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ABSTRACT

A fluid fitting having two fluidly connected connection ends comprising a ferrule connector configured to be fixed onto an end of a conduit, and a female nut connector, wherein the female nut connector is rotatably mounted over a tubular connector section of the fluid fitting, the connector section having a distal end which includes an inwardly tapered sealing section including an annular portion having a convex surface configured for abutting engagement with a cooperating end of a male connector inserted within the nut connector.

FIGURE 2

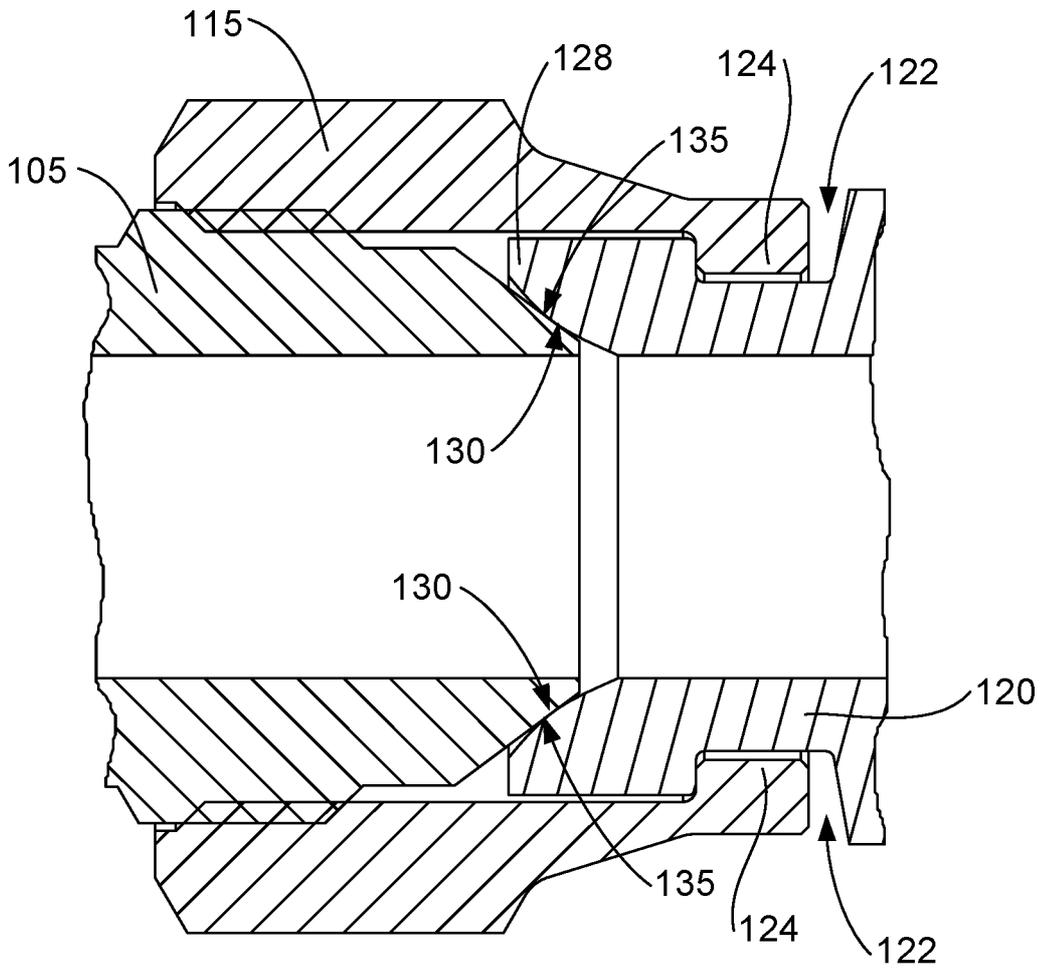
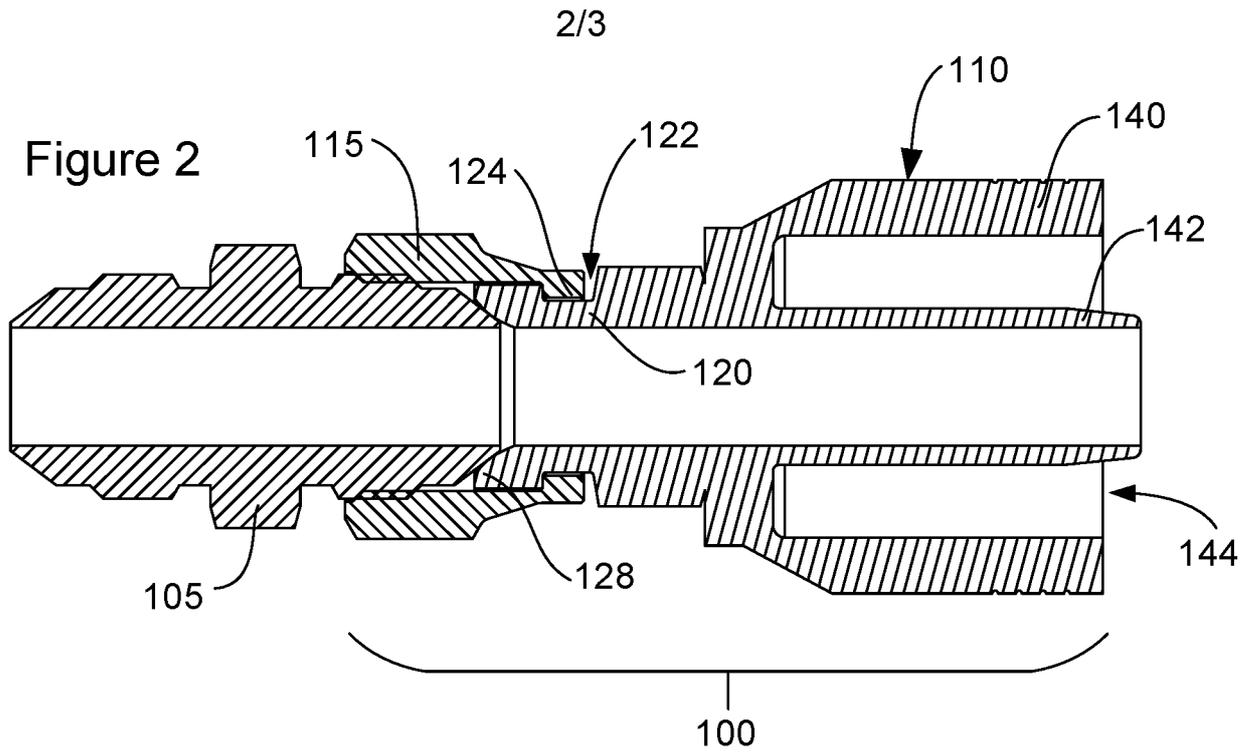


