



(19) **United States**

(12) **Patent Application Publication**
Raper et al.

(10) **Pub. No.: US 2010/0140925 A1**

(43) **Pub. Date: Jun. 10, 2010**

(54) **PIPE COUPLING**

Publication Classification

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(51) **Int. Cl.**
F16L 21/02 (2006.01)
F16L 21/035 (2006.01)
F16L 5/10 (2006.01)

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(52) **U.S. Cl.** **285/136.1; 285/370**

(57) **ABSTRACT**

A pipe coupling device comprising a body (3) adapted for insertion into a pipe (2), the body (3) having a through passage, and on its outer surface a groove (14) for receiving a sealing means (30, 40, 50, 60, 90, 100, 110, 120, 130) for forming a fluid-tight seal between the pipe (2) and the body (3), the sealing means having a retaining portion (38) and a sealing portion (32), wherein either the groove (14), the sealing means or both are constructed and arranged such that the retaining portion (38) holds the sealing means within the groove (14) when the sealing portion (32) is subjected to the insertion force experienced when the pipe coupling device (1) is inserted into a pipe (2). Further, the base portion (31) may be axially wider than the sealing portion (32). Further, the sealing means may include reinforcing means (111) adapted to prevent the sealing means leaving the groove (14).

(21) Appl. No.: **12/530,285**

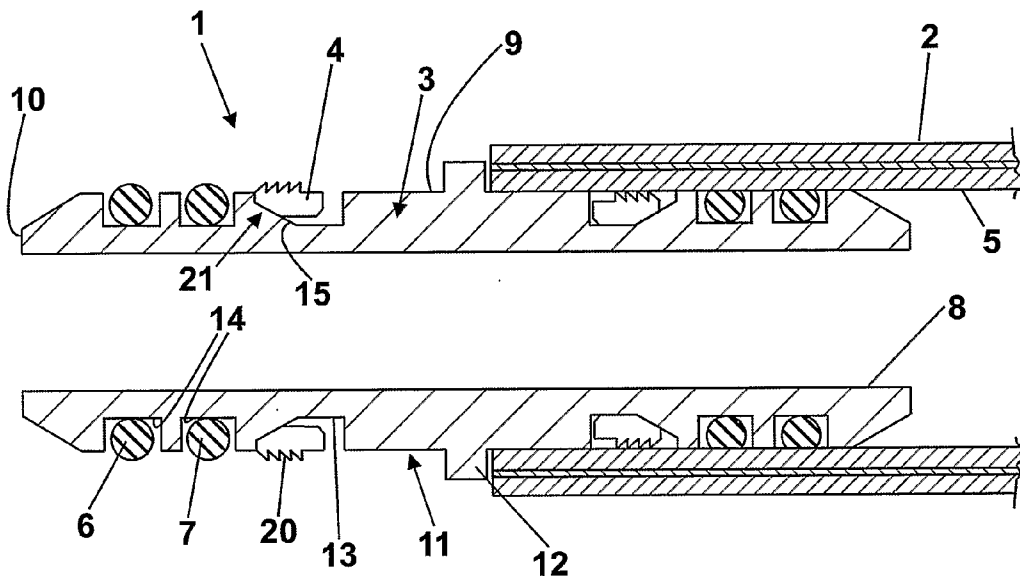
(22) PCT Filed: **Mar. 7, 2008**

(86) PCT No.: **PCT/GB2008/000790**

§ 371 (c)(1),
(2), (4) Date: **Feb. 3, 2010**

(30) **Foreign Application Priority Data**

Mar. 7, 2007 (GB) 0704339.1



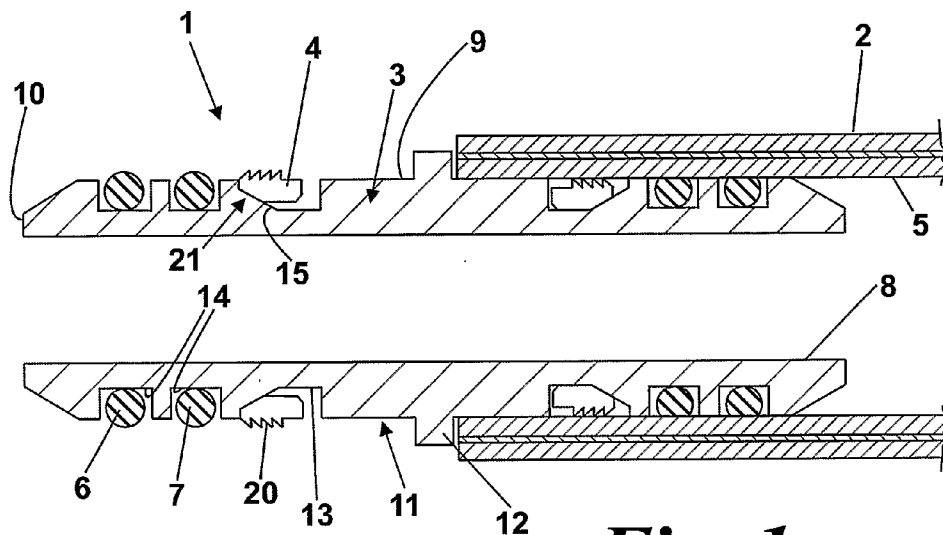


Fig. 1

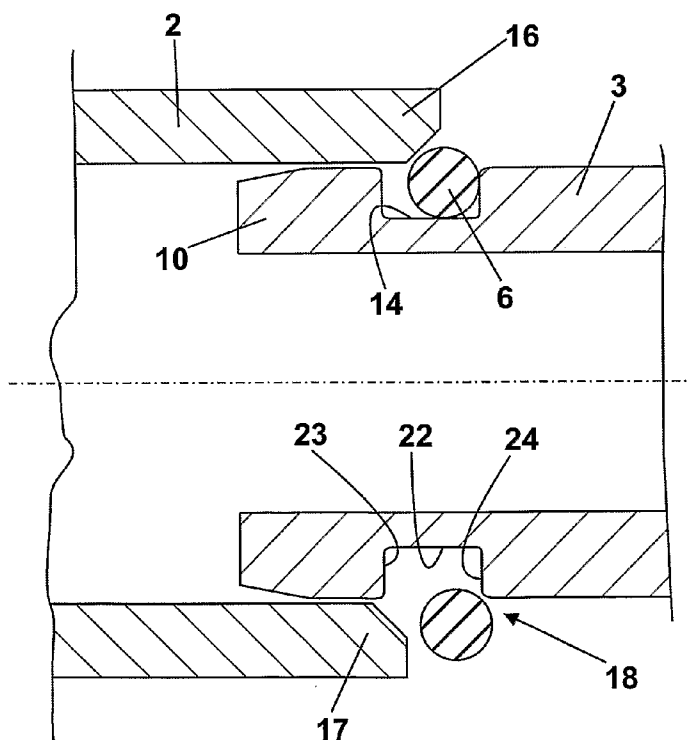


Fig. 2

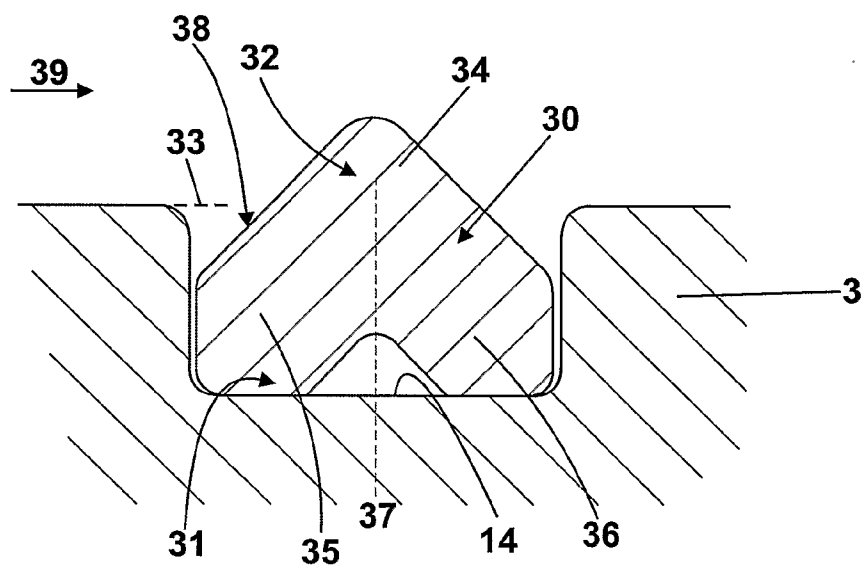


Fig. 3

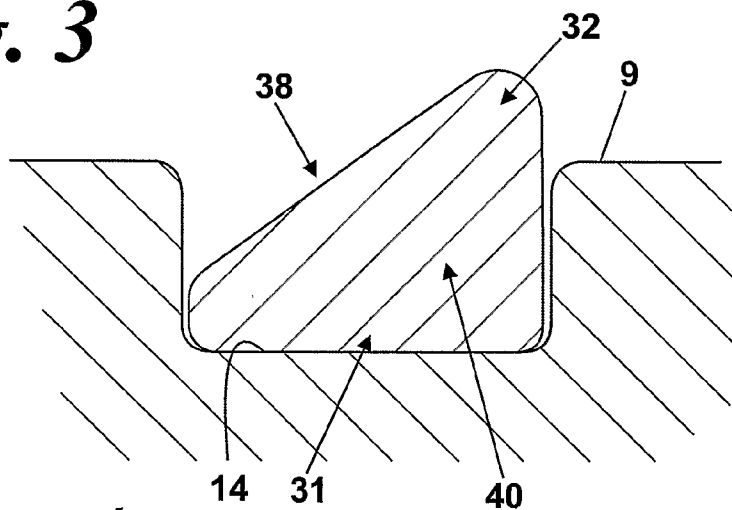


Fig. 4

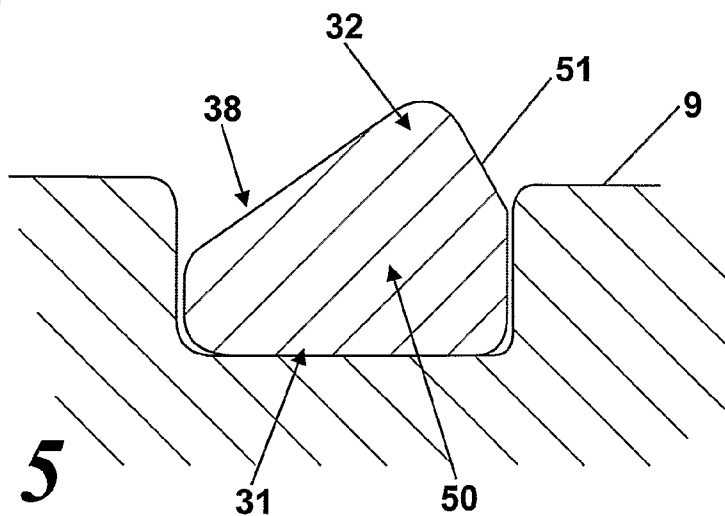


Fig. 5

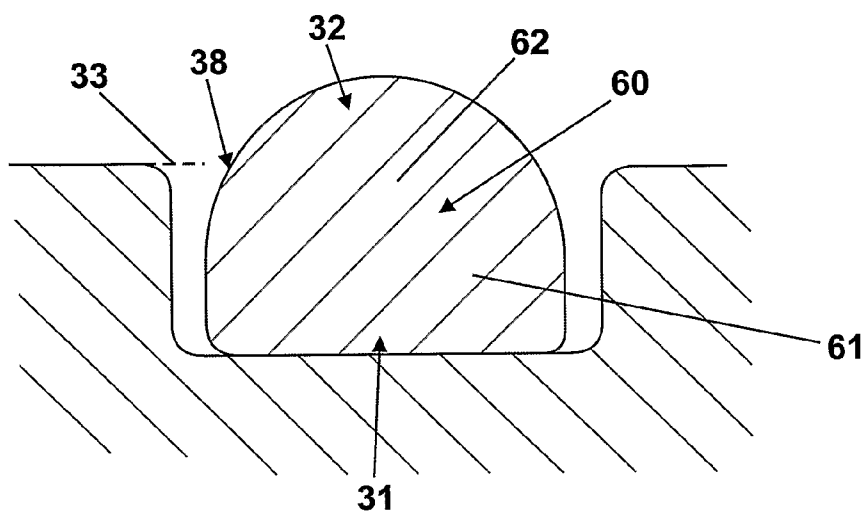


Fig. 6

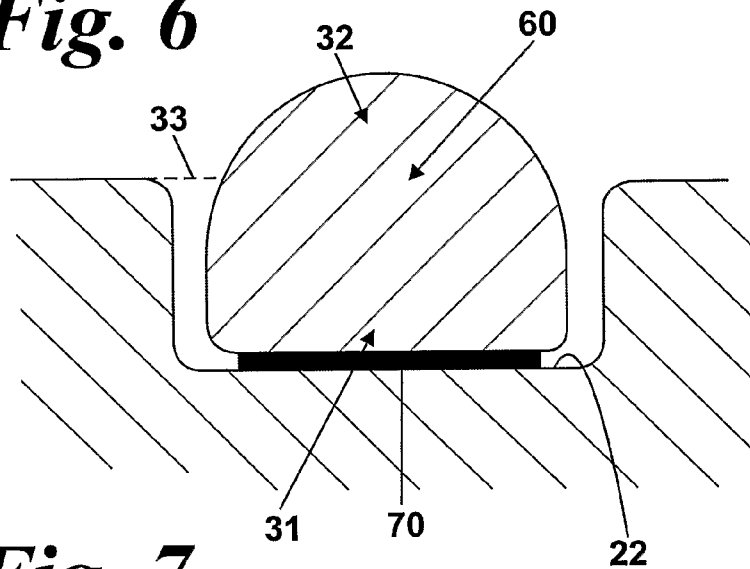


Fig. 7

