

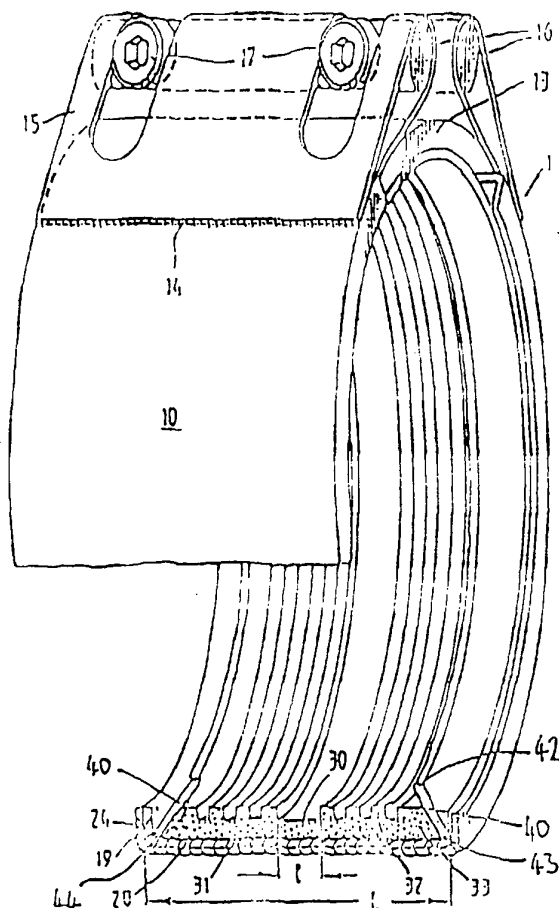


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(21) International Application Number: PCT/GB94/02329 (22) International Filing Date: 24 October 1994 (24.10.94) (30) Priority Data: 9321834.5 22 October 1993 (22.10.93) GB (71) Applicant (for all designated States except US): TAYLOR KERR (COUPLINGS) LIMITED [GB/GB]; 14-18 Heddons Street, Regent Street, London W1R 7LF (GB). (72) Inventors; and (75) Inventors/Applicants (for US only): WEBB, Ian, Richard [GB/GB]; 57 The Uplands, Gerrards Cross, Buckinghamshire SL9 7JQ (GB). TAYLOR, William [GB/GB]; Elm Dyke, Elm Park Road, Pinner, Middlesex HA5 3LN (GB). TAYLOR, Neil, John, Thornton [CA/GB]; 44 Pheasants Way, Rickmansworth, Hertfordshire WD3 2HA (GB). (74) Agent: BRERETON, Paul, Arthur; Reddie & Grose, 16 Theobalds Road, London WC1X 8PL (GB).		(81) Designated States: AU, CA, NO, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>

(54) Title: PIPE COUPLING**(57) Abstract**

A pipe coupling (1) for connecting together two pipes in a fluid-tight manner comprising an outer tubular casing (10), an inner tubular casing (20) and a tubular sealing sleeve (30). The sealing sleeve (30) has two sets of inwardly projecting ribs (32), which in use, are pressed into sealing engagement with the respective ends of the pipes. The inner and outer casings are longitudinally split and tensioning screws (17) on the outer casing can be tightened to tighten the outer casing around the inner casing and the sealing sleeve. Frusto-conical gripping rings (40) grip the pipes by engaging radial abutment surfaces facing away from the pipe ends and positioned close to the ends of said pipes in order to secure the pipes against axial displacement.



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Pipe Coupling

The present invention relates to pipe couplings for connecting together two pipes in a fluid-tight manner of the type comprising a tubular casing formed with a longitudinal gap, a sealing sleeve of resilient flexible material arranged within the casing, and tensioning means for reducing the width of the longitudinal gap. In use, the sealing sleeve is placed around the adjacent pipe ends and the tensioning means are tightened to clamp the sleeve against the outer surfaces of the pipe ends to form a fluid tight seal.

In some applications pipe couplings have to be able to withstand enormous axial forces produced by the hydrostatic pressure within the pipeline. These forces may typically produce a load of the order of 15 tons. It is difficult to construct a coupling that can reliably withstand such forces.

In our patent application GB-A-2,249,366A we described a pipe coupling for connecting together two plain-ended pipes in a fluid-tight manner comprising of a tubular casing, a tubular sealing sleeve, and tensioning means for tightening the casing about the sealing sleeve. At each end the sealing sleeve has a circumferential slot in its outer surface and a gripping ring with inwardly projecting gripping teeth is located in each slot. Tightening the tensioning means causes the sealing sleeve to be pressed into sealing engagement with the pipe ends and the gripping teeth of the gripping rings to penetrate the bottoms of the slots and to engage the outer surfaces of the pipe ends.

The gripping teeth bite into the surface of the pipe to provide an anchoring effect against the axial loads.

There are applications for pipe couplings where the coupling has to withstand high axial loads and where the pipes are made of relatively soft material such as plastics or glass fibres. Such materials may not be sufficiently strong to withstand the pressure of the gripping teeth and may be displaced under large axial load allowing the teeth to slip and thus provide

unsatisfactory anchoring of the pipe to the coupling.

