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Description

The present invention relates to the domain of sub-sea fields oil well drilling and similar, from a working structure or rig which can be a floating or fixed platform of any type.

If the more particularly concerned techniques are those related to off-shore drilling, the definition of sub-sea well should be considered as including all the application cases wherein a well should be drilled starting from a surface covered with a salty, or not, stagnant, or not, water height.

The more particular target of the invention comprises the supplies, installation or equipment to be operated to insure cementing of the internal casing of such a bore hole.

Although no very precise description of the cementing of the internal casing of a drilled well is needed, due to the knowledges of those familiar with the art, it however is appropriate to remind that these cementing techniques consist of launching, inside a casing, a sealed plug, called the bottom plug, designed for cleaning by scraping the internal surface of the casing to eliminate drilling mud traces and avoid any mud/cement slurry contact.

This bottom plug launching relies on pressurized fluid means such as, in particular, cement slurry. After positioning, in a per se well known manner, the bottom plug on the "float collar" or similar, the generated overpressure perforates the bottom plug breakage membrane. In an equally known manner the so called top plug will be launched into the same casing to also be propelled by a pressurized fluid under an overflush during a subsequent distinct operation, generally after the cement slurry has been pumped downhole.

The top plug function is to deliver through the bottom plug the previously pumped cement or similar product so that it is pumped back up through the ring shaped gap or "annulus" between the internal casing and either the adjacent formations, or an external casing.

It will be understood that such a process is difficult to operate in a sub-sea drilling case, due to the fact that the usual cementing head, which bears the plugs, usually is adapted on the working structure or "rig". In the case of sub-sea drilling, such an approach would lead to both plugs moving along a long path between the rig and the sub-sea bottom, with all the inconveniences and problems which such techniques would induce.

To reduce the inconveniences that would result from such an operation, the previous art has proposed solutions, of which one can be considered on the basis of application EP-A 0 167 285.

According to these techniques, the first, so called external, casing which equips the drill well, emerges from the bottom and bears, by means of

a casing hanger, an internal casing. The casing hanger also follows mounting an adapter, called "installation tool", which is prolonged upwards by the drill pipe all through the water height, so as to be linked with the rig, on which such a tube bears a release system for one or several launchers or darts.

The installation tool allows hanging, inside the internal casing, one or several mutually associated plugs, the lips of which are radially stressed to establish a seal with the peripheral wall of the internal casing.

The release system or dart, includes a number of darts equal to the number of plugs, and being able to be launched in succession to cause the plugs to successively be supported and launched by known mechanical action(s).

Such techniques imply a certain number of inconveniences of which the main ones are as follows.

The plugs/installation tool assembly must be threadedly mounted onto the casing hanger. The peripheral lips of the various plugs therefore are submitted to a friction which can damage them, possibly make them unable to exert their basic sealing function, and the mechanical stresses, additionally, can rupture or distort the shear pins between the plugs.

In order to allow the plugs launchings in succession, those plugs require a tubular construction so that the dart can successively pass through them. Such a conformation implies a delicate, highly expensive execution, which requires linking means between two successive plugs, sealing means between them, but also release or mutual unlocking means through a dart action. Furthermore, such plugs also have to bear such complementary linking and sealing means that each one of them builds up a sealed assembly, able to exert the initial plug function, with the corresponding dart.

Above cited EP 0 167 285 pertains to that category, in that it describes a tubular section placed inside the casing. Two plugs are contained in it with a central hole in which darts travel and cooperate with sealing means.

These various means are particularly complex, and furthermore are specific, so that standard plugs, generally operated in surface drilling techniques, cannot be used with a sub-sea head.

In addition, each dart remains adapted to the corresponding plug and constitutes a technical element with a relatively high cost, but with a single utilisation.

The presence of a dart on each plug, on the other hand, causes a problem for the subsequent drilling operation which necessarily has to be performed to start drilling again after the cementing

operation.

These various problems bear an economical aspect, in that they considerably increase the cost of a drill, and mostly generate drilling difficulties which sometimes cannot be solved.

The present invention aims at overcoming the above inconveniences by proposing a new launching equipment for cementing plugs in sub-sea oil wells or similar.

The object of the invention is to propose an equipment which allows using standard plugs according to the surface drilling and cementing techniques.

Another object of the invention is to propose a simple reliable and strong equipment, which can be operated with the commonly used technical means of sub-sea wells drilling and cementing.

Another object of the invention is to propose an equipment which can be operated so as to recover the remote dart in order to sensibly reduce the operating cost of such an equipment and eliminate the subsequent plug drilling problems.

In order to reach the above objects, the remote launching equipment according to invention, of the type including a dart release system comprising at least one dart and assembled on a drill pipe rising from an installation tool mounted on the internal casing, including a remote launching head provided inside the internal casing characterized in that it comprises :

a launch tube, partly communicating with the inside casing and extending, coaxially with the drill pipe, downwards from the installation tool,

a basket secured at the launch tube bottom part, with a cross section smaller than that of the internal casing, open at its bottom end and containing at least one plug with peripheral lips, axially kept stationary inside the basket by its radially prestressed lips,

a launching device, sliding inside the launch tube and including an axial push rod, which cooperates with the plug, and a piston integral with the rod, axially kept stationary in the tube by a limited strength stopping means and designed for an axial movement, caused by a pressure effect exerted by the arrival of the dart, coming from said release system, at the level of the sliding launching device inside the tube on a limited axial run, to insure expulsion of the plug out of the basket.

