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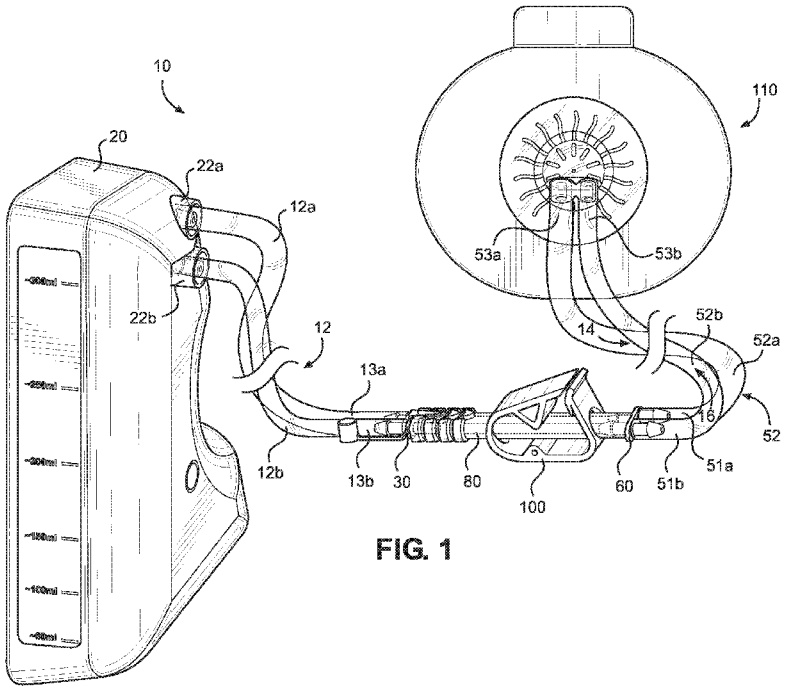


FIG. 1

(57) Abstract: A resilient connector for a negative pressure wound therapy system. The connector includes a first lumen having an entrance dimensioned and configured for slidably engaging a projection of a canister adapter to provide fluid communication of the first lumen to a first portion of reduced pressure tubing and an exit dimensioned and configured for slidably engaging a first projection of a dressing adapter to provide fluid communication of the first lumen to a second portion of reduced pressure tubing. The connector further a second lumen having an entrance dimensioned and configured for slidably engaging a second projection of the canister adapter to provide fluid communication of the second lumen to a first portion of secondary pressure tubing and an exit dimensioned and configured for slidably engaging a second projection of the dressing adapter to provide fluid communication of the second lumen to a second portion of the secondary pressure tubing.

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TUBING CONNECTION SYSTEM FOR NEGATIVE PRESSURE WOUND THERAPY

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to co-pending U.S. Provisional Application Serial No. 62/733,128 filed September 19, 2018, entitled "Connector with Valve for Negative Pressure Wound Therapy System," the entire contents of which is incorporated herein by reference.

FIELD

[0002] This disclosure relates to the field of negative pressure wound therapy. More particularly, this disclosure relates to a tubing connection system for removably connecting a first portion of tubing fluidly connected to a collection canister to a second portion of tubing fluidly connected to a wound site in a negative pressure wound therapy system.

BACKGROUND

[0003] The primary purpose of negative pressure wound therapy (also referred to as "reduced pressure therapy" or "vacuum therapy" in the medical community) is to apply a reduced pressure (also referred to as "negative pressure" or "vacuum pressure" but will be referred to herein as "reduced pressure") to a wound site to stimulate healing and remove excess exudate from the wound site. The major components of a negative pressure wound therapy system (hereinafter "NPWT system") include a reduced pressure source (e.g., vacuum pump), a waste canister for collecting extracted exudate from the wound site, a wound enclosure for covering the wound site (e.g., an assembly for directing air flow at the wound site and enclosing various layers such as a drape, dressing foam, etc. as known in the art), and one or more lumens (e.g., tubing) fluidly connecting the wound enclosure to the reduced pressure source and the canister.

[0004] In certain NPWT systems, at least two fluid flow paths are provided. According to a first fluid flow path, the reduced pressure source is operable to provide a primary reduced pressure to the wound enclosure such that fluid flows from the wound enclosure

to the canister through a first lumen system. The primary reduced pressure generated by the reduced pressure source serves both to stimulate healing by applying the reduced pressure to the wound site and to remove exudate from the wound enclosure to the canister. Using a second fluid flow path connected to the wound enclosure through a second lumen system, the primary reduced pressure being applied to the wound enclosure by the reduced pressure source may be measured/monitored. Further, the second fluid flow path may also be connected to a secondary pressure source (such as the outlet of the reduced pressure source or a separate pump) to provide a secondary pressure to the wound enclosure through the second lumen system to assist the reduced pressure source.

[0005] In NPWT systems, it is desirable to provide a connection system disposed between the canister and the wound enclosure for connecting and disconnecting the application of reduced pressure to the wound site. For example, a wound dressing may need to be replaced before the collection canister is full. Thus, in this situation, the connection system provides the ability for the hospital staff to be able to disconnect the existing wound enclosure from the reduced pressure source to replace the dressing without having to replace the existing canister. Similarly, it may also be desirable to replace the collection canister when it becomes full of exudate without having to remove the wound enclosure as positioned on the user/patient.

[0006] One issue that arises when providing a connection system disposed between the canister and wound enclosure is that it is critical that the different lumen systems used to provide the multiple fluid flow paths are connected correctly to ensure that exudate already removed from the wound enclosure and disposed within the first lumen system is not returned to the wound site. Another issue with existing connections systems (such as the connection system disclosed in U.S. Patent No. 9,408,751) is that existing connectors/adapters include a large profile or otherwise create discomfort to the user when, for example, the user lays on the connection system. Yet another issue with existing connection systems is that they use luer lock type fittings in which it is cumbersome to attach the separate pieces together and/or it is often unclear whether the connections have been made properly to prevent leakage within the system.

[0007] What is needed, therefore, is an improved tubing connection system for a NPWT system.

SUMMARY

[0008] The above and other needs are met by a connection system for providing reduced pressure along a first fluid flow path and secondary pressure along a second fluid flow path to a wound site. The connection system includes a connector formed of a resilient material configured to be fluidly connected to a canister adapter where the canister adapter includes a first projection in fluid communication with a first portion of reduced pressure tubing and a second projection in fluid communication with a first portion of secondary pressure tubing. The connector includes a canister connecting end and a dressing connecting end opposite the canister connecting end. A first lumen extends through the connector from the canister connecting end to the dressing connecting end. The first lumen includes a first lumen entrance disposed at the canister connecting end and a first lumen exit disposed at the dressing connecting end. The first lumen entrance is dimensioned and configured for slidably engaging the first projection of the canister adapter to provide fluid communication of the first lumen to the first portion of reduced pressure tubing along the first fluid flow path. A second lumen also extends through the connector from the canister connecting end to the dressing connecting end with the second lumen being fluidly isolated from the first lumen. The second lumen includes a second lumen entrance disposed at the canister connecting end and a second lumen exit disposed at the dressing connecting end. The second lumen entrance is dimensioned and configured for slidably engaging the second projection of the canister adapter to provide fluid communication of the second lumen to the first portion of secondary pressure tubing along the second fluid flow path.

[0009] According to certain embodiments, the connection system further includes a multi-lumen tube for providing fluid communication of the first fluid flow path and the second fluid flow path from the connector to the wound site, the multi-lumen tubing including the second portion of reduced pressure tubing and the second portion of secondary pressure tubing.

[0010] According to certain embodiments, the connection system further includes a dressing adapter having a first projection fluidly connected to the first lumen exit of the connector, a reduced pressure lumen in fluid communication with the first projection at a proximal end and a second portion of reduced pressure tubing at a distal end, a second projection connected to the second lumen exit of the connector, and a secondary pressure lumen in fluid communication with the second projection at a proximal end and a second portion of secondary pressure tubing at a distal end.

[0011] According to certain embodiments, the dressing adapter includes a third projection and a fourth projection disposed at the distal end of the dressing adapter, the third projection fluidly connecting the reduced pressure lumen of the dressing adapter to the second portion of reduced pressure tubing and the fourth projection fluidly connecting the secondary pressure lumen of the dressing adapter to the second portion of reduced pressure tubing.

[0012] According to certain embodiments, the connection system further includes a wound enclosure for positioning at the wound site, the wound enclosure fluidly connected to the second portion of reduced pressure tubing and the second portion of secondary pressure tubing at a distal end of the tubing opposite the dressing adapter.

[0013] According to certain embodiments, the canister connecting end of the connector is configured to be removably connected to the first and second projections of the canister adapter, the dressing connecting end is fluidly sealed to the first and second projections of the dressing adapter, the distal end of the reduced pressure lumen of the dressing adapter is fluidly sealed to a proximal end of the second portion of reduced pressure tubing, the distal end of the secondary pressure lumen of the dressing adapter is fluidly sealed to a proximal end of the second portion of the secondary pressure tubing, and a wound enclosure is fluidly sealed to the distal ends of the second portions of the reduced pressure tubing and the secondary pressure tubing.

[0014] According to certain embodiments, the connector further includes a key receiver disposed adjacent to the first lumen entrance and the second lumen entrance that is dimensioned and configured to receive a key of the canister adapter disposed adjacent the

first projection and the second projection of the canister adapter. The key receiver is configured for preventing the first projection of the canister adapter from being inserted into the second lumen entrance of the connector and the second projection of the canister adapter from being inserted into the first lumen entrance of the connector.

[0015] According to certain embodiments, the first projection of the canister adapter is spaced apart from the second projection and has a greater circumference than the second projection such that the first lumen entrance of the connector is spaced apart from the second lumen entrance and the first lumen entrance has a diameter that is greater than the second lumen entrance for preventing the first projection of the canister adapter from being inserted into the second lumen entrance of the connector and the second projection of the canister adapter from being inserted into the first lumen entrance of the connector.

[0016] According to certain embodiments, the connection system further includes a clamp disposed around the connector for preventing fluid flow through the first lumen and the second lumen when the clamp is in a clamped position and permitting fluid flow through the first lumen and the second lumen when the clamp is in an unclamped position.

