

Method and Device for Separating Pipes

The invention relates to a method and a device for separating upright pipes of a greater length and greater diameter anchored in the ground at their ends, typically having a length between approx. 30 and 200 m and a diameter of approx. 1800 mm, in particular anchoring pipes of an offshore oil drilling or production platform. The wall thickness is typically 50 to 100 mm.

Depending on the properties of the ocean floor on which the offshore oil drilling or production platforms are situated, the steel anchoring pipes of these platforms are inserted into the ocean floor by being rammed into place, for example, and held there only due to friction in the seabed. If this is not enough, the alternative is to introduce underwater concrete or the like into the base of the anchoring pipes thereby created, in which case some of this concrete may escape from the lower end of the pipe into the surrounding ocean floor and form an artificially created foundation anchored in the ocean floor after it hardens, so that the anchoring effect is added to the effect of the weight of the concrete filling the lower portion of the respective pipe up to a certain height. Regulations that apply to the dismantling of platforms often require the anchoring pipes to be cut off a certain distance below the ocean floor.

Methods and devices for separating upright pipes of a greater length and greater diameter anchored in the ground at their lower ends are already known. In particular DE 196 20 756 A1 discloses such a method and such a device. It is a disadvantage of known methods and devices that sometimes they do not function as reliably as desired under extremely rough ambient conditions (sea water often under a high pressure, mixed with drilled-out concrete or ocean floor) and/or a great effort is required to support and/or secure the pipe that is separated.

The object of the present invention is to create a method and a device which are improved with regard to these disadvantages. This object is achieved by the method defined in claim 1 and by the device defined in claim 4.

With the method according to the invention for separating upright pipes of a greater length and greater diameter anchored in the ground at their lower ends, in particular anchoring pipes of an offshore oil drilling or production platform, a cutting assembly is lowered into the pipe as far as a separation zone, being lowered through the upper end of the pipe to be separated and advanced as far as a separation zone. The cutting assembly acts progressively against the pipe over the circumference. The separation operation takes place by means of a water jet output by at least one water jet nozzle. The pipe wall is severed by a cut with cut width that is at least almost constant, to create two complementary conical cut surfaces, said cut width running diagonally through the pipe wall. To produce the cut running diagonally, the water jet of the at least one water jet nozzle is directed at an angle α which may be between 5° and 60° , for example, to the plane E running perpendicular to the pipe axis A.

Based on the (traveling) cutting axis, this angle α preferably remains constant. The term "water jet nozzle" is also used below to refer to multiple water jet nozzles, unless something else is apparent from the context.

When "upright pipes" are mentioned either above or below, it does not necessarily refer to a vertical orientation of the pipes. Pipes which extend upward from the ground at an angle to the vertical are also included.

The water jet cutting is also performed reliably even under rough ambient conditions, in particular when, as is preferred, the pipe wall is severed in one operation because then only a very minor rate of advance is needed, and any rock fragments that may be present will yield without causing any damage.

The separation zone is preferably located below the ocean floor.

The angle α is preferably 30° .

The weight of the pipe and components optionally connected to it is not secured by additional devices in one embodiment of the separation process. It has been found that these may be omitted because of the self-centering, conical and complementary cut surfaces. This makes it possible to achieve definite cost savings. The pipe can also be subjected to further loading to a limited extent even after the separation operation because the self-centering effect minimizes the risk of a lateral offset of the pipes in the separation zone and the contact surfaces are thereby reduced to the extent that they no longer withstand the forces also due to corrosion damage.

In one embodiment a plurality of water jet nozzles are distributed uniformly over the circumference of the cutting assembly. Two water jet nozzles are preferably provided, preferably being arranged diametrically in particular. This makes the separation process faster in comparison with the use of only a single water jet nozzle while the increased effort remains reasonable.

After a 360° rotation divided by the number of water jet nozzles, the cutting assembly is preferably raised and lowered while the water jet is still turned on, resulting in cuts running in the direction of the pipe axis. When there is only a single water jet nozzle, the raising and lowering are preferably performed after a 360° rotation; when there are two diametrically opposed water jet nozzles the raising and lowering are preferably performed after a 180° rotation. The vertical cuts thus always run in the same location where two cuts meet. The resulting cutting system is capable of compensating for fluctuations in height during the cutting operation, i.e., achieving a reliable separation of the pipe even if the height of the cutting assembly in relation to the pipe varies during the cutting operation.

