

PATENT SPECIFICATION

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(54) PIPE SEAL

(71) We, HUMES LIMITED, a Victorian Company, of 185 William Street, Melbourne, State of Victoria, Commonwealth of Australia, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to pipes and other tubular members and, more particularly, to seals or joints, such as are formed between inner and outer tubular surfaces. The invention is concerned particularly, but is not limited, to seals of the O-ring or D-ring type employed in the joining of concrete pipes, for example, for use between the spigot of one pipe and the socket of an adjacent pipe. The invention is applicable to seals or joints between inner and outer tubular surfaces, such as pipes or other members, in which a sealing member is located in a recess formed in the outer surface, or in the body forming the outer surface.

The term "tubular" in this specification and the following claims includes cylindrical and non-cylindrical continuous curved surfaces, such as ovoid or oval surfaces or bodies, but in most applications cylindrical surfaces are implied.

In the joining of pipes, particularly concrete pipes, there is usually a socket which receives a spigot, either the socket or spigot having retaining means in which there is located an O-ring seal or the like.

The seals have conventionally been compressible and the seal between the socket and spigot is made by radial forces acting inwardly on the spigot and outwardly on the socket.

In order for such seals to be practically successful two criteria have to be met. Firstly, the socket has had to be sufficiently robust to accept the outward radial force without damage to the socket and, secondly, the range of tolerances between the spigot and the socket has had to be relatively fine, firstly, to permit an interconnection which provides a good seal and, secondly, to ensure that when such a connection is made

the outward radial forces on the socket are within the design limits of the socket.

It is an object of the present invention to provide a pipe or other tubular member having an improved seal construction which reduces the previous disadvantages and enables the effectiveness of the resulting seal to be increased.

The invention consists in a pipe or other tubular member having an internal annular sealing member for effecting a seal between the tubular member and an inner member fitted into the tubular member, wherein the annular sealing member is disposed in an annular recess in the inner surface of the tubular member, the inner periphery of said sealing member projecting inwardly of said inner surface and its outer periphery being spaced from the outer peripheral wall of the recess by a substantially annular space, and wherein the sealing member is formed from resilient material and has an annular non-extendable member which is arranged to absorb outward radial forces and substantially prevent transmission of said radial forces to the tubular member.

The annular non-extendable member, which may be formed of metal, may be in contact with the outer periphery of the resilient material of the annular sealing member or may be embedded therein. In the latter case, it may be located at any suitable position within the body of the resilient material but is preferably located closer to the outer periphery of the sealing member than to its inner periphery.

The non-extendable member absorbs, and in some cases may eliminate the outward radial forces exerted by the resilient sealing member and at the same time increases the longitudinal or axial forces (that is, the forces acting in a direction parallel to the tubular surfaces and at right angles to the radial forces) between the resilient sealing member and the side walls of the annular recess in the tubular member in which the sealing member is located. This improves the effectiveness of the seal.

In the case of a seal between a spigot on one pipe which is to be sealed within an

outer socket on the end of another pipe to which the first pipe is to be joined, the invention has the considerable advantage that by reducing the outward radial force of the sealing member on the socket, the radial thickness of the socket can be substantially reduced without detrimentally affecting the pipe joint or seal, which enables substantial economies to be achieved.

In order that the invention may be more readily understood, certain embodiments of the invention, as applied to concrete pipes, will now be described, although it is to be understood that the invention is not restricted to such limited applications.

In the embodiments shown in the accompanying drawings:—

Figure 1 is a diagrammatic view in cross-section of a pipe seal according to the invention used for jointing the spigot of one pipe and the socket of an adjacent pipe.

Figure 2 is a sectional view similar to Figure 1, showing the pipes prior to joining.

Figure 3 is a sectional view similar to Figure 2 wherein the spigot of one pipe is shown entering the socket of the second pipe.

Figure 4 is a sectional view similar to Figure 1 but to a reduced scale showing the two pipes joined and sealed.

Figure 5 is a sectional view of one type of sealing ring according to the invention, and

Figure 6 is a sectional view of another type of sealing ring according to the invention.

Referring to the drawings, reference numeral 10 represents the spigot end of a first pipe 11 which is to be joined to the socket end 12 of a second pipe 13. In the drawings these pipes are shown as concrete pipes, but the pipes may be formed of other materials.

