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(54) **FITTING ASSEMBLY FOR INTERNALLY SEALING A CORRUGATED TUBE AND A METHOD FOR USING THE SAME**

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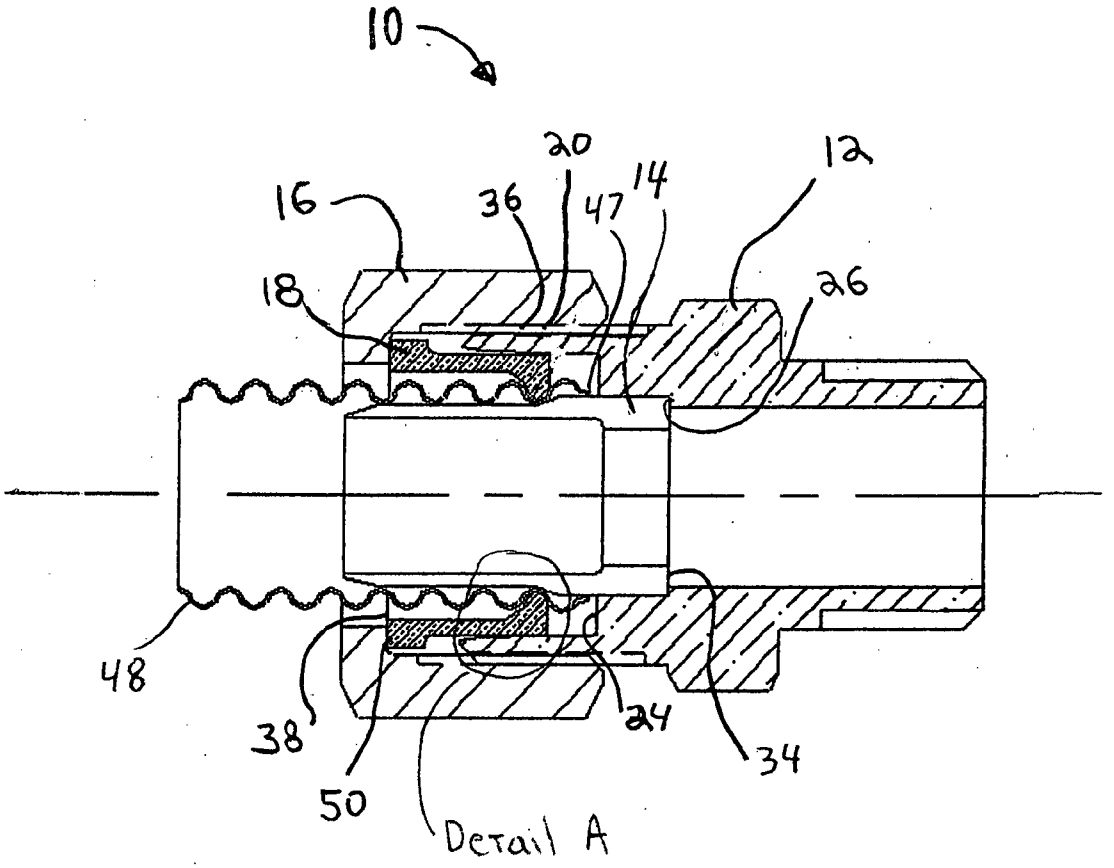
(57) **ABSTRACT**

A fitting assembly for corrugated tubing is provided including a body, an insert, locking means and a bushing. The body includes first connecting means. The locking means includes second connecting means. The insert is sealingly engaged with the body and includes a transition area of increased outside diameter. The bushing includes an inwardly projecting protrusion for engagement with a trough disposed on an external surface of a corrugated tube. The first and second connecting means engage to removably secure the bushing, an end of the corrugated tube and at least a portion of the insert within the body and the locking means to pinch a circumferential section of the corrugated tube between the protrusion and the transition area, and to seal an internal surface of the circumferential section with the transition area.



