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EP 1126207 A2 **WO 2004/063614 A2**
DE 003232221 A1 **US 20060108801 A1**

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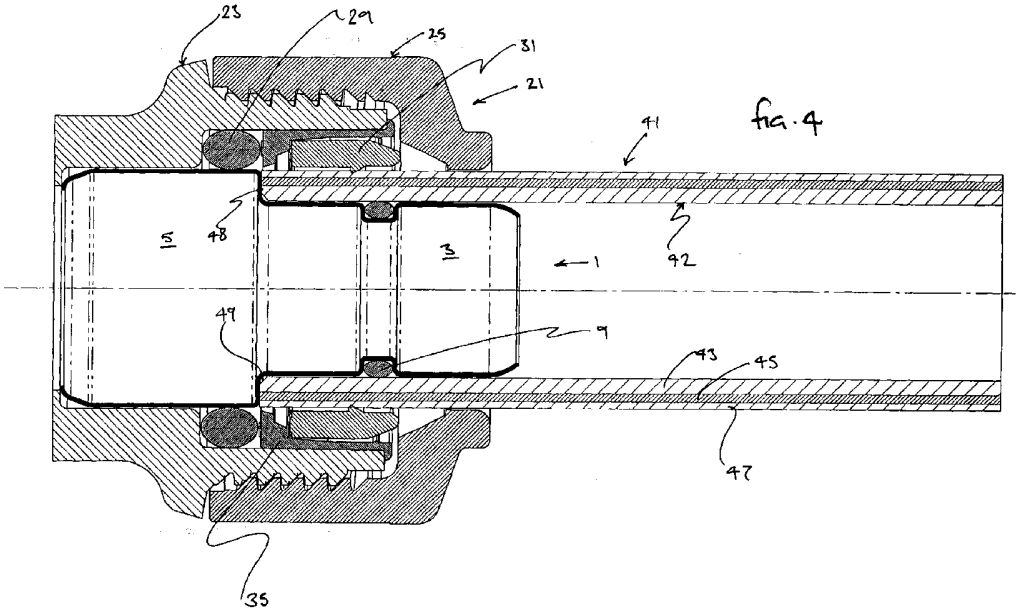
(54) Abstract Title: **Pipe insert for multi-layered pipe**

(57) A pipe insert or adaptor 1 for use with a length of multi-layered barrier pipe comprises two axially adjacent and mutually coaxial cylindrical sleeve portions 3,5. The relatively smaller sleeve portion 3 is provided with a seal on its radially outer surface for sealing against the inner surface of a multi-layered pipe. The outer diameter of the larger sleeve portion 5 is similar to the outer diameter of the pipe 41 and cooperates with a seal 29 in a pipe fitting 21. The two sleeve portions are joined together by an axially-facing shoulder 11, which covers the end surface of the pipe 41 when the first sleeve section 3 is inserted in the end portion of the pipe for use.



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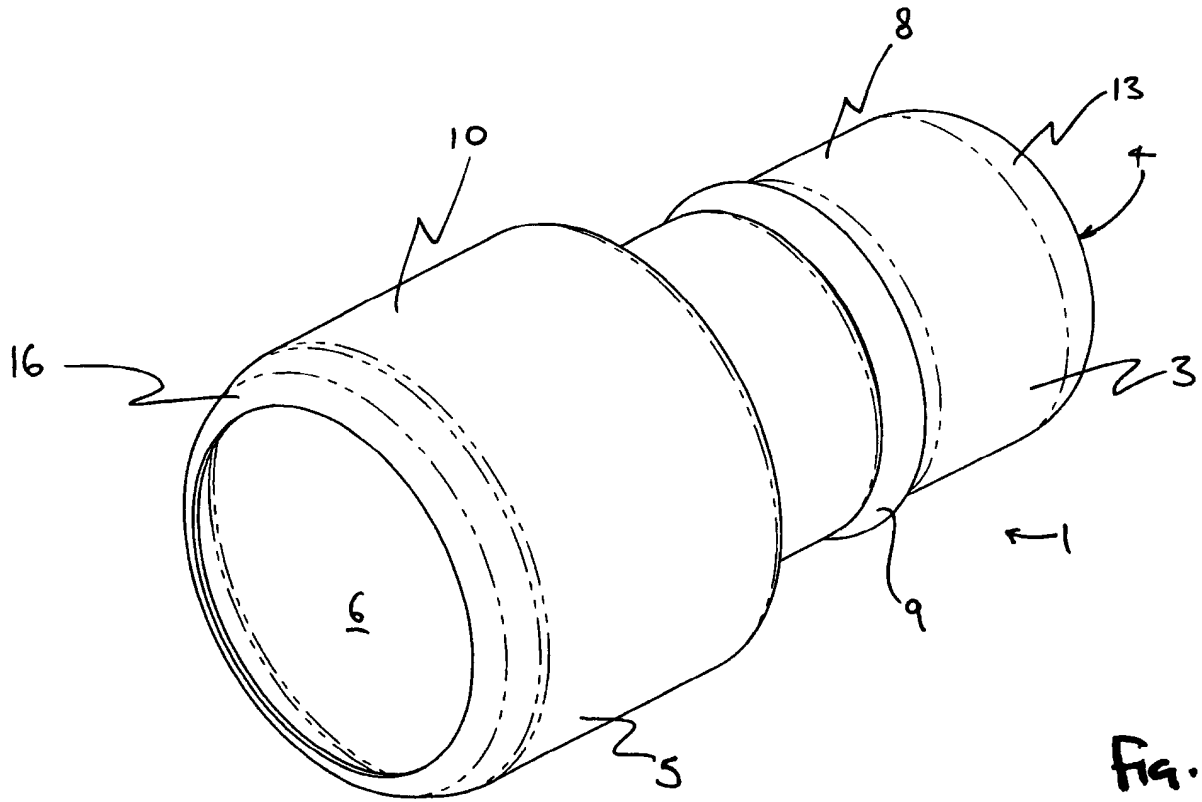

