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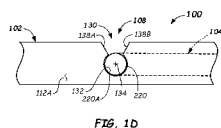
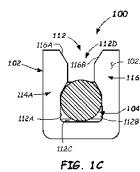
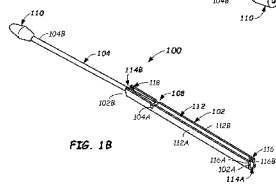
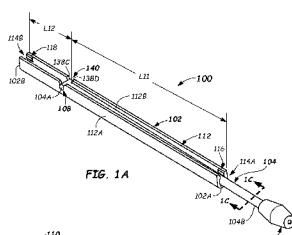
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(54) Title: FOLDABLE SWABS AND METHODS OF USE

(57) Abstract: A foldable swab includes a handle portion including a handle first end and a handle second end. An open channel is located in the handle portion and extends at least partially between the handle first and second end. The foldable swab further includes a shaft including a shaft first end and a shaft second end, wherein the shaft is pivotable about a pivot location on the handle portion at the shaft first end and is receivable in at least a portion of the open channel. An absorbent member is located on the shaft second end. Other foldable swabs and methods of using foldable swabs are disclosed, as are other aspects.



**FOLDABLE SWABS AND METHODS OF USE****FIELD**

[001] The present disclosure relates generally to swabs and methods of using swabs.

**BACKGROUND**

[002] Swabs are used to absorb and collect liquid samples, such as liquid samples from patients. Some swabs include a shaft with an absorbent material affixed to an end of the shaft. Some swabs may be fabricated to collect specific liquid samples for later analysis. For example, a swab with a long, flexible shaft may be appropriate for collecting certain samples, while swabs with shorter and sturdier shafts may be appropriate for collecting other samples. In order to collect a variety of samples, medical personnel or other users of swabs may have to store a variety of different swab types, which may be costly and cumbersome.

**SUMMARY**

[003] According to a first aspect, a foldable swab is provided. The foldable swab includes a handle portion including a handle first end and a handle second end; an open channel located in the handle portion and extending at least partially between the handle first end and the handle second end; a shaft including a shaft first end and a shaft second end, the shaft being pivotable about a pivot location on the handle portion at the shaft first end and receivable in at least a portion of the open channel; and an absorbent member located on the shaft second end.

[004] According to another aspect, a method of using a foldable swab is provided. The method includes providing a foldable swab including: a handle portion including a handle first end and a handle second end; an open channel located in the handle portion and extending at least partially between

the handle first end and the handle second end; a shaft including a shaft first end and a shaft second end, the shaft being pivotable about a pivot location on the handle portion at the shaft first end and receivable in at least a portion of the open channel; and an absorbent member located on the shaft second end. The method further includes pivoting the shaft about the pivot location to where the shaft is proximate one of the handle first end or the handle second end; and placing at least a portion of the shaft into at least a portion of the open channel.

[005] In another aspect, a foldable swab is provided. The foldable swab includes a handle portion including a handle first end and a handle second end; an open channel located in the handle portion extending between the handle first end and the handle second end; a shaft including a shaft first end and a shaft second end, wherein the shaft is at least partially receivable in the open channel; an axle located at the shaft first end; and one or more openings in the handle portion, wherein the axle is received in the one or more openings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[006] FIG. 1A illustrates a top isometric view of a foldable swab in a first or retracted configuration according to one or more embodiments.

[007] FIG. 1B illustrates a top isometric view of a foldable swab in a second or extended configuration according to one or more embodiments.

[008] FIG. 1C illustrates an end view of a foldable swab including an open channel and a cross-sectioned view of a shaft received within the open channel taken along reference view 1C-1C of FIG. 1A according to one or more embodiments.

[0009] FIG. 1D illustrates an enlarged view of a pivot location of a shaft received in a handle portion of a foldable swab according to one or more embodiments.

[0010] FIG. 2A illustrates a front view of a first end of a shaft, including an axle, of a foldable swab according to one or more embodiments.

[0011] FIG. 2B illustrates a side view of the first end of the shaft, including the axle of FIG. 2A, according to one or more embodiments.

[0012] FIG. 3 illustrates a foldable swab transitioning between a first or retracted configuration, an intermediate configuration, and a second or extended configuration according to one or more embodiments.

[0013] FIG. 4A illustrates a top plan view of a foldable swab in a first configuration and located in a sealed wrapper according to one or more embodiments.

[0014] FIG. 4B illustrates a top plan view of a foldable swab in a first configuration and located in a collection device according to one or more embodiments.

[0015] FIG. 5 illustrates a flowchart depicting a method of using a foldable swab according to one or more embodiments.

#### DETAILED DESCRIPTION

[0016] Swabs may be used to collect liquid samples from patients and other sources. The swabs may include a shaft having an absorbent member affixed to an end of the shaft, wherein the absorbent members are configured to absorb the liquid samples for later testing. Different swab types may be used to collect different sample types from different locations. For example, the different sample types may be collected from different locations on a patient. The different swab types may be differentiated from one another as having different shaft lengths and/or different shaft flexibilities.

After a sample is collected in the absorbent member, the swab may be placed in a collection device, such as a sealed bag or sealed tube and sent to a laboratory for analysis. Individual swabs are typically placed in individual collection devices so that individual samples do not contaminate one another.

[0017] Based on the foregoing, sample collection using conventional swabs may involve using a plurality of different swab types and may also involve using a plurality of collection devices having different sizes to accommodate the different swab types. Thus, a conventional swab kit may include a plurality of swab types, each having different lengths and/or different flexibilities. In addition, a conventional swab kit may include a plurality of different collection devices to receive the different swab types. Thus, conventional swab kits or storage facilities for swabs may be relatively large to accommodate the different swab types and their accompanying different container devices.

