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(58) Field of Search:
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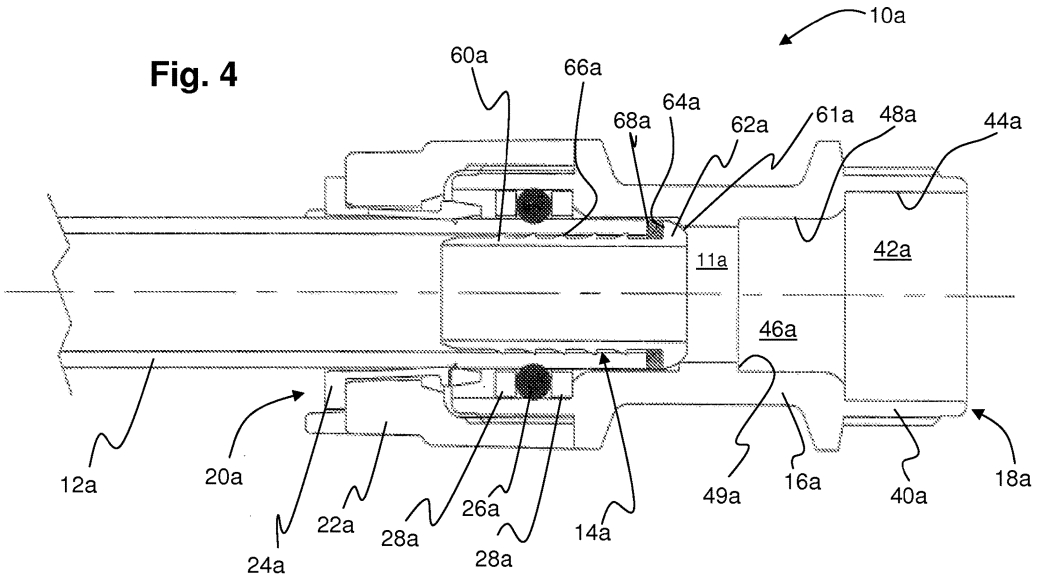
(54) Title of the Invention: **Pipe insert**
Abstract Title: **Pipe insert**

(57) An insert for a pipe comprising first and second ends and defining a flow path between the first and second ends for allowing fluid to flow along a longitudinal axis of the insert. The first end of the insert defines a body configured for insertion into the free end of a pipe. The second end of the insert defines a head configured to project from the free end of a pipe and limit the degree of insertion of the insert into the pipe. One or more radially projecting barbs are positioned on an outer surface of the body for gripping the inside of a pipe into which the first end of the insert has been fitted. A circumferential seal is arranged on the body of the first end for positioning axially between the head of the insert and the free end of a pipe into which the first end of the insert has been fitted for sealing an end surface at the free end of the pipe against fluid contact.

Fig. 4



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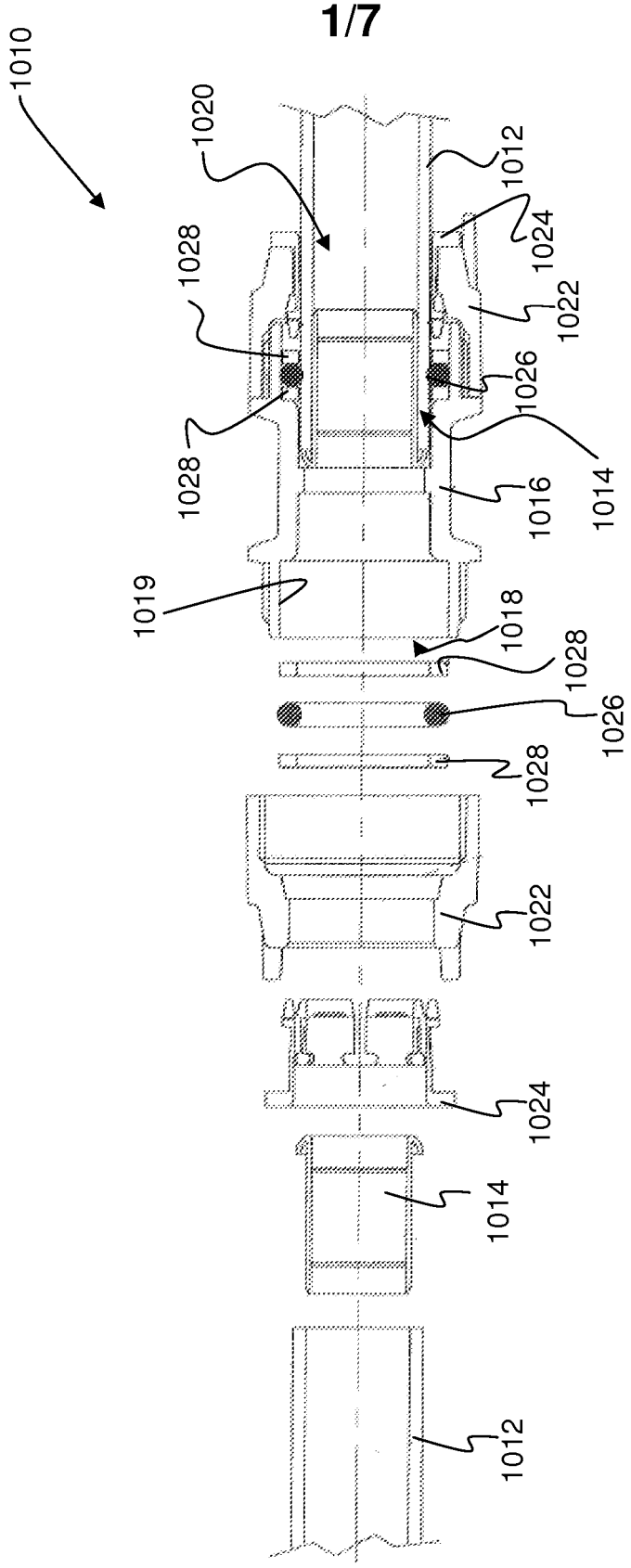
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1012
1024
1028
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1014
1012

Fig.1

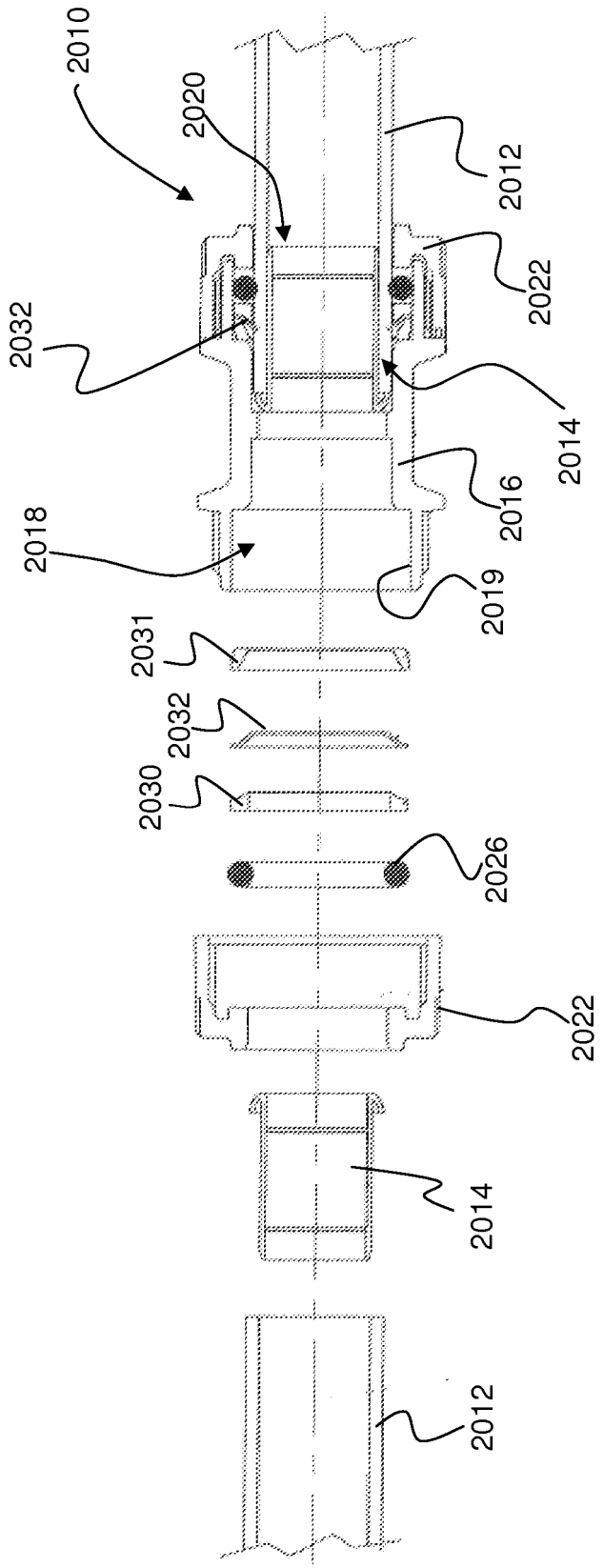
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Fig.2

