

**ATTACHMENT SYSTEM FOR DETACHABLY COUPLING PIPE ENDS TO
EACH OTHER IN ORDER TO FORM FOUNDATION PILES**

5 The present invention relates to an attachment system for detachably coupling a female pipe end and a male pipe end to each other in order to form foundation piles, comprising:

- the female pipe end comprising a pipe sleeve which is provided with a sleeve cavity;
- 10 - the male pipe end comprising a pipe sleeve which is provided with a corresponding sleeve cavity which is alignable with the sleeve cavity in the female pipe end when fitting the male pipe end in the female pipe end;
- a coupling element which is attached to the female pipe end and which comprises a base body and a spring-loaded element, by means of which the base body is configured so as to be displaceable along a direction of displacement in the sleeve cavity in the female pipe end in a free state, 15 between:
 - o a coupling position in which the base body is forced out of the sleeve cavity of the female pipe end by a nose of this base body due to the spring force of the spring-loaded element, in order for said nose to engage in the corresponding sleeve cavity of the male pipe end so as 20 to couple the pipe ends when the sleeve cavities are aligned with respect to each other; and
 - o a coupling position in which the nose of the base body is forced out of the sleeve cavity of the female pipe end due to the action spring force of the spring-loaded element in order for said nose to engage in the sleeve cavity of the male pipe end so as to couple the pipe ends when 25 the sleeve cavities are aligned with respect to each other; and
 - o a release position wherein the nose of the base body is held in the sleeve cavity of the female pipe end counter to the spring force of the spring-loaded element, so that the pipe ends are insertable into and 30 removable from one another;
- uncoupling means which are configured to displace the base body between the free state and a locked state, with the base body being held in the release position and displacement to the coupling position being prevented.

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With most attachment systems for detachably coupling a female pipe end and a male pipe end to each other in order to form foundation piles, a coupling element has to be installed manually which is then in turn secured in one way or another. Examples of attachment systems comprising such a coupling element which is to be installed manually are described and illustrated in WO2022/157650A1 and DE29508441U1. If, for example, 16 coupling elements are used with the attachment systems described herein, then at least 16 actions have to be performed in order to couple or uncouple pipe ends using this attachment system.

10 In order to produce pile foundations, taking into account the basic rule of concrete poured in situ, reinforcement has to be placed in the correct position first and only then can concrete be poured. This means that a steel drill rod is introduced into the ground up to a certain depth. The drill motor of a foundation machine with a so-called open concrete system has an opening at the top via which a reinforcement can be placed. Once this reinforcement has been placed, concrete is poured and the steel drill rod is withdrawn.

15 However, many foundation machines do not have an open concrete system. This means that the drill motor of these foundation machines does not have an opening via which reinforcement cages can be placed. In this case, in practice, a steel drill rod is typically sunk to the desired depth. Then, concrete is poured in the drill rod via the so-called closed concrete system. Subsequently, the drill rod is withdrawn and the reinforcement is pushed into the fresh concrete afterwards. However, this is in contravention to abovementioned basic rule. In practice, often the reinforcement is pushed into fresh concrete in a crooked way, the reinforcement is not situated in the centre of the foundation pile, or not even at the correct depth. By placing the reinforcement after the concrete has been poured, the reinforcement may end up rubbing against the wall of the foundation pile, which may result in soil coming loose and ending up in the concrete. This results in a foundation pile of poor quality may not have sufficient load-bearing capacity for the intended purpose.

When a female pipe end is fitted to the drill motor of the foundation machine and a corresponding male pipe end is fitted at the top of the steel drill rod, which are releasably couplable to each other in order to produce the foundation pile, then, the

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coupling may be released after the drill rod has reached the desired depth, so that the foundation machine can move away from the drill rod. The drill rod is then open at the top and a reinforcement can be placed in the drill rod. Once this drill rod is placed, the foundation machine may again move over the drill rod so that the drill
5 rod can be reattached in order to pour concrete and withdraw the steel drill rod. However, if it is necessary, in practice, to remove 16 coupling elements manually for uncoupling and to then have to fit them again in order to effect coupling, an excessive amount of time is wasted. This is not practical, since there is concrete waiting which will harden to an excessive degree before it can be poured.

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Even with an open concrete system, there is a need to make coupling of pipe ends quicker and safer. If it were possible to automatically couple an attachment system to and uncouple it from the drill motor of an open concrete system, no manual operations have to be performed at elevated height. This means that no individual has
15 to be lifted up to 20m in the foundation machine in order to fit 16 coupling elements.

Several solutions have already been proposed in order to be able to releasably couple such female pipe ends and male pipe ends automatically. Typically, these are complicated attachment systems which can often only be applied to pipes of
20 relatively large diameters.

EP4004327A1 describes and illustrates a complex attachment system which comprises an automatic coupling system, but is in addition also provided with coupling elements which still require manual operations.

WO2015086126A2, DE10040529A1 and DE10023467C1 describe complicated
25 attachment systems for detachably coupling pipe ends automatically.

DE3642387A1, DE19621849A1 and EP2503092A1 describe automatic attachment systems for detachably coupling pipe ends which are not very sturdy, due to the fact that the sleeve cavities in the pipe ends first have to be aligned very accurately with
30 respect to each other in order to be able to couple the pipe ends to one another.

An attachment system according to the introductory part of Claim 1 is described and illustrated in EP1860275A1. However, this is a complicated attachment system.

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US 2023/0193698 A1 describes a simpler coupling for a drill rod describes, in which a drill rod element having a square cross section is releasably attached in a cubic coupling sleeve, by means of coupling elements which are fitted in the coupling position in corresponding sleeve cavities using spring-loaded elements.

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US 3,215,454 A describes a coupling for coupling the bottom end of a maritime conductor pipe at the top end of a drill assembly in a borehole at the seafloor. This coupling can be automatically uncoupled hydraulically. However, following this, the coupling has to be adjusted manually in a laborious manner in order to enable coupling again.

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The object of the present invention is to provide a simpler attachment system for automatically detachably coupling pipe ends in order to form foundation piles.