Fig.1

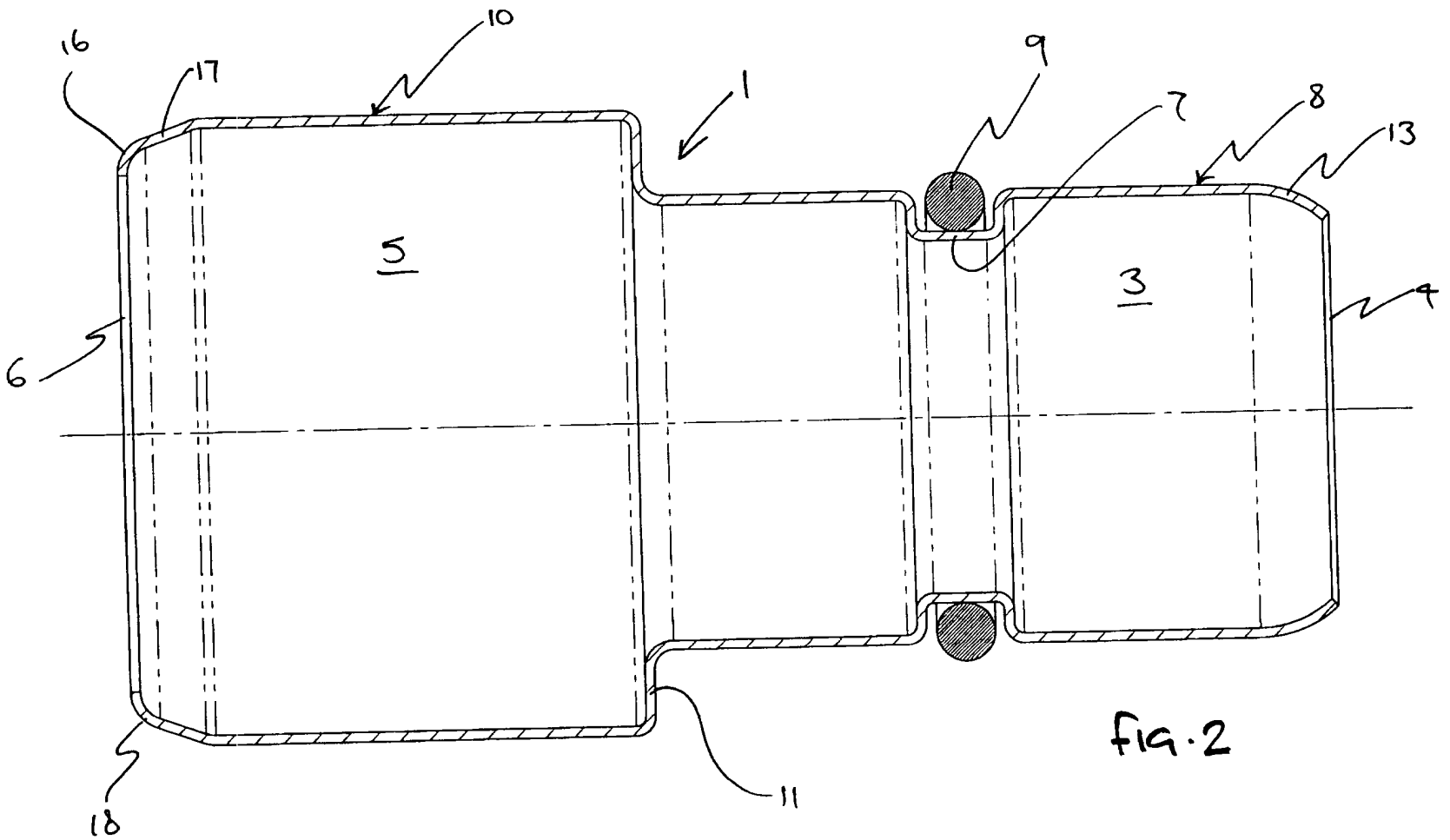

fig.2

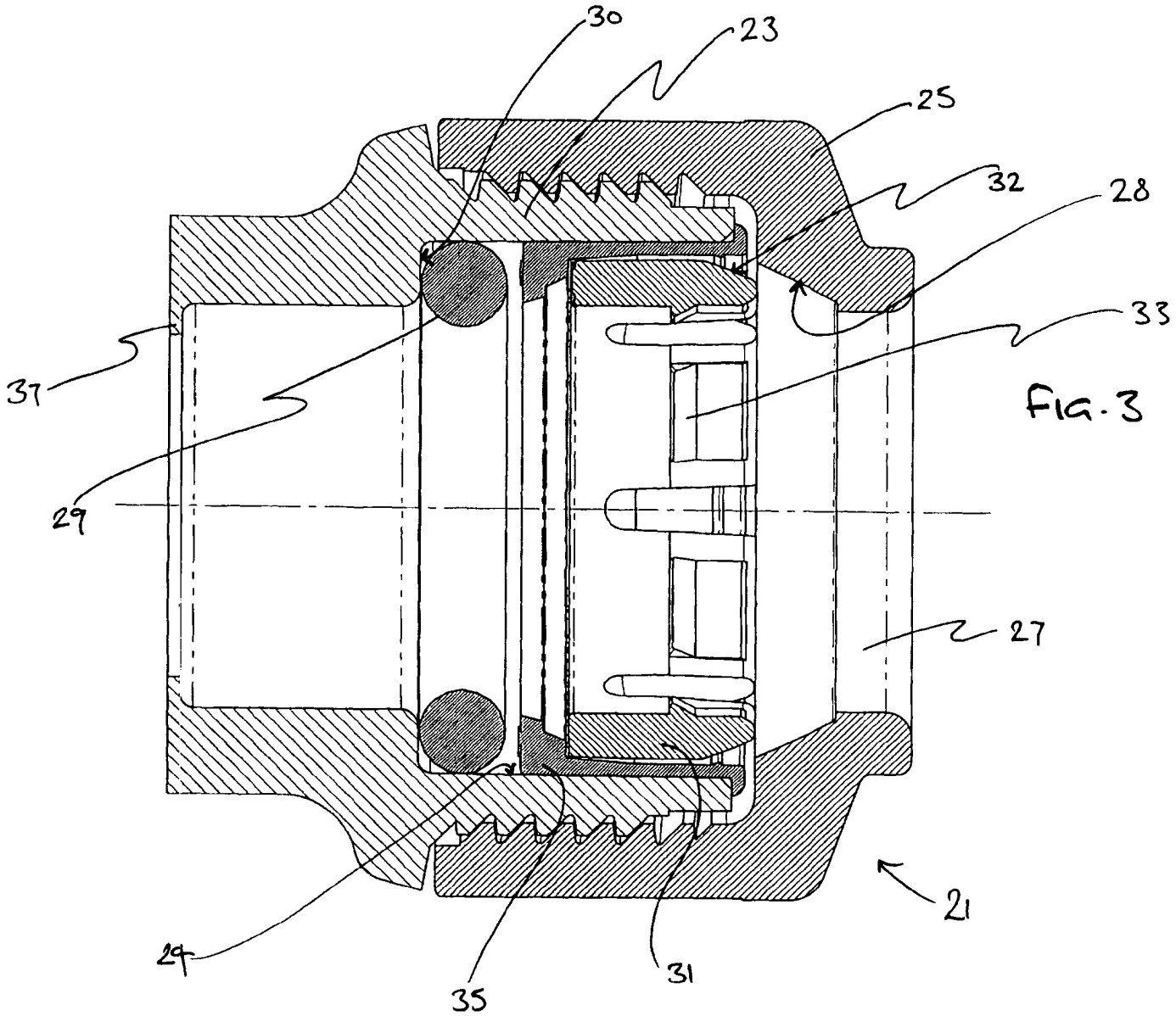

Fig. 3

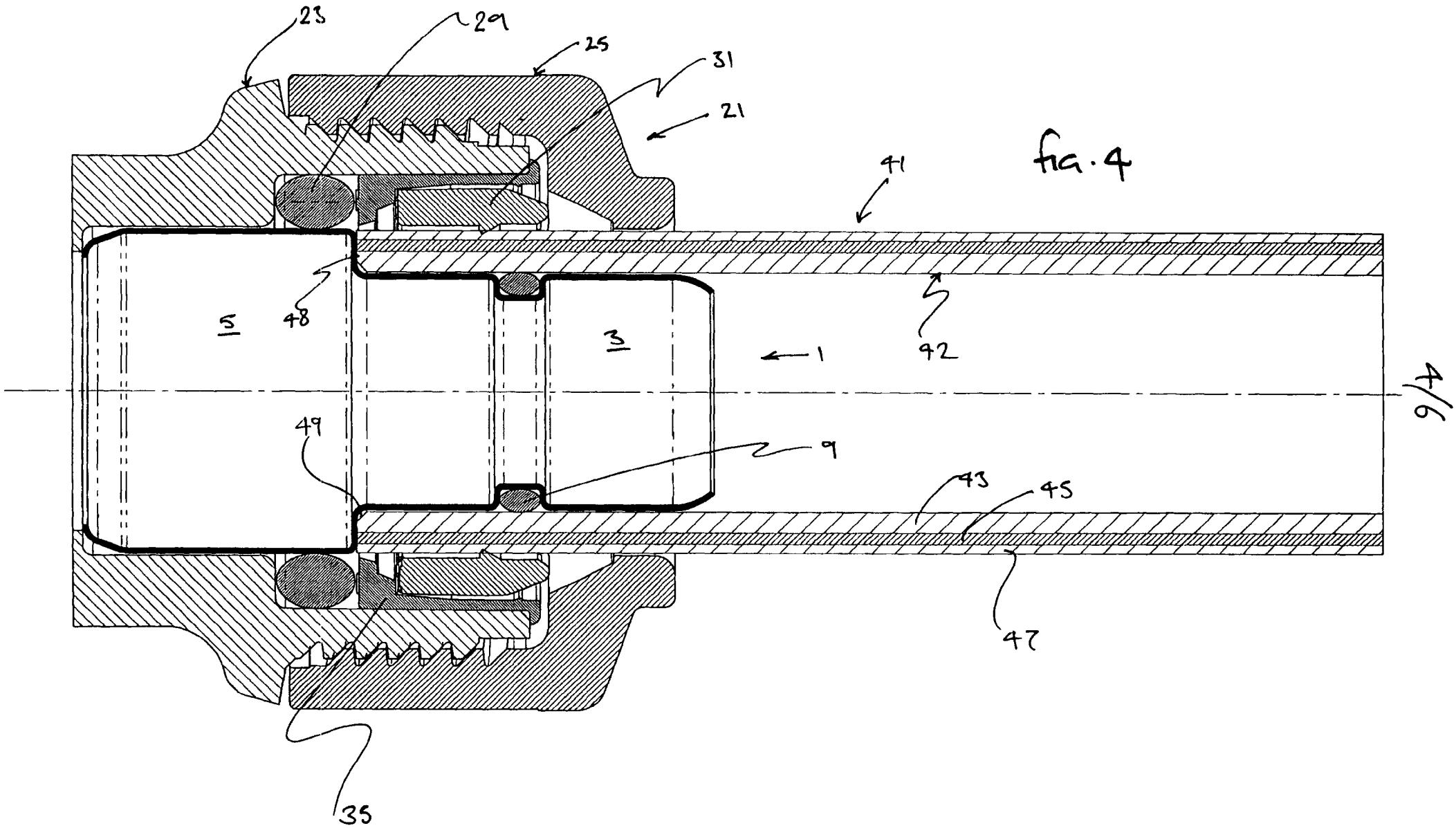

fig. 4

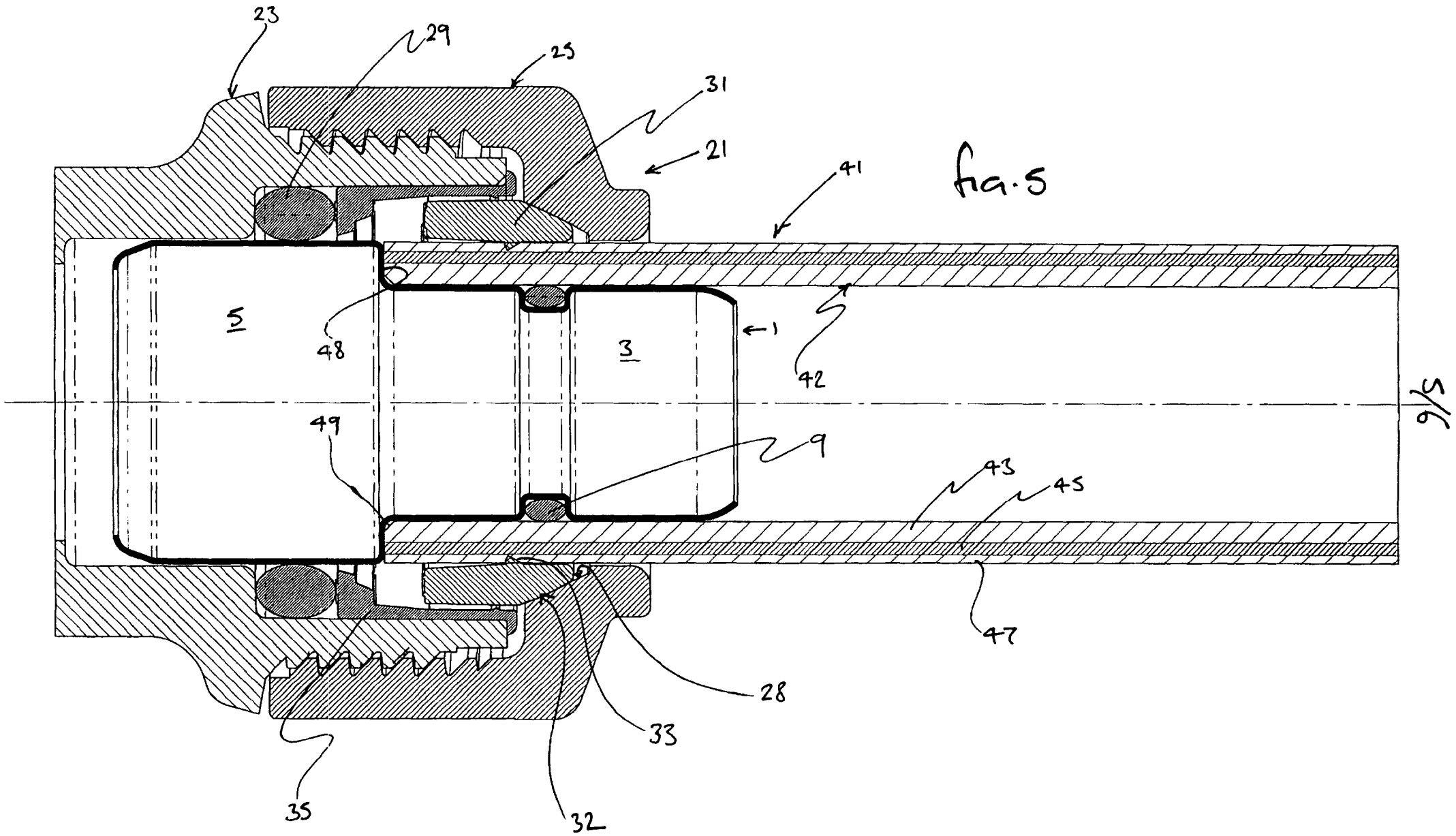

fig. 5

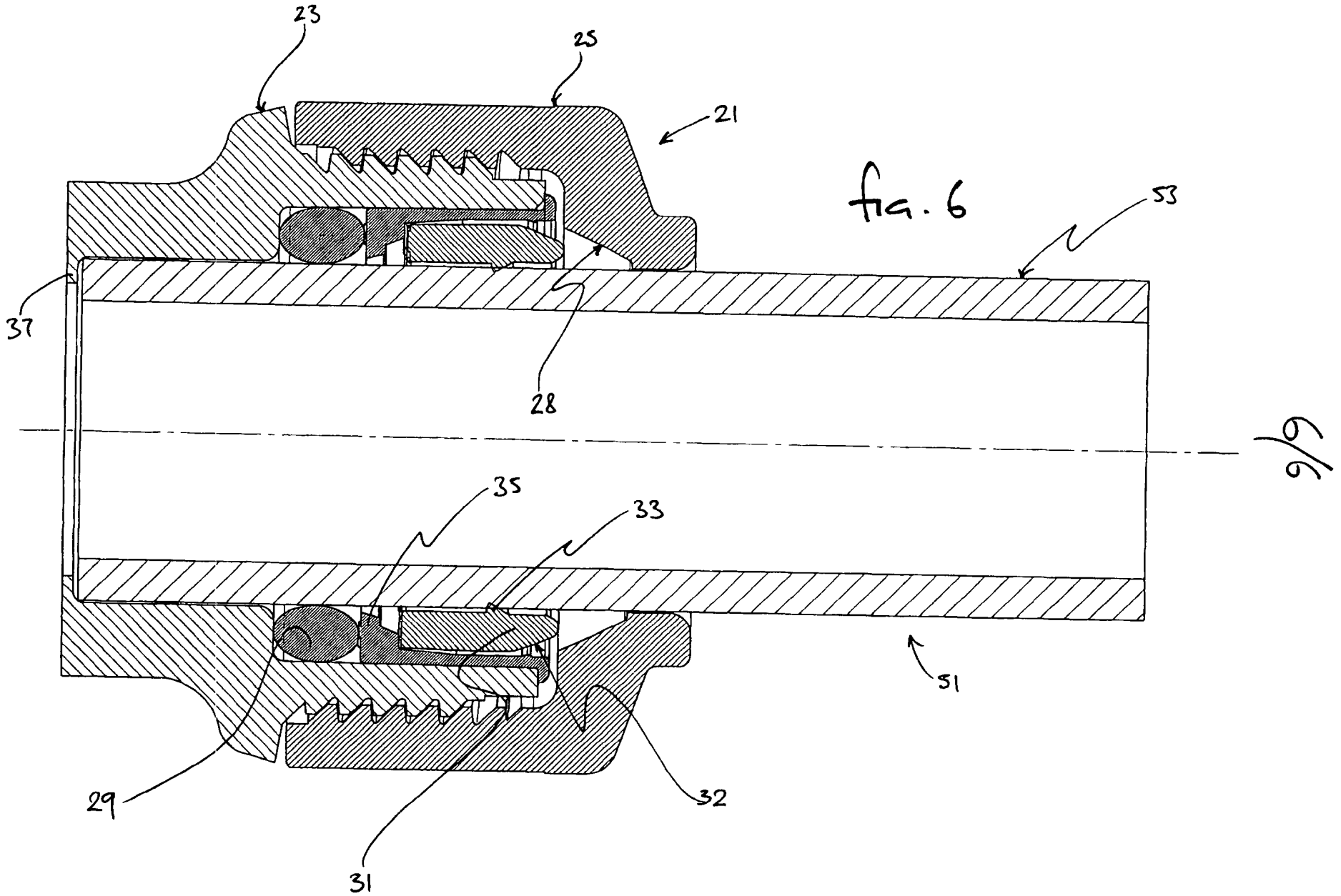

fig. 6

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ADAPTOR FOR USE WITH MULTI-LAYERED PIPE

The present invention relates to an adaptor for use with multi-layered pipe. Particularly, but not exclusively, the invention relates to an adaptor for use with pipe having a layer of aluminium interposed between inner and outer plastics layers.

There are a number of systems for connecting multi-layered pipe lengths to each other, or to other components, such as radiators, for example. As there is a tendency for the connected pipe to delaminate and/or to corrode, these systems all include features designed to preserve the integrity of the pipe during use and the fittings used in the systems tend to fall in three broad categories.

The first category is that of crimp-type fittings. These fittings generally feature a compact, economically styled body with a spigot feature over which the prepared pipe is located. The spigot designs vary a little between manufacturers but are generally of a similar construction with at least one O-ring and various retaining barbs. To make the joint, the pipe is cut squarely and then calibrated, using a separate tool, so as to ensure a round end with a chamfer on the inside edge. The pipe is then pushed over the spigot. The joint is closed by mechanically crimping a sleeve over the pipe and fitting with a tool. The result is a sandwich construction that will not come apart during use. However, whilst such connections are tough and long-lasting, the fittings are not demountable from the pipe. In addition, the fittings cannot be rotated on the pipe, once the joint has been made, thereby restricting the options for post-assembly manipulation.