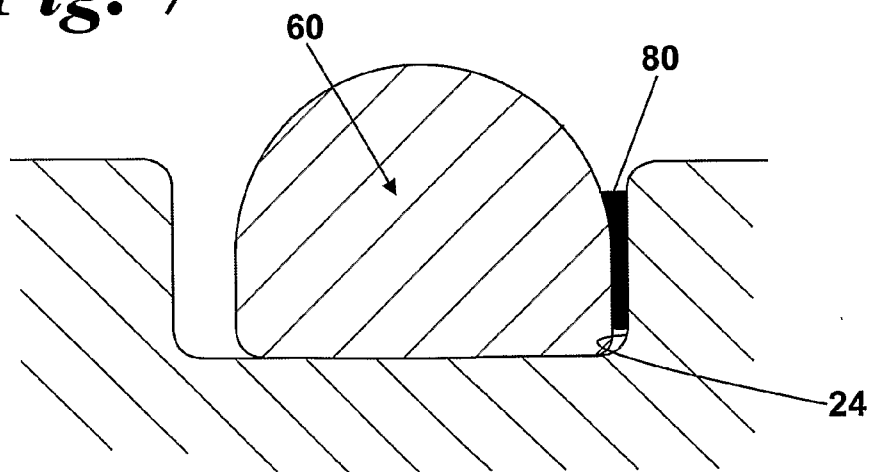


Fig. 8

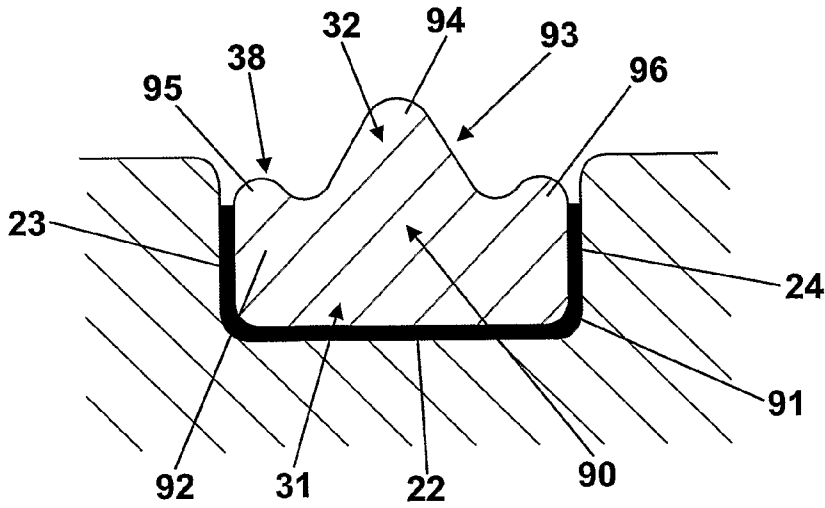


Fig. 9

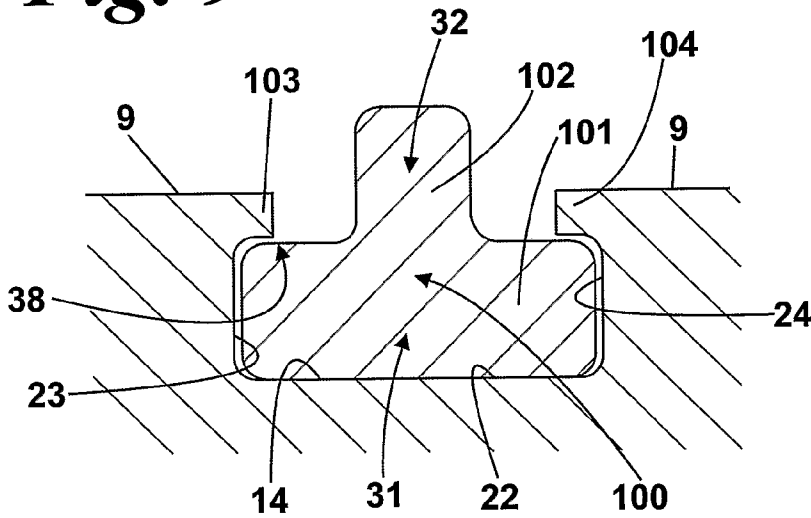


Fig. 10

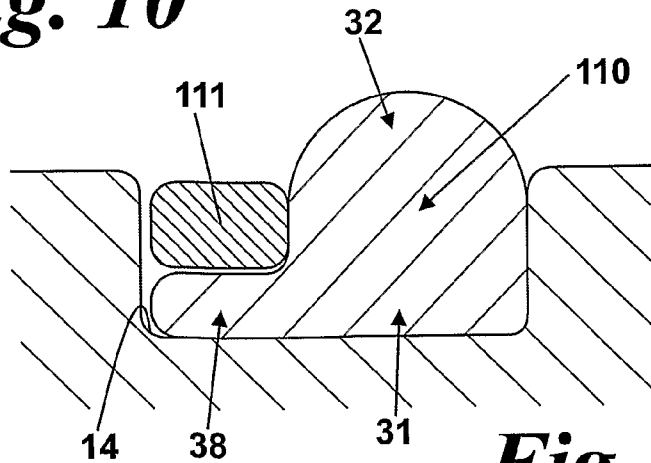


Fig. 11

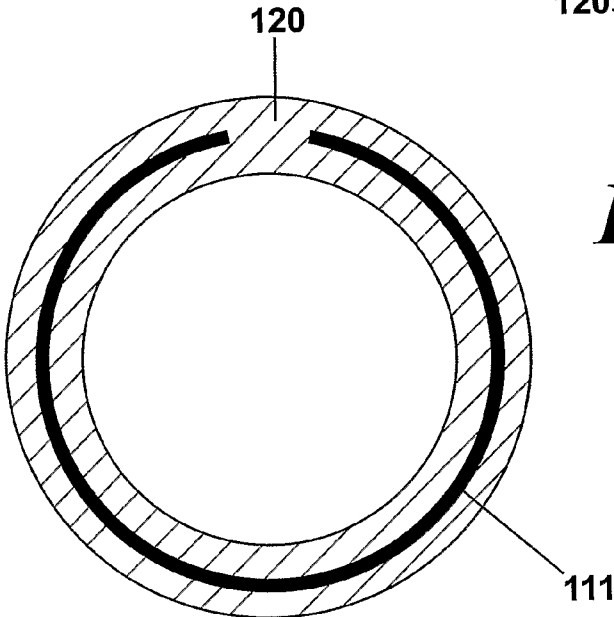


Fig. 12a

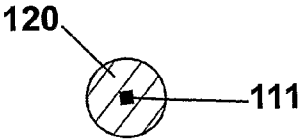


Fig. 12b

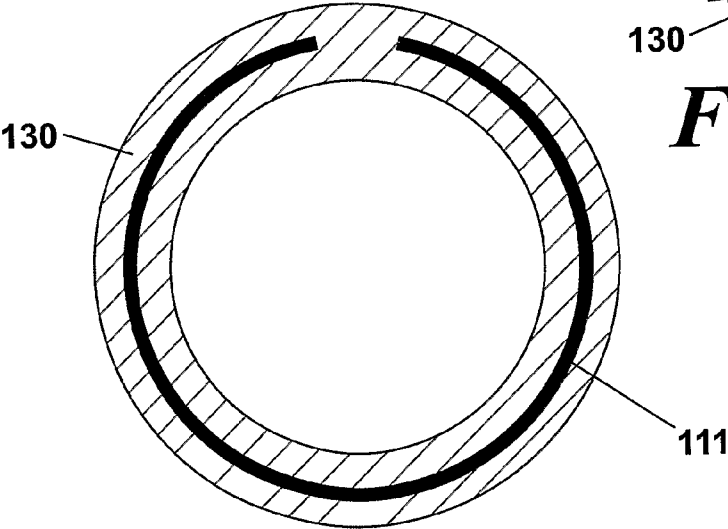


Fig. 13a

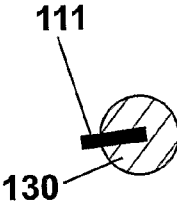


Fig. 13b

PIPE COUPLING

[0001] This invention relates to a pipe coupling having a sealing means and, in particular, to a pipe coupling having a sealing means that engages with the inside surface of a pipe to form a seal between the coupling and the pipe.

