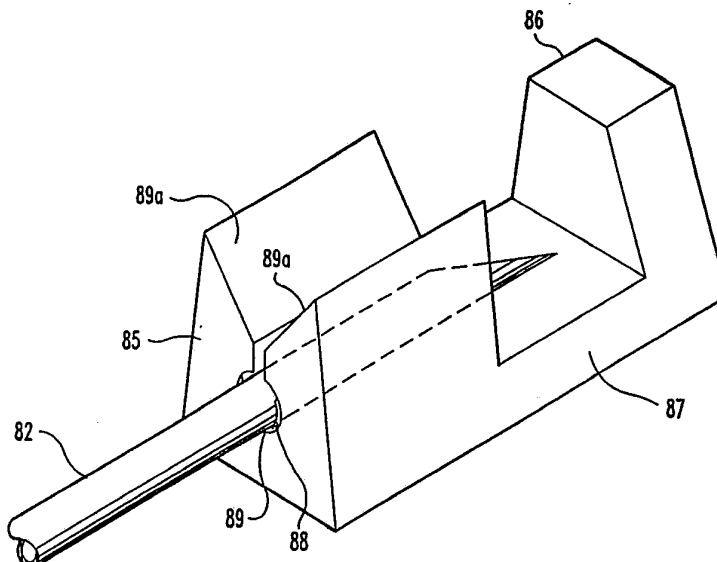




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : A61M 5/32, 5/00</p>	<p>A1</p>	<p>(11) International Publication Number: WO 92/18184 (43) International Publication Date: 29 October 1992 (29.10.92)</p>
<p>(21) International Application Number: PCT/US92/02893 (22) International Filing Date: 9 April 1992 (09.04.92) (30) Priority data: 685,042 15 April 1991 (15.04.91) US (60) Parent Application or Grant (63) Related by Continuation US 685,042 (CIP) Filed on 15 April 1991 (15.04.91) (71)(72) Applicants and Inventors: MCNEIL, Michael, B. [US/US]; 934 N. Highland Ave., Indianapolis, IN 46202 (US). JOHNSON, John, D. [US/US]; Route #2, Box 156, Wabash, IN 46992 (US). MCNEIL, Kimberly, M. [US/US]; MCLAREN, David, B. [US/US]; 4850 Bella Pacific Row, Apt. 260, San Diego, CA 92109 (US).</p>		<p>(74) Common Representative: McNEIL, Michael, B.; 934 N. Highland Avenue, Indianapolis, IN 46202 (US). (81) Designated States: AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GA (OAPI patent), GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL (European patent), NO, PL, RO, RU, SD, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>

(54) Title: NEEDLE TIP COVER



(57) Abstract

A small needle tip cover (84) is provided which is capable of rendering a used disposable needle safe from accidental punctures. Needle tip cover (84) is preferably formed from either extruded or molded plastic. Needle tip cover (84) includes a housing portion (85) and a shield portion (86) that is connected to the housing (85) via connection member (87). Housing portion (85) includes a channel (89) therein which supports a viscous adhesive (88) which produces a friction surface for gripping the shaft of a used disposable needle (82) brought into contact therewith. The needle (82) is placed into channel (89) in a motion that is at least partially transverse to an axis defined by needle (82). Usually however, needle (82) is placed into channel (89) in a motion that is substantially transverse to an axis defined by the needle. In other words, the shaft of needle (82) slides down slanted walls (89a) forcing channel (89) open which allows the needle shaft to enter channel (89). After entering, the opening in the channel (89) closes and the shaft is trapped therein.

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NEEDLE TIP COVER

Field of the Invention

5 This invention relates generally to devices for used disposable needles which render the needle safe from accidental puncture. In particular, this invention relates to covers for used disposable needles, and a method for attaching covers on the tips of used disposable needles.

Background of the Invention

10 Medical personnel throughout the world confront the daily risk of accidental puncture by used disposable needles. In turn, accidental puncture presents the risk of infection by potentially deadly diseases. Over time, the exposure of doctors or veterinarians, nurses, and technicians to used needles is so massive that occasional punctures are almost a certainty. With
15 each occasional puncture comes the risk of potentially deadly disease, with its associated costs.

The medical industry is in dire need of a device that can eliminate these risks. But in order to be accepted, any such device must present a per item cost proportional to the risk
20 present, and the device must be introducable into the medical industry without the need to alter the design of disposable needle assemblies themselves. Unless these two prerequisites are met, the device will likely be destined for the dust bin of history.

25 What is needed is a simply manufactured device that is extremely inexpensive and provides a method of rendering used disposable needles relatively safe from accidental punctures.

Summary of the Invention

In one sense, the present invention may be described as a method of rendering a used disposable needle safe from accidental punctures. The method comprises the steps of providing a needle tip cover and then moving a needle to be covered into the needle tip cover in a motion that is at least partially transverse to an axis defined by the needle. The needle tip cover includes a housing having a channel sized to receive a portion of the shaft of a used disposable needle therein. Means for gripping the shaft of the needle, which includes a friction surface, is supported in the channel of the housing. The housing also includes means for shielding the tip of the needle when the needle is gripped by the gripping means.

In another embodiment, a needle tip cover comprising a first arm and a second arm is provided. A spring means is integrally formed to the two arms and is operable to force the two arms together. The opposing arms include a plurality of serrated burrs which contact the shaft of a used disposable needle situated between the arms in such a way that the tip of the needle is covered and unable to escape. Some means is provided for holding the two arms apart pending the arrival of a needle tip there between. This means is disabled when the needle moves between the arms in a direction that it is at least partially transverse to an axis defined by the needle.

In another embodiment, a needle tip cover comprising a resiliently closable shell is provided. The shell is capable of defining a first open shape which allows a used disposable needle tip to be transversely placed within the shell. After the needle tip is received within the shell, the shell tends to resiliently assume a second closed shape. The shell is provided with a means for preventing the escape of the needle tip when the shell has resiliently assumed its second closed shape. The means for preventing the escape of the needle tip can comprise a pliable surface, either integrally formed with or supported by, the shell which grips the needle and prevents movement thereof.

A method of using the invention is also disclosed. The method comprises a first step of providing a needle tip cover which is capable of assuming a first open shape but tending to resiliently assume a second closed shape. The second step is accomplished by providing a means for opening the needle tip cover to assume its first open shape. Next, the shaft of the disposable needle is placed within the open needle tip cover in a motion which is substantially transverse to an axis defined by the needle. Finally, the means for opening the needle tip cover is disabled thereby allowing the needle tip cover to resiliently assume its second closed shape over the needle tip.

It is an object of the present invention to provide an improved device and method for rendering used disposable needles safe from accidental puncture. Other objects will become clear from the foregoing description.