Figure 3

FERRULE TYPE CONDUIT FITTING

TECHNICAL FIELD

[0001] The present invention generally relates to attachable conduit fittings of the female nut-stem, ferrule type for use with reinforced, flexible hose and an adaptor. The invention is particularly applicable for high pressure pipe and hose applications and high pressure adaptors and it will be convenient to hereinafter disclose the invention in relation to that exemplary application. However, it is to be appreciated that the invention is not limited to that application and could be used in relation to a number of other similar fluid fitting configurations.

BACKGROUND OF THE INVENTION

[0002] The following discussion of the background to the invention is intended to facilitate an understanding of the invention. However, it should be appreciated that the discussion is not an acknowledgement or admission that any of the material referred to was published, known or part of the common general knowledge as at the priority date of the application.

[0003] High pressure pipe and hose operations and high pressure adaptors require a fitting or coupling that can be secured to the end of a conduit (for example a hose or pipe) and provide a secure and fluid tight connection to another fitting. One such attachable conduit fitting includes a ferrule type connector at one end for connection to the end of a conduit and a female nut at the other end configured to receive a threaded male connector of an adaptor.

[0004] Ferrule type conduit fittings typically have a male-stem portion that is insertable into a hose end and a ferrule sleeve that is concentric with the male-stem. Together, the male-stem and ferrule sleeve define an annular cavity for receiving a hose end. A fitting is retained on the hose by pinching the hose end in the annular cavity between the ferrule sleeve and stem, such as by either radially reducing some part or element of the ferrule sleeve, or by radially increasing the size of the male-stem.

[0005] Female nut connectors comprise a rotatable sleeve having an internal thread which is configured to cooperate with the external thread of a

cooperating male connector. The female nut is rotatably mounted on a nut stem which is fluidly connected to the ferrule connector. The nut stem includes a sealing end onto which an end portion of an adaptor (received within the rotatable sleeve) abuts and forms a fluid seal. This sealing end is typically either flat, with the end being radially orthogonal to a longitudinal axis of the fitting, or can include a linear or flat inwardly tapered surface between an outer diameter of the nut stem and an inner diameter of the nut stem.

[0006] Figures 4 and 5 show a prior art ferrule type connector and the details of the internal sealing end of the nut stem (Figure 5). As shown in Figure 5, a seal is created when a tapered end portion of the adaptor received in the nut abuts a tapered sealing surface of the nut stem. In such a configuration, the abutting surfaces between the tapered sealing surface of the sealing end of the nut stem and the adaptor is a small annular area. A fluid tight seal requires a tight and aligned fit between the threaded cooperating parts of the female nut and the adaptor thereby ensuring these relevant surfaces abut. Nevertheless, fluid pressure, rough handling or treatment, and/or damage to this area can alter this fit and thus the integrity of this seal.

[0007] It would therefore be desirable to provide a ferrule type conduit fitting having an alternate or improved seal between the female nut and male connector of an adaptor receivable within the female nut.

SUMMARY OF THE INVENTION

[0008] The present invention provides fitting, and associated systems and methods which include two fluid connected connectors comprising a female nut connector and a unitary integrated ferrule.

[0009] A first aspect of the present invention provides a fluid fitting having two fluidly connected connection ends comprising a ferrule connector configured to be fixed onto an end of a conduit, and a female nut connector, wherein the female nut connector is rotatably mounted over a tubular connector section of the fluid fitting, the connector section having a distal end which includes an inwardly tapered sealing section including an annular portion having a convex

surface configured for abutting engagement with a cooperating end of a male connector inserted within the nut connector.

[0010] The fluid fitting of the present invention includes a convex sealing surface configured for abutting engagement with a cooperating end of a male connector inserted within the nut connector. The cooperating end of the male connector typically includes a cooperating annular surface which abuts a surface of the inwardly tapered sealing section of the tubular connector section, creating a seal therebetween. The convex sealing surface provides a curved engagement surface which better accommodates changes, alignment issues and/or movement between the abutting surfaces. In effect, the sealing surface provides a better fit and seal between the abutting surfaces of the connector stem and male connector. A fluid fitting of the present invention can therefore be used for higher fluid pressure application compared to a conventional fluid fitting having a connector section with a flat tapered sealing surface (for example as is shown in Figures 4 and 5).