The present invention in a first aspect provides a pipe coupling according to claim 1.

The present invention in a second aspect provides an assembly according to claim 12.

We have discovered that by replacing the toothed gripping ring of our previous coupling with a simple frusto-conical gripping ring with a plain inner edge, and by providing a radial abutment surface generally orthogonal to the pipe's cylindrical surface and facing away from the pipe's end for example by forming a shoulder on or by machining a groove in the outer surface of the pipe near its end to receive the gripping ring, a satisfactory anchoring of the pipe against axial loads can be achieved with pipes of all types of material even soft material such as plastics or glass fibre. The radial depth of the abutment surface may be varied to suit the pipe material or the application. For example when using plastics pipes with an abutment surface provided by one side of a groove of 3mm depth, the coupling has been able to withstand an axial load of up to 15 tons.

Where the abutment surface is provided by one side of a groove and it is desired to allow the pipe coupling to accommodate large amounts of expansion and contraction the groove may be made wider than is necessary merely to accommodate the ring so that the ring can slide axially relative to the groove as the pipe expands and contracts.

This invention will work equally well irrespective of whether the axial thrust is generated by internal hydrostatic pressure or by the influence of an external force when the pipe is empty or unpressurised.

Preferably a gripping ring is provided at each end of the coupling. The gripping ring is preferably frusto-conical, may be formed from sheet material, and is an incomplete ring so that

it can easily be expanded and compressed.

Preferably the casing has an inwardly projecting flange at each end and the gripping rings are located with their outer edges in the angles between the tubular portion of the casing and the flanges.

The tubular casing preferably comprises an inner casing and an outer casing. The inner casing fits within the outer casing. The inner casing and the outer casing both have longitudinal gaps and the gap in the inner casing is offset circumferentially from the gap in the outer casing so that the sealing sleeve is supported around its entire periphery either by the inner casing, or the outer casing, or both casings.

Both the inner and outer casing may have their axial end margins bent inwardly to form radial flanges.

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

Fig. 1 shows a perspective cut-away view of a coupling in accordance with the invention;

Fig. 2 shows an end view of the coupling of Fig. 1;

Fig. 3 shows a longitudinal section through the coupling of Fig. 1;

Fig. 4 shows a perspective view of gripping ring of the coupling of Figs. 1 to 3;

Fig. 5 shows a longitudinal section through the assembly of the coupling connected to a different form of pipe;

Fig. 6 shows a side view of the pipe end of Fig. 5; and

Fig. 7 shows a side view of a pipe having an abutment surface formed by a shoulder near its end.

A pipe coupling 1 comprises an outer tubular casing 10 an inner tubular casing 20 and a sealing gasket 30. The outer tubular casing 10 is formed of steel by rolling or stamping, with a longitudinal gap 13. The casing is folded back on itself at its free ends and welded at 14 to form loops 15 along opposite edges

of the longitudinal gap 13. Pins 16 are inserted in the loops. Tensioning screws 17 pass through transverse holes in one of the pins 16 into tapped transverse holes in the other of the pins 16, so as to interconnect the two free ends of the outer casing. Slots 18 are cut in the loops 15 so as to provide clearance for the screws. The axial end margins of the casing 10 are bent inwardly at right angles to form radial flanges 19.

The inner tubular casing 20 is manufactured of steel by rolling or stamping and has a longitudinal gap 23. The end margins of the casing 20 are bent inwardly at right angles to form radial flanges 24. The casing 20 fits inside the outer casing 10, the axial length of the casing 20 being slightly less than that of the casing 10 so that the flanges 24 fit inside and, in use, are supported laterally by the flanges 19.

The sealing gasket 30 is typically formed of rubber from a length of flat extrusion which is rolled into a tube and joined by welding to form a complete cylinder. Alternatively, the rubber gasket may be moulded. The outer surface 31 of the gasket is smooth but the inner surface is formed with two sets of annular sealing ribs 32 which project inwardly and have a square profile. In the present embodiment there are three ribs in each set. Towards each end of the gasket the inner surface is stepped inwardly to form bands 33. The invention is not restricted to having any particular type of sealing gasket; the gasket may alternatively be based on that of our UK patent number GB 2,180,311B wherein pressure sensitive sealing lips are employed.

A gripping device is provided at each end of the casing 10. Each device comprises a frusto-conical ring 40 made from hard sheet steel. The rings are incomplete and have radial gaps 41 so that they are of adjustable diameter. Each ring 40 has a smooth inner surface formed by the inner edge 42 and a smooth outer surface formed by the outer edge 43.

The frusto-conical ring has a slope of approximately 40-50°. The ends of the gasket 30 slope inwardly in a reentrant manner

at a similar angle. The rings 40 are located against the sloping ends of the gasket and are held in position by the inwardly projecting flanges 19 and 24 of the casing, the outer edges 43 of the rings sitting in the angles 44 between the inwardly projecting flanges and the web portion of the casing. The ring is arranged with its smaller diameter end facing into the coupling.