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This object of the invention is achieved by providing an attachment system for detachably coupling a female pipe end and a male pipe end to one another in order to form foundation piles, comprising:

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- the female pipe end comprising a pipe sleeve which is provided with a sleeve cavity;
- the male pipe end comprising a pipe sleeve which is provided with a corresponding sleeve cavity which is alignable with the sleeve cavity in the female pipe end when fitting the male pipe end in the female pipe end;
- a coupling element which is attached to the female pipe end and which comprises a base body and a spring-loaded element, by means of which the base body is configured so as to be displaceable along a direction of displacement in the sleeve cavity in the female pipe end in a free state, between:

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- o a coupling position in which the nose of the base body is forced out of the sleeve cavity of the female pipe end due to the action spring force of the spring-loaded element in order for said nose to engage in the sleeve cavity of the male pipe end so as to couple the pipe ends when the sleeve cavities are aligned with respect to each other; and
- o a release position wherein the nose of the base body is held in the sleeve cavity of the female pipe end counter to the spring force of the

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spring-loaded element, so that the pipe ends are insertable into and removable from one another;

- uncoupling means which are configured to displace the base body between the free state and a locked state, with the base body being held in the release position and displacement to the coupling position being prevented;

5 wherein the nose of the base body is provided with an inclined side, and wherein the male pipe end is provided with a corresponding edge, wherein the inclined side and the edge are configured to engage with each other when fitting the male pipe end in the female pipe end with the base body in the free state, in order to move the base
10 body to the release position, without putting the base body in the locked state, the male pipe end being provided with a limiting element for limiting the fitting of the male pipe end in the female pipe end, and wherein the sleeve cavities are configured in such a way in the corresponding pipe sleeves that the male pipe end is fittable in the female pipe end up to the point where the limiting element limits the fitting, after
15 which the pipe ends are rotatable with respect to each other to align the sleeve cavities, wherein the pipe sleeve of the male pipe end is provided between the edge and the sleeve cavity of the male pipe end to keep the base body in the release position when the male pipe end is being fitted in the female pipe end, without moving the base body to the locked state, until the sleeve cavities are aligned with
20 each other, so that the base body is forced towards the coupling position on account of the spring force when the sleeve cavities have been aligned with respect to each other.

As a result thereof, the base body does not have to be taken from the locked state to
25 the release position in the free state manually or by means of complicated drive systems in order to be able to fit the male pipe end in the female pipe end and/or to be able to move the base body into the coupling position when aligning the sleeve cavities.

With the base body in a free state, the inclined side of the nose of the base body and
30 the edge of the male pipe end engage with each other when fitting the male pipe end in the female pipe end in order to move the base body to a release position. Due to the fact that the base body remains in the free state in this case, this base body can easily be forced into the coupling position when aligning the sleeve cavities on account of the spring force. This makes it possible to make the attachment system

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simpler and sturdier so as to be able to automatically couple the pipe ends to each other.

Using a limiting element, limiting the fitting of the male pipe end into the female pipe end in this case does not depend on moving the base body to the coupling position, so that the attachment system can be made more sturdy. The fitting movement for fitting the male pipe end into the female pipe end is limited before the base body is moved from the release position to the coupling position by aligning the sleeve cavities.

10 In this case, the direction of displacement of the coupling element preferably extends virtually at right angles to the pipe sleeve of the female pipe end. With cylindrical pipe ends, this direction of displacement preferably extends virtually radially with respect to the axis of the cylindrical female pipe end.

15 The female pipe end will typically be provided on the drill motor of a foundation machine, whereas the male pipe end will be provided on the end of a drill rod, as has been described above when discussing the prior art. In alternative embodiments, the pipe ends may also be provided on parts of drill rods which can be coupled to each other in order to form said drill rod. Where these pipe ends have to go underground, the attachment system is preferably protected from dirt and soil on the outside of the drill rod.

25 The edge of the male pipe end preferably has a radius. Alternatively, this edge may, for example, be designed to be bevelled, so that this edge is provided with an inclined side.

In a specific embodiment, it is possible to provide the male and the female pipe end with corresponding guides in order to guide the fitting of the male pipe end in the female pipe end so as to align the sleeve cavities, wherein the pipe ends are automatically coupled to each other due to the fact that the base body is forced into the coupling position when aligning the sleeve cavities.

In a simple embodiment, the male pipe end may be provided with an external recess which is limited by a shoulder, wherein the male pipe end is fittable in the female

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pipe end by means of the external recess in order to fit the male pipe end in the female pipe end, and wherein the shoulder of the male pipe end serves as said limiting element.

5 The female pipe end is preferably also provided with an internal recess which is limited by a shoulder, corresponding to the external recess of the male pipe end. By means of its external recess, the male pipe end is then fittable in this internal recess of the female pipe end.

10 The coupling element preferably comprises a housing which is fixedly attached to the female pipe end and is provided with a cavity, with this cavity ending in the sleeve cavity in the female pipe end, and wherein the spring-loaded element is arranged in this cavity in order to extend between the housing and the base body.

15 In order to be able to also easily uncouple the pipe ends, the coupling element may, in a specific embodiment, comprise a pulling element which forms part of the uncoupling means, wherein this pulling element:

- is attached to the base body in the cavity in a said housing;
- extends in the housing so as to be displaceable along the direction of displacement, through a through-opening in the housing;
- 20 - is rotatable with respect to this housing; and
- is provided with a guide element outside the housing guide element;

wherein the housing is provided with a guide slope which extends along the circumference of the through-opening, and wherein the guide element is held against the guide slope by the spring force of the spring-loaded element, for guiding the guide element upon rotation of the pulling element between a starting point and an end point, wherein the starting point is situated closer to the cavity than the end point in the direction of displacement, so that upon displacement of the pulling element between the starting point and the end point, the base body is displaced between the coupling position and the release position. In the end point, the guide element is 25 more specifically held in the release position by the spring force, with displacement towards the coupling position being prevented and the base body being in the locked state. Only when the guide element is moved back from the end point towards the starting point, the base body is returned to the free state.

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By manually engaging with the pulling element, the pipe ends can then also be easily uncoupled.

5 With such an embodiment comprising a said pulling element, the guide element can also be designed simply as a detaining element which ensures that the base body does not come out of the sleeve cavities on account of the spring force.

10 The pulling element preferably also extends, at least in the release position of the coupling element, outside the housing in such a way that it can serve as a visual verification element, by means of which the position of the coupling element in either the release position or the coupling position can easily be verified visually.

15 With such an embodiment comprising a said pulling element, the housing is preferably provided with a limitation for limiting the displacement movement of the pulling element in the end point.

Alternatively, means may also be provided to automatically easily uncouple the pipe ends.

20 Thus, in a specific embodiment, the cavity in a said housing, may be limited by a shoulder as said uncoupling means towards the sleeve cavity in the female pipe end, wherein the base body is provided with a widening as said uncoupling means, which is configured to engage, in the coupling position, with this shoulder, and wherein the coupling element comprises a hydraulic duct system which furthermore forms part of the uncoupling means and which ends between the shoulder and the widening, so
25 that when the base body is in the coupling position, when applying oil pressure to the hydraulic duct system, a hydraulic chamber is formed between the shoulder and the widening, as a result of which the base body is forced into and held in the release position, counter to the spring force. In this case, the oil pressure at least partly prevents the base body from returning to the coupling position. The base body thus
30 held in the locked position until the oil pressure drops to such a degree that it no longer prevents the base body from returning to the coupling position and the base body is again in the free state.

