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A pipe deflection coupling (10) is designed for coupling the adjoining ends of low pressure fluid pipes which might be angularly misaligned. The coupling (10) includes a socket (12) for attachment to a pipe segment. The coupling also includes a coupling piece (11) for attachment to another pipe. The coupling piece (11) has an external annular seal (16) for engagement with the inner surface of the socket (12). The coupling piece (11) has a wall (15) which tapers inwardly away from the seal (16). The arrangement enables sealed inter engagement of the socket (12) and coupling piece (11) allowing both angular and longitudinal movement.
Pipe Deflection Coupling

The following statement is a full description of this invention, including the best method of performing it known to me.

FIELD OF THE INVENTION

The following invention relates to a pipe deflection coupling. More particularly, though not exclusively, the invention relates to a coupling for connection to the adjoining ends of low pressure fluid pipes which might be angularly misaligned. A particular application of the invention is in sewer pipe installations where the sewer pipe from a house for example is connected to a pipe which in turn lead to a main sewer line.

In new domestic houses for example, it is necessary to connect the new sewer pipes to existing sewer lines. This is usually done by presenting a new sewer pipe to the branch of a junction inserted in-line with the existing sewer pipe. It is sometimes difficult to angularly align the new sewer pipe with the branch of the junction to provide a proper connection. Junctions having a wide range of fixed branch angles are available, usually in 5° increments. Even so, the actual desired branch angle can be inbetween those available.

Another problem associated with the interconnection of new sewer pipes to existing sewer lines is associated with settlement of the new structure or plumbing line. As the new slab settles, the new sewer pipe can be forced against the existing sewer pipe, subjecting both pipes to stress. This stress can result in pipe failure and consequential leaking.
It is known to present a coupling to a branch socket in such a manner as to allow slight pivotal reorientation of the coupling with respect to the longitudinal centre line of the branch socket. However, such proposals have been generally unsuccessful due to susceptibility to leakage and lack of adaptability to lengthwise repositioning or adjustment of the new sewer line with respect to the branch of the junction fixed to the existing sewer line.

OBJECT OF THE INVENTION

It is the object of the present invention to overcome or substantially ameliorate at least one of the above disadvantages and/or more generally to provide an improved pipe deflection coupling.

DISCLOSURE OF THE INVENTION

According to the invention there is provided a pipe deflection coupling for connecting a first pipe having a first longitudinal axis, to a second pipe having a second longitudinal axis, the coupling including:

- a cylindrical socket member having two opposite ends and an inner surface, the socket member being configured for attachment, at one said end, to the first pipe and having a rim at the other said end, wherein the rim defines an opening into the socket member;
- a tubular coupling piece having a first end and an opposite second end, and being configured for attachment, at said first end, to the second pipe, and having an external wall, wherein the external wall has a zone which tapers in a direction from the second end to the first end, and wherein the coupling piece is configured to extend through said opening such that the second end is disposed within the socket member; and
- an annular sealing element attached to one of said inner surface and said external wall, and configured for sealing engagement with the other of said inner surface and said external wall,
wherein the coupling piece is telescopically slidable within the socket member, and pivotable relative to the socket member to enable a varying of the angle between said first and second axes, wherein the extent of said pivoting is limited by engagement of part of said socket member with said zone.

Preferably, said sealing element is located on said external wall adjacent said second end, and is configured for sealing engagement with said inner surface.

Said part of the socket member is preferably constituted by said rim. Preferably, said socket member includes a capture ring which includes said rim. The capture ring is preferably adhered to a remainder of the socket member by solvent cement.

Preferably, said external wall defines an annular groove adjacent said second end, and the sealing element is a ring located within the annular groove.

The pipe deflection coupling preferably includes a flexible boot that fits around the coupling piece and the socket member.