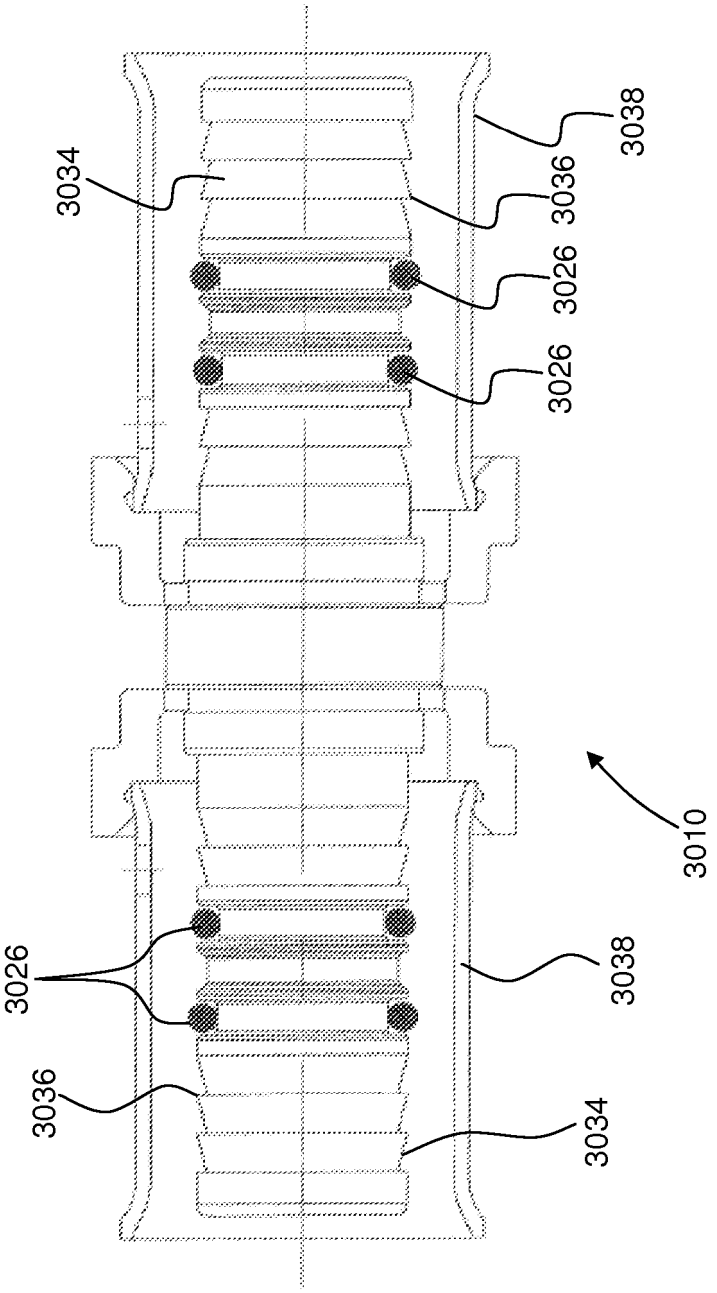
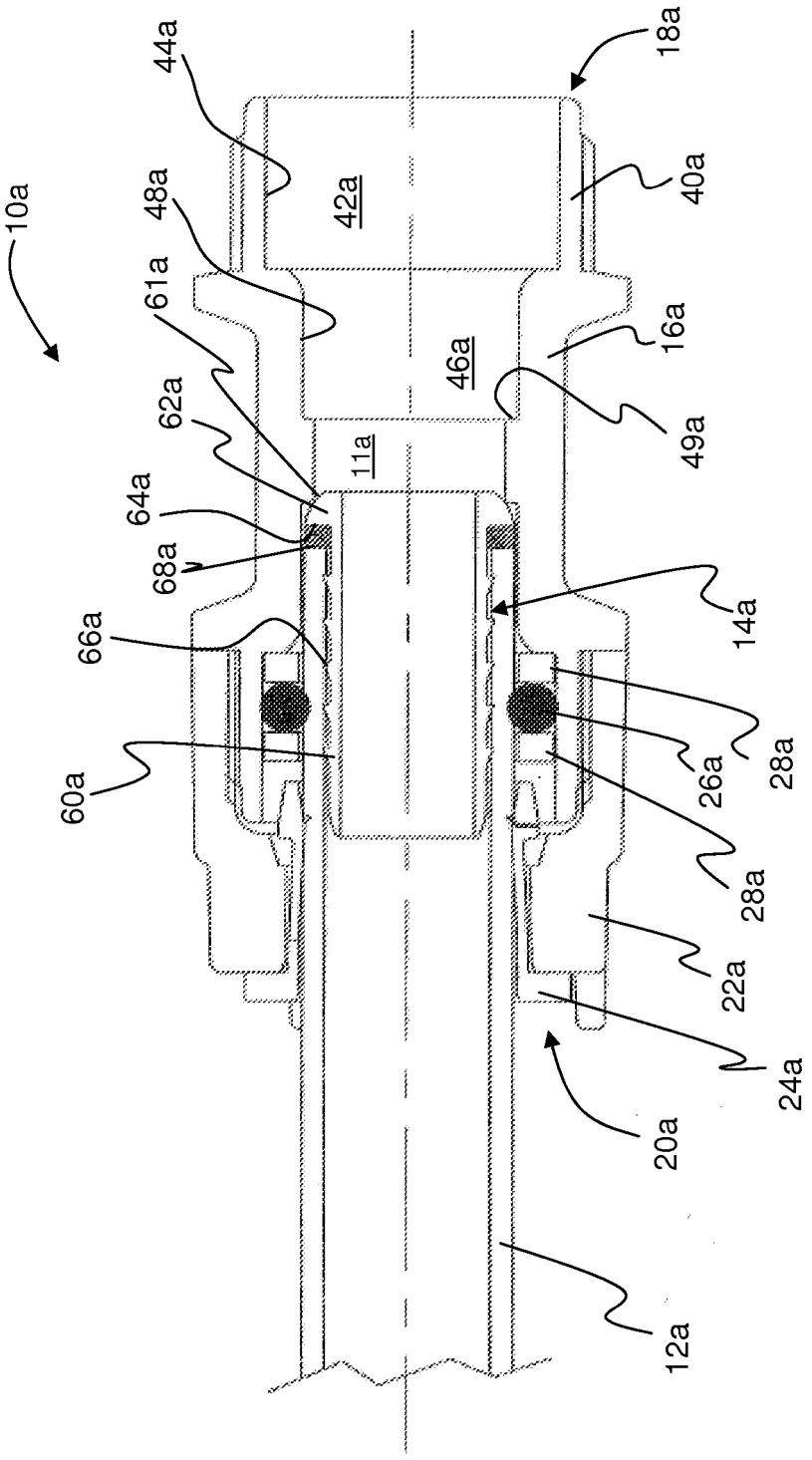


