

The invention relates to a sealing ring in accordance with the features indicated in the precharacterising clause of Patent Claim 1.

DE-U-17 82 489 discloses a sealing ring of this
5 kind which has three sealing lips. These sealing lips each have essentially the same diameter and rest evenly against the outer surface of an inserted spigot end. That side of the rubber sealing ring which faces the socket end face is designed as a hard part and is composed of a
10 relatively hard rubber. The production of a sealing ring of this kind from two materials of different hardness involves a not inconsiderable expenditure. Moreover, difficulties arise with the known sealing ring if a dirty spigot end is inserted into the socket. In fact, it is
15 virtually unavoidable under practical conditions of use that due, for example, to careless storage, the spigot ends will come into contact with sand or dirt and that, as a result, the sealing lips will be damaged during assembly or prevented from resting correctly against the
20 spigot end. Taking as a basis a maximum permissible insertion resistance for the spigot end, all three sealing lips of the sealing ring must each have a comparatively large inside diameter, especially since the sealing lip at the front end should have a comparatively
25 great hardness. It is therefore relatively easy for dirt deposits, such as sand or small stones, to damage the sealing lips or to settle between the sealing lips and the outer surface of the spigot end and hence compromise the sealing effect. Apart from the sealing lip at the
30 front end, the known sealing ring is composed of relatively soft rubber, resulting in further difficulties in the case of relatively large gaps, particularly in view of manufacturing tolerances of the socket and the spigot end.

35 DE-C-33 38 899 discloses a sealing ring which is inserted into a socket of a pipe or fitting and serves to provide sealing in relation to the pipe spigot end to be introduced into the socket. The sealing ring is composed

of an elastomer and is arranged in a bead of the socket. The dimensions of the pipes, the sockets and the beads are laid down for various diameters in DIN Standards 19560 and 19561. Radially towards the inside, the known
5 sealing ring has a sealing lip which rests against the outer surface of the inserted spigot end. Radially towards the outside, the known sealing ring has a circumferential groove which allows air cushioning. The circumferential groove lies axially between two supporting ribs
10 which produce a comparatively high radial stiffness. To obtain a low insertion resistance, the supporting ribs, the circumferential groove and the sealing lip and, in particular, the surfaces of the sealing lip, are suitably matched.

15 DE-A-35 45 370 has furthermore disclosed a profiled sealing ring with a central sealing lip. However, this sealing ring is not symmetrical in design and there is the risk of assembly errors. In the region of the outer surface, the sealing ring is provided with
20 encircling edge strips between which circumferentially spaced recesses are arranged. Very complex moulds are required to produce these recesses. Due to the recesses, the contact pressure in the circumferential direction is by no means uniform. On the contrary, a reduced radial
25 contact pressure is to be expected in the region of the recesses in comparison with the regions of full cross section. Since the sealing effect of the sealing ring is determined by the regions of reduced contact pressure, it is designed for these regions as regards the sealing
30 effect. The regions with a full cross section lead to an increased insertion resistance without improving the sealing effect of the sealing ring.

DE-C-11 55 292 has disclosed a sealing ring with three sealing lips of equal diameters. The sealing lips
35 are of saw-tooth design, with the result that a defined orientation within the bead is necessary and the above-mentioned assembly errors can thus occur. The outer surface of the sealing ring is tapered in accordance with

the shape of the bead, the radial height of the sealing lips being considerably greater than the thickness of the material towards the outer surface. Due to the matching design of the three sealing lips, this sealing ring too leads to a comparatively high insertion resistance. In practice, problems repeatedly arise from the fact that, after the pipe to be introduced has been cut to the required length, the chamfer is not brought into correct contact with the front end of the spigot end to be introduced. This can lead to damage to the sealing ring and can compromise the sealing function overall. A further difficulty can arise if the sealing ring falls out of the bead during transport, prior to assembly, and additional measures may thus be necessary to prevent this from happening under all circumstances.

