising of a strip of material that when permanently folded or fastened to itself creates at least one ridge for holding surgical instruments.

2. The surgical instrument holder of claim 1, wherein a plurality of the strips of material are fastened to each other extending the overall length of the device and the total number of ridges.

3. The surgical instrument holder of claim 1, wherein one or more coatings are applied to the strip of material for reducing the force needed to place and remove the surgical instruments within the surgical instrument holder.

4. The surgical instrument holder of claim 1, wherein one or more therapeutic agents are applied to the strip of material for reducing the growth of infectious organisms and maintaining the sterility of the surgical instruments.

5. The surgical instrument holder of claim 1, wherein the one or more strips are made from a nonwoven lint free material.

6. The surgical instrument holder of claim 1, wherein the one or more strips are made from a metallic material.

7. The surgical instrument holder of claim 1, wherein the one or more strips are made from a fabric material.

8. The surgical instrument holder of claim 1, wherein the one or more strips are made from a polymeric material.

9. The surgical instrument holder of claim 1, wherein the one or more strips are sterilized using steam, ethylene oxide, hydrogen peroxide, gamma radiation, ebeam sterilization steam- flowing or pressurized, chemical agents (alcohol, phenol, heavy metals, ethylene oxide gas), high velocity electronic bombardment, or ultraviolet light radiation and combinations thereof.

10. The surgical instrument holder of claim 1, wherein the one or more strips are capable of being re-sterilized after use.

11. The surgical instrument holder of claim 1, wherein the one or more strips allow the surgical instrument being held to be identified.

12. The surgical instrument holder of claim 1, wherein the one or more strips allow the distal end of the instrument being held to be visualized.

13. A method of use for a surgical instrument holder comprising the steps of:

placing the surgical instrument holder of claim 1 in close proximity to a surgical procedure;

placing surgical instruments in the surgical instrument holder such that the surgical instruments can be identified and easily removed, wherein a distal end of each instrument can be visualized to reduce the incidence of accidental exposure to blood borne pathogens;

using the surgical instrument holder to facilitate a counting of all the surgical instruments; and

disposing of the surgical instrument holder at the end of the surgical procedure.

14. A method of use for a surgical instrument holder comprising the steps of:

placing the surgical instrument holder of claim 1 in close proximity to a surgical procedure;

placing surgical instruments in the surgical instrument holder such that the surgical instruments can be identified and easily removed, wherein a distal end of each instrument can be visualized to reduce the incidence of accidental exposure to blood borne pathogens;

using the surgical instrument holder to facilitate a counting of all the surgical instruments; and

sterilizing the surgical instrument holder at the end of the surgical procedure for subsequent reuse.