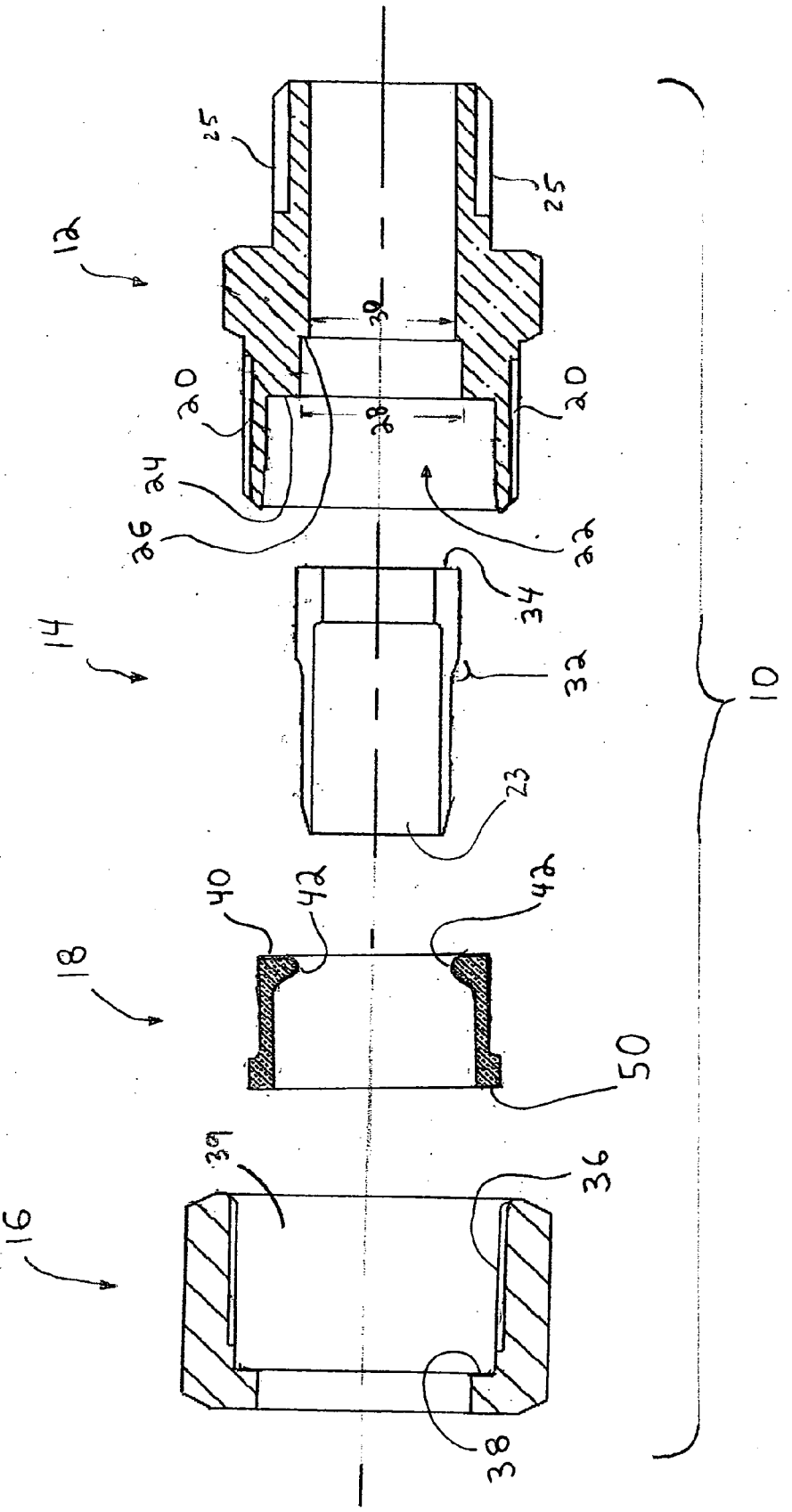
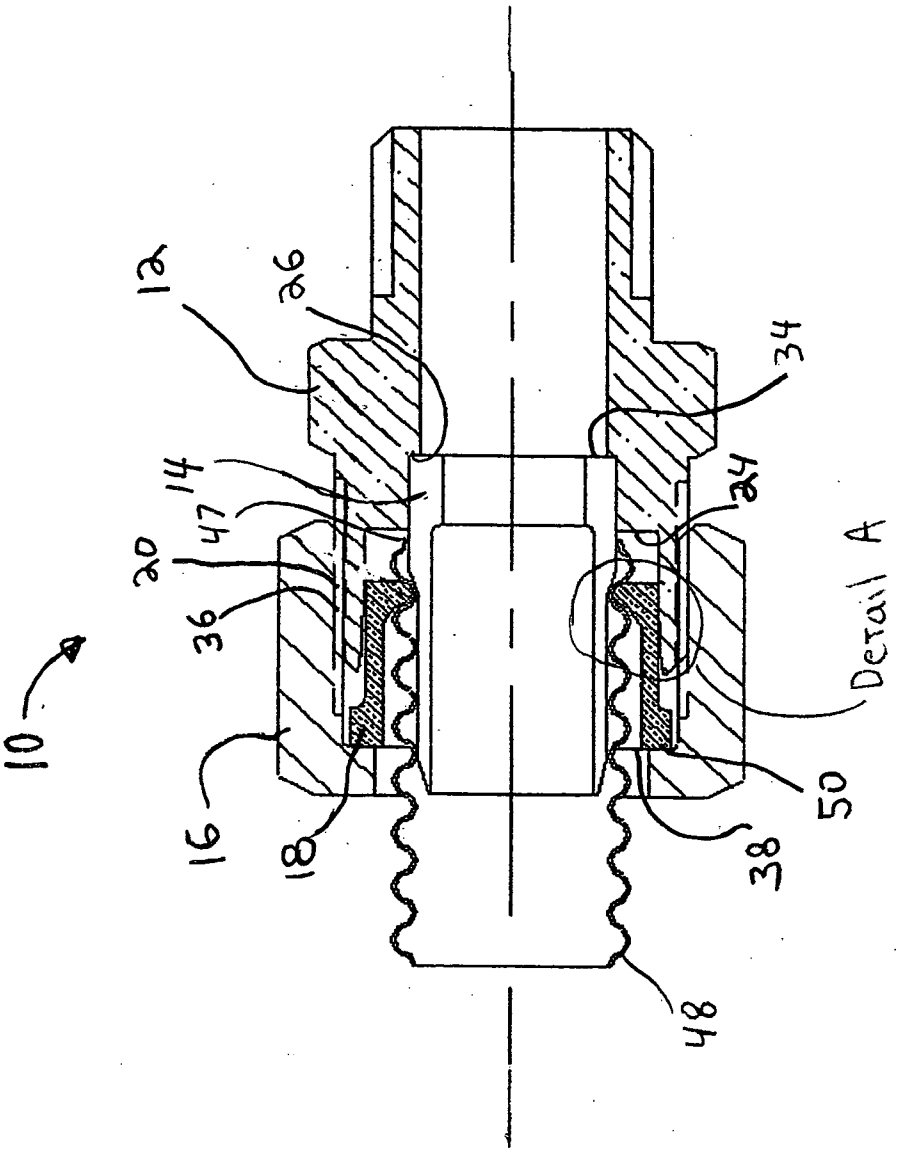