Brief Description of the Drawings

Fig. 1 is a side view of a needle tip cover according to an embodiment of the present invention attached to the tip of a used disposable needle.

5 Fig. 2 is a view along the shaft of a needle showing the needle tip cover of Fig. 1.

Fig. 3 is a top view of the needle tip cover of Fig. 1 held open by a collapsible column.

10 Fig. 4 is a view along the shaft of a needle when the cover is held open and the needle is approaching the collapsible column.

Fig. 5 is a view along the shaft of a needle showing another embodiment of the present invention.

Fig. 6 is an isometric view of the needle tip cover of fig. 5 shown held open.

15 Fig. 7 is an isometric view of still another embodiment of the needle tip cover shown held open.

Fig. 8 is an isometric view of the needle tip cover of fig. 7 shown after resiliently closing on a used disposable needle tip.

20 Fig. 9 is a view along the needle shaft showing still another embodiment of the present invention when the needle shaft itself is holding the cover open.

Fig. 10 is the needle tip cover of fig. 9 shown after the needle tip cover has resiliently closed on a used disposable needle tip.

25 Fig. 11 shows a sectioned view of a dispenser for the needle tip covers shown in figs. 1-4.

Fig. 12 is a side view of the dispenser shown in Fig. 11.

Fig. 13 is an isometric view of another embodiment of the needle tip cover according to the present invention.

30 Fig. 14 is an isometric view of another embodiment of the present invention attached to the tip of a used disposable needle.

Detailed Description

For purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now to Fig. 1, there is shown a needle tip cover 10 according to one embodiment of the present invention, providing a protective cover for the tip of a used disposable needle 7. The tip cover 10 is preferably formed from a single piece of sheet metal, but could equally well be made out of some other substantially rigid material such as molded or extruded plastic. Cover 10 includes a first arm 11 integrally formed with a spring means 13, which in turn is integrally formed with arm 12. In this embodiment, spring means 13 is simply a sheet metal bend that tends to force arms 11 and 12 in opposing directions. As used in this patent, spring means is any resilient structure which operates to force two supported surfaces in opposing directions. As used in this patent, arm is defined as any substantially rigid structure which is capable of covering the tip of a used disposable needle.

In order to prevent needle tip 7 from escaping from between arms 11 and 12, there is provided burrs 14 and 15 which act in opposition to burr 16. As used in this patent, burr is defined as any rigid sharp edge that projects away from a supported surface. Burrs 14, 15 and 16 press against the shaft 17 of needle 7 preventing the needle from either advancing or retreating with respect to cover 10. The area between arms 11 and 12 defines a channel, and burrs 14 through 16 are mounted within the channel and act as means for gripping the needle. Arms 11 and 12 and

spring means 13 combine together can be thought of as defining a housing.

Fig. 2 shows the needle tip cover of Fig. 1 looking axially along the needle shaft. In this embodiment, burrs 15 and 16 are curved toward the center of cover 10. The curvature of burrs 15 and 16 prevents the needle from escaping from between arms 11 and 12 in either direction 18 or 19. Burrs having an infinite number of other shapes would work equally well in preventing the needle shaft from escaping. These shapes include but are not limited to serrated or multiple curve patterns.

Fig. 3 shows the needle tip cover of Fig. 1 when arms 11 and 12 are being held apart by column 20. Arms 11 and 12 include column supports 21 and 22 respectively. Supports 21 and 22 are shaped so that forces acting on the column 20 are substantially axial. Column 20 is preferably formed in the shape of a thin walled tube which is capable of supporting a substantial axial load but which is subject to immediate collapse upon the application of a slight transverse force, such as that provided by the shaft of a needle striking said column. After collapsing, the column either falls away or remains caught within the needle tip cover with the tip of the used needle.

Fig. 4. shows the needle moving in direction 24 transverse with respect to the needle's axis toward the column 20. Fig. 2 shows the cover 10 immediately after the needle 7 has struck the column 20 causing it to collapse. There are numerous other ways in which the arms 11 and 12 could be held apart until a needle tip is brought therebetween. These include but are not limited to providing a specialized dispenser for the tip covers that includes a structure for holding the needle open until the needle comes between the arms, or providing other collapsible support structures which automatically collapse when a needle tip is brought between the arms.

Medical personnel who are charged with removing a disposable needle from a patient can position a single tip cover, or a dispenser containing many clips, within arms reach of the patient from whom the needle is to be removed. A dispenser

could be provided which is small enough to be carried by medical personnel in their pockets throughout the work day. Fig. 11 shows a sectioned view of a possible dispenser 100 for the needle tip covers shown in figs. 1-4 which is small enough to be carried in a pocket. Dispenser 100 carries a plurality of covers 10 placed side by side around the periphery of the dispenser. Each time a needle tip is covered, a needle tip cover 10 is removed from dispenser 100 via hole 101. When a cover is removed, spring 102 advances the covers to reveal a new cover 10 in front of hole 101. Fig. 12 shows a side view of dispenser 100. Dispenser 100 also includes a guide means 103 that guides the tip of the used disposable needle to the appropriate position within the next available needle tip cover.

Fig. 5 shows needle tip cover 40 according to another embodiment of the present invention. Cover 40 is shown after needle 37 has been trapped within the channel defined by the area between arms 41 and 42. Arm 41 includes serrated burr 46 which may be integrally formed thereon. Burr 46 presses needle 37 against pliable surface 44 which in this case is attached to arm 42, but could equally be integrally formed thereon. Pliable surface 44 is preferably made of a material, such as smooth rubber, plastic, or adhesive that presents a relatively high coefficient of static friction with respect to a needle shaft pressed thereagainst. Like the embodiment described earlier, spring means 43 acts to force arms 41 and 42 toward each other. Pliable surface 44 could also include an adhesive layer 45 thereon in order to further increase the coefficient of static friction between the layer 44 and needle 37.

Fig. 6 shows an isometric view of the needle tip cover 40 shown in Fig. 5. Cover 40 is shown being held open by column 60, which is wedged between arms 41 and 42. In this embodiment, arm 41 includes a bore 50 which is sized to allow column 60 to escape therethrough and fall away. A portion of end 51 of column 60 rests against the rim of bore 50. Column 60 is dislodged from the location shown when the shaft of a needle strikes the column 60 in a downward motion that is in a direction at least partially

transverse to an axis defined by the needle. When the column 60 is dislodged, said column escapes through bore 50 allowing arms 41 and 42 to collapse inward on the needle, as shown in Fig. 5. Cover 40 could equally well be held open by a collapsible column as previously described. In which case, the column would collapse upon the application of a slight transverse force. This slight force can be provided by striking the shaft of a used disposable needle against the column.