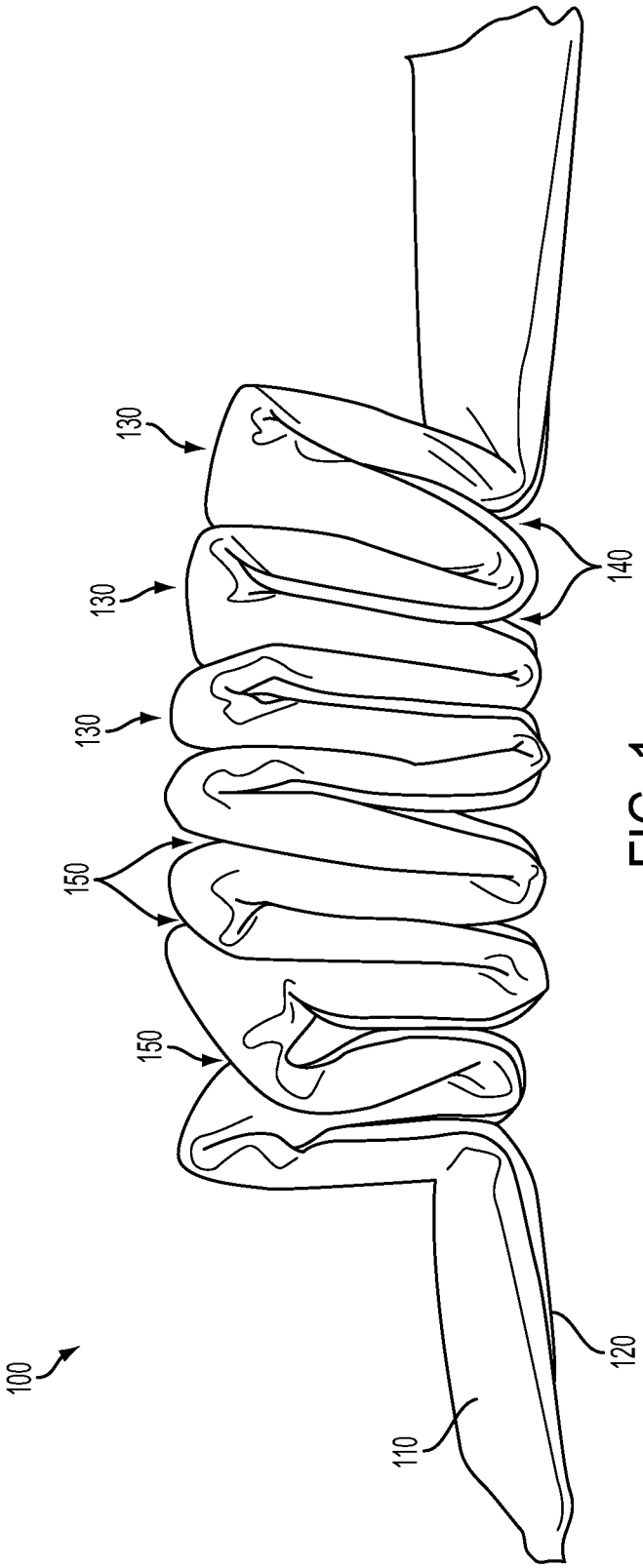

FIG. 1

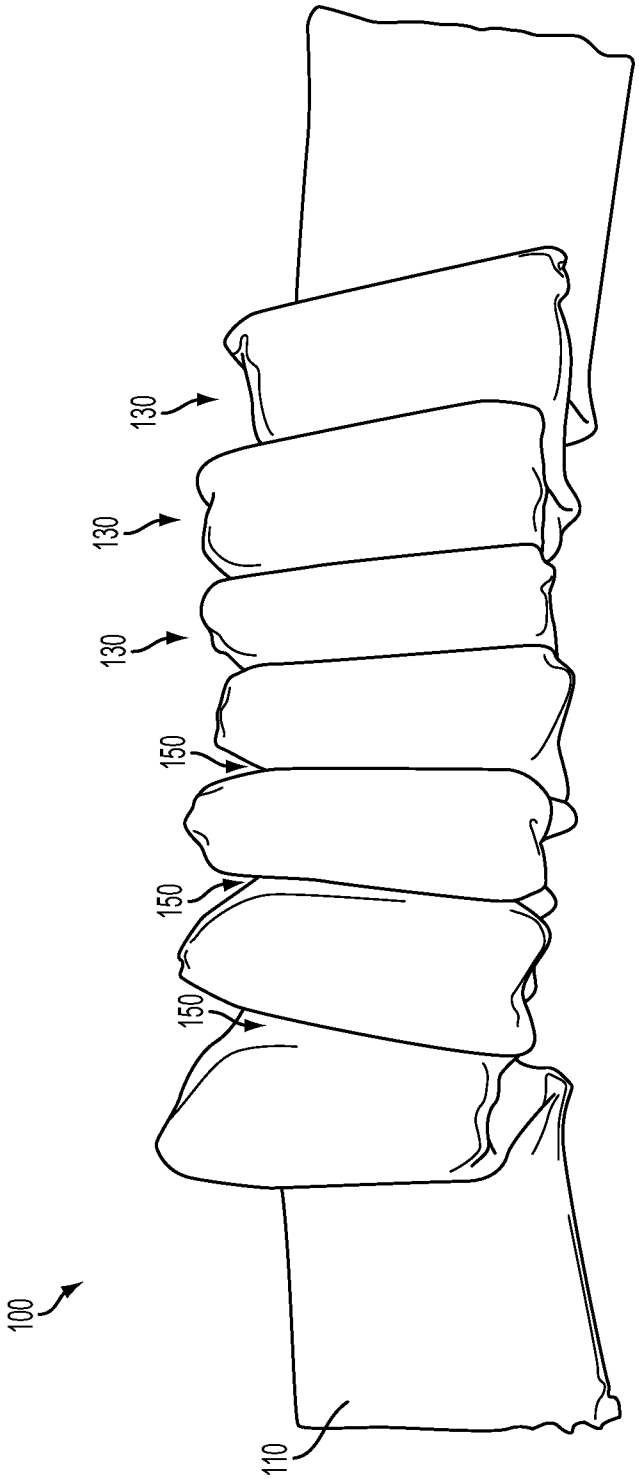

FIG. 2

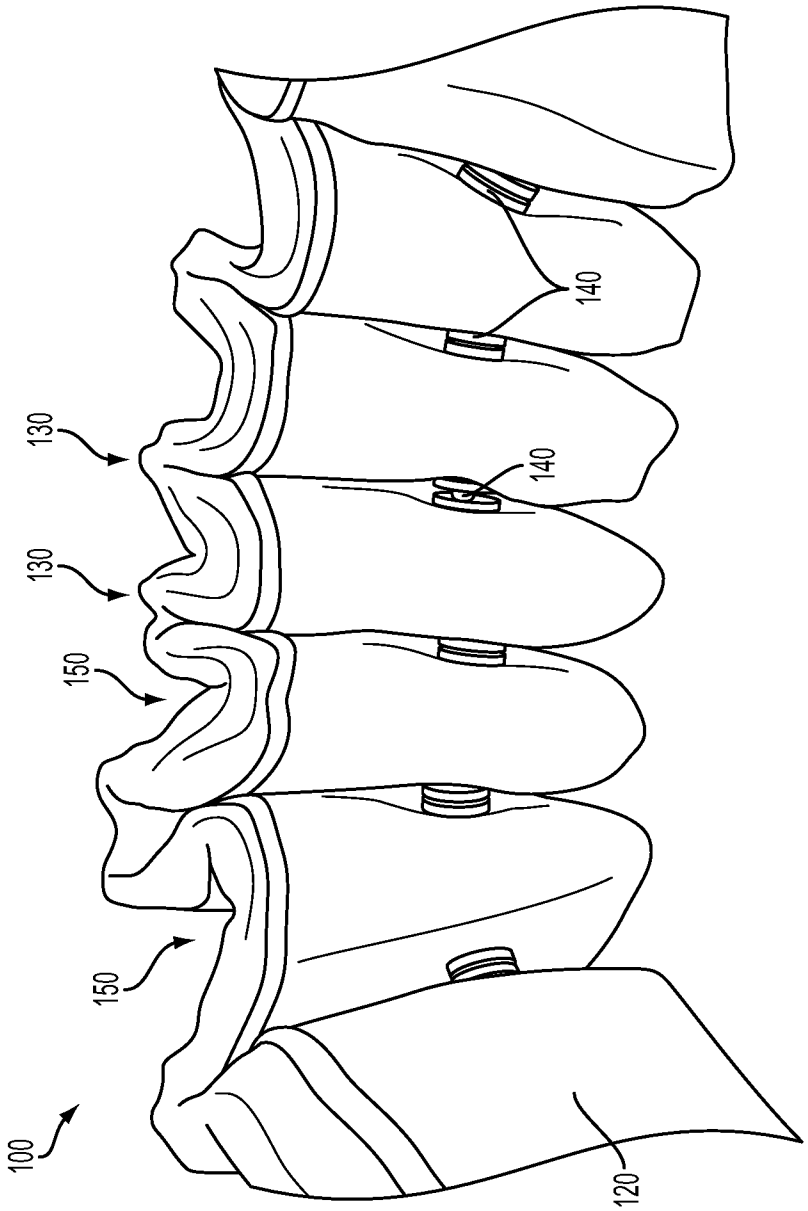

FIG. 3

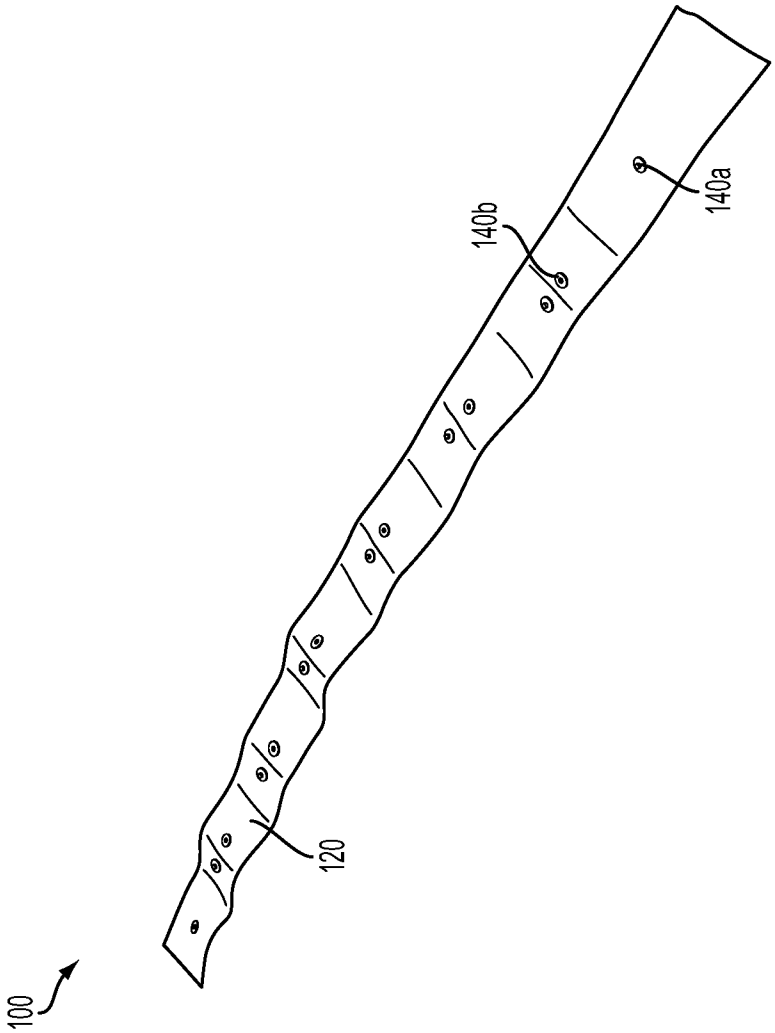

FIG. 4

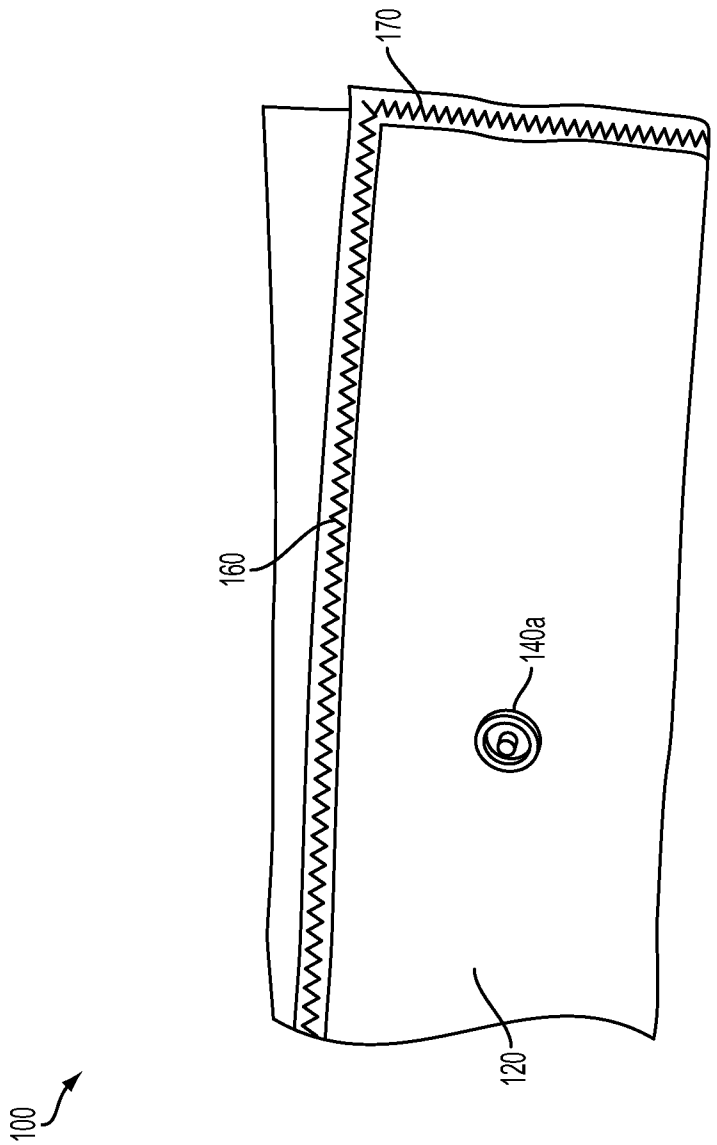

FIG. 5

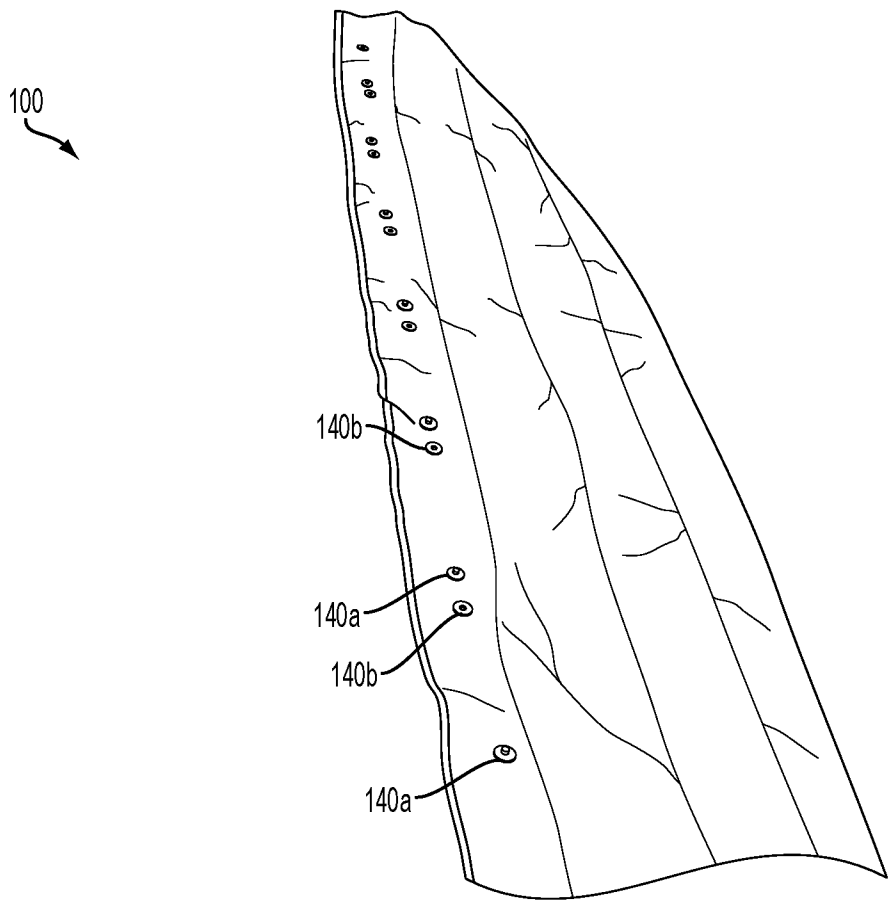

FIG. 6

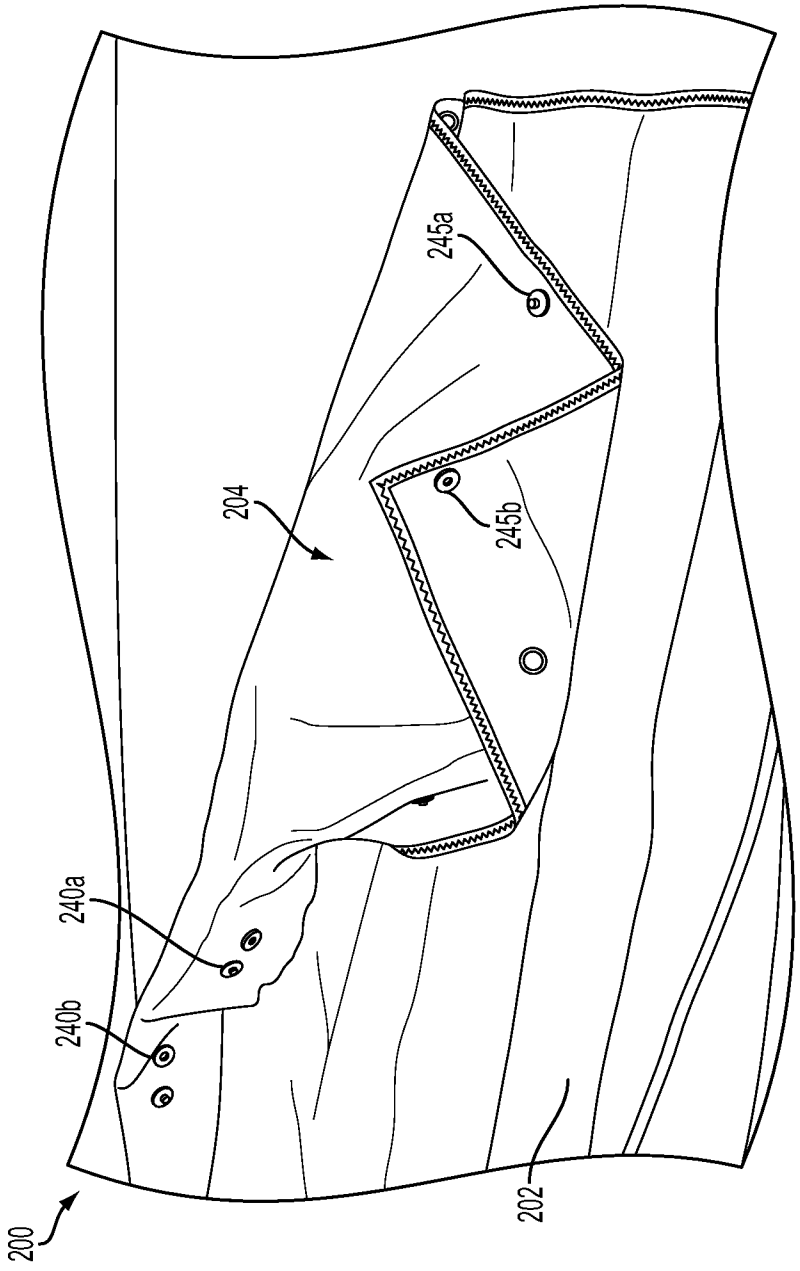