[0017] According to another embodiment of the disclosure, a connection system for providing reduced pressure along a first fluid flow path and secondary pressure along a second fluid flow path to a wound site includes a collection canister operable to be in fluid communication with a reduced pressure source and a canister adapter. The collection canister includes a first nipple for facilitating a flow of reduced pressure along the first fluid flow path from the reduced pressure source to the wound site and receiving exudate collected from the wound site to be deposited in the collection canister, a first portion of reduced pressure tubing having a proximal end fluidly connected to the first nipple, a second nipple for facilitating a flow of fluid along a second fluid flow path from a secondary pressure source to the wound site, and a first portion of secondary pressure tubing having a proximal end fluidly connected to the second nipple. The canister adapter is operable to provide a removable fluid connection along the first fluid flow path between the first portion of reduced pressure tubing to a second portion of reduced

pressure tubing and along the second fluid flow path between the first portion of secondary pressure tubing and a second portion of secondary pressure tubing. The canister adapter includes a base portion, a first set of projections extending from the base portion in a first direction, and a second set of projections extending from the base portion in a second direction. The first set of projections includes a first projection dimensioned and configured to be inserted into a distal end of the first portion of reduced pressure tubing for fluidly connecting the canister adapter to the first fluid flow path and a second projection dimensioned and configured to be inserted into a distal end of the first portion of secondary pressure tubing for fluidly connecting the canister adapter to the second fluid flow path. The second set of projections includes a third projection in fluid communication with the first projection and a fourth projection in fluid communication with the second projection.

[0018] In some embodiments, the proximal end of the first portion of reduced pressure tubing is sealed to the first nipple of the collection canister, the proximal end of the first portion of secondary pressure tubing is sealed to the second nipple of the collection canister, the distal end of the first portion of reduced pressure tubing is sealed to the first projection of the canister adapter, and the distal end of the first portion of secondary pressure tubing is sealed to the second projection of the canister adapter.

[0019] According to certain embodiments, the connection system further includes a connector formed of a resilient material that is configured to be fluidly connected to the canister adapter. The connector includes a first lumen extending through the connector having a first lumen entrance and a first lumen exit, the first lumen entrance dimensioned and configured for removably engaging the third projection of the canister adapter to fluidly connect the first fluid flow path to the first lumen, and a second lumen extending through the connector having a second lumen entrance and a second lumen exit, the second lumen entrance dimensioned for removably engaging the fourth projection of the canister adapter to fluidly connect the second fluid flow path to the second lumen.

[0020] According to certain embodiments, the connection system further includes a multi-lumen tube for providing fluid communication of the first fluid flow path and the

second fluid flow path from the dressing adapter to the wound site, the multi-lumen tubing including the second portion of reduced pressure tubing and the second portion of secondary pressure tubing.

[0021] According to some embodiments, the third projection of the canister adapter includes a circumference greater than a circumference of the fourth projection of the canister adapter and the first lumen entrance of the connector includes a diameter that is greater than a diameter of the second lumen entrance for preventing the third projection of the canister adapter from being inserted into the second lumen entrance and the fourth projection of the canister adapter from being inserted into the first lumen entrance.

[0022] In certain embodiments, the canister adapter further includes a key projection extending from the base portion in the second direction adjacent the third and fourth projections and the connector further includes a key receiver disposed adjacent to the first lumen entrance and the second lumen entrance dimensioned and configured to receive the key of the canister adapter when the canister adapter correctly engages the connector.

[0023] According to some embodiments, the connection system further includes a clamp disposed around the connector for preventing fluid flow through the first lumen and the second lumen when the clamp is in a clamped position and permitting fluid flow through the first lumen and the second lumen when the clamp is in an unclamped position.

[0024] According to certain embodiments, the connection system further includes a dressing adapter including a first projection fluidly connected to the first lumen exit of the connector, a reduced pressure lumen in fluid communication with the first projection at a proximal end and a second portion of reduced pressure tubing at a distal end, a second projection connected to the second lumen exit of the connector, and a secondary pressure lumen in fluid communication with the second projection at a proximal end and a second portion of secondary pressure tubing at a distal end.

[0025] According to certain embodiments, the dressing adapter includes a third projection and a fourth projection disposed at the distal end of the dressing adapter, the third projection fluidly connecting the reduced pressure lumen of the dressing adapter to

the second portion of reduced pressure tubing and the fourth projection fluidly connecting the secondary pressure lumen of the dressing adapter to the second portion of reduced pressure tubing.

[0026] According to another embodiment of the disclosure, a connector for a negative pressure wound therapy system is disclosed. The connector is formed of a resilient material and includes a canister connecting end and a dressing connecting end opposite the canister connecting end, a first lumen, and a second lumen. The first lumen extends through the connector from the canister connecting end to the dressing connecting end and includes a first lumen entrance disposed at the canister connecting end and a first lumen exit disposed at the dressing connecting end. The first lumen entrance is dimensioned and configured for slidably engaging a first projection of a canister adapter to provide fluid communication of the first lumen to a first portion of reduced pressure tubing. The first lumen exit is dimensioned and configured for slidably engaging a first projection of a dressing adapter to provide fluid communication of the first lumen to a second portion of reduced pressure tubing. The second lumen also extends through the connector from the canister connecting end to the dressing connecting end and is fluidly isolated from the first lumen. The second lumen includes a second lumen entrance disposed at the canister connecting end and a second lumen exit disposed at the dressing connecting end. The second lumen entrance is dimensioned and configured for slidably engaging a second projection of the canister adapter to provide fluid communication of the second lumen to a first portion of secondary pressure tubing. The second lumen exit is dimensioned and configured for slidably engaging a second projection of the dressing adapter to provide fluid communication of the second lumen to a second portion of the secondary pressure tubing. According to certain embodiments, the first lumen entrance has a greater diameter than the second lumen entrance.

[0027] According to certain embodiments, the connector further includes a key receiver disposed at the canister connecting end adjacent to the first lumen entrance and the second lumen entrance. The key receiver is dimensioned and configured to receive a key of the canister adapter disposed adjacent the first projection and the second projection of the canister adapter for preventing the first projection of the canister adapter from being

inserted into the second lumen entrance of the connector and the second projection of the canister adapter from being inserted into the first lumen entrance of the connector.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] Other embodiments of the invention will become apparent by reference to the detailed description in conjunction with the figures, wherein elements are not to scale so as to more clearly show the details, wherein like reference numbers indicate like elements throughout the several views, and wherein:

[0029] FIG. 1 depicts a connection system for connecting a NPWT canister to a wound enclosure according to one embodiment of the disclosure;

[0030] FIG. 2 depicts an enlarged view of the connection point between the canister and first portion of tubing of FIG. 1;

[0031] FIG. 3 depicts a front view of a canister having a first nipple for connecting to a first tube and a second nipple for connecting to a second tube according to one embodiment of the disclosure;

[0032] FIG. 3A is a cross-sectional view of the first and second nipples taken along line 3A of FIG. 3 according to one embodiment of the disclosure;

[0033] FIG. 4 depicts a perspective view of a canister adapter according to one embodiment of the disclosure;

[0034] FIG. 5 depicts a top view of the canister adapter of FIG. 4;

[0035] FIG. 6 depicts an overhead perspective view of a resilient connector according to one embodiment of the disclosure;

[0036] FIG. 7 depicts a canister connecting end view of the resilient connector of FIG. 6;

[0037] FIG. 7A depicts a cross-sectional view of the resilient connector taken along line 7A of FIG. 7;

[0038] FIG. 8 depicts an overhead perspective view of the canister adapter of FIG. 4 being connected to the resilient connector of FIG. 6 according to one embodiment of the disclosure;

[0039] FIG. 9 depicts an exploded perspective view of an intended connection of a second portion of tubing, a dressing adapter, resilient connector, and a clamp for the resilient connector according to one embodiment of the disclosure;

[0040] FIG. 10 depicts a side view of a dressing adapter according to one embodiment of the disclosure;

[0041] FIG. 10A depicts a cross-sectional view of the dressing adapter taken along line 10A of FIG. 10;

[0042] FIG. 11 depicts a front view of an alternate embodiment of a dressing adapter according to one embodiment of the disclosure;

[0043] FIG. 12 depicts a side view of the dressing adapter of FIG. 11; and

[0044] FIG. 12A depicts a cross-sectional view of the dressing adapter taken along line 12A of FIG. 12.

DETAILED DESCRIPTION

[0045] Referring initially to FIG. 1, the present disclosure is generally directed to a NPWT tubing connection system 10 for removably connecting a first portion of tubing 12 that is fluidly connected at the proximal end of tubing 12 to a collection canister 20 to a second portion of tubing 52 that is fluidly connected at the distal end of tubing 52 to a wound enclosure 110. In preferred embodiments, the first portion of tubing 12 and second portion of tubing 52 provides at least two fluid flow paths when the first portion of tubing 12 is fluidly connected to the second portion of tubing 52. Thus, first portion of tubing 12 typically includes at least a first lumen 12a and a second lumen 12b while the second portion of tubing 52 also includes a first lumen 52a and a second lumen 52b. When the first portion of tubing 12 is fluidly connected to the second portion of tubing 52, lumen 12a is in fluid communication with lumen 52a to provide the first fluid flow

path while second lumen 12b is in fluid communication with second lumen 52b to provide the second fluid flow path.

[0046] According to the first fluid flow path (indicated by arrow 14), a primary pressure source (not shown) is operable to provide a primary reduced pressure to the wound enclosure 110 such that fluid flows from the wound enclosure 110 to canister 20 through first lumen 12a and first lumen 52a. Thus, the first lumen 12a and first lumen 52a may also be referred to herein as reduced pressure tubing. The primary reduced pressure generated by the primary pressure source serves both to stimulate healing by applying the reduced pressure to the wound site and removing exudate from the wound enclosure 110 to the canister 20.

[0047] According to certain embodiments, the second fluid flow path (indicated by arrow 16) may be used to measure pressure at the wound enclosure 110. In this regard, a pressure measured at one end of a lumen is substantially equal to the pressure at the other end of the lumen so long as very little to no liquid/exudate is present in the lumen and the lumen inside diameter to length ratio is not too small. As result, measuring the pressure of the second fluid flow path of lumens 12b and 52b is able to provide a pressure measurement of the wound enclosure 110 (as compared to a pressure measurement within the reduced pressure tubing), which is helpful to detect leakage and blockage conditions in the first fluid flow path 14.