Fig.3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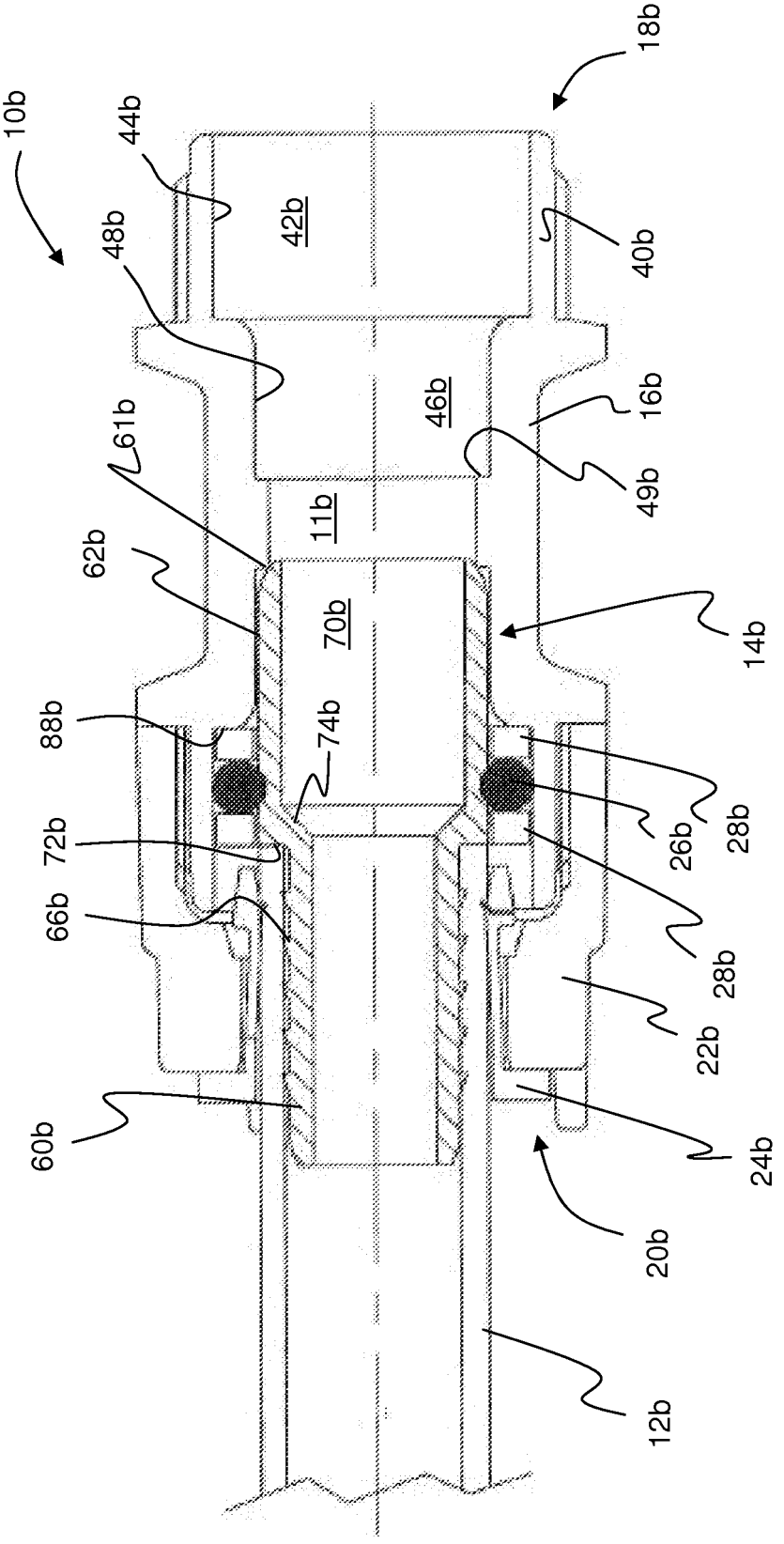
24a
20a
12a

Fig. 4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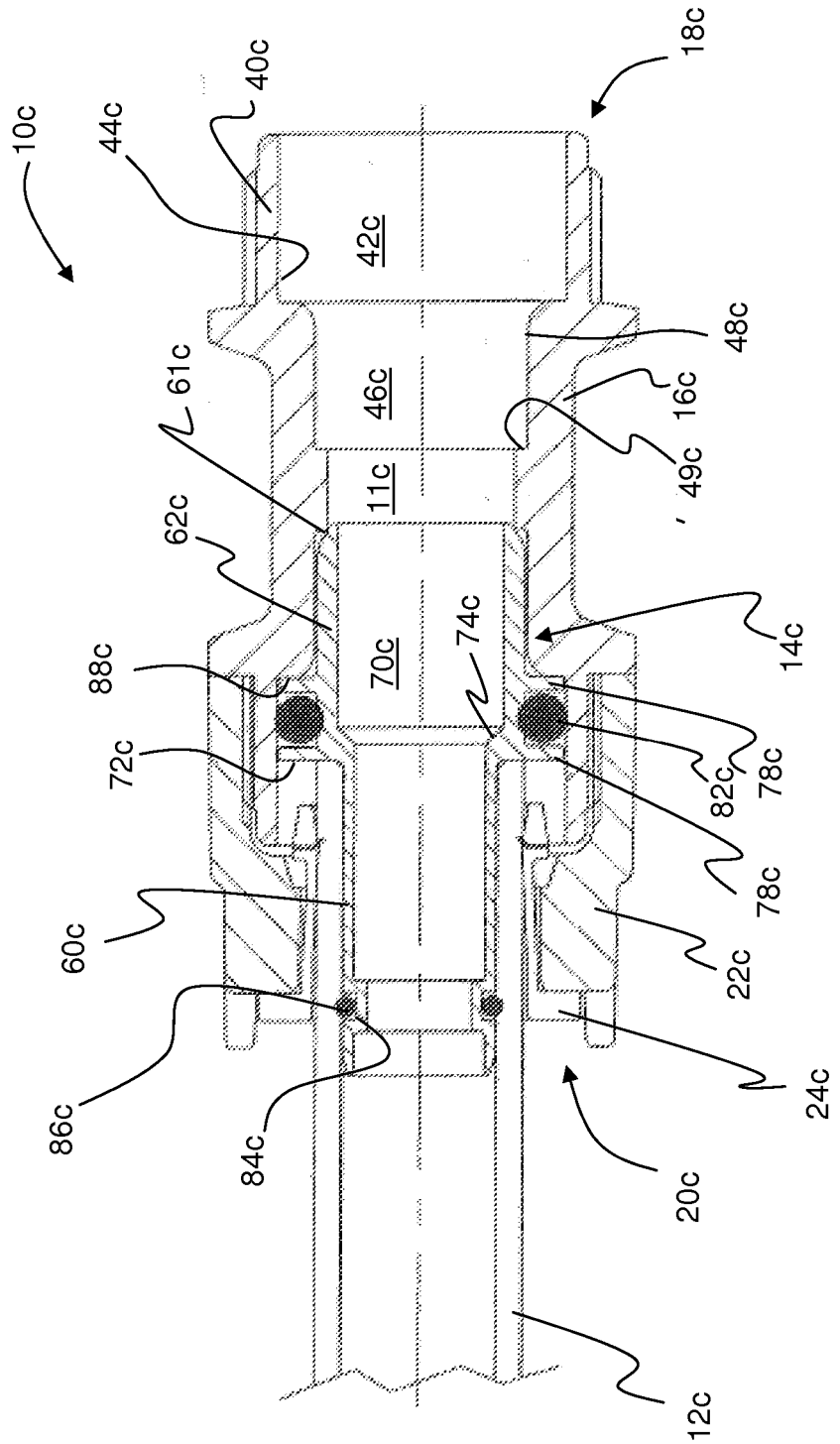
22b
60b
24b
20b
12b

