

WIRE LINE SAMPLING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a wire line sampling device which, in the drilling of a rotary percussion drill, can be applied to the rotary percussion drill to perform core sampling of strata during drilling.

As a conventional strata sampling method, core sampling of strata has been performed utilizing a spindle-type boring machine and using a wire line core barrel such as a single core tube, double core tube, and etc.

However, this conventional method has had the following deficiencies.

- (1) Locations which do not require strata sampling must also be drilled with the above tools.
- (2) Core errors occur according to the stratum.
- (3) Because attachment/detachment of the drill rod and raising/lowering of the drill rod must be repeated, operation takes an extremely long time and requires a large amount of labor.
- (4) The drill progress rate is extremely bad in a drill hole made by a spindle-type boring machine, so that although strata core sampling is performed it requires a large amount of time and expense.
- (5) Since the rotary percussion drill is subjected to

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extremely large shocks due to blows, it is extremely difficult to insert a wire line sampling device into a rotary percussion drill. For that reason in the prior art a sampling device in which the wire line sampling device is inserted in a rotary percussion drill has not yet been proposed.

SUMMARY OF THE INVENTION

The present invention was devised in light of the above situation, and has as its first object to provide a wire line sampling device applied to a rotary percussion drill which can sufficiently withstand percussion shocks.

Also, in those rotary percussion drills which utilize gravity for inserting the wire line sampler, when drilling horizontally gravity does not work and insertion of the wire line sampler is not possible.

The present invention has as its second object to provide, in light of the above points, a wire line sampling device which makes possible insertion of a wire line sampler utilizing the introduced pressure of a drilling fluid in horizontal drilling using a rotary percussion drill.

Further, in drilling operations by means of a rotary percussion drill, there are cases where various responses due to other changes in strata are required. For example, core sampling is partly required in water extraction etc. In



geological surveys it is necessary to measure the inclination and azimuth of strata. Where local drilling hindrances such as spring water, escaping water, collapsed strata, etc. occur, it is necessary to carry out foundation improvement work by introducing cement. When accidents within a hole such as the earth sticking to the tools or collapse etc. occur, recovery operations at the bottom of the hole must be carried out. Also, there are strata which do not require the inner cylinder of the drill.

In the prior art, in cases such as the above, for example where partial core sampling is required, the rotary percussion drill is replaced by a special machine according to each of the above cases, such as replacing the rotary percussion drill with a compact sampling device.

For this reason, in drilling operations with the conventional rotary percussion drill, there is the paradox that although the drilling itself is high speed, cases where the above countermeasures are necessary, much labor and time is required.

The present invention has as its third object, in light of the above points, to provide a wire line sampling device which can simply and easily perform the above various types of operations using a rotary percussion drill.

In order to achieve the above objects, the present invention is a wire line sampling device provided with a wire



line sampler incorporated in a drill rod of a rotary percussion drill and an overshoot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein the wire line sampler has a locking coupling provided at its upper end, and an inner cylinder, provided at its tip with a shoe formed from a hard material, concentrically provided at a lower end portion inside an outer cylinder having a drill bit at its lower end, a core tube is inserted into the inner cylinder and an expandable/compressible latch is coupled to the core tube via a coupling member, a sliding tube having a slit in its side surface is coupled to the coupling member so that it is slidable only within a predetermined range, and the latch is positioned within the sliding tube and is continually urged in an opening direction by a latch spring so as to protrude from the slit of the sliding tube and so that its tip abuts a lower end surface of the locking coupling, the sliding tube is slidable within a predetermined range with respect to the latch, the sliding tube and the latch advance integrally, and the latch compresses against the latch spring with the sliding movement of the sliding tube, an engaging member is provided at the upper end of the sliding tube, and the overshoot assembly has a wire line connected thereto at one end and at the other end an engaging portion which engages with the engaging member of the wire line sampler is



provided.

Also, the overshot assembly of the present invention comprises a piston driven by a drilling fluid and an attachable/detachable push head or latch for pushing or engaging the engaging member of the wire line sampler.

Further, the present invention is a wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein an outer cylinder of the drill rod is constructed so that an expanded portion is formed on the inside of a screw connecting portion by connecting a plurality of pipes with screws, and the wire line sampler which is inwardly and outwardly conveyed via the overshot assembly, which fits together with the expanded portion, is inserted into the inside of the outer cylinder, and when the wire line sampler is conveyed to a predetermined position, fixing devices are interactively provided in the outer cylinder and wire line sampler so that the outer cylinder and wire line sampler rotate integrally.