In practice, such a hydraulic duct system is readily achievable. To this end, for example, a hydraulic system similar to that described and illustrated in

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DE19621849A1 or EP2503092A1 could be used. The systems described therein may be simplified for the attachment system according to the invention, since in this case only uncoupling of the pipe ends has to be driven hydraulically. No hydraulic drive is required in order to couple the pipe ends. Coupling can be achieved on account of the spring force, as described above.

5 In order, in this case, to prevent a shock absorber effect of the oil pressure, the base body, in a preferred embodiment, comprises a base part and a piston part. In this case, the spring-loaded element engages with the base part. This base part comprises the nose of the base body and is provided with a collar. The piston part comprises
10 said widening of the base body and is arranged so as to be displaceable along the direction of displacement with respect to the base part. In the coupling position, the piston part engages with the collar of the base part on the side of the hydraulic chamber. The housing is furthermore provided with a venting duct which ends in the cavity on the side of the widening on which the spring-loaded element is arranged. In
15 addition, the coupling element comprises a second spring-loaded element which forces the piston part towards the shoulder of the housing.

By thus preventing the shock absorber effect, it is ensured that the coupling elements can be forced to the coupling position with a stroke effect when fitting the male pipe
20 end in the female pipe end, after the pipe ends have been rotated and the sleeve cavities have been aligned in the process. Such a stroke effect helps to provide great certainty that the nose is fitted in the correct position in the corresponding sleeve cavity in the male pipe end.

25 Alternatively, it is in principle also possible to develop, in a similar way, a pneumatic duct system which forms part of the uncoupling means in order to drive the uncoupling pneumatically. Still alternatively, a magnetic system may be provided as said uncoupling means for automatically uncoupling the coupling element in order to uncouple the pipe ends.

30 With an embodiment comprising a said hydraulic duct system, this duct system is preferably at least partly incorporated in the pipe sleeve of the female pipe end. In an embodiment comprising a said hydraulic duct system, the coupling element preferably comprises a verification element which is, in the cavity in the housing,

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attached to the base body or part forms part of this base body, which extends through the housing so as to be displaceable along the direction of displacement and which partly extends outside the housing, at least in the release position of the coupling element.

- 5 By means of such a verification element, it is readily possible to visually verify the position of the coupling element in either the release position or the coupling position.

- 10 The sleeve cavity in the male pipe end of an attachment system according to the present invention is preferably a cavity with a virtually constant cross section, wherein the nose of the base body next to the inclined side has a corresponding virtually constant cross section. This cavity may be designed, for example, as a bore, wherein the base body next to the inclined side is designed to be virtually cylindrical. The nose of the base body next to the inclined side is preferably not designed to be
15 conical in order to prevent that the coupling element from being pushed out of the sleeve cavity when applying torque on account of this torque.

- The sleeve cavity in the female pipe end and the sleeve cavity in the male pipe end are preferably designed to be substantially cylindrical, with the base body being
20 correspondingly designed to be substantially cylindrical and with the nose of the base body being provided with a concave rounding, corresponding to the rounding of the pipe sleeve of the male pipe end. In this case, this rounding of the nose does not necessarily have the same radius as the rounding of the pipe sleeve. The nose of the base body is provided with said concave rounding in such a way, corresponding to
25 the rounding of the pipe sleeve of the male pipe end, that this pipe sleeve is able to prevent rotation of the base body in the female pipe end.

- The sleeve cavity in the male pipe end may be configured to run through the pipe sleeve in a continuous manner, without a bottom. Such a continuous sleeve cavity is
30 readily achievable in a pipe sleeve.

Preferably, however, the sleeve cavity in the male pipe end is limited by a bottom. With a terminating sleeve cavity, no cement from inside the drill rod can enter between the base body and the sleeve cavity. A second advantage of a terminating sleeve cavity is that, with the automatic system, it provides an acoustic verification to

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hear whether locking has been effected correctly. Thus, the nose will hit the bottom of the terminating sleeve cavity and generate a banging noise. When the nose is situated on the bottom, the base body of the coupling element has been moved to the coupling position correctly and the coupling element is locked well.

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More specifically, the female pipe end may be provided with several corresponding sleeve cavities, with the male pipe end then being provided with several corresponding sleeve cavities and the attachment system comprising several corresponding coupling elements.

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These sleeve cavities then have to be provided in such a manner that it is possible to align all corresponding sleeve cavities simultaneously, so that all coupling elements can be moved to the coupling position simultaneously.

15 More specifically, various said sleeve cavities in the female pipe end can then be arranged in a row one above the other and various corresponding said sleeve cavities in the male pipe end can be arranged in a row one above the other.

The corresponding sleeve cavities in a row can then be aligned together by rotating the pipe ends with respect to each other in order to move the corresponding coupling elements simultaneously into the coupling position.

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Such a row in this case preferably extends along the length direction of the pipe ends, so that the male pipe end is easily fittable in the female pipe end via this direction, with the coupling elements being held in their release position until all coupling elements can be moved to their coupling position simultaneously by rotating the pipe ends with respect to each other by aligning all corresponding sleeve cavities. In use, this length direction extends along the height direction of the foundation piles to be formed.

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30 Still more specifically, various said sleeve cavities in the female pipe end may be arranged distributed across the circumference of the pipe sleeve and various corresponding said sleeve cavities in the male pipe end may be arranged distributed across the circumference of the pipe sleeve.

In this case, these sleeve cavities are preferably distributed in such a way that there is sufficient space between the sleeve cavities to be able to easily keep the base body in

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the release position between the edge of the male pipe end and these sleeve cavities by means of the pipe sleeve.

Each sleeve cavity in the female pipe end is preferably provided in a said internal recess and each sleeve cavity in the male pipe end is preferably provided in a said external recess.

The present invention will now be explained in more detail by means of the following detailed description of some embodiments of attachment systems according to the present invention. The sole aim of this description is to give illustrative examples and to indicate further advantages and details of the present invention, and can therefore by no means be interpreted as a limitation of the area of application of the invention or of the patent rights defined in the claims.