The radial distance t_1 , between the inner edge 42 and the outer edge 43 of the ring, measured in a direction orthogonal to the axis of the coupling, is greater than the thickness t_2 of the gasket 30, so that the inner edge of the ring projects inwardly beyond the inner surface of the gasket 30. The casing, gasket and rings can be assembled as a sub-assembly prior to mounting on the pipes. This makes the coupling convenient to use in the field as there are no loose parts which might get mislaid.

Two pipes 70 and 71 each have an abutment surface 69 provided by one side of a groove 72 machined in their outer surfaces near the end of the pipes. Typically the grooves are 3mm deep and have square sides.

In use the ends of the two pipes 70 and 71 are inserted into the coupling from opposite ends as shown in Fig. 3. A space of say 10mm may be left between the pipe ends to allow for angular deflection, or to avoid abrasive wear, or to dampen vibration. With the coupling in place, the screws 17 are tightened to clamp the coupling to the pipes. The pipes are located so that the gripping rings are aligned with the grooves 72. As the screws 17 are tightened, the loops 15 of the outer casing 10 are drawn together, thereby applying a radially compressive force to the outer casing. The inner casing is arranged so that its longitudinal gap 23 is diametrically opposite the longitudinal gap 13 in the outer casing. In this way the inner casing supports the gasket in the region of the gap 13 where there is no support from the outer casing. The inner casing is dimensioned so that when the coupling is tightened around the pipe ends, then only a small longitudinal gap 23 remains.

The tightening of the tensioning screws 17 presses the annular sealing ribs 32 into sealing contact with the outer surfaces of the pipe ends, the sealing ribs deforming easily due to their height, width and the grade of material used. At the same time, the gripping ring 40 is pushed inwardly by the angle 44 of the inner casing gripping the outer edge 43 of the ring. The compression of the gripping ring causes the inner edges of the rings 40 to be pressed into their respective grooves 72 in the pipes 70 and 71 until they make contact with the bottoms of the grooves. When axial loads are applied to the pipes tending to pull them apart, the inner edges of the rings may contact with the angles 74 between the bottoms of the grooves and the sides of the grooves facing away from the pipe ends that form the abutment surfaces 69. The rings are placed in compression between the angles 44 and 74.

The coupling described above has the advantage over the coupling described in our earlier patent specification No. GB-A-2,249,366A, in that it is especially well suited to pipes of relatively soft plastics or glass fibre materials that would not provide secure anchorage for the toothed ring. The abutment surface 69 provided by one side of grooves 40 provide a secure seating for the gripping rings. We have found that with an abutment surface of 3mm radial depth on a 400mm diameter pipe, the coupling can be made to withstand an axial load of 15 tons.

The casing of the coupling of the present invention can be of lighter construction than the cast iron casing of some conventional couplings. For example, with a coupling for joining together two pipes of around 400mm in diameter, (approximately 16 inches), the thickness of the outer casing can be approximately 3mm, and the thickness of the inner casing approximately 2.5mm. An advantage of using thinner metal is that the machinery required to form the casings is less expensive.

The arrangement for holding the gripping rings is of simple construction and apart from the casings and the gasket, involves no separate parts. The entire structure is accommodated within

the two pairs of annular flanges 19 and 24 which gives the total structure great strength and stability.

Because of the resilience in the gripping ring and the rubber, the clamping arrangement releases itself when the coupling is released. The gripping rings should be so constructed that in their natural relaxed condition the inner diameter of the rings is greater than the outside diameter of the pipe end.

The ring is able to find its own settlement. The outer-edge is located in the angle between the flange and web portions of the inner casing, and the position of the inner edge is located in the angle between the abutment surface 69 and the bottom of the groove. The angle of approximately 45° which is established between the ring and the pipe surface when the ring first engages the abutment surface is maintained as the coupling is tightened. The angle in the inner casing bears directly against the outer edge of the gripping ring.

Because the ring bears against the angle in the inner casing, the reaction forces from the ring can be spread through the surface of the inner casing to the outer casing.

Although the invention has been described in relation to a coupling for joining pipes of equal diameter it will be appreciated that it can be modified to form a stepped coupling of asymmetric configuration for joining pipes of unequal diameter.

In such a stepped coupling the outer and inner casings would be constructed to extend deeper on the side of the smaller pipe. The gasket would be radially thicker on the side of the smaller pipe, and include a slot, as described above, into which a ring could be fitted. In one form of construction of a stepped coupling, the radial thickness (i.e. the radial dimension from the outer periphery to the inner periphery) of the ring on the side of the smaller pipe could be greater than that of the other ring.

Alternatively, the radial thickness of the rings could be the same, the overall diameter of the ring on the side of the smaller pipe being less than that of the other ring. In this form of construction, the thickness of the inner casing would be increased, on the side of the smaller pipe, so that the respective ring would bear against a portion of the inner casing.