Because the wire line sampler device is incorporated in a rotary percussion drill to perform sampling, compared to drilling by means of a conventional boring machine, the drilling speed is five to six times faster and sampling at



the required depth is possible.

Since the tip of the latch abuts the lower end surface of the locking coupling, the impact in the upward direction of the drill bit can be received by the lower end surface of the locking coupling.

When the engaging member is drawn upward, the sliding tube slides slightly upward and compresses the latch against the latch spring, and engagement with the lower end surface of the locking coupling is released, whereby the wire line sampling device can be drawn upward from the outer cylinder.

Since a shoe formed from a hard material is provided at the end of the inner cylinder, shock due to the drilling of the rotary percussion drill can be sufficiently withstood.

Because the outer cylinder and inner cylinder form a dual-layer cylinder and the core tube is inserted into the inner cylinder and forms a dual tube structure with the inner cylinder, samples can be extracted in a close to natural state. Also because it is a bottom charge type sample outflow is minimal and the extraction rate is high.

When performing horizontal drilling by rotation feeding and impact of the drill rod, a drilling fluid is supplied to the inside of the drill rod and pressure is applied to the piston of the overshot assembly, and the wire line sampler is pushed and the core tube set within the drill rod. The overshot assembly at this time serves as a push head. When



the core tube is set, the overshot assembly is recovered and core sampling performed. Complete filling of the inside of the core tube by the core sample is confirmed by the stroke of the drill being equivalent to a change in the pressure of the drilling fluid or the length of the core tube, whereupon an overshot assembly which has been replaced in the latch is again inserted, the engaging member is engaged by the latch, wire is wound, and the wire line sampler is recovered via the overshot assembly.

Further in a third aspect of the invention, the overshot assembly and wire line sampler which are fitted with an expanded portion are inserted into the outer cylinder in which the expanded portion is formed on the inside of a screw connecting portion by connecting a number of pipes, and the wire line sampler is conveyed inwards to a predetermined position via the overshot assembly. Then, the wire line sampler is fixed to the outer cylinder by fixing devices interactively formed with the outer cylinder and the wire line sampler, and both of these are rotated integrally to be able to perform a predetermined operation.

Upon completion of this operation as well as the fixture of the outer cylinder and the wire line sampler being released, the wire line sampler is conveyed outward from the outer cylinder by the overshot assembly so that another inner tool can be inserted into the outer cylinder and another



operation performed where necessary.

According to the present invention, because core sampling can be performed with fast drilling efficiency, as well as being able to perform strata sampling in a short time and economically, the following effects can be attained.

(1) Because a shoe made of a hard material is provided at the front end of the inner cylinder, impact by drilling with a rotary percussion drill can be sufficiently withstood.

(2) Since it is a dual cylinder type with an outer cylinder and inner cylinder, and the core tube is inserted into the inner cylinder to form a further dual cylinder structure with the inner cylinder, samples are extracted in a state close to their natural state.

(3) Because it is a bottom charge type, outflow of samples is slight, without the lower portions of samples being washed away by drilling fluid, therefore the extraction rate is high.

(4) Since it does not use drilling fluid to maintain the hole, it does not contaminate the environment.

(5) Also, in the second aspect of the invention, since an overshot assembly is inserted in the drill rod of the percussion drill, and the wire line sampler is inserted using the introduced pressure of a drilling fluid, wire line core sampling during horizontal drilling using a perpendicular sampling device is possible, and operational efficiency in



high speed drilling is improved. Also, because a device having a structure which can drill by imposing shock by means of a drilling fluid can be added, improvement of the operating efficiency in cases of difficult-to-drill strata, deep drilling, etc. can be realized.

(6) Further, in a third aspect of the invention, after conveying the wire line sampler to a predetermined position by means of an overshot assembly and fixing it to the outer cylinder, sampling can be performed with both of these rotating integrally.