Reference numerals are used in this detailed description to refer to the attached drawings, in which:

- Fig. 1 shows an embodiment of an attachment system according to the present invention in perspective, with the pipe ends uncoupled;
- Fig. 2 shows the attachment system from Fig. 1 in a longitudinal section, cut through coupling elements, wherein the male pipe end is partly arranged in the female pipe end, wherein some of the coupling elements have been moved to their release position;
- Fig. 3 shows the attachment system from Fig. 1 in a longitudinal section, cut through coupling elements, with the pipe ends coupled;
- Fig. 4 shows a detail of the attachment system from Fig. 1 in a longitudinal section, at the location of and cut through a coupling element, wherein the base body is situated in the coupling position;
- Fig. 5 shows a detail of the attachment system from Fig. 1 in a cross section, at the location of and cut through a coupling element, wherein the base body is held in the release position by the pipe sleeve of the male pipe end;
- Fig. 6 shows a detail of the attachment system from Fig. 1 in perspective at the location of a bottom edge of the female pipe end;
- Fig. 7 shows a front view of a part of the female pipe end of the attachment system from Fig. 1 at the location of a few coupling elements illustrating how

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a hand tool can be used to engage with the pulling element in order to uncouple the pipe ends;

5 - Fig. 8 shows a side view of a part of the female pipe end of the attachment system from Fig. 1 at the location of some coupling elements illustrating how a hand tool can be used to engage with the pulling element in order to uncouple the pipe ends;

- Fig. 9 shows a side view of a part of the female pipe end of the attachment system from Fig. 1 at the location of a coupling elements in more detail;

10 - Fig. 10 shows a part of the female pipe end of the attachment system from Fig. 1 at the location of a coupling element in more detail in perspective;

- Fig. 11 shows a part of a first alternative embodiment of an attachment system according to the present invention in perspective, with the pipe ends uncoupled, at the location of the female pipe end;

15 - Fig. 12 shows a part of a second alternative embodiment of an attachment system according to the present invention in longitudinal section, at the location of the female pipe end, cut through the coupling elements and with the pipe ends uncoupled;

- Fig. 13 shows a detail of the attachment system from Fig. 12 in cross section, cut through a coupling element, with the pipe ends uncoupled;

20 - Fig. 14 shows a detail of the attachment system from Fig. 12 in cross section, cut through a coupling element, wherein the base body is moved to the release position hydraulically;

- Fig. 15 shows a detail of the attachment system from Fig. 12 in longitudinal section, cut through a coupling element, with the pipe ends uncoupled;

25 - Fig. 16 shows a detail of the attachment system from Fig. 12 in longitudinal section, cut through a coupling element, wherein the base body is moved to the release position hydraulically;

- Fig. 17 shows a third alternative embodiment of an attachment system according to the present invention in perspective, with the pipe ends uncoupled;

30 - Fig. 18 shows a fourth alternative embodiment of an attachment system according to the present invention in perspective, with the pipe ends uncoupled;

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- Fig. 19 shows a fifth alternative embodiment of an attachment system according to the present invention without the male pipe end in longitudinal section, at the location of and cut through a coupling element, in a free state, wherein the base body is in the coupling position;
- 5 - Fig. 20 shows the attachment system from Fig. 19 without the male pipe end in cross section, at the location of and cut through the coupling element, in the free state, wherein the base body is in the coupling position;
- Fig. 21 shows the attachment system from Fig. 19 comprising the male pipe end in longitudinal section, at the location of and cut through the coupling element, in the free state, wherein the base body is in the release position;
- 10 - Fig. 22 shows the attachment system from Fig. 19 comprising the male pipe end in cross section, at the location of and cut through the coupling element, wherein the base body is in the release position;
- Fig. 23 shows the attachment system from Fig. 19 comprising the male pipe end in longitudinal section, at the location of and cut through the coupling element, in the free state, wherein the base body is in the coupling position;
- 15 - Fig. 24 shows the attachment system from Fig. 19 comprising the male pipe end in cross section, at the location of and cut through the coupling element, in the free state, wherein the base body is in the coupling position;
- 20 - Fig. 25 shows the attachment system from Fig. 19 comprising the male pipe end in longitudinal section, at the location of and cut through the coupling element, in a locked state, wherein the base body is in the release position;
- Fig. 26 shows the attachment system from Fig. 19 comprising the male pipe end in cross section, at the location of and cut through the coupling element,
- 25 in the locked state, wherein the base body is in the coupling position.

The illustrated attachment systems (1) each comprise a female pipe end (4) and a male pipe end (5). The female pipe end (4) is in this case attached to the drill motor (3) of a foundation machine, while the male pipe end (5) is provided on the end of a drill rod (2).

In alternative embodiments, the pipe ends may also be provided on parts of drill rods which can be coupled to each other to form a said drill rod. Where these pipe ends have to go underground, the attachment system is preferably protected from dirt and soil on the outside of the drill rod.

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The illustrated pipe ends (4, 5) have a circular cross section, but could also have a different cross section. Due to the fact that the pipe ends (4, 5) are cylindrical, these can be made in such a way that they are simpler to rotate with respect to each other.

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In the illustrated embodiments, the female pipe end (4) is provided with an internal recess (24) which is limited by a shoulder (20). The male pipe end (5) is in each case correspondingly provided with an external recess (25) which is limited by a shoulder (21). The male pipe end (5) is fittable in the internal recess (24) of the female pipe end (4) by means of the external recess (25). An inclined side (22) is provided on the edge of the internal recess (24) to facilitate (un)coupling. The corresponding edge of the external recess (25) is provided with a rounding (23). Alternatively, it is also possible to provide both edges with an inclined side or to provide the edge of the internal recess with a rounding, while the edge of the external recess is provided with an inclined side. The shoulders (20, 21) limit the fitting of the male pipe end (5) into the female pipe end (4). The dimensions of both pipe ends (4, 5) similar, with limited tolerances. In order to be able to smoothly fit these pipe ends (4, 5) into one another despite this limited tolerance, it is possible to apply grease or oil to the recesses (24, 25). In alternative embodiments, pipe ends (4, 5) without said recesses (24, 25) may be provided, wherein the fitting of the male pipe end (5) in the female pipe end (4) can then be limited in a different manner.

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The female pipe end (4) is in each case provided with one or several sleeve cavities (6). These cylindrical sleeve cavities (6) pass through the entire pipe sleeve of the female pipe end (4). In the illustrated embodiments, these sleeve cavities (6) are provided in the internal recess (24) of the pipe end (4).

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The male pipe end (5) is in each case provided with one or several corresponding sleeve cavities (7). In the illustrated embodiments, these sleeve cavities (7) are designed to terminate and in this case are limited by a bottom (34). In alternative embodiments, these sleeve cavities (7) are pass through the entire the pipe sleeve of the male pipe end (5). In the illustrated embodiments, these sleeve cavities (7) are provided in the external recess (25) of the pipe end (5).

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In the illustrated embodiments, the sleeve cavities (6, 7) are of a cylindrical design. In alternative embodiments, the sleeve cavities (6, 7) may also have a different shape.

The sleeve cavities (6, 7) are arranged in such a way that corresponding male and female sleeve cavities (6, 7) can be arranged in line with one another. In this case, each sleeve cavity (7) in the male pipe end (5) in the illustrated embodiments adjoins a corresponding sleeve cavity (6) in the female pipe end (4).

For each pair of corresponding sleeve cavities (6, 7) which can be arranged in line with one another, the illustrated attachment systems (1) comprise a coupling element (8).