Figs. 7 and 8 show still another embodiment of the present invention when the needle tip cover 69 is in a first open shape and after it has resiliently assumed a second closed shape. The needle tip cover 69 comprises a resiliently closable shell 70 which supports a pliable surface 71. Surface 71 provides a surface that will present a relatively high coefficient of static friction with respect to a needle shaft pressed thereagainst. Surface 71 might be an adhesive or might simply be an appropriate surface integrally formed on the inner side of shell 70. Cover 69 also includes overlapping flanges 72 and 73 which either may be attached to or integrally formed on shell 70. In this case, needle tip cover 69 is held open by collapsible column 74. When the tip of a used disposable needle strikes column 74, the column buckles and collapses allowing shell 70 to resiliently assume its second closed shape, as shown in fig. 8. When needle tip cover 69 closes on needle 77, pliable layer 71 presses along the shaft of needle 77 preventing the escape thereof. Overlapping flanges 72 and 73 are not necessary but can be provided to further shield and prevent the tip of the needle from escaping.

Figs. 9 and 10 show end views of still another embodiment of the present invention, which could be formed from molded or extruded plastic. In this embodiment, the shaft of needle 82 forces the needle tip cover 79 to assume a first open shape. Needle tip cover 79 includes a resiliently closable shell 80 which defines a channel 83 for receiving the tip and a portion of the shaft of needle 82 therein. Shell 80 supports a pliable surface 81, which could include an adhesive thereon or simply be shaped to present a high coefficient of static friction, especially in the

axial direction, to a needle pressed thereagainst. Fig. 10 shows the needle cover 79 after it has resiliently assumed its second closed shape. Pliable surface 81, which substantially surrounds needle 82, acts to prevent the needle from escaping from cover 79.

The needle tip cover shown in figures 1 through 4 is similar to the embodiments shown in figures 7 through 10, in that arms 11 and 12 combined with spring means 13 define a resiliently closable shell analogous to shell 70 or 80. Figures 3 and 4 show two different views of the needle tip cover 10 defining a first open shape, and figures 1 and 2 show cover 10 after it has resiliently assumed a second closed shape. Figure 3 shows column 20 holding a shell defined by arms 11 and 12, and spring means 13, in its first open shape. Figure 4 shows needle 7 moving to enter the shell in a motion having a direction 24 that is substantially transverse to an axis defined by the needle. The embodiment shown in figures 5 and 6 likewise show a resiliently closable shell defining a closed shape covering a needle and a first open shape held open by a column 60, respectively.

A method of rendering a used disposable needle safe from accidental puncture is also disclosed. The method comprises a first step of providing a needle tip cover which is capable of assuming a first open shape but tending to resiliently assume a second closed shape. The needle tip cover is positioned within arms reach of the location where the nurse is when he or she removes the disposable needle from the patient. Secondly, a means is provided for opening the needle tip cover to assume its first open shape. This means can be provided by the needle itself, as shown in fig. 9, or can be provided by some structural support, such as the collapsible column 20 shown in fig. 3, or possibly by some type of specialized dispenser. A unique third step is provided by placing the tip of a used disposable needle within the open needle tip cover in a motion which must be at least partially, but usually substantially transverse to an axis defined by the needle. This step is shown in fig. 4. The final step involves disabling the means for opening the needle tip cover in

order to allow the needle tip cover to resiliently assume its second closed shape over the needle. This step can be accomplished by striking a collapsible column of the type shown in fig. 3, or by simply passing the needle into the needle tip cover as shown in fig. 10.

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Figure 13 shows a needle tip cover 84 which is similar in form and action to the needle tip cover shown in figures 9 and 10 except that needle tip cover 84 includes a shield portion 86 rigidly attached to but located remotely from the housing 85 by connection member 87. All three portions of needle tip cover 84, including housing 85, connection member 87 and shield portion 86, may be integrally molded together from a single piece of plastic or other suitable material. Figure 13 also shows a used disposable needle 82 being gripped by an adhesive layer 88 in channel 89 of housing 85, and the tip of the needle is shielded by shield portion 86. The shaft of needle 82 enters housing 85 in a manner similar to that shown and described with respect to the embodiment shown in figures 9 and 10. All of the embodiments discussed earlier based upon figures 1 through 10 all show housings having a channel therein and a means for gripping a used disposable needle supported within the channel of the housing.

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Figure 14 shows still another version of the present invention that includes a needle tip cover 90 which is preferably made from a substantially rigid extruded plastic having the profile as shown in figure 14. Like the embodiments discussed earlier, needle tip cover 90 includes a housing 91 having a channel 94 therein, and means, such as an adhesive layer 93, for gripping the shaft of a used disposable needle brought into contact with the outer friction surface of the adhesive 93. Channel 94 has a width and depth greater than the diameter of a needle to be placed within the channel. However, unlike the embodiments described earlier, housing 91 is made from a relatively rigid extruded plastic, and the channel 94 is open rather than biased to a closed position as in the embodiments discussed earlier. A used disposable needle can be placed in channel 94 and into contact with adhesive 93 in a motion that

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includes a component transverse to an axis defined by the needle. In so doing, the needle rides along slanted surfaces 92 and into channel 94 where it is gripped by the adhesive and prevented from escaping the channel 94. In this case, like all the embodiments
5 discussed earlier except for the embodiment shown in figure 13, the housing itself provides the means for shielding the tip of the used disposable needle in order to prevent accidental punctures.

Needle tip covers as in 90 are preferably made from an elongated extruded profile of plastic material in which the
10 channel is continuously partially filled with a viscous adhesive after the extrusion step. Either before or after the adhesive is placed in channel 94, the extruded profile is successively cut into short lengths to yield needle tip covers as in 90 shown in figure 14. The needle tip covers shown in figures 9 and 10 could be
15 made in a like manner. Unlike prior art devices, the needle shaft can enter the channel of the housing of the present invention in a motion that is at least partially transverse to an axis defined by the needle.

While the invention has been illustrated and described in
20 detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character. For instance, the needle tip covers shown could be made from formed sheet metal or molded plastic, and the means for preventing the escape of the needle tip from the cover could be any surface,
25 either integrally formed on or attached to, the inner side of the cover, where the surface presents a sufficiently high coefficient of static friction with respect to the needle that the needle is unable to escape. It being understood that only the preferred embodiments have been shown and described and that all changes
30 and modifications that come within the spirit of the invention are desired to be protected.

We Claim:

1. A needle tip cover comprising:

a housing having a channel sized to receive a portion of the shaft of a used disposable needle therein;

5 means, attached to said housing, for shielding the tip of the needle;

means, including a friction surface supported in said channel of said housing, for gripping the shaft of the needle brought into contact therewith; and

10 whereby the shaft of the needle can enter said channel in a motion at least partially transverse to an axis defined by the needle.

2. The needle tip cover of claim 1 wherein:

15 the needle can enter said channel in a motion substantially transverse by an axis defined by the needle.