[0011] It is to be understood that inwardly tapered sealing section is intended to mean that the taper of the sealing section extends from the outer edge of the distal end into the fitting, i.e. towards the opposite end of the fitting which includes the ferrule connector.

[0012] The female nut connector of the fluid fitting is configured to receive and cooperatively seal with a complementary configured threaded male connector. The cooperative seal is a result of abutting engagement between a surface, typically taper end surface, of the male connector and the inwardly tapered sealing section of the tubular connector section of the fluid fitting. As noted above, the convex shape of the inwardly tapered sealing section of the tubular connector section provides advantageous sealing properties to the fluid fitting of the present invention.

[0013] In some embodiments, the tapered sealing section comprises an inner surface of the tubular connector section, between an outer diameter and an inner diameter of the tubular connector section. The taper of the sealing section

therefore slopes inwardly from the outer diameter to the inner diameter in an axial direction toward the ferrule connector.

[0014] Within the tapered sealing section, the convex surface can comprise a portion of the surface, for example a central annular portion of that surface. The portion may be small, say 10 to 40%, or may extend a larger portion, for example from 50% to 95% of the surface. In some embodiments, the convex surface extends across substantially all of the inwardly tapered sealing section. The surface of the tapered sealing section therefore forms a convex shape.

[0015] The dimensions and curvature of the convex taper can be any suitable dimension. The convex taper can have any suitable curve or arc to provide the convex form. Examples of suitable arc include segments or sectors of a round or curved shape such as a circle, oval or the like, segments of a parabola, arc or the like. In some embodiments, the convex taper comprises a segment or sector of a circle having a radius of between 0.5 to 2 times the inner radius of the tubular connector section. In some embodiments, the convex taper has a radius of between 0.5 and 1.5 times the inner radius of the tubular connector section.

[0016] The nut connector preferably comprises a standard shaped nut connector. Thus, in some embodiments, the nut connector is a hexagonal shaped nut. However, it should be appreciated that other shaped nut connectors can be used, for example a round nut. In some embodiments, the external surfaces of the nut connector are coloured. Whilst any colour is possible, such as red, orange, green, purple, blue, red, violet, white or the like, the external surfaces of the nut connector are preferably coloured black. The colour used on the nut, and in particular a black colour, provides a distinctive contrast to the tubular connector section and ferrule connector portion of the fluid fitting, which are typically of the native material colour of manufacture, for example metallic silver. This contrasting colour combination makes the fitting readily identifiable to consumers, and can provide an indication of origin, and in particular trade origin, of the fluid fitting identifiable with the Applicant.

[0017] The tubular connector section can have any suitable configuration. In some embodiments, the tubular connector section comprises a stem having the nut mounted thereon. The nut can be mounted on the tubular connector section using a variety of mounting configurations. In some embodiments, the connector section includes an annular projection or flange to retain nut connector thereon. In some embodiments, the connector section includes an annular groove or channel which received an annular flange of the nut connector so as to retain the nut connector thereon.

[0018] It should be appreciated that the male connector is preferably one end of a fitting, preferably an adaptor, more preferably a high pressure adaptor. The adaptor has a male connector receivable within the nut connector at one end and another connector configuration (male, clip, snap fit or the like) on the other end. The adaptor can have any suitable configuration selected for a particular application. Examples of suitable adaptors include straight, compact and swept 45° and 90°, sockets, bulkhead, caps, plugs, reducing bushes, tee's, weld-on or the like.

[0019] Ferrule type connectors are configured to be fixed onto an end of a conduit, for example a pipe or hose, preferably a reinforced, flexible hose. The ferrule connector preferably comprises a ferrule sleeve which extends around a ferrule stem to cooperatively capture an end of a conduit within the ferrule connector. The ferrule sleeve is configured to receive a conduit therein and the ferrule stem (a male-stem) is configured to be inserted within the conduit. Together, the ferrule stem and ferrule sleeve define an annular cavity for receiving a hose end.

[0020] A ferrule connector is retained on the conduit by pinching the conduit end in the annular cavity between the ferrule sleeve and stem, such as by either radially reducing some part or element of the ferrule sleeve or by radially increasing the size of the ferrule stem. In some embodiments, the ferrule sleeve is configured to be constricted around the end of a conduit. In some embodiments, the ferrule stem is configured to expand the diameter of the end of the conduit the stem is inserted within. Of course, a combination of the above sleeve constriction and ferrule stem expansion can also be used.

[0021] It should be appreciated that the ferrule connector can have any number of suitable configurations. Some ferrule connectors are of the reusable type and use a mechanical means of the fitting such as threaded members that activate means for pinching a hose against a stem, for example as described in European patent EP0241651. For example, the ferrule connector can comprise a crushable type of ferrule in which the radial size of a ferrule, more particularly the ferrule sleeve is reduced through crushing by, for example, a crimping process or other means. In other embodiments, the ferrule connector comprises a serrated stem with a ferrule locking collar. In some embodiments, a ferrule sleeve may be pre-attached to a stem and then attached to the ferrule locking collar. In exemplary embodiments, the ferrule sleeve is integrally connected with the ferrule stem. The ferrule can be configured to grip a conduit end with or without an insert.

[0022] The ferrule connector can be attached to the connector stem using a variety of different connections. In some embodiments, the ferrule connector is integrally connected, preferably integrally formed, with the tubular connection section. The fluid fitting preferably includes an internal bore extending between the distal end of the connector section and the ferrule connector. Advantageously, that internal bore is continuous when the ferrule connector and tubular connection section are integrally connected. No fluid can therefore leak when flowing through that internal bore.