Fig. 5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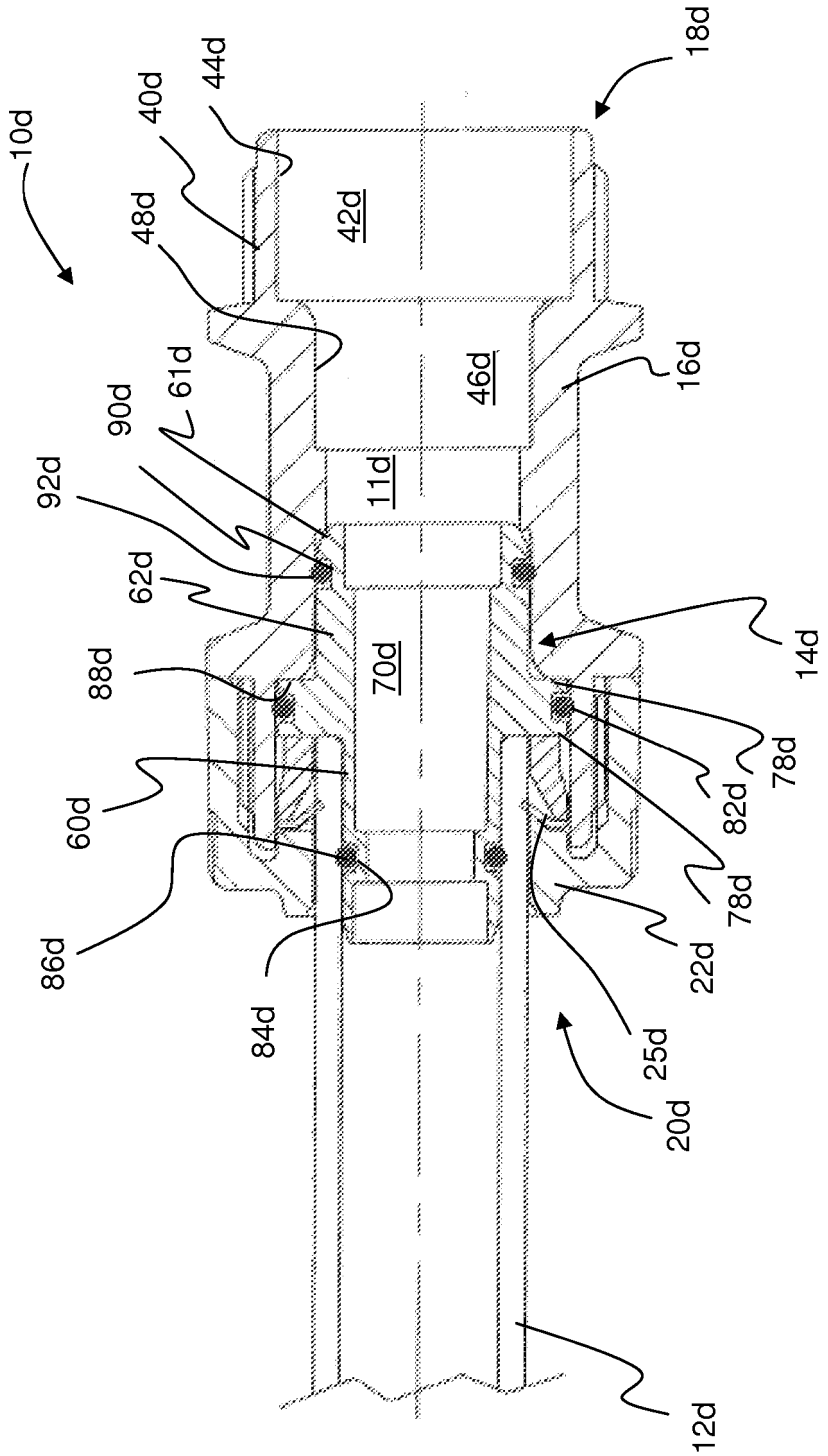
20c
12c

Fig. 6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14d
88d
78d
82d
60d
78d
86d
22d
84d
25d
20d
12d

Fig. 7

Pipe insert

Field of Invention

The present invention relates to an insert for a pipe, e.g. of the kind commonly referred to as a pipe stiffener, and/or a pipe connector assembly of the type comprising a pipe, pipe insert and a pipe connector.

Background

Inserts for use in stiffening the free end of a pipe are known. Such known inserts typically define an elongate body, wherein one end of the body is configured to be positioned in the free end of a pipe and the other end of the body has a lip, flange or other formation intended to limit the extent of insertion of the insert into the pipe.

Figure 1 shows a known arrangement of pipe connector 1010, plastics pipe 1012 and pipe insert 1014. The arrangement is shown in exploded form to the left as viewed in Figure 1 and in assembled form to the right as viewed in Figure 1.

In this instance, the pipe connector 1010 defines an elongate body 1016 having opposing sockets 1018, 1020. Each socket 1018, 1020 is configured for receiving the free end of a pipe 1012 and includes a collet 1024 (mounted in the connector by means of a cap 1022) for gripping the pipe 1012 in a manner known in the art. The pipe insert 1014 is located in the free end of the pipe 1012 prior to insertion into one of the sockets 1018, 1020, and serves to stiffen the free end of the pipe 1012. In order to provide a seal between the pipe 1012 and the connector 1010, an O-ring 1026 is positioned between two washers 1028 inside each socket 1018, 1020. The O-ring 1026 acts between the pipe 1012 and an internal surface 1019 of the respective socket 1018, 1020, to prevent leakage from the connector 1010.

Figure 2 illustrates another known arrangement, which uses a grab ring 2032 instead of a collet 1024. Other features are similar, and so will not be described further here. Similar features are given similar reference numerals as the features of Figure 1, but with a prefix of 2 instead of 1.

The grab ring 2032 is arranged between two washers 2030, 2031 within the respective socket 2018, 2020 and includes a plurality of teeth (not shown) for gripping the pipe 2012 in a manner known in the art. The pipe insert 2014 serves to stiffen the free end of the pipe 2012, and an O-ring 2026 within the connector 2010 provides a seal between the pipe 2012 and an internal surface 2019 of the respective socket 2018, 2020.

Problems may arise if the stiffener is used with a metal composite pipe (MCP), e.g. of the kind having outer and inner layers of plastics material and a metal central layer (generally aluminium), since the end of the pipe may become exposed to fluid flow within the connector. This is problematic because contact with the fluid can cause corrosion of the metal layer, and may cause delamination of the inner and outer plastics layer away from the central metal layer. Delamination can result in blistering of the inner layer. In some cases, pressure failure of the pipe can occur, e.g. if the relatively thin outer plastics layer is subject to the full or near full pressure of the fluid flow through the connector without the reinforcing effect of the central metal layer and the inner plastics layer.

Attempts have been made to overcome this problem by using a connector of a different configuration to that shown in Figures 1 and 2. Such a connector is illustrated generally at 3010 in Figure 3. The connector 3010 has at least one spigot 3034 with a plurality of barbs 3036 formed on the outer surface thereof. Two O-ring seals 3026 are positioned on the spigot 3034 and a stainless steel sleeve 3038 is arranged about the spigot 3034 - initially spaced from the spigot 3034. To attach a pipe to the connector 3010, the pipe is fitted onto the spigot 3034 and the sleeve 3038 is then deformed into an interference fit with the outside of the pipe. This forces the inside of the pipe into close contact with the O-ring seal 3026 on the spigot 3034 to create a seal, and the barbs 3036 on the spigot 3034 provide axial restraint against the pull-out forces generated by internal hydraulic pressure when the connector 3010 is in use. It can be seen that the connector 3010 seals against the inside of the pipe, and so fluid cannot come into contact with the end of the pipe (overcoming the potential for corrosion or delamination at the exposed end of an MCP).

However, a problem with this design of connector is that it requires complex equipment to attach a pipe to the connector, instead of a simple push-fit operation that is possible using the type of connectors shown in Figures 1 and 2.

Summary of the invention

There is a need to address one or more of the above-mentioned problems.

According to one aspect of the invention, there is provided an insert for a pipe, the insert comprising:

first and second ends and defining a flow path between the first and second ends for allowing fluid to flow along a longitudinal axis of the insert;

wherein the first end of the insert defines a body configured for insertion into the free end of a pipe and the second end of the insert defines a head configured to project from the free end of a pipe and limit the degree of insertion of the insert into the pipe;

wherein one or more radially projecting barbs are positioned on an outer surface of the body, for gripping the inside of a pipe into which the first end of the insert has been fitted;

and wherein a circumferential seal is arranged on the body of the first end, for positioning axially between the head of the insert and the free end of a pipe into which the first end of the insert has been fitted, for sealing an end surface at the free end of the pipe against fluid contact.

The provision of one or more barbs advantageously resists movement of the insert relative to the pipe and allows the seal to remain in sealing contact with the end face of the pipe. This is of particular importance when the pipe is a metal composite pipe (MCP), because it can prevent fluid contact that could otherwise lead to corrosion and/or delamination of the free end of the MCP.

