

Ball joint pipe connection

The invention is related to a pipe connection, comprising a ball joint having shell parts, pipe connection means at the ends of the shell parts which face away from each other and which are to be connected to a respective pipe section, which shell parts surround one another in a contacting manner, each define a respective longitudinal centre line and are rotatable in relation to one another between an aligned position, in which the longitudinal centre lines coincide, and a rotated position, in which the longitudinal centre lines form an angle with one another which differs from zero, wherein the shell parts together enclose an axial passage which extends between the ends of the shell parts, a sealing element between the outermost shell part and the innermost shell part, and a lining which extends between the outermost shell part and the corresponding pipe connection means.

Such a pipe connection is known. The lining thereof extends between the outer shell part and a welding sleeve in a frustoconical manner. The purpose of the lining is to protect the inner surface of the case which extends between the outer shell part and the welding sleeve against the abrasive action of the materials which flow through the pipeline. In particular dredging spoils which may contain highly abrasive particles have a detrimental effect on the steel material of the ball joint. Thus, the lining should form a barrier in such a way that the steel material is shielded from the abrasive action of the transported materials.

Although the prior art pipe connection does provide such protection, nevertheless still problems may occur. As a result of the frustoconical shape of the lining, the outer surface of the innermost shell part may still be subjected to the abrasive action mentioned before, in particular in case the ball joint is in a rotated position. In such cases, a fairly wide gap occurs which gives rise to vortices in the flowing materials. These vortex flows have an enhanced abrasive effect, as a result of which the unprotected portion of the innermost shell part is still attacked.

Embodiments of the invention seek to provide a pipe connection of the type described before which is better protected against the abrasion caused by the transported materials. The above may be achieved in that the inner lining surface of the lining has a curvature corresponding to the curvature of the outer surface of the innermost shell part and in that said inner lining surface and said outer surface lie entirely free in relation to

one another.

According to an aspect, there is provided a pipe connection, comprising a ball joint having shell parts, pipe connection means at the ends of the shell parts which face away from each other and which are to be connected to a respective pipe section, which shell parts surround one another in a contacting manner, each define a respective longitudinal centre line and are rotatable in relation to one another between an aligned position, in which the longitudinal centre lines coincide, and a rotated position, in which the longitudinal centre lines form an angle with one another which differs from zero, wherein the shell parts together enclose an axial passage which extends between the ends of the shell parts, a sealing element between the outermost shell part and the innermost shell part, and a lining which extends between the outermost shell part and the corresponding pipe connection means, wherein the outermost shell part comprises shell part halves which enclose the innermost shell part, wherein the contacting surfaces of the innermost shell part and of the outermost shell part are spherical, characterized in that the lining has a shape closely following the path of the innermost shell part while this is being rotated upon adjusting the ball joint, and in that the inner surface of the lining and the outer surface of the innermost shell part lie entirely free in relation to one another, wherein a flow guide is provided in the innermost shell part the flow guide widening in the form of a trumpet to the end of the innermost shell part and extending beyond the end of the innermost shell part which adjoins the lining, and having a nose end lying close up to the inner surface of the lining in the extreme rotated positions of the innermost shell part.

In the pipe connection according to an embodiment of the invention, the lining closely follows the path of the innermost shell part while this is being rotated upon adjusting the ball joint. Thus, only a small gap, preferably with an essentially uniform thickness, is present between the outer surface of the innermost shell part and the lining. Thus, although liquid etc may fill said gap, no vortices will occur as a result of the very limited gap space. Thus, the outer surface of the innermost shell part will no longer be subjected to the abrasive influence of the transported materials. The lining surface may be essentially spherical.

In order to further improve the flow characteristics of the pipe connection, a flow guide may be provided in the innermost shell part. Such flow guide protects the inner

surface of the innermost shell part. Preferably, the flow guide may have a cylindrically and/or spherically curved inner flow guide surface. Best results are obtained in case the flow guide extends beyond the end of the inner shell part which adjoins the lining . Thus, the flow guide may have a nose end which lies free in relation to the lining surface. The nose end and the lining surface may enclose a gap, the size of which is essentially identical to the gap between the lining surface and the outer surface of the inner shell part. Thereby, the innermost shell part is fully protected against the flowing materials.