[0018] Embodiments of foldable swabs disclosed herein include foldable swabs that may transition between a retracted or first configuration and an extended or second configuration. The foldable swabs disclosed herein may include a handle portion and a shaft that is pivotally attached to the handle portion such that the shaft is pivotable about a pivot location on the handle portion. A first end of the shaft may be pivotally attached to the handle portion and a second end of the shaft may include an absorbent member used to absorb a liquid sample. As described above, the foldable swabs may include a first or retracted configuration wherein the shaft is received in an open channel within the handle portion. In the first configuration, the shaft may extend a relatively short distance from a first end of the handle portion, so the shaft may be relatively rigid and short. In the second or extended configuration of the foldable swabs, the shaft may

extend from a second end of the handle portion a greater distance than when the foldable swab is in the first configuration. In the second configuration, the shaft may be received within a portion of the open channel of the handle portion, but the shaft may extend from an opposite end of the handle portion relative to the first position. In the second configuration, the foldable swab may be longer than and may provide more flexibility than when the foldable swab is in the first configuration.

[0019] In operation, a sample may be collected using a foldable swab in either the first configuration or the second configuration. For example, if the sample collection necessitates a long or flexible swab, the foldable swab may be placed in the second configuration. If the sample collection necessitates a short or rigid swab, the foldable swab may be placed in the first configuration. The foldable swab may then be placed in the first configuration, if not already in the first configuration, and placed in a collection device. Therefore, a single type or size of collection device may be used to receive the foldable swabs.

[0020] The above-described embodiments of foldable swabs and methods of using foldable swabs are described in greater detail below with reference to FIGS. 1A-5.

[0021] Reference is made to FIG. 1A, which illustrates a top isometric view of a foldable swab 100 in a first configuration. Reference is also made to FIG. 1B, which illustrates a top isometric view of the foldable swab 100 in a second configuration. FIG. 1A is shown enlarged relative to FIG. 1B. The first configuration of the foldable swab 100 may be referred to as a retracted configuration and the second configuration of the foldable swab 100 may be referred to as an extended configuration. The foldable swab 100 may include intermediate configurations between the first configuration

and the second configuration. The foldable swab 100 includes a handle portion 102 and a shaft 104, wherein the shaft 104 pivots about the handle portion 102 at a pivot location 108.

[0022] The handle portion 102 includes a handle first end 102A and a handle second end 102B located opposite the handle first end 102A. The handle second end 102B may be located closer to the pivot location 108 than the handle first end 102A. Therefore, a length L11, measured from the pivot location 108 to the handle first end 102A, may be longer than a length L12, measured from the pivot location 108 to the handle second end 102B. In some embodiments, the length L11 may be two times the length L12. In some embodiments, the handle portion 102 may be made of a pliable material, such as plastics and other polymers. In some embodiments, the handle portion 102 and/or the shaft 104 may be made of polypropylene and/or polyethylene. In some embodiments, the handle portion 102 may be made of any suitable material that is able to deflect and return to its original shape.

[0023] The shaft 104 includes a shaft first end 104A and a shaft second end 104B located opposite the shaft first end 104A. As described above, the shaft 104 is able to pivot relative to the handle portion 102 about the pivot location 108. For example, the shaft first end 104A may pivot relative to the handle portion 102 at the pivot location 108. The shaft 104 may be made from a flexible material that provides flexibility without breaking when the swab is being used to absorb a liquid. In some embodiments, the handle portion 102 and/or the shaft 104 may be made of polypropylene and/or polyethylene. An absorbent member 110 may be affixed to the shaft second end 104B. In some embodiments, the absorbent member 110 may be integral with the shaft 104. In some embodiments, the absorbent member 110 may be a material commonly used on swabs or any suitable material.

[0024] Additional reference is made to FIG. 1C, which illustrates an end view of the foldable swab 100 including a cross-sectioned view of the shaft 104 taken along reference view 1C-1C of FIG. 1A. The view of FIG. 1C includes an open channel 112 formed in the handle portion 102 and a cross-sectioned view of the shaft 104 received within the open channel 112. The open channel 112 may include a first wall 112A, a second wall 112B located opposite the first wall 112A, and a third wall 112C extending between the first wall 112A and the second wall 112B. The first wall 112A and the second wall 112B may be flexible, meaning that the walls may be able to deflect to enable the shaft 104 to be received into the open channel 112 and removed therefrom. After the shaft 104 is received into or removed from the open channel 112, the first wall 112A and the second wall 112B may return to their original positions. An opening 112D may be located opposite the third wall 112C and between the first wall 112A and the second wall 112B. The shaft 104 may be receivable within the open channel 112 by way of the opening 112D. The open channel 112 may extend at least partially between a channel first end 114A and a channel second end 114B. The channel first end 114A may be located at the handle first end 102A and the channel second end 114B may be located at the handle second end 102B.

[0025] The handle portion 102 may include one or more retention devices that maintain the shaft 104 within the open channel 112. For example, a first retention device 116 may be located proximate the channel first end 114A and a second retention device 118 may be located proximate the channel second end 114B. In some embodiments, the first retention device 116 and the second retention device 118 may be protrusions extending from the first wall 112A and the second wall 112B and spaced from the third wall 112C. Reference is made to the first retention device 116, which may be identical or substantially similar to the second retention device 118.