In the second broad class of existing fittings, a cap is used to hold the joint together. The main benefit of this type of fitting is that the bore of the pipe is not reduced. Instead, the pipe is splayed out in the area of the socket. To make the joint, the pipe is first prepared to ensure a good end condition. In this regard it is initially cut using a suitable cutter to ensure a square end. The pipe end is next calibrated, as described

above. A cap is then placed over the pipe end and a different tool is used to splay the end of the pipe in the area of the socket. The fitting includes a single O-ring for sealing on the inside of the pipe in the region of the splayed end. The cap is screwed down onto the fitting body and a further tool is used to tighten it down. These fittings have the benefit of being de-mountable, although some require the use of a tool for disassembly.

The final class of known fittings for use with multi-layered pipes is that of press-type fittings. These are similar in design to the crimp-type, but a collar of the fitting is instead driven axially down the spigot to close the joint. As with the above fittings, the pipe is first cut squarely and then prepared. The sleeve is placed onto the pipe and the fitting and pipe assembly is placed onto a jointing tool. The tool drives the collar axially, to close the joint. These fittings tend not to require an O-ring, but rely on a mechanical seal on the bore of the pipe. Once again, they are not demountable and the installed fittings cannot be rotated relative to the pipe.

Although the above types of fittings are generally successful in addressing delamination and corrosion issues, the features provided to achieve this introduce complexity and therefore additional manufacturing and assembly expense. In addition, many of the fittings require special equipment for installation. It is consequently the case that such known fittings can be both expensive and time-consuming to use, meaning that they cannot be used generally within a system. The result is that users typically keep one range of fittings and tools for general use and a second for use within multi-layered pipes.

The present invention sets out to obviate or ameliorate the above problems associated with the prior art. That is to say, the invention sets out to provide a means for simplifying the installation and use of multi-layered pipe, whilst ensuring that there is no increased risk of delamination or corrosion.

Accordingly, a first aspect of the invention provides an adaptor for use with a length of multi-layered pipe, the said adaptor comprising two axially adjacent and mutually coaxial cylindrical sleeve portions, each being provided with a respective distal open

end, a first said sleeve portion having a relatively smaller diameter and a second said sleeve portion having a relatively larger diameter; wherein:

the said first said sleeve portion is provided with first sealing means on a radially outer surface thereof for sealing between the said first sleeve portion and a radially inner surface of the said length of multi-layered pipe when the said first sleeve portion is inserted within an end portion of the said length of multi-layered pipe;

the outer diameter of the said second sleeve portion is adapted to be substantially similar to that of the said length of multi-layered pipe;

the said first and second sleeve portions are joined together by an intermediate, radially-extending and axially-facing shoulder, which is adapted to cover an axial end surface of the said multi-layered pipe section when the said first sleeve section is inserted in the said end portion of the said length of pipe; and

the said second sleeve portion comprises a seal bearing surface on a radially outer portion thereof, the said seal bearing surface being adapted to co-operate with a radially inwardly directed second sealing means provided in a socket of a socketted fitting in order to effect a seal between the adaptor and the said socketted fitting.

By use of such an adaptor, it is possible for multi-layered pipe to be used with a wide variety of readily-available fittings that are designed for use with single-layered pipe. Since single-layered pipe is commonplace and users will generally already have a need for these fittings, the invention can not only save cost, but also remove the need for a fitter to have additional, special skills and knowledge.

Preferably, the said sealing means is mounted within an annular channel provided in the said radially outer surface of the said first sleeve portion. The said sealing means may be an O-ring.

The said open end of the said first sleeve portion may be provided with a first radially inwardly directed annular lip, and this may have a cross-sectional profile that is at least partly arcuate and outwardly convex in a radial direction of the adaptor.