FIG. 1

FIG. 2



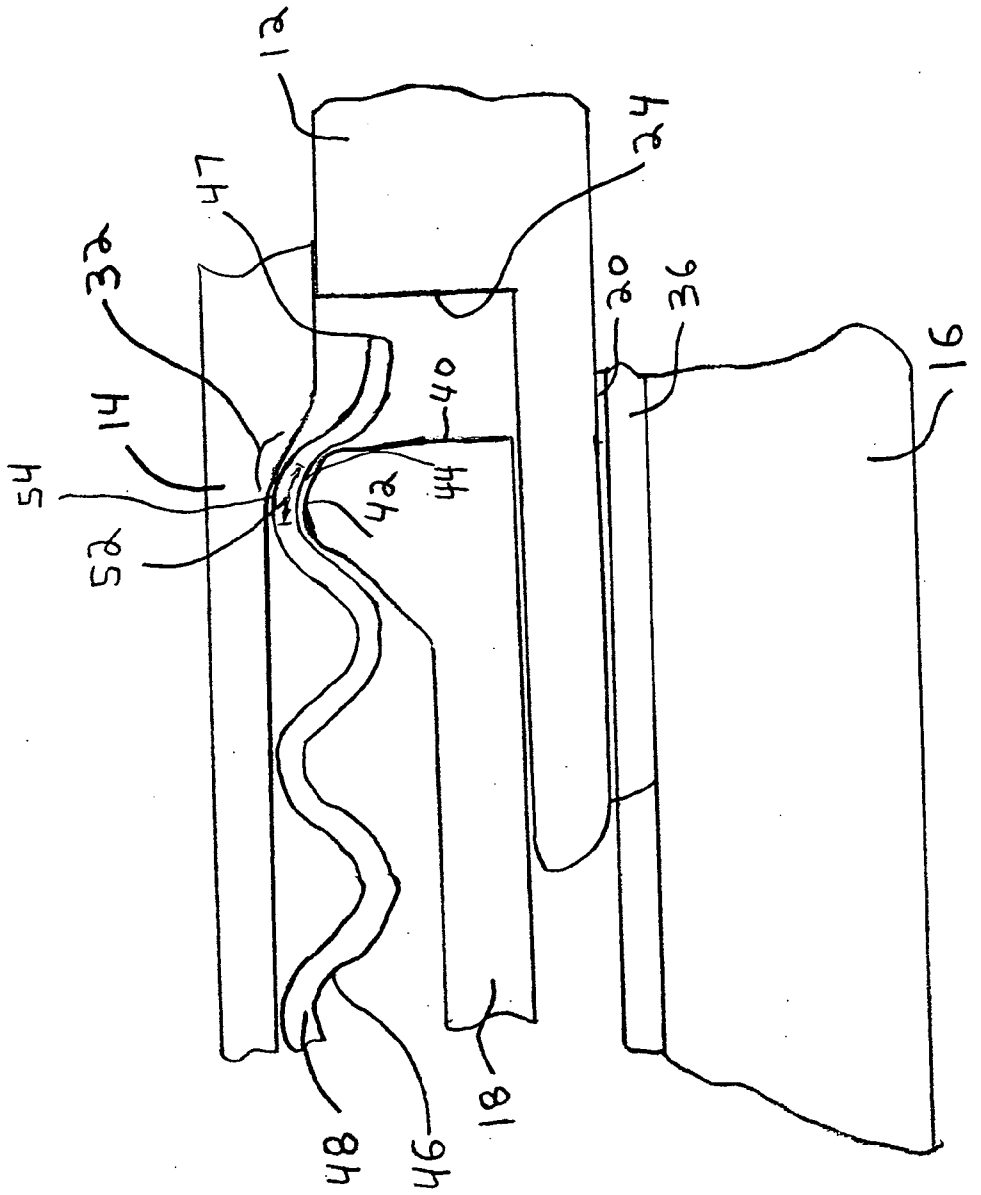
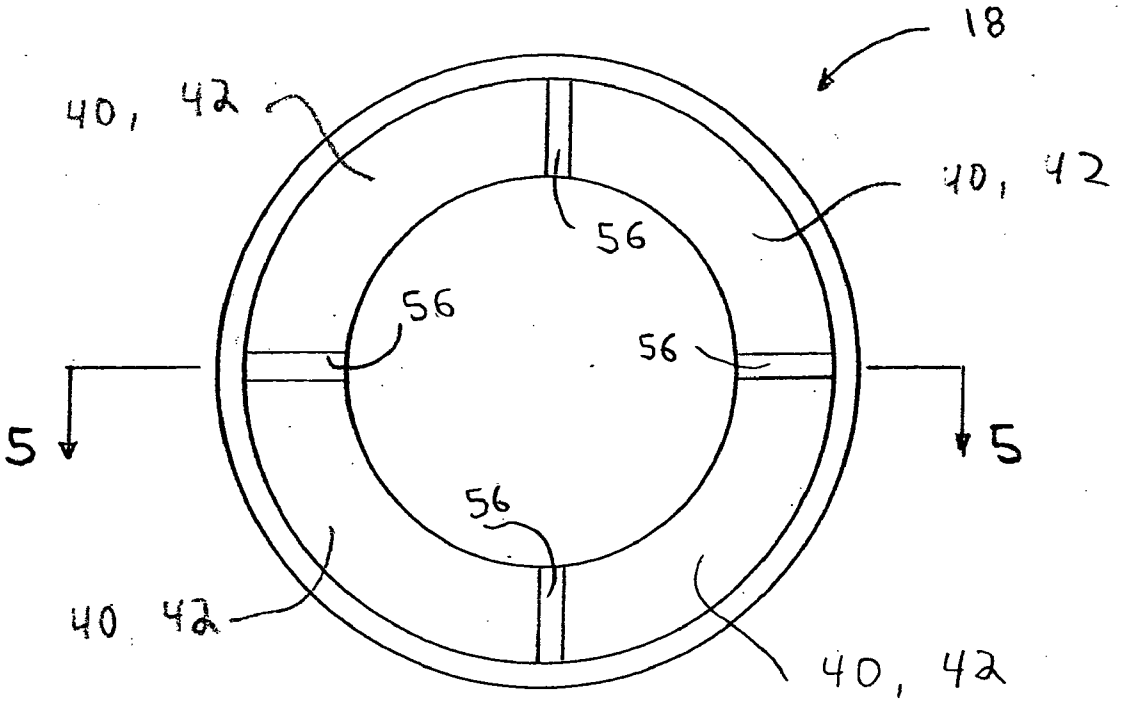