Various other characteristics will appear from the above description when referring to the appended drawings illustrating embodiments of the object of the invention which should be taken as non limiting examples.

Fig. 1 is a schematic view of the equipment according to the invention.

Fig. 2 is a schematic longitudinal section illustrating one of the elements constituting the equip-

ment.

Fig. 3 is an axial cross section taken along line III-III of Fig. 1.

Fig. 4 is a longitudinal section representing an enlarged view of a structure detail of Fig. 3.

Fig. 5 is an enlarged partial longitudinal section along line V-V of Fig. 4.

Figs. 6 to 9 are longitudinal sections showing, at a reduced scale, four particular operational phases of the equipment according to the invention.

Fig. 1 schematically illustrates the application domain of the object of the invention. This domain includes drilling and cementing an oil well 1 or similar, starting from a surface S topped by a water height H. As a preferred application, off-shore drilling from a rig 2, as illustrated in dot-dash lines, which can consist of a floating or a fixed platform, of any type, should be quoted.

The drilling phase of such a well 1, when a first casing 3 generally called external casing has been positionned, implies an internal casing 4 which limits, with the above and/or the well, a ring shaped gap or annulus 5 to be cemented. The object of the invention more particularly aims at allowing a remote control, from platform 2, of this cementing operation.

The plug remote launching equipment according to the invention includes a remote launching head 6 hanging, inside the internal casing 4, from an installation tool 7 mounted on a casing hanger 8 of the internal casing 4, from the external casing 3. The installation tool 7 consists of a ring shaped part which is adapted, by known means, at the end of a drill pipe 9 linked to its platform 2 in order to bear, at its portion emerging from the water height and inside platform 2, a release system for one or several darts.

Fig. 2 illustrates an embodiment of system 10 comprising a body 11 limiting a cylindrical chamber 12 designed for being linked through several fittings with at least one pressurized fluid supply circuit 13. Such a circuit 13 can be connected, although not represented in Fig. 2, with several circuits supplying various fluids, which generally are used for oil wells cementing, as known in the art.

When the equipment is operated according to the invention to perform a cementing operation implying the launching of two successive plugs, generally named bottom plug and top plug, the chamber 12 contains therein two darts 14a and 14b respectively designated as bottom plug launching dart and top plug launching dart. The darts 14a 14b are built in a matter well known in the art to include a body 15 with deformable peripheral lips 16 which are radially stressed to cooperate with chamber 12, in order to establish a peripheral seal between the

latter and the body 15. Preferably, each dart 14 includes a percussion head 17 and a sealing rear buffer 18.

The darts 14a and 14b are axially kept stationary inside chamber 12 while being separated from one another by means of retractable stopping devices 19a and 19b which can be of any, hand or power operated, suitable type.

In the illustrated example according to which chamber 12 includes two darts, three fittings 20, 21, 22 are provided for connection with circuit 13 by means of three taps 23, 24 and 25. Fitting 20 opens into chamber 12, below dart 14a, fitting 21 between the latter and dart 14b, and fitting 22 on top of the latter.

For the mud circulating operation, taps 24 and 25 are closed and tap 23 is open to allow introducing muds or similar inside the oil well through fitting 20.

Obviously, such cementing or drilling techniques could imply a system 10 including a different number of darts, for instance one or three. In the latter case, chamber 12 would include four connection fittings with circuit 13.

Figs. 3 and 4 show the remote launching head, generally designated by numeral 6, in a more detailed manner. Such a head includes a launch tube 30 fixed on the installation tool 7 to extend downwards by being disposed coaxially with the drill pipe 9 inside the internal casing 4. The length of launch tube 30 is a multiple of the elementary length of the darts, which possibly can have mutually different lengths.

The launch tube 30 bears, at its bottom end part, a preferably cylindrical basket 31, open downwards, with a diameter smaller than the cross section of the internal casing 4. Basket 31 can be permanently linked with casing 4, in particular by means of holes 32 provided at different levels inside the basket.

Basket 31, which is coaxially disposed with casing 4, is designed to hold plugs 33, for instance two plugs, the bottom plug and the top plug, maintained superposed in contact while being kept stationary by radial stress. Plugs 33 are of a type used in the surface cementing techniques and generally include a body 34 provided with an external coating which forms resiliently deformable peripheral lips 35. The plugs are axially maintained in the basket by prestressing lips 35.

Plugs 33 are of standard type, i.e. identical to those used in corresponding surface cementing techniques.

The number of plugs 33 is related to the number of darts 14 and the axial length of each plug 33 is chosen in matching relation with the darts length. Preferably, the plugs 33 all have the same axial length, which is equal to the length of the darts 14.

It obviously should be considered that the example according to Fig. 3 illustrates the operation of a basket 31 adapted to hold one bottom plug 33a and one top plug 33b. Obviously, according to the technique to be developed, the basket 31 can be designed to include either one single plug 33, or, for instance, three plugs 33.