FIG. 7

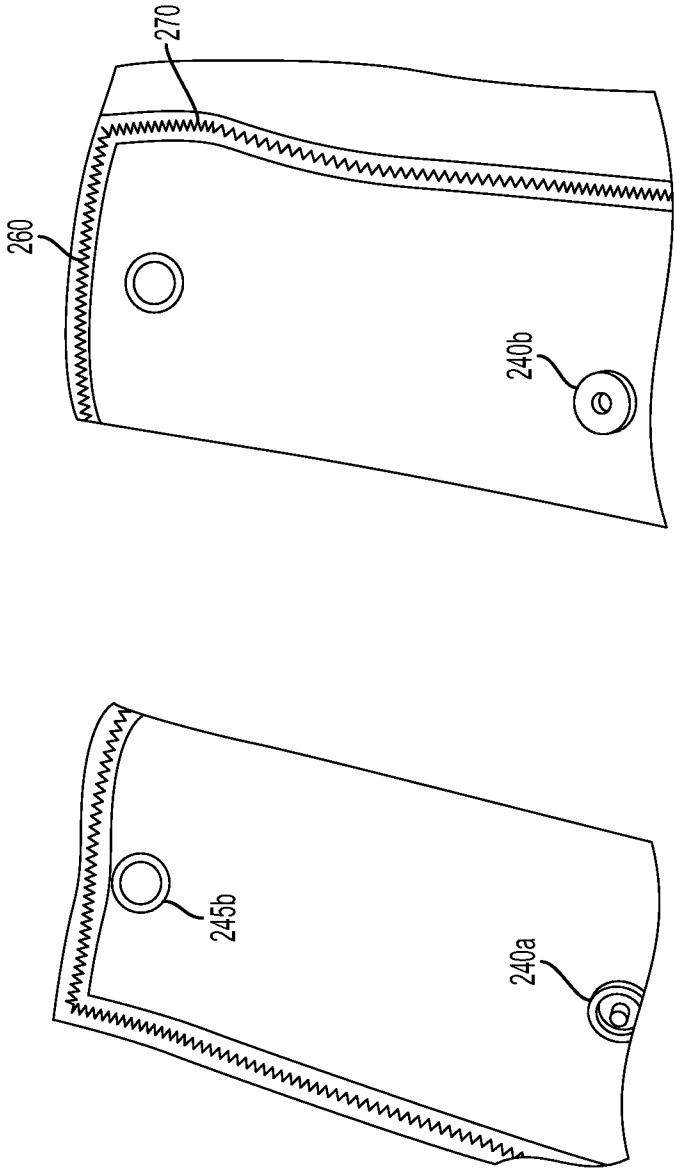

FIG. 8

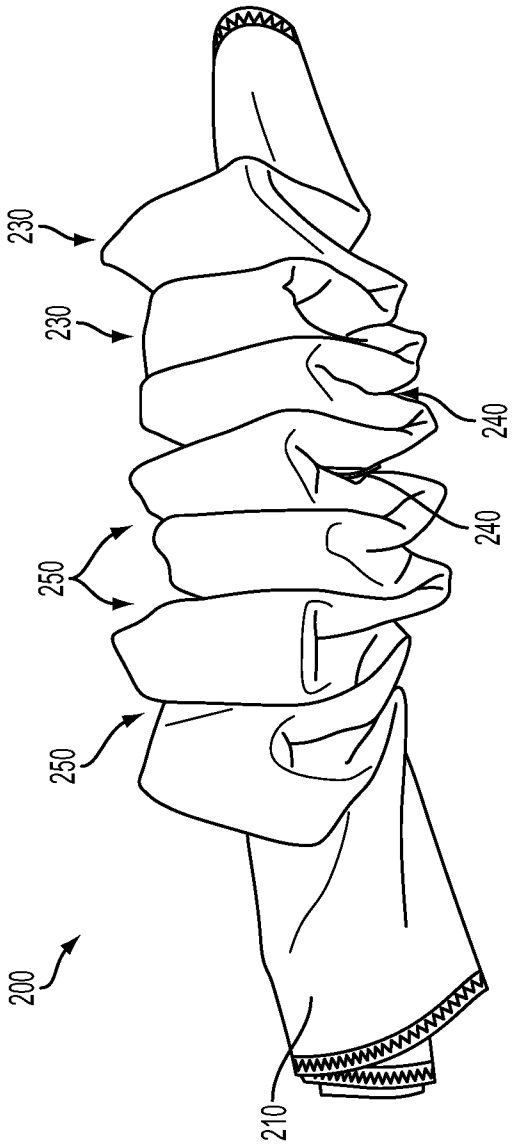

FIG. 9

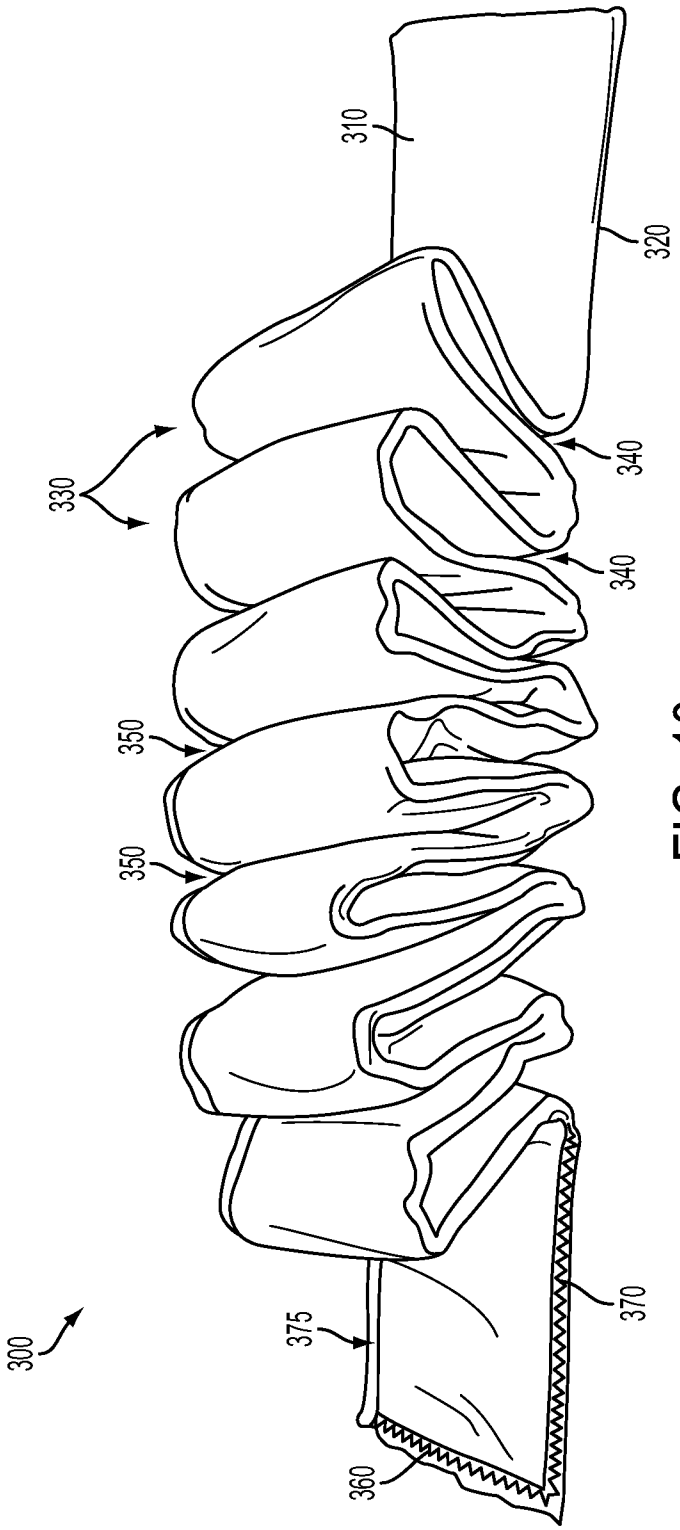

FIG. 10

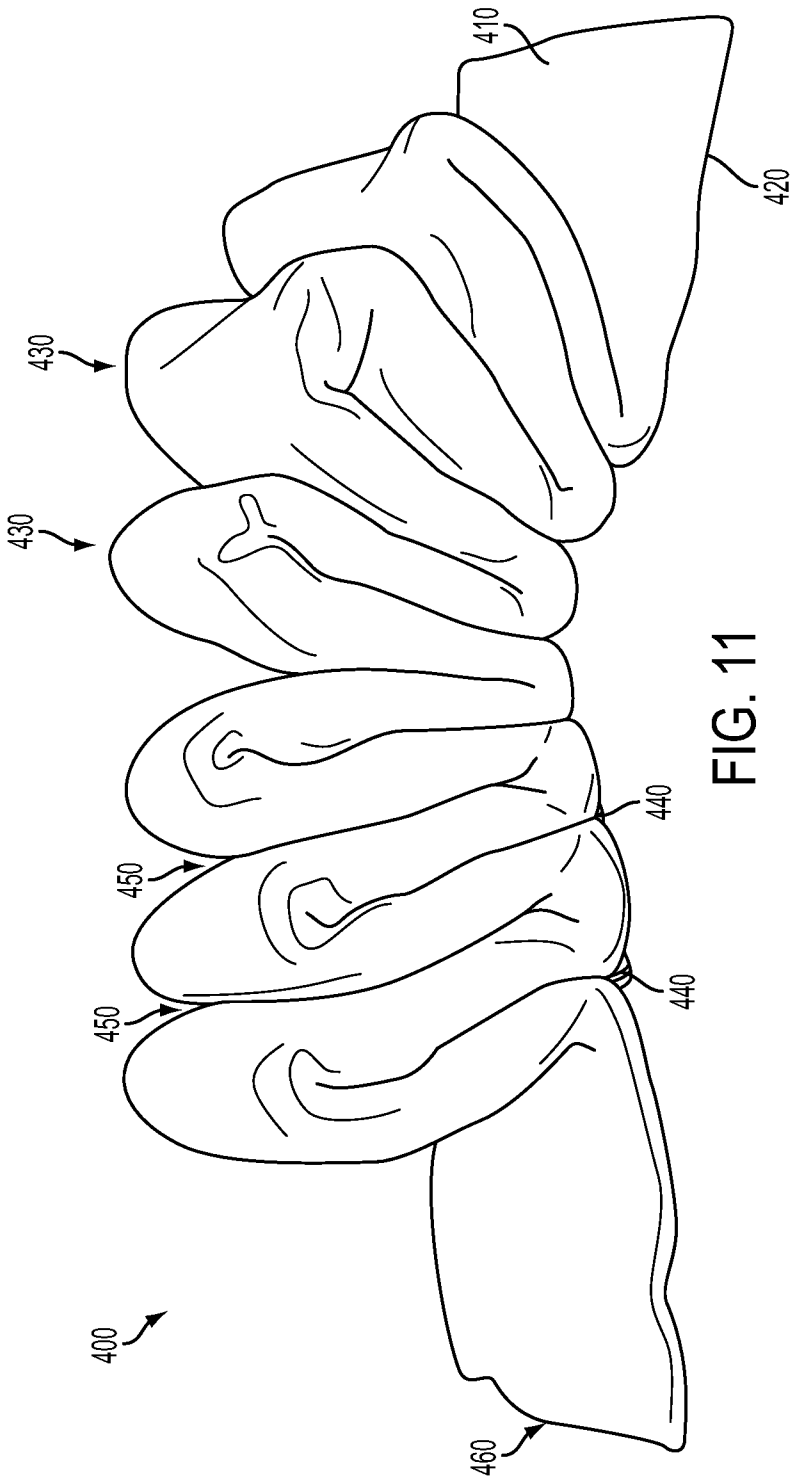

FIG. 11

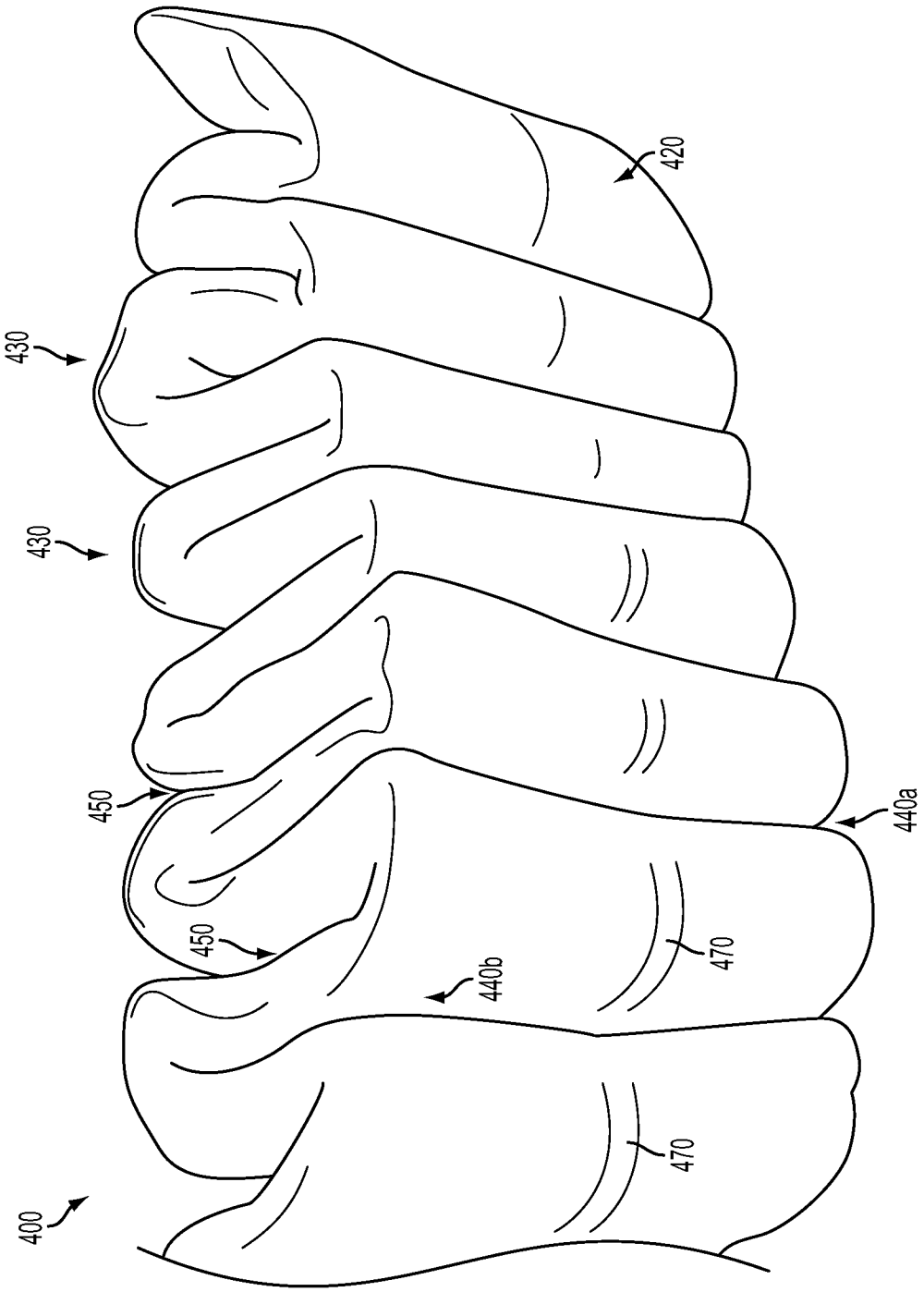

FIG. 12

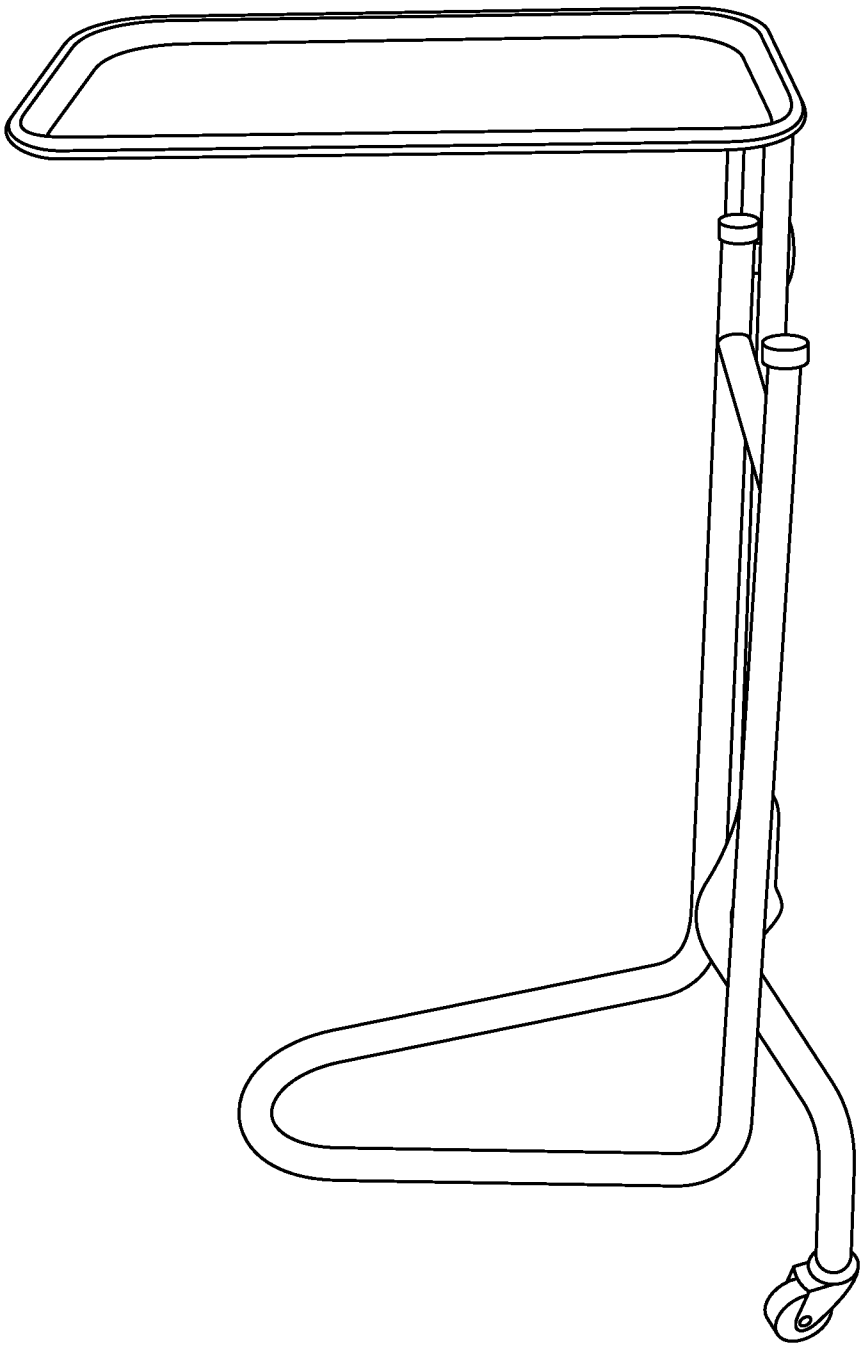

FIG. 13