3. The needle tip cover of claim 2 wherein:

said housing is a resiliently closable shell capable of being deformed into defining a first open shape but tending to resiliently assume a second closed shape;

20 whereby the tip of a used disposable needle can enter said shell in a motion substantially transverse to an axis defined by the needle when said shell is in said first open shape;

said means for gripping includes means within said shell for preventing the escape of the needle tip from within said shell when said shell has resiliently assumed said second closed shape; and

25 the needle tip cover further comprises means for holding said shell in said first open shape, said means being disabled by the arrival of a used disposable needle tip in said shell.

30 4. The needle tip cover of claim 3 wherein:

said means for preventing the escape includes a pliable surface supported within said shell.

5. The needle tip cover of claim 3 wherein:
said means for preventing the escape includes an adhesive supported within said shell.
6. The needle tip cover of claim 3 wherein:
5 said means for holding said shell in said first open shape includes a collapsible column lodged within said shell.
7. The needle tip cover of claim 3 wherein:
said means for preventing the escape includes a plurality of burrs projecting inward in said shell, said burrs contact the
10 needle tip and prevent the movement thereof when said shell resiliently assumes said second closed shape.
8. The needle tip cover of claim 3 wherein:
said means for holding said shell in said first open shape includes a column that is capable of being dislodged.
- 15 9. The needle tip cover of claim 2 wherein:
said housing has a open channel with a width and depth greater than the diameter of the needle.
10. The needle tip cover of claim 9 wherein:
said housing is made of a substantially rigid material; and
20 said means for gripping includes a layer of pliable material at least partially filling said channel.
11. The needle tip cover of claim 10 wherein:
said pliable material is an adhesive.
12. The needle tip cover of claim 11 wherein:
25 said substantially rigid material is plastic.
13. The needle tip cover of claim 2 wherein:

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said means for shielding is a shield rigidly attached to but located remotely from said housing, and said shield is capable of shielding the tip of a used disposable needle when the shaft of the needle is gripped by said means for gripping.

5 14. The needle tip cover of claim 13 wherein:

said housing is a resiliently closable shell capable of being deformed into defining a first open shape but tending to resiliently assume a second closed shape; and

said friction surface is supported within said shell.

10 15. The needle tip cover of claim 14 wherein:

said friction surface is a layer of adhesive supported within said shell.

16. A method of rendering a used disposable needle safe from accidental punctures comprising the steps of:

15 providing a housing having a open channel which supports a gripping surface therein capable of gripping the shaft of a needle brought into contact therewith;

20 moving the tip of a used disposable needle into said open channel in a motion that is at least partially transverse to an axis defined by the needle;

contacting the shaft of the needle against the gripping surface thereby gripping the shaft of the used needle.

17. The method of claim 16 wherein:

25 said motion is substantially transverse to an axis defined by the needle.

18. A method of rendering a used disposable needle safe from accidental punctures comprising the steps of:

30 a) providing a needle tip cover which is capable of assuming a first open shape but tending to resiliently assume a second closed shape;

b) providing means for opening said needle tip cover to assume said first open shape;

5 c) placing a used disposable needle tip within said needle tip cover in a motion which is substantially transverse to an axis defined by the needle; and

d) disabling said means for opening said needle tip cover, thereby allowing said needle tip cover to resiliently assume its second closed shape over the tip of the used disposable needle.

10 19. The method of claim 18 wherein:

the shaft of the used disposable needle pressing against said needle tip cover provides said means for opening said needle tip cover.

20. The method of claim 18 wherein:

15 said means for opening said needle tip cover is a column wedged within said needle tip cover.

21 The method of claim 18 wherein:

said step of disabling said means for opening said needle tip cover is accomplished by striking the needle against said column.