More particularly, when operating a basket 33 designed to hold at least two plugs, as in the example illustrated in Figs. 3 and 4, the launching head 6 includes a remote launching device 36, telescopically mounted inside the launch tube 30. The remote launching device 36 includes a piston 37 provided with a dart positioning boss and extending, opposite to the latter, by means of a push rod 38, the end part of which 39 cooperates with the top plug 33b.

The remote launching device 36 is axially kept stationary in a waiting position, inside the launch tube 30, by limited mechanical strength stopping means 40. These means 40 may consist of shearing type screws, passing across the wall of the launch tube 30 to cooperate with the peripheral groove 41 formed in piston 37. The position of the members 40 is so determined as to match the maximal retractable position of the push rod 38 in which the end part 39 cooperates with the plug 33b arranged in axial contact with plug 33a, totally retracted inside the basket 31.

The launching device 36 is designed, as appears from the following explanation, to control the successive expulsion of plugs 33a 33b in relation to the basket 31. For this purpose, two limited strength stopping means 40a and 40b are provided on the launch tube to exert a function of keeping the rod 38 stationary in an initial operating position, as illustrated in Fig. 3, and in an intermediate position. If basket 31 is designed to hold three plugs 33, a third stage 40 of limited strength stopping means is provided on tube 30. In all cases, the end part 30₁ of tube 30 includes an internal rim 42 which forms an abutment for the end of run of piston 37.

The axial interval between two stopping means stages 40 and/or the ring 42, is provided in relation with the axial length of the plugs 33. In the present case, this length is equal to the length of the plugs 33, which in its turn equals that of darts 14.

Passages 43 are formed in the launch tube 30, just above the top position of piston 37. Passages 43 are designed to allow fluids, pumped from the surface, the flow towards the inside of casing 4 by passing through the ring shaped gap or annulus between inside casing 4 and the outside of basket 31.

Passages 43 are formed at the basis of a bore or chamber 45 with a carefully machined wall, formed in the top part of the launch tube 30 and

designed for sealing with the seals or buffers 18 of darts 14. The diameter of the bore 45 is slightly smaller than all the diameters which can be met, starting from system 10 on, so that the buffers 18 only are really biased into bore 45 where they arrive in a perfect shape. The axial length of the bore 45 is, at least, equal to that of a dart 14.

Pressure balancing holes 46 also are formed in the launch tube 30, between the basis of the latter and the passages 43, so that no strength is exerted on the launching device 36 except as caused by the thrust of darts 14a and 14b, as explained herebelow.

Axial pressure balance grooves 47 also are provided for the same purpose in the ring 42.

When two plugs 33 are used, the cooperation between the end portion 39 of push rod 38 and the top plug 33b is insured by means of the self unlocking linking member 50 (Fig. 5). Such a member 50 includes a release rod 51, slidably mounted inside push rod 38. This release rod 51 is kept stationary in a stable position and includes a butt 52 engaged inside the end portion 39 to control the radial extension of the resiliently retractable locking fingers 53, housed in the end portion 39, which constitute the adaptation nose in the complementary housing 54 formed on the top of top plug 33b. In the radial extension position, fingers 53 are engaged in a matching groove inside housing 54.

The release rod 51 is kept stationary in a stable position, either simply by gravity or by means of a pin 55 passing through the launch tube 30, as appears from Fig. 5. Pin 55 is of the shearing pin type and has a smaller mechanical strength than the stopping means 40b. Preferably, the release rod 51 includes a head 56 with two pins 57 passing through axial oblong guiding holes 58 formed in the push rod 38. The pins 57 are externally projecting out of the push rod 38, so that they can cooperate with the abutment rim 42 as explained hereafter.

For the purpose of a cementing operation, the remote launching equipment described above is operated as follows.

When the bottom plug 33a must be launched, starting with the conditions illustrated in Fig. 3, tap 23 is closed, tap 24 is open, so that circuit 13 supplies a pressurized fluid into that portion of chamber 12 limited by darts 14a and 14b. Such a fluid can be a cementing mixture of any known composition.

The retractable stopping device 19a is retractably controlled to release dart 14a which is propelled inside the drill pipe 9 by the fluid pressure which insures its propagation. Dart 14a is then lead to engage inside chamber 45 where a seal is established by the rear buffer 18.

Dart 14a is brought into contact with piston 37, so as to trigger the operation of the launching device 36. From that position, as illustrated in Fig. 6, the sealing buffer 18, which exerts its function with the chamber 45, blocks the circulation of the fluid through the holes 43, which creates a pressure increase upstream of the dart. The fluid pressure inside the drill pipe 9 then rises until it reaches the triggering threshold of the limited strength stopping means 40a.

When the triggering of means 40a has been effected, the dart 14a, under effect of the pressure developed upstream in the drill pipe, pushes the launching device 36. The rod 38 pushes top plug 33b which expulses plug 33a out of basket 31. The expulsion of bottom plug 33a, as illustrated in Fig. 7, is effected when the launching device 36 reaches the intermediate stable position caused by the stopping means 40b provided, by structure, to oppose a higher strength than the stopping means 40a do, in order to allow differentiating at the time of surface pressure control. In this position, pins 57 are disposed close to the rim 42.