In the embodiment of Fig. 3 the pipes are shown to be of straight cylindrical form. The invention is also applicable to pipes with shaped ends such as that shown in Fig. 6. The pipe is flared towards its end to form a shoulder 76 before terminating in a cylindrical portion 77. A groove 72' can be formed by a machining or otherwise in the outer surface of the cylindrical portion 77 adjacent the shoulder.

When the coupling is used for connecting pipes with ends as shown in Fig. 6 the radially inwardly projecting flange 19 of the outer casing of the coupling is positioned so that it abuts the shoulder 76 as shown in Fig. 5.

The width of the groove 72' is such that when the assembly of coupling and pipe is under axial compression the flange 19 may abut the shoulder 76 that forms the side of the groove furthest from the end of the pipe and the inner edge 42 of the ring engages the bottom of the groove away from the angle 74 between the bottom and side walls. When the coupling and pipe are under axial tension, the outer edge of the gripping ring 40 remains in contact with the angle between the web portion and the radially inwardly projecting flange of the inner casing 24 and the inner edge 42 of the ring moves in the groove to make contact with the angle between the bottom of the groove and the side of the groove adjacent the end of the pipe thus limiting the axial displacement of the pipe end with respect to the coupling. In this way the coupling can accommodate axial expansion and contraction of the pipe.

Although the coupling is particularly useful with plastics or glass fibre pipes, it can be used with pipes of other materials

such as concrete, iron or steel. Although the abutment surface provided by one side of a groove is machined in the pipe near its end in the embodiment described above, it may alternatively be formed by moulding during the manufacturing process. Figure 7 shows an alternative type of abutment surface provided by a shoulder 80. This shoulder may be added to the pipe near its end before the coupling is used or alternatively it may be formed on the external surface of the pipe during the pipe manufacturing process. The inner surface of the gripping ring 40 engages the angle between the radial abutment surface 69 formed by the shoulder 80 and the cylindrical surface 81 formed by the outer surface of the pipe adjacent the radially inner edge of the abutment surface. In other aspects the arrangements of Figure 7 can be identical to the arrangement of Figures 1 to 5.

Claims

1. A pipe coupling for connecting in a fluid-tight manner to the end of a pipe having a radial abutment surface facing away from the pipe end on its outer surface, the coupling comprising a tubular casing, a tubular sealing sleeve, tensioning means for tightening the casing about the sealing sleeve and a gripping ring located within the tubular casing at the end of the sealing sleeve, the arrangement being such that, in use, tightening the tensioning means causes the sealing sleeve to be pressed into sealing engagement with the pipe ends, the tubular casing having a tubular web portion and a radially projecting flange at one end of the web portion, the outer surface of the gripping ring making contact with the angle between the flange and web of the tubular casing and the inner surface of the gripping ring being smooth for engagement with the abutment surface, whereby under axial tension the ring between the pipe and the coupling is placed under compression between the angle in the tubular casing and the angle at the bottom of the abutment surface.

2. A coupling according to claim 1 for connecting together two pipes each having a radial abutment surface on their outer surfaces, the coupling including a gripping ring at each of its ends.

3. A coupling according to claim 1 or 2 in which the casing has an inwardly-projecting flange at each end and the gripping rings are located with their outer edges in the angles between the tubular portion of the casing and the flanges.

4. A coupling according to claim 1, 2 or 3 in which the gripping ring extends in a direction measured orthogonal to the axis of the coupling greater than the thickness of the sealing sleeve.

5. A coupling according to any one of claims 1 to 4 in which the gripping ring is frusto-conical.

6. A coupling according to any one of claims 1 to 5 in which the gripping ring is an incomplete ring.

7. A coupling according to any one of claims 1 to 6 in which the gripping ring is formed from sheet material.

8. A coupling according to claim 7 in which the gripping ring is frusto-conical, the radially outer edge forming the other surface of the ring which is in contact with the angle between the flange and web of the casing, the radially inner edge forming the inner surface of the ring and facing into the coupling.

9. A coupling according to any one of claims 1 to 8 in which the tubular casing comprises an inner casing and an outer casing, the inner casing fitting within the outer casing.

10. A coupling according to claim 9 in which the inner casing and the outer casing both have longitudinal gaps, the gaps in the inner casing being offset circumferentially from the gap in the outer casing so that the sealing sleeve is supported around its entire periphery either by the inner or outer casing or by both casings.

11. A coupling according to claim 9 or 10 in which both inner and outer casing have their axial end margins bent inwardly to form radial flanges.

12. A pipe coupling according to any preceding claim in which the radial abutment surface is provided by one side of a groove.

13. An assembly of a pipe coupling connected in a fluid-tight manner to the end of a pipe having a radial abutment surface facing away from the pipe end on in its outer surface, the coupling comprising a tubular casing, a tubular sealing sleeve, tensioning means for tightening the casing about the sealing sleeve and a gripping ring located within the tubular casing at the end of the sealing sleeve, the arrangement being

such that, in use, tightening the tensioning means causes the sealing sleeve to be pressed into sealing engagement with the pipe ends, the tubular casing having a tubular web portion and a radially inwardly projecting flange at one end of the web portion, the outer surface of the gripping ring making contact with the angle between the flange and web of the tubular casing and the inner surface of the gripping ring being in contact with the abutment surface, whereby the ring acting between the pipe and the coupling is placed under compression between the angle in the tubular casing and the angle at the inner edge of the radial abutment surface, when the assembly is under axial tension.