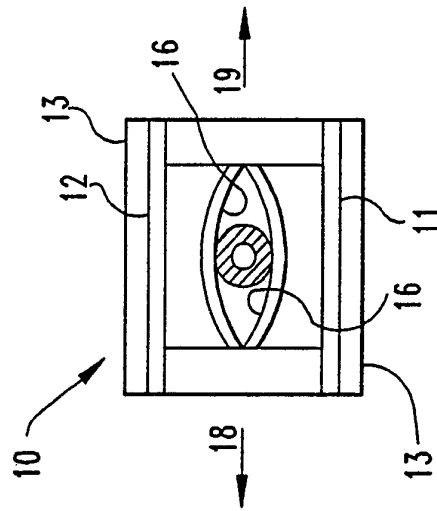


Fig. 2

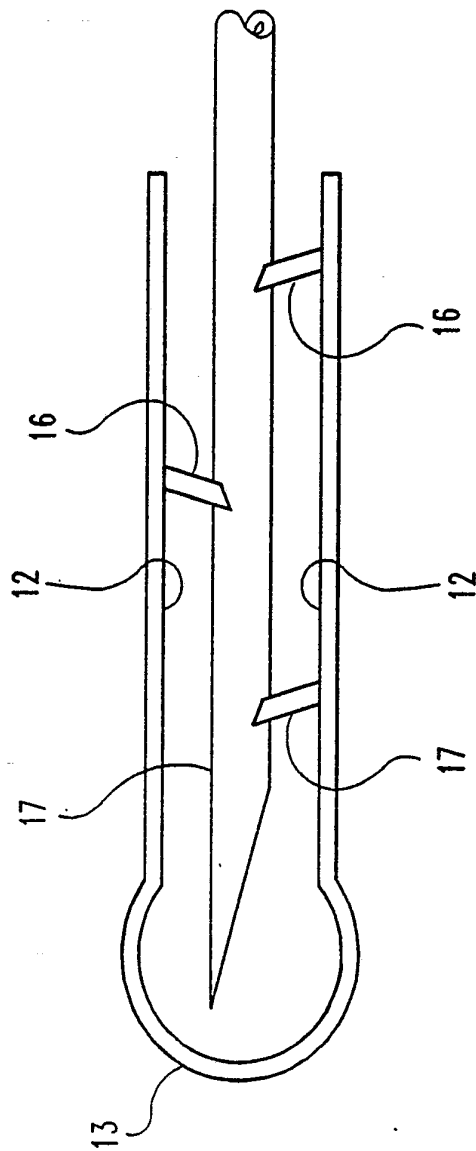


Fig. 1

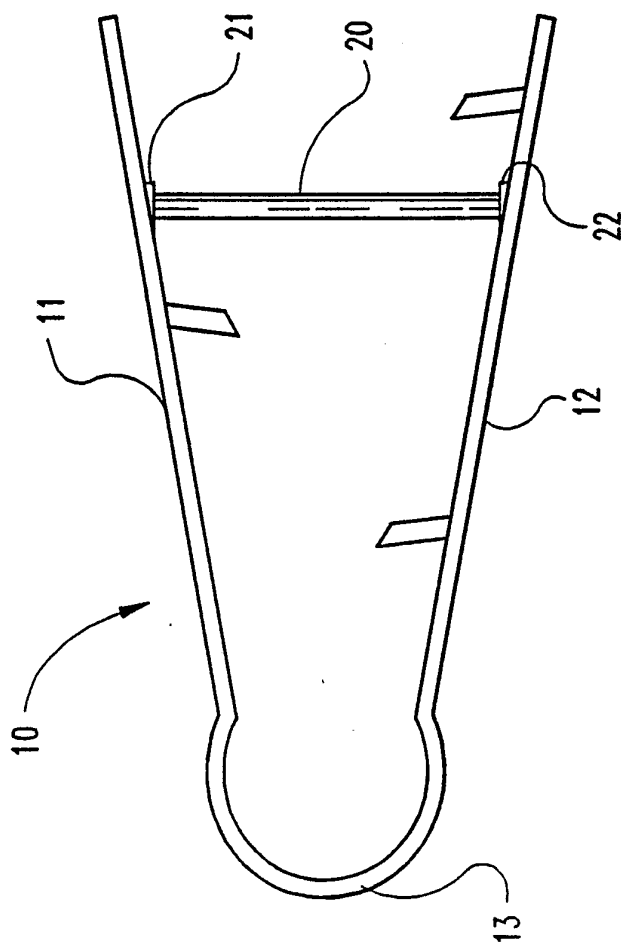


Fig. 3

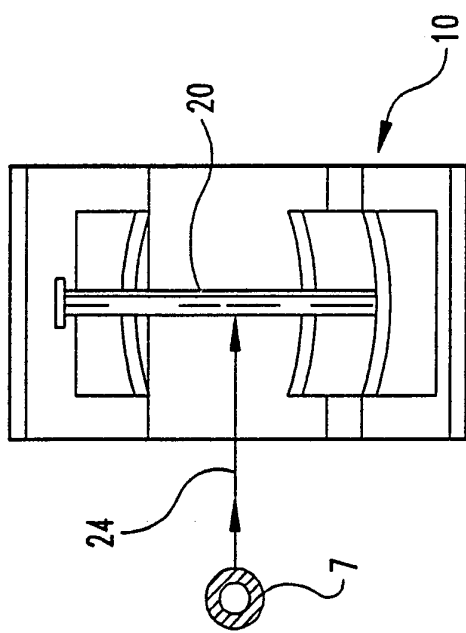


Fig. 4

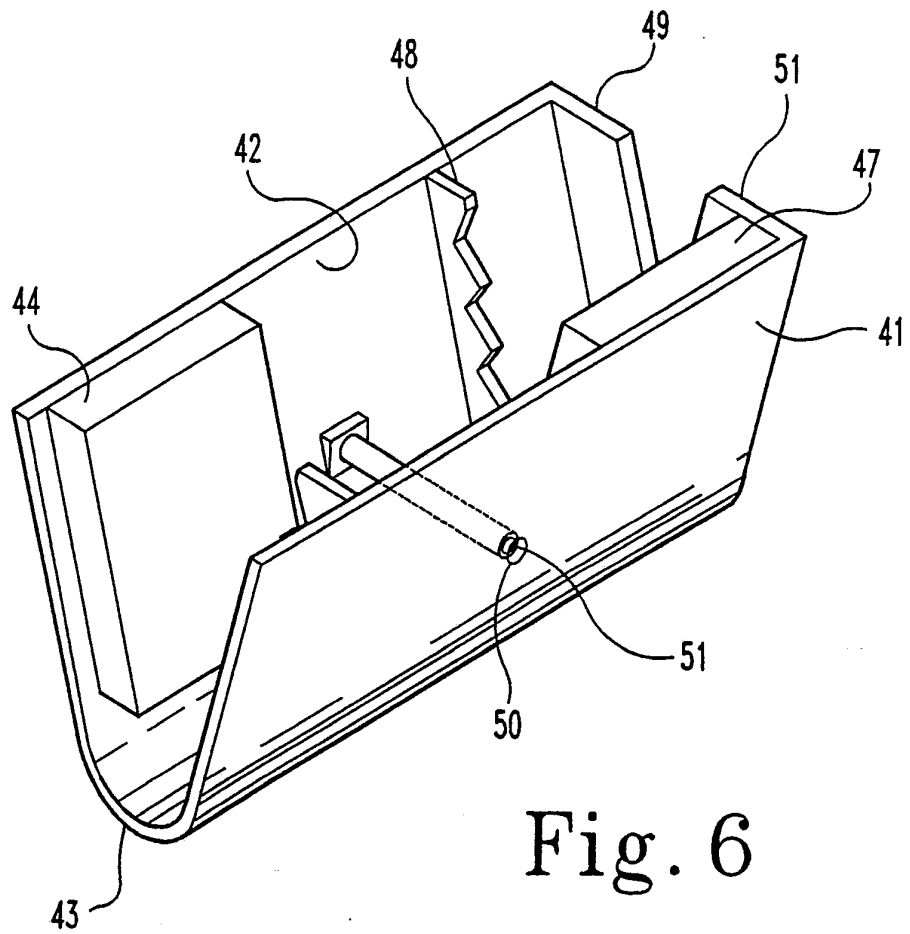


Fig. 6

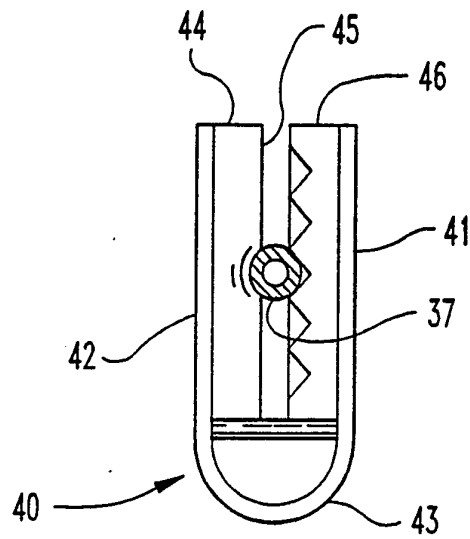


Fig. 5

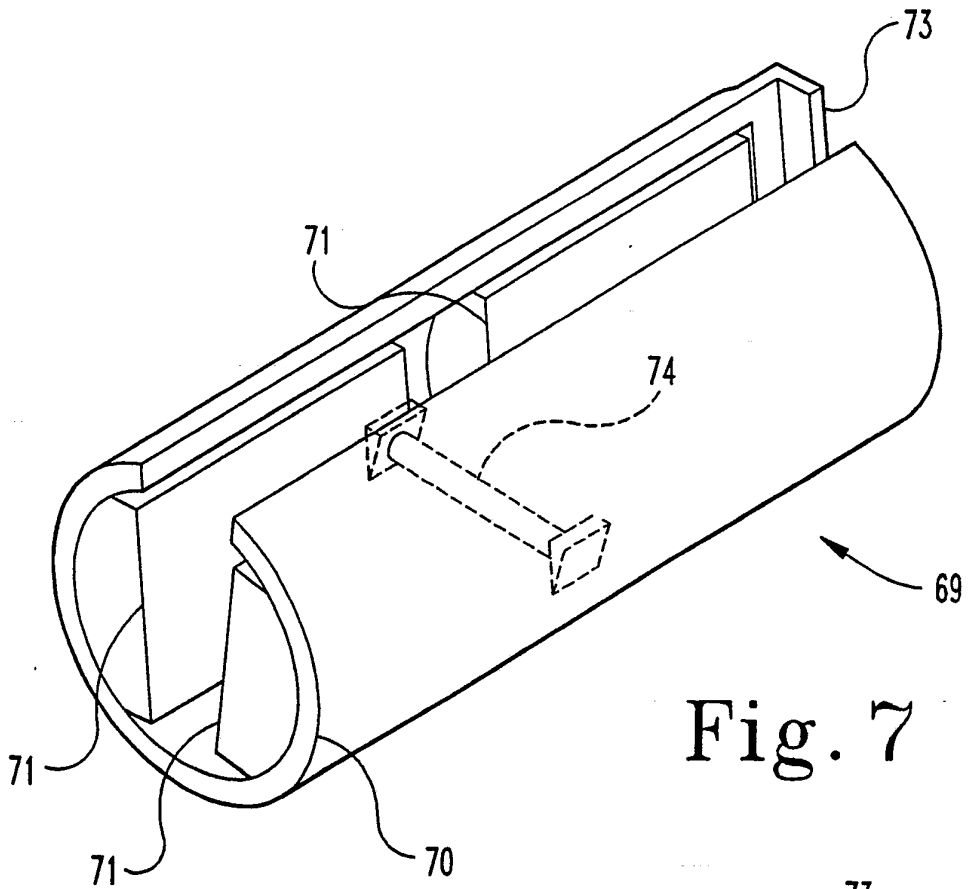


Fig. 7

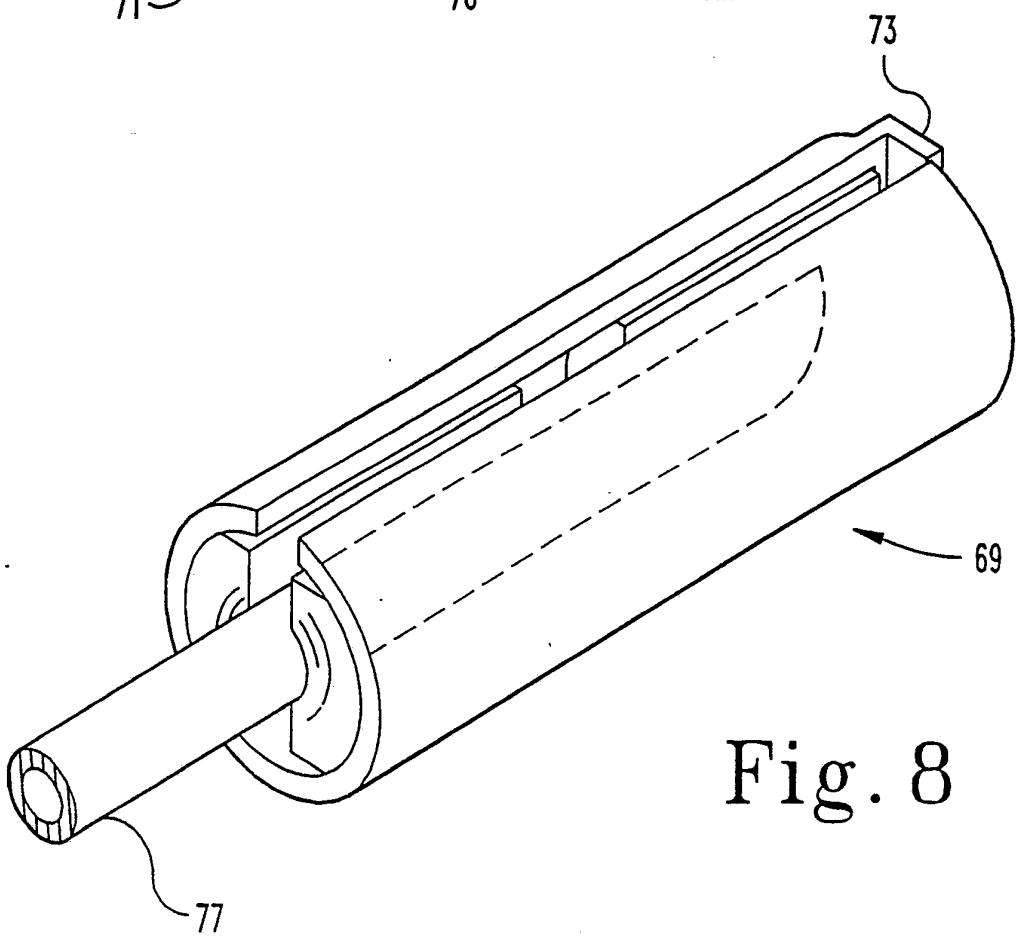


Fig. 8

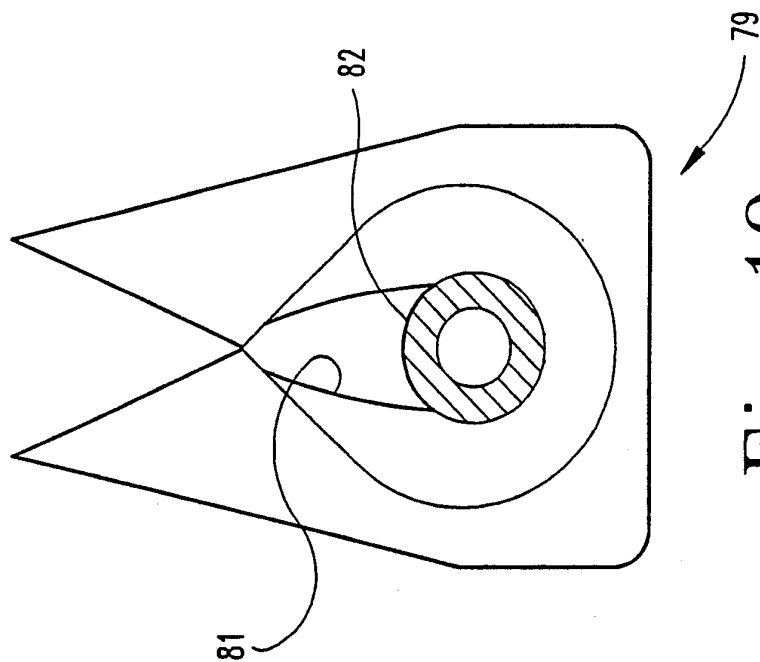