As visible in Fig. 7, the expelling of the bottom plug 33b out of basket 31 releases the prestress imposed upon the peripheral lips 35 which widen out to cooperate with the internal wall of casing 4. In this position, the dart 14a uncovers the transfer passages at the basis of chamber 45, so that the pressurized fluid fills the internal casing 4 and insures the launching and propulsion of bottom plug 33a which has to scrape and clean the internal surface of casing 4 and prevent any mixture of the fluids.

At the end of the run inside casing 4, bottom plug 33a insures a tight closure, so that the fluid pressure in casing 4 increases until it causes a perforation of lid 60 which closes plug 33a, as is well known in the art.

When the desired quantity of cementing fluid has been pumped, the operator closes tap 24 and opens tap 25 after he has released the retractable stopping device 19b. A propelling fluid is delivered into circuit 13 to propel dart 14b, the top lips 16 of which insure a cleaning of chamber 12 and drill pipe 9. Dart 14b then enters chamber 45 to contact dart 14a which has to trigger, for the second time, the operation of launching device 36. The propelling fluid pressure increases until it causes the rupture of the second stage stopping means 40b to release the axial sliding of device 36, as illustrated in Fig. 8. Push rod 38 expels plug 33b out of basket 31, which causes, as illustrated in Fig. 9, the various lips to widen out in succession.

At the beginning of this axial movement, pins 57 abut against rim 42. The axial sliding of rod 38 causes the rupture of pin 55 and is operated without the releasing rod, maintained in axial position,

accompanying it. The axial movement of push rod 38 consequently causes the relative retraction of butt 52, so that fingers 53 resiliently retract to cause automatic unlocking of butt 52 from housing 54.

At the end of the expulsion, dart 14b uncovers the passages 43 of chamber 45, so that the fluid, transferred from the drill pipe and launch tube 30 towards internal casing 4, takes along top plug 33b launched from internal casing 4.

As appears from above, the equipment according to the invention allows a control of the launching of a plug, being in a waiting position at the entrance of the drill well, remotely from the rig from which the dart releasing system operates. Such a launching is performed in a precise manner for each plug, due to the controllability of an effective launching through an appreciation of the pressure peak corresponding to the ruptures in succession of stopping means 40a and 40b.

Another advantage of the equipment results from the simple production and assembling, resulting from the initial assembling under prestress of plugs 33 inside basket 31, the diameter of which is smaller than that of casing 4. This allows eliminating the frictions imposed upon the lips in the traditional assemblies.

An additional advantage of the invention resides in the fact that the plugs used are of the same design as those used in surface cementing techniques. cf EP-A-377 255.

An additional advantage resides in the fact that darts 14 remain included in launch tube 30 and consequently can be recovered for a new use.

Claims

1. Equipment for remote launching of plugs (33) for cementing sub-sea drilled wells (1), of the type comprising, starting from the bottom, a first casing (3) sunk into the well to emerge from the bottom, a casing hanger (8) mounted on the first casing, an internal casing (4) hanging from the hanger, a ring shaped installation tool (7) mounted on the hanger, a drill pipe (9) extending upwards from the installation tool to emerge from the water and be attached to a working structure or rig (2), a launching system (10), mounted onto the drill pipe and containing at least one launcher or dart (14), axially held by a retractable stopping device (19) and at least one plug (33) kept stationary inside the internal casing while it waits for its percussion launching by the cementing head dart, including a remote launching head (6) provided inside the internal casing (4) and characterized in that it comprises:

a launch tube (30), partly communicating

with the inside casing and extending, coaxially with the drill pipe, downwards from the installation tool,

a basket (31) secured at the launch tube bottom part, with a cross section smaller than that of the internal casing, open at its bottom end and containing at least one plug (33) with peripheral lips (35), axially kept stationary inside the basket by its radially prestressed lips,

a launching device (36), sliding inside the launch tube and including an axial push rod (38), which cooperates with the plug, and a piston (37) integral with the rod, axially kept stationary in the tube by a limited strength stopping means (40) and designed for an axial movement, caused by a pressure effect exerted by the arrival of the dart, coming from said release system, at the level of the sliding launching device inside the tube on a limited axial run, to insure expulsion of the plug out of the basket.

2. Equipement according to claim 1, characterized in that:

- the dart release system (10) includes at least two darts (14a, 14b),
- the basket (31) contains at least a bottom plug (33a) and a top plug (33b) kept stationary in mutual contact and being mutually superimposed,
- the launching device (36):
 - . is linked through a self unlocking linking system (39) with the top plug,
 - . is associated with at least two stages (40a, 40b), of limited strength stopping means,
- the launch tube (30) includes transfer passages (43) located just above the first stage.

3. Equipment according to claim 2, characterized in that the limited strength stopping means stages (40) are mutually spaced by an axial distance equal to the respective length of the plugs (33), which in turn is related to the dart length (14).

4. Equipment according to claim 2 or 3, characterized in that the stopping means, at each successive stage, exert a strength which grows from the launch tube top to its bottom.

5. Equipment according to any of claims 2 to 4, characterized in that the first stopping means stage is located at an axial distance, from the launch tube top end, at least equal to a dart length.