[0048] As described in more detail in U.S. Application Serial No. 16/235,113, filed December 28, 2018, entitled "Negative Pressure Wound Therapy System," the entire contents of which is incorporated herein by reference, the second fluid flow path 16 may also be connected to a secondary pressure source (not shown) to provide a secondary pressure to the wound enclosure 110 through second lumen 12b and second lumen 52b. The secondary pressure provided by the secondary pressure source (when activated) may be used to facilitate flow of the exudate from the wound enclosure 110 to the canister 20 through the first lumen 12a and first lumen 52a. For example, according to certain embodiments, the primary pressure source may be configured to deliver a reduced pressure of -125 mmHg to the wound enclosure 110 via first lumen 12a and 52a while the

secondary pressure source delivers a reduced pressure of -80 mmHg to the wound enclosure 110 via the second lumens 12b and 52b. Thus, when both the primary pressure source and secondary pressure source are activated, the second fluid flow path 16 having a pressure of -80 mmHg will converge at the wound enclosure 110 with the first fluid flow path 14 having a pressure of -125 mmHg. The converged fluid flow path in the first lumen 12a and 52a will then have a greater pressure than the -125 mmHG generated by the primary pressure source to facilitate flow of exudate from the wound enclosure 110 to the canister 20 through the first lumens 12a and 52a. Given that the second lumens 12b and 52b will typically have a different pressure than the reduced pressure tubing of the first lumens 12a and 12b whether the second flow path is used to measure pressure at the wound site or to deliver a secondary pressure from a secondary pressure source, second lumens 12b and 52b may also be referred to herein as secondary pressure tubing.

[0049] In certain embodiments, and as depicted in FIG. 1, the first lumen 12a and second lumen 12b of the first portion of tubing 12 are formed of two separate tubes (which may be adhesively joined along at least a portion of their lengths for convenience). In this regard, it is understood that the first fluid flow path 14 must run from the reduced pressure source through the canister 20 for the exudate to be removed from the wound enclosure 110 and then deposited in the canister 20. Further, it is advantageous to also run the second fluid flow path 16 through the collection canister 20 to decrease the footprint of the overall system and/or when the outlet of the reduced pressure source is used as the secondary pressure source. Thus, according to the embodiment shown in FIG. 1, the collection canister includes two spaced apart nipples 22a and 22b. Nipple 22a is in fluid communication with the primary pressure source while nipple 22b is in fluid communication with the secondary pressure source (when a secondary pressure source is included in the system). Referring to FIG. 2, to fluidly connect the first portion of tubing 12 to the canister 20, the proximal end 11a of the first tube/lumen 12a is fluidly connected to the first nipple 22a of the collection canister 20 while the proximal end 11b of the second tube/lumen 12b is fluidly connected to the second nipple 22b. In preferred embodiments, the collection canister 20 would be provided to the user (e.g., medical facility) with the proximal ends 11a and 11b of the first and second tubes 12a and 12b fluidly sealed to the first and second nipples 22a and 22b. For purposes of the present

disclosure, components referred to as being "fluidly sealed" to each other refers to a fluid connection that is intended to be permanent during use of the system. In other words, in preferred embodiments, once the proximal ends 11a and 11b of the first and second tubes 12a and 12b are fluidly sealed to the corresponding first and second nipples 22a and 22b, the connection of the first and second tubes 12a and 12b to the canister 20 is intended to be non-removable.

[0050] In alternate embodiments, an adapter for first and second nipples 22a and 22b could be provided to combine first and second flow paths 14 and 16 within a multi-lumen tube. In other words, using an adapter connected to the canister 20, the first portion of tubing 12 could be a single multi-lumen tube containing both the first lumen 12a and second lumen 12b. However, this results in an additional piece for the canister 20 and yet another connection point within the system 10 in which it must be ensured that the lumens are correctly aligned and fluid leaks are prevented. In yet another alternate embodiment, the second lumen 12b is again a separate tube but it connects to the system somewhere other than at the container (e.g., directly to the pump outlet).

[0051] With continued reference to FIG. 1, the distal ends 13a and 13b of the first and second tubes 12a and 12b are fluidly connected to a canister adapter 30. In preferred embodiments, the canister adapter 30 is formed as a unitary piece of molded, rigid plastic. As shown more specifically in FIGS. 4 and 5, the canister adapter 30 includes a base portion 32, a first set of projections 34 extending from the base portion 32 in a first direction, and a second set of projections 36 extending from the base portion 32 in a second direction opposite the first set of projections 34. The first set of projections 34 includes a first projection 34a for fluidly connecting to the distal end 13a of the first tube 12a and a second projection 34b for fluidly connecting to the distal end 13b of the second tube 12b. To fluidly connect the first and second projections 34a and 34b to the first tubes 12a and 12b, respectively, the projections 34a and 34b are inserted into the corresponding distal ends 13a and 13b of the tubes. The second set of projections 36 then include a third projection 36a that is in fluid communication with the first projection 34a and a fourth projection 36b that is in fluid communication with the second projection 34b. In other words, the canister adapter 30 includes a first lumen extending through the

first projection 34a, the base portion 32, and the third projection 36a for fluidly connecting to the first fluid flow path 14 and a second lumen extending through the second projection 34b, the base portion 32, and the fourth projection 36b for fluidly connecting to the second fluid flow path 16.

[0052] In preferred embodiments, the first projection 34a and second projection 34b are fluidly sealed to the respective distal ends 13a and 13b of the first and second tubes 12a and 12b. As noted above, proximal ends 11a and 11b of the first and second tubes 12a and 12b are preferably fluidly sealed to respective first and second nipples 22a and 22b of the collection canister 20. Thus, in certain embodiments, the canister 20, first and second tubes 12a and 12b, and canister adapter 30 form a canister portion of the connection system 10 that are provided together by the manufacturer in a fluidly sealed arrangement as described above. As described below, the second set of projections 36 of the canister adapter 30 are then able to be used to facilitate a removable fluid connection to a dressing portion of the connection system via connector 80.

[0053] Referring back to FIG. 1, the first and second lumens 52a and 52b of the second portion of tubing 52 may also be provided using separate tubes. According to this embodiment, the proximal end 51a of the first lumen/tube 52a and proximal end 51b of the second lumen/tube 52b are connected to a dressing adapter 60. Referring more specifically to FIGS. 10 and 10A, the dressing adapter 60 is similar to canister adapter 30 described above. In this regard, dressing adapter 60 is preferably a unitary piece of molded, rigid plastic that includes a base portion 62, a first set of projections 64 extending from the base portion 62 in a first direction, and a second set of projections 66 extending from the base portion 62 in a second direction opposite the first direction.

[0054] The first set of projections 64 of the dressing adapter 60 includes a first projection 64a for fluidly connecting to the proximal end 51a of the first tube 52a and a second projection 64b for fluidly connecting to the proximal end 51b of the second tube 52b. To fluidly connect the first and second projections 64a and 64b to the first tubes 52a and 52b, respectively, the projections 64a and 64b are inserted into the corresponding proximal ends 51a and 51b of the tubes. The second set of projections 66 then include a

third projection 66a that is in fluid communication with the first projection 64a and a fourth projection 66b that is in fluid communication with the second projection 64b. In other words, the dressing adapter 60 includes a first lumen extending through the first projection 64a, the base portion 62, and the third projection 66a for fluidly connecting to the first fluid flow path 14 and a second lumen extending through the second projection 64b, the base portion 62, and the third projection 66b for fluidly connecting to the second fluid flow path 16. As described further below, the second set of projections 66 are used to facilitate a removable fluid connection to the canister portion of the connection system 10 via connector 80.

[0055] According to another embodiment of the disclosure, the second portion of tubing 52 may be a multi-lumen tube. In other words, the first and second lumens 52a and 52b of the second portion of tubing 52 may be included within the same tube as known in the art of multi-lumen tubing. According to this embodiment, and with reference to FIGS. 11 – 12 and FIG. 12A, an alternate dressing adapter 70 may be used to fluidly connect the first fluid flow path 14 and second fluid flow path 16 to a multi-lumen tube having first and second lumens 52a and 52b. As shown, dressing adapter 70 similarly includes a base portion 72 and a set of two projections 76a and 76b for providing a removable fluid connection to the canister portion of the connection system 10 via connector 80. However, in contrast to dressing adapter 60, dressing adapter 70 includes only a first projection 74 extending from the base portion 72 in an opposite direction of the set of projections 76a and 76b. Instead of two separate projections, first projection 74 includes a first lumen 74a and a second lumen 74b disposed within the first projection 74. Referring to the cross-sectional view of FIG. 12A, the first lumen 74a of the first projection 74 is in fluid communication with projection 76a and the second lumen 74b is in fluid communication with second projection 76b. First lumen 74a of the dressing adapter 70 is then inserted into the first lumen 52a of multi-lumen tubing for fluidly connecting the dressing adapter 70 to the first fluid flow path 14. Upon insertion, the second lumen 74b of the dressing adapter 70 is aligned with the second lumen 52b of the multi-lumen tube for fluidly connecting the dressing adapter 70 to the second fluid flow path 16.

[0056] In preferred embodiments, the dressing adapter 60 (or dressing adapter 70 if connecting to a second portion of tubing 52 in the form of a multi-lumen tube) is fluidly sealed to the proximal ends 51a and 51b of the first and second lumens 52a and 52b. Referring back to FIG. 1, the distal ends 53a and 53b of the second portion of tubing 52 are also preferably fluidly connected to the wound enclosure 110. Thus, in preferred embodiments, the dressing adapter 60 (or dressing adapter 70), the second portion of tubing 52, and the wound enclosure 110 form a dressing portion of the connection system 10 that are provided together by the manufacturer in a fluidly sealed arrangement. As described below, the projections 66a and 66b of dressing adapter 60 (or projections 76a and 76b of dressing adapter 70) are then able to be used to provide a removable fluid connection to the canister portion of the connection system via connector 80.

[0057] Referring again to FIG. 1, the canister portion of the connection system 10 (canister 20, first portion of tubing 12, and canister adapter 30) is removably connected to the dressing portion of the connection system 10 (dressing adapter 60, second portion of tubing 52, and wound enclosure 110) using connector 80. More specifically, and as shown in FIGS. 6 – 7 and 7A, connector 80 includes a canister connecting end 82 and a dressing connecting end 92 opposite the canister connecting end 82. Extending through the connector 80 from the canister connecting end 82 to the dressing connecting end 92 is a first lumen 84a having a first lumen entrance 83a and a first lumen exit 85a and a second lumen 84b having a second lumen entrance 83b and a second lumen exit 85b.

[0058] With reference to FIGS. 6 – 8, to fluidly connect the connector 80 to the canister adapter 30 at the canister connecting end 82, the first lumen entrance 83a is dimensioned and configured for slidably receiving/engaging projection 36a of the canister adapter 30 to provide fluid communication of the first lumen 84a to the first tube 12a along the first fluid flow path 14. The second lumen entrance 83b is similarly dimensioned and configured for slidably receiving/engaging projection 36b of the canister adapter 30 to provide fluid communication of the second lumen 84b to the second tube 12b along the second fluid flow path 16.

