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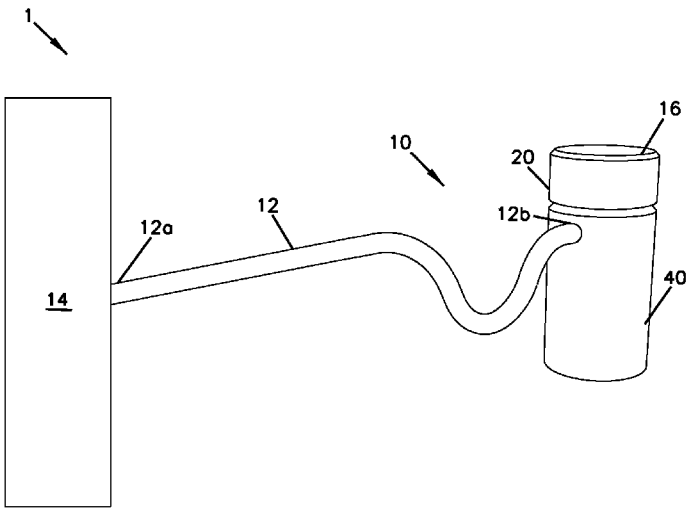
(54) Title: INFLATION SYSTEM

FIG. 1



(57) Abstract: A single-use inflation system (1, 100) is disclosed. In one aspect, the system (1) includes an inflatable device (14) connected to a disposable integrated inflation tool (10, 110) via a length of tubing (12). The integrated inflation tool (10, 110) is configured such that the tool allows compressed fluid to flow into the inflatable device (14) as soon as the end of a container (102) is punctured. As the pressure rises in the inflatable device (14) and reaches and/or exceeds the predetermined pressure at which the inflation tool (10, 110) is set, the inflation tool (10, 110) vents air from the container (102) to prevent overpressurization of the inflatable device (14).

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INFLATION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Patent Application Serial No. 62/105,941, filed January 21, 2015, and claims the benefit of U.S. Patent Application Serial No. 62/154,351, filed April 29, 2015, the disclosures of which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0002] The present disclosure relates to inflation tools, and particularly inflation tools suitable for inflating inflatable devices, such as cable duct seals.

BACKGROUND

[0003] It is often necessary to route cables through an opening in a building structure. In many instances, the cables extending through the opening only partially fill the opening and it is therefore necessary to seal the remaining interstitial spaces in the opening. One known approach to accomplish this sealing function is through the use of an inflatable device known as a cable duct seal. In use, an uninflated cable duct seal is placed in the opening. Once oriented properly, the cable duct seal is inflated and seals off the remaining open spaces in the opening. As it is possible to overinflate the cable duct seal, measures are typically undertaken to ensure that that the cable duct seal is pressurized to a desired pressure, which can require monitoring by the installer. Although tools are available to complete this inflation function, they are generally complicated, require the installation of cartridges, and are associated with a relatively high cost.

SUMMARY

[0004] A single-use inflation system is disclosed. In one aspect, the system includes an inflatable device connected to a disposable integrated inflation tool via a length of tubing. The integrated inflation tool can be provided with a housing assembly including a first housing part and a second housing part connected to the first housing part. In one aspect, the first housing part has an internal chamber in fluid communication with an outlet. In one aspect, the second housing part has an inlet in fluid communication with the internal chamber of the first housing part and an outlet that is connected to the tubing.

[0005] The inflation system may also include a first valve assembly. In one example, the first valve assembly is located in the first housing part. The first valve assembly can be

constructed to be operable from a closed position to an open position to allow for the compressed gas in the internal chamber of the first housing part to flow into the second housing part inlet. In one embodiment, the first valve assembly is movable to the open position by relative movement of the first housing part with respect to the second housing part, for example by moving the first housing part towards the second housing part in a direction parallel to a longitudinal axis of the housing assembly.

[0006] The inflation system may also include a second valve assembly disposed between the second housing part inlet and outlet. In one aspect, the second valve assembly provides a pressure regulating function such that the inflatable device is inflated to a first predetermined pressure. A third valve assembly may also be provided in the second housing part to adjust the operation of the second valve assembly so that the first predetermined pressure can be tuned.

[0007] A second embodiment of an inflation system is disclosed including an inflatable device and a length of tubing as previously described, and a self-venting inflation tool. The inflation tool can include a main body having an inlet port configured for receiving a compressed fluid container, an outlet port in fluid communication with the inlet port and configured to receive the first end of the tubing, and a vent port configured to vent compressed fluid from the container. The vent valve assembly is disposed in a bore of the main body and includes a spring stop member, a spring, and a valve member. The vent valve assembly is operable from a closed position to an open position. In the closed position, the vent valve assembly isolates the vent port from both the inlet and outlet ports such that all fluid from the container is delivered to the inflatable device. In the open position, the vent valve assembly opens the vent port to both the inlet and outlet ports when the inflatable device reaches a predetermined pressure.

[0008] The above features and advantages and other additional features and advantages of the present teachings are readily apparent from the following detailed description of the best modes for carrying out the present teachings, when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Figure 1 is a perspective view of an inflation system including an inflatable device and an integrated inflation tool having features in accordance with the present disclosure.

[0010] Figure 2 is a top view of the integrated inflation tool shown in Figure 1.

[0011] Figure 3 is a cross-sectional view of the integrated inflation tool shown in Figure 1, taken along line 3-3 shown in Figure 2, wherein the integrated inflation tool is in a disabled state.

[0012] Figure 4 is a cross-sectional view of the integrated inflation tool shown in Figure 1, taken along line 3-3 shown in Figure 2, wherein the integrated inflation tool is in an active inflation state.

[0013] Figure 5 is a cross-sectional view of the integrated inflation tool shown in Figure 1, taken along line 3-3 shown in Figure 2, wherein the integrated inflation tool is in a regulated state.

[0014] Figure 6 illustrates an embodiment of the inflation device of Figure 1 having features that are examples of inventive aspects in accordance with the present disclosure shown in an uninflated configuration;

[0015] Figure 7 illustrates the inflation device of Figure 6 with further sealing structures in the form of mastic tape applied thereto;

[0016] Figure 8 illustrates the inflation device of Figure 7 in a folded configuration;

[0017] Figure 9 is a cross-section of the valve structure of the inflation device of Figures 6-8, bisecting the valve structure along a longitudinal axis of the cable sealing structure;

[0018] Figure 10 is an exploded view illustrating the features of the valve structure that are positioned within the internal pocket of the inflation device;

[0019] Figure 11 illustrates the inflation device of FIG. 9 being wrapped around cabling and being inserted into a duct;

[0020] Figure 12 illustrates the cabling with the inflation device of Figure 11 fully inserted into the duct, ready for inflation; and

[0021] Figure 13 illustrates the opposing side of the duct relative to that shown in Figure 6, showing the cutouts defined by the inflation device.

[0022] Figure 14 is a perspective view of a second embodiment of an inflation system including an inflatable device and an integrated inflation tool having features in accordance with the present disclosure.

[0023] Figure 15 is a side view of the integrated inflation tool shown in Figure 14.

[0024] Figure 16 is a cross-sectional view of the integrated inflation tool shown in Figure 15, taken along line A-A shown in Figure 14, wherein the integrated inflation tool is in a first position.

[0025] Figure 17 is a cross-sectional shaded view of the integrated inflation tool shown in Figure 16, wherein the integral inflation tool is shown with an adjustment tool.

DETAILED DESCRIPTION

[0026] Various examples will be described in detail with reference to the drawings, wherein like reference numerals represent like parts and assemblies throughout the several views. Reference to various examples does not limit the scope of the claims attached hereto. Additionally, any examples set forth in this specification are not intended to be limiting and merely set forth some of the many possible examples for the appended claims. Referring to the drawings wherein like reference numbers correspond to like or similar components throughout the several figures.

[0027] As shown in the drawings, an inflation system 1 including an integrated inflation tool 10 is presented. The integrated inflation tool 10 is for providing an inflation means for an inflatable device 14, such as a cable duct seal 14. Cable duct seals 14 are used to seal the remaining open spaces that exist between an opening in a structure and the cables (e.g. telephone, CATV, fiber optic cables, etc.) that pass through the opening. One example of a cable duct seal that can be inflated by the disclosed integrated inflation tool 10 is disclosed in United States Provisional Patent Application Number 62/078,560, filed on November 12, 2014 and entitled "Environmental Cable Seal Structure. The entirety of US 62/078,560 is incorporated by reference herein.

[0028] In one aspect, the inflatable device 14 is connected to a first end 12a of a length of tubing 12 while the integrated inflation tool 10 is connected to a second end 12b of the tubing 12. Taken together, the integrated inflation tool 10, the tubing 12, and the inflatable device 14 form a single use inflation system 1, wherein the integrated inflation

tool 10 is exhausted after a single use and can be discarded along with the tubing 12. Such a configuration is advantageous in that an installer is not required to locate and connect a reusable type tool in order to complete a sealing operation. In one example, the tubing 12 is permanently attached to the inflation tool 10 and is removable from the inflatable device 14, wherein removal of the tubing 12 from the inflatable device 14 causes the inflatable device 14 to become automatically sealed.

[0029] In one aspect, the integrated inflation tool 10 includes a housing assembly 16 including a first housing part 20 connected to a second housing part 40. The first and second housing parts 20, 40 may be formed from a variety of materials, such as plastic and/or metal materials. As shown, the first housing part 20 defines an internal chamber 22 for holding a pressurized gas and an outlet 24 for allowing the pressurized gas to exit the internal chamber 22. The internal chamber 22 is defined by a first wall structure 26 while the outlet 24 is defined by a second wall structure 28 extending from the first wall structure 26.

[0030] Extending between the first and second wall structures 26, 28 and between the internal chamber 22 and the air outlet 24 is a first valve assembly 60. First valve assembly 60 is for preventing the pressurized gas from escaping from the internal chamber 22 until discharge of the pressurized gas is desired. As shown, the first valve assembly 60 includes a valve seat 62 and a valve stem 64. The valve seat and stem 62, 64 can be formed from various materials, such as plastic and/or metal materials. The valve stem 64 includes a head portion 66 that seats within the valve seat 62 and a stem portion 68 extending from the head portion 66. As configured, the first valve assembly 60 is held in a closed position by the pressurized gas held within the internal chamber 22.

[0031] In the example embodiment shown, the first valve assembly 60 is opened by displacing the first housing part 20 in a downward direction D relative to the second housing part 40. This action causes a first end 68a of the valve stem portion 68 to contact a valve actuation member 48 of the second housing part 40, thereby raising the head portion 66 out of the valve seat 62. Once this position is achieved, the pressurized gas is free to flow between the valve seat 62 and the stem portion 68 such that the pressurized gas exits the internal chamber 22, flows through the air outlet 24, and into the air inlet 42 of the second housing part 40. This position of the first valve assembly 60 and the first and second housing parts 20, 40 is illustrated at Figures 4 and 5.

[0032] The first valve assembly 60 and the first and second housing parts 20, 40 may be configured to operate such that the first valve assembly 60 is opened through other relative movements of the housing parts 20, 40. For example, the components could be configured such that the first valve assembly 60 is opened by twisting or rotating the first housing part 20 relative to the second housing part 40.