6. Equipment according to claim 5, characterized in that the launch tube comprises, between the top end and the transfer passages (43), an axial bore defining a sealed sliding chamber (45) for the dart(s). 5
7. Equipment according to claim 2, characterized in that the self unlocking linking member (40) includes a release rod (51) slidably mounted inside the push rod (38), stationarily kept in position and externally forming a butt (52) controlling the extension of the resiliently retractable locking fingers (53) born by the assembling nose (40) which butt is mounted on the push rod (38) to cooperate with the complementary housing (54) formed in the top plug (33b). 10 15
8. Equipment according to claim 7, characterized in that the releasing rod (51) includes, at its top part, projecting pins (57) guided in and passing through axial oblong holes (58) of the push rod (38) and able to butt cooperate with the rim of a ring (42) formed by the bottom end part of the launch tube (30). 20 25
9. Equipment according to claim 1, characterized in that the tube (30) includes equal distribution holes formed between the passages (43) and the basket. 30
10. Equipment according to claim 8 or 9, characterized in that the launch tube (30) includes, at its basis, axial equal distribution grooves formed in the ring (42). 35

Patentansprüche

1. Vorrichtung zum fernbedienten Auswerfen von Stopfen (33) zum Zementieren von Untersee-Bohrschächten (1), welche, beginnend vom Boden umfaßt: ein erstes Gehäuse (3) welches so weit in den Schacht abgesenkt ist, daß es aus dem Boden herausragt, eine Gehäuseaufhängung (8), die an dem ersten Gehäuse angebracht ist, ein inneres Gehäuse (4), welches von der Aufhängung hängt, ein ringförmiges Montagegerät (7), welches auf die Aufhängung montiert ist, ein Bohrröhr (9), welches sich vom Montagegerät so weit nach oben erstreckt, daß es aus dem Wasser herausragt, und welches an einer Arbeitsstruktur oder einem Arbeitsgestell (2) befestigt ist, ein Auswerfsystem (10), welches auf das Bohrröhr montiert ist und wenigstens einen Auswerfer oder Pfeil (14) enthält, der axial durch eine zurückziehbare Stoppeinrichtung (19) gehalten wird, und wenigstens einen Stopfen (33), welcher innerhalb 40 45 50 55

des inneren Gehäuses stationär festgehalten wird, während er auf seinen Stoß-Auswurf durch den Zementierkopf-Pfeil wartet, wobei sie einen innerhalb des inneren Gehäuses (4) vorgesehenen Fernbedienungs-Auswerfkopf (6) aufweist, dadurch **gekennzeichnet**, daß sie umfaßt:

ein Auswerfrohr (30), welches teilweise mit dem inneren Gehäuse in Verbindung steht und welches sich coaxial zum Bohrröhr vom Montagegerät aus nach unten erstreckt, einen am unteren Teil des Auswerfrohrs befestigten Korb (31), dessen Querschnitt kleiner als der des inneren Gehäuses ist, der am unteren Ende offen ist und wenigstens einen mit Umfangslippen (35) versehenen Stopfen (33) enthält, der innerhalb des Korbes durch seine radial vorgespannten Lippen in axialer Richtung stationär gehalten wird, eine Auswerfeinrichtung (36), welche innerhalb des Auswerfrohrs verschiebbar ist und eine axiale Druckstange (38), die mit dem Stopfen zusammenwirkt, sowie einen mit der Stange integrierten Kolben (37) umfaßt, der im Röhr durch eine Stoppeinrichtung eingeschränkter Festigkeit (40) axial stationär gehalten wird und für eine Axialbewegung ausgelegt ist, die durch eine Druckwirkung verursacht wird, welche infolge der Ankunft des von dem Auslösesystem kommenden Pfeiles im Bereich der sich verschiebenden Auswerfeinrichtung innerhalb des Rohrs über einen begrenzten Axialweg ausgeübt wird, so daß ein Ausstoßen des Stopfens aus dem Korb erfolgt.

2. Vorrichtung nach Anspruch 1, dadurch **gekennzeichnet**, daß:

- das Pfeilauslösesystem (10) wenigstens zwei Pfeile (14a, 14b) umfaßt,
- der Korb (31) wenigstens einen unteren Stopfen (33a) und einen oberen Stopfen (33b) enthält, die stationär in gegenseitigem Kontakt gehalten werden und übereinander angeordnet sind,
- die Auswerfeinrichtung (36):
 - über ein selbstentriegelndes Verbindungssystem (39) mit dem oberen Stopfen verbunden ist,
 - mit wenigstens zwei Stufen (40a, 40b) von Stoppeinrichtungen eingeschränkter Festigkeit zusammenwirkt,
- das Auswerfrohr (30) Durchtrittsöffnungen (43) aufweist, die direkt oberhalb der ersten Stufe liegen.

3. Vorrichtung nach Anspruch 2, dadurch **gekennzeichnet**, daß die Stoppeinrichtungsstufen (40) eingeschränkter Festigkeit voneinander

der einen axialen Abstand haben, welcher gleich der jeweiligen Länge der Stopfen (33) ist, die ihrerseits auf die Länge der Pfeile (14) abgestimmt ist.