[0059] Similarly, to connect the connector 80 to the dressing adapter 60 at the dressing connecting end 92, and with reference to FIGS. 7A & 9, the first lumen exit 85a is dimensioned and configured for slidably receiving/engaging projection 66a of the dressing adapter 60 to provide fluid communication of the first lumen 84a to the first tube 52a along the first fluid flow path 14. The second lumen exit 85b is then dimensioned and configured for slidably receiving/engaging projection 66b of the dressing adapter 60 to provide fluid communication of the second lumen 84b to the second tube 52b along the second fluid flow path 16.

[0060] In preferred embodiments, the connector 80 is formed of a flexible/resilient/elastic material. More specifically, the connector is preferably formed of a soft plastic or elastomeric material such as silicone, PVC, polyurethane, polyethylene, etc. such that the lumen entrances 83a and 83b and lumen exits 85a and 85b expand slightly when receiving a more rigid plastic projection of one of the adapters to provide a friction fit type of engagement. In other words, the adapter projections include a circumference that is slightly larger along at least a portion of the length of the projection than the lumen entrances or exits in which the particular projection is inserted. Thus, the material of the connector is able to slightly expand and closely couple to the projections for preventing fluid leaks. This significantly eases connection for users of the system as compared to prior art luer lock type systems and avoids high levels of dexterity required to twisting and turning to lock connectors together. Further, using a connector formed of a resilient material permits a low-profile connection that is essentially defined by the thickness of the adapters. This low-profile connection, along with the soft material used for the connector 80, avoids unnecessary pressure/discomfort points to the patient if they lay over the connector 80 and accompanying adapters. Further advantages of providing a connection system with adapters having small projections inserted into a resilient connector 80 include the ability to create a simple to use but removable seal via the resilient material of the connector being friction fitted around the adapter projections while having a design that is efficient to manufacture.

[0061] In certain embodiments, either the canister connecting end 82 is fluidly sealed to the canister adapter 30 or the dressing connector end 92 is fluidly sealed to the dressing

adapter 60. Thus, when the other components of connection system 10 are fluidly sealed as described above, there will be only one point within the system 10 in which a removable connection is permitted/intended. In preferred embodiments, and with reference to the exploded view FIG. 9, the connector 80 is fluidly sealed to one end of the dressing adapter 60, the dressing adapter 60 is fluidly sealed to the proximal ends of the second tubing portion 52 at its opposite end, and, as shown in FIG. 1 the distal ends of the second tubing portion 52 is then sealed to the wound enclosure. Thus, in this embodiment, the canister connecting end 82 of the connector 80 may be removably connected to the canister adapter 30.

[0062] In certain embodiments, and as shown in the present figures, the connector 80 may include a "grip" feature 90 (e.g., knurlments, raised ribs, ridges, etc.) at the canister connecting end 82 to both assist the user in locating the removable connection point and to assist the user in gripping the connector 80 at the appropriate location to remove the connector from the canister adapter 30.

[0063] According to another aspect of the disclosure, and as best shown in FIG. 8, the canister adapter 30 may include a key projection 38 extending from the base portion 32 in the same direction as the projections 36a and 36b while the connector 80 includes a key receiver 88 extending inward from the canister connecting end 80 (i.e., disposed adjacent the first lumen entrance 83a and the second lumen entrance 83b). In operation, when the projections 36a and 36b of the canister adapter 30 are inserted into the lumen entrances 83a and 83b, the key projection 38 and key receiver 88 are positioned and configured such that the key projection 38 is inserted into the key receiver 88. This operates to both confirm that canister adapter 30 is being connected to the connector 80 properly (i.e., tube 12a is fluidly connected to lumen 84a of the connector 80 and tube 12b is fluidly connected to lumen 84b) and that the projections 36a and 36b are inserted a proper depth into the appropriate lumen entrances 83a and 83b. It should be understood that key projection 38 and key receiver 88 may take various forms within the scope of the present disclosure.

[0064] According to another aspect of the disclosure, and as shown best in FIG. 5 and 7, at least projections 36a and 36b of the canister adapter 30 include different circumferences while the first lumen entrances 83a and 83b of the connector include corresponding different diameters. This also helps ensure that canister adapter 30 is being connected to the connector 80 properly (in replace of or in addition to the key projection 38 / key receiver 88 combination described above). As a result of this feature, other components within the system may also have different circumferences or diameters as depicted in the present figures. In particular, referring to FIGS. 1 and 2, the first tube 12a and second tube 12b of at least the first portion of tubing 12 may have different diameters. Given that first tube 12a is intended to deliver wound exudate to the canister 20, first tube 12a will typically have a larger diameter than second tube 12b as depicted. As a result of the different diameters between the first tube 12a and the second tube 12b, the first and second nipples 22a and 22b of the collection canister 20 may have different corresponding diameters as shown best in the cross-sectional view of FIG. 3A.

[0065] According to another aspect of the disclosure, a clamp 100 may be disposed around the resilient connector 80. In the clamped position fluid flow through the connector 80 along the first and second fluid paths 14 and 16 is prevented while the fluid flow is permitted in the unclamped position. This allows for a dressing change and/or replacing a canister without disconnecting the entire system. Applying the clamp 100 to the resilient connector 80 as opposed to the PVC tubing as known in the art has several advantages. In particular, a lower actuation force is required to move the clamp to the clamped position as a result of the resilient material of the connector 80. Further, the clamp is configurable to be closely coupled to the connector 80 such that the clamp is held in place by the connector during a dressing or canister change even when the tubing is disconnected on one end of the connector (i.e., the clamp 100 is disposed around the connector 80 such that the connector slightly deforms to provide a friction fit engagement between the clamp 100 and the connector 80. In certain embodiments, one end of the clamp 100 may also be disposed around a set of projections of one of the adapters (typically the dressing adapter 60) to further prevent unintended removal of the clamp 100 when tubing is disconnected from one end of the connector 80. Another advantage is that the clamp 100 allows for the user or medical staff to quickly identify/locate the

removable connection point of the system 10. Similarly, providing the clamp 100 adjacent the removable connection point will remind the user to clamp the fluid flow paths before disconnection and to unclamp after re-connection. Yet another advantage is that the clamp 100 provides additional gripping surface area to disconnect one end of the resilient connector 80 from the appropriate adapter.

[0066] According to another aspect of the disclosure, canister adapter 30 preferably includes a cap 40 configured to be placed over at least projection 36a when the connector 80 is disconnected from the canister adapter 30 to prevent exudate in tube 12a from leaking out of the adapter 36a. Similarly, in embodiments in which connector 80 is intended to be disconnected from dressing adapter 60, a cap may also be provided for projection 64a.

[0067] According to another aspect of the disclosure, and as shown in the figures, certain projections of the adapters may include radially expanded tip portions to help seal the projections to the appropriate tubes or lumens of the connector 80. However, in preferred embodiments, the projections of the removable connection are gently sloped to expand in circumference toward the base portion of the particular adapter (see projections 36a and 36b of FIG. 5) to assist in inserting and removing the projections from the connector 80. Similarly, the lumen entrances 83a and 83b of the connector 80 may include a wider portion that slopes inward toward first lumen 84a and 84b as depicted in FIG. 7A.

[0068] The foregoing description of preferred embodiments for this invention have been presented for purposes of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiments are chosen and described in an effort to provide the best illustrations of the principles of the invention and its practical application, and to thereby enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly, legally, and equitably entitled.

CLAIMS

What is claimed is:

1. A connection system for providing reduced pressure along a first fluid flow path and secondary pressure along a second fluid flow path to a wound site, the connection system comprising a connector formed of a resilient material configured to be fluidly connected to a canister adapter, the canister adapter having a first projection in fluid communication with a first portion of reduced pressure tubing and a second projection in fluid communication with a first portion of secondary pressure tubing, the connector including:

a canister connecting end and a dressing connecting end opposite the canister connecting end,

a first lumen extending through the connector from the canister connecting end to the dressing connecting end, the first lumen having a first lumen entrance disposed at the canister connecting end and a first lumen exit disposed at the dressing connecting end, the first lumen entrance dimensioned and configured for slidably engaging the first projection of the canister adapter to provide fluid communication of the first lumen to the first portion of reduced pressure tubing along the first fluid flow path, and

a second lumen extending through the connector from the canister connecting end to the dressing connecting end, the second lumen being fluidly isolated from the first lumen and having a second lumen entrance disposed at the canister connecting end and a second lumen exit disposed at the dressing connecting end, the second lumen entrance dimensioned and configured for slidably engaging the second projection of the canister adapter to provide fluid communication of the second lumen to the first portion of secondary pressure tubing along the second fluid flow path.

2. The connection system of Claim 1 further comprising a multi-lumen tube for providing fluid communication of the first fluid flow path and the second fluid flow path from the connector to the wound site, the multi-lumen tubing including the second portion of reduced pressure tubing and the second portion of secondary pressure tubing.

3. The connection system of Claim 1 further comprising a dressing adapter including:

a first projection fluidly connected to the first lumen exit of the connector;

a reduced pressure lumen in fluid communication with the first projection at a proximal end and a second portion of reduced pressure tubing at a distal end;

a second projection connected to the second lumen exit of the connector; and

a secondary pressure lumen in fluid communication with the second projection at a proximal end and a second portion of secondary pressure tubing at a distal end.

4. The connection system of Claim 3 wherein the dressing adapter includes a third projection and a fourth projection disposed at the distal end of the dressing adapter, the third projection fluidly connecting the reduced pressure lumen of the dressing adapter to the second portion of reduced pressure tubing and the fourth projection fluidly connecting the secondary pressure lumen of the dressing adapter to the second portion of reduced pressure tubing.

5. The connection system of Claim 3 wherein the canister connecting end of the connector is configured to be removably connected to the first and second projections of the canister adapter, the dressing connecting end is fluidly sealed to the first and second projections of the dressing adapter, the distal end of the reduced pressure lumen of the dressing adapter is fluidly sealed to a proximal end of the second portion of reduced pressure tubing, the distal end of the secondary pressure lumen of the dressing adapter is fluidly sealed to a proximal end of the second portion of the secondary pressure tubing, and a wound enclosure is fluidly sealed to the distal ends of the second portions of the reduced pressure tubing and the secondary pressure tubing.