The open end of the said second sleeve portion may be provided with a second radially inwardly directed annular lip and this may have a cross-sectional profile which is at

least partly arcuate and outwardly convex in a radial direction of the adaptor. Preferably, the said second lip then has a cross-sectional profile comprising an inclined portion, extending radially inwardly and axially outwardly, terminating in a portion which has a portion that is arcuate and outwardly convex in a radial direction of the adaptor.

A second aspect of the invention provides a pipe assembly comprising a length of multi-layered pipe and an adaptor, the said adaptor comprising two axially adjacent and mutually coaxial cylindrical sleeve portions, each being provided with a respective distal open end, a first said sleeve portion having a relatively smaller diameter and a second said sleeve portion having a relatively larger diameter; wherein:

the said first said sleeve portion is provided with first sealing means on a radially outer surface thereof for sealing between the said first sleeve portion and a radially inner surface of the said length of multi-layered pipe when the said first sleeve portion is inserted within an end portion of the said length of multi-layered pipe;

the outer diameter of the said second sleeve portion is adapted to be substantially similar to that of the said length of multi-layered pipe;

the said first and second sleeve portions are joined together by an intermediate, radially-extending and axially-facing shoulder, which is adapted to cover an axial end surface of the said multi-layered pipe section when the said first sleeve section is inserted in the said end portion of the said length of pipe; and

the said second sleeve portion comprises a seal bearing surface on a radially outer portion thereof, the said seal bearing surface being adapted to co-operate with a radially inwardly directed second sealing means provided in a socket of a socketted fitting in order to effect a seal between the adaptor and the said socketted fitting.

A third aspect of the invention provides a jointing system comprising a socketted fitting, a length of multi-layered pipe and an adaptor, the said adaptor comprising two axially adjacent and mutually coaxial cylindrical sleeve portions, each being provided with a respective distal open end, a first said sleeve portion having a relatively smaller diameter and a second said sleeve portion having a relatively larger diameter; wherein:

the said first said sleeve portion is provided with first sealing means on a radially outer surface thereof for sealing between the said first sleeve portion and a

radially inner surface of the said length of multi-layered pipe when the said first sleeve portion is inserted within an end portion of the said length of multi-layered pipe;

the outer diameter of the said second sleeve portion is adapted to be substantially similar to that of the said length of multi-layered pipe;

the said first and second sleeve portions are joined together by an intermediate, radially-extending and axially-facing shoulder, which is adapted to cover an axial end surface of the said multi-layered pipe section when the said first sleeve section is inserted in the said end portion of the said length of pipe; and

the said second sleeve portion comprises a seal bearing surface on a radially outer portion thereof;

the arrangement being such that the end portion of the said pipe and the adaptor can be inserted together into a socket of the said socketted fitting to form a joint, whereupon a radially inwardly directed sealing means of the said socket bears upon the said seal bearing surface and a gripping means provided in the socket bears upon a radially outer surface of the said first sleeve portion in such a manner as to retain the said length of pipe and adaptor within the socket.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a pipe adaptor in accordance with a first embodiment of the invention;

Figure 2 is a cross-section of the pipe adaptor of Figure 1;

Figure 3 is a cross-section of a pipe fitting;

Figure 4 is a cross-section of the adaptor of Figures 1 and 2 installed upon a length of multi-layered pipe and inserted within the fitting of Figure 3;

Figure 5 is a cross-section corresponding to Figure 4, but showing the arrangement under axial load; and

Figure 6 is a cross-section of the fitting of Figures 3 to 5, in use with conventional single-layered pipe.

Referring now to Figure 1, it will be seen that an adaptor 1 according to a first embodiment of the invention is defined by two basic sections: an inner sleeve portion 3 and an outer sleeve portion 5. The inner sleeve portion 3 and outer sleeve portion 5 are integrally formed and coaxial; they are connected by an intermediate radial shoulder 11. The adaptor is open at both ends, thereby defining an inner mouth 4 at the distal end of the inner sleeve portion 3, and an outer mouth 6 at the distal end of the outer sleeve portion 5. The inner sleeve portion 3 is circumscribed by an inner lip 13 and the outer mouth 6 is circumscribed by an outer lip 16. Each of the inner lip 13 and outer lip 16 are directed radially inwardly and axially outwardly.

As will be more readily apparent from Figure 2, the inner lip 13 has an entirely arcuate cross-sectional profile. The outer lip 16 is formed from a frustoconical section 17 which terminates in an arcuate section 18 at its distal end.

The inner sleeve portion 3 is provided with an annular, rectangular-section channel 7 half way along its axis. The annular channel 7 receives and provides a seat for an O-ring 9, which defines a first sealing means.

The main body of the adaptor 1 is formed from stainless steel, however other materials could be used, such as brass or a plastics material (e.g. polyphenylsulfone, which is an amorphous polymer with good chemical resistance and toughness). The main requirements are that the material is capable of withstanding the internal pressures and temperatures expected during use and that it is also resistant to chemical attack and able to pass relevant to taste and odour test requirements.

Figure 3 shows an example of a socket 21 forming part of a fitting to which a length of pipe is to be connected. The fitting is, in this case, conventional and could be any of a large range of typical system components – e.g. a connector, an elbow, a t-junction, an adaptor, etc. It will now be briefly described for ease of understanding.

The socket 21 comprises a body 23, upon which is mounted a screw-fit cap 25. The cap 25 comprises a mouth 27, through which a pipe can be inserted in order to form a junction between the pipe end and the socket 21 (see Figure 6).

Inside the socket, there is an O-ring 29, which addresses an axially outwardly facing shoulder 30 and defines a second sealing means. In addition, the socket is provided with an annular gripping means 31, which comprises radially inwardly directed teeth 33. The gripping means 31 is received within a support ring 25. At its axially innermost end, the fitting comprises an inner flange 37.

The conventional use of the socket 21 is illustrated in Figure 6. Here it can be seen that a pipe end 51 is inserted within the socket 21 to form a junction between the pipe 51 and the fitting 21. The O-ring 29 effects a seal between the socket 21 and the radially outer surface of the pipe 53 and the gripping means 31 closely surrounds the radially outer surface of the pipe 53, with its teeth 33 embedded in its surface. Under an axial tensile load, the movement of the pipe 51 out of the socket 21 is resisted by the teeth 33 of the gripping means 31, which are forced deeper into the surface of the pipe 51, as a frustoconical radially outer surface 32 of the gripping means 31 bears against a frustoconical inner surface 28 of the mouth 27 in a camming action. Continued pressure forces the gripping means 31 more tightly against the radially outer surface of the pipe 51, thereby eventually wedging it in place and resisting the axial load.