4. Vorrichtung nach Anspruch 2 oder 3, dadurch **gekennzeichnet**, daß die Stoppeinrichtungen in jeder der aufeinanderfolgenden Stufen eine Festigkeit haben, die vom oberen Ende des Auswerfrohrs zu seinem unteren Ende hin zunimmt. 10
5. Vorrichtung nach einem der Ansprüche 2 bis 4, dadurch **gekennzeichnet**, daß die erste Stoppeinrichtungsstufe mit einem axialen Abstand vom oberen Ende des Auswerfrohrs angeordnet ist, welcher wenigstens gleich einer Pfeillänge ist. 15
6. Vorrichtung nach Anspruch 5, dadurch **gekennzeichnet**, daß das Auswerfrohr zwischen dem oberen Ende und den Durchtrittsöffnungen (43) eine Axialbohrung aufweist, die eine abgedichtete Verschiebekammer (45) für den (die) Pfeil(e) bildet. 20 25
7. Vorrichtung nach Anspruch 2, dadurch **gekennzeichnet**, daß die selbstentriegelnde Verbindungseinrichtung (40) eine verschiebbar innerhalb der Druckstange (38) angeordnete Auslösestange (51) umfaßt, welche stationär in Position gehalten wird und an ihrer Außenseite ein Kopfende (52) bildet, welches das Ausfahren der elastisch zurückziehbaren, von der Montagenase (40) gehaltenen Verriegelungsfinger (53) steuert, wobei das Kopfende an der Druckstange (38) montiert ist, um mit der im oberen Stopfen (33b) ausgebildeten komplementären Aufnahme (54) zusammenzuwirken. 30 35 40
8. Vorrichtung nach Anspruch 7, dadurch **gekennzeichnet**, daß die Auslösestange (51) an ihrem oberen Teil vorstehende Stifte (57) aufweist, die in axialen Längslöchern (58) der Druckstange (38) geführt sind und durch diese hindurchtreten und dazu ausgelegt sind, mit dem Rand eines Ringes (42) anschlagnmäßig zusammenzuwirken, welcher durch den unteren Endbereich des Auswerfrohrs (30) gebildet ist. 45 50
9. Vorrichtung nach Anspruch 1, dadurch **gekennzeichnet**, daß das Rohr (30) Ausgleichsverteilsöffnungen aufweist, die zwischen den Durchtrittsöffnungen (43) und dem Korb ausgebildet sind. 55

10. Vorrichtung nach Anspruch 8 oder 9, dadurch **gekennzeichnet**, daß das Auswerfrohr (30) an seiner Basis Ausgleichsverteilsnuten aufweist, die in dem Ring (42) ausgebildet sind.

5

Revendications

1. Système à commande à distance pour lancer des bouchons (33) afin de cimenter des puits sous-marins (1), du type comprenant, en partant du bas, un premier tubage (3) enfoncé à l'intérieur du puits de manière à émerger à partir du bas, un dispositif de suspension du tubage (8) monté sur le premier tubage, un tubage interne (4) suspendu au dispositif de suspension, un outil d'installation (7) annulaire monté sur le dispositif de suspension, un tube de forage (9) s'étendant vers le haut à partir de l'outil d'installation de manière à émerger hors de l'eau et à être rattaché à une structure de travail ou tour de forage (2), un système de lancement (10) monté sur le tube de forage et contenant au moins un lanceur ou verrou (14), retenu axialement par un dispositif d'arrêt retractable (19), et au moins un bouchon (33) maintenu stationnaire à l'intérieur du tubage interne durant sa phase d'attente en vue de son lancement par percussion au moyen du lanceur de tête de cimentation incluant une tête de lancement à distance (6) disposée à l'intérieur du tubage interne, et caractérisé en ce qu'il comprend :

un tube de lancement (30) en communication partielle avec le tubage interne et s'étendant, coaxialement par rapport au tube de forage, vers le bas à partir de l'outil d'installation,

un panier (31) fixé sur la partie basse du tube de lancement, avec une section transversale inférieure à celle du tubage interne, ouvert à son extrémité inférieure et contenant au moins un bouchon (33) à lèvres périphériques (35), maintenu stationnaire axialement à l'intérieur du panier au moyen de ses lèvres précontraintes radialement,

un dispositif de lancement (36), coulissant à l'intérieur du tube de lancement et incluant une tige de poussée axiale (38) qui coopère avec le bouchon, et un piston (37) contruit de manière intégrale avec la tige, maintenu stationnaire axialement dans le tube par un moyen d'arrêt à résistance limitée (40) et conçu pour autoriser un mouvement axial causé par un effet de pression exercé par l'arrivée du verrou en provenance dudit système de déclenchement, au niveau du dispositif de lancement coulissant à l'intérieur du tube selon une course axiale limitée de manière à assurer l'expulsion du bouchon à l'extérieur du panier.

2. Système selon la revendication 1, caractérisé en ce que :

- le système de libération du lanceur (10) inclut au moins deux verrous (14a, 14b),
- le panier (31) contient au moins un bouchon inférieur (33a) et un bouchon supérieur (33b) maintenus immobiles en contact mutuel et superposés mutuellement,
- le dispositif de lancement (36) :
 - . est lié au bouchon supérieur par l'intermédiaire d'un système de liaison (39) à déverrouillage automatique,
 - . est associé à au moins deux étages (40a, 40b) de moyens d'arrêt à résistance limitée,
- le tube de lancement (30) inclut des passages de transfert (43) situés juste au-dessus du premier niveau.