6. The connection system of Claim 1 wherein the connector further includes a key receiver disposed adjacent to the first lumen entrance and the second lumen entrance that is dimensioned and configured to receive a key of the canister adapter disposed adjacent the first projection and the second projection of the canister adapter, the key receiver for preventing the first projection of the canister adapter from being

inserted into the second lumen entrance of the connector and the second projection of the canister adapter from being inserted into the first lumen entrance of the connector.

7. The connection system of Claim 1 wherein the first projection of the canister adapter is spaced apart from the second projection and has a greater circumference than the second projection such that the first lumen entrance of the connector is spaced apart from the second lumen entrance and the first lumen entrance has a diameter that is greater than the second lumen entrance for preventing the first projection of the canister adapter from being inserted into the second lumen entrance of the connector and the second projection of the canister adapter from being inserted into the first lumen entrance of the connector.

8. The connection system of Claim 1 further comprising a clamp disposed around the connector for preventing fluid flow through the first lumen and the second lumen when the clamp is in a clamped position and permitting fluid flow through the first lumen and the second lumen when the clamp is in an unclamped position.

9. A connection system for providing reduced pressure along a first fluid flow path and secondary pressure along a second fluid flow path to a wound site, the connection system comprising:

a collection canister operable to be in fluid communication with a reduced pressure source, the collection canister including:

a first nipple for facilitating a flow of reduced pressure along the first fluid flow path from the reduced pressure source to the wound site and receiving exudate collected from the wound site to be deposited in the collection canister,

a first portion of reduced pressure tubing having a proximal end fluidly connected to the first nipple,

a second nipple for facilitating a flow of fluid along a second fluid flow path from a secondary pressure source to the wound site, and

a first portion of secondary pressure tubing having a proximal end fluidly connected to the second nipple; and

a canister adapter for providing a removable fluid connection along the first fluid flow path between the first portion of reduced pressure tubing to a second portion of reduced pressure tubing and along the second fluid flow path between the first portion of secondary pressure tubing and a second portion of secondary pressure tubing, the canister adapter including:

a base portion,

a first set of projections extending from the base portion in a first direction, the first set of projections including a first projection dimensioned and configured to be inserted into a distal end of the first portion of reduced pressure tubing for fluidly connecting the canister adapter to the first fluid flow path and a second projection dimensioned and configured to be inserted into a distal end of the first portion of secondary pressure tubing for fluidly connecting the canister adapter to the second fluid flow path, and

a second set of projections extending from the base portion in a second direction, the second set of projections including a third projection in fluid communication with the first projection and a fourth projection in fluid communication with the second projection.

10. The system of Claim 9 wherein the proximal end of the first portion of reduced pressure tubing is sealed to the first nipple of the collection canister, the proximal end of the first portion of secondary pressure tubing is sealed to the second nipple of the collection canister, the distal end of the first portion of reduced pressure tubing is sealed to the first projection of the canister adapter, and the distal end of the first portion of secondary pressure tubing is sealed to the second projection of the canister adapter.

11. The connection system of Claim 9 further comprising a connector formed of a resilient material, the connector configured to be fluidly connected to the canister adapter and including:

a first lumen extending through the connector having a first lumen entrance and a first lumen exit, the first lumen entrance dimensioned and configured for removably

engaging the third projection of the canister adapter to fluidly connect the first fluid flow path to the first lumen;

a second lumen extending through the connector having a second lumen entrance and a second lumen exit, the second lumen entrance dimensioned for removably engaging the fourth projection of the canister adapter to fluidly connect the second fluid flow path to the second lumen.

12. The connection system of Claim 11 wherein the third projection of the canister adapter includes a circumference greater than a circumference of the fourth projection of the canister adapter and the first lumen entrance of the connector includes a diameter that is greater than a diameter of the second lumen entrance for preventing the third projection of the canister adapter from being inserted into the second lumen entrance and the fourth projection of the canister adapter from being inserted into the first lumen entrance.

13. The connection system of Claim 11 wherein:

the canister adapter further includes a key projection extending from the base portion in the second direction adjacent the third and fourth projections; and

the connector further includes a key receiver disposed adjacent to the first lumen entrance and the second lumen entrance dimensioned and configured to receive the key of the canister adapter when the canister adapter correctly engages the connector.

14. The connection system of Claim 11 further comprising a clamp disposed around the connector for preventing fluid flow through the first lumen and the second lumen when the clamp is in a clamped position and permitting fluid flow through the first lumen and the second lumen when the clamp is in an unclamped position.

15. The connection system of Claim 11 further comprising a multi-lumen tube for providing fluid communication of the first fluid flow path and the second fluid flow path from the connector to the wound site, the multi-lumen tubing including the second portion of reduced pressure tubing and the second portion of secondary pressure tubing.

16. The connection system of Claim 11 further comprising a dressing adapter including:

a first projection fluidly connected to the first lumen exit of the connector;

a reduced pressure lumen in fluid communication with the first projection at a proximal end and a second portion of reduced pressure tubing at a distal end;

a second projection connected to the second lumen exit of the connector; and

a secondary pressure lumen in fluid communication with the second projection at a proximal end and a second portion of secondary pressure tubing at a distal end.

17. The connection system of Claim 16 wherein the dressing adapter includes a third projection and a fourth projection disposed at the distal end of the dressing adapter, the third projection fluidly connecting the reduced pressure lumen of the dressing adapter to the second portion of reduced pressure tubing and the fourth projection fluidly connecting the secondary pressure lumen of the dressing adapter to the second portion of reduced pressure tubing.

18. A connector for a negative pressure wound therapy system, the connector formed of a resilient material and comprising:

a canister connecting end and a dressing connecting end opposite the canister connecting end;

a first lumen extending through the connector from the canister connecting end to the dressing connecting end, the first lumen having a first lumen entrance disposed at the canister connecting end and a first lumen exit disposed at the dressing connecting end, the first lumen entrance dimensioned and configured for slidably engaging a first projection of a canister adapter to provide fluid communication of the first lumen to a first portion of reduced pressure tubing, and the first lumen exit dimensioned and configured for slidably engaging a first projection of a dressing adapter to provide fluid communication of the first lumen to a second portion of reduced pressure tubing; and

a second lumen extending through the connector from the canister connecting end to the dressing connecting end, the second lumen being fluidly isolated from the first lumen and having a second lumen entrance disposed at the canister connecting end and a second lumen exit disposed at the dressing connecting end, the second lumen entrance

dimensioned and configured for slidably engaging a second projection of the canister adapter to provide fluid communication of the second lumen to a first portion of secondary pressure tubing, and the second lumen exit dimensioned and configured for slidably engaging a second projection of the dressing adapter to provide fluid communication of the second lumen to a second portion of the secondary pressure tubing.

19. The connector of Claim 18 wherein the first lumen entrance has a greater diameter than the second lumen entrance.

20. The connector of Claim 18 wherein the connector further includes a key receiver disposed at the canister connecting end adjacent to the first lumen entrance and the second lumen entrance, the key receiver dimensioned and configured to receive a key of the canister adapter disposed adjacent the first projection and the second projection of the canister adapter, the key receiver for preventing the first projection of the canister adapter from being inserted into the second lumen entrance of the connector and the second projection of the canister adapter from being inserted into the first lumen entrance of the connector.

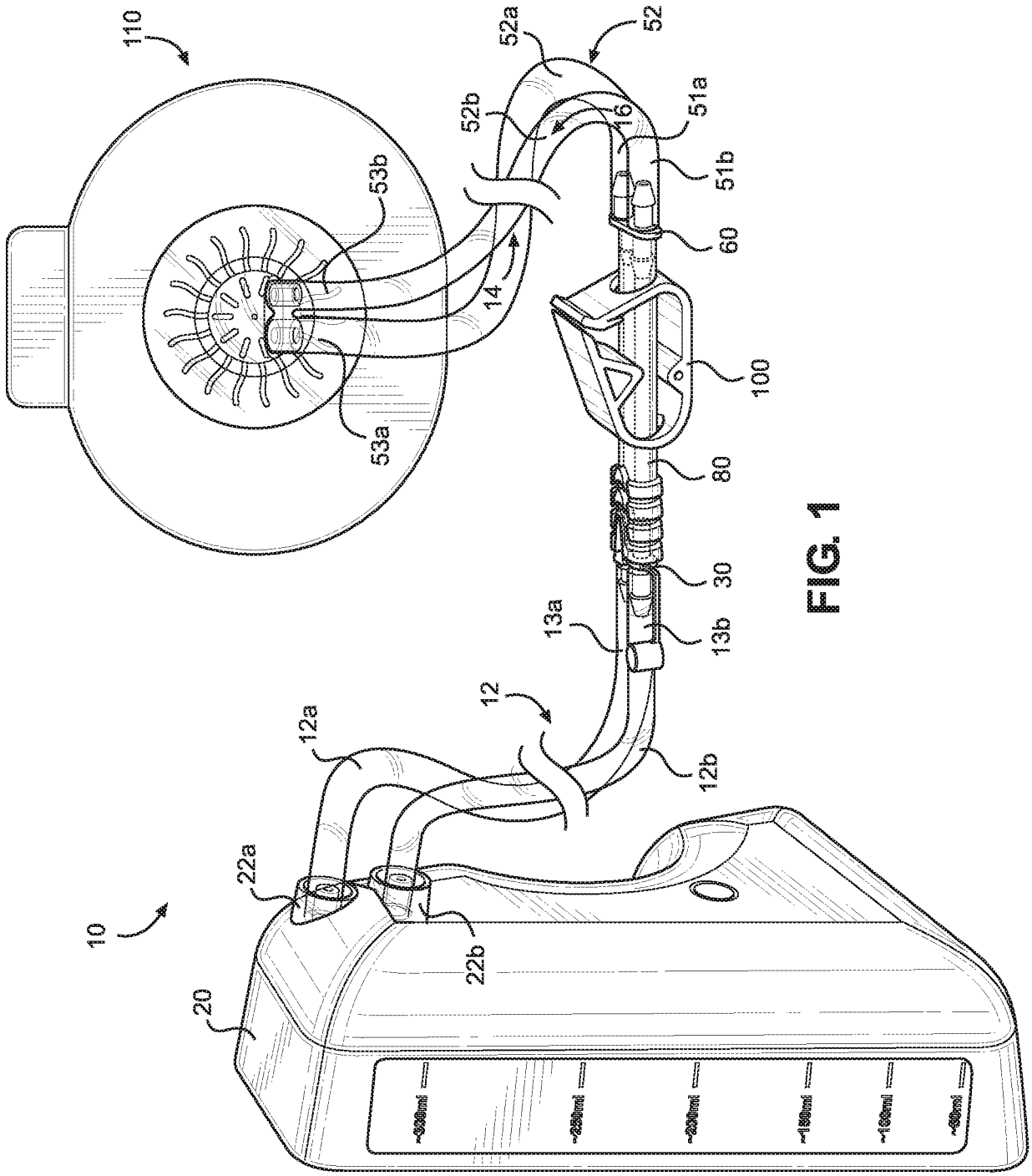

110
52a
52
52b
16
51a
51b
60
53b
14
100
53a
80
30
13a
13b
12
12a
12b
22a
22b
10
20

