

Description

Technical Field

The invention relates to pipe joints in which sealing rings are compressed by axially movable members. Such joints are suitable for pipe ends, couplings and fittings. The pipes may be used for conveying fluids, and particularly in mains water supply and drainage.

Background Art

O-ring seal pipe joints comprising a sealing ring which is radially compressed to form a seal between a spigot and a sleeve or socket are well known in the art. An example of such a joint, incorporated into a pipe coupling, is discussed in Patent Specification GB 2156466. The joint disclosed therein has an O-ring which is seated in the flange of a sleeve, and contacts a spigot which is inserted into the sleeve. An axially movable ring surrounding the end of the sleeve compresses the O-ring against the flange and causes the O-ring radially to deform. The radial deformation forms a seal between the sleeve and the spigot. Stuffing box seal pipe joints, such as that disclosed in US-A-2543185, operate on a similar principle. The sealing member is axially compressed, and the axial compression causes an increase in the radial dimension of the sealing member (the so-called Poisson Effect) which creates the seal between the sleeve and the spigot. Joints utilising sealing mechanisms such as this are limited, however, by their tolerance of a variation in the outside diameter of the spigot which is received by the sleeve. Conventional joints are designed to accommodate only pipes which are manufactured to standard tolerances, and are unsuitable for jointing pipes which are constructed from different materials and consequently may have incompatible spigot diameters.

Another type of seal known for use in pipe joints is a wedge seal. The sealing member has an outwardly tapering wedge surface which cooperates with a complementary tapering surface on the sleeve so that, when a gland is tightened against a shoulder of the sealing member, the entire sealing member is driven down the tapering surface of the sleeve, with compression, until it acquires a smaller internal diameter and establishes sealing contact with the spigot. A wedge seal can accommodate greater variations in the size of the spigot outside diameter than can O-ring seals or stuffing box seals, but it is still necessary to provide a range of seals, joints, couplings and fittings to accommodate different spigot diameters.

The problem is to design a joint which enables spigots of different materials and different diameters to be jointed and thereby eliminates the necessity for a variety of joints, couplings and fittings, each of which is dedicated toward a specific material and a specific diameter of piping.

The Invention

The invention provides a pipe joint comprising a sleeve defining a socket chamber for receiving a spigot, an annular sealing member for positioning between the sleeve and the spigot, and a gland around the spigot for applying an axial load to a trailing heel portion of the sealing member to move a nose portion of the sealing member axially into contact with a section of the sleeve having a progressively radially inwardly increasing slope to its internal profile, CHARACTERISED IN THAT the internal profile of the sleeve and the nose portion of the sealing member are so shaped, and the sealing member is so proportioned, that in a wide tolerance situation, when the sealing member is loose on the spigot, when the gland applies a load to the trailing heel portion of the sealing member to move the trailing heel portion axially along the socket chamber, the internal profile of the sleeve causes the line of attack of the nose portion to turn from a purely axial direction to one with an inward radial component, rotating the nose portion inwardly to advance it towards and against the spigot whilst the heel portion of the sealing member maintains substantially the same radial position in the socket chamber.

The pipe joint may be integrally formed as part of a pipe end, or the joint may be utilised in a coupling or in a pipe fitting such as a T-junction or a bend. The possibility of their being a clearance between the sleeve or socket and the spigot makes it possible for the sleeve or socket to accommodate spigots of different diameter and formed of different materials.

The tip of the leading nose portion of the sealing member is preferably, but not necessarily, rounded in axial section, the better to react to the deflecting internal profile of the sleeve. The deflecting internal profile of the sleeve may itself be rounded in axial section, although not necessarily to the same radius of curvature as the tip of the leading nose portion of the sealing member, in order to enhance the deflection and the rotation of the line of attack of the leading nose portion of the sealing member. Alternatively the deflecting internal profile of the sleeve may be a shape other than rounded, such as a series of conical surfaces of progressively increasing slope, to achieve the desired deflection as a load is applied to the sealing member.

The heel portion of the sealing member maintains its original radial position in the socket chamber. Any tendency to reduce the diameter of the sealing member when it is axially loaded is resisted by radial forces in the sealing member, aided when necessary by a precompression of the sealing member when it is fitted into the socket chamber prior to jointing.

The Drawings

Fig 1 is a cross sectional view of the circumference of a pipe coupling incorporating a pair of joints according to the invention depicted with their sealing rings uncompressed, and

Fig 2 is a cross sectional view of the circumference of a pipe coupling incorporating a pair of joints according to the invention depicted in the sealed mode.