DEFINITION

As used herein, the term “pipe segment” means any length of pipe or the branch of a pipe junction.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred form of the present invention will now be described by way of example with reference to the accompanying drawings wherein:

Figure 1 is a schematic cross sectional side elevational view of a pipe deflection coupling;

Figure 2 is a schematic cross sectional side elevational view of a socket;

Figure 3 is a schematic cross sectional side elevational view of a capture ring;

Figure 4 is a schematic cross sectional side elevational view of a coupling piece;
Figure 5 is a schematic cross sectional side elevational detailed view of the detail shown at A in Figure 4;

Figure 6 is a schematic end elevational view of the coupling piece;

Figure 7 is a schematic cross sectional side elevational partial view of a sealing ring; and

Figure 8 is a schematic cross sectional side elevational partial view of another sealing ring.
DESCRIPTION OF THE PREFERRED EMBODIMENT

In Figure 1 of the accompanying drawings there is schematically depicted a pipe deflection coupling assembly 10. The components are typically moulded plastics material such as PVC.

Assembly 10 includes a coupling piece 11 partially inserted into a socket 12. Affixed typically by solvent cement to the opening 31 of the socket 12 is a capture ring 13.

As shown in Figure 2, the socket 12 which is circular in transverse cross section includes openings at each end. Opening 31 receives the capture ring 13 shown in Figure 3. At the other end of the socket 12 there is provided an end extension 19 having an inwardly tapered opening 20. The internal diameter of the end extension 19 is typically the same as the external diameter of standard PVC sewer pipe. It might alternatively be approximately equivalent to the external diameter of the branch of a junction to be fixed in-line with a sewer line. It is intended that the end extension 19 be adhered to the sewer pipe or branch by means of solvent cement. The internal taper 20 enables easy insertion of the PVC pipe or branch into the socket 12. The socket 12 also includes an internal annular abutment 21 which limits the extent to which the sewer pipe or branch can be inserted into the socket.

From the position of the abutment 21, the socket 12 tapers outwardly in a curved profile to a cylindrical wall portion 14. At a position nearby the point at which the curve transitions with the cylindrical wall 14, there is provided an external ring 18 to be received within an internal annular recess of sealing boot 17 shown in Figure 1.

Figure 3 depicts the capture ring 13 to be adhered to the opening 31 of socket 12. Ring 13 includes an internally facing annular engagement surface 22 which, in use, bears against the external surface of the tapered wall 15 of coupling piece 11.
The coupling piece 11 is depicted in Figure 4. It includes at the left hand end an annular channel 27 which is adapted to receive a sealing ring 16. Alternative sealing rings are identified by numbers 29 and 30 in Figures 7 and 8 respectively.

The sealing ring is sized so as to bear and seal against the internal surface of the cylinder wall 14 of socket 12.

As shown in more detail in Figure 5, the channel 27 is defined between a pair of outwardly extending annual walls 32 and 33. A number of circumferentially spaced longitudinal webs 28 surround the wall 33 as shown in Figures 5 and 6.

From the position of the webs 28 there extends to the right an inwardly tapered wall 15. The angle of this taper as identified by the letter $\alpha$ in Figure 4 is typically about $5^\circ$, however this angle might vary slightly. From the point of minimum diameter of the tapered wall 15, the coupling piece increases in diameter to an end extension 34 terminating at an internally tapered opening 26. The internal diameter of the opening 26 is to be approximately equal to the external diameter of standard PVC sewer pipe or other standard fitting. The taper provides for easy insertion of the pipe or other fitting to the opening. Adjacent to the opening 26 there is provided an external ring 25 to be received within an annular recess at the other end of boot 17.

Boot 17 is typically a flexible, extendible rubber or other plastics member.

The deflection coupling assembly 10, configured and assembled as shown in Figure 1 can be used to couple a pair of pipe fittings to be interconnected. For example, the end of a branch of a sewer junction can be inserted into the end extension 19 and adhered thereto by means of solvent cement. Similarly, the end of another length of pipe (typically a new length of pipe) is inserted into the opening 26 and adhered by solvent cement to the end extension 34 of the coupling piece 11. The angularly deflectable and longitudinally extendible nature of the deflection coupling assembly 10 enables the assembly to cater for positional and alignment inaccuracies of the mating pipes. As
the seal 16 remains slidably engaged inside the cylindrical wall 14, and as the boot 17 is flexible, the coupling accommodates movement due, for example, to settlement over time.