FIG. 3

FIG. 4



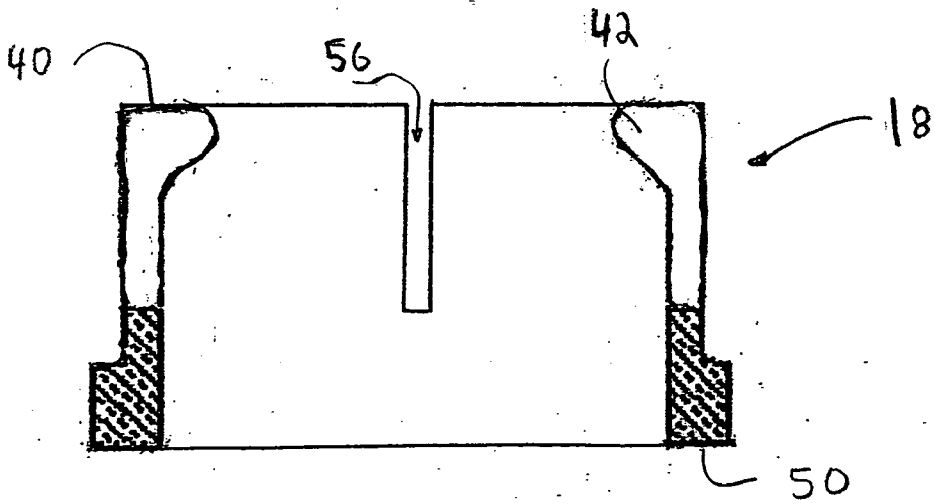
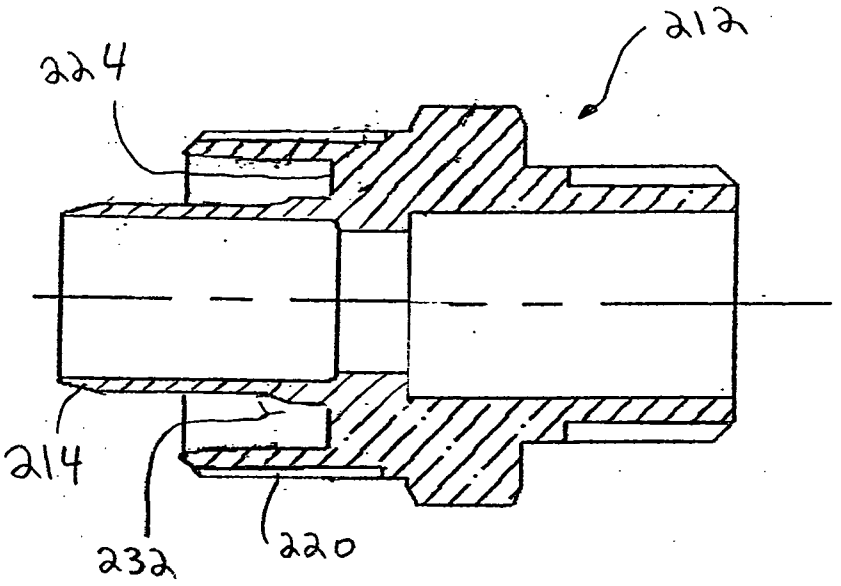