[0033] The integrated inflation tool 10 may also be provided with a separation mechanism 30 for preventing the undesirable actuation of the first valve assembly 60, for example during shipping of the tool 10. As most easily seen at Figure 3, the separation mechanism 30 is disposed between the first housing part 20 and the second housing part 40 such that the first housing part 20 cannot be moved in the direction D relative to the second housing part 40. In one example, the separation mechanism 30 is configured to be torn away or otherwise removed from the integrated inflation tool by an operator prior to inflation. The separation mechanism 30 can also be configured to be movable between locked and unlocked positions without necessarily requiring partial or complete removal of the separation mechanism 30. Once the separation mechanism 30 is removed, the first and second housing parts 20, 40 can be moved to actuate the first valve assembly 60. As shown, the separation mechanism 30 is constructed as a plastic or rubber ring. In one embodiment, the separation mechanism 30 is provided with a tear location, such as a perforated area, such that the ring can be easily broken by the installer. In one embodiment, the separation mechanism 30 is configured such that it can be initially broken by a twisting or rotational motion between the first and second housing parts.

[0034] To provide an air-tight seal between the air outlet 24 of the first housing part 20 and the air inlet 42 of the second housing part 40, a seal 32 may be provided between the second wall structure 28 and the body 46 of the second housing part 40. In one embodiment, the seal 32 is an O-ring having a circular cross-section, but other shapes and other types of seals may be used without departing from the concepts herein.

[0035] As shown, the second housing part has an internal passageway 50 extending between the air inlet 42 and an air outlet 44 to allow the pressurized gas to flow from the first housing part internal chamber 22 to the inflatable device 14 via outlet 44 and tubing 12. Disposed within the internal passageway 50 is a second valve assembly 70. The second valve assembly 70 is configured as a pressure regulator serving two functions. First, the second valve assembly 70 is configured such that it isolates the internal chamber

22 from the air outlet 44 and will only open when the pressure in the internal chamber 22 is above a first predetermined pressure. This operation ensures that air that has been delivered to the inflatable device 14 will not migrate back into the inflation tool 10 as the pressure decreases in the internal chamber 22. Second, the second valve assembly 70 is configured to regulate the pressure at the air outlet 44 such that the inflatable device 14 is inflated to a second predetermined pressure, for example about 3 bars, to prevent over inflation of the inflatable device 14. When the pressure at the air outlet 44 reaches the second predetermined pressure, the second valve assembly 70 will isolate the internal chamber 22 from the air outlet 44.

[0036] To achieve the above described functions, the second valve assembly 70 is configured with a number of components disposed within the air passageway 50 which divide the air passageway into first through fourth passageway sections 50a, 50b, 50c, and 50d. In one aspect, the second valve assembly 70 is provided with a main valve body 72 having an upper surface 72a and a lower surface 72b separated by a perimeter surface 72c. As shown, a seal 74, such as an O-ring, can be provided at the perimeter surface 72c to ensure that the second passageway portion 50b is isolated from the fourth passageway portion 50d by the main valve body 72. When the upper surface 72a of the main valve body 72 is placed against a corresponding seal surface 46a of the housing body 46 of the second housing part, the main valve body 72 also isolates the second passageway section 50b from the third passageway section 50c which extends between the outlet 44 and the surface 46a. As shown, the main body 72 is supported by a spring 76 which engages with a bottom surface 46b of the second housing part body 46 and with the lower surface 72b of the main valve body 72. In the example shown, spring 76 is a helical spring.

[0037] In operation, the spring 76 urges the valve main body 72 in a direction U to seal the passageway section 50c from sections 50a and 50b such that the outlet 44 is effectively sealed from the internal chamber 22. Thus, the valve main body 72 only opens the internal chamber 22 to the outlet 44 after two conditions are met: (1) when the first valve assembly 60 is open; and (2) when the pressurized gas within the internal chamber 22 acts sufficiently on the upper surface 72a (i.e. the effective surface area of the upper surface 72a orthogonal direction U) to overcome the force of the spring 76 to displace the main body 72 in a downward direction such that surfaces 46a and 72a are spaced apart. Such a position is shown at Figure 4.

[0038] Attached to the upper surface 72a of the main valve body 72 is a valve stem 78 that is configured to cooperate with a valve seat 80 attached to the housing body 46 at the first passageway portion 50a. The valve seat and stem 78, 80 can be formed from various materials, such as plastic and/or metal materials. The valve stem 78 includes a head portion 82 that seats within the valve seat 80 and a stem portion 84 extending from the head portion 82. As configured, when the main valve body 72 is sufficiently displaced in direction U, the head portion 82 will engage with the valve seat 80, thereby isolating the first passageway portion 50a from the second passageway portion 50b. As most easily seen at Figure 5, the pressure at the outlet 44 has reached the second predetermined pressure and the resulting force exerted on the upper surface 72a of the main valve body 72 is sufficient to displace the main valve body 72 downward to the point that head portion 82 is seated against the valve seat 80.

[0039] The integrated inflation tool 10 can also be provided with a third valve assembly 90. The third valve assembly 90 provides for a method of adjustment so that the desired regulated pressure (i.e. the second predetermined pressure) can be finely tuned to accommodate for any differences that might otherwise exist due to construction tolerances and material properties. In one aspect, the third valve assembly 90 includes a valve stem 92 that is configured to cooperate with a valve seat 94 attached to an interior passageway 72d of the main valve body 72. In one aspect, the valve stem 92 includes a head portion 96 that seats within the valve seat 80 and a stem portion 98 extending from the head portion 82. The valve stem and seat 92, 94 can be formed from various materials, such as plastic and/or metal materials.

[0040] As shown, an adjustment screw 99 is provided in the second housing part body 46 and is configured to engage the valve stem 94 to unseat the head portion 96 from the valve seat 94 when the main valve body 72 is fully displaced in the direction U such that the second valve assembly 70 is closed. Once opened, the third valve assembly places the second passageway portion 50b in communication with the fourth passageway portion 50d via an aperture 72e in the main valve body 72. Once in this position, as shown at Figure 5, pressurized air from the inflatable device 14 exerts a pressure on the lower surface 72b of the valve main body 72, thereby urging the valve main body 72 in direction D against the pressure exerted by the compressed gas from internal chamber 22 and with the force of

spring 76. The adjustment screw 99 is provided to engage with the valve stem 92 at the appropriate location to ensure that the desired regulated pressure is achieved.

[0041] As disclosed, the above described inflation system 1 provides for a low cost, single-use method for sealing cable ducts and the like. As the integrated inflation tool 10 is provided with an internal chamber 22 for storing a pressurized gas, there is no need for the operator to install a cartridge in order to conduct the operation which results in time savings during installation. Further, as the valve assemblies 60, 70, and 90 control the inflation process, the only requirement of the operator is to simply initiate the inflation process without the need for further monitoring of the pressure. As initiation of the inflation process only requires removal of the separation device 30 and the depression of the first housing part 20 against the second housing part 40, this operation is simple and straightforward for the installer. Additionally, as the inflation tool 10 can be discarded after use, the operator need not spend additional time cleaning the tool 10 after use or in ensuring that the tool stays sufficiently clean during use.

[0042] Referring to Figures 14 to 17, a second embodiment of an inflation system 100 and inflation tool 110 is presented. Where like or similar features or elements are shown, corresponding or like reference numbers will be used where possible (e.g. 110 instead of 10). Many of the concepts and features of the second embodiment are similar to the first embodiment shown in Figures 1-13. As such, the description for the first embodiment is applicable for the second embodiment. The description for the second embodiment will be limited to the differences between the first and second embodiments. As discussed above, the first embodiment of the inflation tool 10 prevents overpressurization of the inflatable device by closing off a valve between a pressurized internal chamber and the inflatable device 14. In contrast, the second embodiment of the inflation tool 110 prevents overpressurization of the inflatable device 14 by relieving excess air from a fluid storage container 102 to the atmosphere.

[0043] With reference to Figure 14, it can be seen that inflation tool 110 has a main body 146, wherein the main body 146 is connected to an inflation tubing 12 at an outlet port 144 and is connected to the compressed fluid storage container 102 at an inlet port 142. The inflation tool is also provided with a vent port 143 to vent any fluid not needed from container 102 at inflatable device 14.

[0044] With reference to Figures 15-17, it can be seen that the vent port 143 is formed by a first threaded bore 180 defining passageway 156, inlet port 142 is formed by a second threaded bore 182 defining a passageway 162, and the outlet port 144 is formed by a third threaded or non-threaded bore 188 defining a passageway 164. A bore 186 connects each of the bores 180, 182, 188 together such that ports 142, 143, and 144 are in fluid communication with each other, absent the presence of any internal components.

[0045] As shown, an insert 157 is disposed within bore 186. The insert 157 defines a central passageway 158 that connects passageway 162 with passageway 164. The insert further defines one or more passageways or radial openings 160 that place the central passageway 158 in fluid communication with the passageway 156 associated with the vent port 143. A puncture pin structure 150 is also shown as being disposed within bore 186 and is disposed against the insert 157. As shown, a base portion 152 of the pin structure 150 rests against the insert 157 while a pin portion 151 extends from the base portion 152 and towards the inlet port 142. A passageway 153 extends entirely through the pin and base portions 151, 152 such that the passageway 162 is open to passageways 158 and 164.

[0046] The puncture pin structure 150 operates to puncture the end of the compressed fluid storage container 102 (e.g. a CO_2 cartridge) as the container 102 is threaded into the bore 182 and in engagement with the puncture pin structure 150. Once the end of the container 102 is punctured, compressed fluid flows from the container 102, through passageways 153, 158, and 164 to the inflatable device 14. A sealing member 154 can be provided to prevent fluid leakage between the container 102 and the pin structure 150 and/or between the container 102 and the main body 146. Alternatively, container 102 can be provided as an internal chamber and opened in a manner similar to that described for the first embodiment such that movement of a part of the tool 110 causes the internal chamber to open.

[0047] To prevent over inflation of the inflatable device 14 by the container 102, a regulating vent valve assembly 170 can be provided in the bore 180. As shown, the regulating vent valve assembly 170 includes a valve member 172, a sealing member 174, a spring stop member 130, and a spring 176 disposed between the spring stop member 130 and the valve member 172. The spring stop member 130 is provided with threads and is designed to be threaded into the bore 180 to a desired position with a tool 105 (Figure 17). The position of the spring stop 130 is set such that the valve member 172 will only open at

a predetermined pressure. The spring stop 130 is also provided with a passageway 132 to allow fluid to flow from passageway or openings 160 to the vent port 143.

[0048] The valve member 172 is slidably disposed within the bore 180 at a non-threaded portion and forms a seal with sealing member 174 when fully seated. The valve member 172 is seated into a closed position by the force of the spring 176 acting against the spring stop 130. In this position, the valve member 172 prevents flow to the vent port 143 from either of the inlet and outlet ports 142, 144. However, it is noted that even in this position, the inlet and outlet ports 142, 144 remain in fluid communication with each other. When the valve member 172 is unseated, enough clearance exists at a clearance gap 177 located between the sidewall of the valve member 172 and the bore 180 to allow air to flow between passageway 150 and passageway 156. The valve member 172 and seal member 174 can be additionally or alternatively configured such that openings are provided in the valve member 172 that are closed off when the valve member 172 seats against the seal member 174 and are open when the valve member 174 unseats to selectively allow for air to pass from passageway 160 to passageway 156.

[0049] During an inflation operation, the container 102 is threaded into the inlet port 142 and compressed fluid flows to the inflatable device 14 as soon as the end of the container 102 is punctured by the pin structure 150. As the pressure rises in the inflatable device 14, the pressure exerted on the valve member 172 correspondingly increases. Once the inflatable device 14 reaches and/or exceeds the predetermined pressure at which the valve assembly 170 is set, the valve member 172 is forced open to allow fluid to vent to the vent port 143 via passageway or openings 160 and passageway 156. This venting action occurs until the container 102 becomes exhausted and the pressure equalizes at the predetermined pressure in both the inflatable device 14 and the container 102. At this stage, the tubing 12 can be clamped or separated from the main body 146 in a similar fashion as already described with respect to system 1 and tool 10.