[0023] The fluid fitting typically includes an intermediary portion between the nut connector and ferrule connector which fluidly connects these connector ends of the fluid fitting. The intermediary portion can have any suitable configuration. In some embodiments, the intermediary portion is a straight or linear configuration. In other embodiments, the intermediary portion is angled, for example right angle, 45 degree angle, 30 degree angle or the like. In yet other embodiments, the intermediary portion include one or more curved sections.

[0024] The conduit fitting of the present invention can be manufactured of any suitable material including (but not limited to) polymer, metals, alloys thereof or

the like. Examples include plastics, stainless steel, steel, iron, copper, brass or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The present invention will now be described with reference to the figures of the accompanying drawings, which illustrate particular preferred embodiments of the present invention, wherein:

[0026] Figure 1A is a perspective view of a ferrule type fluid fitting according to one embodiment of the present invention connected with a male-to-male adaptor.

[0027] Figure 1B is a further perspective view of one form of ferrule type fluid fitting as shown in Figure 1A.

[0028] Figure 2 is a front cross-sectional view of the ferrule type fluid fitting and connected male-to-male adaptor shown in Figure 1A.

[0029] Figure 3 is an enlarged view of the connection between a nut connector of the ferrule type fluid fitting and male-to-male adaptor shown in Figure 2.

[0030] Figure 4 is a front cross-sectional view of a conventional (prior art) ferrule type fluid fitting and connected male-to-male adaptor.

[0031] Figure 5 is an enlarged view of the connection between a nut connector of the conventional (prior art) ferrule type fluid fitting and male-to-male adaptor shown in Figure 4.

DETAILED DESCRIPTION

[0032] A complete fitting/ fluid fitting 100 according to the present invention connected with an adaptor fitting 105 are illustrated in Figures 1A to 3. A conventional (prior art) fluid fitting 200 connected with the same adaptor fitting 105 (as shown in Figures 1A to 3) is illustrated in Figures 4 and 5 for comparative purposes.

[0033] Turning firstly to Figures 1A to 3 showing the fluid fitting 100 according to the present invention, it can be seen in that the fluid fitting 100 (as best shown in Figures 1A, 1B and 2) includes three distinct sections, comprising a ferrule connector 110, a nut connector 115, and a connector stem 120 on which the nut connector 115 is rotatably mounted. The ferrule connector 110 is integrally formed with connector stem 120, with the connector stem 120 forming one axial end of the fluid fitting 100 and the ferrule 110 forming the other axial end of the fluid fitting 100 to form a unitary one-piece unit. As best shown in Figure 2, the fluid fitting 100 has an internal bore 120 running longitudinally through the center of the fitting 100, forming a fluid passage between the ferrule connector 110, and the nut connector 115.

[0034] The illustrated adaptor fitting 105 comprises a high pressure adaptor having a straight male-to-male thread configuration, thus having two threaded male connector ends. It should be appreciated that this adaptor fitting 105 can have any suitable configuration selected for a particular application. Furthermore, whilst one end comprises a threaded male connector, in other embodiments, the other connector end could have any suitable connector configuration including female, quick fit, snap fit or the like. Examples of adaptor fitting 105 that could be received by nut connector 115 include straight, compact and swept 45° and 90°, sockets, bulkhead, caps, plugs, reducing bushes, tee's, weld-on or the like.

[0035] The illustrated nut connector 115 comprises a hexagonally shaped internally threaded nut which is rotatably mounted over the tubular connector stem 120. The connector stem 120 comprises a tubular stem extending from the end of the ferrule connector 110. The connector stem 120 includes an annular channel 122 which receives an annular flange 124 of the nut connector 115 so as to retain the nut thereon. The annular channel 122 forms an annular projection/ flange 126 which seats behind the annular flange 124 of the nut connector 115 to retain nut connector 115 thereon.

[0036] As shown in Figure 1B, the external surfaces of the nut connector 115 are coloured black in some embodiments. Black provides a distinctive contrast to the stem connector 120 and ferrule connector 110 portion of the fluid fitting

100, which are typically of the native material colour of manufacture, for example metallic silver. This contrasting colour combination makes the fluid fitting 100 readily identifiable to consumers, and can provide an indication of origin, and in particular trade origin, of the fitting identifiable with the Applicant. It should be appreciated that the colour can be applied using any suitable method, such as the application of a coating. The coating may be a coloured paint, powder coating or the like designed to coat and adhere to the material of the nut connector 115. In some embodiments, the colour may be a result of the composition of the material of the nut connector 115 or outer surface layers of the nut connector 115.

[0037] The nut connector 115 is configured to receive and cooperatively seal with a complementary configured threaded male connector, for example adaptor fitting 105. As best shown in Figure 3 the connector stem 120 has a distal end 128 which includes an inwardly tapered sealing surface 130. That sealing surface 130 has a convex shape. The sealing surface 130 slopes inwardly from the outer diameter to the inner diameter in an axial direction toward the ferrule connector 110. The dimensions and curvature of the convex shape can be any suitable dimension. The convex taper can have any suitable curve or arc to provide the convex form.

[0038] A cooperative seal between the male connector 105 and the nut connector 115 is a result of abutting engagement between a taper end surface 135 of the male connector 105 and the convex sealing surface 130 of the connector stem 120. The convex sealing surface 130 provides a curved engagement surface which is better at accommodating changes, alignment issues or movement between the abutting surfaces. The convex shape of the sealing surface 130 of the connector stem 120 therefore provides advantageous sealing properties to the fluid fitting 100 of the present invention.