3. Système selon la revendication 2, caractérisé en ce que les étages (40) de moyens d'arrêt à résistance limitée sont espacés mutuellement par une distance axiale égale à la longueur respective des bouchons (33), qui est elle-même reliée à la longueur du clapet (14).

4. Système selon la revendication 2 ou 3, caractérisé en ce que les moyens d'arrêt, au niveau de chaque étage successif, exercent une force qui croît à partir du sommet du tube de lancement jusqu'à son extrémité inférieure.

5. Système selon l'une quelconque des revendications 2 à 4, caractérisé en ce que le premier étage de moyens d'arrêt est situé à une distance axiale, à partir de l'extrémité supérieure du tube de lancement, au moins égale à une longueur de verrou(s).

6. Système selon la revendication 5, caractérisé en ce que le tube de lancement comprend, entre l'extrémité supérieure et les passages de transfert (43), un alésage axial définissant une chambre coulissante étanche (45) pour le(s) verrou(s).

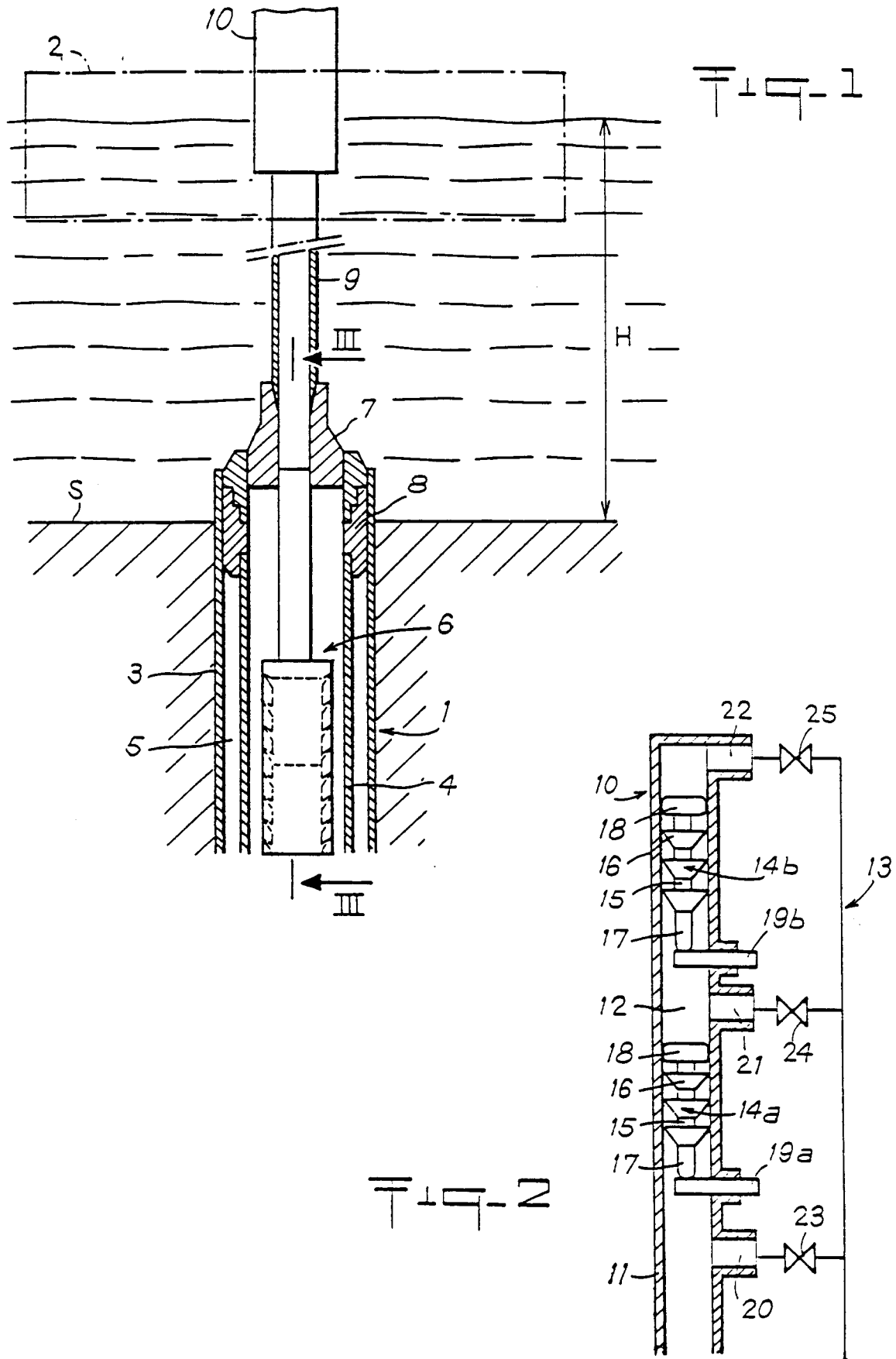
7. Système selon la revendication 2, caractérisé en ce que l'élément de liaison (40) à déverrouillage automatique inclut une tige de libération (51) montée coulissante à l'intérieur de la tige de poussée (38), maintenue immobile en position et formant un aboutement (52) externe commandant l'extension de doigts de verrouillage (53) retractables par résilience, supportés par le nez d'assemblage (40), lequel aboutement est monté sur la tige de poussée (38) de manière à coopérer avec le logement complé-

mentaire (54) formé dans le bouchon supérieur (33b).