[0050] The inflation tool 110 and container 102 can be provided together as a single use kit, or the inflation tool 110 can be separately provided and reused multiple times. In some embodiments, the tool 10, 110 can be attached to the tubing 12 and an inflatable device 14 during a manufacturing process such that a single use inflation system 1, 100 is provided. The inflation tool 10, 110 can also be attached to the inflatable device 14 via tubing 12 in the field before use.

[0051] While the best modes for carrying out the many aspects of the present teachings have been described in detail, those familiar with the art to which these teachings relate will recognize various alternative aspects for practicing the present teachings that are within the scope of the appended claims.

PART NUMBERS

[0052] 1 inflation system
[0053] 10 integrated inflation tool
[0054] 12 inflation tubing
[0055] 12a first end
[0056] 12b second end
[0057] 14 inflatable device
[0058] 16 housing assembly
[0059] 20 first housing part
[0060] 22 internal chamber
[0061] 24 air outlet
[0062] 26 first wall structure
[0063] 28 second wall structure
[0064] 30 separation mechanism
[0065] 32 seal
[0066] 40 second housing part
[0067] 42 air inlet
[0068] 44 air outlet
[0069] 46 housing body
[0070] 46a seal surface
[0071] 46b bottom surface
[0072] 48 valve actuation member
[0073] 50 internal passageway
[0074] 50a first passageway portion
[0075] 50b second passageway portion
[0076] 50c third passageway portion
[0077] 50d fourth passageway portion
[0078] 60 first valve assembly
[0079] 62 valve seat
[0080] 64 valve stem
[0081] 66 head portion
[0082] 68 stem portion
[0083] 68a first end
[0084] 70 second valve assembly
[0085] 72 main valve body
[0086] 72a upper surface
[0087] 72b lower surface
[0088] 72c perimeter surface
[0089] 72d interior passageway
[0090] 72e aperture
[0091] 74 seal
[0092] 76 spring
[0093] 78 valve stem

[0094] 80 valve seat
[0095] 82 head portion
[0096] 84 stem portion
[0097] 90 third valve assembly
[0098] 92 valve stem
[0099] 94 valve seat
[0100] 96 head portion
[0101] 98 seat portion
[0102] 99 adjustment screw
[0103] 100 inflation system
[0104] 102 compressed fluid storage container
[0105] 105 adjustment tool
[0106] 110 integrated inflation tool
[0107] 130 spring stop
[0108] 132 passageway
[0109] 142 inlet port
[0110] 143 vent port
[0111] 144 outlet port
[0112] 146 valve body
[0113] 150 puncture pin structure
[0114] 151 pin
[0115] 152 base
[0116] 153 passageway
[0117] 154 sealing member
[0118] 156 passageway
[0119] 157 insert
[0120] 158 passageway
[0121] 160 passageway
[0122] 162 passageway
[0123] 164 passageway
[0124] 170 regulating vent valve assembly
[0125] 172 valve member
[0126] 174 sealing member
[0127] 176 spring
[0128] 177 clearance gap
[0129] 180 first bore
[0130] 182 second bore
[0131] 184 third bore
[0132] 186 fourth bore
[0133] 188 fifth bore
[0134] 189 sixth bore

WHAT IS CLAIMED IS:

1. An inflation system (100) comprising:
    a. an inflatable device (14);
    b. a length of tubing (12) having a first end (12a) and a second end (12b), the first end (12a) being removably connected to the inflatable device (14); and
    c. an inflation tool (100) including:
        i. a main body (146) having an inlet port (142) configured for receiving a compressed fluid container (102), an outlet port (144) in fluid communication with the inlet port (142) and configured to receive the first end (12a) of the tubing (12), and a vent port (143) configured to vent compressed fluid from the container (102); and
        ii. a vent valve assembly (170) disposed in a bore (180) of the main body (146) and including a spring stop member (130), a spring (176), and a valve member (174), wherein the vent valve assembly (170) is operable from a closed position to an open position:
            1. in the closed position, the vent valve assembly (170) isolates the vent port (143) from both the inlet and outlet ports (142, 144) such that all fluid exiting the container (102) is delivered to the inflatable device (14);
            2. in the open position, the vent valve assembly (170) opens the vent port (143) to both the inlet and outlet ports (142, 144) when the inflatable device (14) reaches a predetermined pressure.

2. The inflation system (100) of claim 1, wherein a position of the spring stop member (130) is adjustable.

3. The inflation system (100) of claim 2, wherein the spring stop member (130) position is adjustable by threading the spring stop member (130) within the bore (180).

4. The inflation system (100) of claim 1, wherein a clearance gap (177) exists between a sidewall of the valve member (172) and the bore (180) such that fluid

can pass within the clearance gap when the vent valve assembly (170) is in the open position.

5. A method of sealing a cable within a duct, the method comprising:
    a. wrapping a pouch configured to receive a pressurizing fluid for inflating the pouch around the cable;
    b. inserting the cable with the pouch into a duct;
    c. filling the pouch with the pressurizing fluid via a fill tube from a single use pressure source external of the pouch through a valve opening of a valve structure of the pouch;
    d. removing the fill tube from connection with the pouch when a predetermined pressure has been reached;
    e. sealing the valve opening with a seal after the fill tube is removed from the valve opening.

6. A method according to claim 5, wherein the pressure source includes enough of the pressurizing fluid to fill the pouch to a predetermined pressure, but does not include enough of the pressurizing fluid to fill a second similar pouch to the predetermined pressure.

7. A method according to claim 5, wherein the pressure source includes a breakable and/or removable separation mechanism between the pressure source and a pressure regulator connected in line to the fill tube.

8. A method according to claim 7, wherein the pressure source and the pressure regulator connected in line to the fill tube are affixed to the pouch before wrapping the pouch around the cable.

9. A single-use inflation system (1) comprising:
    a. an inflatable device (14);
    b. a length of tubing (12) having a first end (12a) and a second end (12b), the first end (12a) being removably connected to the inflatable device (14); and
    c. an integrated inflation tool (10) including:

i. a first housing part (20) having an internal chamber (22) for holding a pressurized gas and having an outlet (24);
ii. a second housing part (40) connected to the first housing part (20) and having an inlet (42) for receiving the compressed gas from the first housing part outlet (24), the second housing part (40) having an outlet (44) connected to the second end (12b) of the tubing (12);
iii. a first valve assembly (60) operable from a closed position to an open position by relative movement (40), wherein:
    1. in the closed position, the first valve assembly (60) isolates the internal chamber (22) from the second housing part inlet (42);
    2. in the open position, the first valve assembly (60) places the internal chamber (22) in fluid communication with the housing part inlet (42).

10. The single-use inflation system of claim 9, further comprising:
    a. a second valve assembly (70) disposed between the second housing part inlet (42) and outlet (44), the second valve assembly (70) being operable between a closed position and an open position to regulate pressure at the second housing part outlet (44).

11. The single-use inflation system of claim 9, wherein the first valve assembly (60) is disposed in the first housing part (20).

12. The single-use inflation system of claim 9, wherein the first valve assembly (60) is moved from the close position to the open position by displacing the first housing portion (20) in a direction towards the second housing portion (40).

13. The single-use inflation system of claim 9, further comprising:
    a. a removable separation member (30) located between the first and second housing parts (20, 40), the separation member (30), when installed, preventing actuation of the first valve assembly (60) by preventing relative movement between the first and second housing parts (20, 40).

14. A single-use inflation system (1) comprising:
    a. an inflatable device (14);
    b. a length of tubing (12) having a first end (12a) and a second end (12b), the first end (12a) being removably connected to the inflatable device (14); and
    c. an integrated inflation tool (10) including:
        i. a first housing part (20) having an internal chamber (22) for holding a pressurized gas and having an outlet (24);
        ii. a second housing part (40) connected to the first housing part (20) and having an inlet (42) for receiving the compressed gas from the first housing part outlet (24), the second housing part (40) having an outlet (44) connected to the second end (12b) of the tubing (12);
        iii. a first valve assembly (60) operable from a closed position to an open position by relative movement (40), wherein:
            1. in the closed position, the first valve assembly (60) isolates the internal chamber (22) from the second housing part inlet (42);
            2. in the open position, the first valve assembly (60) places the internal chamber (22) in fluid communication with the housing part inlet (42);
    d. a second valve assembly (70) disposed between the second housing part inlet (42) and outlet (44), the second valve assembly (70) being operable between a closed position and an open position to regulate pressure at the second housing part outlet (44).

15. The single-use inflation system of claim 14, wherein the first valve assembly (60) is disposed in the first housing part (20).

16. The single-use inflation system of claim 14, wherein the first valve assembly (60) is moved from the close position to the open position by displacing the first housing portion (20) in a direction towards the second housing portion (40).

17. The single-use inflation system of claim 14, further comprising:
    a. a removable separation member (30) located between the first and second housing parts (20, 40), the separation member (30), when installed,

preventing actuation of the first valve assembly (60) by preventing relative movement between the first and second housing parts (20, 40).

18. An integrated inflation tool (10) comprising:
    a. a first housing part (20) having an internal chamber (22) for holding a pressurized gas and having an outlet (24);
    b. a second housing part (40) connected to the first housing part (20) and having an inlet (42) for receiving the compressed gas from the first housing part outlet (24), the second housing part (40) having an outlet (44);
    c. a first valve assembly (60) operable from a closed position to an open position by relative movement (40), wherein:
        i. in the closed position, the first valve assembly (60) isolates the internal chamber (22) from the second housing part inlet (42);
        ii. in the open position, the first valve assembly (60) places the internal chamber (22) in fluid communication with the housing part inlet (42) .

19. The integrated inflation tool (10) of claim 18, further comprising:
    a. a second valve assembly (70) disposed between the second housing part inlet (42) and outlet (44), the second valve assembly (70) being operable between a closed position and an open position to regulate pressure at the second housing part outlet (44).

20. The integrated inflation tool (10) of claim 18, wherein the first valve assembly (60) is disposed in the first housing part (20).

21. The integrated inflation tool (10) of claim 18, wherein the first valve assembly (60) is moved from the close position to the open position by displacing the first housing portion (20) in a direction towards the second housing portion (40).

22. The integrated inflation tool (10) of claim 18, further comprising:
    a. a removable separation member (30) located between the first and second housing parts (20, 40), the separation member (30), when installed,

preventing actuation of the first valve assembly (60) by preventing relative movement between the first and second housing parts (20, 40).

23. A single-use inflation system (1) comprising:
    a. an inflatable device (14);
    b. a length of tubing (12) connected at a first end (12a) to the inflatable device (14); and
    c. a disposable inflation tool (10) including:
        i. a housing (20, 40) having an internal chamber (22) for holding a pressurized gas and an outlet (44) connected to a second end (12b) of the tubing (12);
        ii. a first internal valve assembly (60) disposed within the housing (20, 40) that is movable to an open position to allow fluid communication between the internal chamber (22) and the outlet (44);
        iii. a second internal valve assembly (80) disposed within the housing (20, 40) and being configured to ensure that the inflatable device (14) is pressurized to a first predetermined pressure after the first valve assembly (60) has been moved to the open position.

24. The single-use inflation system (1) of claim 23, wherein:
    a. the housing (20, 40) includes a first housing part (20) within which the internal chamber (22) is located and includes a second housing part (40) having the outlet (24).