14. An assembly according to claim 13 wherein the abutment surface makes an angle of 90° or less to the cylindrical surface on the outside of the pipe adjacent the inner edge of the abutment surface.

15. An assembly according to claim 13 or 14 wherein the abutment surface has a radial depth of about 3mm high.

16. An assembly according to any one of claims 13 to 15 connecting together more than one pipe each having a radial abutment surface facing away from the pipe end on in its outer surface, the coupling including a gripping ring at each of its ends.

17. An assembly according to any one of claims 13 to 16 wherein the flange of the outer casing abuts the side of a groove which is not adjacent the end of the pipe.

18. An assembly according to any one of claims 13 to 17 in which the radial abutment surface is provided by one side of a groove.

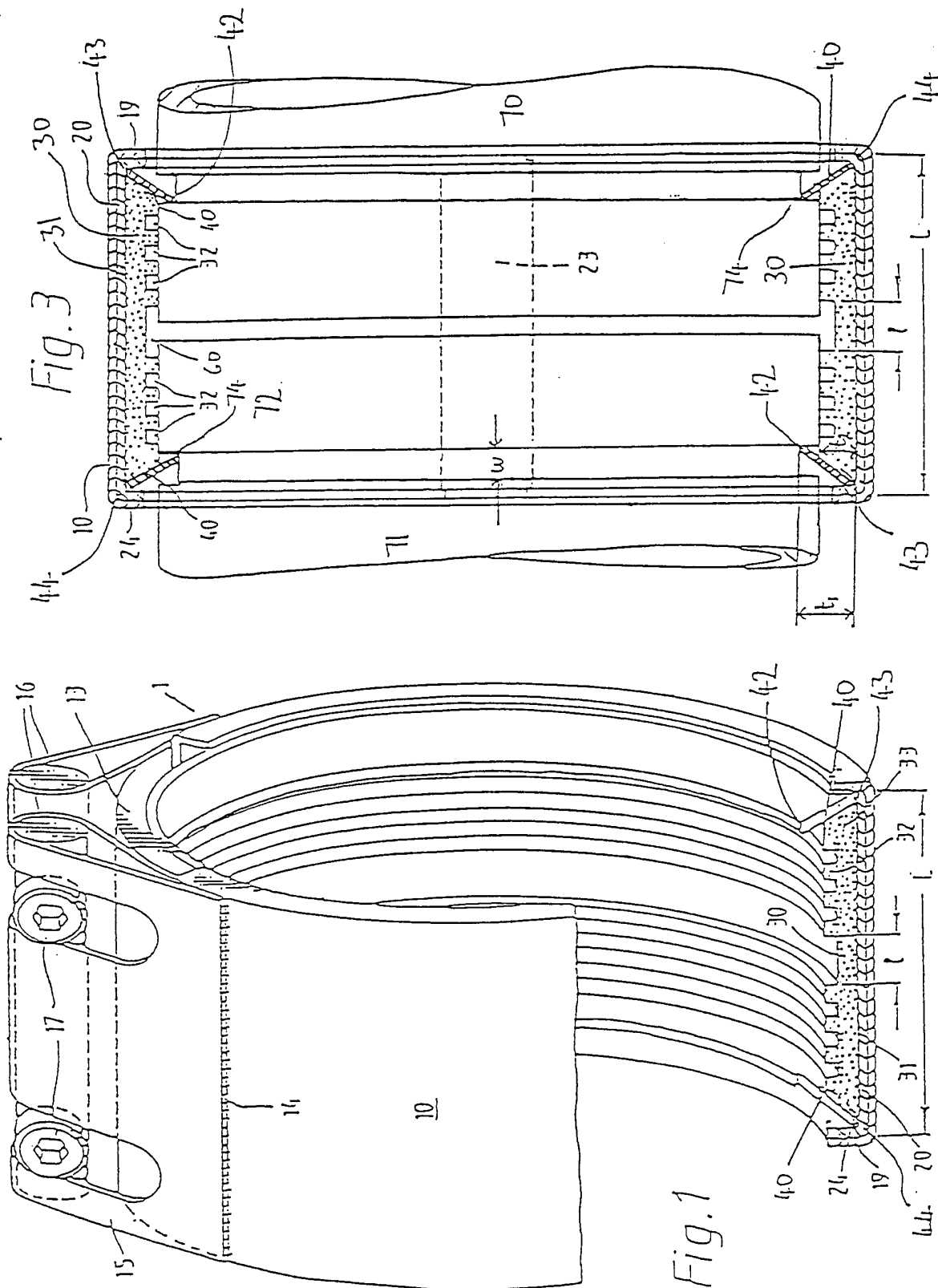
19. A coupling substantially as hereinbefore described with reference to the accompanying drawings.