The first retention device 116 may include a first retainer 116A extending from the first wall 112A and a second retainer 116B extending from the second wall 112B. The shaft 104 may be receivable between the third wall 112C and the first retention device 116. As described above, the first wall 112A and the second wall 112B may be pliable. Thus, in use, the shaft 104 may be forced into the open channel 112, which deflects the first wall 112A and the second wall 112B to enable the shaft 104 to enter the open channel 112 and to be retained between the first retention device 116 and the third wall 112C. The shaft 104 may be removed from the open channel 112 by pulling the shaft 104 from the open channel 112, which causes the first wall 112A and the second wall 112B to deflect to enable the shaft 104 to be removed from the open channel 112. Other suitable retention devices may be used.

[0026] The first retention device 116 and the second retention device 118 are illustrated as being located proximate the handle first end 102A and the handle second end 102B, respectively. In some embodiments the first retention device 116 and the second retention device 118 may be located in other regions of the handle portion 102. In other embodiments, the first retention device 116 and the second retention device 118 may extend to the pivot location 108 or proximate the pivot location 108.

[0027] Additional reference is made to FIG. 2A, which illustrates a front view of the shaft first end 104A, and FIG. 2B, which illustrates a side view of the shaft first end 104A. The shaft first end 104A may include an axle 220 located thereon. The axle 220 may be a device that is at least partially circular or at least partially curved so as to enable the shaft 104 to rotate in circular holes in the first wall 112A and the second wall 112B as described below. The axle 220 may include one or more axle portions. In the

embodiment of FIGS. 2A-2B, the axle 220 includes a first axle portion 220A that is receivable in the first wall 112A and a second axle portion 220B that is receivable in the second wall 112B. The axle 220, including the first axle portion 220A and the second axle portion 220B, are illustrated as being round. In other embodiments, the axle 220, including the first axle portion 220A and the second axle portion 220B may be at least partially curved, partially circular, or semicircular.

[0028] Additional reference is now made to FIG. 1D, which illustrates an enlarged view of the first axle portion 220A received in a first opening 130 in the first wall 112A. A similar or identical second opening 140 (FIG. 1A) may be located in the second wall 112B. The first opening 130 may include a circular portion 132 that may be at least partially circular (e.g., semicircular). A radius of the circular portion 132 may be equal to or slightly larger than a radius of the first axle portion 220A to enable the first axle portion 220A and, thus, the shaft 104, to pivot or rotate within the first opening 130. The circular portion 132 may constitute a pivot location 134 where the shaft 104 is pivotable about the handle portion 102. The pivot location 108 and the pivot location 134 may be the same location.

[0029] The first opening 130 may include one or more first tabs 138A, 138B that retain the first axle portion 220A in the circular portion 132. Second tabs 138C, 138D (FIG. 1A) may be located in a second opening 140 in the second wall 112B that is similar to the first opening 130. The tabs 138A-138D may be integrally formed with the handle portion 102 and may be pliable. Thus, the axle 220 of the shaft 104 may be pressed into the first opening 130 and the second opening 140 with enough force to cause the tabs 138A-138D to separate slightly and allow the axle 220 to pass into the first opening 130 and the second opening 140. The tabs 138A-138D retain the axle 220

within the first opening 130 and the second opening 140 during operation of the foldable swab 100. For example, the tabs 138A-138D may exert no force or a small force small on the axle 220, which does not prevent the axle 220 from rotating relative to the handle portion 102.

[0030] As described above, the shaft 104 is pivotal relative to the handle portion 102 about the pivot location 108. Additional reference is made to FIG. 3, which illustrates the foldable swab 100 transitioning between the first configuration and the second configuration. When the foldable swab 100 is in the first configuration, the shaft 104 may be referred to as being in a first position and when the foldable swab 100 is in the second configuration, the shaft 104 may be referred to as being in a second position. The absorbent member 110 extends a first length L31 from the handle first end 102A when the foldable swab 100 is in the first configuration. The absorbent member 110 extends a length L32 from the handle second end 102B when the foldable swab 100 is in the second configuration, wherein the first length L31 is less than the second length L32. Thus, a longer portion of the shaft 104 is received in the open channel 112 when the foldable swab 100 is in the first configuration than when the foldable swab 100 is in the second configuration. FIG. 3 also illustrates the foldable swab 100 in an intermediate configuration, which is between the first configuration and the second configuration. When the foldable swab 100 is in the intermediate configuration, the shaft 104 may not be received in the open channel 112.

[0031] In the embodiment depicted in FIG. 3, the axle 220 pivots about the pivot location 134 between the first position and the second position. The first position of the shaft 104 and the second position of the shaft 104 are separated by an angle  $\alpha$ . In some embodiments, the angle  $\alpha$  is at least  $170^\circ$ . In

other embodiments, the angle  $\alpha$  is at least  $180^\circ$ . The first opening 130 and the second opening 140 (FIG. 1A) may be slightly higher than the third wall 112C (FIG. 1D), which may cause the angle  $\alpha$  to be slightly greater than  $180^\circ$ . In some embodiments, the angle  $\alpha$  may be less than  $180^\circ$ .

**[0032]** Additional reference is made to FIG. 4A, which illustrates a top plan view of the foldable swab 100 located in a sealed wrapper 446 prior to use. In the embodiment of FIG. 4A, the foldable swab is in the first configuration while it is in the sealed wrapper. Because the foldable swab 100 may be transitioned to the second or extended configuration after the foldable swab 100 is removed from the sealed wrapper 446, a single-sized wrapper may be used to store the foldable swab 100. In other embodiments, the foldable swab 100 may be in the second configuration when it is located in the sealed wrapper 446.