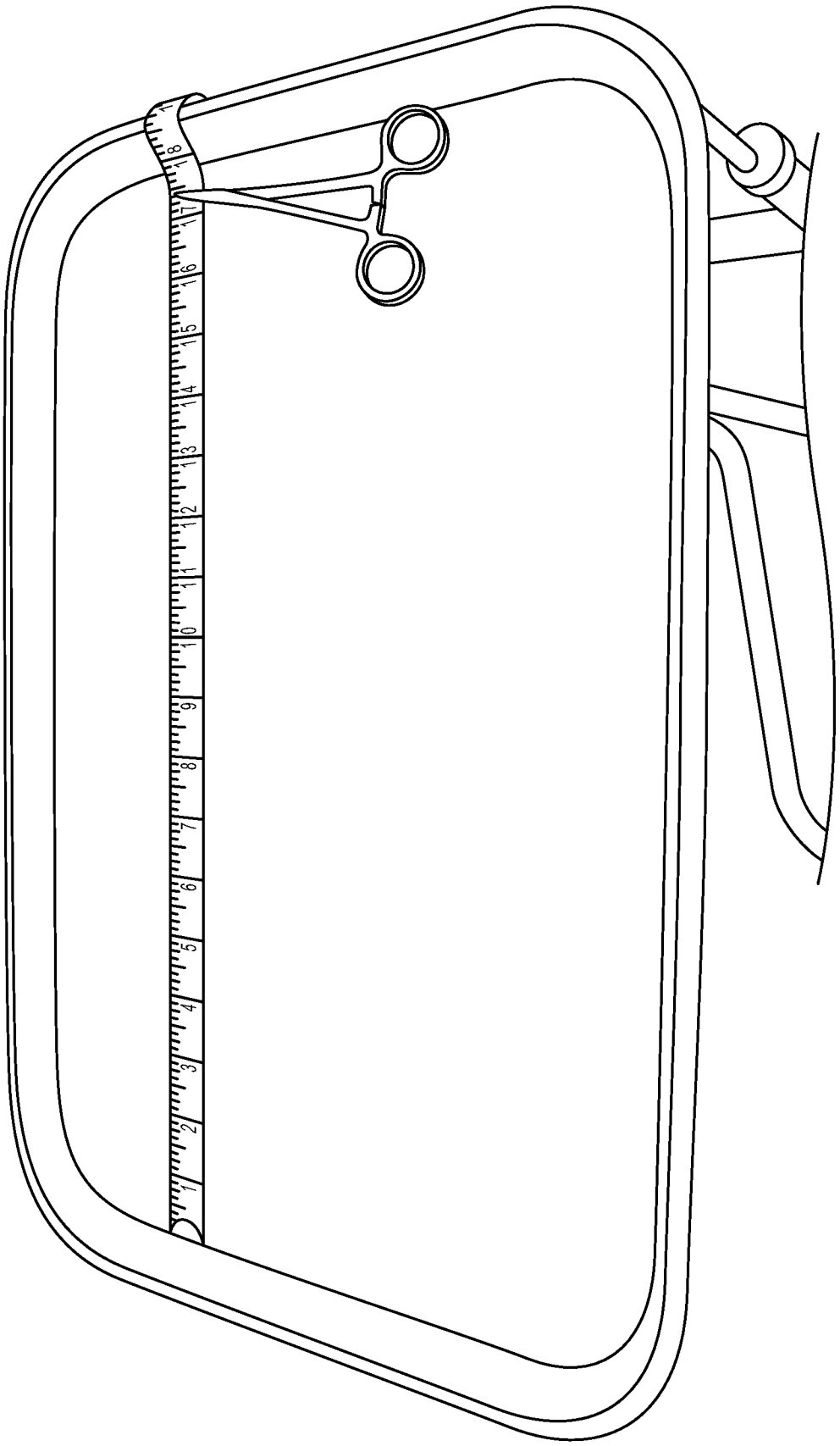

FIG. 14

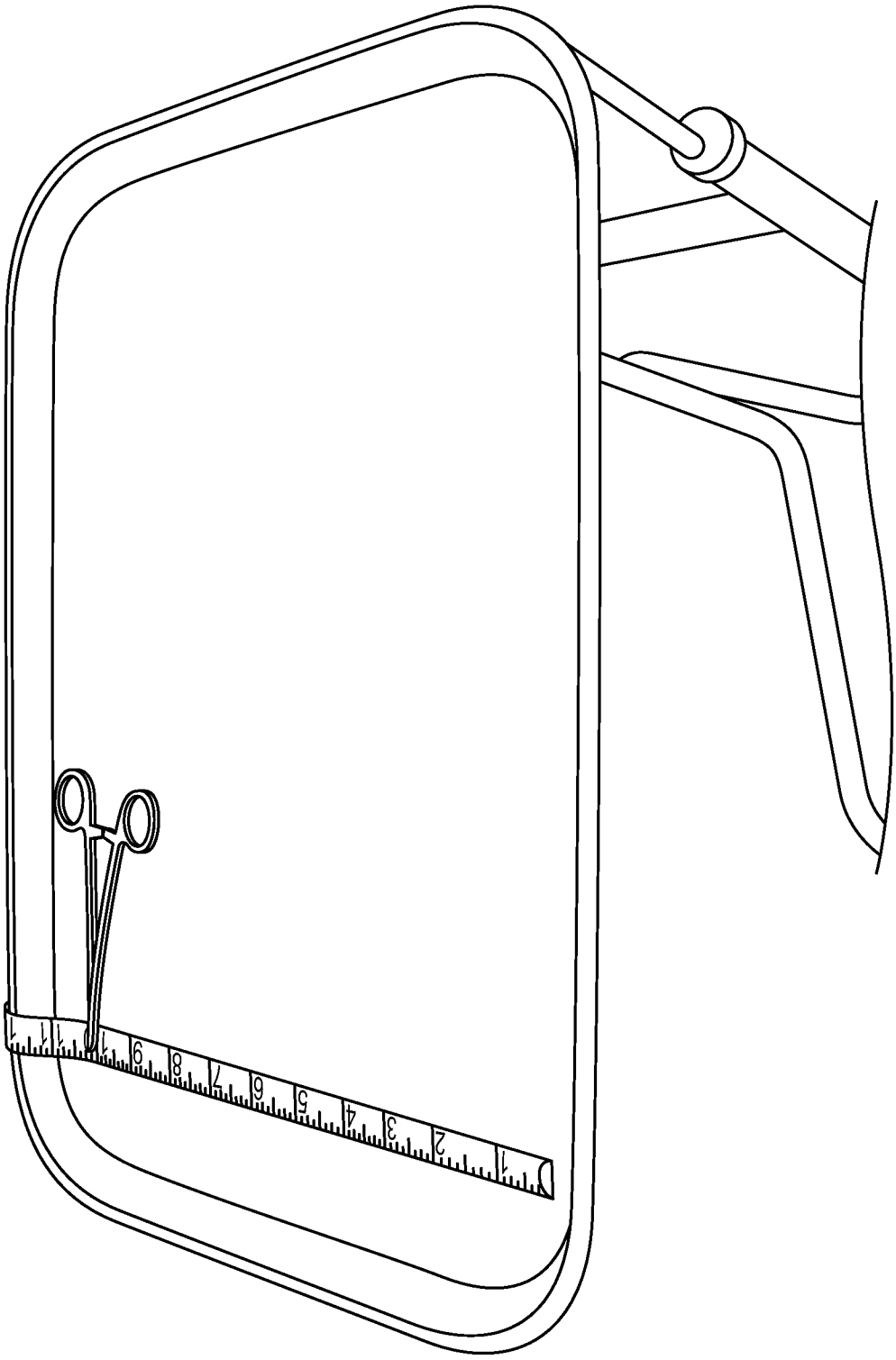

FIG. 15

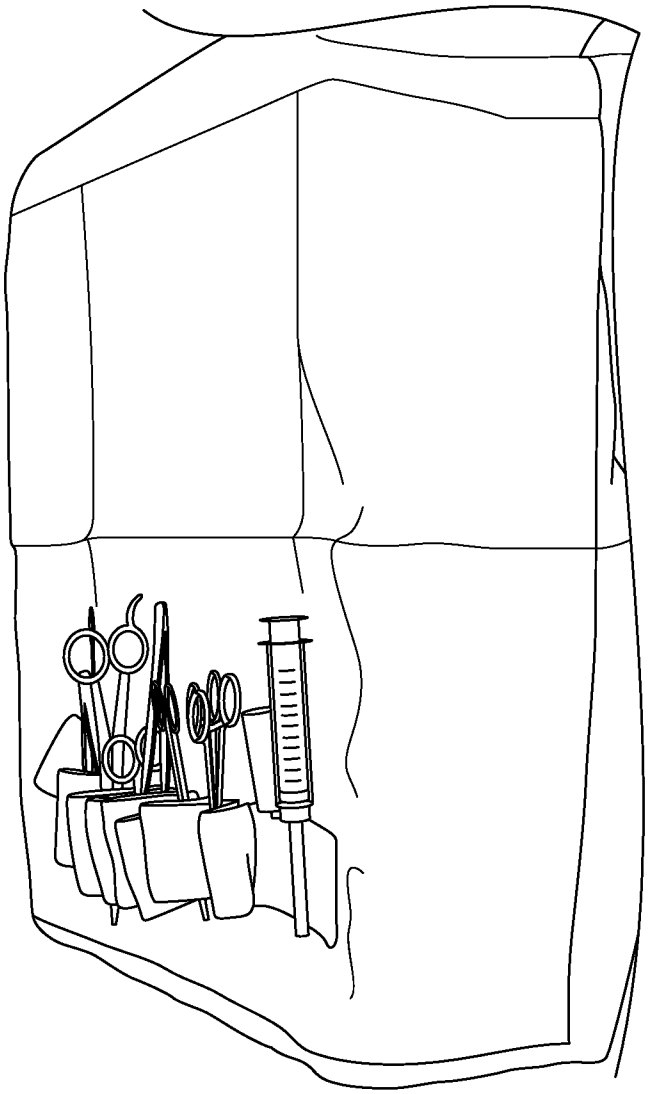

FIG. 16

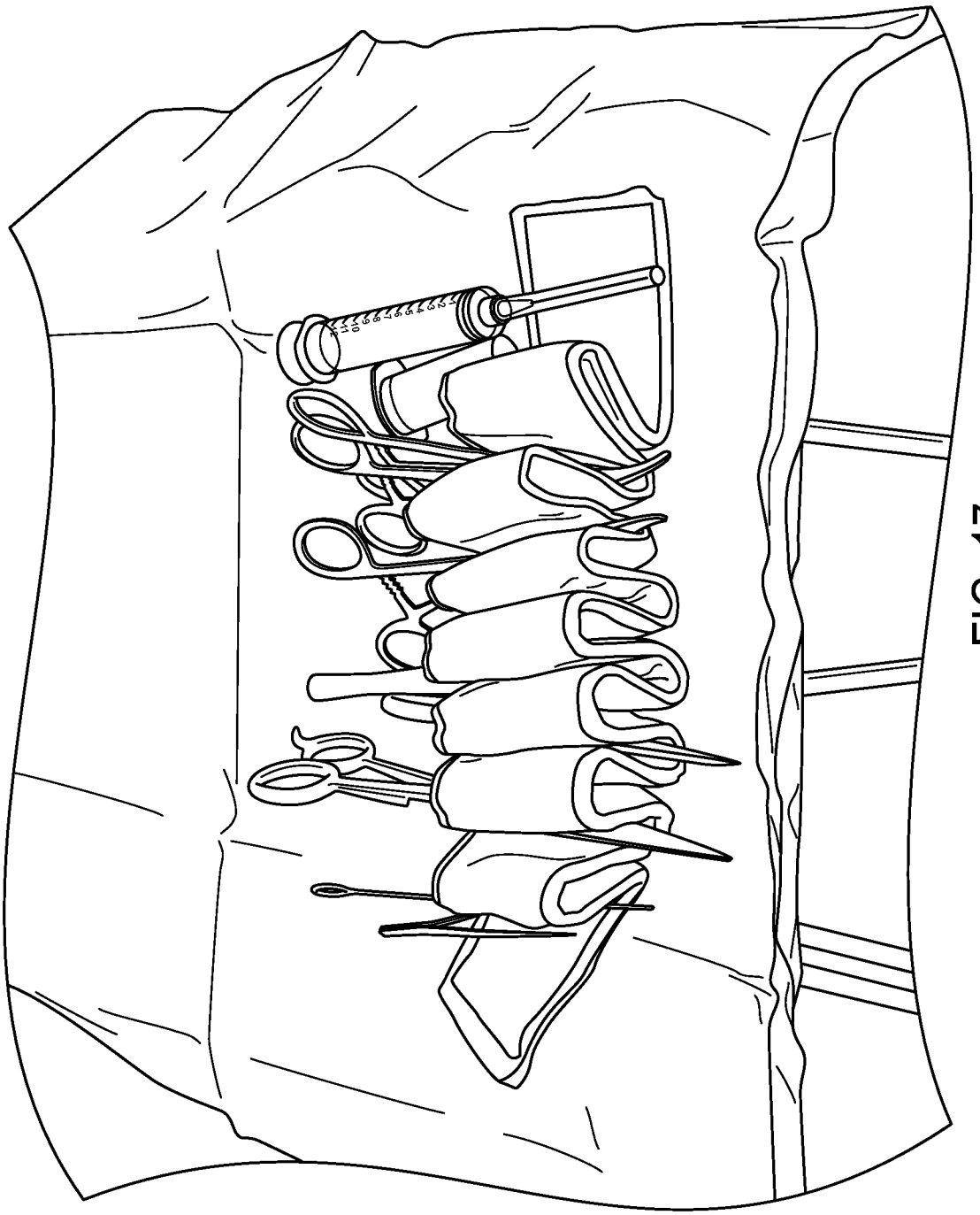

FIG. 17

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2010/047837

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - B65D 85/00 (2010.01)
USPC - 206/362
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)
IPC(8) - B65D 85/00 (2010.01)
USPC - 206/362, 363, 478; 211/70.6

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)
MicroPatent, Google patent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,082,111 A (CORBITT, JR. et al) 21 January 1992 (21.01.1992) entire document	1-3, 5, 7-8, 11-12
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Y		4, 6, 9-10, 13-14
Y	US 4,523,679 A (PAIKOFF et al) 18 June 1985 (18.06.1985) entire document	4
Y	US 3,967,728 A (GORDON et al) 06 July 1976 (06.07.1976) entire document	6
Y	US 3,654,047 A (BERKOWITZ) 04 April 1972 (04.04.1972) entire document	10
Y	US 5,181,609 A (SPIELMANN et al) 26 January 1993 (26.01.1993) entire document	13, 14
Y	US 3,180,485 A (NEVITT) 27 April 1965 (27.04.1965) entire document	14

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* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"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)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"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
"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
"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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 December 2010	14 DEC 2010

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774