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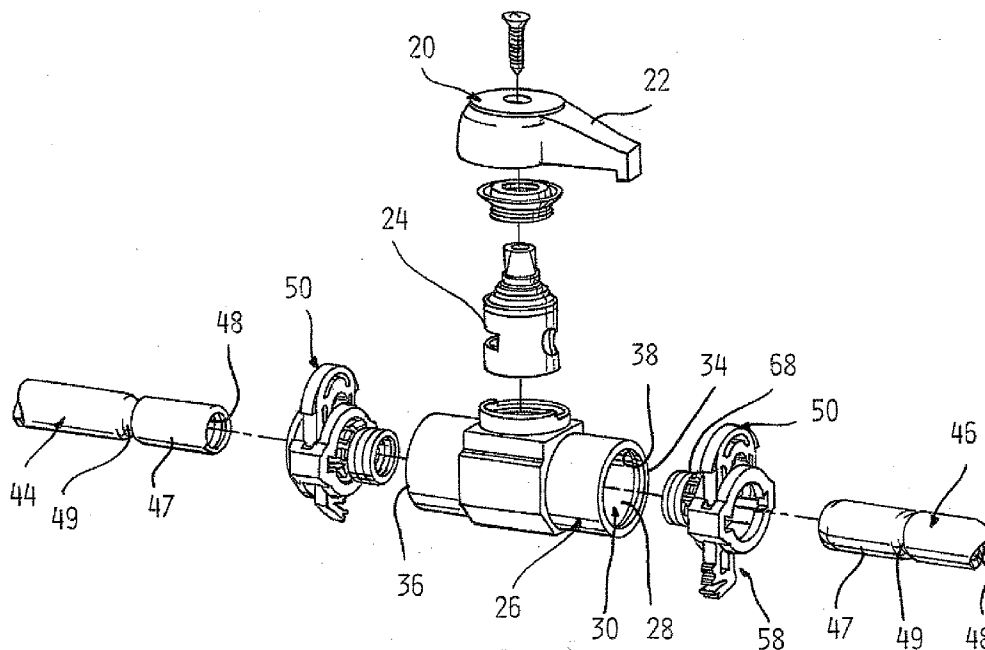
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[Continued on next page]

(54) Title: QUICK CONNECT FLUID CONNECTION



(57) Abstract: A fluid quick connect fluidually couples a conduit having an attachment groove for a retainer on a quick connect housing. The housing includes circumferential ly spaced fingers of each which include a barbed end that engages a corresponding internal groove within a valve housing. The housing fits over conduit and is aligned with the attachment groove. The end of the conduit may be closed and a cut-off indicator provided to enable cut-off of the sealed end after a system pressure test. Complementary anti-rotation features may be provided on the conduit and one of quick connect housing and a valve housing.

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QUICK CONNECT FLUID CONNECTION

BACKGROUND

[0001] The present invention relates to fluid connection and, more particularly, to fluid connections using quick connects.

[0002] In building and housing water delivery systems, conduits, typically formed of rigid metal or plastic, are connected to various fluid control devices, such as faucets, showerheads, toilets, etc., through valves or fittings which require brazing, treading compression or other time consuming assembly and disassembly procedures.

[0003] Snap-in quick connects are used in the automotive industry to interconnect fluid and vapor carrying conduits and hoses to valves, manifolds, etc.

[0004] It would desirable to provide an improved quick connect fluid connection which overcomes these deficiencies.

SUMMARY

[0005] In one aspect, a fluid quick connect fluidically a housing having a plurality of circumferentially spaced fingers disposed about an axis for fluidically coupling a conduit having an attachment groove to a valve having a bore extending from one end and an internal groove spaced from the one end. A slot is formed generally transverse to the axis of a bore in the housing. A retainer is mounted within the slot. The retainer has a set of conduit attachment legs and a set of housing attachment legs, the set of housing attachment legs being engageable with the housing to secure the retainer within the housing; and the set of conduit attachment legs being engageable with the attachment groove to attach the housing to the conduit.

[0006] The retainer in the quick connect housing engages a groove in the endform portion of the conduit to quickly attach or enable the disattachment of the conduit to the valve without tools, brazing, etc.

[0007] The end of one conduit may be initially sealingly closed. A cut-off indicator, such as an annular groove, is spaced between the closed end and the attachment groove. The cut-off indicator marks the location for the closed end to be cut-off after the fluid system pressure test.

[0008] Anti-rotation features, such as flats, ribs, knurls, etc., fixedly engage complementary surfaces in the quick connect housing or the valve body to prevent rotation between the conduit and the quick connect or valve.

[0009] In another aspect, a fluid connection includes a valve having a bore extending from one end and an internal groove spaced from the one end, a fluid conduit having an attachment groove, a housing having a plurality of circumferential spaced fingers disposed about an axis for fluidically coupling a conduit having an attachment groove to a valve having a bore extending from one end and an internal groove spaced from the one end. A retainer movable in a transverse slot in the housing has a set of conduit attachment legs and a set of housing attachment legs, the set of housing attachment legs being engageable with the housing to retain the retainer within the mount housing; and the set of conduit attachment legs being engageable with the attachment groove to attach the housing to the conduit.

[0010] The fluid quick connect disclosed herein uniquely enables fluid conduits to be quickly attached to or be removed from a valve or other fitting. The fluid connect housing is snap-in connectible to a groove in the valve body without requiring the use of tools as in prior fluid connections.

BRIEF DESCRIPTION OF THE DRAWING

[0011] The various features, advantages and other uses of the present invention will be understood by referring to the following description and drawing in which:

[0012] Fig. 1 is an exploded, perspective view of a quick connect fluid connection for a valve;

[0013] Fig. 2 is a longitudinal, cross-section view of the assembled fluid connection shown in Fig. 1;

[0014] Fig. 3 is a perspective view of the retainer shown in Figs. 1 and 2;

[0015] Figs. 4A and 4B are end views of the quick connect housing with the retainer in a prelatched storage position and in the endform latched position, respectively;

[0016] Fig. 5 is a perspective view of one aspect of a stub-out;

[0017] Fig. 6 is a plan cross-sectional view of the stub-out shown in Fig. 5;

[0018] Fig. 7 is a perspective view of another aspect of a stub out;

[0019] Fig. 8 is a perspective view of another aspect of a stub-out with anti-rotation features;

[0020] Fig. 9 is a cross-sectional view generally taken along line 9 in Fig. 8;

[0021] Fig. 10 is a perspective view of a stub-out with another aspect of an anti-rotation feature; and

[0022] Fig. 11 is a perspective view of a stub-out with another aspect of an anti-rotation feature.