[0039] This can be seen when compared to a conventional flat tapered sealing surface 230 of a conventional fluid fitting shown in Figure 4 and 5. It should be appreciated that this fluid fitting 200 has a similar configuration to the fluid fitting 100 shown in Figures 1A to 3, with the exception of the configuration of the

tapered sealing surface 230. Like features have been provided the same reference numeral plus 100.

[0040] As best shown in Figure 5, the connector stem 215 of this conventional fluid fitting 200 has a distal end 228 which includes a flat inwardly tapered sealing surface 230. A cooperative seal between the adaptor fitting 105 and the nut connector 215 is therefore a result of abutting engagement between a taper end surface 135 of the adaptor fitting 105 and the flat sealing surface 230 of the connector stem 215. The abutting surfaces between the flat sealing surface 230 of the connector stem 215 and the adaptor fitting 105 is a small annular area. A fluid tight seal requires a tight and aligned fit between the threaded cooperating parts of the nut connector 215 and the adaptor fitting 105 thereby ensuring these relevant surfaces abut. The fluid pressure and damage can alter the fit in this small abutting connection/ sealing area.

[0041] Referring again to Figures 1A to 3, the illustrated ferrule connector 110 comprises a ferrule sleeve 140 which extends around a ferrule stem 142. Together, the ferrule stem 142 and ferrule sleeve 140 define an annular cavity 144 for receiving a hose end. The ferrule sleeve 140 and ferrule stem 142 cooperatively capture an end of a conduit (not illustrated in the figures) within the ferrule connector 110. The ferrule sleeve 140 is configured to receive a conduit therein. The ferrule stem 142 (a male-stem) configured to be inserted within the conduit.

[0042] A ferrule connector 110 is retained on a conduit by pinching the conduit end in the annular cavity 144 between the ferrule sleeve 140 and stem 142, such as by either radially reducing some part or element of the ferrule sleeve 140 or by radially increasing the size of the ferrule stem 142. This can be by constricting, crushing or the like, the ferrule sleeve 142 around the end of a conduit and/or by expanding the diameter of the end of the conduit around the ferrule stem 142. It should be appreciated that the present invention encompasses all of these ferrule connector configurations. In illustrated embodiments, the ferrule sleeve 140 and stem 142 are integrally connected.

[0043] Whilst the illustrated fluid fitting 100 comprises a linear fitting, it should be appreciated that the fluid fitting could include an intermediary angled or curved portion. For example, the intermediary portion could include a right angle, 45 degree angle, 30 degree angle or one or more curved sections or the like.

[0044] The fluid fitting 100 is secured to a conduit (not illustrated) by inserting an open conduit end into the annular cavity 144 within the ferrule sleeve 140 of the ferrule connector 110 and onto the ferrule stem 142. The conduit is then secured therein using friction, crushing as is appropriate for that ferrule connector design. The attached conduit is then ready for attachment to a fluid system by threading the nut connector 115 onto an adapter or other termination, for example the illustrated adaptor fitting 105.

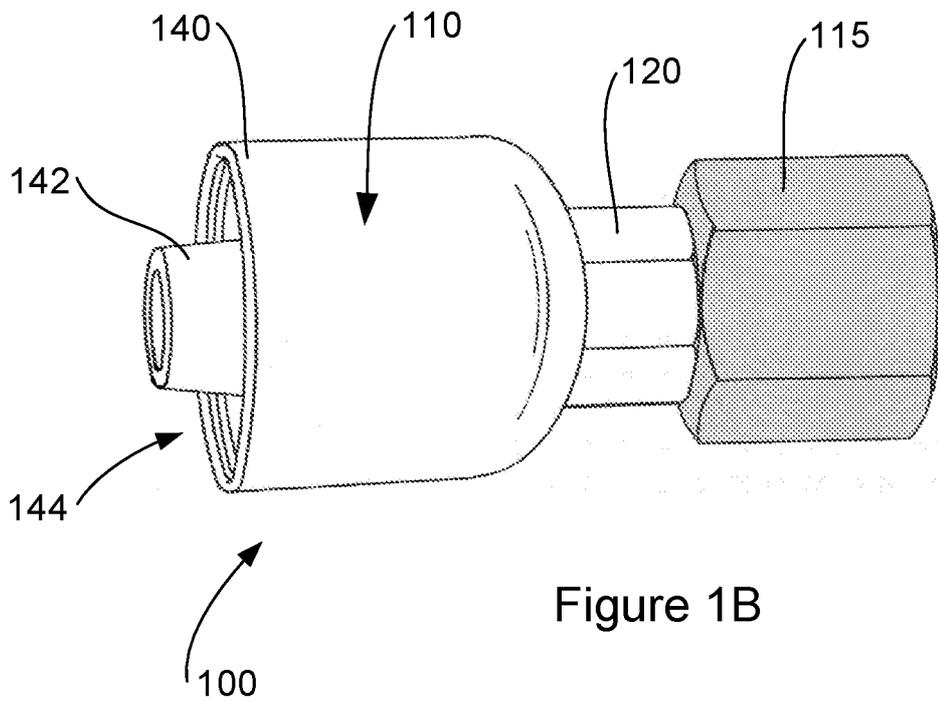
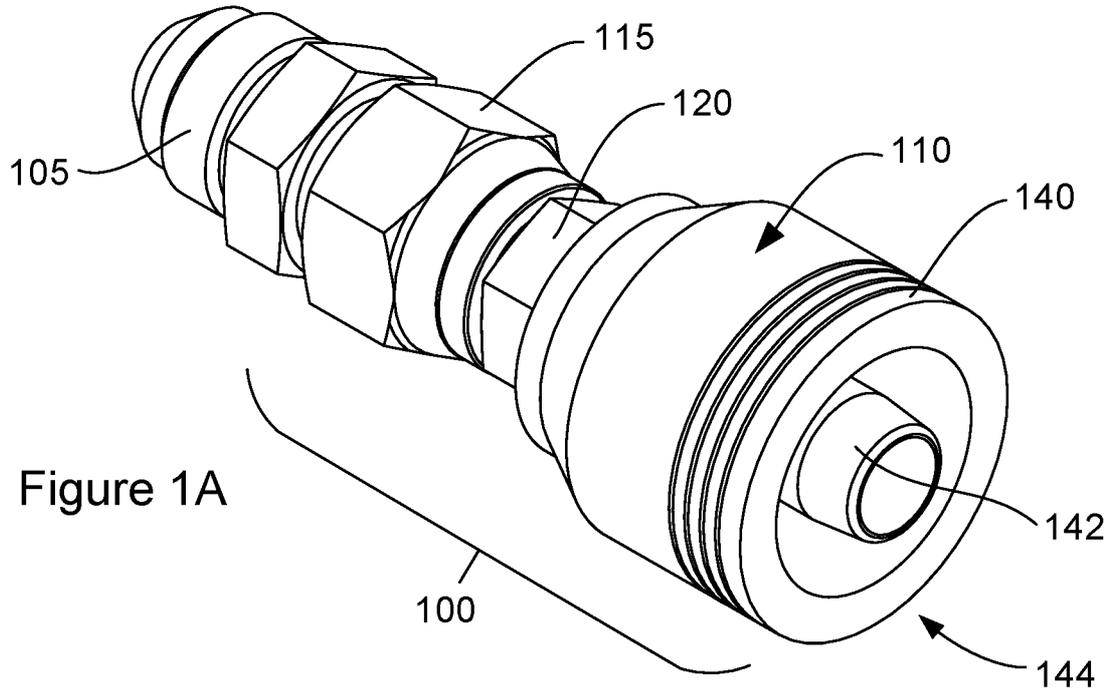
[0045] Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. It is understood that the invention includes all such variations and modifications which fall within the spirit and scope of the present invention.