FIG. 1

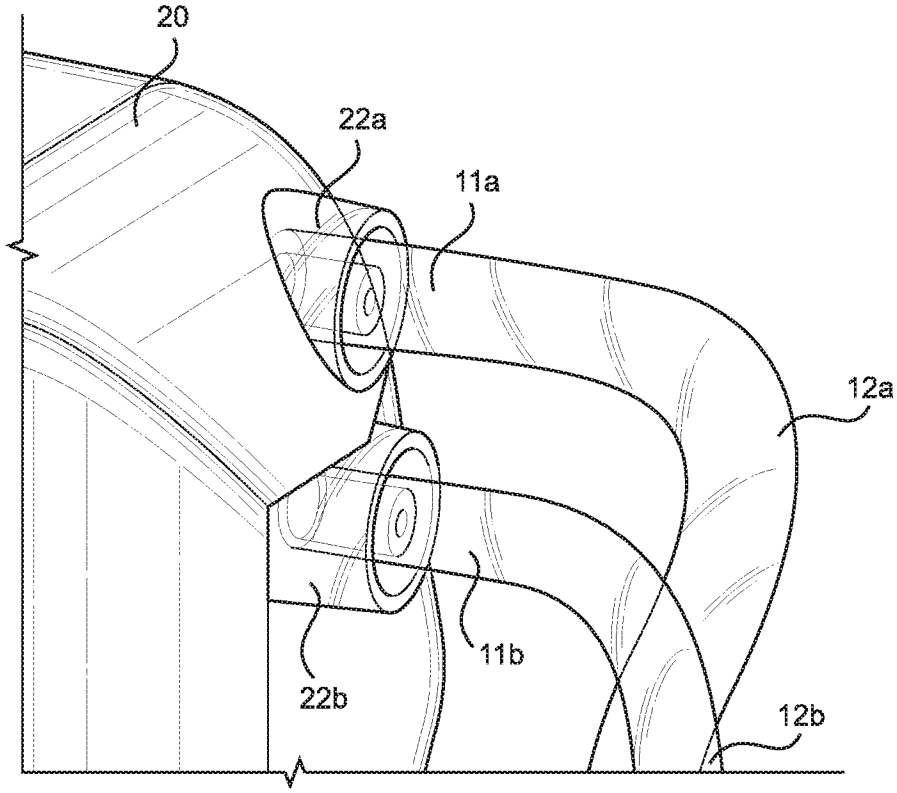


FIG. 2

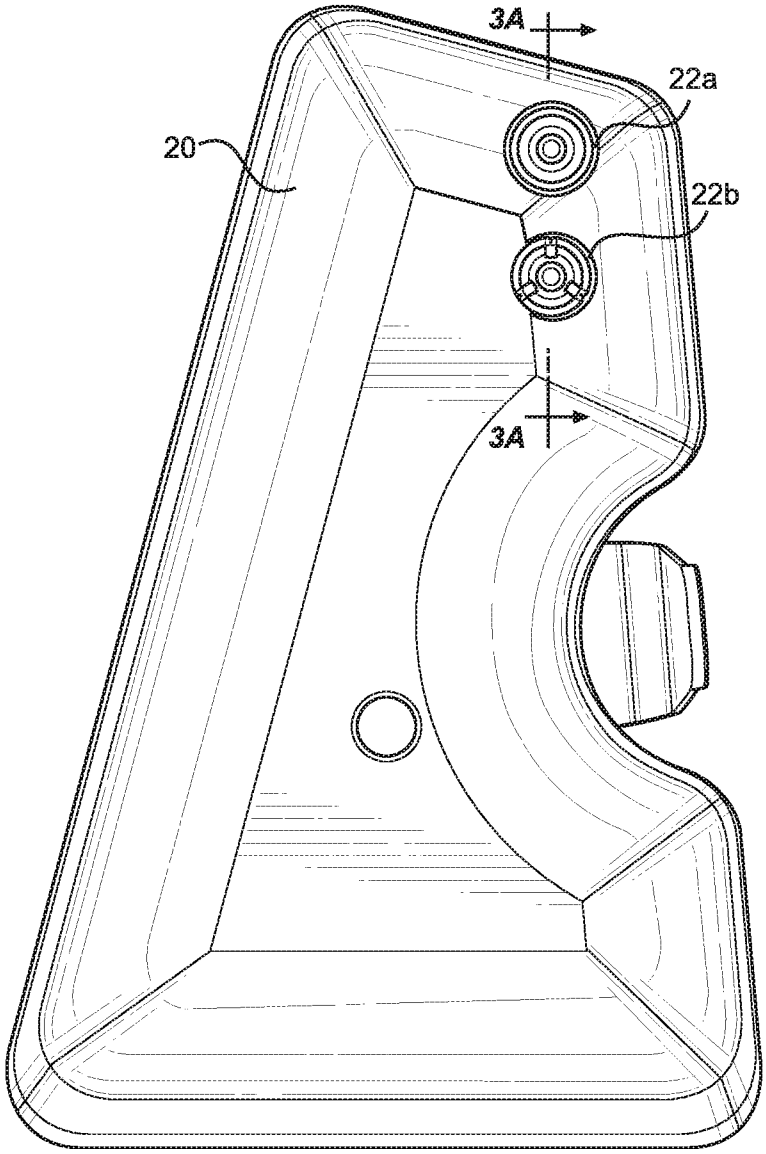


FIG. 3

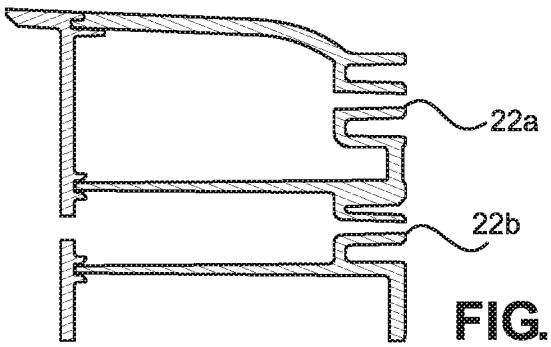


FIG. 3A

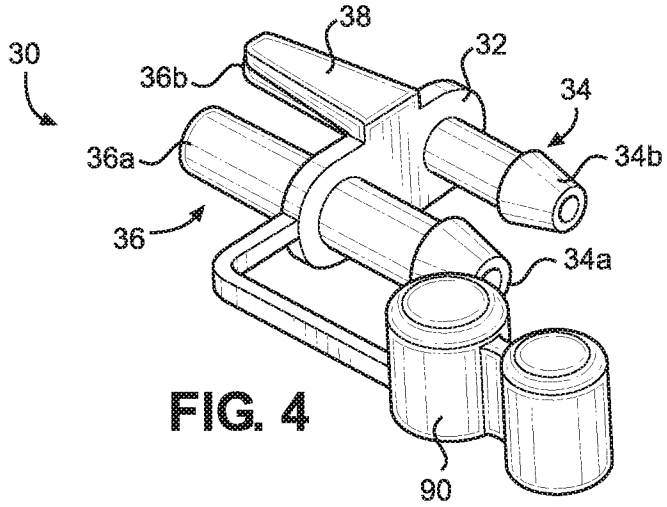


FIG. 4

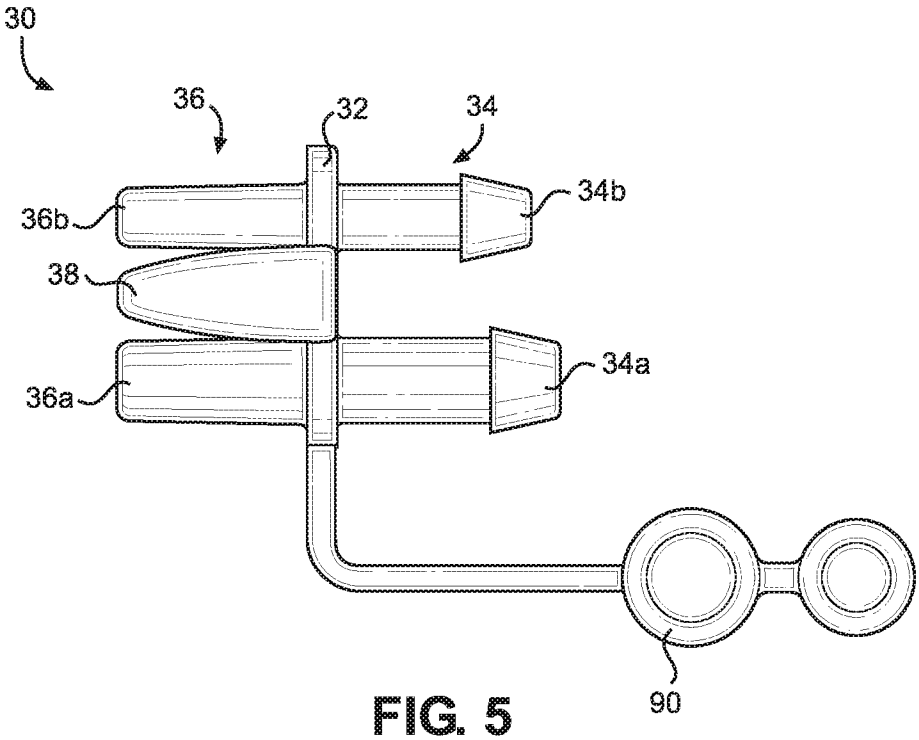