**[0033]** After use of the foldable swab 100, the shaft 104, including the absorbent member 110, may be separated from the handle portion 102 and placed in a collection device for transport and/or storage. Referring to FIG. 3, the shaft 104 may be rotated about the pivot location 108 to cause the axle 220 (FIGS. 2A-2B) to dislodge from the tabs 138A-138D. For example, the shaft 104 may be rotated beyond the handle portion 102, which forces the shaft 104 from the pivot location 108. In the examples of FIGS. 2A, 2B, and 3, the first axle portion 220A may be removed from the first opening 130 by being released from the tabs 138A-138B and the second axle portion 220B may be removed from the second opening 140 by being released from the tabs 138C-138D. Other methods may be used to separate the shaft 104 from the handle portion 102.

**[0034]** Additional reference is made to FIG. 4B, which illustrates a top plan view of the shaft 104, including the absorbent member 110, located in a collection device 448. A

portion of the shaft 104 and the absorbent member 110 may be placed in the collection device 448 after a sample has been collected in the absorbent member 110. The collection device 448 may enclose at least a portion of the shaft 104 and/or the absorbent member 110 to prevent samples collected in the absorbent member 110 from becoming contaminated. In some embodiments, the shaft 104 may be broken so that only a portion of the shaft 104 and the absorbent member 110 is placed in the collection device 448. The collection device 448 may include a container 450, such as a tube, and a cap 452 that seals the container 450. In some embodiments, the foldable swab 100 may be placed in the collection device 448.

**[0035]** Reference is now made to FIG. 5, which illustrates flowchart describing a method 500 of using a foldable swab (e.g., foldable swab 100). The method 500 includes, at 502, providing a foldable swab comprising: a handle portion (e.g., handle portion 102) including a handle first end (e.g., handle first end 102A) and a handle second end (e.g., handle second end 102B); an open channel (e.g., open channel 112) located in the handle portion and extending at least partially between the handle first end and the handle second end; a shaft (e.g., shaft 104) including a shaft first end (e.g., shaft first end 104A) and a shaft second end (e.g., shaft second end 104B), the shaft being pivotable about a pivot location (e.g., pivot location 108) on the handle portion at the shaft first end and receivable in at least a portion of the open channel; and an absorbent member (e.g., absorbent member 110) located on the shaft second end. The method includes, at 504, pivoting the shaft about the pivot location to where the shaft is proximate one of the handle first end or the handle second end. The method includes, at 506, placing at least a portion of the shaft into at least a portion of the open channel.

**[0036]** While the disclosure is susceptible to various

modifications and alternative forms, specific apparatus embodiments and methods thereof have been shown by way of example in the drawings and are described in detail herein. It should be understood, however, that it is not intended to limit the invention to the particular apparatus or methods disclosed, but, to the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the scope of the claims.

## CLAIMS

WHAT IS CLAIMED IS:

1. A foldable swab, comprising:
  - a handle portion including a handle first end and a handle second end;
  - an open channel located in the handle portion and extending at least partially between the handle first end and the handle second end;
  - a shaft including a shaft first end and a shaft second end, the shaft being pivotable about a pivot location on the handle portion at the shaft first end and receivable in at least a portion of the open channel; and
  - an absorbent member located on the shaft second end.
2. The foldable swab of claim 1, further comprising a retention device located in the open channel, wherein the retention device is configured to retain the shaft within the open channel.
3. The foldable swab of claim 1, wherein the open channel includes a channel first end located proximate the handle first end and a channel second end located proximate the handle second end, and further comprising a first retention device located in the open channel proximate the channel first end, wherein the shaft is receivable in the first retention device and wherein the first retention device is configured to retain the shaft in the open channel.
4. The foldable swab of claim 3, further comprising a second retention device located in the open channel proximate the channel second end, wherein the second retention device is configured to retain the shaft in the open channel.

5. The foldable swab of claim 1, wherein the pivot location is located closer to the handle second end than the handle first end.

6. The foldable swab of claim 1, further comprising one or more openings located in the handle portion at the pivot location, wherein at least a portion of the shaft first end is receivable in the one or more openings.

7. The foldable swab of claim 6, wherein the one or more openings are at least partially curved, wherein the shaft first end includes one or more axle portions that are at least partially curved, and wherein the one or more axle portions are received in the one or more openings.

8. The foldable swab of claim 1, wherein the handle portion includes a first wall and a second wall facing the first wall, wherein the first wall and the second wall at least partially form the open channel, and further comprising:

a first opening located in the first wall, wherein at least a portion of the shaft first end is received in the first opening; and

a second opening located in the second wall, wherein at least a portion of the shaft first end is received in the second opening.

9. The foldable swab of claim 8, wherein:

the first opening is least partially curved;

the second opening is at least partially curved;

the shaft first end includes a first axle portion that is at least partially curved and is received in the first opening; and



the shaft first end includes a second axle portion that is at least partially curved and is received in the second opening.

10. The foldable swab of claim 8, further comprising:

first tabs located at the first opening, wherein the first tabs retain at least a portion of the shaft first end in the first opening; and

second tabs located at the second opening, wherein the second tabs retain at least a portion of the shaft first end in the second opening.

11. The foldable swab of claim 1, wherein the open channel includes a channel first end located proximate the handle first end and a channel second end located proximate the handle second end, wherein the shaft is pivotable between a first position and a second position, wherein at least a portion of the shaft is received in the open channel at the channel first end when the shaft is in the first position, and wherein at least a portion of the shaft is received in the open channel at the channel second end when the shaft is in the second position.

12. The foldable swab of claim 11, wherein a longer portion of the shaft is received in the open channel when the shaft is in the first position than when the shaft is in the second position.