The cut surface obtained when there are fluctuations in height and comprising one or more discontinuities is still also referred to as a conical cut surface within the scope of this document.

For the case when there is some sort of material such as ocean floor or concrete in the pipe in the zone where it is to be separated, so that the pipe can be cemented for better anchoring in the ground, this material is preferably drilled out of the pipe from above in lowering the cutting assembly, namely to a level below the separation zone.

The cutting assembly is preferably fixedly connected to the drill string, more preferably by flange connection.

To accelerate the separation process, the inside wall of the pipe is preferably cleaned in the area of the separation zone. Therefore concrete or material from the ocean floor which may still be adhering to the pipe walls after optionally being drilled out is thus removed. This is preferably done by means of rotary drill bits, which may be activatable, if located in the area of the separation zone, or may be constantly in use, i.e., during the entire drilling and/or lowering operation.

The following process steps are preferably provided:

- Drilling out the material located inside the pipe such as the ocean floor material or concrete down to a level below the separation zone,
- Raising the drill string by approx. 0.5 m and securing the height of the drill string,
- Deactivating the main hydraulic drive of the drill string and activating an auxiliary hydraulic drive,
- Extraction and positioning of the at least one water jet nozzle,
- Starting operation of the water jet.

The following additional process steps may be performed:

After drilling out the pipe, water lines may be connected along with any electric lines for the drill string, preferably by means of fast-acting connectors. These may not yet be connected during the lowering and/or drilling operations. After starting operation of the

water jet, it is possible to wait until a sensor preferably a hydrophone detects that the pipe wall has been severed by the water jet. Operation of the auxiliary hydraulic drive may then begin. The rate of advance, i.e., the rotational speed of the auxiliary hydraulic drive, may be increased until the sensor detects a complete cut and then it may be reduced until the sensor detects that the water jet has completely severed the pipe wall. Then the cutting operation can be terminated and performed elsewhere (somewhat higher or lower) using the parameters thereby obtained and optimized. All the parameters may be stored.

Abrasive particles are preferably added to the water. This separation process is thus a so-called "abrasive jetting" process. The water jet nozzles used for this process are also known as "abrasive water jet cutting nozzles" or simply "AWJ cutting nozzles."

An air blanket comprised of multiple air nozzles is preferably created around the water jet. A better performance is achieved in this way.

In a particularly preferred embodiment of the method according to the invention, loose solids are transported out of the interior of the pipe during the separation process. It has surprisingly been found that the separation process is accelerated and the quality of the conical cut surfaces is improved in this way. One explanation for this might be that, despite the relative small cut width achieved during the cutting operation, quantities of loose solids, e.g., sand between the cut surfaces may reach the interior of the pipe and have a negative effect on the cutting operation.

Removal of these solids preferably takes place by using the so-called air-lift method in which air is blown into the interior of the drill string into a hollow drill string which is at least essentially filled with water, at a location beneath the water surface, preferably near the location where the transport is to take place. The drill string has a section opening beneath the injection site. Because of the change in density of the water column produced by the injected air, an upward flow is created in the interior of the drill

string, entraining loose solids from the surroundings of the section opening into the interior of the drill string and transporting them away.

If the method according to the invention also comprises the step of drilling out a pipe filled with concrete for example, then with the help of the same air-lift method, material released during the drilling process for example concrete particles may be conveyed out of the interior of the pipe.