The coupling element (8) is in each case attached to the female pipe end (4) and comprises a base body (9) and a spring-loaded element (13), by means of which the base body (9) is provided so as to be displaceable in a sleeve cavity (6) in the female pipe end (4) along a direction of displacement (X). The direction of displacement (X) is radial with respect to the axis of the cylindrical female pipe end. In a free state, the base body (9) is in this case displaceable between:

- a coupling position in which the base body (9) is forced out of the sleeve cavity (6) of the female pipe end (4) by a nose (12) of this base body (9), due to the spring force of the spring-loaded element (13) in order for said nose (12) to engage in the corresponding sleeve cavity (7) of the male pipe end (5) so as to couple the pipe ends (4, 5) when the sleeve cavities (6, 7) are aligned with respect to each other; and
- a release position wherein the nose (12) of the base body (9) is held in the sleeve cavity (6) of the female pipe end (4) counter to the spring force of the spring-loaded element (13), so that the pipe ends (4, 5) are insertable into and removable from one another.

The nose (12) of the base body (9) is provided with an inclined side (10) which is configured to engage with said edge (23) of the male pipe end (5) when fitting the male pipe end (5) in the female pipe end (4), in order to move the base body (9) in the release position. The pipe sleeve of the male pipe end (5) is in each case provided between this edge (23) and the corresponding sleeve cavity (7) of the male pipe end (5) in order to, during fitting of the male pipe end (5) in the female pipe end (4), with

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the base body (9) in the free state, keep this base body (9) in the release position until the corresponding sleeve cavities (6, 7) are aligned with each other.

5 In the illustrated embodiments, the coupling elements (8) in each case comprise a housing (14) which is arranged in a recess (36) in the female pipe end (4) and is fixedly attached to the female pipe end (4) by means of screws (26). This housing (14) is provided with a cavity (30) which ends in the sleeve cavity (6) in the female pipe end.

10 The spring-loaded element (13) is in each case arranged in this cavity (30) so as to extend between the housing (14) and the base body (9). In the illustrated embodiments, the spring-loaded element (13) is in each case a compression spring (13) extends concentrically with the sleeve cavity (6) and the base body (9). Obviously, other suitable spring-loaded elements are conceivable. Alternatively, two or more springs may be provided as spring-loaded elements. If, for example, two
15 springs are provided as spring-loaded elements, then these are preferably arranged, in the case of a cylindrical sleeve cavity (6), on either side of the axis of this cylindrical sleeve cavity (6).

20 In each of the embodiments, a verification element (15, 31, 44) is furthermore attached to the base body (9) or part of the base body (9) in the cavity (30) in the housing (14). In the first four illustrated embodiments, this verification element (15, 31) is in each case attached by means of a screw connection (35). In the fifth illustrated embodiment, this verification element (44) is an integral part of the base body (9). This verification element (15, 31) extends through the housing (14) so as to
25 be displaceable along the direction of displacement (X), through a through-opening (38) in the housing (14). At least in the release position, this verification element (15, 31, 44) partly extends outside the housing (14).

30 In addition to the inclined side (10), the nose (12) of the base body (9) has a virtually constant cross section which corresponds to the cross section of the sleeve cavity (7) in the male pipe end (5). With cylindrical sleeve cavities (7), the base body (9) is correspondingly designed to be substantially cylindrical.

The nose (12) of the base body (9) is furthermore preferably provided with a concave rounding (11), corresponding to the rounding of the pipe sleeve of the male pipe end

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- (5), as can be seen in Figs. 5-6. In this case, the concave rounding (11) of the nose (12) does not necessarily have the same radius as the rounding of the pipe sleeve. This concave rounding (11) may deviate slightly therefrom, as long as this concave rounding (11) of the nose (12) is provided in such a manner that the pipe sleeve is able to prevent rotation of the base body (9) in the female pipe end (4). Thus, it is possible to produce the same coupling elements (8) with a well-chosen concave rounding (11) of the nose (12) which can be used in various attachment systems (1) comprising pipe ends (4, 5) having various diameters.
- 10 In the illustrated embodiments, the sleeve cavities (6, 7) are in each case arranged in such a manner that the male pipe end (5) is fittable in the female pipe end (4), wherein the coupling elements (8) are first held next to the sleeve cavities (7) at the location of a closed zone of the pipe sleeve of the male pipe end (5).
- As is illustrated in Figs. 1, 17, 18, 21 and 22, the female pipe end (4) is in this case positioned above the male pipe end (5) in such a way that the sleeve cavities (6) in the female pipe end (4) are displaced with respect to the sleeve cavities (7) in the male pipe end (5). In this case, the base body (9) of the coupling elements (8) is in each case in the free state. The coupling on the drill motor (3) is moved downwards so that the male pipe end (5) slides into the female pipe end (4). When fitting the male pipe end (5) into the female pipe end (4) in this way, the base body (9) will first be moved into the release position by the inclined side (10) engaging with the edge (23) of the male pipe end (5), without the base body (9) is in this case moved into a locked state. In this way, the verification elements (15, 31) are also pushed outwards as a visual verification, as can be seen in Fig. 2.
- 25 Thereafter, it is possible to ensure that the coupling elements (8) remain next to the sleeve cavities (7) at the location of this closed zone when fitting the male pipe end (5) into the female pipe end (4), until the shoulders (20, 21), as limiting elements, limit the fitting of the male pipe end (5) into the female pipe end (4). In this case, the pipe sleeve of the male pipe end (5) keeps the base body (9) of the coupling element (8) in the release position, without the base body (9) in this case being moved to a locked state. In the embodiments from Fig. 1 and Fig. 18, the female pipe end (4) may in this case be moved straight down. In the embodiment from Fig. 17, the female pipe end (4) in this case has to be moved down in a helical manner. During

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the downward sliding movement, the concave rounding (11) on the nose (12) prevents the base body (9) from rotating in the housing (14).

As soon as the male pipe end (5) has been pushed completely into the female pipe end (4), the shoulders (20, 21) of both pipe ends (4, 5) come to lie against each other and all verification elements (15, 31) are pushed outwards.

After the pipe ends (4, 5) have thus been fitted inside one another, the female pipe end (4) can then be rotated in order to align the sleeve cavities (6, 7). To this end, the drill motor (3) may execute a rotary movement. During alignment, the base body (9) of the coupling elements is then moved into the coupling position. As soon as the sleeve cavities (6) of the female pipe end (4) are aligned with the sleeve cavities (7) in the male pipe end (5), the spring (13) in the coupling element (8) will push the base body (9) into the corresponding sleeve cavity (7), without a manual operation having to be performed first to this end. In this way, the attachment system (1) is completely locked in one movement. Visually, this is perceivable by the fact that all verification elements (15, 31, 44) have been retracted inwards, as can be seen in Fig. 3. The bottom (34) in the sleeve cavities (7) in the male pipe end (5) may also be provided in such a way that the base body (9) strikes against this bottom (34) in the coupling position. As a result thereof, a banging noise is produced during coupling as an acoustic verification to hear whether locking has been effected satisfactorily.