25. The single-use inflation system (1) of claim 24, wherein:
    a. the first valve assembly (60) is located within the first housing part (20) and the second valve assembly (80) is located within the second housing part (20).

26. The single-use inflation system (1) of claim 24, wherein the first valve assembly (60) is movable to the open position by a relative movement between the first housing part (20) and the second housing part (40)

27. The single-use inflation system (1) of claim 26, wherein the relative movement is a linear movement in which the first housing part (20) is moved towards the second housing part (40).

28. The single-use inflation system of claim 23, wherein the first predetermined pressure is about 3 bar.

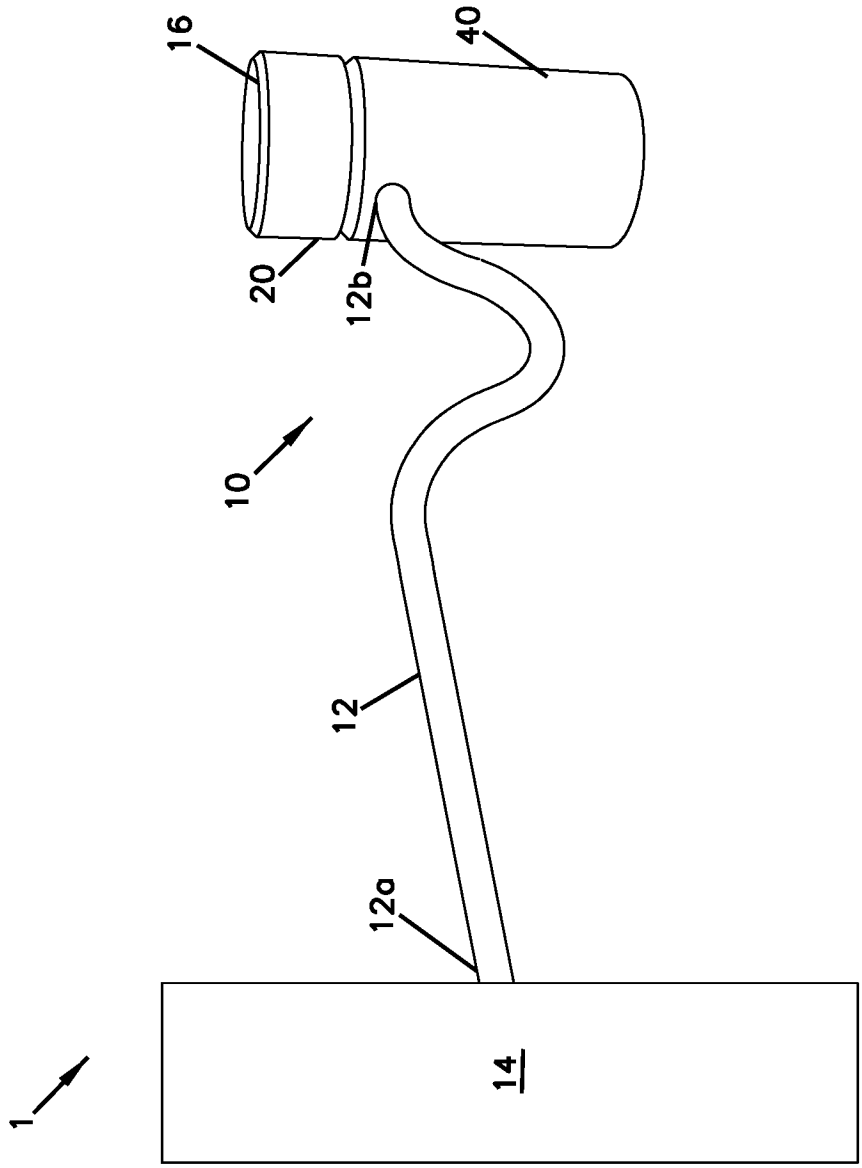

FIG. 1

FIG. 2

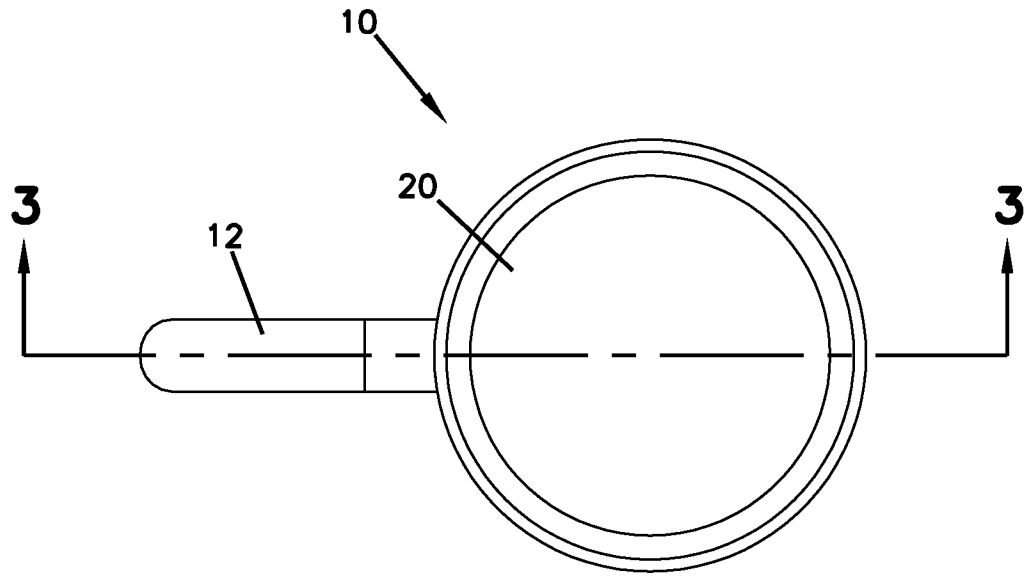

FIG. 3

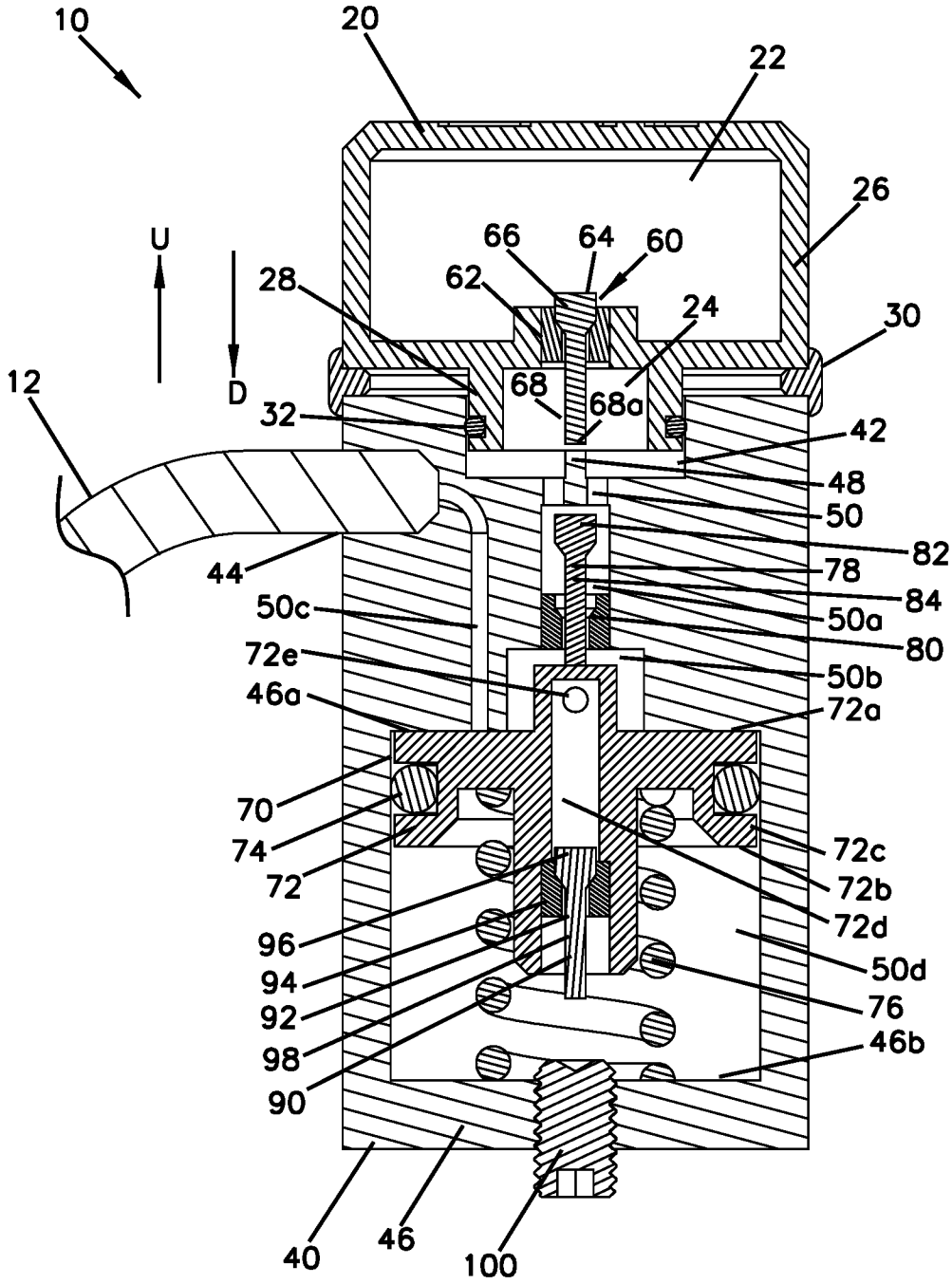
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FIG. 4

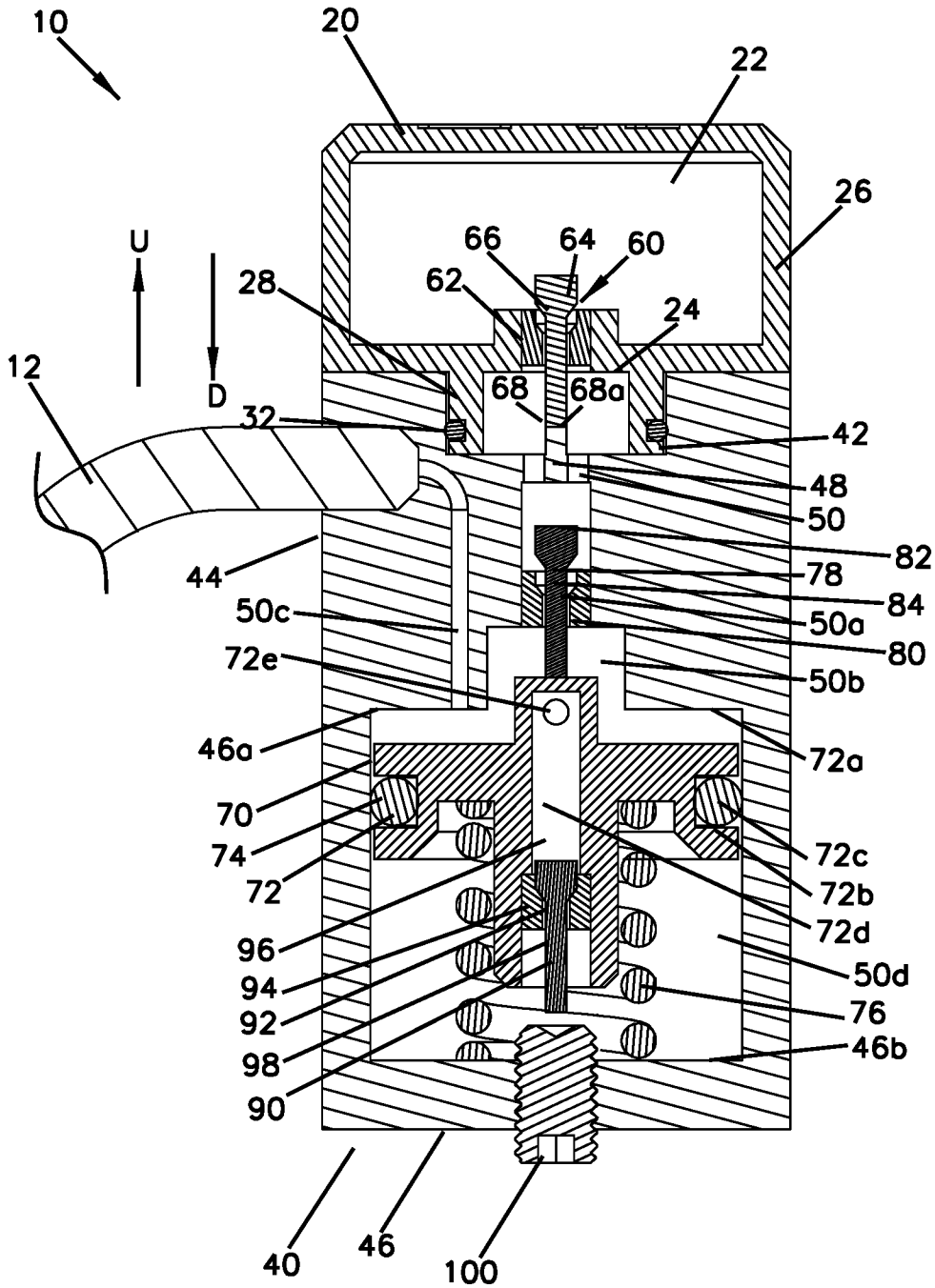
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FIG. 5