In its aspect pertaining to the device, the object is achieved by a device for separating upright pipes of a greater length and a greater diameter anchored in the ground at their lower ends, in particular for severing anchoring pipes of an offshore oil drilling or production platform where the device comprises a cutting assembly which can be lowered into the pipe through the upper end of the pipe to be separated and advanced as far as a separation zone. The cutting assembly preferably acts progressively on the inside circumference of the pipe in the circumferential direction in this separation zone which is preferably narrow axially and thereby severs the pipe. At least one water jet nozzle is provided to achieve the separation operation. Positioning means are provided to facilitate the positioning of the water jet nozzle in relation to the pipe wall in such a way that the water jet output by the water jet nozzle strikes the pipe wall at an angle α to the plane running perpendicular to the pipe axis, so that when the separation of two complementary conical cut surfaces is achieved. In this way, even after separation, the pipes are thus in surface contact with one another at these separation faces in the separation zone after separating the pipes. They are self-centering, so that the pipe can still absorb forces compressive forces in particular to a limited extent, so any securing or support of the separated pipe may be omitted.

The angle α is preferably 5° to 60° , preferably approx. 30° in particular. It has been found that this provides sufficient self-centering with acceptable tensile and compressive forces in the circumferential direction in the pipe wall on the cut surfaces, and the cut length increases only to an acceptable extent. The tensile and compressive forces in the circumferential direction are understood to be the forces which result from

the conical shape of the cut surfaces and tend to spread one end of the pipe and to compress the adjacent pipe.

Two water jet nozzles are further preferred.

A drill head which is preferably arranged beneath the cutting assembly can be used to drill out the inside cross section of the pipe down to a depth such that the cutting assembly can be brought to bear in the intended cutting zone, to remove material located in the lower area of the pipe such as material from the ocean floor or concrete or the like, so that the pipe can be cemented for better anchoring.

The drill head can preferably be driven to rotate. The cutting assembly is preferably fixedly connected to the drill head and/or to the drill pipe.

In addition, rotary drill bits which clean out the inside wall of the pipe to remove concrete or residues of the ocean floor material or the like are preferably also provided. These are preferably radially prestressed. They may be engaged at all times or they may be activatable, so that they are used only in the region of the separation zone.

In addition to the main hydraulic drive of the drill pipe, an auxiliary hydraulic drive is preferably provided and can be used during the separation process, supplying only a low torque, rotating extremely slowly and being characterized by a particularly uniform rotational speed. The rotational speed may amount to one revolution every two hours for example. This achieves the required uniform and slow advance for the water jet nozzles and thus ensures reliable separation.

The positioning means preferably comprise a guide car with guide rollers that can be brought into contact with the inside wall of the pipe. The water jet nozzle is preferably fixedly connected at a selected angle to the guide car so that the water jet nozzle is automatically aligned at the correct constant angle to the pipe wall when the guide car is

in contact with the pipe wall and a constant nozzle spacing from the cut surface is also ensured.

Extraction means comprising a pneumatic cylinder and a spring are preferably provided. The water jet nozzle is thus preferably extractable with the guide car and more preferably by a pneumatic cylinder. A retracted position of the water jet nozzle with the guide car is thus provided, this position preferably being assumed during the letdown and retrieval of the cutting assembly in the pipe and an extracted position when the cutting assembly is in use.

Multiple air jets are preferably provided around the water jet nozzle. By blasting air during the cutting operation, the water jet is separated from the surrounding water thereby preventing the water jet from being decelerated due to the surrounding water which would thus reduce the efficiency of the device.

As explained, two water jet nozzles may be arranged diametrically in the same level. Each nozzle must separate only half the circumference. This reduces the cutting time almost in half in comparison with use of just a single water jet nozzle. In the event of a larger number of water jet nozzles distributed uniformly over the circumference, which is also conceivable, the same rule applies to the number thereof accordingly.

In one embodiment two water jet nozzles are arranged one after the other in the same plane to form a water jet nozzle pair. Each nozzle must cut the full circumference and the cutting time is twice as long as with two diametrically opposed water jet nozzles. The advantage here is that it yields a greater certainty that the full cross section will be completely severed because one of the two water jet nozzles will cut with at least almost the same certainty, even when there are some discontinuities (i.e., irregularities) in the rate of advance.

It is conceivable that multiple water jet nozzle pairs distributed uniformly over the circumference or in diametric opposition are provided. In the embodiment of the method

according to the invention in which the cutting assembly is raised and lowered after a 360° rotation divided by the number of water jet nozzles while the water jet is still turned on, reference to the number of water jet nozzles is understood to refer to the number of water jet nozzle pairs.