FIG. 5

FIG. 6



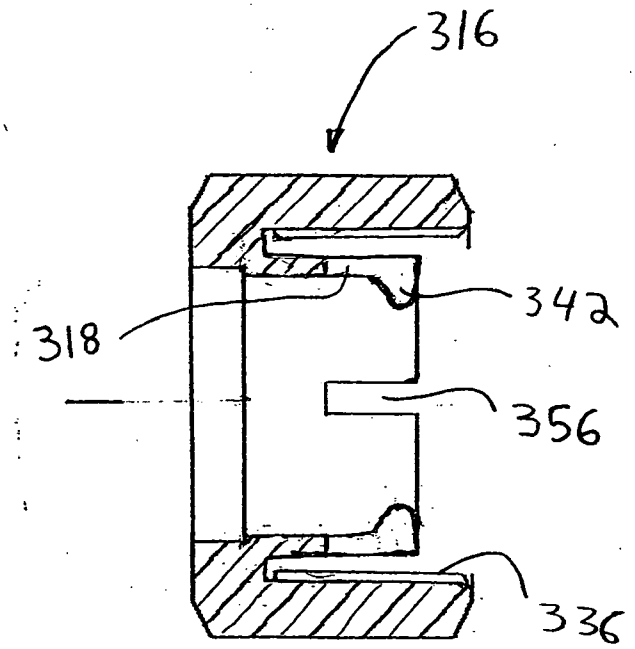


FIG. 7

FITTING ASSEMBLY FOR INTERNALLY SEALING A CORRUGATED TUBE AND A METHOD FOR USING THE SAME

[0001] This application claims priority from provisional application serial No. 60/701,072, filed Jul. 19, 2005, the disclosure of which is incorporated by reference in its entirety.

FIELD OF THE INVENTION

[0002] This present invention is generally directed to a fitting assembly for sealing a corrugated tube and more specifically directed to sealing a portion of the fitting assembly with an internal section of the corrugated tube.

BACKGROUND OF THE INVENTION

[0003] In plumbing applications, sections of pipe, tubing, or conduit are typically connected to one another to provide for the flow of fluids within a system. In connecting these sections, it is generally desirable to seal the connections in order to avoid or at least minimize the loss of fluid due to leaks or fugitive emissions. Various techniques exist for sealing the connections. Two of such techniques include welding and the use of adhesives.

[0004] When sections of pipe, tubing, or conduit are connected by welding, disconnection for service, repair, routine maintenance, or restructuring of the system often involves cutting or otherwise physically separating the sections. Disconnection usually involves cutting using high speed rotary tools. When the sections being cut apart are metal, sparks are often generated, which creates an undesirable condition. Even if the sections being cut are plastic, dust or flying debris may be generated. In either case, the integrity of the pipe, tubing, or conduit is compromised, and new sections must be fabricated and reinstalled.

[0005] When sections are connected with adhesives, disconnection may also involve cutting or some other physical method of separation (e.g., melting the adhesive), or it may involve effecting a chemical change to the adhesive. Melting the adhesive or using chemical techniques to separate the sections are often time consuming and costly practices. Reassembly of the system generally involves adhesively connecting new systems of pipe.

[0006] Therefore, connectors and fittings which provide releasable sealing capability are preferred for applications where disassembly is likely. Various connectors and fittings having releasable sealing capability are used to seal the outside surfaces of sections of pipe, tubing, or conduit with one another. However, in applications using corrugated tubing, inside and outside surfaces have ridges and troughs making sealing with prior art connectors and fittings ineffective. In addition, sealing on the outside surface of tubing is undesirable because walls of the tubing can become unintentionally distorted when the connector is secured thereby increasing the potential for leakage.

[0007] There is a need to provide a fitting or connector for releasably sealing corrugated tubing where the sealing is made inside the tubing. Prior art connectors and fittings for addressing these needs were either too expensive, inefficient, ineffective, or a combination of all of these. Based on the foregoing, it is the general object of the present invention to improve upon or overcome the problems and drawbacks of the prior art.