13. The foldable swab of claim 11, wherein a first length of the shaft extends from the channel first end when the shaft is in the first position, wherein a second length of the shaft extends from the channel second end when the shaft is in the second position, and wherein the first length is less than the second length.

14. The foldable swab of claim 11, wherein the shaft is pivotable at least 170° between the first position and the second position.

15. The foldable swab of claim 11, wherein the shaft is pivotable at least 180° between the first position and the second position.

16. The foldable swab of claim 1, wherein the shaft is pivotable at least 170° about the pivot location.

17. A method of using a foldable swab, comprising:  
providing a swab comprising:

    a handle portion including a handle first end and a handle second end;

    an open channel located in the handle portion and extending at least partially between the handle first end and the handle second end;

    a shaft including a shaft first end and a shaft second end, the shaft being pivotable about a pivot location on the handle portion at the shaft first end and receivable in at least a portion of the open channel; and

    an absorbent member on the shaft second end;

    pivoting the shaft about the pivot location to where the shaft is proximate one of the handle first end or the handle second end; and

    placing at least a portion of the shaft into at least a portion of the open channel.

18. The method of claim 17, further comprising retaining at least a portion of the shaft within at least a portion of the open channel.

19. The method of claim 17, further comprising removing the shaft from the handle portion.

20. A foldable swab, comprising:

a handle portion including a handle first end and a handle second end;

an open channel located in the handle portion and extending at least partially between the handle first end and the handle second end;

a shaft including a shaft first end and a shaft second end, wherein the shaft is at least partially receivable in the open channel;

an axle located at the shaft first end; and

one or more openings in the handle portion, wherein the axle is received in the one or more openings.