Also, upon completion of this operation, as well as the fixture of the outer cylinder and the wire line sampler being released, the wire line sampler is conveyed outward by the overshot assembly, and a another inner tool can be inserted into the outer cylinder where necessary and another operation performed, therefore the disadvantage of the prior art wherein the rotary percussion drill is replaced by special device is eliminated and there is the advantage that various types of operations in the prior art can be rapidly performed.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will become better understood with reference to the following description, appended claims and



accompanying drawings, wherein:

FIG. 1 is an upper portion cross-sectional view showing an embodiment of the present invention,

FIG. 2 is a central portion cross-sectional view showing an embodiment of the present invention,

FIG. 3 is a lower portion cross-sectional view showing an embodiment of the present invention,

FIG. 4 is an upper half cross-sectional view of an overshot assembly,

FIG. 5 is a lower half cross-sectional view of an overshot assembly,

FIG. 6 is a partial side view showing an engaging portion,

FIG. 7 is a cross-sectional view showing a second embodiment of the present invention,

FIG. 8 is a cross-sectional view of the second embodiment when a wire line sampler is inserted,

FIG. 9 is a cross-sectional view of the second embodiment when the wire line sampler is recovered,

FIG. 10 is a cross-sectional view of the second embodiment showing a deformation example,

FIG. 11 is a longitudinal cross section of a third embodiment of the present invention during dual tube drilling,

FIG. 12 is a longitudinal cross section of the third



embodiment of the present invention when the wire line sampler is conveyed inward,

FIG. 13 is a longitudinal cross section of the above wire line sampler when it is fixed,

FIG. 14 is a longitudinal cross section of the above wire line sampler when it is conveyed outward,

FIG. 15 is an enlarged view of part of FIG. 13,

FIG. 16 is a cross section along line VI-VI of FIG. 15,

FIG. 17 is a cross section along line VII-VII of FIG. 15,

FIG. 18 is a view along the arrow A of FIG. 15,

FIG. 19 is an enlarged longitudinal cross-sectional view of part of FIG. 12,

FIG. 20 is a longitudinal cross-sectional view showing a deformation example of the third embodiment of the present invention when the wire line sampler is fixed,

FIG. 21 is a longitudinal cross-sectional view of part of FIG. 20 when the wire line sampler is conveyed outward,

FIG. 22 is a cross section along line XII-XII of FIG. 20, and

FIG. 23 is a cross section along line XIII-XIII of FIG. 20.

DETAILED DESCRIPTION OF THE INVENTION

Herebelow, the present invention will be described in



detail with regard to the embodiments show in the drawing.

FIGs. 1 through 3 are cross-sectional views illustrating a first embodiment of the present invention. In these drawings, 1 indicates an outer cylinder of a rotary percussion drill, a drill bit 2 being provided at the lower end thereof.

A wire line sampler 3 is incorporated into the outer cylinder 1 of the rotary percussion drill. This wire line sampler 3 comprises an inner cylinder 4, a core tube 5, a piston member 6, a latch 7, a sliding tube 8 and an engaging member 9 or the like.

The inner cylinder 4 is concentrically provided in the downward direction of the outer cylinder 1, the lower end thereof is connected to a connecting rod 10 by being screwed together, and a thick shoe 4a formed from a material of high hardness is provided at the lower end thereof. In the present embodiment a female thread is provided in the inner peripheral surface of the lower end portion of the inner cylinder 4, and this is attached by threading a male thread provided in the outer peripheral surface of the upper end portion of the shoe 4a. Thereby, the abrasion resistance of the inner cylinder 4 due to the drill bit 2 is improved and the end of the inner cylinder 4 is protected.

The core tube 5 is positioned upwards from the shoe 4a of the inner cylinder 4 and bonded to the inner cylinder 4.



This core tube 5 is regulated at its upper end by a connecting rod 10 and at its lower end by the upper end of the shoe 4a.

The sliding tube 8 is provided concentrically with the outer cylinder 1 upwards of the inner cylinder 4, and the piston member 6 is provided in the sliding tube 8. The lower end of this piston member 6 is elongated downwards from the sliding tube 8 and the connecting rod 10 is connected to the elongated lower end thereof. The sliding tube 8 is slidable with respect to the piston member 6 within a range h in which a stopper step portion 8c provided in an inner wall surface of the sliding tube 8 is stopped at a step portion 6a of the piston member 6, although normally a gap h is maintained by a spring 11 interposed between the sliding tube 8 and the piston member 6.

An expandable/compressible latch 7 is provided at the upper end of the piston member 6. This latch 7 has latch hooks 7a and 7b which are pivoted by a pivot, is normally urged in an opening direction by a latch spring 12, and although the outside of the ends of the latch hooks 7a and 7b abut the inner wall surface of the outer cylinder 1 extracted from a slit 8a provided in the sliding tube 8, when the sliding tube 8 is slid upward they are compressed the sliding tube 8.

In other words, the latch hooks 7a and 7b are provided



in fan shapes opening upward, and upon the sliding tube 8 sliding upward, they are compressed by an inclined surface 8b at the lower end of the slit 8a.