[0046] Where the terms "comprise", "comprises", "comprised" or "comprising" are used in this specification (including the claims) they are to be interpreted as specifying the presence of the stated features, integers, steps or components, but not precluding the presence of one or more other feature, integer, step, component or group thereof.

CLAIMS

1. A fluid fitting having two fluidly connected connection ends comprising a ferrule connector configured to be fixed onto an end of a conduit, and a female nut connector, wherein the female nut connector is rotatably mounted over a tubular connector section of the fluid fitting, the connector section having a distal end which includes an inwardly tapered sealing section including an annular portion having a convex surface configured for abutting engagement with a cooperating end of a male connector inserted within the nut connector.
2. A fluid fitting according to claim 1, wherein the tapered sealing section comprises an inner surface of the tubular connector section, between an outer diameter and an inner diameter of the tubular connector section.
3. A fluid fitting according to claim 1 or 2, wherein the convex surface extends across substantially all of the inwardly tapered sealing section.
4. A fluid fitting according to any preceding claim, wherein the external surfaces of the nut connector are coloured, preferably black.
5. A fluid fitting according to any preceding claim, wherein the tubular connector section comprises a stem having the nut connector mounted thereon.
6. A fluid fitting according to any preceding claim, wherein the connector section includes at least one of:
 - an annular projection to retain nut connector thereon; or
 - an annular groove or channel which received an annular flange of the nut connector so as to retain the nut connector thereon.
7. A fluid fitting according to any preceding claim, wherein the ferrule connector is integral with the tubular connection section.
8. A fluid fitting according to any preceding claim, wherein the ferrule connector comprises a ferrule sleeve which extends around a ferrule stem to cooperatively capture an end of a conduit within the ferrule connector, the

ferrule sleeve configured to receive a conduit therein and the ferrule stem configured to be inserted within the conduit.