FIG. 5

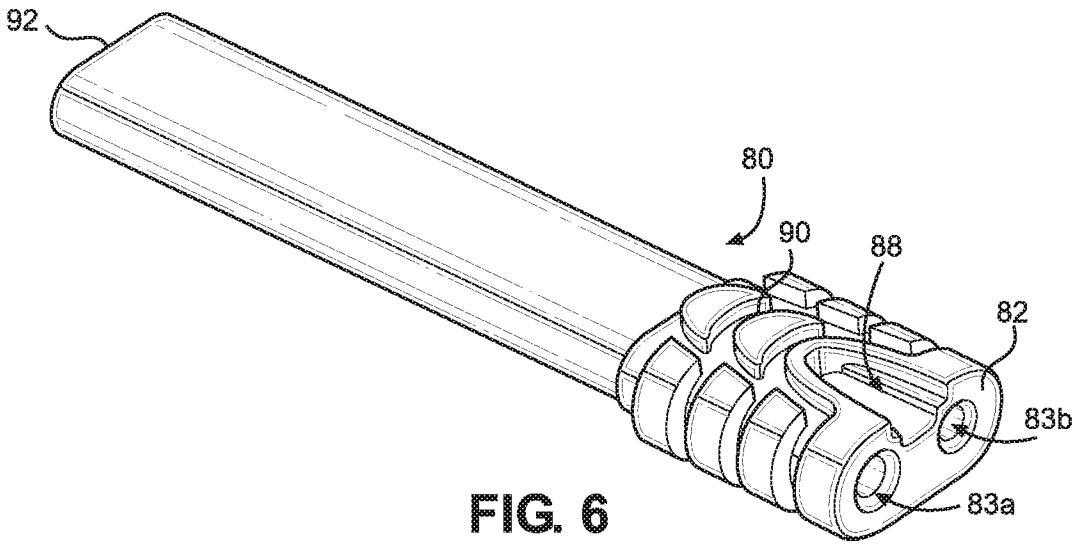


FIG. 6

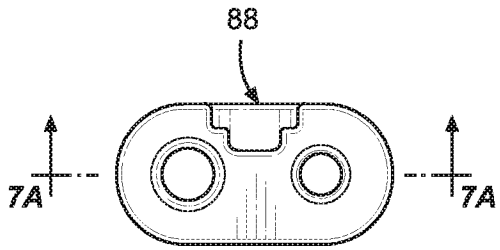


FIG. 7

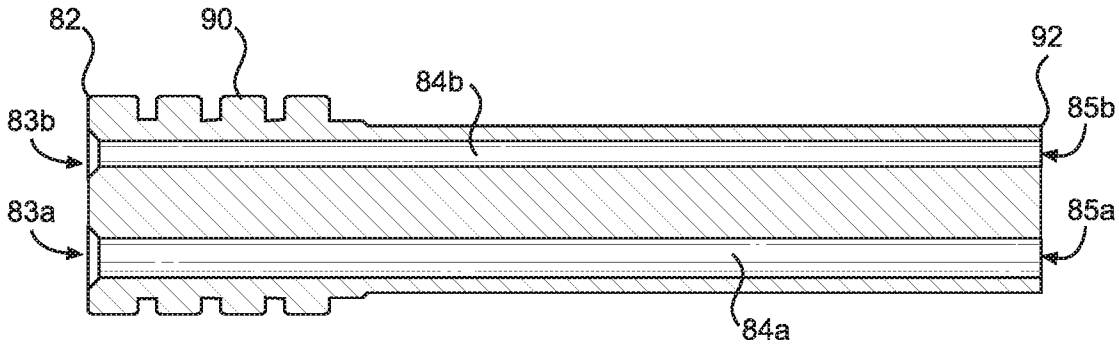


FIG. 7A

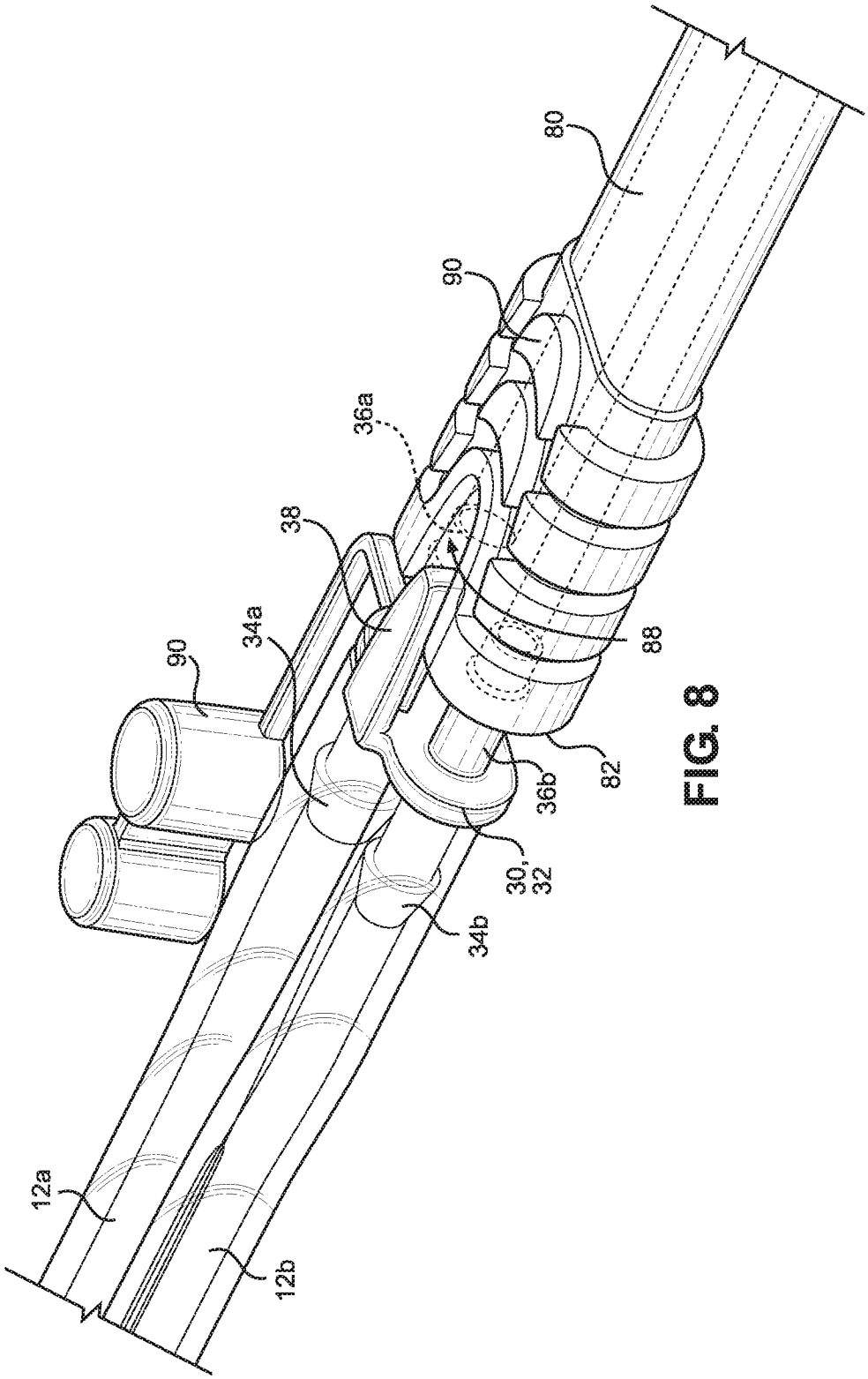


FIG. 8

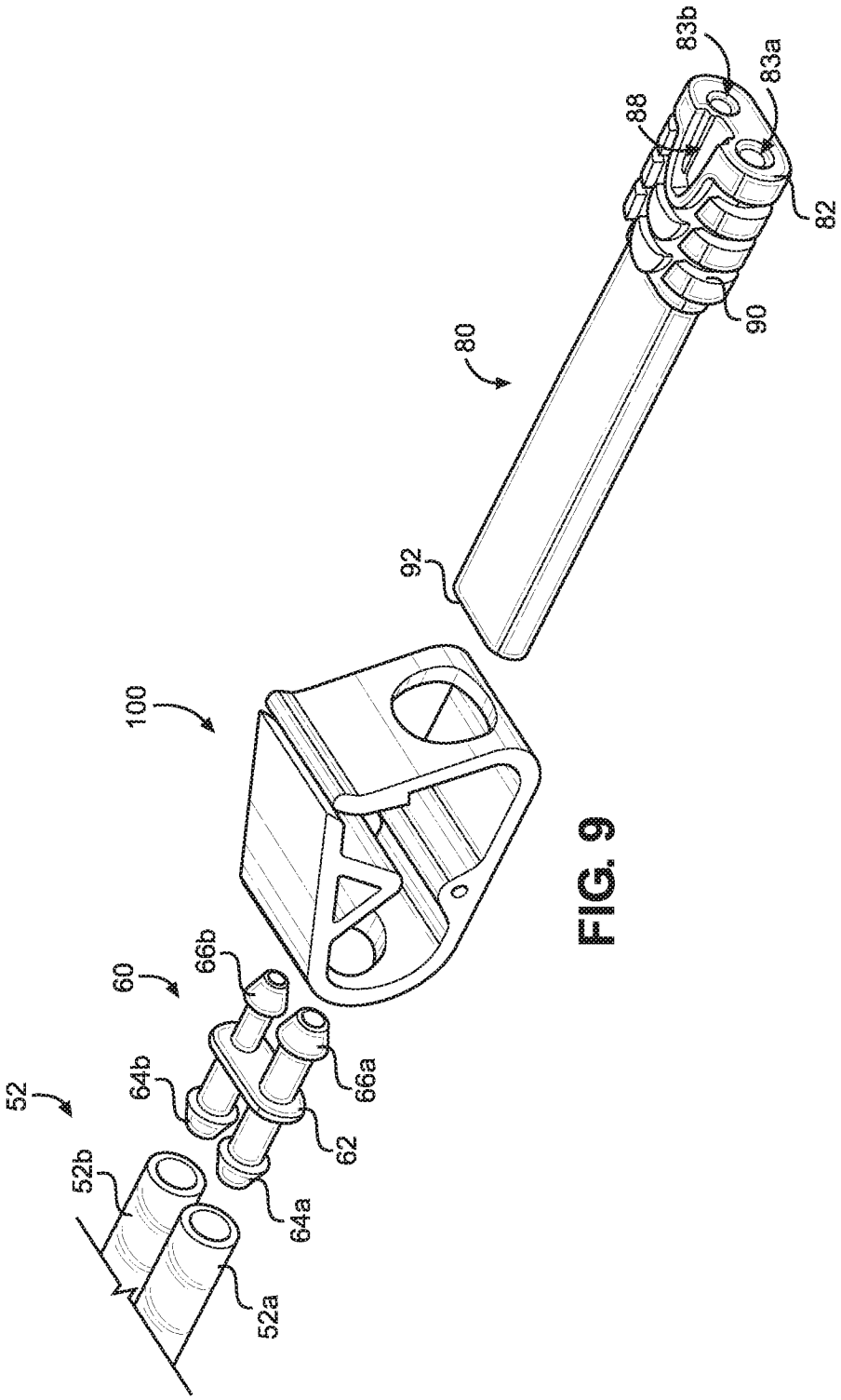


FIG. 9