The spigot 10 of pipe 11 is formed at its end with an inwardly tapered peripheral face 14. The reference numeral 15 indicates the cylindrical recess in the socket end 12 of the pipe 13 into which the spigot 10 is adapted to fit. An annular space 16 exists between the inner tubular face 17 of the socket end 12 and the outer tubular surface 18 of the pipe 11.

An annular recess 19 of rectangular radial section is formed in the inner surface of the socket end 12 of the pipe 13 and an annular sealing member 20, which is formed of rubber or other resilient material, is fitted within the recess 19. The annular sealing member 20 may comprise an O-ring or D-ring or may be of any other suitable shape, but is conveniently of the shape shown in Figures 5 and 6.

The side walls of the annular sealing member 20 may be flat or curved and are preferably in pressure contact with the side walls 22 of the recess 19 when the annular

member 20 is fitted into the recess. If the side walls 21 of the member 20 are curved before the member is inserted in the recess 19, they will normally assumed a flat configuration when in pressure contact with the side walls 22.

The annular sealing member 20 completely surrounds the spigot 10 of the pipe 11 and is of such dimensions that the inner curved surface 23 of the sealing member 20 is in pressure contact with the outer tubular surface 18 of the spigot 10 when the spigot has been fully inserted into the socket 12.

The annular sealing member 20 is provided with an annular non-extendable member 25 which may be formed of metal or other substantially non-extendable material, and is of continuous or endless, preferably, circular shape. The non-extendable member 25 may comprise a bar or strip as shown in Figures 1 to 5, or it may comprise a wire or similar member of cylindrical or other suitable cross-sectional shape as shown in Figure 6.

The non-extendable member 25 may be embedded in the material of the sealing member 20, preferably at or near the outer periphery 26 of the sealing member 20 as shown in Figures 1 and 4, or may be arranged to surround the outer surface or periphery 26 of the resilient body of the sealing member 20 as shown in Figure 5 or it may be embedded in the resilient body as shown in Figure 6. Preferably the non-extendable member 25 is located closer to the outer periphery 26 of the sealing member 20 than to its inner periphery 23.

When the spigot 10 of the pipe 11 is forced into the recess 15 in the socket 12 of the pipe 13 the tapered face 14 of the spigot 10 engages the inner periphery 23 of the sealing member 20, the sealing member 20 being so constructed that its inner periphery 23 is normally of smaller diameter than the outer periphery 18 of the spigot 10. As the spigot 10 is inserted in the socket, the tapered faced 14 expands the resilient sealing member 20, as shown in Figure 3, and forces it outwardly into the recess 19 in the socket 12 so that when the spigot 10 is fully inserted into the socket 12, as shown in Figures 1 and 4, the inner periphery 23 of the sealing member 20 is in pressure contact with the outer tubular surface 18 of the spigot 10.

The non-extendable member 25 has the effect of absorbing the outward radial forces resulting from the compression of the sealing member 20 and thereby preventing these radial outward forces from being transmitted to the outer periphery 27 of the recess 19 and thereby to the socket 12.

The outer radial forces exerted by the deformable resilient sealing member 20 are absorbed by the non-extendable member 25

as indicated by the arrows 28 in Figure 1, and are translated into longitudinal forces indicated by the arrows 29 in Figure 1 which act against the side walls 22 of the recess 19 in the socket member 12, this effect being achieved by deformation of the resilient body of the sealing member 20.

It will be appreciated that there is a certain radial component in the forces applied to the sealing member 20 and, although pressure is maintained between the sealing member 20 and the outer surface 18 of the spigot 10, as indicated by the arrows 30 in Figure 1, the main forces are substantially longitudinal of the socket 12 as indicated by the arrows 29 in Figure 1.

By means of this invention it is possible to manufacture sockets 12 which are substantially thinner for any particular sized pipe than would normally be the case, and in addition the tolerance range available can be very much greater than has been the case previously because more compression of the sealing member adds little if any radial strain to the socket and on less compression of the sealing member a good seal is still made around the edges of the recess in the socket.

By this invention therefore, it is possible substantially to reduce the cost of socket members and of pipe joints and also to improve the effectiveness of sealing means for pipe joints and also for the sealing of spaced tubular members other than pipes.

The radial thickness of the socket 12 may be, due to the use of this invention, substantially less than the radial thickness of the socket of a conventional pipe of the same diameter.