An engaging member 9 is provided at the upper end of the sliding tube h. This engaging member 9 is positioned within a locking coupling 13 provided at the upper end of the outer cylinder 1.

According to the structure of the above embodiment, although shocks during drilling by the rotary percussion drill are transmitted from the drill bit to the shoe 4a, inner cylinder 4, connecting rod 10, piston member 6 and latch 7 and received by the lower end surface of the locking end coupling 13, as shown in FIGs. 4 through 6, upon the overshot assembly 21 being lowered from above and engaging with the engaging member 9 and the wire line sampler 3 being raised, since the sliding tube 8 is moved upward, the latch 7 is compressed, and engagement with the lower end surface of the locking coupling 13 is released, the wire line sampler sampler 3 is raised upwards.

The above overshot assembly 21 has a ring 22 for hanging a wire line such as a hoist for the light in the upper portion thereof as shown in FIGs. 4 to 6 for example, and an engaging portion 23 is provided at the lower end thereof. This engaging portion 23 has pincer plates 24a and 24b corresponding to the above engaging member 9 and pivotably



attached so as to be able to open and close, and continuously urged in the closing direction by a spring 25, whereby upon the overshot assembly 21 being lowered to the inside of the locking coupling 13, the engaging portion 23 automatically fits to the engaging member 9.

However, while incorporating the wire line sampler 3 in the rotary percussion drill and drilling a predetermined drill hole, if core sampling of another stratum is performed and the core sample completely fills the inside of the core tube 5, the overshot assembly 21 which has been raised to the wire line from an upper portion opening of the locking coupling 13 by a hoist is lowered, the engaging portion 23 is engaged with the engaging member 9 of the wire line sampler device 3, the wire line sampler 3 is raised and extracted, and the core in the core tube 5 can be recovered.

Since the wire line sampler 3 can be incorporated in a rotary percussion drill in this manner, core sampling can be performed with drilling efficiency of various levels compared to a conventional spindle-type boring machine. In this regard a drilling efficiency of five to six times of the prior art can be exhibited.

Next a second embodiment of the present invention will be described.

FIGS. 7 through 9 are cross-sectional views showing the second embodiment of the present invention. In these



drawings one indicates the outer cylinder of the rotary percussion drill, a drill bit 2 being provided at the end thereof.

A wire line sampler 3 is incorporated in the outer cylinder 1 of the rotary percussion drill. This wire line sampler 3 comprises an inner cylinder 4, core tube 5, piston member 6, latch 7, sliding tube 8 and engaging member 9 or the like.

The inner cylinder 4 is concentrically provided in a forward position of the outer cylinder 1, the aft end thereof is connected to a connecting rod 10 by being screwed together therewith, and a thick shoe 4a is formed from a hard material is provided at the front end thereof. In this embodiment a female thread is provided in the inner peripheral surface of the front end portion of the inner cylinder core, and is attached by being screwed together with a male thread provided in the aft end portion outer peripheral surface of the shoe 4a. Thereby, the abrasion resistance of the inner cylinder 4 due to the drill bit 2 is improved and the tip of the inner cylinder 4 is protected.

The core tube 5 is positioned behind the shoe 4a in the inner cylinder 4 and bonded to the inner cylinder 4. This core tube 5 is regulated at its rear end by the connecting rod 10 and at its front end by the rear end of the shoe 4a.

Behind the inner cylinder 4, the sliding tube 8 is



concentrically provided with respect to the outer cylinder 1, and the piston member 6 is provided in this sliding tube 8. The front portion of this piston member 6 is elongated forward from the sliding tube 8, and the connecting rod 10 is connected to the elongated tip thereof. Although the sliding tube 8 is slidable with respect to the piston member 6 within a range h in which the stopper step portion 8a provided in the inner wall surface of the sliding tube 8 is stopped at a step portion 6a of the piston member 6, the gap h is normally maintained by the spring 11 interposed between the sliding tube 8 and the piston member 6.

A latch 7 comprising expandable/compressible latch hooks 7a and 7b is provided at the upper end of the piston member 6. These latch hooks 7a and 7b are pivoted by a pivot 70 and urged by a latch spring 12 in direction in which they open. Further, the outer sides of the top ends of the latch hooks 7a and 7b extend beyond the slit 8a provided in the sliding tube 8 and are in contact with the inner wall surface of the outer cylinder 1 but when the sliding tube 8 is slid upward, they are compressed inward by the sliding tube 8.

That is, the latch hooks 7a, 7b are fan-shaped with the rear portions thereof being made to open outward and when the sliding tube 8 is slid rearward, the latch hooks 7a, 7b are compressed inward by the front end face 8b of the slit 8.