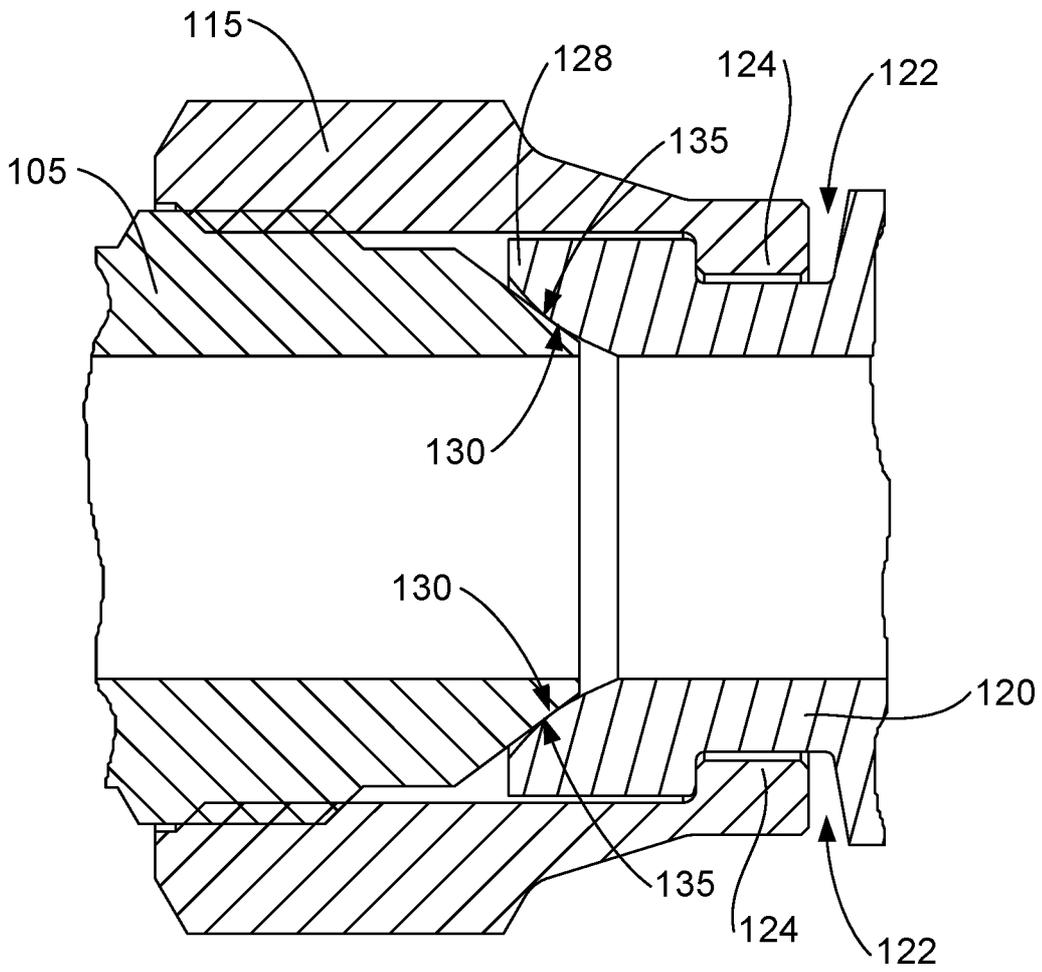
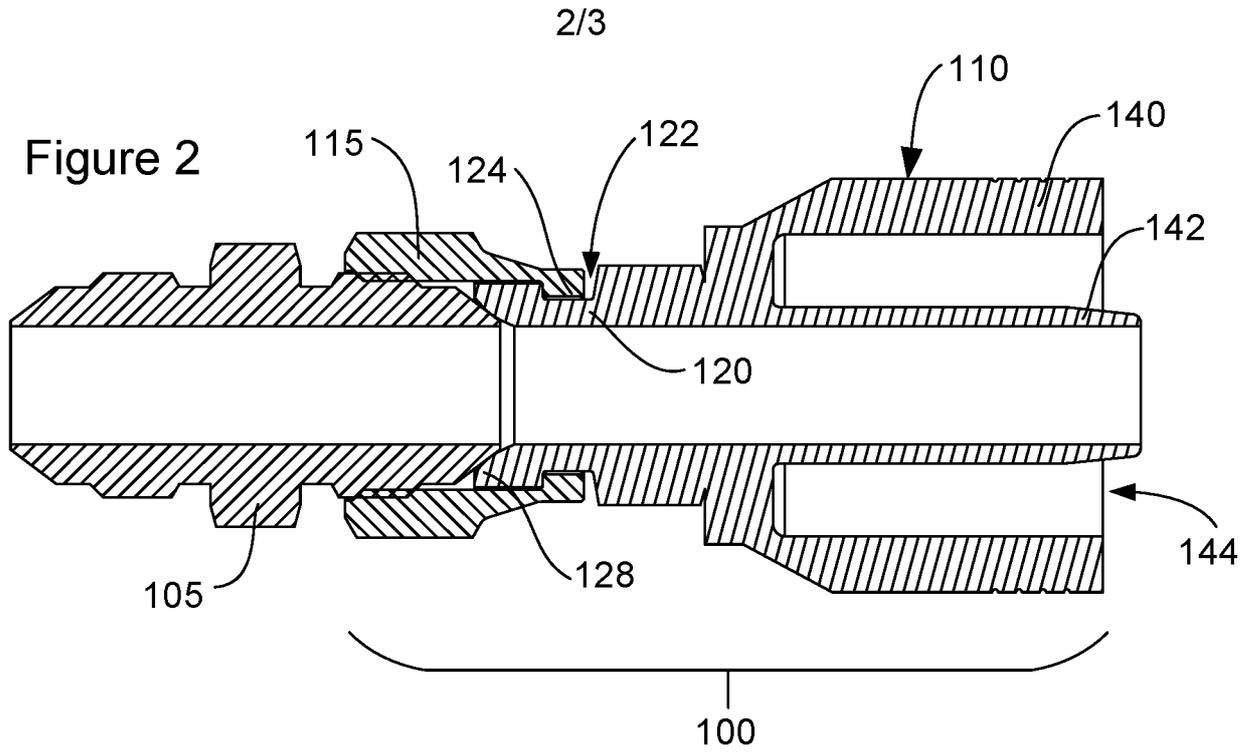