20. An assembly substantially as hereinbefore described

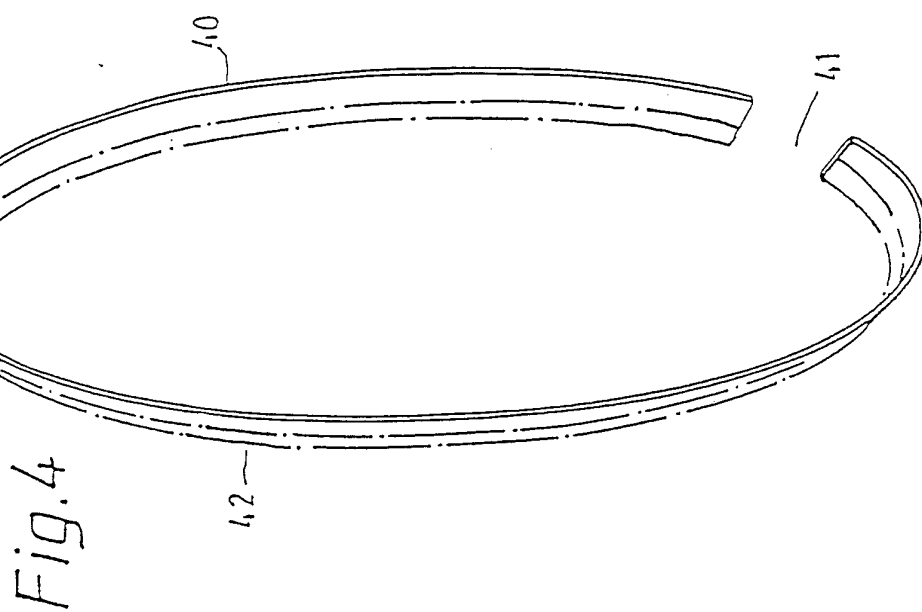
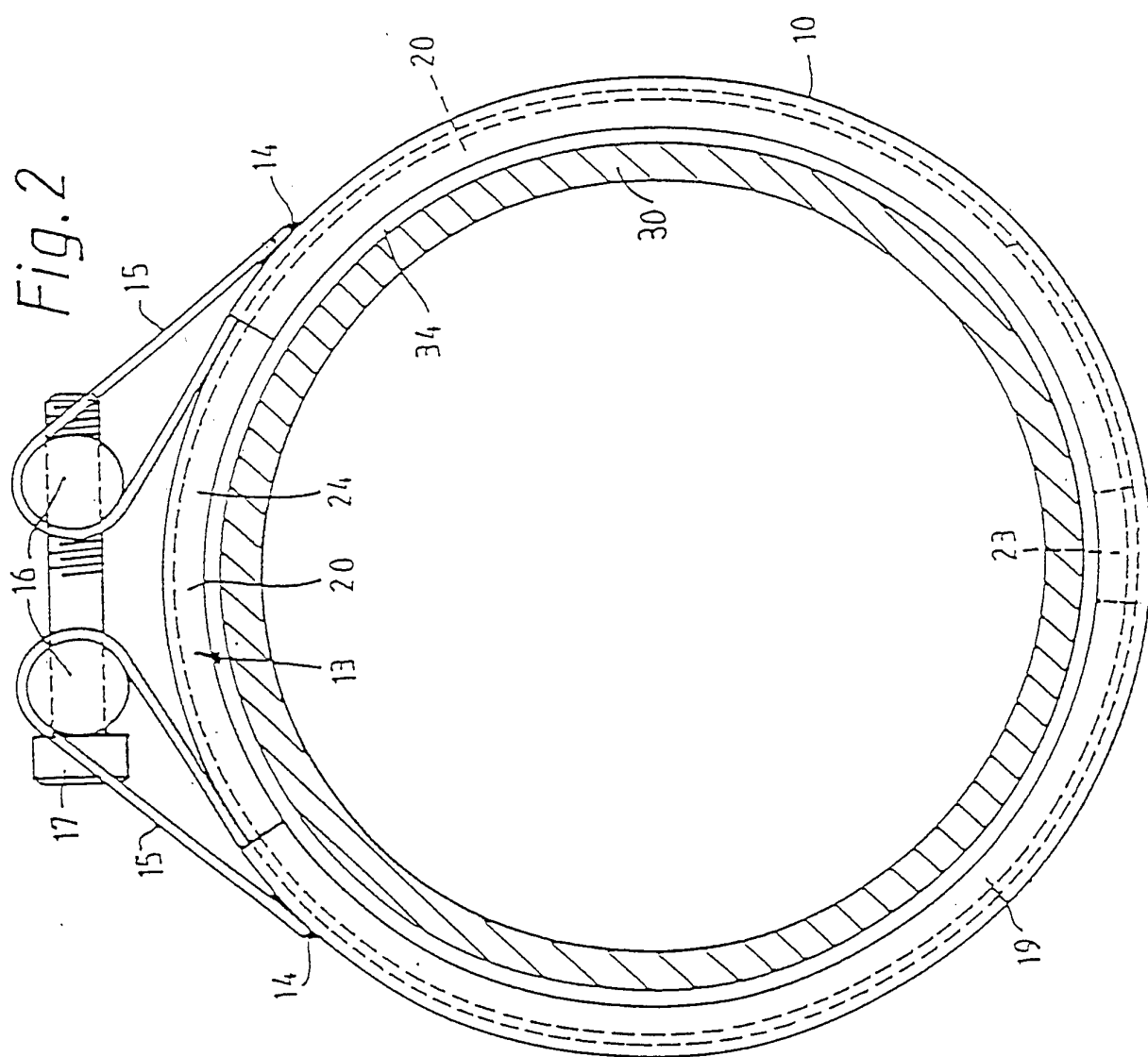
with reference to the accompanying drawings.