8. Système selon la revendication 7, caractérisé en ce que la tige de libération (51) inclut, dans sa partie supérieure, des ergots de projection (57) guidés à l'intérieur et passant au travers de trous oblongs axiaux (58) de la tige de poussée (38), et permettant une coopération par butée avec la bordure d'un anneau (42) formé par la partie extrême inférieure du tube de lancement (30).

9. Système selon la revendication 1, caractérisé en ce que le tube (30) inclut des trous assurant une distribution homogène, formés entre les passages (43) et le panier.

10. Système selon la revendication 8 ou 9, caractérisé en ce que le tube de lancement (30) inclut, des rainures assurant une distribution axiale homogène, formées dans l'anneau (42).



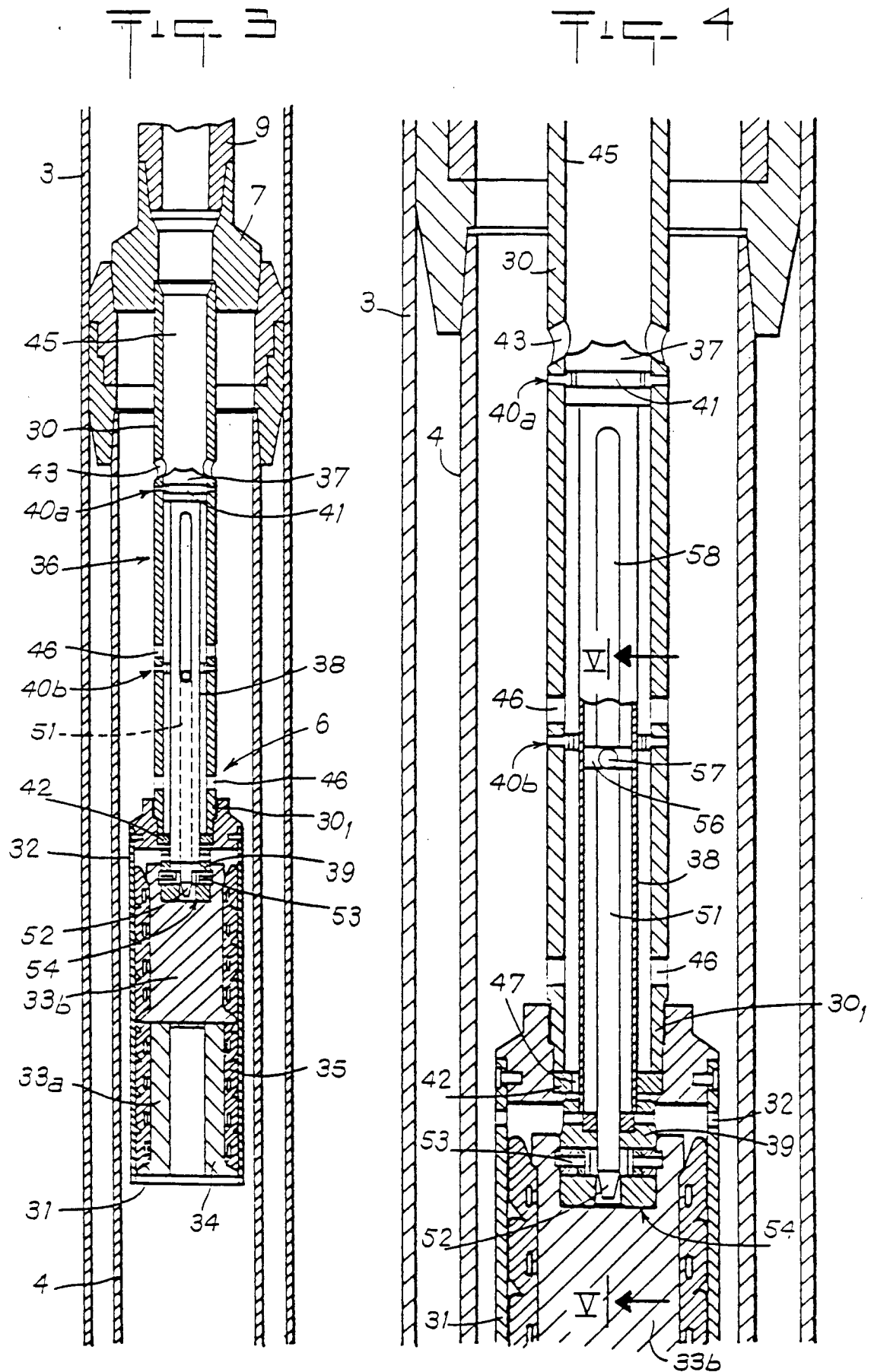


Fig. 5