DETAILED DESCRIPTION

[0023] Although the following description uses a fluid stop valve as an example, the quick connect fluid connections can be used with any other valve or fitting connection.

[0024] A stop valve 20 is shown in Figs. 1 and 2. Any stop valve can be employed, such as stop valves from Brass Craft Manufacturing, Inc. The stop valve includes a handle 22, a valve body 24 and a housing 26 with a through bore 28 extending between opposed apertures or ports 30 and 32 in first and second ends 34 and 36, respectively, of the housing 26. An internal groove 60 and 40 is formed adjacent each aperture 30 and 32, respectively.

[0025] Fluid conduits 44 and 46 are fluidically coupled to the housing 26 through the apertures 30 and 32 by quick connects 50. The conduits 44 and 46 are formed of a rigid metal or plastic and have an end form profile, hereafter referred to as an "end form," extending from a tip end 47. A bore 48 extends from each tip end 47.

[0026] An engagement feature, such as a recessed groove 49, is formed exteriorly on each endform 45 spaced from the tip end 47.

[0027] Each quick connect 50, shown in Figs. 1 and 2, which are shown as being identically constructed by example only, generally includes a first O-ring seal 52, a spacer 54, a second O-ring 56, a housing 58, and a retainer 60 which fits within a housing slot 62.

[0028] As shown in detail in Figs. 3, 4A and 4B, the first end of the housing 50 is formed with a pair of opposed, exterior flat surfaces 240 and 242. The flat surfaces 240 and 242 are diametrically opposed on the first end and may be centrally located on each diametrical side of the first end. The adjacent surfaces of the housing

58 to one side of the flat surfaces 240 and 242 form an opposed pair of lock surfaces or flats, such as a first flat 243 and a second flat 244. A second pair of flats 245 and 246 are formed on the housing 58 on the other side of the flat surfaces 240 and 242. The flats 243 and 244 extend axially a short distance from the first end of the housing 58. Opposed surfaces 248 and 250 of the first end of the housing 58 between the flats 243 and 244 and the flats 245 and 246 have a generally arcuate shape as shown in Figs. 4A and 4B. Apertures 249 and 251 are formed respectively in each surface 248 and 250. The apertures 249 and 251 are aligned to form a transverse bore extending through the first end of the housing 58 which is disposed in communication with the throughbore in the housing 58.

[0029] The retainer 60 is formed of a one-piece body of a suitable plastic, such as polyketone, for example, and has an end wall 262 formed of a generally curved or arcuate shape, by way of example only, and first and second spaced side legs 264 and 266. The side legs 264 and 266 extend generally parallel to each other from opposite ends of the end wall 262. Further, each side leg 264 and 266 has an outer end 272, although it is also possible to connect the side legs 264 and 266 at a lower portion by an arcuate member.

[0030] A pair of projections 270 extend along the length of the retainer 60 between opposed side edges of the side legs 264 and 266, respectively. The projections 270 are located adjacent the outer end 272 of each leg 264 and 266. The projections 270 engage surfaces on the housing 58 to position the retainer 60 in the shipping position shown in Fig. 4AA, or in the fully inserted, latched position shown in Fig. 4AB. Further, a pair of outward extending lock tabs or edges 274 are formed adjacent the end wall 262 on each side leg 264 and 266.

[0031] The projections 270 on the legs 264 and 266 of the retainer 226 are formed with an angled hook-like shape terminating in a tip 256. The tip 256 is disposed at an acute, upturned angle with respect to the corresponding legs 264 and 266.

[0032] Grooves 240' and 242' are formed in the interior of the flat surfaces 240 and 242, respectively, of the housing 58 and include a recess or notch 296 at one end which is shaped complimentary to the shape of the tip 256 of the projection 270 on each of the legs 264 and 266 of the retainer 60. In this manner, pull out of the

retainer 60 from the housing 58 is resisted by the interlocking tips 256 on the legs 264 and 266 of the retainer 60 which are seated within the notches 258 in the grooves 240' and 242' in the housing 212 as shown in the partially inserted, shipping position of the retainer 60 in Fig. 4AA. The flats or lock edges 244 and 246 are disposed at an angle complimentary to the acute angle of the tips 256 on the legs 264 and 266 of the retainer 60. This enables interlock of the tips 256 with the flats 244 and 246 resists pull out of the retainer 60 from the housing 58 from the fully latched position shown in Fig. 4B.

[0033] The hook shaped tips 256 on the legs 264 and 266 of the retainer 60 in conjunction with the grooves 240' and 242' in the housing 58 also provide a distinct, "avalanche effect" snap action of the retainer 16 in the housing 58. The grooves 240' and 242' in the housing 58 are formed in generally planar flat surfaces. The inner surfaces force the ends 272 of the legs 264 and 266 laterally inward toward each other when the retainer 16 is inserted into the housing 58. When the tips 256 clear one edge of the grooves 240' and 242', the resilient nature of the legs 264 and 266 snaps the ends 72 and the tips 256 laterally outward to create an "avalanche effect" which provides a distinct tactile feedback to the user indicating that the retainer has lockingly engaged the housing 58 in either the partially inserted position, shown in Fig. 4AA, or the fully inserted position shown in Fig. 4B.

[0034] It should be noted that further insertion force on the retainer 60 moving the retainer 60 from the partially inserted position in Fig. 4AA to the fully inserted position shown in Fig. 4B again causes the end 272 of the legs 264 and 266 to be urged laterally inward when the tips 256 of the legs 264 and 266 slide along the lower portion of the inner surfaces. When the tips 256 clear the outer end of the inner surfaces, the legs 264 and 266 spring laterally outward in a distinct "avalanche effect" manner. The lower ends of the grooves 240' and 242' are angled to enable the tips 256 to slide out of the grooves 240' and 242' toward the fully latched position.

[0035] The retainer 60 can be first be installed on the housing 58 in a shipping or storage position depicted in Fig. 4AA. In this position, the projections 270 on the side legs 264 and 266 of the retainer 60 snap into and engage the longitudinally extending grooves 240' and 242'.