SUMMARY OF THE INVENTION

[0008] According to one aspect of the present invention, a fitting assembly for a corrugated tube includes a body, an insert, a locking device, and a bushing. The body includes a first connector, a first bore, a first shoulder, and a second shoulder. The insert is receivable on the second shoulder and has a second bore, two external surfaces (one of increased outside diameter), and a transition area between the two external surfaces. The locking device has a second connector that is selectively receivable on the first connector. The bushing is slidable over the insert and securable in the body and the locking device via the first and second connectors.

[0009] According to another aspect of the present invention, an internally sealable fitting assembly includes a body having a bore; an insert coaxially positioned in the bore; a castellated bushing receivable over said insert; and a locking device selectively receivable on the body. The insert is dimensioned to receive a corrugated tube thereon. Receiving the locking device on the body urges the bushing against the corrugated tube to clamp the corrugated tube against the insert.

[0010] When the fitting is assembled, the first and second connectors engage to releasably secure the bushing, the end of the corrugated tube, and at least a portion of the insert within the body and the locking device. In addition, a circumferential section of the corrugated tube is clamped between the protrusion and the transition area to seal an internal surface of the circumferential section with the transition area.

[0011] In another aspect of the present invention, a method of installing a fitting assembly for a corrugated tube includes providing the fitting assembly, sliding a locking device of the fitting assembly onto the corrugated tube, sliding a bushing of the fitting assembly onto the corrugated tube, positioning a protrusion on the bushing into a trough in the corrugated tube, abutting an insert against a surface in a body to sealingly engage the insert with the body, sliding the locking device, the bushing, and the corrugated tube over the insert, and engaging the locking device and the body to releasably secure the bushing, an end of the corrugated tube, and at least a portion of the insert within the body and the locking device. When the locking device and the body are fully engaged, a circumferential section of the corrugated tube is clamped between the protrusion and the insert to seal the corrugated tube.

DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is an exploded cross sectional view of the fitting assembly for a corrugated tube.

[0013] FIG. **2** is a cross sectional view of the fitting assembly installed on a section of corrugated tube.

[0014] FIG. **3** is a view of detail A of FIG. **2** illustrating a circumferential section of the corrugated tube held between the projection and the transition area.

[0015] FIG. **4** is a top view of an embodiment of a castellated bushing.

[0016] FIG. **5** is a cross sectional view of the castellated bushing shown in FIG. **4**.

[0017] FIG. **6** is a cross sectional view of an embodiment of the body having the insert integral therewith.

[0018] FIG. **7** is a cross sectional view of locking means having the bushing integral therewith.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Referring to FIG. **1**, a fitting assembly for sealing an end of a corrugated tube to create a gas or liquid seal is shown at **10**. The fitting assembly **10** includes a body **12**, an insert **14**, a locking device **16**, and a bushing **18** and can be used between lengths of corrugated tube, as an adapter to another coupling device or fitting, or to terminate a length of corrugated tube. Sealing is effected between an inner surface of the corrugated tube and an outer surface of the insert **14** received in an end of the corrugated tube.

[0020] The body **12** includes a first connector **20** having male threads, a first bore **22**, a first shoulder **24**, and a second shoulder **26**. The first bore **22** transitions to a reduced cross section **28** at the first shoulder **24**, and the reduced cross section transitions to a further reduced cross section **30** at the second shoulder **26**. While the first connector **20** is shown as having male threads, the present invention is not limited in this regard as other connecting means may also be utilized including but not limited to bayonet type connections. The body **12** may also have male threads **25** located on an end opposite the end at which the first connector **20** is shown to facilitate the connection to any other device having connectable female threads. In the alternative, the body **12** may be capped at the end opposite the end at which the first connector **20** is shown.

[0021] The insert **14**, which provides for the free flow of fluid (or at least negligible or minimal restriction of fluid flow), has a second bore **23** and a transition area **32**. The transition area **32** is defined by a curved surface that extends radially from a portion of the external surface of the insert to another portion of the external surface having an increased outside diameter. The insert **14** is coaxially received in the bore **22**, and at least a portion of one end **34** of the insert **14** abuts the second shoulder **26** to sealingly engage the insert with the second shoulder. While the insert **14** is described as being sealing engaged with the second shoulder **26**, the present invention is not limited in this regard as the insert may be sealingly engaged with the reduced cross section **28**, any suitable surface of the body **12**, or a combination thereof.

[0022] The bushing **18** is a castellated member defined by a plurality of splits formed, cut, or otherwise disposed at a first end **40**. An inwardly projecting protrusion **42** is located at the first end **40**. The inwardly projecting protrusion **42** is configured such that as the bushing **18** is received over corrugated tubing, the splits allow the bushing to flex so that the surfaces of the inwardly projecting protrusion are received on the external surfaces of the corrugation.