In exemplary embodiments, the or each barb is dimensioned for an interference fit with an internal surface of the pipe, so as to create a seal between the outer surface of the body and the bore of the pipe, for further protecting the free end of the pipe against contact from fluid flowing within the pipe. This is of particular importance if the pipe is an MCP.

According to another aspect of the invention, there is provided a pipe connector assembly comprising:

a pipe having a free end;

an insert fitted in the free end of the pipe;

a pipe connector having a pipe socket, wherein the free end of the pipe with the insert fitted therein is received in the socket, the pipe socket including a chamber in which the free end of the pipe and the insert are located;

wherein the insert has first and second ends and defines a flow path between the first and second ends for allowing fluid to flow along a longitudinal axis of the insert, wherein the first end of the insert defines a body which is fitted into the free end of the pipe and the second end of the insert defines a head which projects from the free end of the pipe and limits the degree of insertion of the insert into the pipe; and

wherein one or more radially projecting barbs are positioned on an outer surface of the body, to grip and provide an interference fit with an internal surface of the pipe, so as to create a seal between the outer surface of the body and the pipe.

Advantageously, the use of an insert of the kind referred to in the above statement serves to protect the free end of the pipe against contact from fluid flowing within the pipe. This is of particular importance if the pipe is an MCP.

In exemplary embodiments, a circumferential seal is arranged on the body of the first end, positioned axially between the head of the insert and the free end of a pipe into which the first end of the insert has been fitted, for sealing against an inner surface of the chamber into which the end of the pipe and insert have been located. Hence, the end of the pipe is protected against fluid flow from within the pipe and within the connector. This is of particular importance if the pipe is an MCP.

According to a further aspect of the invention, there is provided a pipe connector assembly comprising:

a pipe having a free end;

an insert fitted in the free end of the pipe;

a pipe connector having a pipe socket, wherein the free end of the pipe with the insert fitted therein is received in the socket, the pipe socket including a chamber in which the free end of the pipe and the insert are located;

wherein the insert has first and second ends and defines a flow path between the first and second ends for allowing fluid to flow along a longitudinal axis of the insert, wherein the first end of the insert defines a body which is fitted into the free end of the

pipe and the second end of the insert defines a head which projects from the free end of the pipe and limits the degree of insertion of the insert into the pipe;

wherein a circumferential seal is arranged on the body of the first end, positioned axially between the head of the insert and the free end of a pipe into which the first end of the insert has been fitted, and defines a sealing surface generally orthogonal to the longitudinal axis of the insert, for sealing against an inner surface of the chamber in which the end of the pipe and insert have been located; and

wherein the first end of the insert has been welded or fused to the inside of the pipe, to secure the insert relative to the pipe and create a seal between the outer surface of the insert body and the internal surface of the pipe.

Advantageously, the end of the pipe is protected against fluid flow from within the pipe and within the connector. This is of particular importance if the pipe is an MCP.

According to still further aspects of the invention, there is provided a pipe connector assembly as set forth in claim 30 or claim 31.

These configurations of assembly alleviate the problem of fluid flow through the pipe and connector contacting an end of the pipe. This is of particular importance if the pipe is an MCP.

According to a further aspect of the invention, there is provided a pipe connector assembly as set forth in claim 39.

This configuration of assembly alleviates the problem of fluid flow through the pipe and connector contacting an end of the pipe. This is of particular importance if the pipe is an MCP.

Description of drawings

Embodiment(s) of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows sectional exploded and assembled views of a pipe connector assembly of the prior art incorporating a collet for gripping a pipe received in the connector;

Figure 2 shows sectional exploded and assembled views of another pipe connector assembly of the prior art incorporating a grab ring for gripping a pipe received in the connector;

Figure 3 is a sectional view of a further pipe connector assembly of the prior art, wherein the connector is a press fitting having a deformable sleeve for retaining the pipe on a spigot of the fitting;

Figure 4 shows a sectional view of a pipe fitted in the socket of a pipe connector, and with a pipe insert fitted in a free end of the pipe;

Figure 5 is similar to Figure 4, showing a sectional view of a pipe fitted in the socket of a pipe connector, with a different embodiment of pipe insert arranged in communication with the free end of a pipe;

Figure 6 is similar to Figure 5, but incorporating a further embodiment of pipe insert; and

Figure 7 is similar to Figures 5 and 6, but incorporating a still further embodiment of pipe insert.

Detailed description

Referring to Figure 4, a pipe connector is indicated generally at 10a. The pipe connector 10a is similar to the kind shown in Figure 1. As such, it defines a body 16a having first and second sockets 18a, 20a, each configured for receiving the free end of a pipe 12a. A channel 11a extends between the first and second sockets 18a, 20a, e.g. for permitting fluid to pass through the body 16a from one pipe 12a to another. In this embodiment, the connector body 16a is made from polybutylene. However, in alternative embodiments the connector body may be made from other suitable plastics (e.g. such as acetal or polysulphone) or metals such as brass, DZR brass or stainless steel.

In this embodiment, the sockets 18a, 20a are of identical configuration. However, for ease of illustration, only the internal structure of the socket 18a (as defined by body 16a of the connector 10a) is shown to the right as viewed in Figure 4, whereas the full detail of socket 20a is shown to the left as viewed in Figure 4.

Socket 20a includes a cap 22a which serves to locate a conventional collet 24a in the connector 10a. The collet 24a is used for gripping the outer surface of a pipe 12a in a manner known in the art. The cap 22a is mounted on an annular end part 40a of the body 16a (e.g. by snap-fit or threaded engagement). The end part 40a defines a first chamber

42a within the respective socket 18a, 20a. The first chamber 42a includes an annular internal surface 44a. Axially inwardly of the first chamber 42a (e.g. to the left when viewing socket 18a in Figure 4), the body 16a defines a second chamber 46a within the respective socket 18a, 20a. The second chamber 46a includes an annular internal surface 48a, which terminates at a stop surface 49a adjacent the channel 11a. The internal diameter of the first chamber 42a is greater than the internal diameter of the second chamber 46a.

An O-ring 26a is arranged within the first chamber 42a of the socket 20a, between two washers 28a, for providing a seal between the pipe 12a and the internal surface 44a of the socket 20a. In particular, the O-ring 26a is intended for preventing fluid leakage between the external surface of the pipe 12a and the connector 10a.

In use, a free end of the pipe 12a is inserted into the socket 20a. The free end of the pipe 12a passes through the collet 24a, through the first chamber 42a and into the second chamber 46a, as illustrated to the left as viewed in Figure 4. As can be seen, the O-ring 26a is axially spaced from the free end of the pipe 12a, when the pipe 12a is inserted in the manner illustrated in Figure 4.

The collet 24a is configured to permit the pipe 12a to slide into the connector 10a with ease. The collet 24a acts to prevent the pipe 12a being pulled from the connector 10a. However, the connector 10a is removable from the pipe 24a, by moving the collet 24a in a conventional manner, e.g. in an axial direction towards the socket body 16a, to cause the collet 24a to release its grip with the pipe 12a.

A pipe insert 14a is shown fitted in the free end of the pipe 12a. The insert 14a defines a bore along a longitudinal axis of the insert 14a for allowing fluid to flow into or out of the bore of the pipe 12a. The insert 14a has a first end which defines a generally tubular main body 60a configured to extend within the pipe 12a, and a second end which defines a head 62a configured to limit the extent of insertion of the insert 14a into the pipe 12a. Inserts of this kind have been found to improve performance during pipe connector pull-out tests, and are more commonly referred to as pipe ‘stiffeners’.

The insert 14a is made from either a plastics material or a metal, for example the insert can be made from polysulphone, PEX, PERT, polybutylene or stainless steel.

Radially extending barbs 66a are positioned on the outer surface of the main body 60a. The barbs 66a are configured to grip an internal surface of the pipe 12a, in order to prevent or significantly limit movement of the insert 14a relative to the pipe 12a under the influence of fluid flow (e.g. under full bore conditions in a direction to the right as viewed in Figure 4).