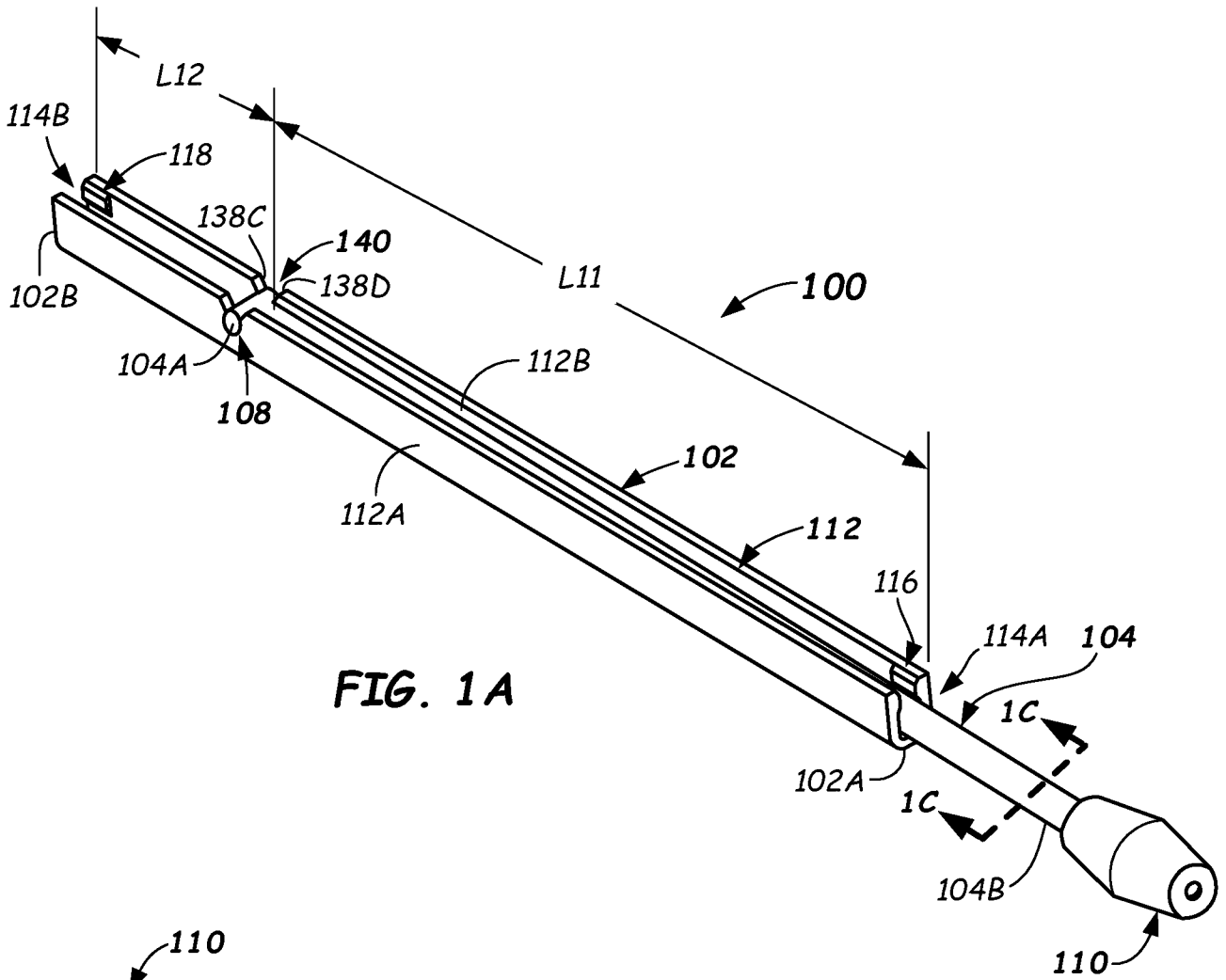


FIG. 1A

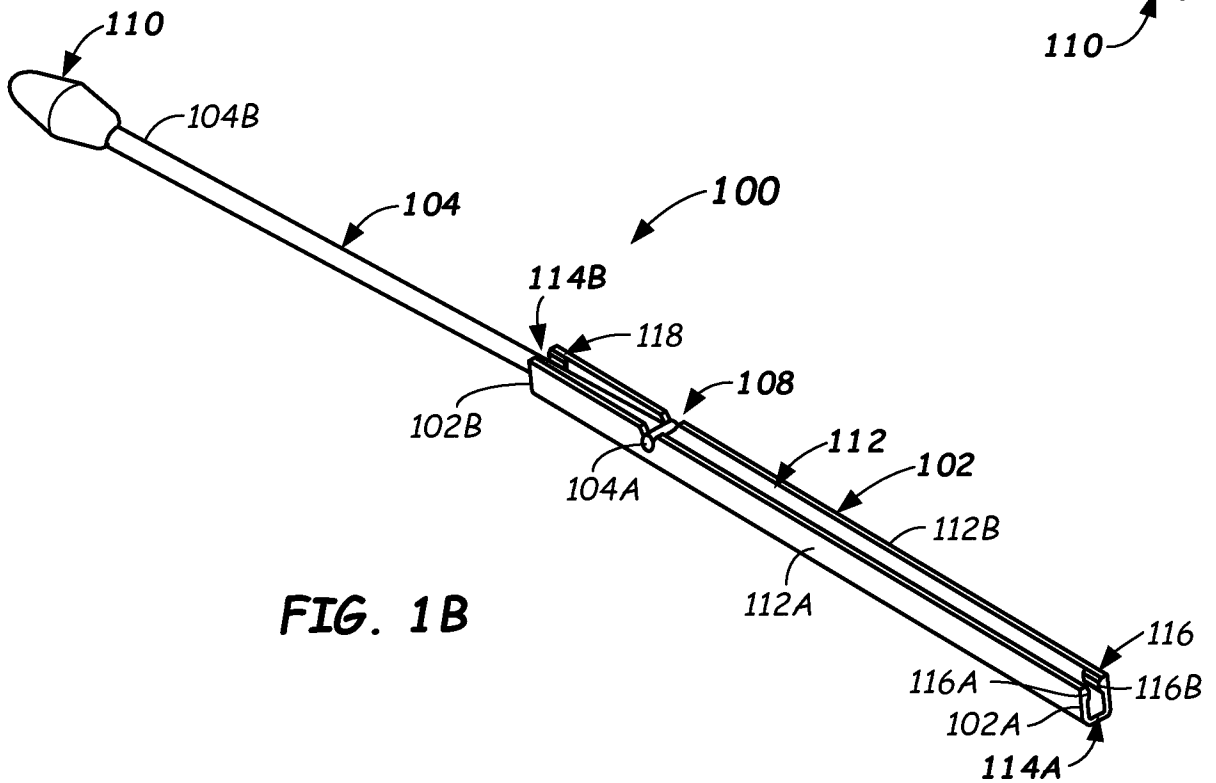


FIG. 1B

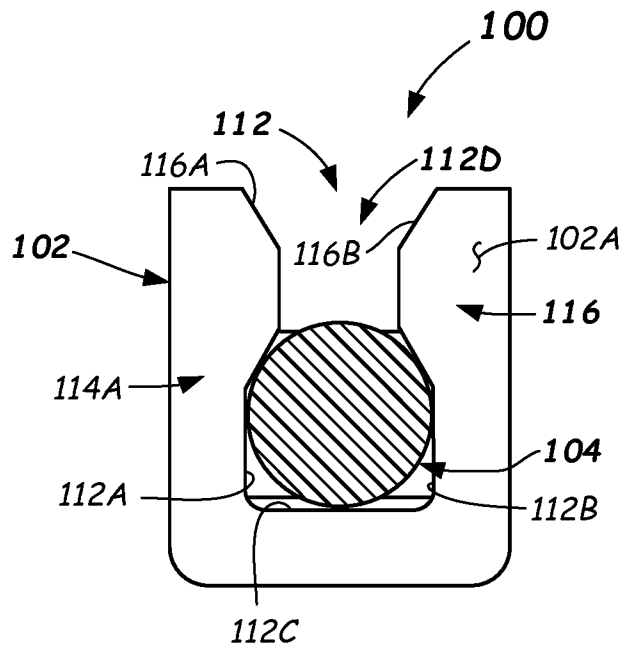


FIG. 1C

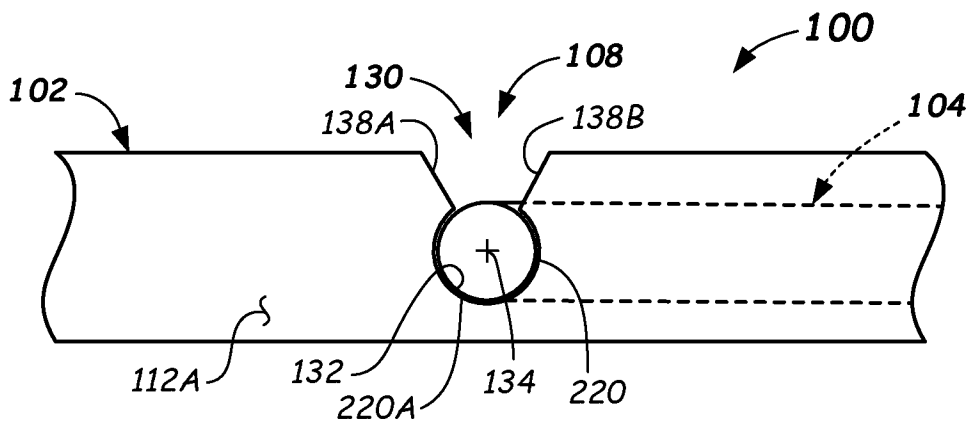