As an alternative to attaching the deflection coupling in the assembled state as shown in Figure 1, the end extension 19 of the socket 12 can be adhered by solvent cement to the end of a length of sewer pipe of the branch of a sewer junction for example. The boot 10 and capture ring 13 can then be placed (in that order) over the end of another length of sewer pipe to be connected with the sewer pipe to which the socket is adhered. The end of the length of sewer pipe over which the boot and capture ring are now in position can now be inserted through the tapered opening 26 and adhered to the internal surface of the extension 34 of coupling piece 11. The seal end of coupling piece 11 can now be inserted into the cylindrical portion 14 of the socket 12. The capture ring 13 can then be adhered by means of solvent cement about the opening 31 of socket 12.

Once the solvent cement has cured, the boot 17 can be fitted over the ring 18 on socket 12. The coupling piece can now be adjusted in and out of the socket 12 as well as allowing for angular misalignment of the respective longitudinal axes of the connected pipes.

The extent to which the misalignment is allowed is determined by the angle $\alpha$. Moreover, this angle of misalignment is limited by the engagement of annular engagement surface 22 with the external surface of the tapered wall 15. This angle does not vary with longitudinal repositioning of the surface 22 along the tapered wall 15.

The seal 16 might lift slightly from the internal surface of the cylindrical wall 14 and it is for this reason that the boot 17 is provided as a secondary seal. Moreover, the seal 16 might be considered as a wiper seal preventing the ingress of solid matter to the annular space between the boot 17 and the components 11, 12 and 13.
A substantially constant maximum misalignment angle is provided regardless of the longitudinal position of the coupling piece 11 with respect to socket 12. This is provided by the tapered wall 15.

Alternative seals are shown in Figures 7 and 8. In Figure 7, the transverse cross section of the seal is rectangular. In Figure 8, the seal 30 is provided with an annular external concavity which diverges from the longitudinal axis of the coupling piece 11 by an angle $\beta$ which is typically $5^\circ$, though may vary slightly from this. The angles $\alpha$ and $\beta$ are typically equal.

It should be noted that the extent of longitudinal position adjustment of the components 11 and 12 is maximised by the chosen external profile of webs 28 and matching internal profile of the capture ring 13.

Once buried in the ground, the pipe deflection coupling will allow for continued relative movement of the adjoining pipe segments which might typically occur as a result of building settlement or soil movement.

It should be appreciated that modifications and alterations obvious to those skilled in the art are not to be considered as beyond the scope of the present invention. For example, the capture ring 13 might be provided with internal thread and the external surface of the socket may be provided with matching thread so as to obviate the need for solvent cement to join these two components. Furthermore, instead of providing an externally facing seal on an internally located tapered component, the seal could be provided internally of a non-tapered component with a narrower component having a cylindrical outer wall and a tapered extension located therein.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A pipe deflection coupling for connecting a first pipe having a first longitudinal axis, to a second pipe having a second longitudinal axis, the coupling including:
   a cylindrical socket member having two opposite ends and an inner surface, the socket member being configured for attachment, at one said end, to the first pipe and having a rim at the other said end, wherein the rim defines an opening into the socket member;
   a tubular coupling piece having a first end and an opposite second end, and being configured for attachment, at said first end, to the second pipe, and having an external wall, wherein the external wall has a zone which tapers in a direction from the second end to the first end, and wherein the coupling piece is configured to extend through said opening such that the second end is disposed within the socket member;
   and
   an annular sealing element attached to one of said inner surface and said external wall, and configured for sealing engagement with the other of said inner surface and said external wall,
   wherein the coupling piece is telescopically slidable within the socket member, and pivotable relative to the socket member to enable a varying of the angle between said first and second axes, wherein the extent of said pivoting is limited by engagement of part of said socket member with said zone.

2. The pipe deflection coupling of Claim 1 wherein said sealing element is located on said external wall adjacent said second end, and is configured for sealing engagement with said inner surface.

3. The pipe deflection coupling of Claim 2 wherein said part of the socket member is constituted by said rim.

4. The pipe deflection coupling of Claim 3 wherein said socket member includes a capture ring which includes said rim.
5. The pipe deflection coupling of Claim 4 wherein the capture ring is adhered to a remainder of the socket member by solvent cement.

6. The pipe deflection coupling of any one of Claims 2 to 5 wherein said external wall defines an annular groove adjacent said second end, and the sealing element is a ring located within the annular groove.

7. The pipe deflection coupling of any one of the preceding claims including a flexible boot that fits around the coupling piece and the socket member.

8. A pipe deflection coupling substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 26th day of May 2003
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