Preferably at least one sensor which detects when the water jet passes through the pipe wall is provided, preferably a hydrophone. This makes it possible to achieve reliable and complete separation of the pipe in the shortest possible cutting time.

An embodiment of the device according to the invention in which means are provided with which loose solids can be conveyed out of the interior of the pipe during the separation process is most especially preferred. The term "loose solids" is understood in particular to refer to material from the ocean floor, which can enter the interior of the pipe between the cut surfaces during the cutting operation and can interfere with the cutting operation there. If a drill head by means of which material in the lower area of the pipe can be drilled out is situated beneath the cutting assembly, this preferably includes the same means with which the dissolved material can be conveyed out of the pipe during the drilling process.

These means are preferably designed so that the solids are conveyed out of the pipe with the help of the air-lift method, in which an intake opening communicating with the internal volume of the drill string is provided beneath the cutting assembly on the same drill string on which the cutting assembly is also situated, and an air injection opening which communicates with the inside wall of the drill string is preferably provided on the drill string above the cutting assembly. An air line which is fixedly connected to the drill string may be connected to the air inlet opening and is also connected to a compressor set up outside of the pipe.

The present invention will now be explained in greater detail with reference to exemplary embodiments illustrated in the drawings, in which:

- Figure 1 shows a perspective view of a supporting structure with the production platform raised up from it;
- Figure 2 shows schematically a side view of a supporting structure;
- Figure 3 shows a schematic side view of a drilling operation in the air-lift method;
- Figure 4 shows a side view of an drill head according to the invention with the cutting assembly in the retracted position and arranged fixedly above it;
- Figure 5 shows a view like that in Figure 4 in an enlarged detail;
- Figure 6 shows a view like that in Figure 4 with the cutting assembly in an extracted position;
- Figure 7 shows a view like that in Figure 6 with a view in the direction of the pipe axis;
- Figure 8 shows a detail view from Figure 6;
- Figure 8a shows a detail view from Figure 4;
- Figure 9 shows a detail view from Figure 6 with sectional diagrams;
- Figure 10 shows another detail view from Figure 6 with an altered angle of view;
- Figure 11 shows a purely schematic diagram of the method according to the invention and the device according to the invention;
- Figure 12 shows a supporting leg 2 with anchoring pipes 2a;

Figure 13 shows another exemplary embodiment of a cutting assembly intermediate piece;

Figure 14 shows a schematic side view of a device according to the invention during the separation process;

Figure 15 shows the detail X in Figure 14 in an enlarged scale.

Figure 1 shows an example of an oil drilling or production platform 100 that has already been separated into its main components, comprising an actual platform 20 which is supported on a supporting structure, labeled as 21 on the whole, in the installed state. All the equipment normally arranged on the platform 20, such as the drilling apparatus, accommodations, etc., has already been dismantled and is no longer shown in the drawing. Crane boats 46 having cranes 19 whose height of lift above sea level may be 100 m or more are used for assembling and dismantling the oil drilling or production platforms 100 and/or the supporting structures 21. In the phase illustrated here, the actual platform 20 is already suspended from the cranes 19 after being released from the supporting structure 21. Of the supporting structure 21, Figure 1 shows only the part above sea level 23 (Figure 2), which may be 30 meters to 40 meters high. The supporting structure 21 is designed as a tower-type structure having supporting legs 2 and timbered cross struts and is anchored in the ocean floor beneath the water surface by means of its anchoring pipes 2a (indicated with dash-dot lines) extending downward into the water. To this end, the pipes 1 are also filled with concrete in their lower area. The water is usually between 30 and 200 meters deep and can allow each anchoring pipe 2a to be inserted, e.g., rammed into the ocean floor, by a comparable distance. The anchoring pipes 2a are thus very long, consisting of large pipes 1 with a diameter of 1800 mm in particular and with a substantial wall thickness of 80 mm in particular.