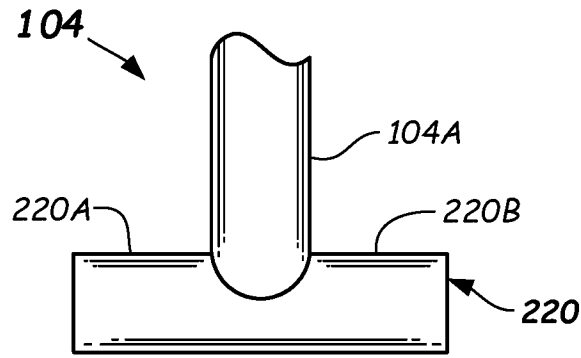
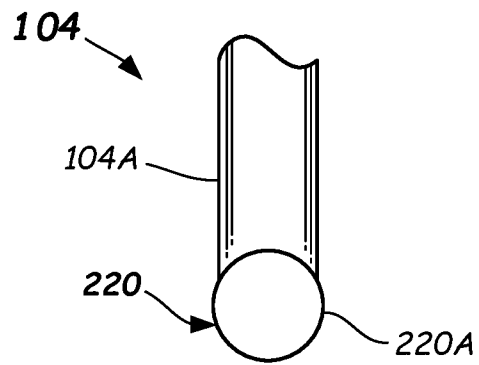


FIG. 1D



**FIG. 2A**



**FIG. 2B**

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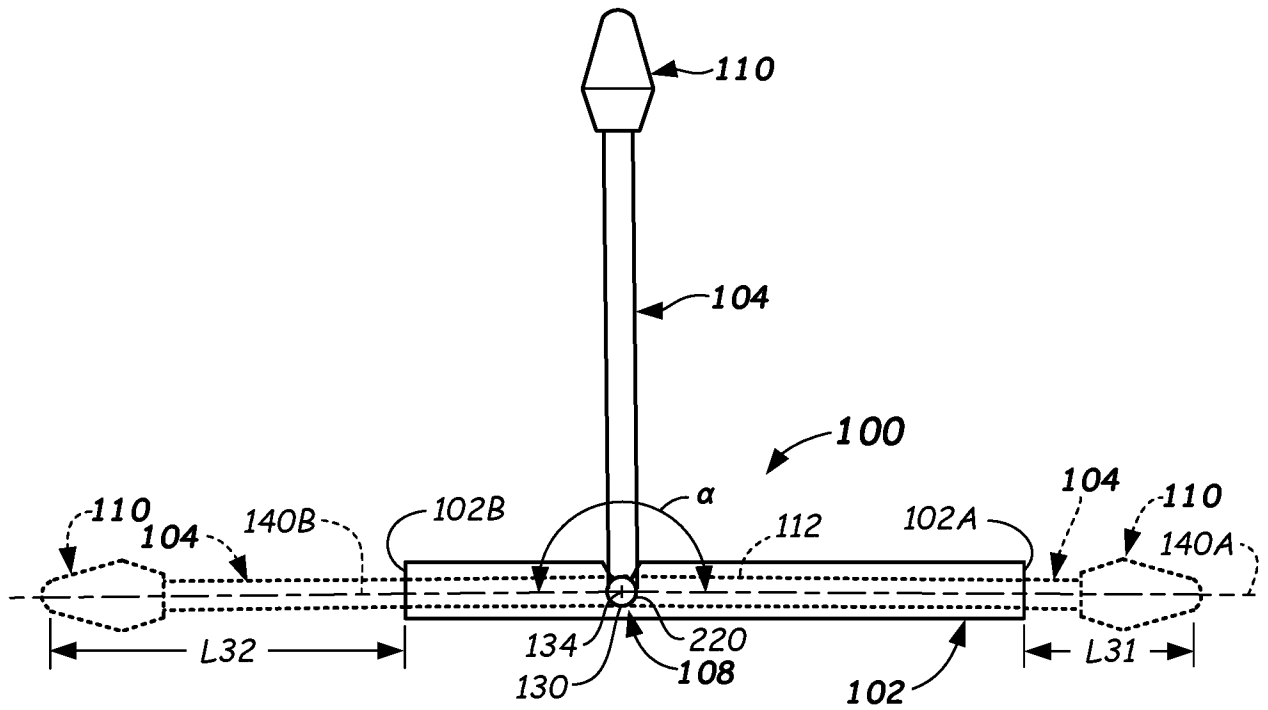