[0036] Further insertion of the retainer 60 through the aligned apertures 249 and 251 in the housing 58 causes the ends 272 of the legs 264 and 266 to pass along the lower portion of the inner surfaces of the flat surfaces 240 and 242 until the tips 256 clear the ends of the surfaces and then snap outward exteriorly of the outer surface of the first end 224 of the housing 58 as shown in Fig. 4B. In this fully inserted position of the endform 46 in the housing 58, an annular groove 49 on the endform 46 is situated ahead of the arms 282 and 284 of the retainer 60. This position represents the fully latched position in which the endform 46 is fully seated in and lockingly engaged with the connector housing 58. The full insertion of the retainer 60 into the housing 58 also provides visible indication of the fully locked connection of the endform 46 and the housing 58.

[0037] In this aspect of the invention, by example only, the retainer 60 includes an endform latch member 280 in the form of an arcuate projection 283 extending radially inward between the arms 282 and 284. The projection 283 may have any one of a number of different cross sections, such as a smoothly curved, hemispherical shaped cross section, a squared off, polygonal cross section, etc. Further, the projection 283 may be continuous over a predetermined angular extent of the inner surface of the arms 282 and 284 of the retainer 60 or formed of a plurality of discrete, non-continuous, circumferentially aligned segments.

[0038] The arms 282 and 284 have an axial length in the illustrated view, greater than the axial length of the projections 283. Alternately, the arms 282 and 284 and the projection 283 can be combined into a single arcuate projection with the outer surfaces spaced from the outer legs 264 and 266. Further, the projection 283 and the arms 282 and 284 can be integrally combined with the legs 264 and 266.

[0039] However, it will be understood that the cross section as well as the radial height of the projection 283 is complementary to the cross section and radial depth of the annular recess 49 in the end form 46. This provides releasable interlocking of the projection 283 in the recess 49 to latch the endform 46 in the housing 58 when the retainer 60 is moved into the fully latched position.

[0040] It will also be apparent that if the retainer 60 is in the fully latched position shown in Figs. 2 and 4B, prior to insertion of the endform 46 into the housing 58, the radially inward extent of the projection 283 blocks full insertion of

the endform 46 into the housing 58. Likewise, the endform 46 must be fully inserted into the bore in the housing 58, as shown in Fig. 2, for the projection 283 to axially align with and engage the recess 419 in the endform 46 so as to enable the retainer 60 to be moved to the fully latched position shown in Figs. 2 and 4B. If the tip end 47 of the endform 46 is spaced from the fully inserted position in the bore in the housing 58 shown in Fig. 2, the projection 283 on the retainer 60 will not align with the recess 49 in the endform 46 such that the retainer 60 cannot be transversely moved into the fully latched position. When this occurs, the outer edge of the central leg 262 of the retainer 60 will extend outward from the housing 58 to provide an indication of a non-fully inserted endform 214. Further details of the construction and operation of the retainer 16 can be had by referring to U.S. Pat. No. 6,637,779.

[0041] It will be understood that the above-description of a retainer configured for releasable engagement with a recess in an endform to releasably latch the endform to the quick connector housing this is by way of example only. Other retainer and endform latching configurations, such as the transversely mounted retainer which engages an endform having a raised bead described in U.S. Pat. Nos. 5,542,716, 5,782,502, 5,951,063, and 5,782,502, can also be employed in the quick connector 11 of the present invention.

[0042] In addition, axially mounted retainers and quick connector housing configurations, typically employed with raised SAE flanged or beaded endforms, as shown in U.S. Pat. No. 6,402,204 may also be employed in the quick connector 50.

[0043] Returning to Fig. 3, one of the retainer's legs 264 extends to define a "locking flap 265" at its free end 272. The locking flap 265 is preferably separated from the rest of the leg 246 by a "living hinge 269" or similar bridging member of reduced thickness. In this manner, the locking flap 265 is advantageously integrally formed with the retainer 60. It will be appreciated, however, that the use of a separately formed, e.g., separately molded, flap member which is thereafter hingedly interconnected with one of the retainer's legs 264 or 260 so as to pivot about a second axis 269 generally parallel to the first axis, either through use of integrally-formed hinge or a separate joining element is also contemplated.

[0044] The locking flap 265 is permitted to pivot at the living hinge 269 about a second axis towards and, ultimately, into interlocking engagement with the

free end 270 of the retainer's other leg 266, the latter being accomplished in the retainer 60 by means of interlocking engagement of a ramped locking projection 272 on the inside of leg 248 with a complementary slot formed in the locking flap 265 adjacent its leg's free end 266.

[0045] In order to prevent loss of the locking flap 265 in the event of a structural failure of living hinge 269, a ramped locking projection 275 is also provided on the inside of leg which likewise interlockingly engages a complementary slot in the locking flap 265 immediately adjacent to hinge 269.

[0046] When the locking flap 265 is pivoted about axis 269 into interlocking engagement with the retainer's other leg 266, a surface 281 on the locking flap 265 is brought into axial opposition with and, preferably, axially engages the endform 46 seated within the connector body's axial bore. The locking flap 265 thus axially engages the endform 46 along a circumferential portion thereof diametrically opposite to the circumferential portion axially engaged by locking surface 258 on the retainer's bight 250.

[0047] The quick connect housing 58 includes a plurality of circumferential spaced cantilevered fingers 66 defined about a longitudinal axis. Each finger 66 includes a barbed end 68. Each barbed end 68 engages one corresponding internal groove 60 or 40 within the valve housing 26. The barbed end 68 further defines a stop surface 70 which axially retains the first O-ring seal 52, the spacer 54 and the second O-ring 56 within the valve housing 26.

[0048] The housing 58 fits over the outer diameter of the conduit 44 or 46 until the retainer 60 is aligned with the attachment groove 49. The retainer 60 includes a partially annular set of conduit attachment legs 282 and 284 and a set of housing attachment legs 264 and 266. The conduit attachment legs 282 and 284 engage the attachment groove 49 to axially retain the conduit 44 therein.