In exemplary embodiments, the barbs 66a are configured to provide an interference fit with the internal surface of the pipe 12a, and thereby define a seal between the insert 14a and the pipe 12a. Depending on the degree of interference fit between the insert 14a and the pipe 12a, an insertion tool or jig may be required to correctly locate the insert 14a into the end of the pipe 12a.

When the main body 60a of the insert is fitted in an interference fit with the bore of the pipe 12a, the barbs 66a provide a seal with the inside of the pipe 12a.

An O-ring seal (not shown) may be provided on the main body 60a of the insert 14a to act as an additional seal between the main body 60a and the pipe 12a, augmenting the sealing effect of the interference fit between the barbs 66a and the pipe 12a.

In the illustrated embodiment, there are five discrete circumferential barbs 66a, although any suitable number of barbs 66a may be used. In alternative embodiments, one or more helical barbs 66a may be used, allowing the insert 14a to be readily rotated into the pipe 12a. In such cases, a tool engagement formation may be formed on the head 62a, for engagement by a tool used to rotate the insert, e.g. a drill or the like. The tool engagement formation may be one or more ribs or recesses formed on an end surface or a bore of the head 62a. In exemplary embodiments, the helical formation will be configured to prevent fluid moving along the helix from reaching the end face of the pipe 12a.

In alternative embodiments, the outer surface of the main body 60a of the insert 14a may be welded or fused to the bore of the pipe 12a (e.g. by spin welding, localised butt

welding, ultrasonic welding, socket fusion or electro fusion), in order to secure the position of the insert 14a relative to the end of the pipe 12a, and provide a seal between the insert 14a and the bore of the pipe 12a, for preventing fluid flow within the pipe from contacting the end face of the pipe.

In the illustrated embodiment, the head 62a defines a radially extending flange having an end face 64a arranged orthogonal to a longitudinal axis of the insert 14a and intended to be positioned proximal the exposed end face of the pipe 12a. In exemplary embodiments, the outer diameter of the end face 64a is dimensioned to be at least a substantial match for the outer diameter of the pipe 12a into which the insert 14a is to be fitted, e.g. in order to extend radially over at least a significant proportion of the exposed end face of the pipe 12a (in particular, over at least the central metal layer of an MCP).

The outer surface of the head 62a defines a curved end 61a. In alternative embodiments, the end of the insert 14a may include angled surfaces (e.g. defining an end of the insert which is trapezoidal in cross-section).

In the illustrated embodiment, an annular seal 68a is provided on the body 60a of the insert 14a. The seal 68a is not a typical O-ring seal, but is instead of cylindrical shape. As can be seen, the outer diameter of the seal 68a is configured to be at least a substantial match for the end face of the pipe 12a (at least to cover the central metal layer of an MCP, in exemplary embodiments).

The seal 68a may be made from rubber, a soft plastics material (e.g. such as polybutylene or PEX), or a thermoplastic elastomer.

In use, the seal 68a is positioned in abutment between the head 62a and the end face of the pipe 12a (as illustrated). In exemplary embodiments, when the insert 14a is fitted into the pipe 12a, the end face 64a of the head 62a compresses the seal 68a against the end face of the pipe 12a, forcing the seal 68a into sealing abutment with the end of the pipe 12a. This provides a watertight seal to prevent fluid flow in the pipe 12a or connector 10a from contacting an end of the pipe 12a (e.g. to prevent fluid within the connector 10a from contacting the central metal layer of an MCP). Compression of the seal 68a can be

maintained by the gripping action of the barbs 66a or the welding/fusing of the insert 14a to the pipe 12a.

The hardness or modulus of elasticity of the material selected to manufacture the seal, and/or the dimensions of the seal may be selected so that when the seal 68a is compressed by the head 62a, the seal 68a is displaced or expands radially so that it contacts the inner surface 48a of the chamber 46a of the connector 10a, so as to produce a seal with the connector 10a, in addition to the seal with the pipe 12a. In alternative embodiments, the seal 68a may be configured (e.g. in terms of its outer diameter) to provide a seal with the inner surface 48a of the connector 10a without the need for compression of the seal 68a.

Advantageously, when the pipe 12a is an MCP, the insert 14a protects the central metal layer from contact with fluid flow in the pipe 12a or connector 10a.

Although the embodiment shown in Figure 4 uses a collet 24a as a pipe gripper, the connector may be of a type having another type of pipe gripper, for example a grab ring (e.g. as shown in Figure 2).

Figure 5 shows another pipe connector assembly incorporating a pipe insert according to another embodiment of the invention. Only the differences between this embodiment and previously described embodiment will be described here, and similar reference numerals are used but with a suffix "b".

In this embodiment, the insert 14b has a main body 60b positioned within a pipe 12b and a head portion 62b positioned outside the pipe 12b but within the connector 10b. In this embodiment, the connector 10b and/or insert 14b are configured such that the head portion 62b extends from the first chamber 42b to the second chamber 46b of the connector 10b. As such, the O-ring seal 26b within the connector 10b acts on the head portion 62b of the insert 14b (rather than on the pipe 12b).

The interaction between the O-ring seal 26b within the connector chamber 42b and the head portion 62b of the insert 14b alleviates the need for an external seal (e.g. an O-ring) on the head portion 62b, thus reducing the likelihood of a loss of sealing performance as a result of damage to the insert when passing the insert through a collect or grab ring.

The connector 10b and/or the insert 14b may be configured so that the distal end of the head portion 62b locates in an interference fit with the internal surface 48b of the second chamber 46b.

The head portion 62b is of greater outer diameter than the main body 60b, and the insert 14b defines a step having a radial surface 72b at the transition between the main body 60b and the head portion 62b. In use, the radial surface 72b abuts an end face of the pipe 12b. In this embodiment, the outer diameter of the head portion 62b is substantially the same as the outer diameter of the pipe 12b.

As can be seen, the bore 70b of the insert 14b has a greater diameter within the head portion 62b than within the main body 60b, and a tapered section 74b is provided at the transition between the head portion 62b and the main body 60b.

Radially projecting barbs 66b are formed on the main body 60b, to grip the pipe and provide a seal between the main body 60b of the insert 14b and the internal surface of the pipe 12b. In this embodiment there are five barbs, but any suitable number of barbs may be provided. In this embodiment the barbs are circumferential.

In an alternative embodiment, the main body 60b of the insert 14b may be permanently fixed to the pipe 12b (e.g. by spin welding, butt welding, ultrasonic welding, socket fusion or electro fusion), in a manner suitable to create a seal between the insert and the pipe (i.e. instead of the barbs 66b). Such configurations will be suited for use with connectors having a collet or a grab-ring, whereas configurations having a 'barbed' main body 60b would only be suitable for use with a collet-type connector.

The combination of a seal between the main body of the insert and the bore of the pipe and a seal between the head portion of the insert and the chamber within the connector serves to protect the end of the pipe from exposure to fluid flow. This is particularly advantageous if the pipe is an MCP.

The distal end of the main body 60b is shaped to define a lead-in for easing reception of the insert 14b into the pipe 12b. Similarly, the distal end of the head portion 62b is

shaped to define a lead-in for easing passage of the insert 14b into the connector 10b (e.g. to pass through the collet 24b).

Figure 6 shows a pipe connector assembly incorporating a pipe insert according to another embodiment of the invention. Again, only the differences between this embodiment and previously described embodiments will be described here, and similar reference numerals are used but with a suffix "c".

The assembly shown in Figure 6 is similar in many ways to the assembly of Figure 5. However, in this embodiment, an O-ring is not provided within the connector chamber 42c. Instead, the seal for sealing between the connector 10c and the head portion 62c of the insert 14c is provided by an O-ring 82c carried on the head portion 62c of the insert 14c.

The O-ring seal 82c is located in a channel on the head portion 62c, as defined by two radial projections 78c. The first of the projections 78c (to the left as viewed in Figure 6) forms part of the radial surface 72c that abuts the end of the pipe 12c, whereas the other projection 78c (to the right as viewed in Figure 6) is arranged for abutment with an internal stop 88c within the first chamber 42c of the connector 10c.

As illustrated, the projections 78c are configured to project towards the internal surface 44c of the first chamber 42c of the connector 10c, and the connector 10c and/or insert 14c may be configured so that the projections 78c provide a close fit (e.g. an interference fit) with the internal surface 44c, with the O-ring 82c in sealing engagement with the internal surface 44c.