FIG. 3

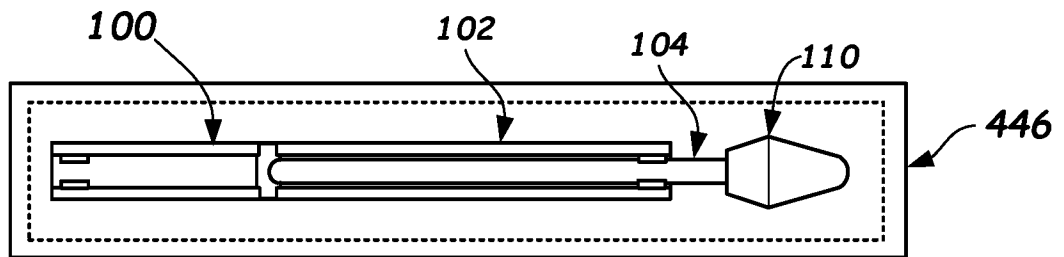


FIG. 4A

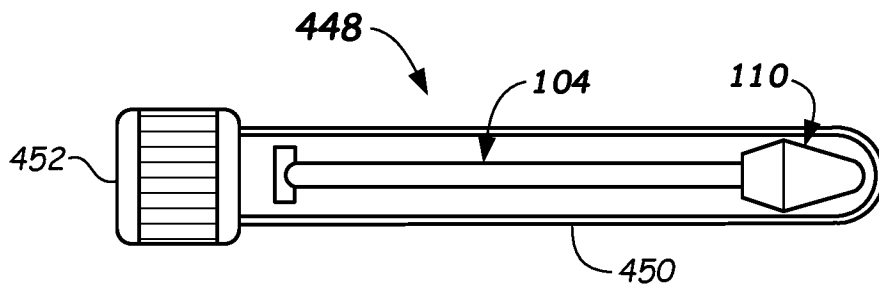


FIG. 4B

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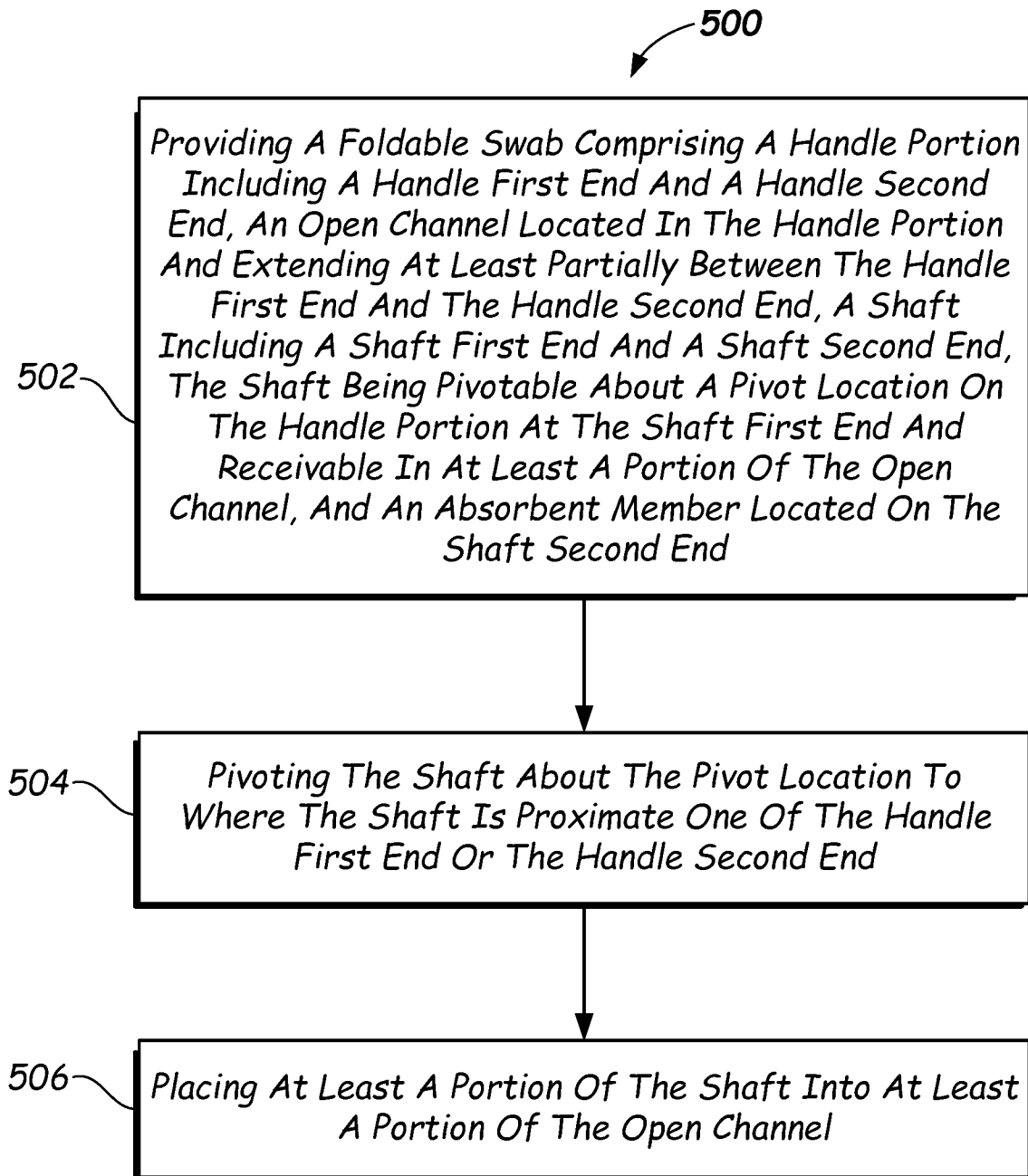


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US20/70298

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC - A61F 13/36, 13/38; A61B 10/02; G01N 1/02 (2020.01)  
 CPC - A61F 13/36, 13/38; A61B 10/02; G01N 1/02

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)  
 See Search History document

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 203988153 U (JIELI, Q) 10 December 2014 (10.12.2014) see machine translation	1-20
A	US 2002/0177798 A1 (DAVIDSON, K) 28 November 2002 (28.11.2002) entire document	1-20
A	US 2008/0214977 A1 (JULIUS, R) 04 September 2008 (04.09.2008) entire document	1-20
A	US 4,492,305 A (AVERY, C) 08 January 1985 (08.01.1985) entire document	1-20

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

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance	"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
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"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 18 September 2020 (18.09.2020)	Date of mailing of the international search report <b>06 OCT 2020</b>
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