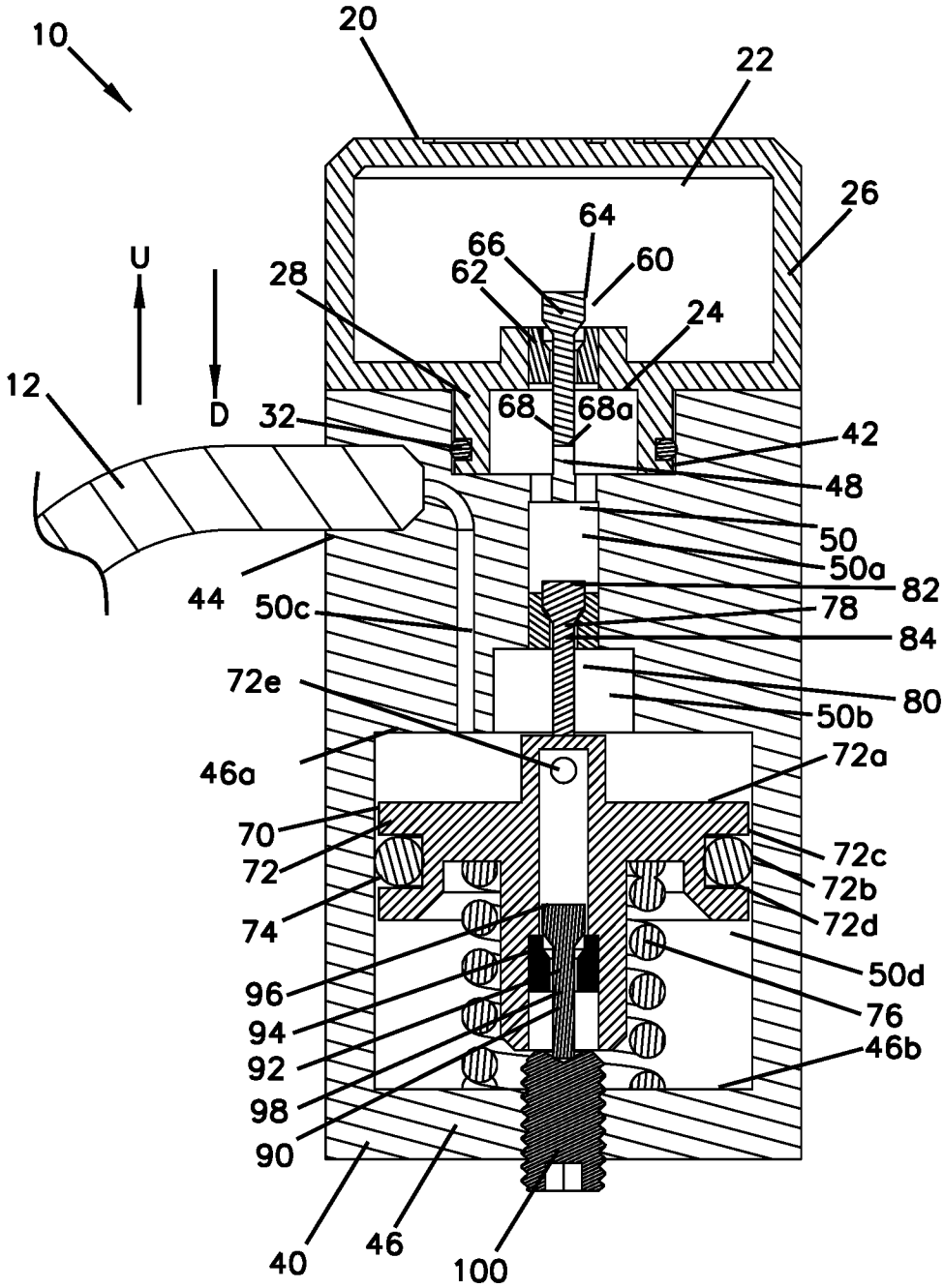
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FIG. 6

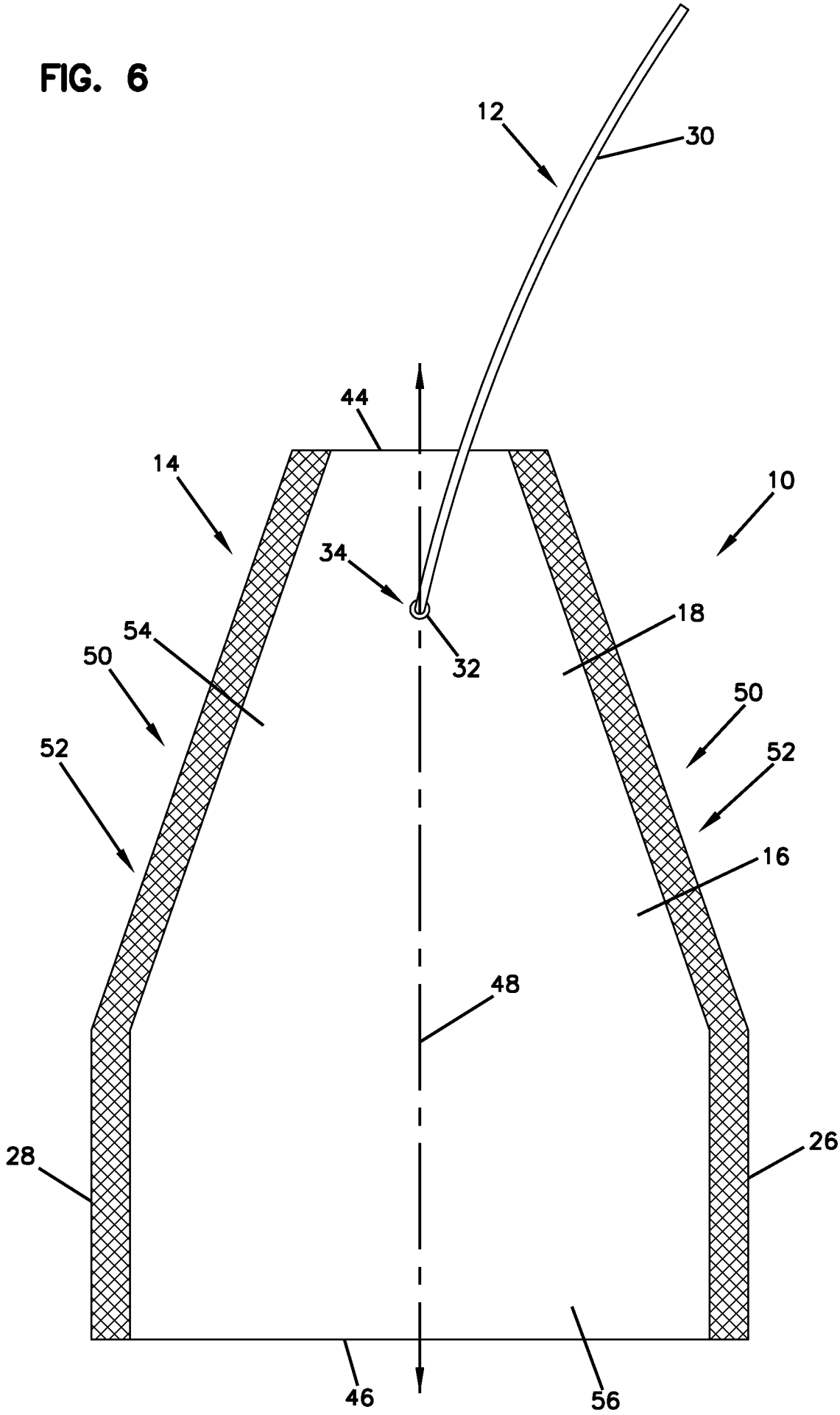
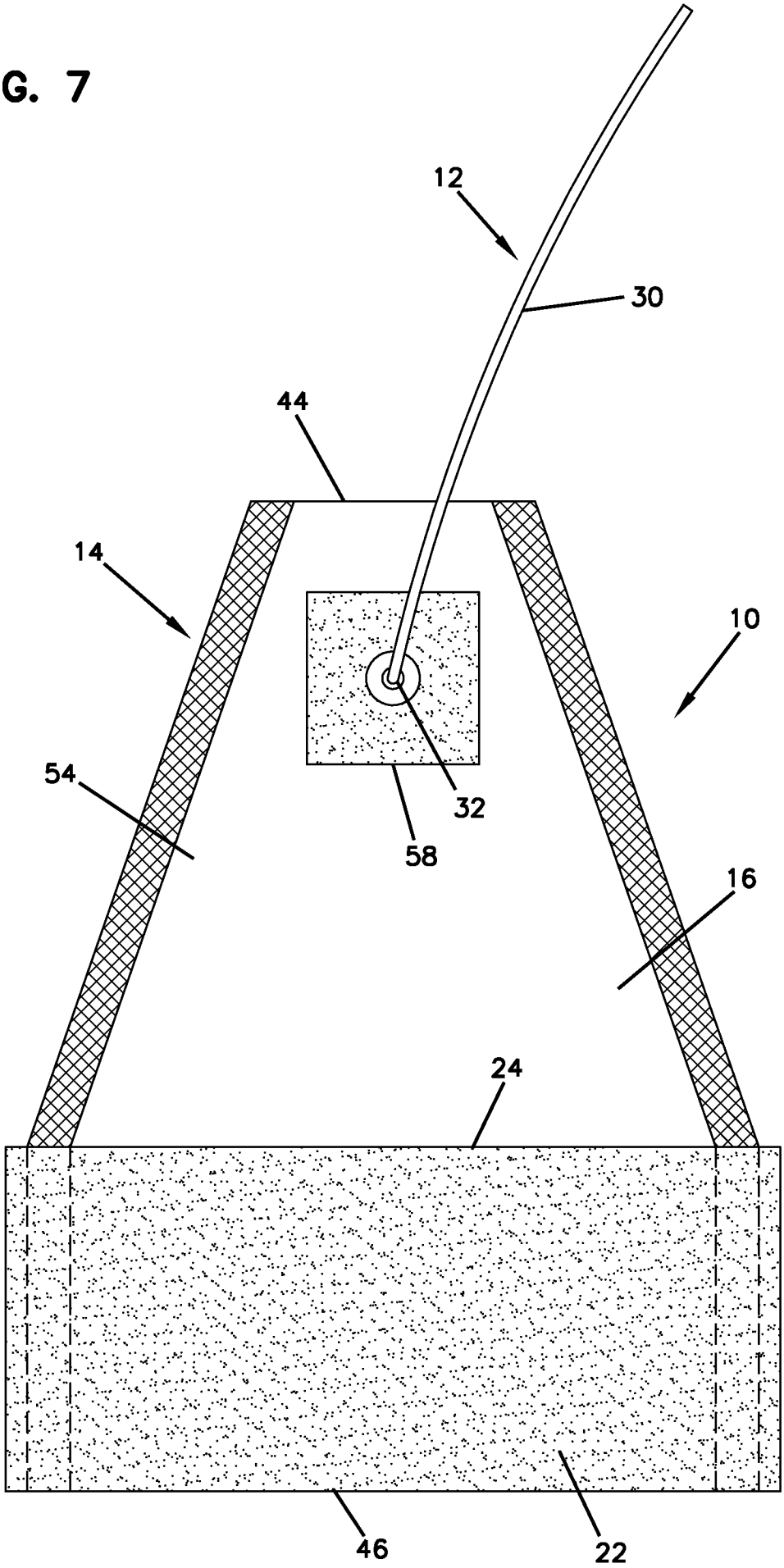