The object on which the invention is based is therefore to further develop a sealing ring of the type stated at the outset such that the insertion forces during assembly, i.e. during the introduction of the spigot end of a pipe or shaped piece are as low as possible. The sealing ring is to be designed in such a way that a spigot end can be installed and sealed in a functionally reliable manner even if the chamfer has not been formed correctly or has not been formed at all. It should furthermore also be possible to guarantee reliable assembly when the front face of the spigot end to be introduced is not exactly perpendicular to the longitudinal axis, thus, for example, if the cutting plane was at an angle to the longitudinal axis during the cutting of the pipe end. It should furthermore be possible to install the sealing ring in the bead in a simple manner and, if required, for example in the case of repair, for it to be replaced with another sealing ring. Moreover, however, reliable holding of the sealing ring in the bead should also be ensured to prevent it from falling out with a high degree of reliability, particularly during transport. On the other hand, however, it should be ensured that no additional measures

to secure it in the bead become necessary.

This object is achieved according to the features indicated in the characterising clause of Patent Claim 1.

5 The sealing ring designed in accordance with the invention is distinguished by a high functional reliability and, due to the configuration of the lips, guarantees easy assembly and reliable sealing. The connection established between the spigot end and the socket can be easily disassembled, if required. The
10 combination of the central sealing lip with adjoining additional scraper lips separated from it in both axial directions by a recess guarantees a good sealing effect in combination with low insertion forces even if the spigot end has not been provided with a chamfer in the
15 manner required. The central sealing lip has a smaller inside diameter than the two additional scraper lips, which serve to scrape off impurities or dirt on the outer surface of the spigot end. The two annular interspaces present between the said three lips allow the sealing lip
20 at the front in the insertion direction to be at least partially taken up during the insertion of a spigot end, damage or even pinching off thus being reliably avoided. An annular air cushion which is very advantageous for the sealing effect can furthermore form in the interspaces,
25 this being particularly expedient. The sealing ring is of symmetrical design in relation to the centre plane which extends through the central sealing lip and is essentially orthogonal to the longitudinal axis of the socket. The inner surfaces of the two scraper lips, which
30 surfaces face the central lip, are also expediently arranged essentially parallel to the centre plane and thus likewise lie in radial planes in relation to the longitudinal axis of the socket.

35 The relatively small inside diameter of the central sealing lip in comparison with the two additional lips arranged at an axial distance results in a high ring stiffness, which is particularly advantageous in view of the risk of falling out before assembly. Together with

that part of the sealing ring which is situated in the bead, the central sealing lip has a fundamentally T-shaped cross section. By virtue of this cross section, a high moment of resistance is achieved and this advantageously counteracts the release of the sealing ring from the bead, for example if the socket is dropped. The radially inward-directed sealing lip forms the central web of the T cross section, the important part as regards the moment of resistance, and that part of the sealing ring which lies in the bead forms the cross piece. A further increase in the moment of resistance is brought about by the two additional lips, which are likewise oriented inwards in the radial direction. The central sealing lip is directed radially inwards and has a cross section corresponding to that of an isosceles triangle. The base width of the sealing lip is essentially equal to the radial height of the additional lips. These additional lips are also of essentially triangular design, the side face which faces the central sealing lip in each case lying essentially in a radial plane. The base width of these additional lips is in each case essentially equal to the base width of the central sealing lip and/or to its radial height. The combination of the central sealing lip with the lips arranged at a distance to the side results overall in a high moment of resistance which expediently counteracts the unintentional release of the sealing ring from the bead. Additional means or even an additional ring for reinforcement, which may also hinder assembly, are not required due to the design according to the invention of the sealing ring. The sealing ring is furthermore of symmetrical design, and there is thus no risk of incorrect insertion into the bead.

Further expedient configurations and further developments of the invention emerge from the subclaims and from the description below of a particular illustrative embodiment.