21. A pipe coupling for connecting in a fluid-tight manner to the end of a pipe having an annular groove in its outer surface, the coupling comprising a tubular casing, a tubular sealing sleeve, tensioning means for tightening the casing about the sealing sleeve and a gripping ring located within the tubular casing at the end of the sealing sleeve, the arrangement being such that, in use, tightening the tensioning means causes the sealing sleeve to be pressed into sealing engagement with the pipe ends, the tubular casing having a tubular web portion and a radially projecting flange at one end of the web portion, the outer surface of the gripping ring making contact with the angle between the flange and web of the tubular casing and the inner surface of the gripping ring being smooth for engagement in the groove adjacent the end of the pipe, whereby under axial tension the ring between the pipe and the coupling is placed under compression between the angle in the tubular casing and the angle in the groove.

22. An assembly of a pipe coupling connected in a fluid-tight manner to the end of a pipe having an annular groove in its outer surface, the coupling comprising a tubular casing, a tubular sealing sleeve, tensioning means for tightening the casing about the sealing sleeve and a gripping ring located within the tubular casing at the end of the sealing sleeve, the arrangement being such that, in use, tightening the tensioning means causes the sealing sleeve to be pressed into sealing engagement with the pipe ends, the tubular casing having a tubular web portion and a radially inwardly projecting flange at one end of the web portion, the outer surface of the gripping ring making contact with the angle between the flange and web of the tubular casing and the inner surface of the gripping ring being in contact with the groove, whereby the ring acting between the pipe and the coupling is placed under compression between the angle in the tubular casing and the angle between the bottom of the groove and the side of the groove adjacent the end of the pipe, when the assembly is under axial tension.