[0049] To attach the valve 20 to the conduit 44, the quick connect housing 58 is fitted over the tip end 47 until the slot 62 is aligned with the groove 49. The retainer 58 is then pressed into the slot 62 such that conduit attachment legs 282 and 284 extend around and at least partially seat within the groove 49; while housing attachment legs 264 and 266 are flexed inward in response to interaction with a surface of the housing 58. Once the leg ends have reached a relief in the slot 62, the

housing attachment legs 264 and 266 spring outward such that the leg ends 68 engage a corresponding surface in the housing 58 to lock the retainer 60 into the slot 62. Such a locking arrangement permits the rapid attachment of the valve assembly 20 to each conduit 44 or 46.

[0050] Referring now to Figs. 5 – 7, there are depicted different aspects of a conduit stub-out for utilization with the quick connect of Figs. 1 and 2 that is formed with an integral test cap. Through controlled forming processes, the end of the conduit is closed to form a sealed end.

[0051] Figs. 5 and 6, the end 120 of the stub-out conduit 122 is spherical or bullet-shaped. A first radial inward extending groove 124 is positioned to receive the retainer of a quick aspect, not shown, as described above for Figs. 1 and 2.

[0052] A second groove 126, which can have a continuous or discontinuous annular shape, and a square or arcuate cross-section, is formed closer to the end 120. The groove 126 forms a cut-out location indicator for the plumber to cut off the end 120 after the system pressure test.

[0053] The outer diameter of the remainder of the stub-out 122 may be constant, or as illustrated, have a stepped configuration.

[0054] In the aspect shown in Fig.7, the end 132 of a stub-out 134 is flat. The cut-off indicator is the second groove 136 located adjacent the end 132.

[0055] Figs. 5 to 11 illustrate various stub-out endforms which provide mating with a quick connect assembly with an anti-rotation feature. The endforms provide for sealing and the option of incremental positions relative to the terminal fitting. The outer diameter of the endform seals to a mating fitting utilizing a rubber seal such as an O-ring. The anti-rotation feature may be achieved through the use of various geometric shapes that interlock or interface with mating geometry located within the quick connect fitting. For fluid connection systems, the optional anti-rotation feature utilizes, preferably, hex, dimples, ribs, splines, flats, knurls, or the like.

[0056] In Figs. 5 and 7, the anti-rotation feature is provided by one or more flats 140 on the conduit 122 or 134 axially spaced from the retainer receiving grooves 124. The flats 142 and intervening arcuate portions 143 of the stub-out 122 engage surfaces 144 in the interior of the quick connect housing 58.

[0057] In Figs. 8 and 9, one or more radially outward extending ribs 150, with four shown by example only, are formed on a stub-out 152 spaced from the retainer receiving groove 154. The ribs 150 slide into complementary shaped grooves 156 in the quick connect housing.

[0058] Four ribs 160 are formed in a first outer diameter stepped portion 162 of a stub-out 164 in Fig 10. A second larger outer diameter conduit wall 166 extends from the ribs 160.

[0059] In Fig. 11, knurls 170 are formed on the end 172 of a stub-out 174 and functionally engage an inner surface of the valve housing 26.

What is claimed is:

1. A fluid quick connect for fluidically coupling a conduit having an attachment groove to a valve having a bore extending from one end and an internal groove spaced from the one end comprising:

a housing having a plurality of circumferential spaced fingers disposed about an axis of a throughbore and a transverse slot;

a retainer movable within the slot, the retainer having a set of conduit attachment legs and a set of housing attachment legs, the set of housing attachment legs engageable with the housing to retain the retainer within the mount housing; and

the set of conduit attachment legs engageable with the attachment groove to attach the housing to the conduit.

2. The fluid quick connect of claim 1 wherein:
each of the fingers includes a radially outward extending barb adapted to engage the internal groove in the valve.

3. The fluid quick connect of claim 2 wherein:
each of the fingers is cantilevered from the housing.

4. The fluid quick connect of claim 1 wherein:
each of the fingers has an end for securing at least one seal element in the bore in the housing.

5. The fluid quick connect of claim 4 wherein:
the fingers position the at least one seal element for sealing engagement with the conduit when the conduit is inserted into the valve bore.

6. A fluid connection comprising:
a valve having a bore extending from one end and an internal groove spaced from the one end;
a fluid conduit having an attachment groove;

a housing having a plurality of circumferential spaced fingers disposed about an axis of a throughbore adapted for fluidically coupling the housing to the valve; and

a retainer movable in a transverse slot in the housing, the retainer having a set of conduit attachment legs and a set of housing attachment legs, the set of housing attachment legs engageable with the housing to secure the retainer within the housing the set of conduit attachment legs engageable with the attachment groove in the conduit to attach the housing to the conduit.

7. The fluid connection of claim 6 wherein:
each of the fingers includes a radially outward extending barb adapted to engage the internal groove in the valve.

8. The fluid connection of claim 6 wherein:
each of the fingers is cantilevered from the housing.

9. The fluid connection of claim 7 wherein:
each of the fingers has an end for securing at least one seal element in the bore in the housing.

10. The fluid connection of claim 9 wherein:
the fingers position the at least one seal element for sealing engagement with the conduit when the conduit is inserted into the valve bore.

11. The fluid connection of claim 6 wherein:
the valve has a second end and a second internal groove spaced from the second end;
another fluid conduit having an attachment groove;
another housing and retainer for attaching the another fluid conduit valve through the second end of the valve.

12. The fluid connection of claim 6 further comprising:

first and second seal members and an intervening spacer disposed in the bore of the valve axially ahead of the quick connect housing.

13. The fluid connection of claim 6 further comprising:
one end of the conduit is closed; and
a cut-off indicator intermediate the one end and the attachment groove in the conduit.
14. The fluid connection of claim 13 wherein the cut-off indicator comprises:
a groove formed in the conduit.
15. The fluid connection of claim 14 wherein:
the groove is an annular groove.
16. The fluid connection of claim 13 further comprising:
an anti-rotation feature cooperatively formed between the conduit and one of the quick connect housing and the valve housing.
17. The fluid connection of claim 16 wherein the anti-rotation feature comprises:
at least one radially outward extending rib carried on the conduit; and
a complementary groove in the housing.
18. The fluid connection of claim 16 wherein the anti-rotation feature comprises:
at least one flat carried on the conduit; and
a complementary surface carried in the quick connect housing.
19. The fluid connection of claim 16 wherein the anti-rotation feature comprises:

knurls carried on the one end of the conduit non-rotatingly engageable with an inner surface of the valve housing.