Fig. 10

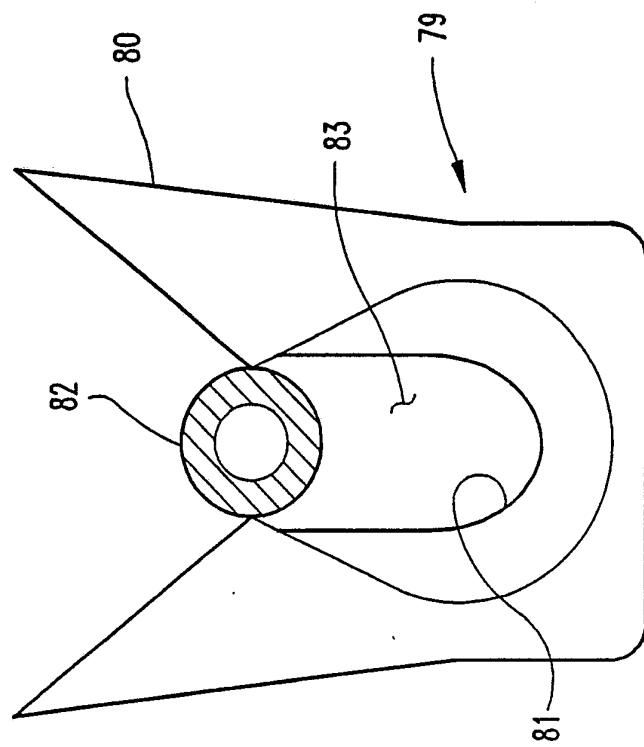


Fig. 9

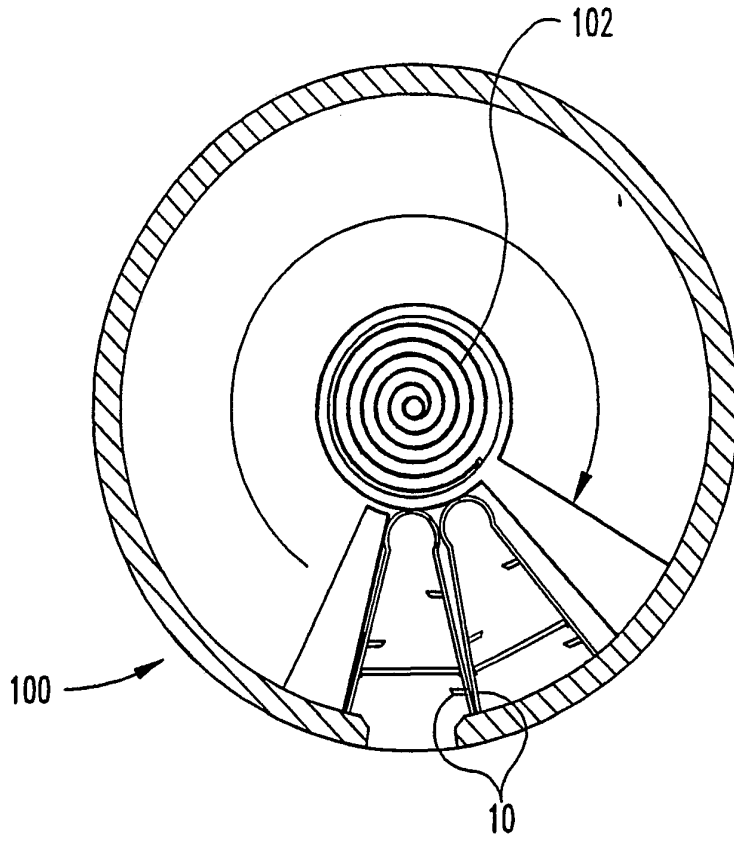


Fig. 11

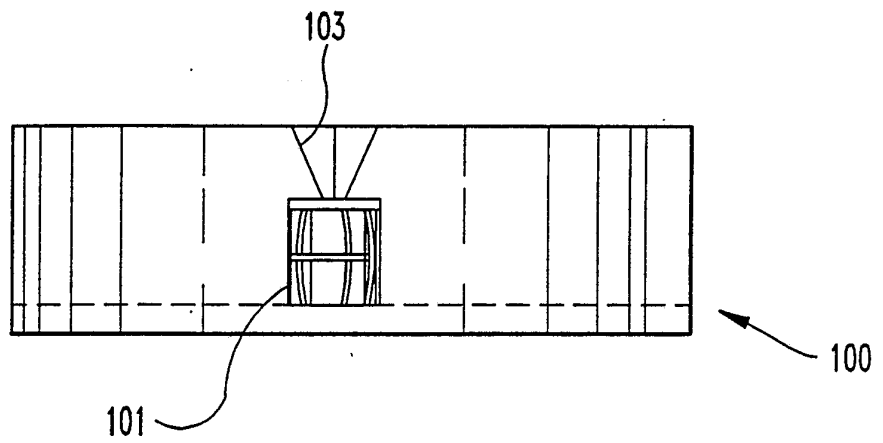


Fig. 12

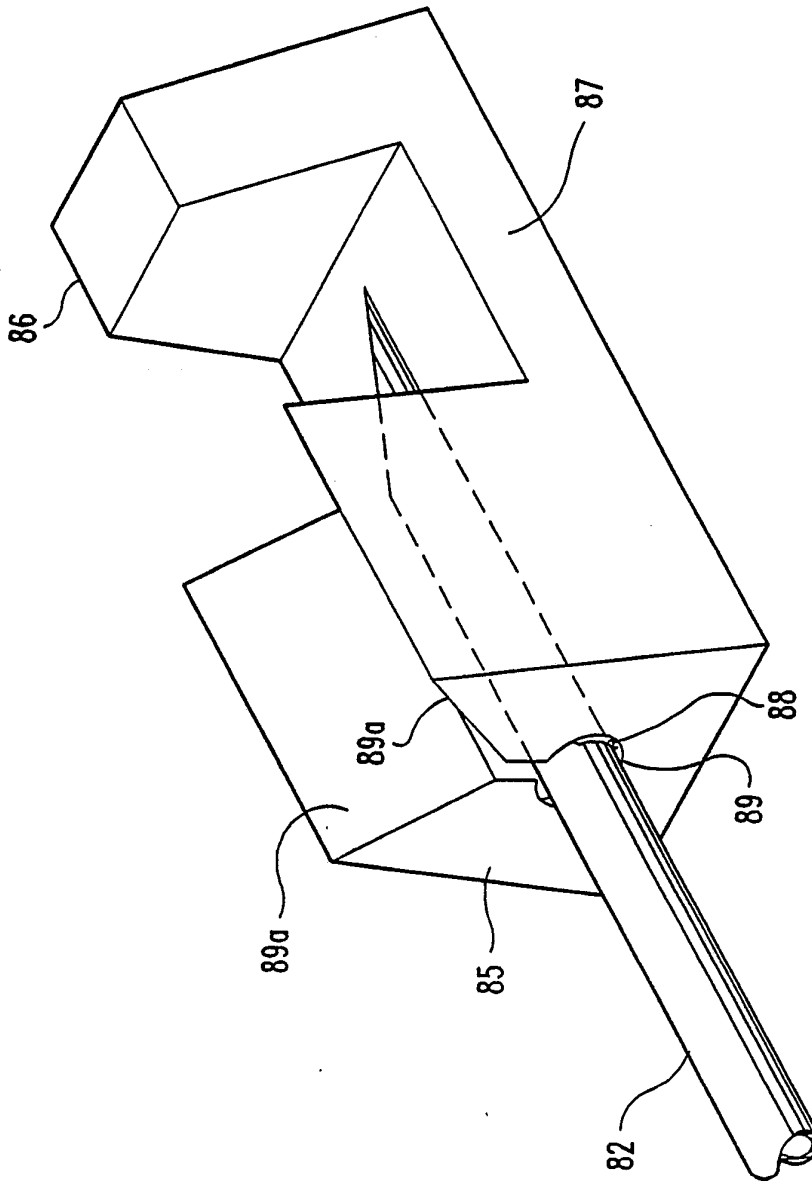


Fig.13

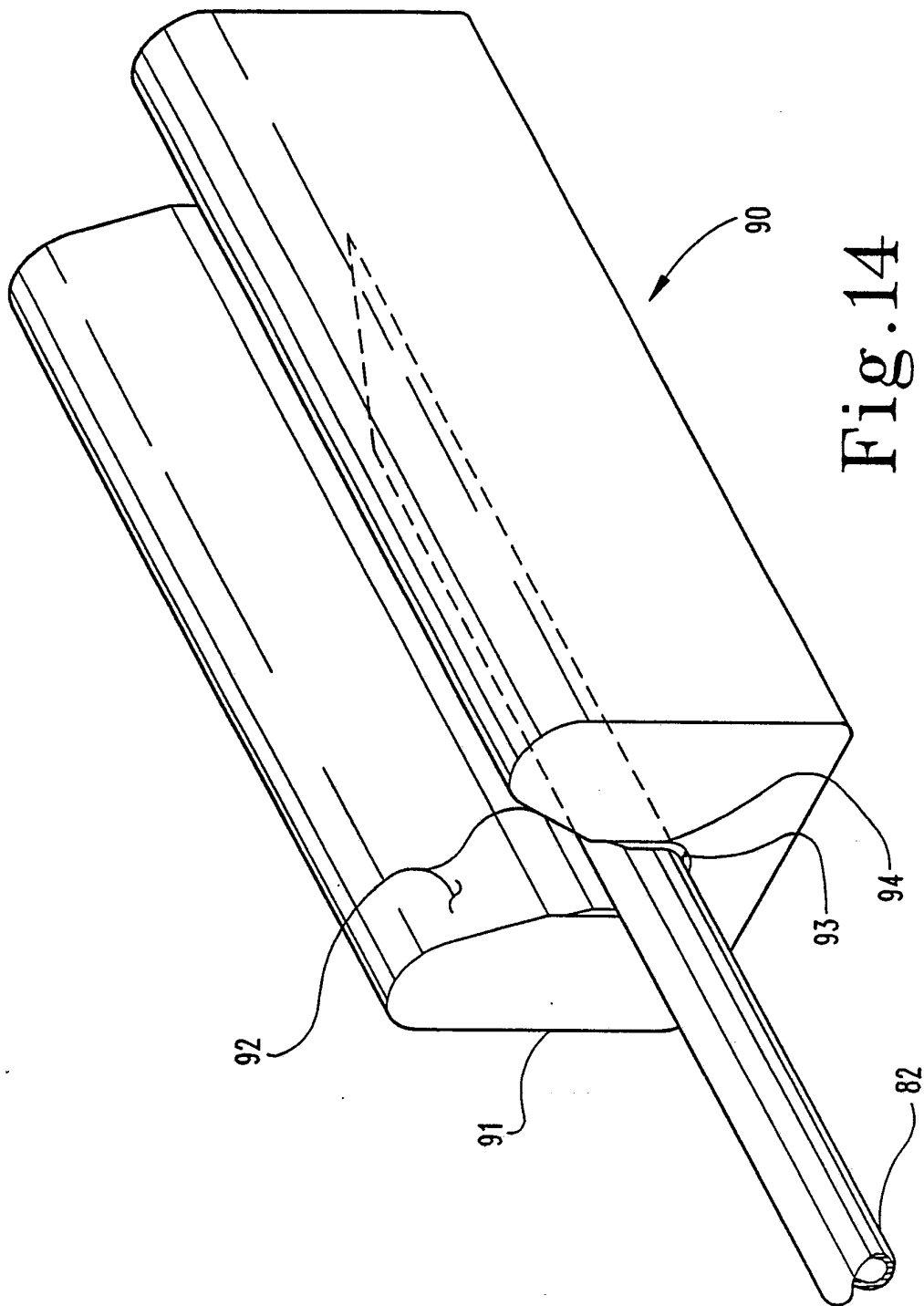


Fig. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/02893

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(5) :A61M 5/32,5/00
 US CL :604/192,263
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 U.S. : 604/167,180,197,198,283,905,110

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US,A 5,053,017 (CHAMUEL) 01 OCTOBER 1991 SEE ENTIRE DOCUMENT	1-4,9,10, 13,14
X Y	US,A 3,094,033 (HAERR) 09 SEPTEMBER 1975 SEE ENTIRE DOCUMENT	1-4,9,10,13 <u>14,16,17</u> 10,11,12,15
X Y	US,A 4,929,241 (KULLI) 29 MAY 1990 SEE ENTIRE DOCUMENT	1-3,7,9,13 <u>14,16,17</u> 10,11,12,15
Y	US,A 4,801,296 (VAILLANCOURT) 31 JANUARY 1989 SEE ENTIRE DOCUMENT	11,12,15
A	US,A 4,982,842 (HOLLISTER) 08 JANUARY 1991 SEE ENTIRE DOCUMENT	

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be part of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"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 16 SEPTEMBER 1992	Date of mailing of the international search report 22 SEP 1992
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