[0002] Pipe couplings that engage with the internal surface of a pipe are known. Such couplings typically comprise a body having a diameter that is slightly smaller than that of the inside diameter of a pipe to which they are adapted to couple with. The body includes gripping means and sealing means mounted to its external surface to engage with the internal surface of the pipe. The gripping means and sealing means are usually mounted in grooves formed in the body. The gripping means and sealing means project out of the grooves so they can effectively engage with the inside surface of a pipe. The gripping means and sealing means are typically adapted to project sufficiently out of the grooves to compensate for any slight deviations in the diameter of the pipe due to manufacturing tolerances, for example. Thus, when the pipe coupling is inserted into a pipe end, the sealing means is compressed as it engages with the end of the pipe and is forced into the pipe.

[0003] The most common type of sealing means used in these couplings are O-rings. O-rings are particularly effective at sealing between the coupling and the pipe. If the pipe end is not prepared appropriately it can be difficult for the sealing means to be reliably received within the pipe. This problem is exacerbated the more the seal projects from the groove to compensate for tolerances. Insufficiently prepared pipes may have burrs caused by cutting of the pipe or may not have been chamfered. Further, if the pipe has been deformed when it was cut, or squashed, or the coupling is inserted into the pipe at an angle to the pipe's axis, the sealing means can be drawn out of its groove making the seal ineffective. Thus, as the pipe coupling is inserted into the pipe, the sealing means will engage with the pipe end, which may cause the sealing means, or more commonly a part of the sealing means, to leave its groove and compromise the seal.

[0004] According to a first aspect of the invention we provide a pipe coupling device comprising a body adapted for insertion into a pipe to be coupled to the device, the body having a through passage, and on its outer surface a groove for receiving a sealing means for forming a fluid-tight seal between an internal surface of the pipe and the body, the sealing means having a retaining portion and a sealing portion, wherein either the groove, the sealing means or both are constructed and arranged such that the retaining portion holds the sealing means within the groove when the sealing portion is subjected to the insertion force experienced when the pipe coupling device is inserted into a pipe.

[0005] This is advantageous as the sealing means is constructed and arranged in the groove such that the retaining portion can hold the sealing means in the groove even when the pipe coupling is inserted into the pipe at an angle. The retaining portion of the sealing means is captured by a pipe that is inserted over the coupling device prior to it engaging with the sealing portion, which prevents the sealing means being drawn from the groove. The retaining portion of the sealing means engages with the groove or the inside surface of the pipe and acts to hold the sealing means in the groove.

[0006] Preferably the sealing means has an asymmetric cross-section. Preferably, the retaining portion comprises a part of the sealing means that, in use, lies wholly within the

groove. Thus, when the pipe coupling device is inserted into a pipe, the retaining portion will be received within the pipe without resistance and can then act against the groove or pipe to retain the sealing means within the groove.

[0007] The retaining portion may comprise at least 25% of the axial width of the sealing means. Preferably, the retaining portion comprises between 25% and 75% of the axial width of the sealing means.

[0008] Preferably, the pipe coupling device includes a reinforcing ring that is mounted in the groove radially outwardly of the retaining portion to assist in retaining the sealing means in the groove.

[0009] The groove may include a ledge portion that engages with the retaining portion to assist in retaining the sealing means in the groove.

[0010] Preferably, the sealing means comprises a base portion, which abuts the groove, that is wider than the sealing portion. The wider base portion resists the torsional force exerted on the sealing means when the pipe contacts and slides over the sealing portion, which projects out of the groove.

[0011] Preferably the sealing means is annular. Preferably, the sealing means is of plastics material or a rubber material.

[0012] Preferably the sealing means has a V-shaped cross-section. Alternatively it may have a right-angled triangular cross-section or a T-shaped cross-section or rectangular cross-section having a semicircular outwardly facing side. Further, the sealing means may have a ridged outwardly facing surface.

[0013] According to a second aspect of the present invention we provide a pipe coupling device comprising a body adapted for insertion into a pipe to be coupled to the device, the body having a through passage, and on its outer surface a groove for receiving a sealing means for forming a fluid-tight seal between an internal surface of the pipe and the body, the sealing means comprises a base portion that abuts the body and a sealing portion that is adapted to abut the pipe, wherein the base portion is axially wider than the sealing portion.

[0014] When the pipe coupling device is inserted into a tube, the sealing portion, which projects from the groove, is contacted by the pipe which places a shear or torsional force on the sealing means. However, the wider base portion advantageously prevents the sealing means from being urged out of the groove.

[0015] Preferably, the base portion comprises two annular, axially spaced ridges. Alternatively, the base portion may have a substantially rectangular cross-section.

[0016] The base portion may be secured to the groove by an adhesive layer. The layer may secure the sealing means to a base of the groove, a side wall of the groove or a combination.

[0017] According to a third aspect of the present invention we provide a pipe coupling device comprising a body adapted for insertion into a pipe to be coupled to the device, the body having a through passage, and on its outer surface a groove for receiving a sealing means for forming a fluid-tight seal between an internal surface of the pipe and the body, wherein the sealing means includes reinforcing means adapted to prevent the sealing means leaving the groove when the sealing means is subjected to the insertion force experienced when the pipe coupling device is inserted into a pipe.

[0018] The reinforcing means is such that it is flexible enough to allow the sealing means to be assembled onto the body of the coupling, but provides sufficient rigidity to hold the sealing means in the groove when the coupling device is

inserted into a pipe. The use of a reinforcing means is advantageous as the sealing means can be made of a material that is sufficiently soft to form a seal and the reinforcing means gives the sealing means the required rigidity to be reliably retained in the groove.