As can be seen, the main body 60c of the insert includes a channel 86c for positioning an O-ring seal 84c on the main body. This may be omitted in other embodiments, in which case it may be preferable to include barbs or permanently fix (e.g. by welding or fusion) the main body of the insert to the pipe, in order to secure the position of the insert and provide a sealing effect between the main body of the insert and the pipe.

In this embodiment, it is intended that the insert 14c is fitted within the connector 10c (e.g. as an internal component of the connector 10c) prior to insertion of a pipe 12c into the connector 10c.

Figure 7 shows a further pipe connector assembly incorporating a pipe insert according to another embodiment of the invention. Only the differences between this embodiment and the embodiment of Figure 6 will be described here, and similar reference numerals are used but with a suffix "d".

In this embodiment, a grab ring 25d is used to grip the pipe 12d.

The insert 14d is similar in many ways to the insert 14c. A significant difference between these embodiments is the diameter of the O-ring seal 82d which acts between the connector chamber 42d and the insert 14d. In Figure 7, the O-ring seal 82d has a smaller diameter and the projections 78d are shorter.

A groove is formed circumferentially on the distal end of the head portion 62d, creating a channel 90d for an O-ring seal 92d, which acts on an internal surface 48d of the second chamber 46d of the connector 10d.

The cap 22d of the connector 10d may include an inner angled surface to support the grab ring 25d and prevent it from flattening out during use, particularly when subjected to extreme conditions.

Those embodiments which provide a seal between the main body of the insert and the internal surface of a pipe into which they are fitted, as well as a seal between the insert and an internal surface of a socket within the connector (e.g. as shown in Figures 6 and 7) have particular advantage when used in combination with plastics pipes (e.g. flexible hot water pipes made from polybutylene, PEX, PERT etc) and conventional push-fit connectors. For instance, if the external surface at the free end of the pipe becomes scored (e.g. as a result of rough handling or being dragged along a floor surface), the insert maintains a seal with the inside of the pipe (since the inside of the pipe is unlikely to be affected by the scoring on the outside of the pipe).

Typically, the inserts described herein will be used in plumbing systems and the like, e.g. of the kind having pipes for conveying a water supply and requiring an insert to assist connection of the pipe to a fitting within the system and/or to provide protection for a multilayered pipe within the system. In exemplary embodiments, the inserts and connector assemblies will be configured for use in central heating systems. In other embodiments, the inserts and connector assemblies will be configured for use in other water supply applications, including indoor and outdoor applications (domestic and/or commercial). The inserts and connector assemblies may also be configured for use in other fluid flow applications.

The connectors for use in or with exemplary embodiments of the invention may be of any suitable shape and may be configured with one, two or more sockets for receiving the free end of a pipe. This will include conventional elbow and T-sections, as well as 'straight' or double-ended connectors (e.g. of the kind illustrated herein), radiator valves and socket blank ends. The connectors may be of any suitable material, such as plastics, brass, copper or stainless steel.

Claims

1. An insert for a pipe, the insert comprising:

first and second ends and defining a flow path between the first and second ends for allowing fluid to flow along a longitudinal axis of the insert;

wherein the first end of the insert defines a body configured for insertion into the free end of a pipe and the second end of the insert defines a head configured to project from the free end of a pipe and limit the degree of insertion of the insert into the pipe;

wherein one or more radially projecting barbs are positioned on an outer surface of the body, for gripping the inside of a pipe into which the first end of the insert has been fitted;

and wherein a circumferential seal is arranged on the body of the first end, for positioning axially between the head of the insert and the free end of a pipe into which the first end of the insert has been fitted, for sealing an end surface at the free end of the pipe against fluid contact.

2. The insert according to claim 1 wherein the seal is configured for providing a sealing surface generally orthogonal to the longitudinal axis of the insert, for sealing against an inner surface of a connector into which the pipe and insert may be fitted.

3. The insert according to claim 1 or claim 2 wherein the seal is made from a compressible material such that when the first end of the insert has been fitted into the free end of a pipe and the seal has been compressed between the head and the free end of the pipe, the seal expands radially for providing a sealing surface generally orthogonal to the longitudinal axis of the insert, for sealing against an inner surface of a connector into which the pipe and insert may be fitted.

4. The insert according to any of claims 1 to 3 wherein the seal is of generally cylindrical form when in a non-compressed state.

5. The insert according to claim 4 wherein the seal has an outer diameter configured to be at least a substantial match for the end face of a pipe into which the insert is intended to be fitted.

6. The insert according to any of claims 1 to 5 wherein the seal is made from rubber, soft plastics material (e.g. such as polybutylene or PEX), or a thermoplastic elastomer.

7. The insert according to any of claims 1 to 6 wherein the or each barb is dimensioned for an interference fit with an internal surface of the pipe, so as to create a seal between the outer surface of the body and the pipe, for protecting the free end of the pipe against contact from fluid flowing within the pipe.

8. The insert according to any of claims 1 to 7 wherein the or each barb is a discrete circumferential ring.

9. The insert according to any of claims 1 to 7 wherein the or each barb is helical.

10. The insert according to claim 9 wherein a tool engagement formation is provided on the second end of the insert for receiving a tool to rotate the insert into a bore of a pipe.

11. The insert according to claim 10 wherein the tool engagement formation comprises one or more ribs or recesses.

12. The insert according to any of claims 7 to 11 wherein an O-ring seal is provided on the body for acting as an additional seal between the body and the pipe into which the insert has been fitted.

13. The insert according to any of claims 1 to 12 wherein the head includes an end surface orthogonal to a longitudinal axis of the insert for use in clamping the seal against the free end of a pipe into which the first end of the insert has been fitted.

14. The insert according to claim 13 wherein the outer diameter of the end surface is configured to be at least a substantial match for the outer diameter of the pipe into which the insert is intended to be fitted.

15. The insert according to any of claims 1 to 14 wherein the head has a curved or angled outer surface.

16. A pipe connector assembly comprising:

a pipe having a free end;

an insert fitted in the free end of the pipe;

a pipe connector having a pipe socket, wherein the free end of the pipe with the insert fitted therein is received in the socket, the pipe socket including a chamber in which the free end of the pipe and the insert are located;

wherein the insert has first and second ends and defines a flow path between the first and second ends for allowing fluid to flow along a longitudinal axis of the insert, wherein the first end of the insert defines a body which is fitted into the free end of the pipe and the second end of the insert defines a head which projects from the free end of the pipe and limits the degree of insertion of the insert into the pipe;

wherein one or more radially projecting barbs are positioned on an outer surface of the body, to grip and provide an interference fit with an internal surface of the pipe, so as to create a seal between the outer surface of the body and the pipe, for protecting the free end of the pipe against contact from fluid flowing within the pipe;

and further wherein a circumferential seal is arranged on the body of the first end, positioned axially between the head of the insert and the free end of a pipe into which the first end of the insert has been fitted, and the seal defines a sealing surface generally orthogonal to the longitudinal axis of the insert, for sealing against an inner surface of the chamber in the socket into which the end of the pipe and insert have been located.

17. The pipe connector assembly according to claim 16 wherein the seal is made from a compressible material and is compressed between the head and the free end of the pipe second end of the body and a pipe, in order to expand radially for providing a sealing surface generally orthogonal to the longitudinal axis of the insert.

18. The pipe connector assembly according to claim 16 or claim 17 wherein the seal is of generally cylindrical form when in a non-compressed state.

19. The pipe connector assembly according to any of claims 16 to 18 wherein the outer diameter of the seal is at least a substantial match for the end face of a pipe into which the insert has been fitted.

20. The pipe connector assembly according to any of claims 16 to 19 wherein the seal is made from rubber, soft plastics material (e.g. such as polybutylene or PEX), or a thermoplastic elastomer.

21. The pipe connector assembly according to any of claims 16 to 20 wherein the or each barb is a discrete circumferential ring or a helical formation.

22. The pipe connector assembly according to any of claims 16 to 21 wherein an O-ring seal is provided on the body for acting as an additional seal between the body and the pipe into which the insert has been fitted.