In the embodiment as illustrated in Fig. 18, the female pipe end (4) comprises a single sleeve cavity (6) comprising a coupling element (8) arranged therein, and the male pipe end (5) comprises a single corresponding sleeve cavity (8). Optionally, the male pipe end (5) could in this case also be provided with several similar sleeve cavities (7) in order optionally to lock the coupling element (8) in the one or in the other sleeve cavity (7) by engaging the base body (9) in this cavity.

In the embodiment as illustrated in Fig. 17, three helically arranged rows of in each case three sleeve cavities (6) are provided in the female pipe end (4) and three corresponding helically arranged rows of in each case three sleeve cavities (7) are provided in the male pipe end (5). These rows are in this case arranged offset over 120° with respect to each other. The female pipe end (4) may in this case be arranged on top of the male pipe end (5) with the sleeve cavities (6) offset over 60° with respect to the sleeve cavities (7) of the male pipe end (5), and after the shoulders (20, 21) have limited the fitting, may be rotated further over 60° with respect to the male

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pipe end (5) in order to lock the coupling elements (8) in order thus to couple the pipe ends (4, 5) to each other.

In the embodiment as illustrated in Fig. 1, four vertically arranged rows of in each case four sleeve cavities (6) are provided in the female pipe end (4) and four corresponding rows of in each case four sleeve cavities (7) are helically arranged in the male pipe end (5). These rows are in this case arranged offset over 90° with respect to each other. The female pipe end (4) may in this case be arranged on top of the male pipe end (5) with the sleeve cavities (6) offset over 45° with respect to the sleeve cavities (7) of the male pipe end (5), and after the shoulders (20, 21) have limited the fitting, may be rotated further over 45° with respect to the male pipe end (5) in order to lock the coupling elements (8) in order thus to couple the pipe ends (4, 5) to each other.

In alternative embodiments (not shown), it is possible to provide the pipe ends (4, 5) with corresponding guides for guiding the fitting of the male pipe end (5) into the female pipe end (4) and/or for aligning the sleeve cavities (6, 7).

Thus, it is for example possible, with sleeve cavities (6, 7) which are positioned as is the case with the illustrated embodiments from Figs. 17 and 18, to provide guides by means of which the pipe ends (4, 5) can only be fitted into each other if the corresponding sleeve cavities (6, 7) are positioned exactly above one another and are in this case axially displaced with respect to each other until the coupling elements (8) are coupled.

Alternatively, it is for example possible, with sleeve cavities (6, 7) which are positioned as is the case with the illustrated embodiments from Figs. 1 and 17, to provide guides by means of which the pipe ends (4, 5) can both be displaced with respect to each other in the length direction displaced and be rotated with respect to each other, wherein the sleeve cavities (6, 7) are aligned with respect to each other at the end of a rotary movement of the pipe ends (4, 5).

Such guides may be provided, for example, in the form of a slot in the external sleeve surface of the male pipe end (5) and a corresponding pin-shaped projection on the internal sleeve surface of the female pipe end (4) which is provided to engage in this slot, or vice versa.

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The uncoupling of the pipe ends (4, 5) may be brought about in various ways, by means of various possible uncoupling means. These uncoupling means are in each case configured to displace the base body (9) between the free state and a locked state, with the base body (9) being held in the release position and displacement to the coupling position being prevented.

In the first illustrated embodiment, said verification element (15) is also configured as a pulling element (15) which forms part of the uncoupling means and which, to this end, is provided with an engagement element (16) with which, as is illustrated in Figs. 7 and 8, a hand tool (27) can engage in order to move the base body (9) to the release position. To this end, this pulling element (15) is arranged so as to be rotatable with respect to this housing (14) and is provided with a guide element (17) outside the housing (14). The housing (14) is provided with a guide slope (18) which extends along the circumference of the through-opening (38), in which the pulling element (15) is provided so as to be displaceable. The guide element (17) is held against the guide slope (17) by the spring force of the spring-loaded element (13) in order to guide the guide element (17) when the pulling element (15) is being rotated, between a starting point and an end point. In the direction of displacement (X), the starting point is situated closer to the cavity (30) than the end point, so that, when the pulling element (15) is displaced between the starting point and the end point, the base body (9) is displaced between the coupling position and the release position. The guide element (17) is also configured as a detaining element which, on account of the spring force, ensures that the base body (9) does not become dislodged from the sleeve cavity (6). The housing (14) is furthermore provided with a limitation (19) for limiting the displacement movement of the pulling element (15) in the end point. In the end point, the base body (9) is held in the release position, more specifically by the spring force, with displacement to the coupling position being prevented and the base body (9) being in the locked state. Only when the guide element (17) is moved back from the end point to the starting point, the base body (9) is returned to the free state.

Instead of configuring the pulling element (15) in such a way that it can be engage with a hand tool (27), it may also be provided with a handle (37), as in the embodiment from Fig. 11.

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By using the hand tool (27) or the handle (37) to perform a rotating movement on the pulling element (15), the guide element (17) of the pulling element (15) is guided across the guide slope (18) of the housing (14), thus pulling the base body (9) backwards. At the end of the guide slope (18), flat sides (41) are provided, so that it is easier for the pulling element (15) to remain in this position in order to keep the base body (9) in the locked state. In an alternative embodiment comprising a pulling element (15) with a handle (37), the guide slope (18) may also be omitted and the required rotating and pulling movement to displace the base body (9) can be performed by the handle (37), in which case a holding element may be provided in order to keep the base body (9) in the locked state.

If all coupling elements (8) of the attachment system (1) are placed in this position, the male pipe end (5) can slide out of the female pipe end (4).

Once all coupling elements (8) have then been returned to the free state, with the base body (9) in the coupling position, the attachment system (1) can be coupled again.

Instead of uncoupling means comprising the pulling element (15) illustrated here, it would, for example, also be possible to provide alternative uncoupling means, similar to the uncoupling means as described and illustrated in EP1860275A1 or US 2023/0193698 A1.

Instead of uncoupling an attachment system (1) according to the present invention manually, this may also be uncoupled in an entirely automatic way, for example via a hydraulic mechanism. To this end, for example, hydraulic systems as described and illustrated in DE19621849A1 or EP2503092A1 are suitable, with it being possible to simplify these systems due to the fact that now only the uncoupling of the pipe ends has to be driven hydraulically. No hydraulic drive is required in order to couple the pipe ends (4, 5), as is described above.

In order for uncoupling to take place hydraulically (entirely automatically), the female pipe end (4) is provided with a hydraulic duct system (28) which forms part of the uncoupling means. Such a hydraulic duct system (28) is preferably at least partly incorporated in the pipe sleeve of the female pipe end (4), as in the embodiments from Figs. 12-16 and 19-26. Hydraulic oil can flow through this

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hydraulic duct system (28) by means of the drill motor (3) or by means of a hydraulic hose to be coupled separately.