FIG. 7



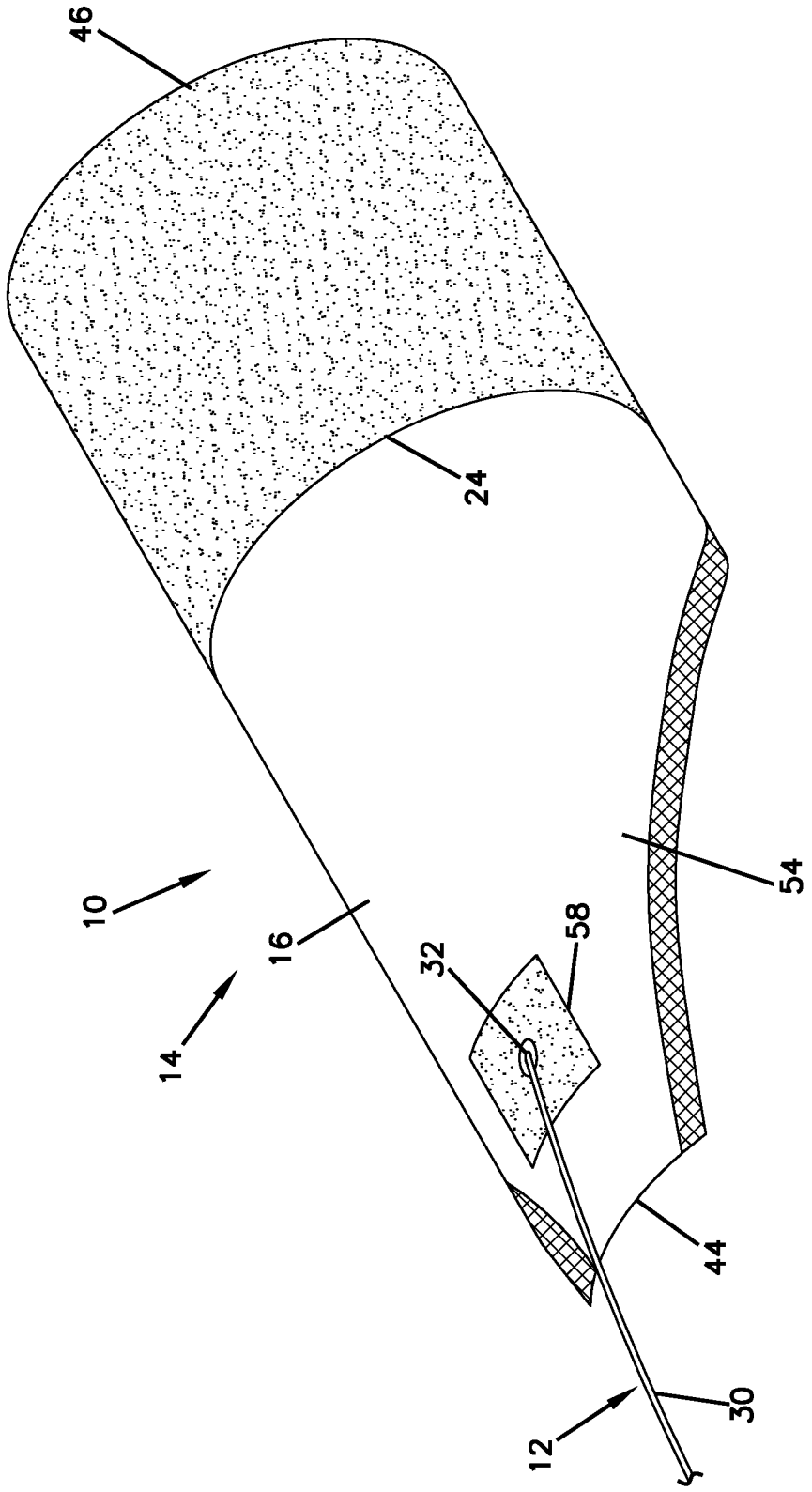


FIG. 8

FIG. 9

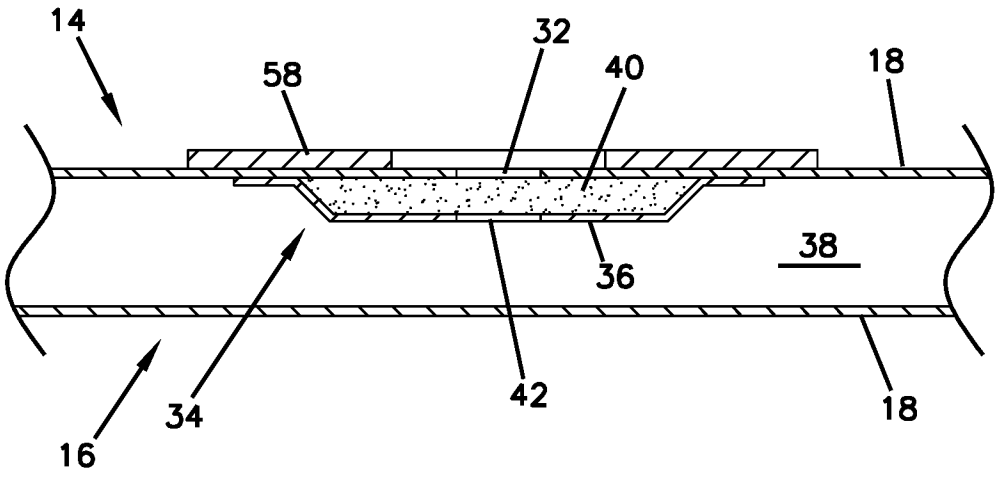
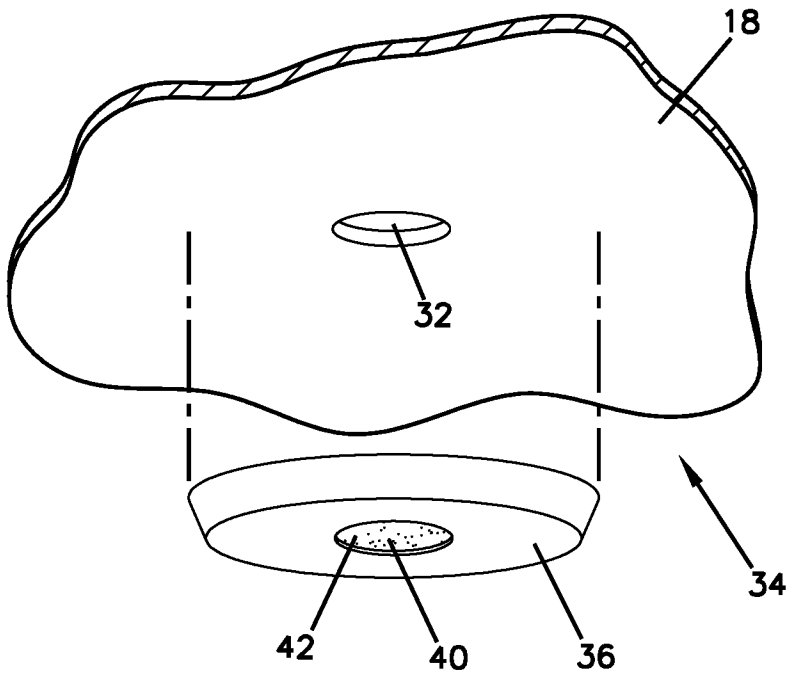