In the drawing, the sealing ring 2, which is composed of an elastomer, is shown sectioned in an axial section plane and encircling lines have not been shown for reasons of clarity. The sealing ring 2 is of symmetrical design relative to a centre plane or plane 4 of symmetry, which lies perpendicular to the longitudinal axis of the socket or bead into which the sealing ring 2 is inserted. The inner surface of the bead 6 is indicated by a chain-dotted line. The inside diameter 7 of the bead 6 is specified for the respective nominal diameter of the pipe in accordance with the standards mentioned at the beginning. The outside diameter 8 of the sealing ring 2 is larger by a predetermined amount than the diameter 7 of the bead. According to the invention, the sealing ring 2 is fixed under prestress in the bead 6 due to the difference in the inside diameter 7 and the outside diameter 8. Within the context of the invention, this difference is between 1.5 - 3.5 %, expediently between 2 and 3 % in relation to the inside diameter of the bead. This ensures, on the one hand, that the sealing ring 2 is reliably fixed in the bead and, on the other hand, that it is not released from the bead, for example under the action of external forces, due to an excessive prestress.

In its longitudinal centre, the sealing ring has the central sealing lip 10, which has an approximately triangular cross section. The central sealing lip 10 lies in the plane of symmetry of the sealing ring. Arranged on each side of the central sealing lip 10, in the direction of the axial end faces of the sealing ring, is an additional lip 12, 14, these being designed as scraper lips. Like the centre plane 4, the inner faces 13, 15 facing the centre plane 4 extend essentially in radial planes in relation to the longitudinal axis of the socket. Between the sealing lip and the axially adjacent lip there is in each case an interspace 16, 18. The bottom 20 of the interspace 16, 18 is at a distance 24 from the outer surface 22 which is essentially equal to the height 26 of the sealing lip 10 measured from the bottom 20. The

broken line 30 indicates the maximum possible position, allowing for tolerances, of the outer surface of the spigot end or pipe to be introduced into the socket. The second line 32, on the other hand, indicates the position of the outer surface of the pipe if the minimum tolerances are met. The essential point is that the cross-sectional area of the lip 12, 14 which lies radially towards the inside in relation to the said first line 30 is at least approximately as large as that part of the interspace 16, 18 which lies between the bottom 20 and the first line 30. This ensures that, when the pipe end is introduced, the lip 12, 14 is pressed into the adjacent interspace without being damaged in the process. The radially inner tips of the sealing lip 10 and of the additional lips 12, 14 are preferably provided with a radius.

The two outer lips 12, 14 have a height 34 relative to the bottom surface 20. Lips 12, 14 serve, in particular, to scrape off dirt during the insertion of a spigot end. An additional sealing function is furthermore obtained. In the context of this invention, the line 30 which indicates the maximum tolerance of the outer surface of the pipe is essentially half way up the height 34 of the lip 12, 14. Let it be assumed first of all that the spigot end is pushed into the socket, in the bead of which the sealing ring 2 is arranged, in the direction of the arrow 36. Even if the spigot end has the maximum possible outside diameter, the specified design of the scraper lip 12, 14 and, especially, the design of the height 34 ensures that that part of the lip 12, 14 which is radially to the inside in relation to the line 30 can yield into the interspace 16. Foreign bodies such as, for example, sand or relatively small impurities can also pass into this interspace and are deposited there and do not reach the sealing lip. An air cushion favourable for the sealing effect can furthermore form in the interspace 16. If the spigot end is pushed in further, the sealing lip 10 is furthermore displaced in the direction of the

arrow 36. The interspace 18 adjoining the other lip 14 allows the sealing lip 10 to yield and fold over and it comes to rest in part against the said other lip 14. The interspace 18 is partially filled by the material of the sealing lip 10 but part of it remains free for the aircushion. This free part of the interspace 18 forms as it were a closed chamber with an air cushion for the sealing lip 10.