Returning to the adaptor 1 shown in Figures 1 to 5, the inner sleeve 3 is configured to be received within an end portion of a length of multi-layered pipe 41 during use. This can be best seen in Figure 4. The lip 13 is configured so as to facilitate this insertion. Once installed, the O-ring 9 provides a close seal between the radially outer surface 8 of the inner sleeve portion 3 and the radially inner surface 42 of the pipe end 41. The shoulder 11 serves to abut against the axial end surface 48 of the pipe 41, so as to locate the adaptor 1 relative to the pipe 41 for use. Preferably, the pipe end is calibrated (chamfered at its radially inner surface) in a similar manner to the prior art, although this is not absolutely necessary. If the chamfering is undertaken, then the inner lip 13 could potentially be omitted or at least reduced in size.

The radial dimensions of the radially outer surface 10 of the outer sleeve portion 5 are essentially identical to those of the length of pipe 41. Consequently, when the adaptor 1 is fitted to the end of the pipe 41, the outer sleeve portion 5 is flush with the pipe 41.

Once the adaptor 1 is installed on the pipe 41, it can be inserted into the fitting 21 in a largely conventional manner, as can be seen in Figure 4. The configuration of the mouth 6 on the outer sleeve portion 5 assists this. Reference to this figure will quickly show that the outer sleeve portion 5 sits within the axially innermost portion of the fitting 21, with the pipe extending axially outwardly beyond its mouth 27.

When assembled in this manner, the adaptor 1 enables the multi-layered pipe 41 to be employed with this conventional fitting, but in such a way as to preserve the integrity of the multi-layered pipe 41 during use and, particularly, protect it against delamination and corrosion. More specifically, it will be noted that the shoulder 11 abuts the axial end surface 48 of the multi-layered pipe 41 such that the boundaries between the first, second and third layers 43, 45, 47 of the pipe are overlapped by the shoulder 11. In addition, the boundary between the radially inner surface 42 of the pipe 41 and the radially outer surface 8 of the inner sleeve portion 3 is sealed by the O-ring 9. This provides a seal against fluid flowing in the direction from the pipe 41 towards the fitting 21. Furthermore, the fitting O-ring 29 provides a seal between the radially inner surface 24 of the fitting 21 and the radially outer surface 10 of the outer sleeve portion 5. Thus the radially outer surface 10 of the outer sleeve portion 5 defines a seal bearing surface, which co-operates with the O-ring 29 to provide a seal against fluid flowing in the opposite direction, from the fitting 21 towards the pipe 41.

As a consequence of the above-described arrangement, it will therefore be seen that the relatively vulnerable portion of the pipe end 41, that is to say its axial end surface 48, is protected from both flow directions by a respective seal, and also by direct abutment with the shoulder 11. Sealing in this manner avoids fluid accessing this portion and drastically reduces the risk of any delamination or corrosion. The seal bearing surface 10 effectively extends the length of pipe by adding a portion which can co-operate with the pre-existing internal sealing means (in this case O-ring 29) of the fitting in a largely

conventional manner. It will therefore be understood that this embodiment of the invention enables multi-layered pipe to be used successfully in a conventional fitting.

The position of the channel 7 and therefore the O-ring 9 is determined by the relative position of the radially flexing part of the gripping means 31 (in this case, axially extending fingers) in use. More specifically, the channel is situated, so as to be substantially axially aligned with these fingers, so as to allow for its maximum compression and therefore maximum sealing efficiency. In other embodiments, the seal could be located at different axial positions, depending upon the configuration of the preferred socket with which it was to be used.

Figure 5 is a view similar to Figure 4, but shows the assembled joint under an axial tensile load. It will be noted that the radially compressive action of the camming arrangement between the gripping means 31 and the frustoconical inner surface 28 ensures that the pipe end 41 is radially clamped onto the inner sleeve 3. This clamping action ensures that the adaptor 1 moves with the pipe 41, despite the axial resistance provided by the O-ring 29, thereby ensuring that the two remain connected together. Although this performance characteristic is preferred, it is not essential and the coupling could be designed for the adaptor 1 to remain in the axial position of figure 4, with the pipe sliding along the length of the inner sleeve portion 3 under load. In such a situation the axial end surface 48 of the pipe 41 would separate from the shoulder 11, but it would still be protected, as it would still be isolated from the water/pressure by the two O-rings 9, 29.

The particular configuration of the fitting shown in the figures is merely a single example of a wide number of conventional fittings that can be used with multi-layered pipe as a consequence of an adaptor in accordance with an embodiment of the invention. For the avoidance of doubt, the invention is not limited to use with the illustrated fitting. By its very nature, the invention instead aims to broaden the range of components with which multi-layered pipe can be used.

Many modifications and variations will suggest themselves to those versed in the art upon making reference to the foregoing embodiment of the invention, which is given by

way of example and which is not intended to limit the scope of the invention, that being determined by the appended claims. For example, the inner sleeve 3 could easily be provided with an alternative sealing configuration, such as two or more axially separated O-rings. These would typically provide alternative alignment and sealing characteristics during use, but manufacturing costs will then increase. Alternatively, the O-ring could be replaced by a specially-shaped seal, a flat band or a whole variety of other shapes. It is also possible for a supplementary seal to be provided on the shoulder 11.

When the adaptor is made from metal, it is possible that an electrolytic action can be generated between the adaptor shoulder and the cut end of a multi-layer pipe incorporating a metal layer following assembly. Further embodiments of the invention therefore include a non-metallic layer located on the surface of the intermediate shoulder 11, which abuts the axial end-surface 48 of the pipe 41. Various insulating polymeric materials could be used, examples being polyethylene and polypropylene.