[0019] Preferably, the reinforcing means comprises a split ring embedded in the sealing means. The sealing means may be formed by moulding it around reinforcing means. Preferably the reinforcing ring is of plastics, although it may be of metal.

[0020] Preferably the reinforcing ring is contained wholly within the sealing means. Alternatively, the reinforcing means may comprise a reinforcing band that projects out of the sealing means.

[0021] There now follows by way of example only a detailed description of the present invention with reference to the accompanying drawings in which;

[0022] FIG. 1 shows a known pipe coupling;

[0023] FIG. 2 shows a terminal portion of the pipe coupling of FIG. 1 part-inserted into a pipe;

[0024] FIG. 3 shows a first embodiment of the sealing means mounted in a groove of a pipe coupling in accordance with the first and second aspects of the invention;

[0025] FIG. 4 shows a second embodiment of the sealing means in accordance with the first and second aspects of the invention;

[0026] FIG. 5 shows a third embodiment of the sealing means in accordance with the first and second aspects of the invention;

[0027] FIG. 6 shows a fourth embodiment of the sealing means in accordance with the first and second aspects of the invention;

[0028] FIG. 7 shows the fourth embodiment of the sealing means including an adhesive base layer;

[0029] FIG. 8 shows the fourth embodiment of the sealing means including an adhesive side layer;

[0030] FIG. 9 shows a fifth embodiment of the sealing means secured in the groove by adhesive in accordance with the first and second aspects of the invention;

[0031] FIG. 10 shows a sixth embodiment of the sealing means mounted in a modified groove in accordance with the first and second aspects of the invention;

[0032] FIG. 11 shows a seventh embodiment of the sealing means in combination with a securing ring in accordance with the first, second and third aspects of the invention;

[0033] FIGS. 12a and 12b show an eighth embodiment of the sealing means in accordance with the third aspect of the invention having a reinforcing ring through the centre thereof; and

[0034] FIGS. 13a and 13b show a ninth embodiment of the sealing means having a reinforcing strip partially therein in accordance with the third aspect of the invention.

[0035] The coupling device 1 of FIG. 1 is for coupling two plastics pipes 2, for example for use in domestic water systems, in a fluid-tight manner. Only one pipe 2 is shown, on the right-hand side of the Figure, the left-hand side being shown before a pipe is attached.

[0036] The device 1 comprises a metal body 3 carrying a gripping means in the form of a grip ring 4 for engagement with an internal surface 5 of the pipe 2 to retain the pipe on the body 3, and two seals 6,7 for sealing in a fluid-tight manner between the internal surface 5 of the pipe 2 and the body 3. The grip ring 4 is an externally toothed split member of relatively flexible plastics with four teeth 20 on its external

surface. The body 3 has a straight through-bore 8, and a profiled external surface 9. Only one end of the body 3 will be described, as the other end is a mirror-image.

[0037] The free end 10 of the body 3 is frusto-conical in shape, for ease of insertion into the pipe 2, while the central portion 11 has a projection 12 forming a stop for the end of the pipe 2. Adjacent the projection 12 the body 3 has an external grip ring groove 13 in which the grip ring 4 is received. Two further external grooves 14 are formed adjacent the free end 10 for receiving the first sealing means 6 and the second sealing means 7, both comprising O-ring seals.

[0038] To assemble the pipe coupling 1 the grip ring 4 is first put onto the body 3 into the groove 13, and then the O-rings 6,7 are pushed on from the free end, into their grooves 14, as shown in the left-hand side of FIG. 1. It will be appreciated that the O-rings project radially out of the grooves 14, and that the teeth 20 of the grip ring 4 also project radially out of the groove 13. The amount the grip ring 4 and the O-rings project out of the groove 14 affects the insertion force required to operate the coupling. Therefore, it will be appreciated that the grip ring 4 and O-rings project sufficiently to engage with a pipe but do not project to a degree to hinder assembly of the coupling 1 and pipe 2.

[0039] In use, in order to attach a pipe 2 to the pipe coupling 1 the user inserts the free end 10 of the body 3 into the free end of the pipe 2, and then pushes the two together. The body 3 will be inserted until the end of the pipes 2 engages the projection 12. As the body is inserted the O-rings 6,7 are compressed against their grooves 14 and the internal surface 5 of the pipe thereby forming a seal therebetween. The teeth 20 of the grip ring 4 engage with the pipe 2 to secure it in engagement with the coupling 1. If the user attempts to separate the pipe 2 and coupling 1, an inclined portion 21 of the grip ring 4 will engage with a ramped portion 15 of the groove 14 thereby increasing the diameter of the grip ring 4. This causes the teeth 20 to engage more securely with the pipe 2 thereby holding the pipe 2 and coupling 1 together.

[0040] FIG. 2 shows an enlarged view of the free end 10 wherein only one groove 14 and one sealing means 6 is shown for simplicity. The groove 14 comprises a base 22, a first side wall 23 and a second side wall 24. The pipe 2 has been inserted over the free end 10 at an angle to the axis of the coupling 1, such that a first portion 16 of the pipe 2 contacts the sealing means 6 prior to the diametrically opposite second portion 17. As can be seen from FIG. 2, the O-ring seal 6 has been forced against the second side wall 24 and out of the groove 14 at position 18. As can be appreciated, with the O-ring seal in this position, the seal between the body 3 and the pipe 2 will not be reliable.

[0041] Also, further insertion of the coupling 1 into the pipe 2 could cause damage to the O-ring, particularly if the pipe 2 was metal.