As illustrated, the inner line 32 of the tolerance range runs through the tips of the lips 12, 14. The scraping function of the lips 12, 14 can thus be guaranteed even under these conditions. It is thereby ensured that any dirt adhering to the spigot end to be introduced is removed by means of the scraper lips 12, 14 under all conditions before the spigot end reaches the sealing lip. That part of the insertion resistance which results from the scraper lip 12 positioned in front is considerably less than that of the sealing lip 10. The reason for this is, first of all, the fact that the height 34 of the scraper lip 12, 14 is considerably smaller than the height 26 of the sealing lip 10. The height 34 is smaller by a predetermined factor than the height 26 of the sealing lip. This factor is expediently within the range 0.7 - 0.8, and is preferably 0.75. The two scraper lips 12, 14 each have a total thickness 35 relative to the outer surface 22, and the corresponding total thickness 37 of the central sealing lip 10 is greater by a predetermined factor. This factor is within the range 1.1 - 1.3, expediently 1.15 - 1.25, a value of 1.2 having proven particularly expedient. It is also important that the front face 38 of the scraper lip 12, 14 should be arranged obliquely in relation to a radial plane 40, at an angle 42 which is larger than the corresponding angle 44 between the front face 46 of the sealing lip 10. That part of the insertion resistance which is caused by the scraper lip 12 is considerably less than that caused by the sealing lip 10. It has proven particularly expedient to make the angle 42

between the front face 38 and the radial plane 40 lie within the range 25° - 35° , and expediently essentially 30° . The said angle 44 of the sealing lip 10 is expediently in the range 10° - 20° and is preferably essentially 15° .

In the region of its outer surface 22, the sealing ring 2 has radially inward-directed recesses 48 which extend as circumferential grooves over the circumference of the sealing ring. Between these recesses 48 there are rounded projecting subregions or beads 50. This design ensures compensation in the case of any irregularities or foreign bodies on the bottom of the bead and prevents excessively high local prestressing of the ring.

Together with the transversely lying part (shown at the top in the drawing), which is arranged in the bead, the central, radially inward-directed sealing lip 10 forms an essentially T-shaped cross section, a high moment of resistance expediently being achieved. The base width 52 of the sealing lip 10, measured in the region of the bottom surface 20 of the recesses 16, 18 is essentially the same as the corresponding base width 54 of the scraper lips 12, 14. The width 56 of the recess 16, 18 is essentially half the base width 52 and 54. Due to this configuration a high moment of resistance is, on the one hand, achieved with a reduced use of material and a low insertion resistance is, on the other hand, guaranteed. The total width 58 of the sealing ring 2 is essentially four times the base width 52 and/or the base width 54. Like the central lip 10, the scraper lips 12, 14 have rounded tips. The centre planes of the additional lips 12, 14 extend through these tips, these centre planes each being at the same distance 59 from the plane 4 of symmetry. This distance 59 is essentially equal to the base width 52 of the sealing lip 10. It is furthermore expedient if the said distance 59 is essentially one quarter of the total width 58 of the sealing ring 2. The total width 58 is larger than the total thickness 37 of the central sealing lip by a predetermined factor. This

factor is within the range 1.1 - 1.3 and is expediently in the range 1.15 - 1.25, a factor of essentially 1.2 having proven particularly expedient.

At the axial ends of the sealing ring, not only does the front face 38 of the additional lip 12 extend at an acute angle 42 to the radial plane 40 but the end face 60 assigned to the bead wall is also arranged obliquely at an angle 62 to the radial plane 40. At the axial end, the front face 38 and the end face 60 thus enclose an obtuse angle and there is an as it were roof-like or triangular point 64. The angle 62 is specified such that the sealing ring 2 can be used even in beads which, due to a special manufacturing method, have oblique side walls. The radially inner tips both of the central sealing lip 10 and of the two additional lips 12, 14 arranged at an axial distance from the latter are provided with a radius and rounded. This is expedient, on the one hand, for obtaining a large sealing and contact surface on the spigot end to be introduced and, on the other hand, for allowing the spigot end to be removed again with little effort if required. The rounded design of the three tips of the said lips furthermore provides advantages in manufacture, especially since tolerances can be compensated well.