In order to streamline the flow in a proper manner, the flow guide may comprise a flow guide part which is located close to the pipe connection means of the innermost shell part which is essentially cylindrical. Additionally, the flow guide may comprises a further, adjacent flow guide part which is located close to the outermost shell part and which is designed as widening in the form of a cone or trumpet. The latter embodiment has a free cross sectional flow area which remains essentially unobstructed even in the most extreme rotated positions of the shell parts with respect to each other. This represents a further advantage in comparison to the prior art pipe connection, the latter one exhibiting an increasing reduction of the free cross sectional flow area when rotating the shell parts with respect to each other.

Depending on the materials to be transported, the flow guide comprises a specific wear resistant material, such as hardened steel or white-cast iron. Also, the lining comprises such wear resistant material. These materials are selected on the basis of the resistance against the abrasive and possibly chemical properties of the transported

materials.

In a known manner, the outermost shell part may comprise shell part halves which enclose the innermost shell part. Preferably, each outer shell part half contacts the innermost shell part in a direct fashion. In addition to this direct contact, one or both
5 outer shell part half may contact the innermost shell part through the sealing element. In particular, a yoke or yoke ring may be attached to the one of the shell part halves of outermost shell part, a gland ring being provided which constitutes the other shell part half of the outermost shell part and which cooperates with said yoke.

Onto the pipe connection, pipe sections may be mounted for instance by means of
10 welding sleeves. Alternatively, mounting flanges may be used.

In a preferred embodiment, a case is provided which extends between the outer shell part and the corresponding pipe connection means, said case being releasably connected to the outer shell part, and the lining being enclosed between facing abutments on the outer shell part and the case. The lining may thus be introduced in the
15 case, and subsequently be mounted onto the outer shell part.

The invention will now be described further with reference to the figure.

The pipe connection shown in figure consists of the ball joint 1 and two pipe sections welded at opposite ends thereof. The ball joint 1 comprises the innermost shell part 3 and the outermost shell part 4 which are slidingly in contact with each other so as
20 to enable rotational movements of the centre lines of the pipe sections. To that end, the shell parts 3, 4 are spherical. In particular, the inner surface 5, 12 of the outermost shell part 4 and the outer surface 7 of the innermost shell part 3 contact each other and are spherical. A sealing element 6 is connected to the outermost shell part 4 and sealingly engages the outer surface 7 of the innermost shell part 3.

25 The outermost shell part 4 consists of the shell part halves 11, 23. Shell part half 23 forms part of the ring-shaped yoke 8. Said yoke 8 consists of the annular body 9 and a number of jaws 10 distributed over the circumference of said body 9. The other shell part half 11 or ring gland is held in place by means of the jaws 10 of the yoke 8. Between these outer shell part halves 11, 23, the inner shell part 3 is held captive, in
30 such a way that it can rotate as described before.

A lining 13 is provided, which abuts the stop face 25 of the shell part half 23. Furthermore, a case 24 is connected to the shell part of 23 by means of the bolts 26. The case 24 has a stop face 26 as well, in such a way that the lining 13 is held captive

between the stop faces 25 and 26. The lining has an inner hollow surface 14, the shape of which corresponds to the spherical shape of the outer surface 7 of the innermost shell part 3. A narrow gap 15 is formed between these surfaces 7, 14, which gap has an essentially uniform thickness, also in the different rotated positions of the shell parts 3, 4 with respect to each other. As a result of the immediate proximity of the lining 13 with respect to the outer surface 5 of the innermost shell part 3, hardly any turbulence or vortex can develop in the liquid substance located in the gap 15. As a result, the surface 5 will hardly be attacked, in such a way that the condition thereof will remain suitable for a prolonged period.