Figure 2 illustrates the dismantling situation for a supporting structure 21 which deviates structurally somewhat from that in Figure 1. The upper parts 26 of the supporting legs 2 are cut off at the freely accessible cutoff point 22 and still belong to the actual platform

20, which is raised by cranes according to Figure 1. The supporting structure 21 extends above sea level 23 and also extends downward to the ocean floor 8 by a distance which corresponds to the depth of the water. The anchoring pipes 2a extend deep into the ocean floor and can be anchored in the ocean floor 8 at their lower ends by underwater concrete, which is pressed into the pipes or a similar foundation-type anchoring. With the object of an oil drilling or production platform 100, it is often required that the anchoring pipes 2a are separated from their lower ends, which extend deep into the ocean floor 8, at severing locations and/or separation zones 4, which are situated a distance 24 of a few meters below the ocean floor 8. The separation zones 4 are difficult to reach from the outside.

Figure 3 shows general information with regard to the so-called air-lift principle. An air-lift pipe and/or drill string 29 is provided, a drill head 36 being arranged at its lower end. This may be for example a rock cutting drill head and/or a rock cutting drill bit. A compressed air line 27 is carried in the drill string 29 at its upper end via an air-lift rinse head 31. The compressed air is sent downward in the drill string to the compressed air inlet valve 30, where it flows through an intake opening 48 into the interior of the drill string 29, where it creates buoyancy with which material from the ocean floor that has been released by the drill head 36 is raised through the interior of the drill string. This clearance of clearing stroke 34 enters a slag pit 35 through an outlet tube 33. A power drive head or a rotary drive 32 is provided on the upper end of the drill string. A stand pipe 28 is arranged around the drill string.

Since it is difficult to reach the separation zone 4 from the outside, the pipe 1 is severed from the inside. The exemplary embodiment illustrated in the figures relates to the method and the device used when the pipe 1 is filled with concrete 16 or soil or the like to a level above the separation zone 4.

Figure 4 shows the drill string 37 which is designed as an air-lift drill pipe and/or drill string 29. A rock cutting drill head and/or a rock cutting drill bit 36 is arranged at its lower end. A cutting assembly adapter and/or a cutting assembly intermediate piece 47

is/are arranged between the drill head 36 and the drill string 37. This cutting assembly adapter is connected by a flange to the drill head and to the drill string. The cutting assembly adapter and/or the cutting assembly intermediate piece 47 may be mountable on a traditional drill string 37 and a traditional drill head. The cutting assembly adapter and/or the cutting assembly intermediate piece 47 comprise(s) the cutting assembly 3.

Figure 5 shows a larger region of the drill string 37. A stabilizer 38 which is supported in the pipe 1 and in which the drill string 37 is mounted rotatably can be seen in the upper region of Figure 5. A plurality of heavy rods may be provided.

Figure 6 shows the cutting assembly 3 in action. The cutting assembly 3 comprises two water jet nozzles 5, 5'. The water jet nozzles are progressively displaceable in the circumferential direction of the pipe 1, in a plane E which is essentially perpendicular to the pipe axis A. The two water jet nozzles are diametrically opposed to one another. It is also conceivable for these water jet nozzles to be arranged directly side-by-side to ensure a reliable cutting and to increase the redundancy (not shown in the figures). As shown in Figure 8 in particular, multiple air jets 14 are arranged around each water jet nozzle 5. The water jet nozzles 5, 5' are each positioned by positioning means 9a, comprising a guide car 11, 11' having guide rollers 12, 12'. Each water jet nozzle 5, 5' is thus arranged on a guide car 11, 11', each car having four guide rollers 12, 12'. In the extracted position of the water jet nozzles 5, 5', the guide rollers 12, 12' are in contact with the inside wall of the pipe. The water jet nozzles 5, 5' are each fixedly mounted on the guide car 11, 11' so that the water jet 15 does not strike the pipe wall 6 parallel to the plane E which runs perpendicular to the pipe axis A. Figure 8 shows in particular that the water jet nozzle 5 and/or the water jet output by it form(s) an angle α of 30° to this plane E. The same is also true of the other water jet nozzle 5'. The cut width B is small and almost constant. In this way, the complementary conical cutting surfaces 7c, 7d are created when the guide cars 11, 11' have run completely over the inside circumference of the pipe 1 and the water jets have completely severed the pipe. The pipe above the separation zone 4 is thus supported in a self-centering manner on the

pipe remaining below the separation zone 4. Therefore, the pipe need not necessarily be supported or secured.