[0042] FIG. 3 shows a first embodiment of the sealing means 30 of the invention mounted in a groove 14 of body 3. The sealing means 30 comprises a base portion 31, that abuts the body 3 at the base of the groove 14, and a sealing portion 32, that engages with the pipe 2 and forms a seal. The sealing portion 32 substantially comprises the part of the sealing means 30 that projects out of the groove above a level 33 defined by the body 3. It will be appreciated that when the coupling 1 is inserted into a pipe 2, the sealing means 30 will deform and therefore there may be parts of the sealing means in addition to the sealing portion 32 that form a seal with the pipe 2. Further, there may be parts of the sealing

means 30 in addition to the base portion 31 that form a seal with the body 3. This may occur in all of the embodiments discussed herein.

[0043] The sealing means 30 is annular and comprises a circumferential head part 34 and two circumferential leg parts 35, 36. The leg parts 35 and 36 extend radially inwardly from the head part 34, but are also each inclined at an angle either side of the radially inwardly direction (represented by dashed line 37). Thus, the sealing means 30 has a substantially V-shaped cross-section. The head part 34 forms the sealing portion 32 and the two leg parts 35 and 36 form the base portion 31, which abuts the base 22 of the groove. Therefore, the base portion 31 comprises two annular, axially spaced ridges. Thus, a wide base portion 31 is formed by the diverging leg parts 35, 36 to stabilise the sealing means 30 in the groove 14. This prevents the sealing means 30 being urged out of the groove when it is subjected to the insertion force of the pipe coupling device 1 being inserted into a pipe 2. This is further aided by a retaining portion 38. In this embodiment the coupling device 1 is adapted such that the pipe 2 is inserted over the coupling in the direction of arrow 39. Thus, the pipe 2 will pass over the retaining portion 38 and then contact the sealing portion 32. As the retaining portion 38 makes up a substantial part of the sealing means 30, it acts against the inside surface of the pipe 2 to prevent the sealing means 30 being twisted, rolled or urged out of the groove 14.

[0044] A second embodiment of the sealing means is shown in FIG. 4 and is designated 40. The sealing means 40 is annular and has a cross-section that is substantially right-angled triangular in shape, wherein the annular corners are rounded. The sealing means 40 includes a base portion 31 that abuts the base of the groove 14 and a sealing portion 32 to contact and seal against a pipe 2. Due to the shape of the sealing means 40, the retaining portion 38 is larger than the retaining portion 38 of the first embodiment. Therefore, a substantial amount of the sealing means 40 will be held beneath the pipe 2 when the pipe contacts the sealing portion 32. This, in combination with the wide base portion 31, prevents the sealing means 40 being forced out of the groove 14 on insertion of a pipe 2 over the coupling 1.

[0045] The third embodiment shown in FIG. 5 is a modification of the second embodiment. The sealing means 50 has a substantially right-angled triangular profile but one of the corners is replaced with an inclined section 51. The inclined section 51 is advantageous as it spaces the sealing portion 32 from the external surface 9 adjacent the groove 14. If the sealing means 40 of FIG. 4 is required to be particularly flexible, then the sealing portion 32 may be deformed by the pipe 2 such that it is pinched between the pipe 2 and surface 9, which may damage it. The presence of the inclined surface 51 reduces the chance that the sealing portion 32 could be damaged.

[0046] FIG. 6 shows a fourth embodiment in which the sealing means 60 comprises an annular seal having a cross-section comprising a rectangular part 61 and a semi-circular part 62. The semi-circular part 62 extends from the outwardly facing side of the rectangular part 61. The semi-circular part 62 projects from the groove 14 above level 33 and forms the sealing portion 32. The rectangular part 61 abuts the base of the groove 14 and forms the base portion 31.

[0047] The sealing means 60 of FIG. 7 is identical to that of FIG. 6 and therefore the same reference numeral has been used. However, the sealing means 60 has been further secured in the groove by an adhesive 70. The adhesive 70 has been

applied to the inwardly facing surface of the sealing means 60 and thus secures the base portion 31 to the base 22 of the groove. Similarly, the sealing means 60 of FIG. 8 employs an adhesive layer 80 that secures the sealing means 60 to the second side wall 24. The adhesive layers 70 and 80 both work in addition to the wide base portion 31 and retaining portion 38 to hold the sealing means in the groove 14.

[0048] FIG. 9 shows a fifth embodiment of the sealing means designated 90. The sealing means 90 is annular and has a cross-section comprising a rectangular part 92 and a ridged part 93. The ridged part 93 extends from the outwardly facing side of the rectangular part 92. The ridged part 93 comprises two axially spaced small ridges 95 and 96 separated by a large central ridge 94 that forms the sealing portion 32. For a pipe 2 that is inserted over the coupling from left to right as shown in the Figure, the ridge 95 will form the retaining portion 38. The sealing means 90 is also secured to the base 22 of the groove 14 and its side walls 23 and 24 by an adhesive layer 91. It will be appreciated that the adhesive layer 91 may not be necessary depending on the application and the forces expected to be applied to the coupling 1.

[0049] FIG. 10 shows a sixth embodiment of the sealing means 100 and a modification to the groove 14. The sealing means 100 is annular as in previous embodiments and comprises a ring portion 101 of rectangular cross-section, that forms the base portion 31, and an annular flange 102 that extends from the outwardly facing surface of the ring portion 101 and forms the sealing portion 32.

[0050] The groove 14 comprises a base 22 and first and second side walls 23 and 24 respectively, as before. However, it also comprises a first annular ledge 103 extending from the first side wall 23 adjacent the surface 9 and a second annular ledge 104 extending from the second side wall 24 adjacent the surface 9. In this embodiment, the retaining portion 38 is received under the first ledge 103 and will therefore be retained in the groove 14 when the sealing portion 32 is subjected to the insertion forces of the coupling 1 into the pipe 2.