For further improvement of the durability of the pipe connection, a flow guide 16 is provided on the inside of the innermost shell part 3. This flow guide extends from the welding sleeve 20 of the ring 9 to which the one pipe section is welded to near the inner surface 14 of the lining 13. Near the inner surface 14, the flow guide 16 changes into a nose 19 which lies close up to the surface 14, forming a gap 22. This gap 22 between the nose 19 and the lining 13 has a dimension which is roughly as great as that of the gap 15 between the lining 13 and the innermost shell part 3. The flow guide promotes a regular flow of the medium fed through the pipe connection, in such a way that as little turbulence as possible occurs therein. In this context, the flow guide preferably has an essentially cylindrical part 17 close to the welding sleeve 21, which changes into a part 18 which widens in the form of a trumpet and ends in the nose 19.

Furthermore, as a result of the widening shape of the innermost surface of the flow guide 16, the free flow area remains largely unobstructed, also in the extreme rotated positions of the innermost shell part 3.

Claims

1. Pipe connection, comprising a ball joint having shell parts, pipe connection means at the ends of the shell parts which face away from each other and which are to be connected to a respective pipe section, which shell parts surround one another in a contacting manner, each define a respective longitudinal centre line and are rotatable in relation to one another between an aligned position, in which the longitudinal centre lines coincide, and a rotated position, in which the longitudinal centre lines form an angle with one another which differs from zero, wherein the shell parts together enclose an axial passage which extends between the ends of the shell parts, a sealing element between the outermost shell part and the innermost shell part, and a lining which extends between the outermost shell part and the corresponding pipe connection means, wherein the outermost shell part comprises shell part halves which enclose the innermost shell part, wherein the contacting surfaces of the innermost shell part and of the outermost shell part are spherical, characterized in that the lining has a shape closely following the path of the innermost shell part while this is being rotated upon adjusting the ball joint, and in that the inner surface of the lining and the outer surface of the innermost shell part lie entirely free in relation to one another, wherein a flow guide is provided in the innermost shell part the flow guide widening in the form of a trumpet to the end of the innermost shell part and extending beyond the end of the innermost shell part which adjoins the lining, and having a nose end lying close up to the inner surface of the lining in the extreme rotated positions of the innermost shell part.

2. Pipe connection according to claim 1, wherein a yoke is attached to the one of the shell part halves of outermost shell part, a gland ring being provided which constitutes the other shell part half of the outermost shell part and which cooperates with said yoke.

3. Pipe connection according to any of the preceding claims, wherein the inner surface of the lining and the outer surface of the innermost shell part enclose a

gap with an essentially uniform thickness.

4. Pipe connection according to one of the preceding claims, wherein the inner surface of the lining is essentially spherical.

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5. Pipe connection according to Claim 4, wherein the flow guide has a cylindrically and/or spherically curved inner flow guide surface.

6. Pipe connection according to any of Claims 1-5, wherein the nose end lies free
10 in relation to the inner surface of the lining.

7. Pipe connection according to Claim 6, wherein the nose end and the inner surface of the lining enclose a gap, the size of which is essentially identical to the gap between the inner surface of the lining and the outer surface of the innermost shell part.

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8. Pipe connection according to one of Claims 1-7, wherein the flow guide comprises a flow guide part which is located close to the pipe connection means of the innermost shell part and which is essentially cylindrical.

20 9. Pipe connection according to one of Claims 1-8, wherein the flow guide comprises a flow guide part which is located close to the outermost shell part and which is designed as widening in the form of a cone or trumpet.

10. Pipe connection according to one of Claims 1-9, wherein the flow guide
25 comprises a hardened material.

11. Pipe connection according to one of the preceding claims, wherein the lining comprises a hardened material.

30 12. Pipe connection according to one of the preceding claims, wherein the pipe connection means comprise welding sleeves.

13. Pipe connection according to any of the preceding claims, wherein the pipe connection means comprise connection flanges.

5 14. Pipe connection according to any of the preceding claims, wherein a case is provided which extends between the outer shell part and the corresponding pipe connection means, said case being releasably connected to the outer shell part, and the lining being enclosed *between facing abutments on the outer shell part and the case.*