Figure 3

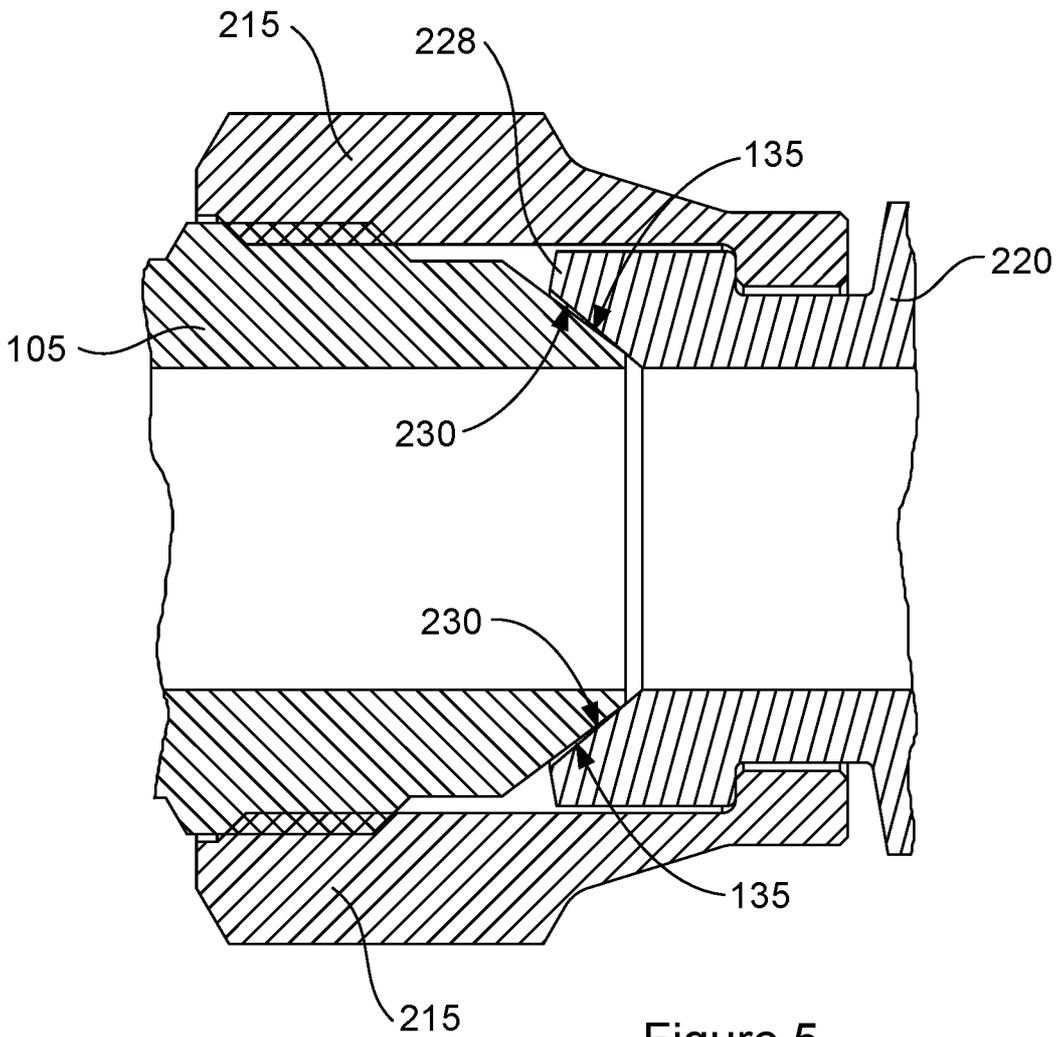
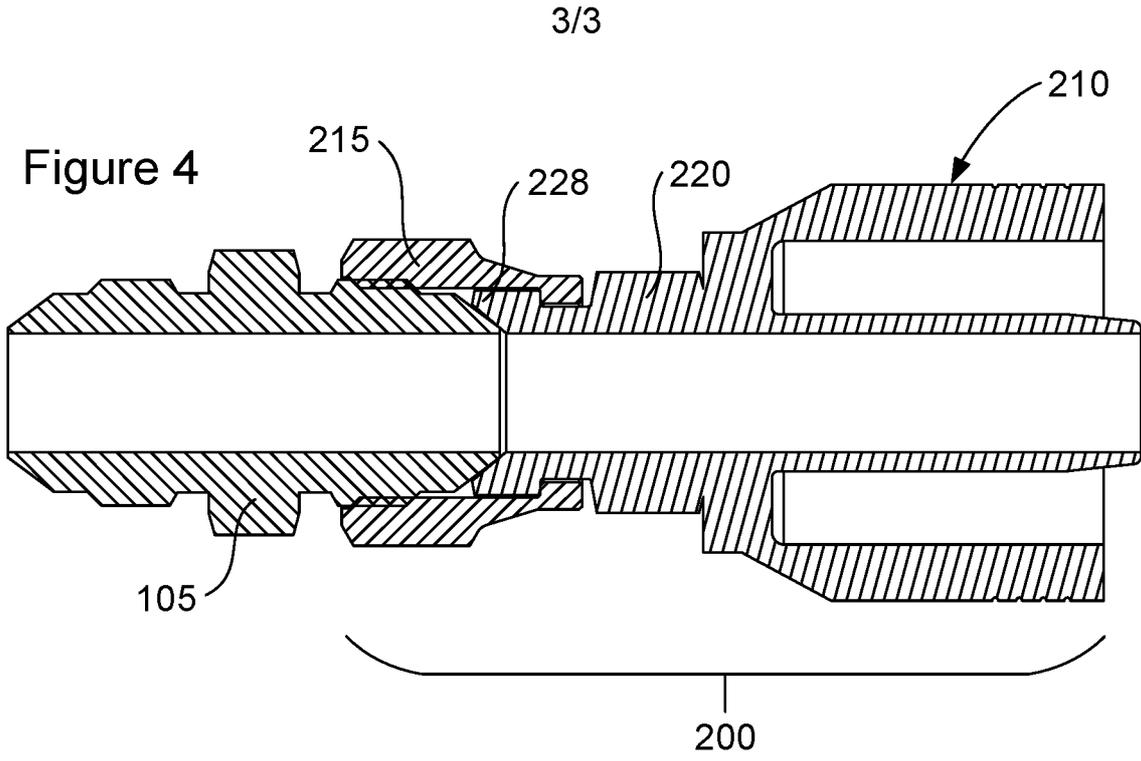


Figure 5