Best Mode

With reference to figure 1, a coupling indicated generally at 1 has a sleeve 2 defining a socket chamber 3 for receiving a pair of spigots 4 and 5. A pair of sealing rings 6 and 7 are seated respectively between the spigots 4 and 5 and the sleeve 2. Each of the sealing rings 6 and 7 is circumferentially precompressed when it is seated in the sleeve 2 prior to jointing. The degree of precompression is dependent upon the relative diameters of the sealing rings 6 and 7 and the sleeve 2. Each or a pair of glands 8 and 9 extend axially into one end of the sleeve 2 around the spigots 4 and 5 respectively. One of a series of circumferentially arranged bolts 10 is shown, fastening together the two glands 8 and 9.

With reference to figure 2, the joints are sealed by tightening the bolts 10 which urge the glands 8 and 9 axially into the sleeve 2. The glands 8 and 9 act upon trailing heel portions 11 and 12 of the sealing rings 6 and 7 forcing leading nose portions 13 and 14 of the sealing rings 6 and 7 to follow a path dictated by the internal curvature of axially outer end portions 15 and 16 the sleeve 2. The noses 13 and 14 of the sealing rings 6 and 7, which are rounded to assist their cooperation with the profile or internal curvature of the sleeve end portion 15 and 16, are deflected and moved radially inwards until they abut the spigots 4 and 5, forming a seal between the sleeve 2 and the spigots 4 and 5.

Figure 2 clearly shows the ability of the joint to accommodate spigots of different diameters. The curved internal profiles of the sleeve end portions 15 and 16 cause a radially inward deflection of the leading nose portions 13 and 14 of the sealing rings 6 and 7, moving the nose portions 13 and 14

radially inwardly to different extents until a seal is formed with each of the spigots 4 and 5. In contrast, the trailing heel portions 11 and 12 of the sealing rings 6 and 7 remain at substantially their original diameters due to the radial forces induced by a change in the diameter of the sealing rings 6 and 7, and by the circumferential precompression of the sealing rings 6 and 7. The radially inward movement of the leading nose portions, 13 and 14 of the sealing rings 6 and 7 is greater in the case of the ring 7 which surrounds the smaller spigot 5. The sealing is also assisted by a servo action produced by the positive pressure of the fluid conducted by the pipes, which forces the sealing rings 6 and 7 against the spigots 4 and 5.

The interior diameter of the sleeve 2 is graduated to allow for pivoting of the spigots 4 and 5 about the joint, although this design of sleeve has been chosen merely to illustrate one possibility of providing a flexible coupling according to the invention and is of no other relevance.

Claims

1. A pipe joint comprising a sleeve (2) defining a socket chamber (3) for receiving a spigot (5), an annular sealing member (7) for positioning between the sleeve (2) and the spigot (5), and a gland (9) around the spigot (5) for applying an axial load to a trailing heel portion (12) of the sealing member (7) to move a nose portion (14) of the sealing member (7) axially into contact with a section of the sleeve (2) having a progressively radially inwardly increasing slope to its internal profile, CHARACTERISED IN THAT the internal profile of the sleeve (2) and the nose portion (14) of the sealing member (7) are so shaped, and the sealing member (7) is so proportioned, that in a wide tolerance situation, when the sealing member (7) is loose on the spigot (5), when the gland (9) applies a load to the trailing heel portion (12) of the sealing member (7) to move the trailing heel portion (12) axially along the socket chamber (3), the internal profile of the sleeve (2) causes the line of attack of the nose portion (14) to turn from a purely axial direction to one with an inward radial component, rotating the nose portion (14) inwardly to advance it towards and against the spigot (5) whilst the heel portion (12) of the sealing member (7) maintains substantially the same radial position in the socket chamber (3).

2. A pipe joint according to claim 1 wherein the gland (9) extends into the socket chamber (3).

The heel portion of the sealing member maintains its original radial position in the socket chamber. Any tendency to reduce the diameter of the sealing member when it is axially loaded is resisted by radial forces in the sealing member, aided when necessary by a precompression of the sealing member when it is fitted into the socket chamber prior to jointing.

The Drawings

Fig 1 is a cross sectional view of the circumference of a pipe coupling incorporating a pair of joints according to the invention depicted with their sealing rings uncompressed, and

Fig 2 is a cross sectional view of the circumference of a pipe coupling incorporating a pair of joints according to the invention depicted in the sealed mode.

Best Mode

With reference to figure 1, a coupling indicated generally at 1 has a sleeve 2 defining a socket chamber 3 for receiving a pair of spigots 4 and 5. A pair of sealing rings 6 and 7 are seated respectively between the spigots 4 and 5 and the sleeve 2. Each of the sealing rings 6 and 7 is circumferentially precompressed when it is seated in the sleeve 2 prior to jointing. The degree of precompression is dependent upon the relative diameters of the sealing rings 6 and 7 and the sleeve 2. Each or a pair of glands 8 and 9 extend axially into one end of the sleeve 2 around the spigots 4 and 5 respectively. One of a series of circumferentially arranged bolts 10 is shown, fastening together the two glands 8 and 9.