20. The fluid connection of claim 6 comprising:
an anti-rotation feature cooperatively formed between the conduit and one of the quick connect housing and the valve housing.

21. The fluid connection of claim 20 wherein the anti-rotation feature comprises:
at least one radially outward extending rib carried on the conduit; and
a complementary groove in the housing.

22. The fluid connection of claim 20 wherein the anti-rotation feature comprises:
at least one flat carried on the conduit; and
a complementary surface carried in the quick connect housing.

23. The fluid connection of claim 20 wherein the anti-rotation feature comprises:
knurls carried on the one end of the conduit non-rotatingly engageable with an inner surface of the valve housing.

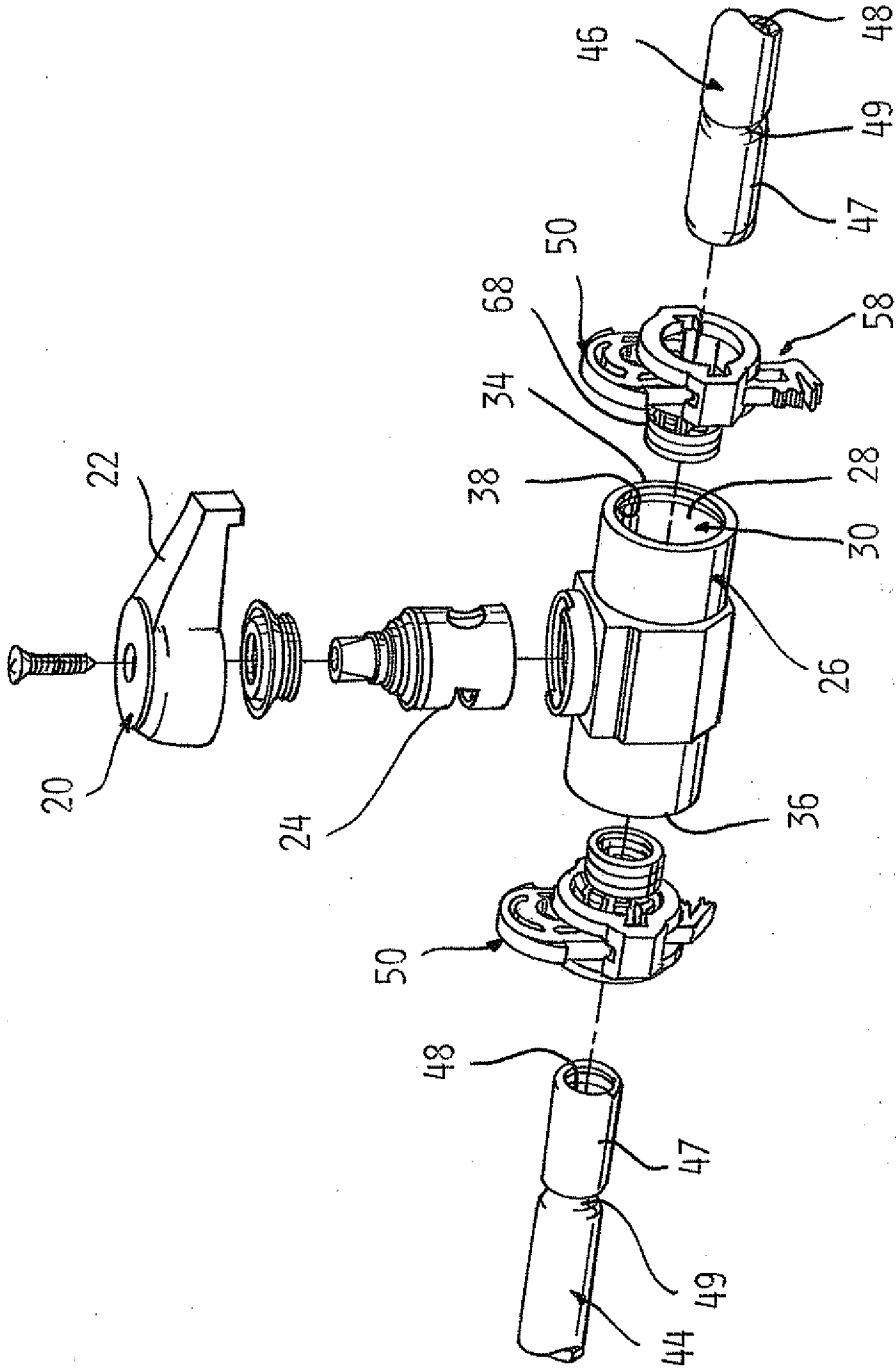