[0023] The locking device **16** is a member having a through bore **39** extending therethrough. A second connector **36** defined by female threads is located in the through bore. **39** proximate one end in which the bushing **18** is received. The opposing end includes a receiving shoulder **38** on which the bushing may be received. The locking device **16** is open at the end having the second connector **36** to receive the bushing **18**, the insert **14**, and the body **12** and is also open at the opposite end to allow the corrugated tube to extend therethrough. While the second connector **36** is described as having female threads, the present invention is not limited in this regard as other connectors may also be utilized including, but not limited to, bayonet-type connections.

[0024] Referring to FIG. **2**, the first connector **20** on the body **12** and the second connector **36** on the locking device **16** engage to releasably secure the body and the locking device together. An opposing end **50** of the bushing **18** is seated on the receiving shoulder **38** of the locking device **16**. Securing the body **12** and the locking device **16** together urges the bushing and an end **47** of the corrugated tube **48** over the insert **14** towards the first shoulder **24**. The first connector **20** and the second connector **36** engage to seal the corrugated tube **48** to the insert **14** and to secure the bushing **18**, the end **47** of the corrugated tube, and at least a portion of the insert within the body **12** and the locking device **16**.

[0025] Referring now to FIG. **3**, when the fitting assembly **10** is properly assembled with a corrugated tube **48**, the protrusion **42** on the bushing **18** engages with a trough **44** in or formed by an external surface **46** of the corrugated tube. When the protrusion **42** engages the trough **44**, a circumferential section **52** of the corrugated tube **48** is clamped between the protrusion and the transition area **32**, thereby sealing an internal surface **54** of the circumferential section with the transition area. The sealing engagement between the internal surface **54** and the transition area **32** is maintained until the body **12** is released relative to the locking device **16**, which causes the bushing **18** and the insert **14** to move in opposite directions, thereby releasing the internal surface from the transition area.

[0026] Referring now to FIGS. **4** and **5**, the bushing **18** is shown as having four splits **56** extending through the protrusion **42**, the splits terminating between the first end **40** and the opposing end **50**. The splits **56** are circumferentially disposed around the bushing **18** for allowing the bushing to flex when sliding the bushing axially along the corrugated tube **48** shown in FIGS. **2** and **3**. While four splits **56** are illustrated, the present invention is not limited in this regard as the bushing may have any number of cuts to allow the bushing to flex.

[0027] Referring now to FIG. **6**, a body **212** is shown having an integral insert **214**. The insert **214** is attached to the body **212** at a first shoulder **224**. A transition area **232** is formed on the exterior surface of the insert **214**. A connector **220** having male threads is formed on the body **212** to allow the body to be connected to a locking device.

[0028] Referring now to FIG. **7**, a locking device **316** is shown having an integral bushing **318**. The bushing **316** is shown having splits **356** for allowing the bushing to flex when the bushing is pushed axially along the corrugated tube **48** shown in FIGS. **2** and **3**.

[0029] Referring generally to FIGS. **1-6** the insert **14**, **214** is manufactured from a material softer than the corrugated tube **48**. Similarly, the body **12**, **212** is manufactured from a material softer than the corrugated tube **48**. While the insert **14**, **214** is said to be softer than the corrugated tube **48**, the present invention is not limited in this regard as in another embodiment of the present invention the insert may be manufactured from a material which is as hard as or harder than the corrugated tube. Although the body **12**, **212** is said to be softer than the corrugated tube **48**, the present invention is not limited in this regard as in another embodiment

the body may be manufactured from a material which is as hard as or harder than the corrugated tube.

[0030] A method of using the fitting assembly for the corrugated tube **48** as shown in FIGS. **1-5** includes the steps of providing the fitting assembly **10**; sliding the locking device **16** onto the corrugated tube **48**; sliding the bushing **18** onto the corrugated tube; positioning the protrusion **42** into the trough **44**; abutting the insert **14** against the second shoulder **26** to sealingly engage the insert with the body **12**; sliding the locking device, the bushing, and the corrugated tube over the insert towards the first shoulder; and engaging the first and second connectors to removably secure the bushing, an end **47** of the corrugated tube, and at least a portion of the insert within the body by clamping a circumferential section **52** of the corrugated tube between the transition area and the protrusion, thereby sealing an internal surface **54** of the circumferential section with the transition area.

[0031] Another method of using the fitting assembly for the corrugated tube as shown in FIG. **6** includes the steps of providing a fitting assembly in which the body **212** is integral with the insert **214**; sliding the locking device onto the corrugated tube; sliding the bushing onto the corrugated tube; positioning the protrusion in the trough of the corrugated tube; sliding the locking device, the bushing, and the corrugated tube over the insert **214**; and engaging the first and second connectors to releasably secure the bushing and an end of the corrugated tube within the body by clamping the corrugated tube and sealing an internal surface of the corrugated tube against insert.

[0032] Another method of using the fitting assembly for a corrugated tube as shown in FIG. **7** includes the steps of providing a fitting assembly in which the bushing **318** is integral with the locking device **316**; sliding the integral bushing and locking device onto the corrugated tube; positioning the protrusion **342** of the bushing in the trough of the corrugated tube; sliding the corrugated tube over the insert; and engaging first and second connectors on the body and locking device, respectively, to releasably secure the bushing, an end of the corrugated tube, and at least a portion of the insert within the body by clamping the corrugated tube and sealing an internal surface of the corrugated tube against insert.