23. The pipe connector assembly according to any of claims 16 to 22 wherein the head includes an end surface orthogonal to a longitudinal axis of the insert, and the seal is clamped between the end surface of the head and the free end of the pipe into which the first end of the insert has been fitted.

24. The pipe connector assembly according to any of claims 16 to 23 wherein the circumferential seal is arranged in sealing abutment with the end surface at the free end of the pipe to protect the end surface against fluid contact.

25. A pipe connector assembly comprising:

a pipe having a free end;

an insert fitted in the free end of the pipe;

a pipe connector having a pipe socket for receiving the free end of the pipe with the insert fitted therein, the pipe socket including a chamber in which the free end of the pipe and the insert are located;

wherein the insert has first and second ends and defines a flow path between the first and second ends for allowing fluid to flow along a longitudinal axis of the insert, wherein the first end of the insert defines a body which is fitted into the free end of the pipe and the second end of the insert defines a head which projects from the free end of the pipe and limits the degree of insertion of the insert into the pipe;

wherein a circumferential seal is arranged on the body of the first end, positioned axially between the head of the insert and the free end of a pipe into which the first end of the insert has been fitted, and defines a sealing surface generally orthogonal to the

longitudinal axis of the insert, for sealing against an inner surface of the chamber in which the end of the pipe and insert have been located; and

wherein the first end of the insert has been welded or fused to the inside of the pipe, to secure the insert relative to the pipe and create a seal between the outer surface of the insert body and the internal surface of the pipe.

26. The pipe connector assembly according to claim 25 wherein the seal is made from a compressible material and is compressed between the head and the free end of the pipe, in order to expand radially for providing a sealing surface generally orthogonal to the longitudinal axis of the insert, for sealing against the inner surface of said chamber.

27. The pipe connector assembly according to claim 25 or claim 26 wherein the seal is of generally cylindrical form when in a non-compressed state.

28. The pipe connector assembly according to any of claims 25 to 27 wherein the outer diameter of the seal is at least a substantial match for the end face of the pipe into which the insert has been fitted.

29. The pipe connector assembly according to any of claims 25 to 28 wherein the seal is made from rubber, soft plastics material (e.g. such as polybutylene or PEX), or a thermoplastic elastomer.

30. A pipe connector assembly comprising:

a pipe having a free end;

a connector having a socket receiving the free end of the pipe and including a gripper for gripping the pipe, wherein said socket defines a first chamber and a second chamber positioned axially inwardly of the first chamber; the assembly further comprising:

an insert having a body with first and second ends, and defining a fluid flow path between the first and second ends;

wherein the first end of the insert is positioned within the pipe and the second end of the insert is in abutment with an end face of the pipe, the second end of the insert extends from the first chamber to the second chamber of the connector, and the first end of the insert includes barbs in an interference fit with the inside of the pipe, for fixing the

position of the insert with respect to the pipe and providing a seal between the insert and the inside of the pipe.

31. A pipe connector assembly comprising:

a pipe having a free end;

a connector having a socket receiving the free end of the pipe and including a gripper for gripping the pipe, wherein said socket defines a first chamber and a second chamber positioned axially inwardly of the first chamber; the assembly further comprising:

an insert having a body with first and second ends, and defining a fluid flow path between the first and second ends;

wherein the first end of the insert is positioned within the pipe and the second end of the insert is in abutment with an end face of the pipe, the second end of the insert extends from the first chamber to the second chamber of the connector, and the first end of the insert is welded or fused to the pipe so as to fix the position of the insert with respect to the pipe and provide a seal between the insert and the inside of the pipe.

32. The pipe connector assembly according to claim 30 or claim 31, further comprising a seal acting between an internal surface of the connector and the second end of the insert.

33. The pipe connector assembly according to claim 32 wherein the seal is an O-ring mounted within the connector.

34. The pipe connector assembly according to claim 33 wherein the O-ring is mounted between two spacers.

35. The pipe connector assembly according to any of claims 30 to 34 wherein the second end of the insert has a rounded or angled end face so as to ease insertion of the insert into the connector during assembly.

36. The pipe connector assembly according to any of claims 30 to 35 wherein the bore of the insert at the second end is greater in diameter than at the first end of the insert.

37. The pipe connector assembly according to any of claims 30 to 36 wherein the insert defines a step between the first and second ends, and the step includes a face in abutment with the free end of the pipe.

38. The pipe connector assembly according to any of claims 30 to 37 wherein the outside diameter of the second end of the insert matches or is a substantial match for the outside diameter of the pipe.

39. A pipe connector assembly comprising:

a pipe having a free end;

a connector having a socket receiving the free end of the pipe and including a gripper for gripping the pipe, wherein said socket defines a first chamber and a second chamber positioned axially inwardly of the first chamber; the assembly further comprising:

an insert having a body with first and second ends, and defining a fluid flow path between the first and second ends;

wherein the second end of the insert is in abutment with an end face of the pipe, the second end of the insert extends from the first chamber to the second chamber of the connector, and a seal is provided between an internal wall of the first chamber and the second end of the insert.

40. A pipe connector assembly according to claim 39 wherein the first end of the insert comprises barbs in an interference fit with the inside of the pipe, for fixing the position of the insert with respect to the pipe and creating a seal with the inside of the pipe.

41. A pipe connector assembly according to claim 39 wherein the first end of the insert is fused or welded to the pipe so as to fix the position of the insert with respect to the pipe and creating a seal with the inside of the pipe.

42. The pipe connector assembly according to any of claims 39 to 41 wherein the insert defines a step between the first and second ends, and the step includes a face in abutment with the free end of the pipe.

43. The pipe connector assembly according to any of claims 39 to 42 wherein the outside diameter of the second end of the insert matches or is a substantial match for the outside diameter of the pipe.

44. The pipe connector assembly according to any of claims 39 to 43 wherein the seal between the internal wall of the first chamber and the second end of the insert is an O-ring mounted within the connector.

45. The pipe connector assembly according to claim 39 wherein the seal between the internal wall of the first chamber and the second end of the insert is an O-ring carried on the insert.

46. A pipe connector assembly according to claim 39 wherein the seal between the internal wall of the first chamber and the second end of the insert is located in a channel or groove formed on the second end of the insert.

47. The pipe connector assembly according to claim 46 wherein the seal is located in a channel comprising a radial projection on the insert.

48. The pipe connector assembly according to claim 47 wherein the radial projection is in abutment with a stop surface inside the connector.

49. The pipe connector assembly according to claim 48 wherein the stop surface is defined by a transition from the first chamber to the second chamber of the connector.

50. A pipe connector assembly according to claim 39 or any of claims 45 to 49 wherein the first end of the insert includes an O-ring or other annular seal for sealing contact with an internal surface of the pipe

51. A pipe connector assembly according to claim 39 or any of claims 45 to 50 wherein the insert is a pre-fitted component within the connector prior to insertion of the free end of the pipe into the socket on the connector.

52. The pipe connector assembly according to claim 39 or any of claims 45 to 51, further comprising a seal located circumferentially around the second end of the insert to act to provide a seal between the second chamber and the insert.

53. An insert substantially as herein before described with reference to and/or as shown in Figures 4, 5, 6 or 7.

54. A pipe connector assembly substantially as herein before described with reference to and/or as shown in Figures 4, 5, 6 or 7.

Application No:	GB1215256.7	**Examiner:**	Damien Huxley
Claims searched:	1 to 54	**Date of search:**	7 December 2012

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	1	EP 2400201 A1 (JOHN GUEST INTERNATIONAL LIMITED) See the whole document
A	1	US 2008/0169646 A1 (WERTH) See the whole disclosure
A	1	WO 2007/002027 A2 (RAIN BIRD CORPORATION) See the whole document
A	1	DE 29622638 U1 (OVENTROP) See the figures and WPI Abstract Accession Number 1997-204961.
A	1	US 4893848 B (MELCHER) See the whole document

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Field of Search:

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F16L

The following online and other databases have been used in the preparation of this search report

ONLINE: WPI, EPODOC

International Classification:

Subclass	Subgroup	Valid From
F16L	0037/08	01/01/2006
F16L	0033/20	01/01/2006
F16L	0037/092	01/01/2006
F16L	0037/098	01/01/2006