The water comes out of the water jet nozzles 5, 5' at a very high velocity.

Figure 9 shows the sectional diagram 7a of the water jets. After both water jet nozzles 5, 5' have together run through the entire inside circumference of the pipe 1, i.e., after a 180° rotation of the cutting assembly 3, the cutting assembly 3 is raised and lowered slightly, resulting in cuts 7e (discernible on only one side in Figure 9) running in the direction of the pipe axis to compensate for a variation in height of the cutting assembly 3 during the cutting operation, which may last for several hours. The raising and lowering of the cutting assembly while the water jet is turned on is done to such an extent that the pipe 1 is reliably severed even with the anticipated fluctuations in height.

The water jet nozzles 5, 5' and the positioning means 9a are extracted from an inserted position into an extracted position by means of extraction means 9. The extraction means 9 comprise an essentially straight pivot arm 40 and a pneumatic cylinder 10. The pivot arm 40 has the guide cars 11 or 11' rotatably mounted on one end. On the opposite end it is rotatably mounted on the other cutting assembly 3. In a central region of the pivot lever which is located closer to the cutting assembly side position than at its other end, the free end of the piston rod of the pneumatic cylinder 10 acts on the pivot arm 40 by way of a rotatable connection. The pneumatic cylinder 10 itself is also rotatably and/or pivotably fastened to the cutting assembly 3.

As shown in Figure 6 for example, three additional rotary drill bits 18, 18', 18" are provided on the drill head 36. These drill bits clean the inside wall of the pipe 1 in the region of the separation zone 4 to remove concrete 16 or ocean floor material 8 remaining in this region. The additional rotary drill bits 18, 18', 18" are each prestressed by a pneumatic cylinder 18a (Figure 11). Thus a device which cleans an annular region in the separation zone down to the metal of the pipe 1 to remove the adhering material

is thus assigned to the cutting assembly 3 and comprises the additional rotary drill bits 18, 18', 18".

Above and below the water jet nozzles 5, 5' and their extraction means 9 and positioning means 9a protective plates 39 are provided. These plates are rigid and protect the water jet nozzles and the extraction means and positioning means in the retracted position of the water jet nozzles 5, 5'.

If the pneumatic cylinder 10 in the retracted position of the water jet nozzles 5, 5' is acted upon by compressed air and is extracted, then it pivots the pivot arm 40 out of a position in which it is in contact with the circumference of the cutting assembly 3 into an extracted position which is spread around the circumference and in which the guide car 11 is in contact with the inside wall of the pipe.

Figure 11 illustrates the device according to the invention and the method according to the invention in a highly schematized form. Some of the elements are not shown in their "correct" positions. This shows the drill string 37 at the lower end of which the drill head 36 is provided. An additional rotary drill bit 18 can be seen to the right of this, prestressed with a pneumatic cylinder 18a. The elements of the cutting assembly 3 are shown at the left of the drill head 36. This shows extraction means 9, comprising the pneumatic cylinder 10 and the pivot lever 40. The guide car 11 is not shown here. A water jet nozzle 5 and a water jet 15 can be seen here. Unlike the diagram in Figure 11, the water jet 15 here has only an extremely slight widening. The water jet nozzle 5 is connected by a water line 13 to a mixing valve 44 through which abrasive particles 43 are added. This shows the high pressure water pump 41 with the additional water line 42. A compressor 45 can be seen on the other side of the drill string 37. The compressed air line shown on the right side of the drill string leads over the air-lift flushing head 31 to the compressed air inlet valve 30 through which the compressed air for the air-lift method is injected into the drill string 37. Shown on the other side of the drill string 37, the compressed air line leads to the cutting assembly 3, where it splits

again into a line leading to the pneumatic cylinder and another line leading to the air nozzles 14.

Figure 12 shows as an example a supporting leg 2 with anchoring pipes 2a to be separated. The separation zone 4 is 6 meters below the ocean floor 8 with a water depth of 140 meters. The anchoring pipes 2a are filled with concrete and weighted down. The anchoring pipes 2a and the supporting legs are inclined at an angle of approx. 9.5° . The ocean floor consists of compact sand with layers of varying composition (sand and organic sediments).