WHAT WE CLAIM IS:—

1. A pipe or other tubular member having an internal annular sealing member for effecting a seal between the tubular member and an inner member fitted into the tubular member, wherein the annular sealing member is disposed in an annular recess in the inner surface of the tubular member, the inner periphery of said sealing member projecting inwardly of said inner surface and its outer periphery being spaced from the outer peripheral wall of the recess by a substantially annular space, and wherein the sealing member is formed from resilient material and has an annular non-extendable member which is arranged to absorb out-

ward radial forces and substantially prevent transmission of said radial forces to the tubular member.

2. A tubular member as claimed in claim 1, wherein the non-extendable member is in contact with the outer periphery of the annular sealing member.

3. A tubular member as claimed in claim 1, wherein the non-extendable member is embedded in the resilient material of the sealing member.

4. A tubular member as claimed in claim 3, wherein the non-extendable member is located closer to the outer periphery of the sealing member than to its inner periphery.

5. A tubular member as claimed in claim 1, 2, 3 or 4, wherein the non-extendable member comprises a metal band.

6. A tubular member as claimed in any one of the preceding claims, wherein the non-extendable member causes the outward radial forces to be translated into and thereby to increase the longitudinal forces between the sealing member and the side walls of the annular recess.

7. A tubular member as claimed in any one of the preceding claims, wherein the sealing member and annular recess therefore are disposed within a socket formed at one end of the member.

8. A tubular member as claimed in any one of the preceding claims, which is a concrete pipe.

9. A tubular member as claimed in claims 7 and 8, wherein the radial thickness of the socket wall is substantially less than the radial thickness of the socket of a conventional concrete pipe of the same diameter.

10. A pipe or other tubular member constructed substantially as hereinbefore describe with reference to Figures 1 to 4 of the accompanying drawings.

11. A pipe or other tubular member constructed substantially as hereinbefore described with reference to Figure 5 of the accompanying drawings.

12. A pipe or other tubular member constructed substantially as hereinbefore described with reference to Figure 6 of the accompanying drawings.

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By means of this invention it is possible to manufacture sockets 12 which are substantially thinner for any particular sized pipe than would normally be the case, and in addition the tolerance range available can be very much greater than has been the case previously because more compression of the sealing member adds little if any radial strain to the socket and on less compression of the sealing member a good seal is still made around the edges of the recess in the socket.

By this invention therefore, it is possible substantially to reduce the cost of socket members and of pipe joints and also to improve the effectiveness of sealing means for pipe joints and also for the sealing of spaced tubular members other than pipes.

The radial thickness of the socket 12 may be, due to the use of this invention, substantially less than the radial thickness of the socket of a conventional pipe of the same diameter.

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1. A pipe or other tubular member having an internal annular sealing member for effecting a seal between the tubular member and an inner member fitted into the tubular member, wherein the annular sealing member is disposed in an annular recess in the inner surface of the tubular member, the inner periphery of said sealing member projecting inwardly of said inner surface and its outer periphery being spaced from the outer peripheral wall of the recess by a substantially annular space, and wherein the sealing member is formed from resilient material and has an annular non-extendable member which is arranged to absorb out-

ward radial forces and substantially prevent transmission of said radial forces to the tubular member.

2. A tubular member as claimed in claim 1, wherein the non-extendable member is in contact with the outer periphery of the annular sealing member.

3. A tubular member as claimed in claim 1, wherein the non-extendable member is embedded in the resilient material of the sealing member.

4. A tubular member as claimed in claim 3, wherein the non-extendable member is located closer to the outer periphery of the sealing member than to its inner periphery.

5. A tubular member as claimed in claim 1, 2, 3 or 4, wherein the non-extendable member comprises a metal band.

6. A tubular member as claimed in any one of the preceding claims, wherein the non-extendable member causes the outward radial forces to be translated into and thereby to increase the longitudinal forces between the sealing member and the side walls of the annular recess.

7. A tubular member as claimed in any one of the preceding claims, wherein the sealing member and annular recess therefore are disposed within a socket formed at one end of the member.

8. A tubular member as claimed in any one of the preceding claims, which is a concrete pipe.

9. A tubular member as claimed in claims 7 and 8, wherein the radial thickness of the socket wall is substantially less than the radial thickness of the socket of a conventional concrete pipe of the same diameter.

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