With reference to figure 2, the joints are sealed by tightening the bolts 10 which urge the glands 8 and 9 axially into the sleeve 2. The glands 8 and 9 act upon trailing heel portions 11 and 12 of the sealing rings 6 and 7 forcing leading nose portions 13 and 14 of the sealing rings 6 and 7 to follow a path dictated by the internal curvature of axially outer end portions 15 and 16 the sleeve 2. The noses 13 and 14 of the sealing rings 6 and 7, which are rounded to assist their cooperation with the profile or internal curvature of the sleeve end portion 15 and 16, are deflected and moved radially inwards until they abut the spigots 4 and 5, forming a seal between the sleeve 2 and the spigots 4 and 5.

Figure 2 clearly shows the ability of the joint to accommodate spigots of different diameters. The curved internal profiles of the sleeve end portions 15 and 16 cause a radially inward deflection of the leading nose portions 13 and 14 of the sealing rings 6 and 7, moving the nose portions 13 and 14

radially inwardly to different extents until a seal is formed with each of the spigots 4 and 5. In contrast, the trailing heel portions 11 and 12 of the sealing rings 6 and 7 remain at substantially their original diameters due to the radial forces induced by a change in the diameter of the sealing rings 6 and 7, and by the circumferential precompression of the sealing rings 6 and 7. The radially inward movement of the leading nose portions, 13 and 14 of the sealing rings 6 and 7 is greater in the case of the ring 7 which surrounds the smaller spigot 5. The sealing is also assisted by a servo action produced by the positive pressure of the fluid conducted by the pipes, which forces the sealing rings 6 and 7 against the spigots 4 and 5.

The interior diameter of the sleeve 2 is graduated to allow for pivoting of the spigots 4 and 5 about the joint, although this design of sleeve has been chosen merely to illustrate one possibility of providing a flexible coupling according to the invention and is of no other relevance.

Claims

1. A pipe joint comprising a sleeve (2) defining a socket chamber (3) for receiving a spigot (5), an annular sealing member (7) for positioning between the sleeve (2) and the spigot (5), and a gland (9) around the spigot (5) for applying an axial load to a trailing heel portion (12) of the sealing member (7) to move a nose portion (14) of the sealing member (7) axially into contact with a section of the sleeve (2) having a progressively radially inwardly increasing slope to its internal profile, CHARACTERISED IN THAT the internal profile of the sleeve (2) and the nose portion (14) of the sealing member (7) are so shaped, and the sealing member (7) is so proportioned, that in a wide tolerance situation, when the sealing member (7) is loose on the spigot (5), when the gland (9) applies a load to the trailing heel portion (12) of the sealing member (7) to move the trailing heel portion (12) axially along the socket chamber (3), the internal profile of the sleeve (2) causes the line of attack of the nose portion (14) to turn from a purely axial direction to one with an inward radial component, rotating the nose portion (14) inwardly to advance it towards and against the spigot (5) whilst the heel portion (12) of the sealing member (7) maintains substantially the same radial position in the socket chamber (3).
2. A pipe joint according to claim 1 wherein the gland (9) extends into the socket chamber (3).



3. A pipe joint according to claim 1 or 2 wherein the tip of the leading nose portion (14) of the sealing member (7) is rounded.
4. A pipe joint according to any preceding claim, wherein the section of the internal profile consists of a plurality of inwardly sloping conical sections of successively increasing slope.
5. A pipe joint according to any of claims 1 to 3, wherein the section of the internal profile is radially inwardly curved.
6. A pipe joint according to any preceding claim wherein the internal diameter of the sleeve (2) is further graduated to allow for pivoting of the spigot (5) about the sealing member (7).