The method according to the invention can be carried out under rough conditions such as high winds, high waves and low temperatures. The limiting factor is the dynamic load capacity of the supporting leg 2 with the anchoring pipes 2a cut off under rough weather conditions.

Figure 13 shows a slightly modified cutting assembly adapter 47.3. The cutting assembly adapter 47 in this exemplary embodiment has additional rotary drill bits 18, 18', 18". In addition other rotary bits 18b are also provided on the drill head 36. Two compressed air lines 27, 27' are shown. One compressed air line 27' causes the guide car 11 to be extracted and produces the air blanket around the water jet. The other compressed air line 27" leads to the additional rotary drill bits 18, 18' and the additional rotary bits 18b, 18b' and causes them to be extracted at the same time. The functions of the two compressed air lines can be controlled independently of one another.

Another variant of the method according to the invention will now be explained with reference to Figures 14 and 15.

Figure 14 shows schematically a device according to the invention during the separation process. With the help of a drill head 36 situated at the lower end of the air-lift drill string 29, concrete 16 inside the pipe is drilled out down to below the ocean floor 8 and then the air-lift drill string 29 is raised into the position illustrated in Figure 14 where the

cutting assembly 3 is in a position in which the separation zone 4 is still beneath the ocean floor 8 but a clearance remains between the drill head and the surface O of the concrete 16.

During the separation process, the air-lift process is continued further by injecting air into the air-lift drill string 29 through the compressed air line 27 and the compressed air inlet valve 30 as illustrated in Figure 15 in order that loose solids, such as marine sediment 50, that are still present in the pipe 2a during the separation process or that have penetrated through the slots 49 formed during the separation process cannot interfere with or even block the separation process. The air flow is symbolized by the arrows shown in the compressed air line 27. Marine sediment inside the anchoring pipe 2a is removed by upward directed flow thereby created in the interior of the air-lift stream, represented by the arrows pointing up in the diagram. As shown in Figure 14, water (symbolized by the large dots in Figure 14) is introduced through an inlet 51 provided above the sea level 23, namely in a volume flow such that the water level 23' inside the supporting pipe 2a is consistently above sea level 23.

List of reference numerals

100	Offshore oil drilling or production platform
1	Pipe
2	Supporting legs
2a	Anchoring pipes
3	Cutting assembly
4	Separation zone
5, 5'	Water jet nozzle
6	Pipe wall
7	Cut, section
7a	Sectional diagram
7b	Cuts running in the direction of the axis of the pipe
7c, 7d	Complementary conical cut surfaces
8	Ocean floor
9	Extraction means
9a	Positioning means
10	Pneumatic cylinder
11, 11'	Guide car
12, 12'	Guide rollers
13	Water line
14	Air nozzles
15	Water jet
16	Concrete
17	Free
18, 18', 18"	Additional rotary drill bits
18a	Pneumatic cylinder
18b	Additional rotary bits
19	Crane
20	Actual platform

21	Supporting structure
22	Freely accessible separation site
23	Sea level
23'	Water level
24	Distance of the separation zone from the ocean floor
25	Lower ends of the pipes 1
26	Upper parts of the supporting legs
27, 27', 27"	Compressed air lines
28	Stand pipe
29	Air-lift drill string
30	Compressed air inlet valve
31	Air-lift flushing head
32	Power drive head or rotary drive
33	Extraction tube
34	Clearance
35	Slag pit
36	Drill head
37	Drill string
38	Stabilizers
39	Protective plates
40	Pivot arm
41	High pressure pump (water)
42	Additional water line
43	Abrasive particles
44	Mixing valve
45	Compressor
46	Crane boat
47	Cutting assembly adapter or cutting assembly intermediate piece
48	Intake opening
49	Slots