[0033] Although the present invention has been disclosed and described with reference to certain embodiments thereof, it should be noted that other variations and modifications may be made, and it is intended that the following claims cover the variations and modifications within the scope of the invention.

1. A fitting assembly for a corrugated tube comprising:

a body having first connecting means, a first bore, a first shoulder in said first bore, and a second shoulder in said first bore;

an insert having a second bore, a first external surface, a second external surface of increased outside diameter, and a transition area intermediate said first external surface and said second external surface, said insert being receivable in said first bore;

locking means having a through bore, a receiving shoulder in said through bore, and second connecting means selectively receivable on said first connecting means; and

a bushing slidable over said insert and securable in said body and said locking means, a first end of said bushing having an inwardly projecting protrusion for engagement with a trough disposed on an external surface of a corrugated tube.

2. The fitting assembly of claim 1, wherein said first bore transitions to a reduced cross section at said first shoulder and wherein said reduced cross section transitions to a further reduced cross section at said second shoulder.

3. The fitting assembly of claim 1, wherein at least a portion of one end of said insert abuts at least a portion of said second shoulder, and wherein said insert is sealingly engaged with said body.

4. The fitting assembly of claim 1, wherein a second end of said bushing seats on said receiving shoulder for urging said bushing and an end of said corrugated tube over said insert towards said body.

5. The fitting assembly of claim 1, wherein said first connecting means and said second connecting means engage to releasably secure said bushing, said end of said corrugated tube, and at least a portion of said insert within said body and said locking means.

6. The fitting assembly of claim 5, wherein the engagement of said first connecting means and said second connecting means clamps a circumferential section of said corrugated tube between said protrusion and said transition area to seal an internal surface of said circumferential section with said transition area.

7. The fitting assembly of claim 1 wherein said bushing has a plurality of splits axially extending though said protrusion, said splits terminating between said first end and a second end of said bushing, wherein said splits are circumferentially disposed around said bushing to allow said bushing to flex when sliding said bushing along said corrugated tube.

8. The fitting assembly of claim 1 wherein said insert is integral with said body.

9. The fitting assembly of claim 1, wherein said bushing is integral with said locking means.

10. The fitting assembly of claim 1 wherein said insert is made from a material that is harder than said corrugated tube.

11. The fitting assembly of claim 1 wherein said insert is made from a material that is softer than said corrugated tube.

12. The fitting assembly of claim 1 wherein said body is made from a material that is harder than said corrugated tube.

13. The fitting assembly of claim 1 wherein said body is made from a material that is softer than said corrugated tube.

14. The fitting assembly of claim 1 wherein said first connecting means comprises male threads and wherein said second connecting means comprises female threads.

15. An internally sealable fitting assembly, comprising:

a body having a bore;

an insert coaxially positioned in said bore, said insert being dimensioned to receive a corrugated tube thereon;

a castellated bushing receivable over said insert and said corrugated tube; and

a locking device selectively receivable on said body;

wherein receiving said locking device on said body urges said bushing against said corrugated tube to clamp said corrugated tube against said insert.

16. The internally sealable fitting assembly of claim 15, wherein said bushing comprises a protrusion disposed at the castellated end.

17. The internally sealable fitting assembly of claim 16, wherein said protrusion is receivable in a trough of said corrugated tube to clamp said corrugated tube against said insert.

18. The internally sealable fitting assembly of claim 15, wherein said insert is integral with said body.

19. The internally sealable fitting assembly of claim 15, wherein said bushing is integral with said locking device.

20. The internally sealable fitting assembly of claim 15, wherein said insert comprises a radially-extending curved surface against which said corrugated tube can be clamped.

21. A method of installing a fitting assembly for a corrugated tube, said method comprising the steps of:

providing a fitting assembly for said corrugated tube comprising a body having first connecting means, a first bore, a first shoulder, and a second shoulder; wherein said first bore transitions to a reduced cross section at said first shoulder, and wherein said reduced cross section transitions to a further reduced cross section at said second shoulder; an insert having a second bore and a transition area of increased outside diameter; locking means having second connecting means disposed therein and an internally directed receiving shoulder; a bushing, a first end thereof having an inwardly projecting protrusion for engagement with a trough disposed on an external surface of said corrugated tube; wherein an opposing end of said bushing seats on said receiving shoulder;

sliding said locking means onto said corrugated tube,

sliding said bushing onto said corrugated tube,

positioning said protrusion into said trough,

abutting said insert against said second shoulder to sealingly engage said insert with said body,

sliding said locking means, said bushing, and said corrugated tube over said insert towards said first shoulder; and

engaging said first and second connecting means to removably secure said bushing, an end of said corrugated tube, and at least a portion of said insert within said body and said locking means, to clamp a circumferential section of said corrugated tube between said transition area and said protrusion and to seal an internal surface of said circumferential section with said transition area.

* * * * *