[0051] The seventh embodiment shown in FIG. 11 comprises a sealing means 110 similar in shape to the fourth embodiment, but includes an axially extending portion that forms the retaining portion 38. Thus, in this embodiment, the retaining portion also forms part of the base portion 31. In addition to the sealing means 110, a reinforcing means 111 comprising a securing ring is mounted within the groove 14. The securing ring comprises a split ring of plastics material that lies adjacent to and radially outwardly of the retaining portion 38. The retaining portion 38 is adapted to bear against the securing ring 111 thereby holding the sealing means 110 in the groove 14.

[0052] FIGS. 12a and 12b show a sectional plan view and a cross-sectional view of an eighth embodiment. The sealing means 120 comprises an O-ring of circular cross-section having a reinforcing means 111 therein.

[0053] The sealing means 120 may be moulded around the reinforcing means, which comprises a split ring of moulded plastics. The split ring 111 enables the sealing means to be made of a sufficiently deformable material to form a reliable seal between the pipe 2 and the body 3, while having sufficient rigidity due to the ring 111 to be held in the groove 14. Thus, the reinforcing means 111 should be of sufficient strength to prevent the sealing means escaping from the groove under the pipe 2 insertion force, while being flexible

enough to allow the sealing means 120 to be mounted on over the body 3 and into the groove 14.

[0054] FIGS. 13a and 13b are similar views to those shown in FIGS. 12a and 12b and show a sealing means 130 including a reinforcing means 111. In this embodiment, the reinforcing means 111 comprises a split annular moulded plastics band. The band 111 acts in the same way as the wire ring of the eighth embodiment. It will be appreciated that the ring 111 of FIGS. 12a and 12b and the band 111 of FIGS. 13a and 13b may alternatively be of metal.

1. A pipe coupling device comprising a body adapted for insertion into a pipe to be coupled to the device, the body having a through passage, and on its outer surface a groove for receiving a sealing means for forming a fluid-tight seal between an internal surface of the pipe and the body, the sealing means having a retaining portion and a sealing portion, wherein either the groove, the sealing means or both are constructed and arranged such that the retaining portion holds the sealing means within the groove when the sealing portion is subjected to the insertion force experienced when the pipe coupling device is inserted into a pipe.

2. A pipe coupling device according to claim 1, in which the sealing means has an asymmetric cross-section.

3. A pipe coupling device according to claim 1, in which the retaining portion comprises a part of the sealing means that, in use, lies wholly within the groove.

4. A pipe coupling device according to claim 1, in which the retaining portion comprises at least 25% of the axial width of the sealing means.

5. A pipe coupling device according to claim 1, in which the retaining portion comprises between 25% and 75% of the axial width of the sealing means.

6. A pipe coupling device according to claim 1, in which the pipe coupling device includes a reinforcing ring that is mounted in the groove radially outwardly of the retaining portion to assist in retaining the sealing means in the groove.

7. A pipe coupling device according to claim 1, in which the groove includes a ledge portion that engages with the retaining portion to assist in retaining the sealing means in the groove.

8. A pipe coupling device according to claim 1, in which the sealing means comprises a base portion, which abuts the groove, that is wider than the sealing portion.

9. A pipe coupling device according to claim 1, in which the sealing means is annular.

10. A pipe coupling device according to claim 1, in which the sealing means is of plastics material.

11. A pipe coupling device according to claim 1, in which the sealing means is of rubber material.

12. A pipe coupling device according to claim 1, in which the sealing means has a V-shaped cross-section.

13. A pipe coupling device according to claim 1, in which the sealing means has a right-angled triangular cross-section.

14. A pipe coupling device according to claim 1, in which the sealing means has a T-shaped cross-section.

15. A pipe coupling device according to claim 1, in which the sealing means has a rectangular cross-section having a semicircular outwardly facing side.

16. A pipe coupling device according to claim 1, in which the sealing means has a ridged outwardly facing surface.

17. A pipe coupling device comprising a body adapted for insertion into a pipe to be coupled to the device, the body having a through passage, and on its outer surface a groove for receiving a sealing means for forming a fluid-tight seal between an internal surface of the pipe and the body, the sealing means comprising a base portion that abuts the body and a sealing portion that is adapted to abut the pipe, wherein the base portion is axially wider than the sealing portion.

18. A pipe coupling device according to claim 17, in which the base portion comprises two annular, axially spaced ridges.

19. A pipe coupling device according to claim 17, in which the base portion has a substantially rectangular cross-section.

20. A pipe coupling device according to claim 17, in which the base portion is secured to the groove by an adhesive layer.

21. A pipe coupling device according to claim 20, in which the adhesive layer (70) secures the sealing means to a structure selected from a base of the groove or, a side wall of the groove, or both the base of the groove and a sidewall of the groove.

22. A pipe coupling device comprising a body adapted for insertion into a pipe to be coupled to the device, the body having a through passage, and on its outer surface a groove for receiving a sealing means for forming a fluid-tight seal between an internal surface of the pipe and the body, wherein the sealing means includes reinforcing means adapted to prevent the sealing means leaving the groove when the sealing means is subjected to the insertion force experienced when the pipe coupling device is inserted into a pipe.

23. A pipe coupling device according to claim 22, in which the reinforcing means comprises a split ring embedded in the sealing means.

24. A pipe coupling device according to claim 22, in which the sealing means is formed by moulding it around reinforcing means.

25. A pipe coupling device according to claim 22, in which the reinforcing ring is of plastics.

26. A pipe coupling device according to claim 22, in which the reinforcing ring is of metal.

* * * * *