50	Marine sediment
51	Inlet
A	Pipe axis
B	Cut width
E	Plane perpendicular to pipe axis
α	Angle
O	Surface

Patent Claims

1. A method for separating upright pipes (1) of a greater length and greater diameter anchored in the ground at their lower ends, in particular anchoring pipes (2a) of an offshore oil drilling or production platform (100) in which a cutting assembly (3) is lowered into the pipe (1) through the upper end of the pipe (1) to be separated, as far as a separation zone (4), said cutting assembly acting progressively against the pipe (1) over the circumference, and the separation process takes place by means of a water jet (15) output by at least one water jet nozzle (5, 5'), characterized in that the pipe wall (6) is severed by a cut (7) having at least almost a constant cut width (B) to create two complementary conical cut surfaces (7c, 7d), this cut running at a skewed angle through the pipe wall (6), such that the water jet (15) of the at least one water jet nozzle is directed at an angle (α) to the plane (E) running perpendicular to the pipe axis (A) in order to create the cut (7) running skewed through the pipe wall.
2. The method according to claim 1, characterized in that the weight of the pipe (1) and components optionally connected to it is not secured by additional devices in the separation process.
3. The method according to claim 1 or 2, characterized in that abrasive particles are mixed with the water of the water jet.
4. The method according to any one of claims 1 to 3, characterized in that after rotation by 360° divided by the number of water jet nozzles (5, 5'), the cutting assembly (3) is raised and lowered while the water jet is activated, thus resulting in cuts (7b) running in the direction of the axis (A) of the pipe.
5. The method according to any one of claims 1 to 4, characterized in that loose solids are transported out of the interior of the pipe during the separation process.

6. The method according to claim 5, characterized in that the solids are transported out of the pipe with the help of the air-lift method.
7. A device for separating upright pipes (1) of a greater length and greater diameter anchored in the ground at their lower ends, in particular separating them from anchoring pipes (2a) of an offshore oil drilling or production platform (100) by using a cutting assembly (3) which can be lowered through the upper end of the pipe (1) to be separated, lowering it into the pipe as far as a separation zone (4), such that the cutting assembly acts progressively on the inside circumference of the pipe (1) in the circumferential direction in this separation zone (4) and severs the pipe (1), wherein at least one water jet nozzle (5, 5') is provided to accomplish the separation process, characterized in that positioning means (9a) are provided to position the water jet nozzle (5, 5') with regard to the pipe wall (6), such that water jet (15) output by the water jet nozzle (5, 5') strikes the pipe wall (6) at an angle (α) to the plane (E) running perpendicular to the pipe axis (A), such that when the separation is complete the result is two complementary conical cut surfaces (7c, 7d).
8. The device according to claim 7, characterized in that the angle α is between 5° and 60°, preferably approx. 30° and preferably two water jet nozzles (5, 5') are provided.
9. The device according to claim 7 or 8, characterized in that a drill head (36) is arranged beneath the cutting assembly (3) so that material inside the pipe such as material from the ocean floor or concrete (16) or the like can be drilled out by means of this cutting assembly over the inside cross section of the pipe (1) so that the pipe can be cemented for better anchoring, said drilling out being continued to a depth such that the cutting assembly (3) can be used in the intended separation zone (4).

10. The device according to any one of claims 7 to 9, characterized in that rotary drill bits (18, 18', 18'') are provided, cleaning out the inside wall of the pipe to remove concrete or residues of the ocean floor or the like.
11. The device according to any one of claims 7 to 10, characterized in that in addition to the main hydraulic drive of the drill string, an auxiliary hydraulic drive is provided which can be used during the separation process and rotates extremely slowly and is characterized by a particularly uniform rotational speed.
12. The device according to any one of claims 7 to 11, characterized in that the positioning means (9a) comprise a guide car (11, 11') having guide rollers (12, 12'), which can be brought into contact with the inside wall of the pipe.
13. The device according to any one of claims 7 to 12, characterized in that a plurality of air jets (14) is arranged around the water jet nozzle (5, 5').
14. The device according to any one of claims 7 to 13, characterized in that means are provided by which loose solids can be conveyed out of the interior of the pipe during the separation process.
15. The device according to claim 14, characterized in that an intake opening that communicates with the interior volume of the drill string is provided on the drill string beneath the cutting assembly, and an air injection opening, which communicates with the interior volume of the drill string is provided preferably above the cutting assembly on the drill string.