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.

~~The object~~Embodiments of the invention ~~is~~ seek to provide a pipe connection of the type described before which is better protected against the abrasion caused by the transported materials. ~~Said object is~~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 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

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

Claims

1. Pipe connection, comprising a ball joint ~~(1)~~ having shell parts ~~(3, 4)~~, pipe connection means ~~(20, 21)~~ at the ends of the shell parts ~~(3, 4)~~ which face away from each other and which are to be connected to a respective pipe section, which shell parts ~~(3, 4)~~ 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 ~~(3, 4)~~ together enclose an axial passage which extends between the ends of the shell parts ~~(3, 4)~~, a sealing element ~~(6)~~ between the outermost shell part ~~(4)~~ and the innermost shell part ~~(3)~~, and a lining which extends between the outermost shell part ~~(4)~~ and the corresponding pipe connection means ~~(21)~~, ~~characterized in that~~ wherein the inner lining surface ~~(14)~~ of the lining ~~(13)~~ has a curvature corresponding to the curvature of the outer surface ~~(5)~~ of the innermost shell part ~~(3)~~ and in that said inner lining surface ~~(14)~~ and said outer surface ~~(5)~~ lie entirely free in relation to one another.

2. Pipe connection according to claim 1, wherein the outermost shell part ~~(4)~~ comprises shell part halves ~~(11, 23)~~ which enclose the innermost shell part ~~(3)~~ and which preferably each directly contact said innermost shell part.

3. Pipe connection according to claim 2, wherein a yoke ~~(8)~~ is attached to the one of the shell part halves ~~(23)~~ of outermost shell part ~~(4)~~, a gland ring ~~(11)~~ being provided which constitutes the other shell part half of the outermost shell part ~~(4)~~ and which cooperates with said yoke.

4. Pipe connection according to any of the preceding claims, wherein the lining surface ~~(14)~~ and the outer surface ~~(5)~~ of the inner shell part ~~(3)~~ enclose a gap ~~(15)~~ with an essentially uniform thickness.

5. Pipe connection according to one of the preceding claims, wherein the lining surface ~~(14)~~ is essentially spherical.

6. Pipe connection according to one of the preceding claims, wherein a flow guide ~~(16)~~ is provided in the innermost shell part ~~(3)~~.

7. Pipe connection according to Claim 6, wherein the flow guide ~~(16)~~ has a cylindrically and/or spherically curved inner flow guide surface ~~(17, 18)~~.

8. Pipe connection according to Claim 6 or 7, wherein the flow guide ~~(16)~~ extends beyond the end of the inner shell part ~~(3)~~ which adjoins the lining ~~(13)~~.

9. Pipe connection according to Claim 8, wherein the flow guide has a nose end ~~(19)~~ which lies free in relation to the lining surface ~~(14)~~.

10. Pipe connection according to Claim 9, wherein the nose end ~~(19)~~ and the lining surface ~~(14)~~ enclose a gap ~~(22)~~, the size of which is essentially identical to the gap ~~(15)~~ between the lining surface ~~(14)~~ and the outer surface ~~(5)~~ of the inner shell part ~~(3)~~.

11. Pipe connection according to one of Claims 6-10, wherein the flow guide ~~(16)~~ comprises a flow guide part ~~(17)~~ which is located close to the pipe connection means ~~(20)~~ of the innermost shell part ~~(3)~~ and which is essentially cylindrical.

12. Pipe connection according to one of Claims 6-11, wherein the flow guide ~~(16)~~ comprises a flow guide part ~~(18)~~ which is located close to the outermost shell part ~~(4)~~ and which is designed as widening in the form of a cone or trumpet.

13. Pipe connection according to one of Claims 6-12, wherein the flow guide ~~(16)~~ comprises a hardened material.

14. Pipe connection according to one of the preceding claims, wherein the lining comprises a hardened material ~~(13)~~.

15. Pipe connection according to one of the preceding claims, wherein the pipe

connection means comprise welding sleeves ~~(20, 21)~~.

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

17. Pipe connection according to any of the preceding claims, wherein the contacting surfaces ~~(7; 5, 12)~~ of the innermost shell part ~~(3)~~ and of the outermost shell part ~~(4)~~ are spherical.

18. Pipe connection means according to any of the preceding claims, wherein a case ~~(24)~~ is provided which extends between the outer shell part ~~(4)~~ and the corresponding pipe connection means ~~(20)~~, said case being releasably connected to the outer shell part, and the lining ~~(16)~~ being enclosed between facing abutments ~~(25, 26)~~ on the outer shell part ~~(4)~~ and the case ~~(24)~~.