The cavity (30) in the housing (14) is limited by a shoulder (33) towards the sleeve cavity (6) in the female pipe end (4), and the base body (9) is provided with a widening (32) is configured as a piston in the cavity. In the coupling position, the widening (32) engages with the shoulder (33). The hydraulic duct system (28) ends in the coupling element (8) between the shoulder (33) and the widening (32). By allowing hydraulic oil to flow in the hydraulic duct system (28), a hydraulic chamber (29) is formed between the shoulder (33) and the widening (32) and filled with the oil when the base body (9) is in the coupling position, as a result of which the base body (9) is forced, under hydraulic pressure and counter to the spring force, to the release position and displacement to the coupling position is prevented. As a result thereof, the base body (9) is moved to the locked state.

When the hydraulic pressure is removed and the base body (9) is consequently brought back to the free state, the base body (9) is returned to the coupling position by the spring force, following which the attachment system (1) can be coupled again, as described above.

In the embodiment illustrated in Figs. 12-16, the housing (14) of the hydraulic mechanism is provided with a sealing plug (39) for safety reasons. If this sealing plug (39) is removed, a tool can be screwed into the screw thread (40) in the base body (9). By means of this tool, the base body (9) can be pulled backwards manually in case of problems or lack of hydraulic pressure.

In Figs. 19-26, the base body (9) is also configured as a verification element (44), with this verification element (44) being directly provided with said screw thread (40) in order to be able to pull the base body (9) backwards manually in case of problems or the lack of hydraulic pressure.

In order to prevent a shock absorber effect of the oil pressure when recoupling the coupling elements (8), the base body (9) in the fifth illustrated embodiment comprises a base part (91) and a piston part (92). Said spring-loaded element (13) engages with the base part (91) and the base part (91) comprises the nose (12) and is provided with a collar (45). The piston part (92) comprises said widening (32) and is

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arranged so as to be displaceable along the direction of displacement (X) with respect to the base part (91). In the coupling position, the piston part (92) on the side of the hydraulic chamber (29) engages with the collar (45). The housing (14) is furthermore provided with a venting duct (43) which ends in the cavity (30) on the side of the widening (32) where the spring-loaded element (13) is arranged. In addition, the coupling element (8) comprises a second spring-loaded element (42) which forces the piston part (92) towards the shoulder (33) of the housing (14).

As a result thereof, the second spring-loaded element (42) pushes the piston part (92) back when there is no hydraulic pressure. In this case, this piston part (92) slides across the base part (91), but is not fixedly connected thereto. The collar (45) on the base part (91) concomitantly pushes the base part (91) backwards when the hydraulic chamber (29) is filled with hydraulic oil.

In the free state, with the base body (9) in the coupling position, as illustrated in Figs. 19 and 20, the first-mentioned spring-loaded element (13) pushes the base body (9) with its nose (12) out of the sleeve cavity (7) of the female pipe end (4).

When the male pipe end (5) is pushed into the female pipe end (4), as is illustrated in Figs. 21 and 22, the base part (91) of the base body (9) with its nose (12) is pushed back into the sleeve cavity (7) of the female pipe end (4), due to the fact that the inclined side (10) engages with the male pipe end (5). In this case, the base part (91) can freely move backwards, without the piston part (92), since the base part (91) is not connected to the piston part (92).

When subsequently rotating the male pipe end (5) and the female pipe end (4) with respect to each other, the sleeve cavities (6, 7) are aligned with respect to each other. Once these sleeve cavities (6, 7) are aligned, the base part (91) is pushed forwards by the first-mentioned spring-loaded element (13) and is thus introduced in the corresponding sleeve cavity (7) of the male pipe end (5).

In order to uncouple the coupling element (8) again, the hydraulic chamber (29) is filled with oil via the hydraulic duct (28) and the piston part (92) is pushed backwards in this way. In this way, the base part (91) is concomitantly pushed backwards due to the fact that the piston part (92) engages with its collar (45). In this case, air from the cavity (30) escapes via the venting duct (43). As a result thereof, the male pipe end (5) can be removed from the female pipe end (4).

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In order to subsequently couple the coupling element (8) again, the hydraulic pressure is released, in which case the second spring-loaded element (42) pushes back the piston part (92) so as to return the base body (9) to the free state.

By thus preventing the shock absorber effect, it is ensured that the coupling elements (8) can be forced into the coupling position using a stroke effect when fitting the male pipe end (5) in the female pipe end (4), after rotation of the pipe ends (4, 5) and in this case aligning of the sleeve cavities (6, 7). Such a stroke effect helps to provide great certainty that the nose (12) is fitted in the correct position in the corresponding sleeve cavity (7) in the male pipe end (5).

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In the illustrated embodiment, the second spring-loaded element (42) is a compression spring (42) which extends concentrically with the sleeve cavity (6) and the base body (9). Obviously, other suitable spring-loaded elements are conceivable. Alternatively, it is also possible to provide two or more springs as second spring-loaded elements. If, for example, two springs are provided as second spring-loaded elements, then these are preferably arranged, in the case of a cylindrical sleeve cavity (6), on either side of the axis of this cylindrical sleeve cavity (6).

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In order to automatically uncouple the pipe ends (4, 5), it is alternatively also possible to develop, in a similar way, a pneumatic duct system which forms part of the uncoupling means in order to drive the uncoupling pneumatically. Still alternatively, a magnetic system may be provided as said uncoupling means for automatically uncoupling the coupling element in order to uncouple the pipe ends.

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CLAIMS

1. Attachment system (1) for detachably coupling a female pipe end (4) and a male pipe end (5) to each other in order to form foundation piles, comprising:
- 5 – the female pipe end (4) comprising a pipe sleeve which is provided with a sleeve cavity (6);
- the male pipe end (5) comprising a pipe sleeve which is provided with a corresponding sleeve cavity (7) which is alignable with the sleeve cavity (6) in the female pipe end (4) when fitting the male pipe end (5) in the female pipe end (4);
- 10 – a coupling element (8) which is attached to the female pipe end (4) and which comprises a base body (9) and a spring-loaded element (13), by means of which the base body (9) is configured so as to be displaceable along a direction of displacement (X) in the sleeve cavity (6) in the female pipe end (4) in a free state, between:
- 15 i. a coupling position in which the base body (9) is forced out of the sleeve cavity of the female pipe end (4) by a nose (12) of this base body (9) due to the spring force of the spring-loaded element (13), in order for said nose (12) to engage in the corresponding sleeve cavity (7) of the male pipe end (5) so as to couple the pipe ends (4, 5) when the sleeve cavities (6, 7) are aligned with respect to each other; and
- 20 ii. a release position wherein the nose (12) of the base body (9) is held in the sleeve cavity (6) of the female pipe end (4) counter to the spring force of the spring-loaded element (13), so that the pipe ends are insertable into and removable from one another;
- 25 – uncoupling means which are configured to displace the base body (9) between the free state and a locked state, with the base body (9) being held in the release position and displacement to the coupling position being prevented;
- 30 characterized in that the nose (12) of the base body (9) is provided with an inclined side (10), and in that the male pipe end (5) is provided with a corresponding edge (23), wherein the inclined side (10) and the edge (23) are