FIG. 1

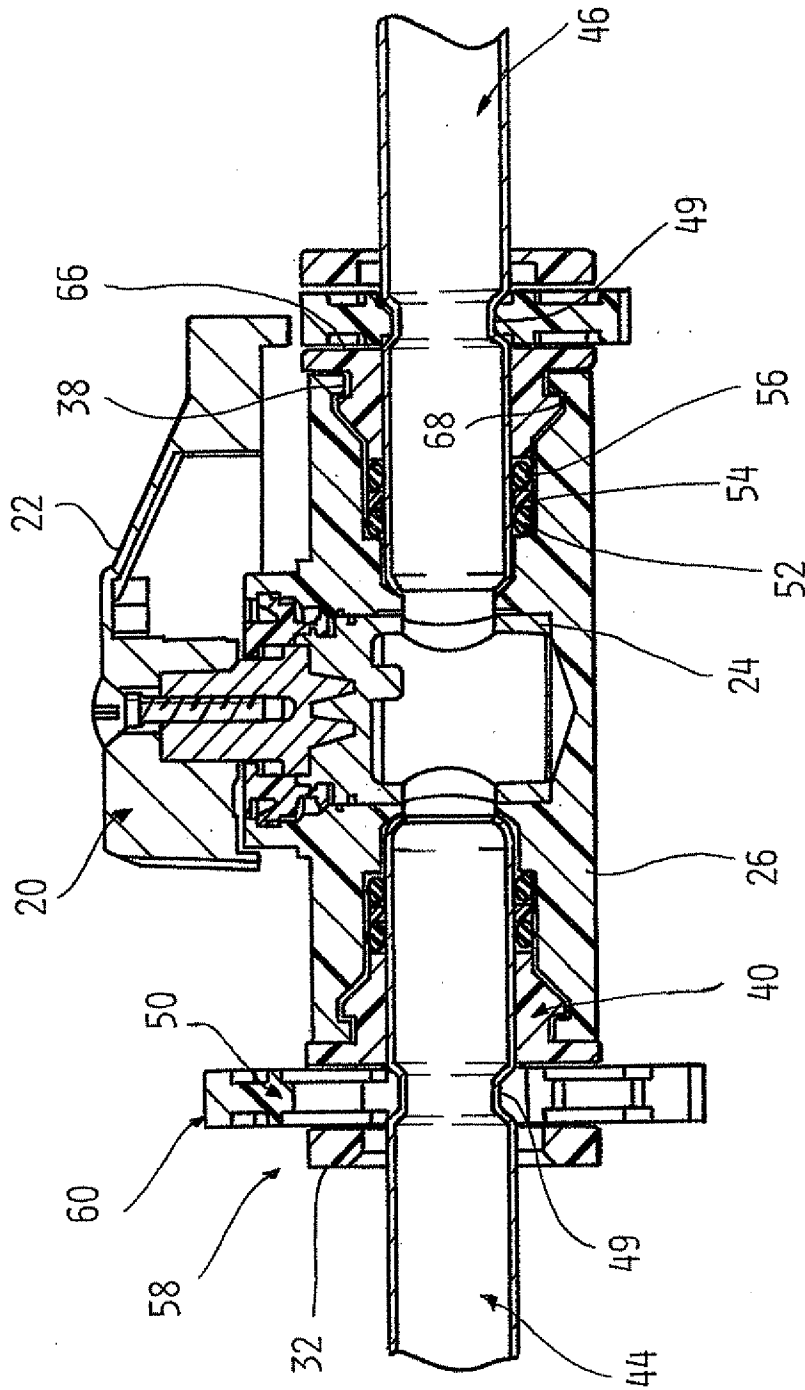


FIG. 2

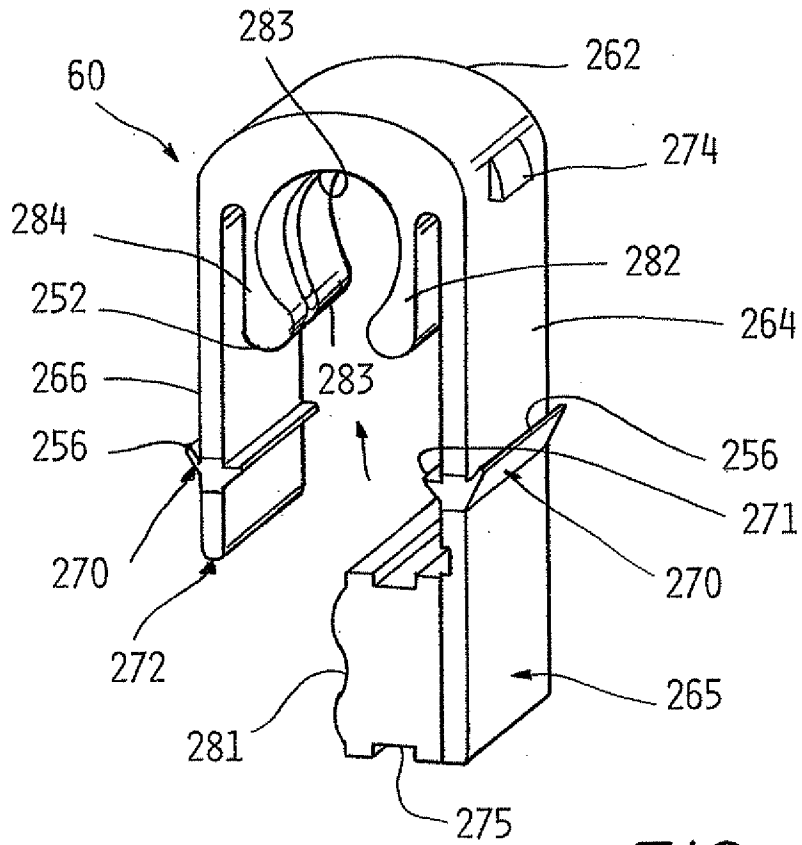


FIG. 3

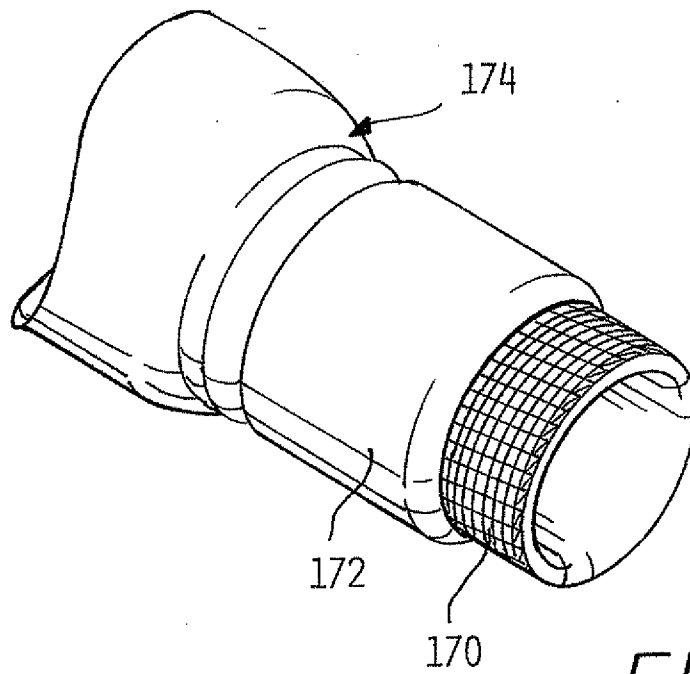


FIG. 11

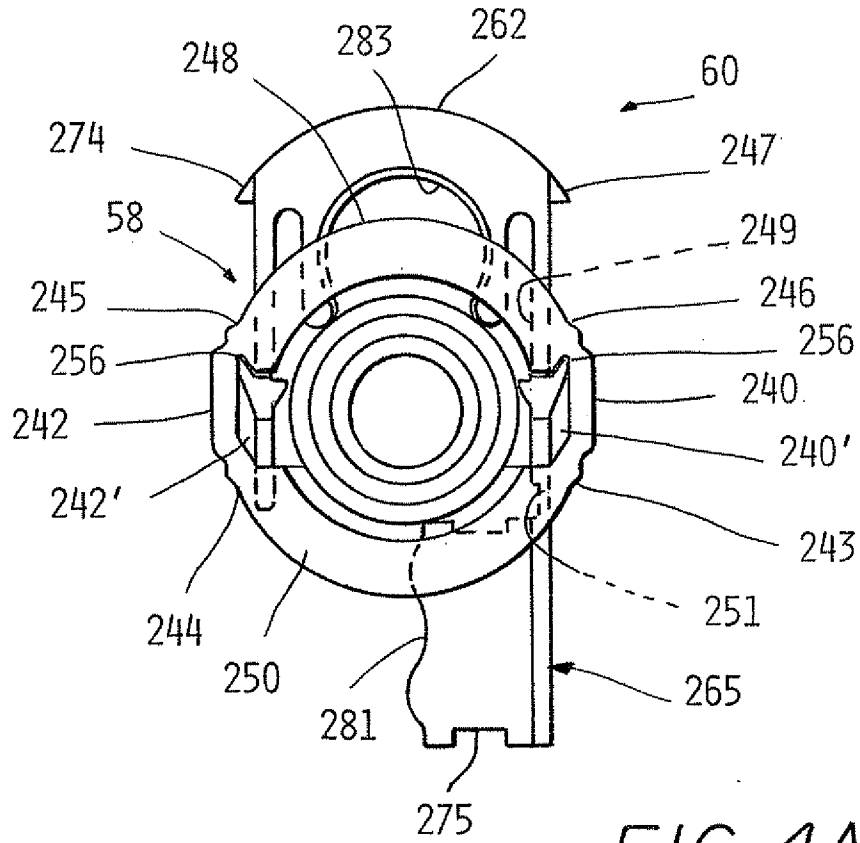


FIG. 4A

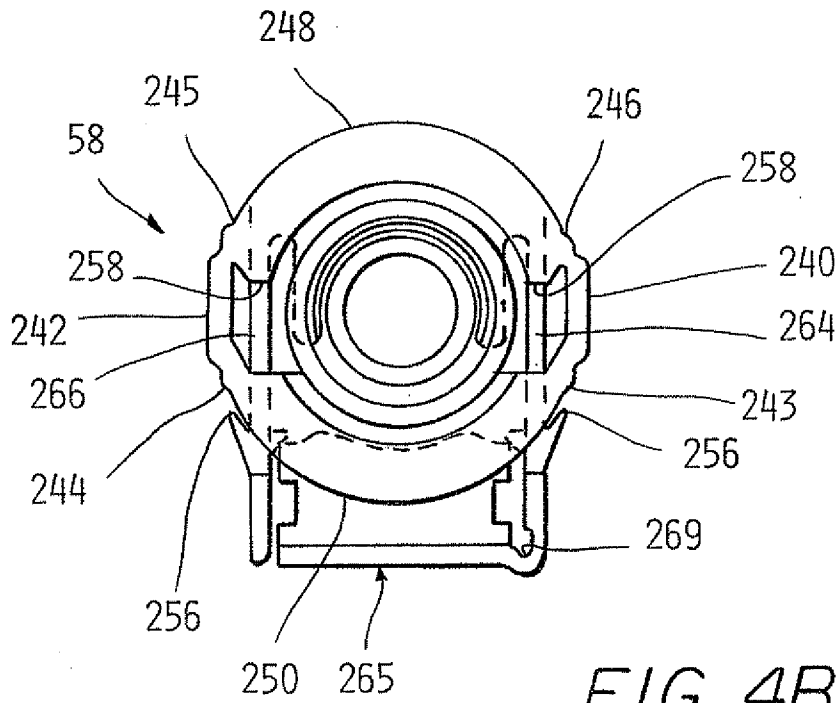
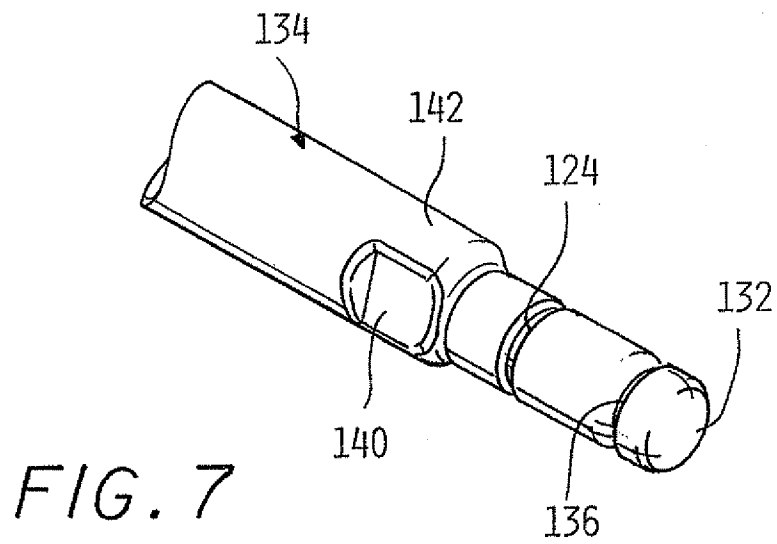
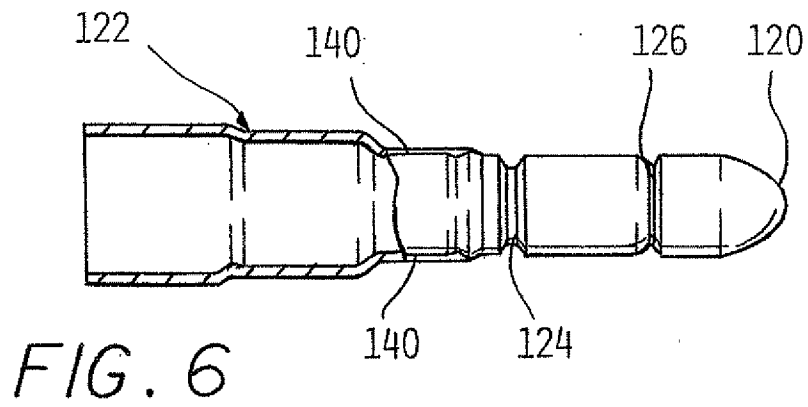
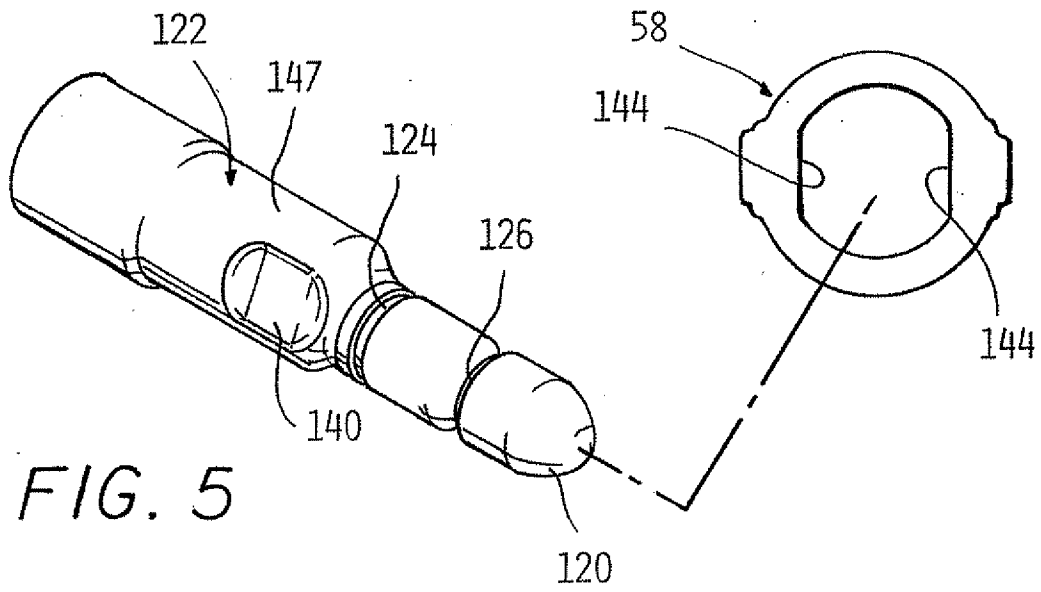