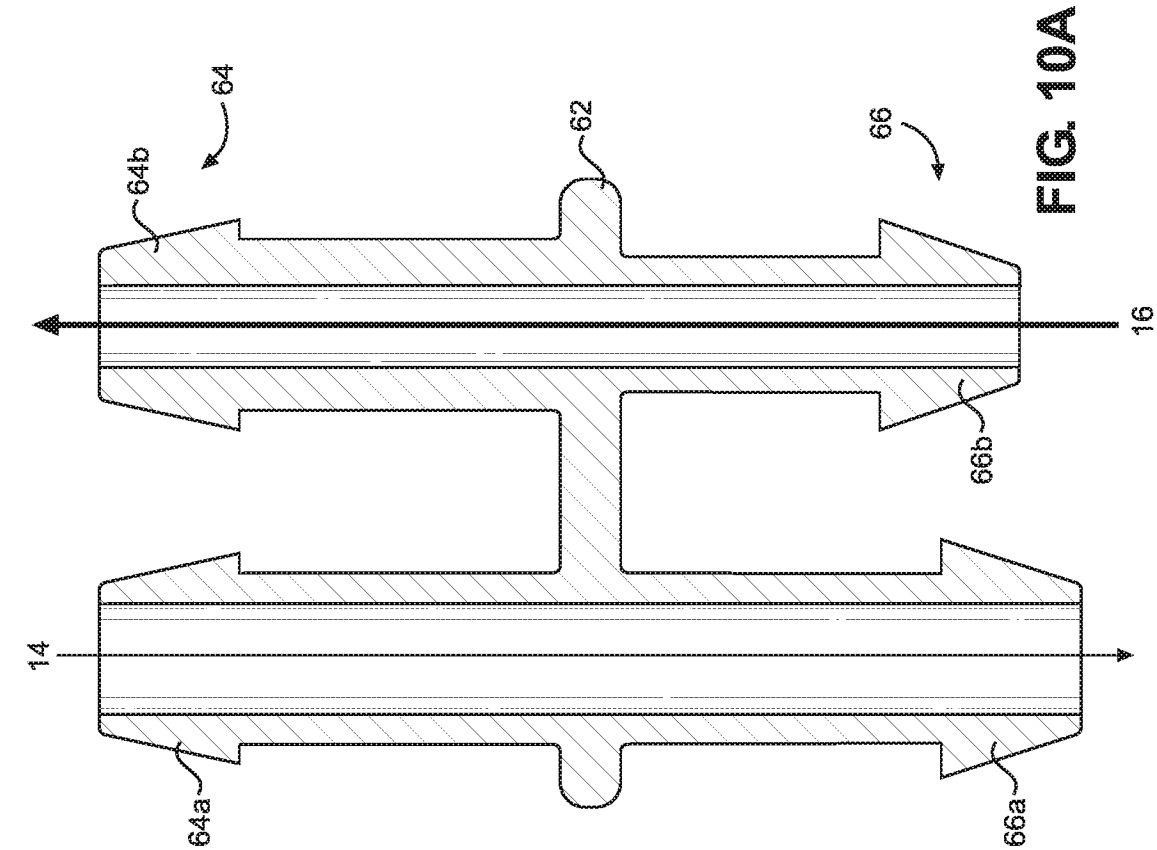


FIG. 10A

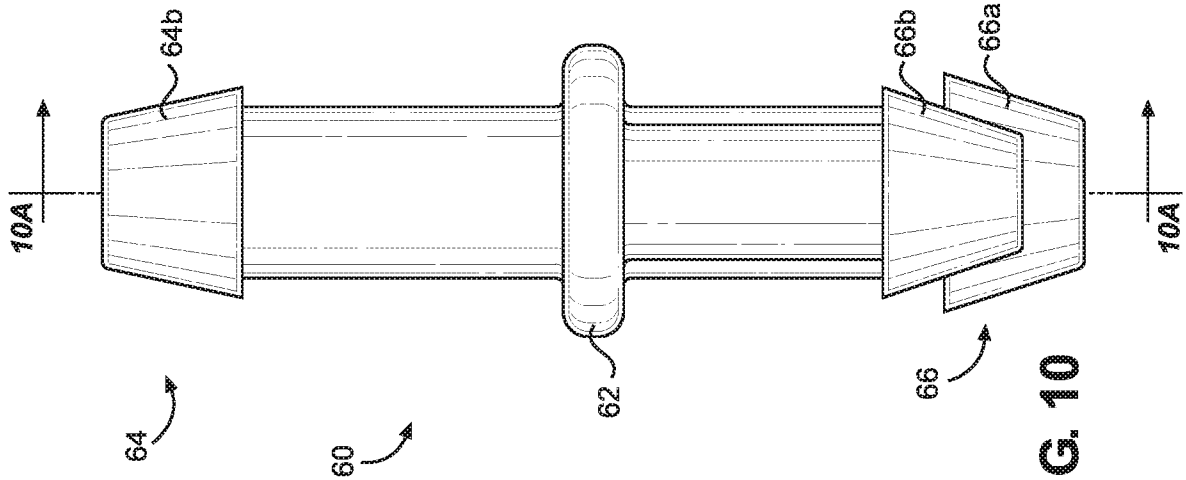


FIG. 10

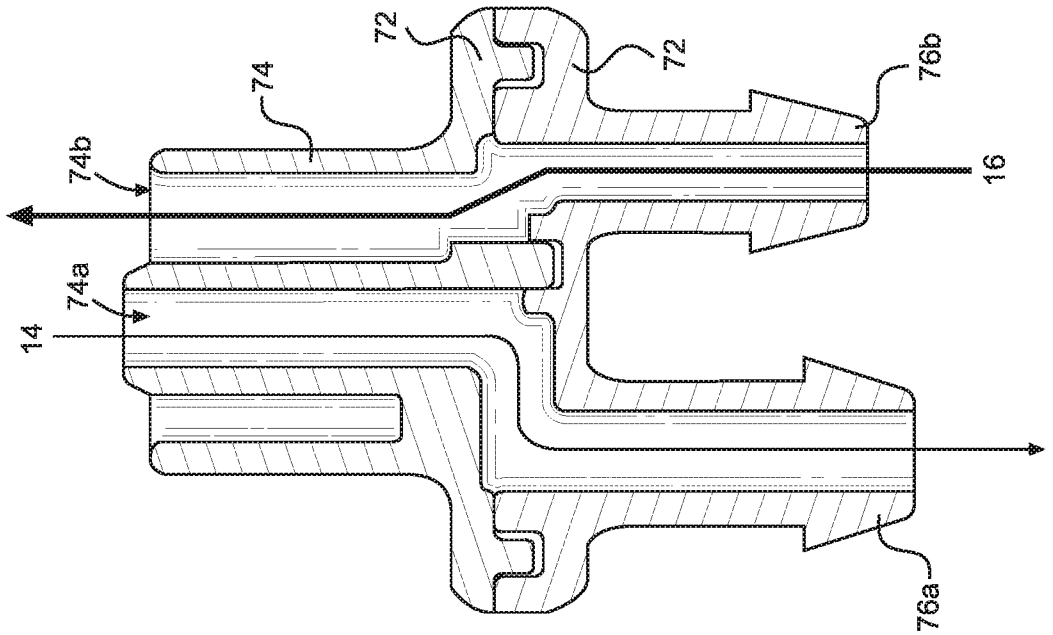


FIG. 12A

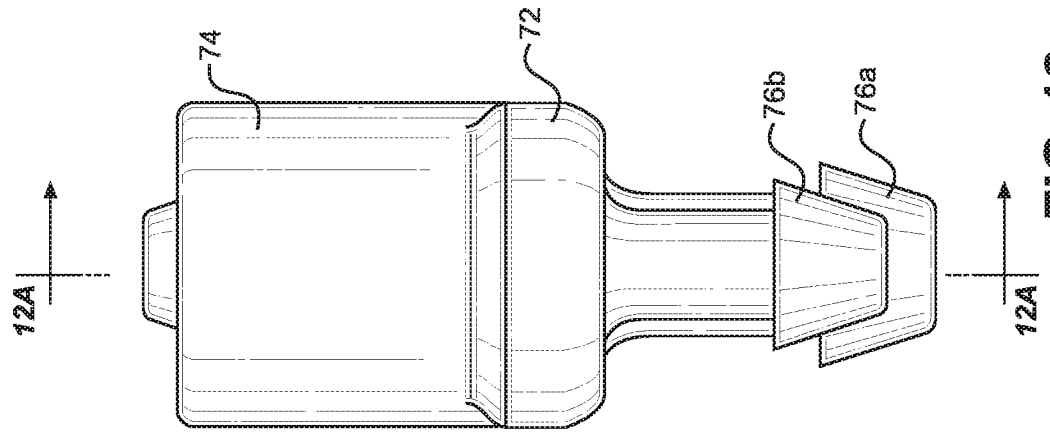


FIG. 12

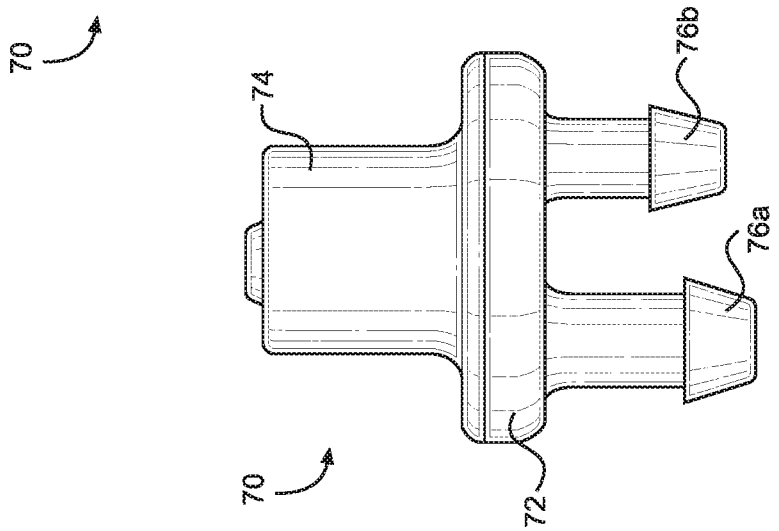


FIG. 11