List of Reference Numerals

	2	Sealing ring
	4	Plane of symmetry
	6	Bead
5	8	Outside diameter
	10	Central sealing lip
	12, 14	Scraper lip
	13, 15	Inner surface
	16, 18	Interspace
10	20	Bottom
	22	Outer surface
	24	Distance
	26	Height of 10
	30	Line, maximum tolerance
15	32	Line, minimum tolerance
	34	Height of 12, 14
	35	Total thickness of 12, 14
	36	Arrow
	37	Total thickness of 10
20	38	Front face of 12
	40	Radial plane
	42, 44	Angle
	46	Front face of 10
	48	Recess
25	50	Bead
	52	Base width of 10
	54	Base width of 12, 14
	56	Width
	57	Centre plane
30	58	Total width of 2
	59	Distance
	60	Front face
	62	Angle
	64	Point



Patent Claims

1. Sealing ring (2) which can be inserted into a bead (6) of a socket of a pipe or fitting, especially a pipe or fitting composed of plastic, having a central sealing lip (10) which rests in sealing fashion against the spigot end of a pipe which can be introduced into the socket, having two additional lips (12, 14) which are arranged at an axial distance on each side of the central sealing lip (10) and symmetrically to the latter, having a respective interspace (16, 18) arranged between the central sealing lip (10) and the additional lips (12, 14) and furthermore having an outer surface (22) which can be brought to rest against the inner wall of the bead (6), characterised in that the additional lips (12, 14) are designed as scraper lips and have a larger inside diameter than the central sealing lip (10), in that the centre plane (57) of the additional lips (12, 14) is in each case at a distance (59) from the plane (4) of symmetry extending through the central sealing lip (10) which is essentially equal to a base width (52) of the central sealing lip (10) measured in the region of the bottom (20) of the interspace (16, 18), and in that the bottom (20) of the interspace (16, 18) is at a distance (24) from the outer surface (22) which is essentially equal to the height (26), likewise relative to this bottom (20), of the central sealing lip (10).

2. Sealing ring according to Claim 1, characterised in that, in relation to the total thickness (37) of the central sealing lip (10), the total width (58) is larger by a predetermined factor which is between 1.1 and 1.3, expediently between 1.15 and 1.25, and essentially 1.2.

3. Sealing ring according to Claim 1 or 2, characterised in that the total thickness (37) of the central sealing lip (10) is greater than the respective total thickness (35) of the additional lips (12, 14) by a predetermined factor which is between 1.1 and 1.3, preferably between 1.15 and 1.25, and essentially 1.2.



4. Sealing ring according to one of Claims 1 to 3, characterised in that the height (34) of the additional lips (12, 14) relative to the bottom (20) of the interspace (16, 18) is considerably smaller than the
5 comparable height (26) of the central sealing lip (10), the height (34) being smaller, preferably by a factor between 0.7 and 0.8, expediently essentially 0.75, than the said height (26) of the sealing lip (10).

5. Sealing ring according to one of Claims 1 to 4,
10 characterised in that the front face (38) of the additional lip (12) is arranged obliquely in relation to the radial plane (40) at an angle (42) which is larger than the corresponding angle (44) of the front face (46) of the central sealing lip (10), the former angle (42)
15 expediently being larger by a factor between 1.5 and 2.5, preferably essentially 2.

6. Sealing ring according to one of Claims 1 to 5, characterised in that the inner surfaces (13, 15) of the additional lips (12, 14), which face the plane (4) of
20 symmetry, are arranged essentially parallel to the plane (4) of symmetry.

7. Sealing ring according to one of Claims 1 to 6, characterised in that a number of annular recesses (48) are arranged in the outer surface (22), four recesses
25 (48) at equal spacings preferably being arranged, and/or in that, axially between the recesses (48), there is in each case an annular bead (50) essentially in the same radial plane as the bottom (20) of the interspace (16, 18), there being expediently a total of five such beads
30 (50), uniformly spaced in the axial direction, in the region of the outer surface (22).

8. Sealing ring according to one of Claims 1 to 7, characterised in that the sealing lip (10) is arranged symmetrically to the plane (4) of symmetry as an
35 isosceles triangle and is directed radially inwards and/or in that the base width (52) of the sealing lip (10), measured in the region of the bottom (20) of the interspace (16, 18), is essentially equal to the



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corresponding base width (54) of the additional lip (12, 14).

9. Sealing lip according to one of Claims 1 to 8, characterised in that the distance (59) of the centre plane (57) of the additional lip (12, 14) from the plane (4) of symmetry of the sealing lip (10) is essentially one quarter of the total width (58).
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