FIG. 4B



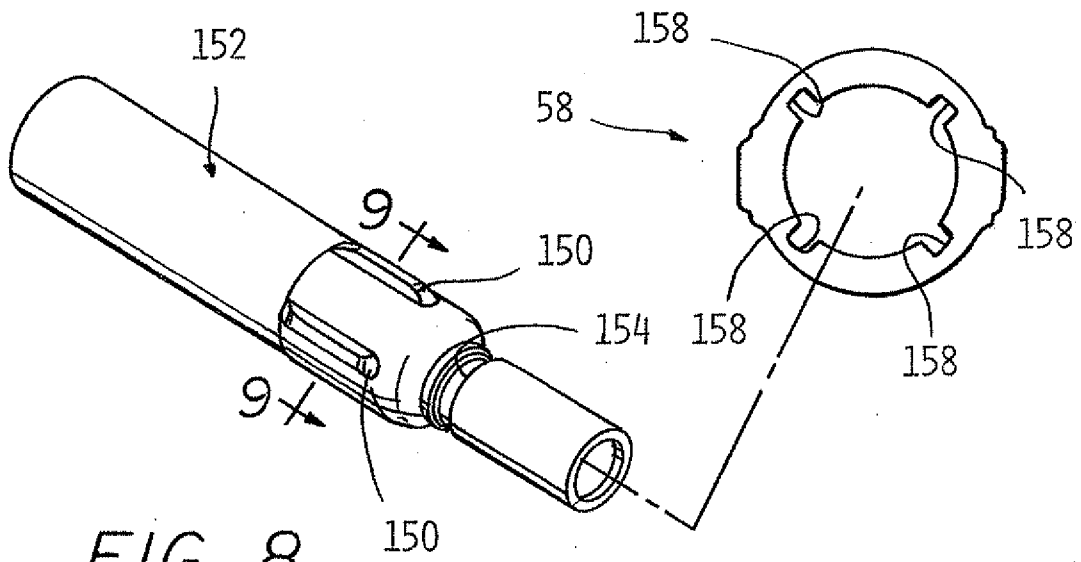


FIG. 8

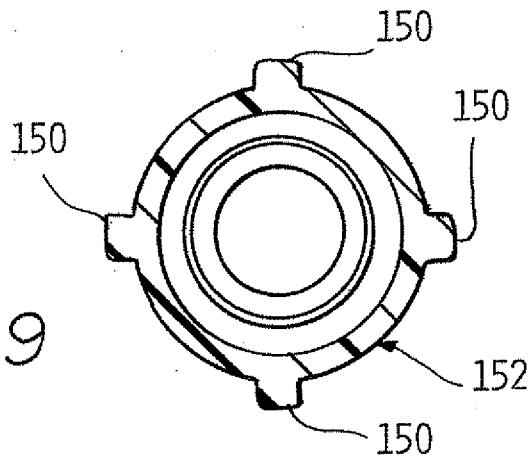


FIG. 9

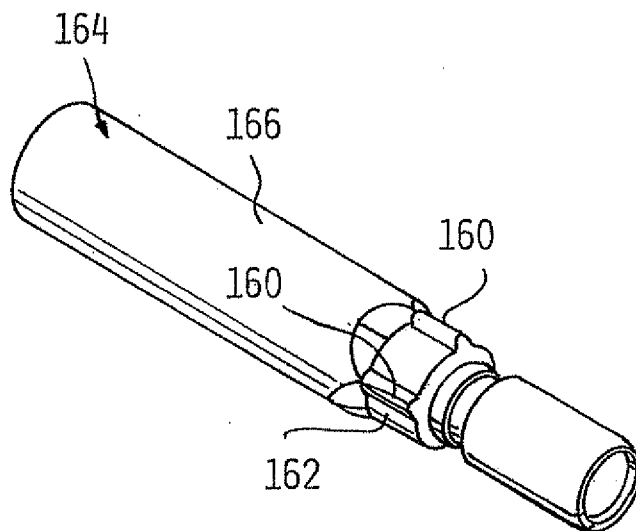


FIG. 10