Many of the other features of the above embodiment can also be varied or omitted – for example, either of the mouths could be modified in shape or reduced in size if insertion characteristics are required to be different or are of lesser importance.

CLAIMS:

1. An adaptor for use with a length of multi-layered pipe, the said adaptor comprising two axially adjacent and mutually coaxial cylindrical sleeve portions, each being provided with a respective distal open end, a first said sleeve portion having a relatively smaller diameter and a second said sleeve portion having a relatively larger diameter; wherein:

the said first said sleeve portion is provided with first sealing means on a radially outer surface thereof for sealing between the said first sleeve portion and a radially inner surface of the said length of multi-layered pipe when the said first sleeve portion is inserted within an end portion of the said length of multi-layered pipe;

the outer diameter of the said second sleeve portion is adapted to be substantially similar to that of the said length of multi-layered pipe;

the said first and second sleeve portions are joined together by an intermediate, radially-extending and axially-facing shoulder, which is adapted to cover an axial end surface of the said multi-layered pipe section when the said first sleeve section is inserted in the said end portion of the said length of pipe; and

the said second sleeve portion comprises a seal bearing surface on a radially outer portion thereof, the said seal bearing surface being adapted to co-operate with a radially inwardly directed second sealing means provided in a socket of a socketted fitting in order to effect a seal between the adaptor and the said socketted fitting.

2. An adaptor according to Claim 1, wherein the said first sealing means is mounted within an annular channel provided in the said radially outer surface of the said first sleeve portion.

3. An adaptor according to any preceding claim, wherein the said first sealing means is an O-ring.

4. An adaptor according to any preceding claim, wherein the said open end of the said first sleeve portion is provided with a first radially inwardly directed annular lip.

5. An adaptor according to Claim 4, wherein the said first lip has a cross-sectional profile that is at least partly arcuate and outwardly convex in a radial direction of the adaptor.

6. An adaptor according to any preceding claim, wherein the open end of the said second sleeve portion is provided with a second radially inwardly directed annular lip.

7. An adaptor according to any preceding claim, wherein the said second lip has a cross-sectional profile which is at least partly arcuate and outwardly convex in a radial direction of the adaptor.

8. An adaptor according to Claim 8, wherein the said second lip has a cross-sectional profile comprising an inclined portion, extending radially inwardly and axially outwardly, terminating in a portion which has a portion that is arcuate and outwardly convex in a radial direction of the adaptor.

9. An adaptor according to any preceding claim, comprising a non-metallic layer on the said shoulder, for contacting a pipe end.

10. An adaptor according to Claim 9, wherein the said non-metallic layer is made from a polymer.

11. A pipe assembly comprising a length of multi-layered pipe and an adaptor, the said adaptor comprising two axially adjacent and mutually coaxial cylindrical sleeve portions, each being provided with a respective distal open end, a first said sleeve portion having a relatively smaller diameter and a second said sleeve portion having a relatively larger diameter; wherein:

the said first said sleeve portion is provided with first sealing means on a radially outer surface thereof for sealing between the said first sleeve portion and a radially inner surface of the said length of multi-layered pipe when the said first sleeve portion is inserted within an end portion of the said length of multi-layered pipe;

the outer diameter of the said second sleeve portion is adapted to be substantially similar to that of the said length of multi-layered pipe;

the said first and second sleeve portions are joined together by an intermediate, radially-extending and axially-facing shoulder, which is adapted to cover an axial end surface of the said multi-layered pipe section when the said first sleeve section is inserted in the said end portion of the said length of pipe; and

the said second sleeve portion comprises a seal bearing surface on a radially outer portion thereof, the said seal bearing surface being adapted to co-operate with a radially inwardly directed second sealing means provided in a socket of a socketted fitting in order to effect a seal between the adaptor and the said socketted fitting.

12. A jointing system comprising a socketed fitting, a length of multi-layered pipe and an adaptor, the said adaptor comprising two axially adjacent and mutually coaxial cylindrical sleeve portions, each being provided with a respective distal open end, a first said sleeve portion having a relatively smaller diameter and a second said sleeve portion having a relatively larger diameter; wherein:

the said first said sleeve portion is provided with first sealing means on a radially outer surface thereof for sealing between the said first sleeve portion and a radially inner surface of the said length of multi-layered pipe when the said first sleeve portion is inserted within an end portion of the said length of multi-layered pipe;

the outer diameter of the said second sleeve portion is adapted to be substantially similar to that of the said length of multi-layered pipe;

the said first and second sleeve portions are joined together by an intermediate, radially-extending and axially-facing shoulder, which is adapted to cover an axial end surface of the said multi-layered pipe section when the said first sleeve section is inserted in the said end portion of the said length of pipe; and

the said second sleeve portion comprises a seal bearing surface or a radially outer portion thereof;

the arrangement being such that the end portion of the said pipe and the adaptor can be inserted together into a socket of the said socketted fitting to form a joint, whereupon a radially inwardly directed sealing means of the said socket bears upon the said seal bearing surface and a gripping means provided in the socket bears upon a radially outer surface of the said first sleeve portion in such a manner as to retain the said length of pipe and adaptor within the socket.

13. An adaptor substantially as hereinbefore described with reference to Figures 1 to 5 of the accompanying drawings.

14. A jointing system substantially as hereinbefore described with reference to Figures 1 to 5 of the accompanying drawings.

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Application No:	GB0620489.5	**Examiner:**	Peter Middleton
Claims searched:	1-14	**Date of search:**	5 February 2007

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, 11, 12	EP1126207 A2 (GUEST) see abstract and figures: pipe insert for multi-layer pipe
A	1, 11, 12	WO2004/063614 A2 (CALIFORNIA MARINE TECHNOLOGIES) see abstract and figures: pipe insert suitable for multi-layered pipe
A	1, 11, 12	US2006/108801 A1 (GROSCH) see abstract and figures: pipe insert suitable for multi-layer pipes
A	1, 11, 12	DE3232221 A1 (JESCHKE) see figures and WPI abstract accession number 1984-057142 [10]: pipe insert 7 in plastic pipe

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

F2G

Worldwide search of patent documents classified in the following areas of the IPC

F16L

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

Online: WPI, EPODOC