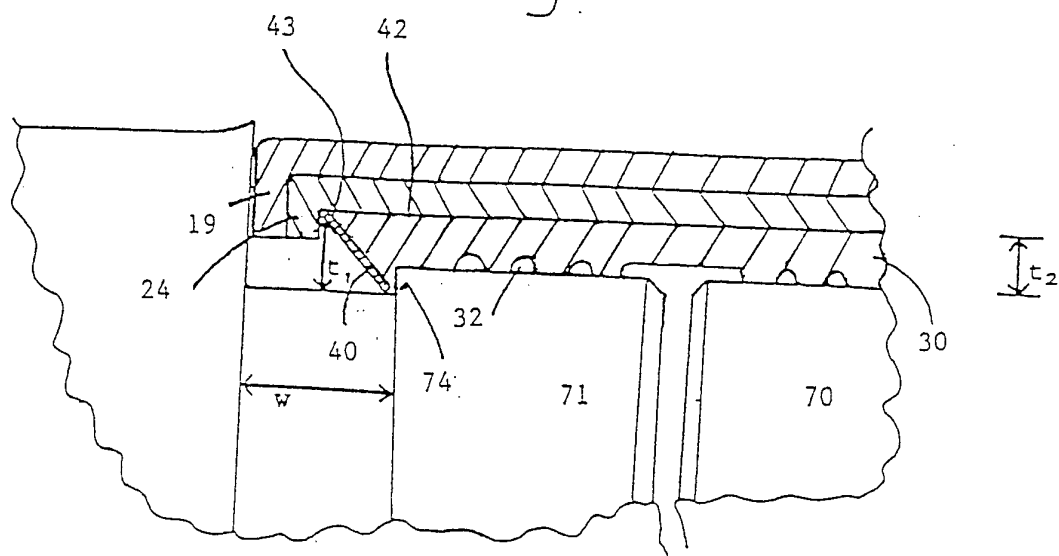


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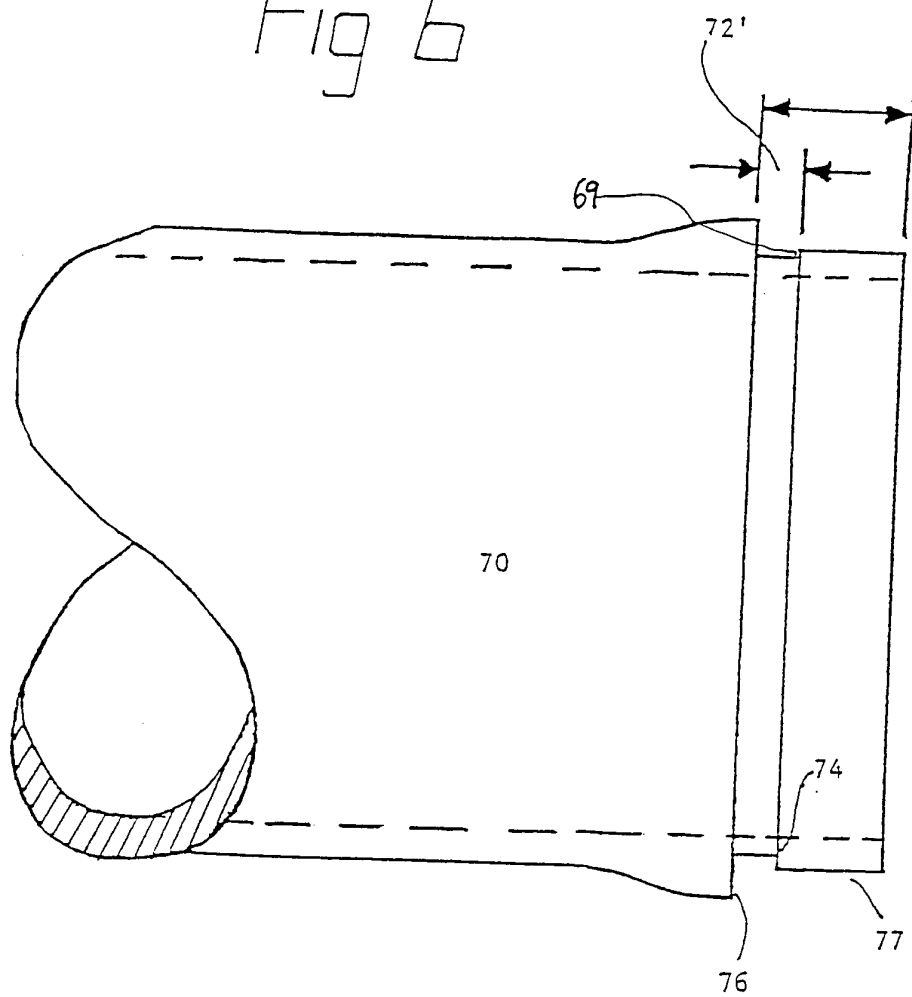
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Fig. 5



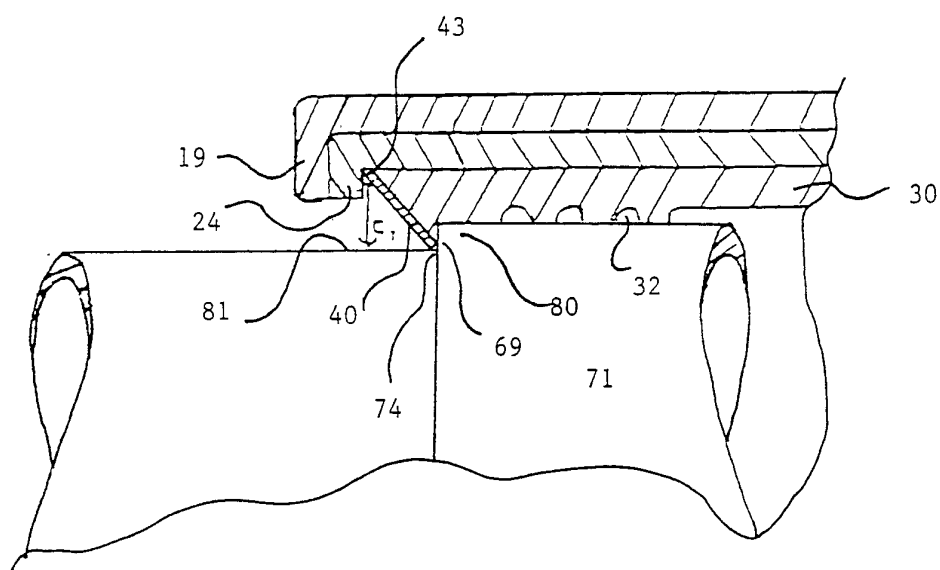
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Fig 6



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Fig 7



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 94/02329

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 F16L21/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	GB,A,2 249 366 (TAYLOR KERR LIMITED) 6 May 1992 cited in the application see the whole document ---	1-22
Y	US,A,3 851 901 (SILLS) 3 December 1974 see figures ---	1-22
A	EP,A,0 550 813 (STRAUB FEDERFABRIK AG.) 14 July 1993 see figures ---	1-22
A	US,A,3 877 733 (STRAUB) 15 April 1975 see figures -----	1-22

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

17 January 1995

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INTERNATIONAL SEARCH REPORT

information on patent family members

Intern. Application No

PCT/GB 94/02329

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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