FIG. 10



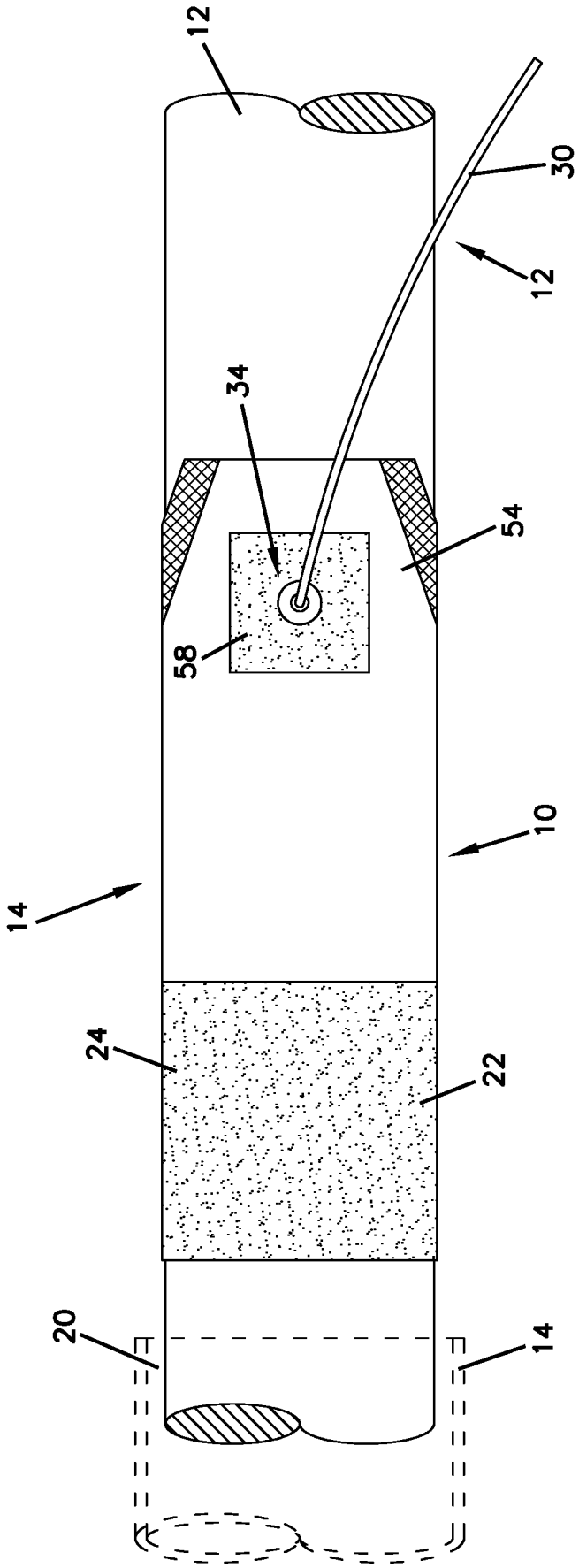


FIG. 11

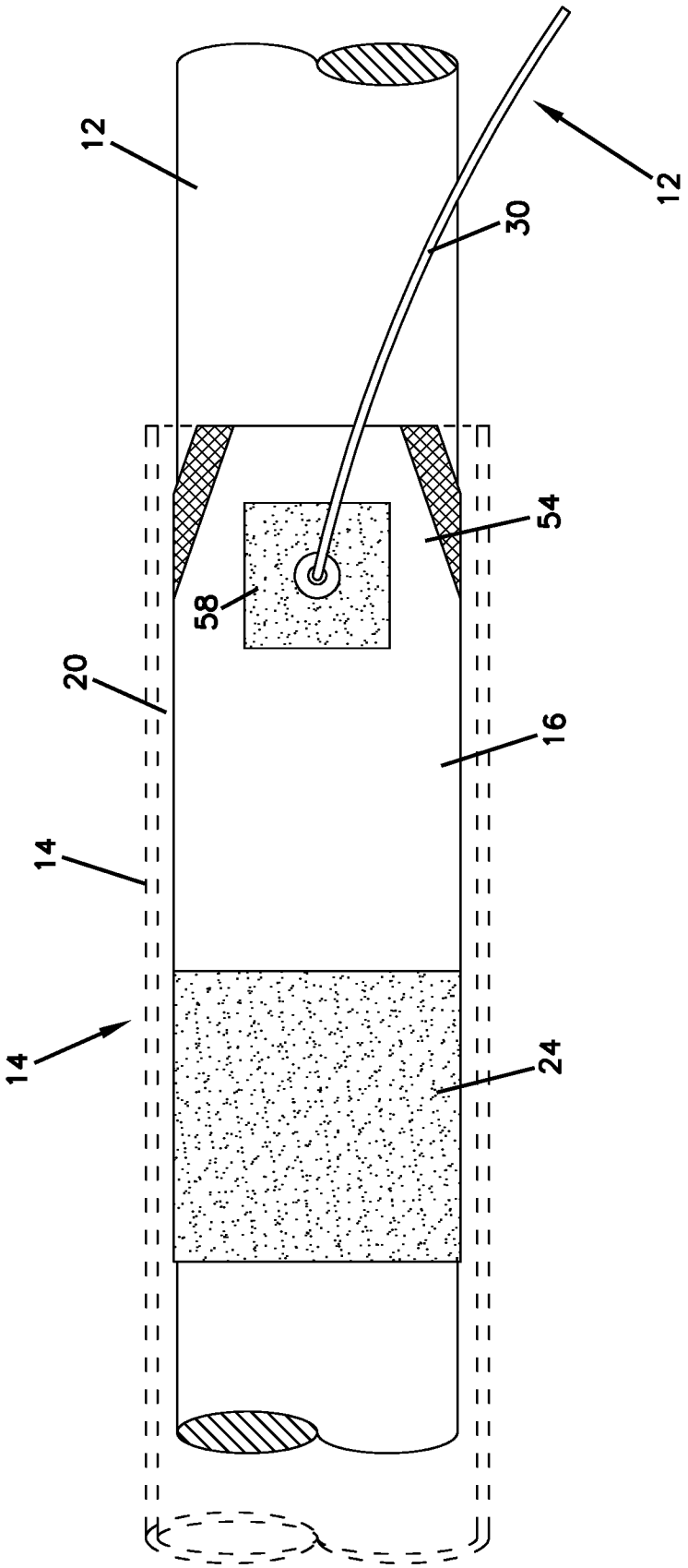


FIG. 12

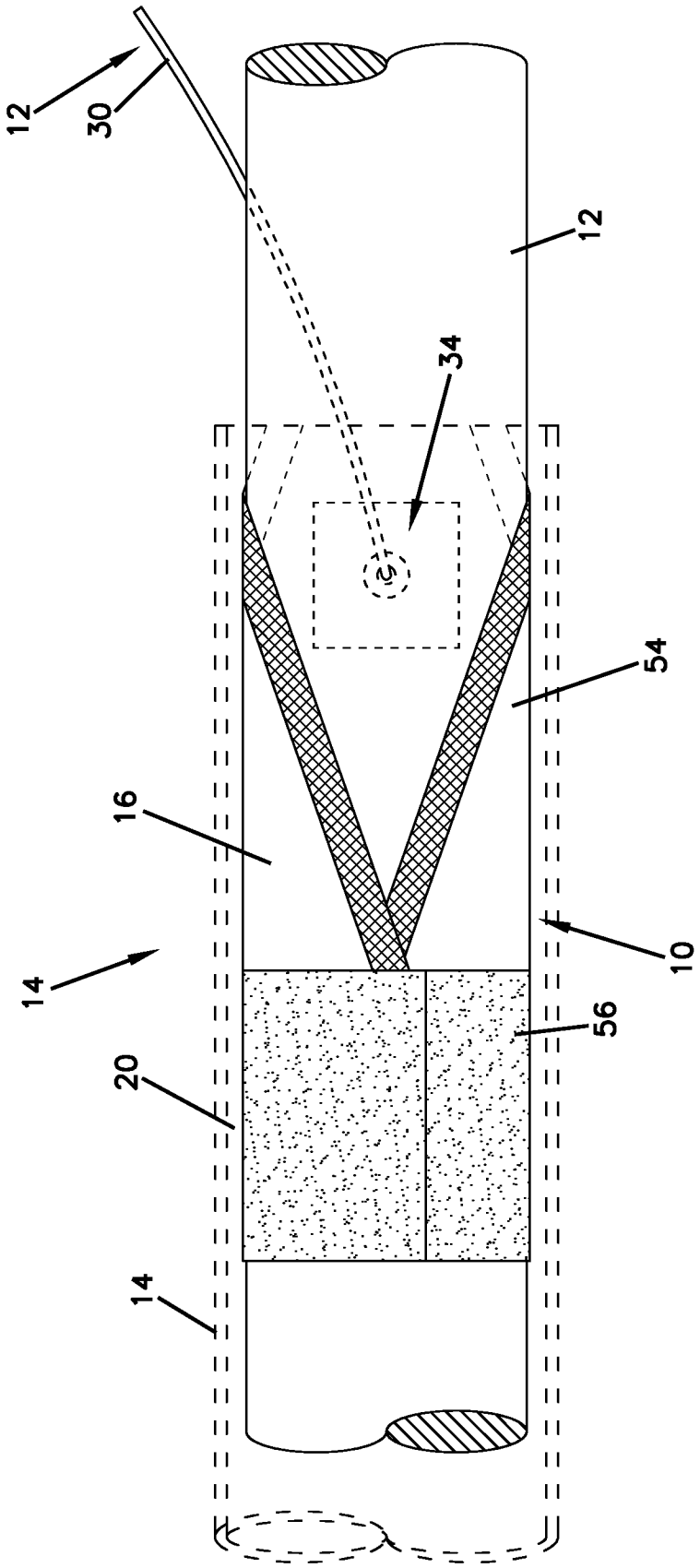


FIG. 13

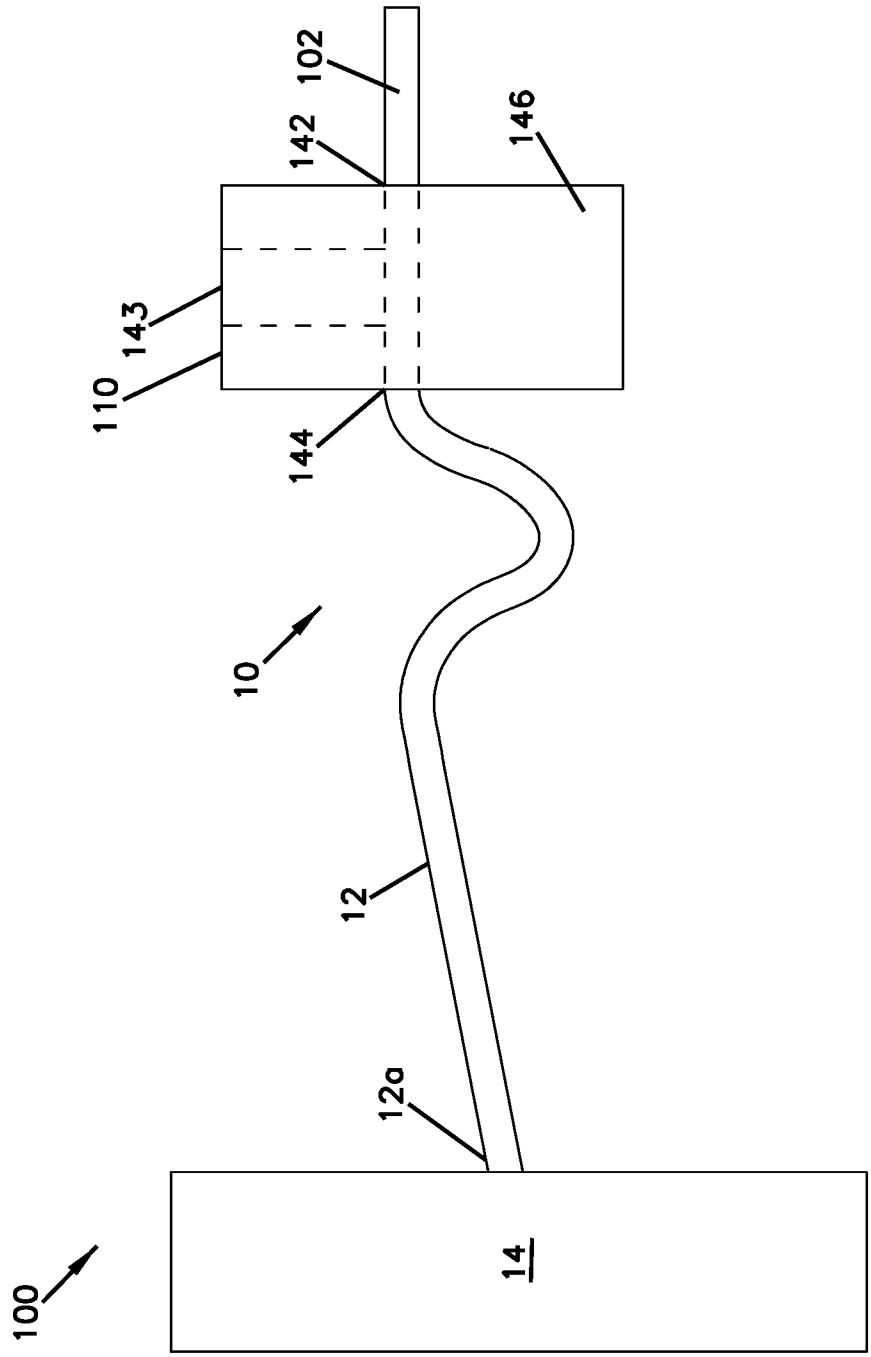


FIG. 14

FIG. 15

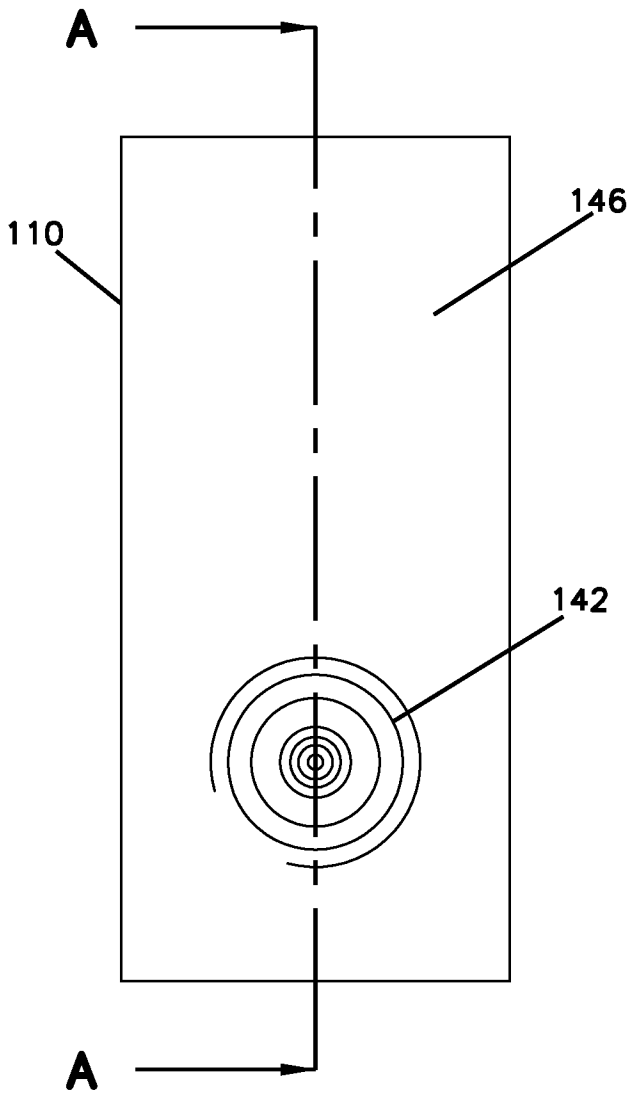


FIG. 16

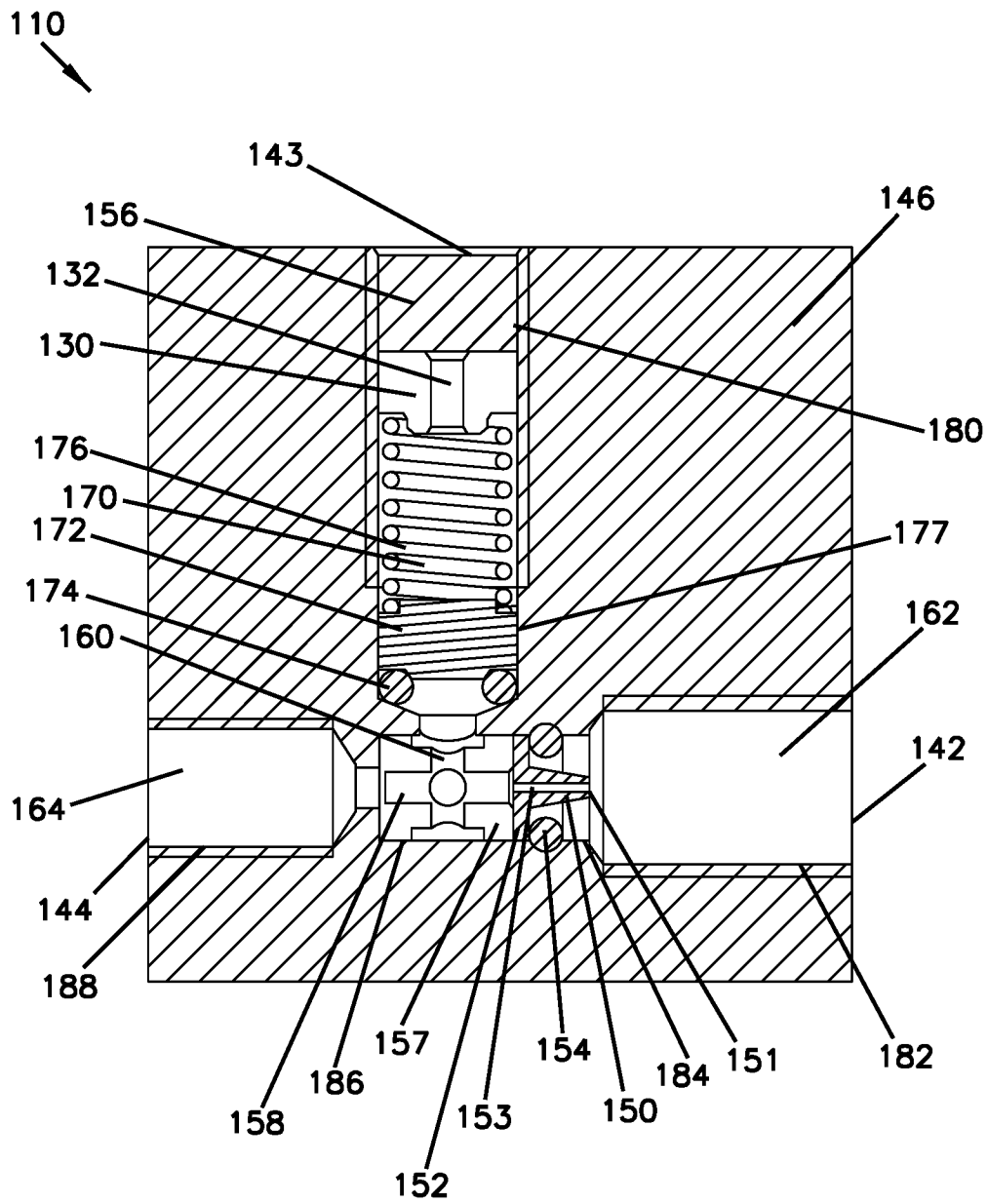

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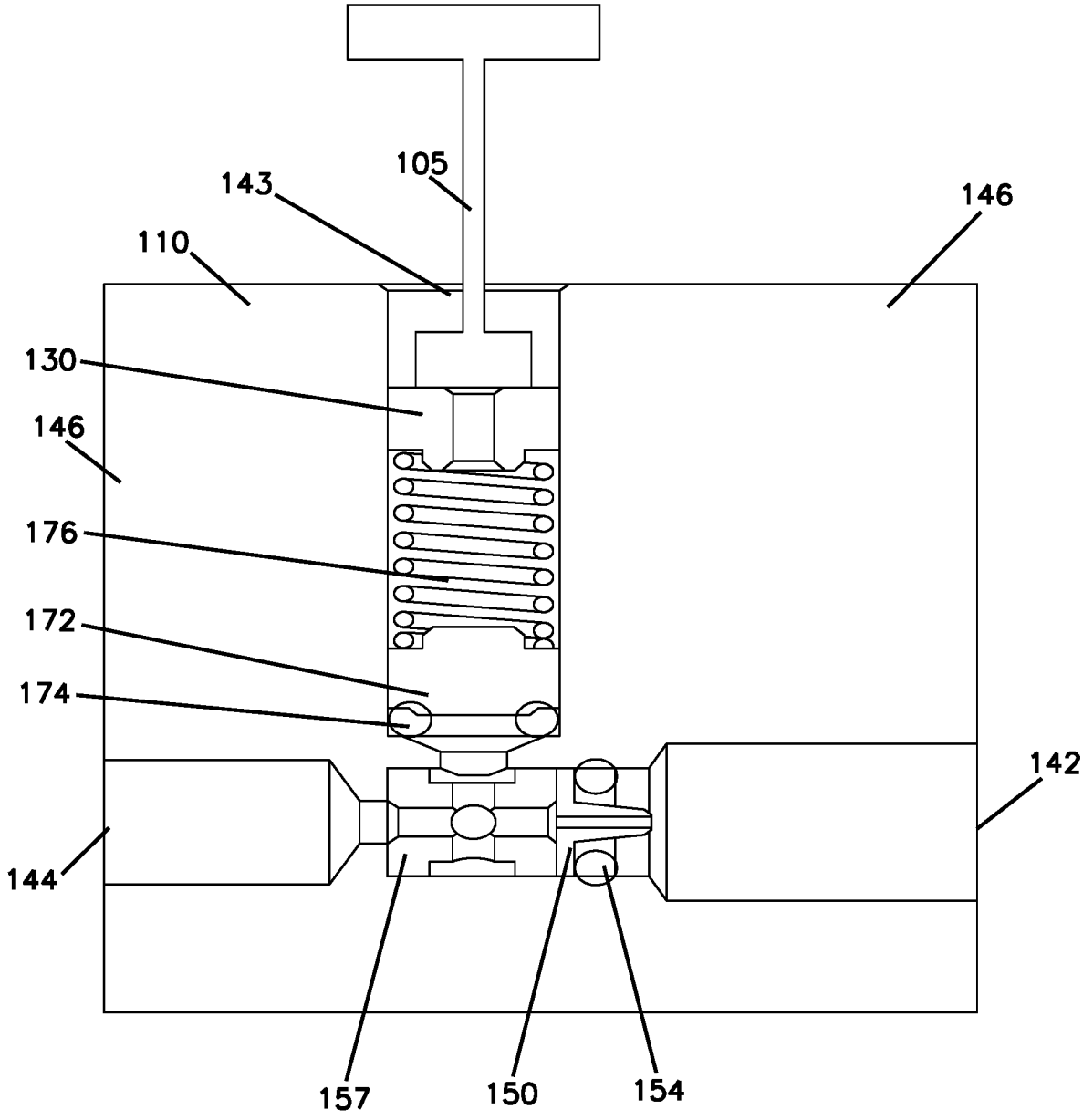
FIG. 17



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/051249

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02G15/013
ADD.

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)
H02G

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Raychem Corporation: "RDSS Rayflate Duct Sealing System For Moisture Sealing on 2" to 6" Ducts with 0, 1, or 2 Cables For 3 or More Cables the RDSS-Clip is also required Product Installation Instructions", , 24 December 1997 (1997-12-24), XP055257039, Retrieved from the Internet: URL:http://sigma.octopart.com/14886183/instruction_sheet/TE-Connectivity-RDSS-AD-210(S4).pdf [retrieved on 2016-03-10]	5-8
Y	the whole document	1-4

-/--

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"E" earlier application or patent but published on or after the international filing date

"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
12 April 2016	02/05/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Bossi, Paolo

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/051249

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/206401 A1 (NIEBEL RUEDIGER [DE]) 19 August 2010 (2010-08-19) paragraph [0032] figure 4	1-4

X	"RDSS Rayflate Duct Sealing System for power cables RDSS Rayflate Duct Sealing System for power cables", , 31 May 2002 (2002-05-31), XP055257177, Retrieved from the Internet: URL:http://www.cablejoints.co.uk/upload/Duct_Seals___Raychem_Duct_Sealing.pdf [retrieved on 2016-03-10]	5-9,18
Y	the whole document	10,14, 16,19
A		1-4

Y	US 4 682 622 A (WEBER KENT [US]) 28 July 1987 (1987-07-28)	10,14, 16,19
A	figure 1	9,18

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/051249

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010206401 A1	19-08-2010	CN 102483631 A	30-05-2012
		EP 2401663 A2	04-01-2012
		RU 2011136558 A	20-03-2013
		US 2010206401 A1	19-08-2010
		WO 2010092487 A2	19-08-2010
US 4682622 A	28-07-1987	NONE	