Patentansprüche

1. Rohrverbindung mit einer Hülse (2), die eine Buchsenkammer (3) zur Aufnahme einer Muffe (5) bildet, mit einem ringförmigen Dichtungsglied (7) zur Anordnung zwischen der Hülse (2) und der Muffe (5) und mit einer Stopfbüchse (9) um die Muffe (5) herum zum Aufbringen einer axialen Last auf einen nach außen weisenden Absatzteil (12) des Dichtungsglieds (7) zur Bewegung eines Nasenteils (14) des Dichtungsglieds (7) axial in Berührung mit einem Abschnitt der Hülse (2), der an seinem inneren Profil eine progressiv radial nach innen zunehmende Neigung hat, dadurch gekennzeichnet, daß das innere Profil der Hülse (2) und des Nasenteils (14) des Dichtungsglieds (7) so geformt sind und das Dichtungsglied (7) so gestaltet ist, daß in einer Situation mit weiten Toleranzen, wenn das Dichtungsglied (7) lose auf der Muffe (5) ist, wenn die Stopfbüchse (9) eine Last auf den nach außen weisenden Absatzteil (12) des Dichtungsglieds (7) ausübt, um den nach außen weisenden Absatzteil (12) axial entlang der Buchsenkammer (3) zu bewegen, das innere Profil der Hülse (2) veranlaßt, daß die Angriffslinie des Nasenteils (14) sich von einer rein axialen Richtung in eine Richtung mit einer einwärts gerichteten radialen Komponente verdreht, wodurch der Nasenteil (14) nach innen verschwenkt wird, um ihn gegen die Muffe (5) vorwärts zu bewegen, während der nach außen weisende Absatzteil (12) des Dichtungsglieds (7) im wesentlichen die radiale Position in der Buchsenkammer (3) beibehält.
2. Rohrverbindung nach Anspruch 1, bei der die Stopfbüchse (9) sich in die Buchsenkammer (3) erstreckt.

3. Rohrverbindung nach Anspruch 1 oder 2, bei der die Spitze des vorausgehenden Nasenteils (14) des Dichtungsglieds (7) abgerundet ist.
4. Rohrverbindung nach einem vorhergehenden Anspruch, bei der der Abschnitt des inneren Profils aus einer Vielzahl von nach innen geneigten konischen Abschnitten mit allmählich zunehmender Neigung besteht.
5. Rohrverbindung nach einem der Ansprüche 1 bis 3, bei der der Abschnitt des inneren Profils radial nach innen gekrümmt ist.
6. Rohrverbindung nach einem vorhergehenden Anspruch, bei der der innere Durchmesser der Hülse (2) ferner so abgestuft oder abgewandelt ist, daß er ein Verschwenken der Muffe (5) um das Dichtungsglied (7) gestattet.

Revendications

1. Raccord de tuyau comprenant un manchon (2) définissant une chambre formant cavité (3) pour recevoir une extrémité de tuyau (5), un élément annulaire d'étanchéité (7) à positionner entre le manchon (2) et l'extrémité de tuyau (5), et un serre-garniture (9) autour de l'extrémité de tuyau (5) pour appliquer une charge axiale à une partie formant talon arrière (12) de l'élément d'étanchéité (7), afin de déplacer une partie formant nez (14) de l'élément d'étanchéité (7) axialement en contact avec une section du manchon (2) ayant une inclinaison progressivement croissante radialement vers l'intérieur par rapport à son profil interne, caractérisé en ce que le profil interne du manchon (2) et la partie formant nez (14) de l'élément d'étanchéité (7) sont formés de telle manière, et l'élément d'étanchéité (7) est ainsi proportionné, que dans une situation de large tolérance, quand l'élément d'étanchéité (7) n'est pas serré sur l'extrémité de tuyau (5), quand le serre-garniture (9) applique une charge sur la partie formant talon arrière (12) de l'élément d'étanchéité (7), afin de déplacer la partie formant talon arrière (12) axialement le long de la chambre formant cavité (3), le profil interne du manchon (2) amène la ligne d'attaque de la partie formant nez (14) à tourner à partir d'une direction purement axiale vers une direction avec une composante radiale intérieure, faisant tourner la partie formant nez (14) intérieurement pour l'avancer vers et contre l'extrémité de tuyau (5), tandis que la partie formant talon (12) de l'élément d'étanchéité (7) conserve sensiblement la même position radiale dans la chambre formant cavité



(3).

2. Raccord de tuyau selon la revendication 1, dans lequel le serregarniture (9) s'étend à l'intérieur de la chambre formant cavité (3). 5
3. Raccord de tuyau selon la revendication 1 ou 2, dans lequel l'extrémité de la partie menante formant nez (14) de l'élément d'étanchéité (7) est arrondie. 10
4. Raccord de tuyau selon l'une quelconque des revendications précédentes, dans lequel la section du profil interne est constituée d'une pluralité de sections coniques s'inclinant vers l'intérieur selon une inclinaison successivement croissante. 15
5. Raccord de tuyau selon l'une quelconque des revendications 1 à 3, dans lequel la section du profil interne est incurvée radialement vers l'intérieur. 20
6. Raccord de tuyau selon l'une quelconque des revendications précédentes, dans lequel le diamètre intérieur du manchon (2) est de plus gradué, pour permettre un pivotement de l'extrémité de tuyau (5) autour de l'élément d'étanchéité (7). 25

30

35

40

45

50

55

5