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- 5 configured to engage with each other when fitting the male pipe end (5) in the female pipe end (4) with the base body (9) in the free state, in order to move the base body (9) to the release position, without putting the base body (9) in the locked state, in that the male pipe end (5) is provided with a limiting element (21) for limiting the fitting of the male pipe end (5) in the female pipe end (4), in that the sleeve cavities (6, 7) are configured in such a way in the corresponding pipe sleeves that the male pipe end (5) is fittable in the female pipe end (4) up to the point where the limiting element (21) limits the fitting, in that the pipe ends are then rotatable with respect to each other to align the sleeve cavities (6, 7), and in that the pipe sleeve of the male pipe end (5) is provided between the edge (23) and the sleeve cavity (7) of the male pipe end (5) to keep the base body (9) in the release position when the male pipe end (5) is being fitted in the female pipe end (4), without moving the base body (9) to the locked state, until the sleeve cavities (6, 7) are aligned with each other, so that the base body (9) is forced towards the coupling position on account of the spring force when the sleeve cavities (6, 7) have been aligned with respect to each other.
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2. Attachment system (1) according to Claim 1, characterized in that the male pipe end (5) is provided with an external recess (25) which is limited by a shoulder (21), and in that the male pipe end (5) is fittable in the female pipe end (4) by means of the external recess (25) in order to fit the male pipe end (5) in the female pipe end (4), wherein the shoulder (21) of the male pipe end (5) serves as said limiting element (21).
 3. Attachment system (1) according to any of the preceding claims, characterized in that the coupling element (8) comprises a housing (14) which is fixedly attached to the female pipe end (4) and is provided with a cavity (30), with this cavity (30) ending in the sleeve cavity (6) in the female pipe end (4), and wherein the spring-loaded element (13) is arranged in this cavity (30) in order to extend between the housing (14) and the base body (9).

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4. Attachment system (1) according to Claim 3, characterized in that the coupling element (8) comprises a pulling element (15) which forms part of the uncoupling means, wherein this pulling element:
- is attached to the base body (9) in the cavity (30) in the housing (14);
 - 5 – extends in the housing (14) so as to be along the direction of displacement (X), through a through-opening (38) in the housing (14);
 - is rotatable with respect to this housing (14); and
 - is provided with a guide element (17) outside the housing (14);
- 10 wherein the housing (14) is provided with a guide slope (18) which extends along the circumference of the through-opening (38), and wherein the guide element (17) is held against the guide slope (18) by the spring force of the spring-loaded element (13), for guiding the guide element (17) upon rotation of the pulling element (15) between a starting point and an end point, wherein the starting point is situated closer to the cavity (30) than the end point in the
- 15 direction of displacement (X), so that upon displacement of the pulling element (15) between the starting point and the end point, the base body (9) is displaced between the coupling position and the release position.
5. Attachment system (1) according to Claim 4, characterized in that the housing
- 20 (14) is provided with a limitation (19) for limiting the displacement movement of the pulling element (15) in the end point.
6. Attachment system (1) according to Claim 3, characterized in that the cavity
- 25 (30) in the housing (14), towards the sleeve cavity (6) in the female pipe end (4), is limited by a shoulder (33) as said uncoupling means, in that the base body (9) is provided with a widening (32) as said uncoupling means, which is configured to engage, in the coupling position, with this shoulder (33), and in that the coupling element (8) comprises a hydraulic duct system (28) which furthermore forms part of the uncoupling means and which ends between the
- 30 shoulder (33) and the widening (32), so that when the base body (9) is in the coupling position, when applying oil pressure to the hydraulic duct system (28), a hydraulic chamber (29) is formed between the shoulder (33) and the widening (32), as a result of which the base body (9) is forced into and held in the release position, counter to the spring force.

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7. Attachment system (1) according to Claim 6, characterized in that the base body (9) comprises a base part (91) and a piston part (92), wherein the spring-loaded element (13) engages with the base part (91) and the base part (91) comprises the nose (12) and is provided with a collar (45), and wherein the piston part (92) comprises said widening (32) and is arranged so as to be displaceable along the direction of displacement (X) with respect to the base part (91) and is arranged to engage, in the coupling position, with the collar (45) on the side of the hydraulic chamber (29), in that the housing (14) is provided with a venting duct (43) which ends in the cavity (30) on the side of the widening (32) on which the spring-loaded element (13) is arranged, and in that the coupling element (8) comprises a second spring-loaded element (42) which forces the piston part (92) towards the shoulder (33) of the housing (14).
8. Attachment system (1) according to Claim 6 or 7, characterized in that the hydraulic duct system (28) is at least partly incorporated in the pipe sleeve of the female pipe end (4).
9. Attachment system (1) according to any of the Claims 6 to 8, characterized in that the coupling element (8) comprises a verification element (15, 31, 44) which is, in the cavity (30) in the housing (14), attached to the base body (9) or forms part of the base body (9) which extends through the housing (14) so as to be displaceable along the direction of displacement (X) and which partly extends outside the housing (14), at least in the release position of the coupling element (8).
10. Attachment system (1) according to any of the preceding claims, characterized in that the sleeve cavity (7) in the male pipe end (5) is a cavity with a virtually constant cross section, and in that the nose (12) of the base body (9) next to the inclined side (10) has a corresponding virtually constant cross section.

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11. Attachment system (1) according to any of the preceding claims, characterized in that the sleeve cavity (6) in the female pipe end (4) and the sleeve cavity (7) in the male pipe end (5) are designed to be substantially cylindrical, in that the base body (9) is correspondingly designed to be substantially cylindrical, and in that the nose (12) of the base body (9) is provided with a concave rounding (11), corresponding to the rounding of the pipe sleeve of the male pipe end (5).
12. Attachment system (1) according to any of the preceding claims, characterized in that the sleeve cavity (7) in the male pipe end (5) is limited by a bottom (34).
13. Attachment system (1) according to any of the preceding claims, characterized in that the female pipe end (4) is provided with several corresponding sleeve cavities (6), in that the male pipe end (5) is provided with several corresponding sleeve cavities (7), and in that the attachment system (1) comprises several corresponding coupling elements (8).
14. Attachment system (1) according to Claim 13, characterized in that various said sleeve cavities (6) in the female pipe end (4) are arranged in a row one above the other, and in that various corresponding said sleeve cavities (7) in the male pipe end (5) are arranged in a row one above the other.
15. Attachment system (1) according to Claim 13 or 14, characterized in that various said sleeve cavities (6) in the female pipe end (4) are arranged distributed across the circumference of the pipe sleeve, and in that various corresponding said sleeve cavities (7) in the male pipe end (5) are arranged distributed across the circumference of the pipe sleeve.