Engaging member 9 is provided at the rear end of the



sliding tube 8. The engaging member 9 is positioned within the locking coupling 13 provided at the rear end of the outer tube 1.

In FIG. 8 and FIG. 9, 21 is an overshot assembly, in which a pair of couplings 23 and 24 are attached to a valve shaft 22, a connecting member 25 is screwed into the foremost coupling 24, and a push head 27 (FIG. 8) or a latch case 28 (FIG. 9) is screwed into and fixed to an inner thread portion 26 of the connecting member 25. A pair of latches 30 and 30 are pivoted by a spring pin 29 in the latch case 28. These latches are urged in a direction in which their front end portions are continuously closed by a spring 31. A connecting tube 32 is attached between the couplings 23 and 24 and a rubber piston 33 is installed at the outer periphery of this connecting tube 32.

A drill rod 34 is connected to the locking coupling 13 of the rotary percussion drill, and the first overshot assembly 21 is inserted into the drill rod 34. In the embodiment of Figs. 8 and 9 the drill rod 34 used is for a conventional rotary percussion drill, and although the inner diameter of the drill rod 34 in the connecting portion 35 is compressed, the rubber piston 33 in the inner peripheral surface of the connecting portion 35 is bonded.

FIG. 10 shows a deformation example of the second embodiment, the drill rod 34 being for percussion line wire



use, and because the inner diameter of the drill rod 34 is uniform, the rubber piston 33 is not used in the overshot assembly 21 and is constructed with a ring-shaped piston 35 is inserted in the couplings 23 and 24.

Next the operation of the above embodiment will be described.

When performing horizontal drilling by rotation of the drill rod 34, a drilling fluid is transmitted into the drill rod 34 in the direction of the arrow 36, pressure is applied to the piston rubber 33 or piston 35, and the wire line sampler 3 is pushed via the push head 27 and engaging member 9 to set the wire line sampler 3.

When setting of the wire line sampler 3 is complete, the wire is wound up and the overshot assembly 21 recovered, whereafter the core in the percussion drill is extracted.

When it is confirmed by a change in the pressure of the drilling fluid or by the drill stroke being equal to the length of the core cylinder that the core sample has completely filled the core cylinder 5, the push head 27 of the overshot assembly 21 is replaced in the latch head 28 and re-inserted, and as shown in FIG. 3 the head portion of the engaging member 9 is held by the latch 30 and the wire 37 is wound up, whereby the wire line sampler is recovered. At this time, by pulling the valve shaft 22, the valve 38 is disengaged, the drilling fluid flows into the interior of the

overshot assembly 21, and fluid resistance is eliminated.

Note that in the present invention a device having a structure which can perform drilling by incurring impact by means of a drilling fluid can be added.

Next, a third embodiment of the present invention will be described with regard to FIGs. 11 through 23.

The drawings show a rotary percussion drill in a case where partial core sampling is performed using a wire line sampler, FIG. 11 being a longitudinal cross section during dual tube drilling, FIG. 12 being a longitudinal cross section when the wire line sampler is conveyed inward, FIG. 13 being a longitudinal cross section of the wire line sampler when it is fixed, and FIG. 14 being a longitudinal cross section of the wire line sampler when it is conveyed outward.

In FIG. 11, a drill rod 100 is constructed as a dual tube comprising an outer cylinder 101 and an inner cylinder 102 inserted into the outer cylinder 101, the gap between the outer cylinder 101 and the inner cylinder 102 serving as a through-path for drilling fluid. The outer cylinder 101 comprises an outer tube 103, an extension tube 104, a locking coupling 105, an outer rod 106, an upset rod 107, etc., connected in sequence by screw connections 108, while an outer bit 109 is provided at the front end portion thereof.

Also, an inner bit 111 is provided at the front end of



the inner cylinder 102.

Drilling is performed imposing rotation, feeding and impact on the drill rod 100.

Once the above drilling has reached a predetermined core sampling point, the inner cylinder 102 is removed from the outer cylinder 101, and a wire line sampler 120 serving as the inner tool, an overshot assembly 121 for conveying the wire line sampler 120 inward and outward and an inward conveyor 122 provided between the wire line sampler 120 and the overshot assembly 121 and used only when the wire line sampler 120 is conveyed inward are inserted into the interior of the outer cylinder 101 as shown in FIG. 12. The wire line sampler 120 is conveyed inward to a predetermined position at the front end portion of the outer cylinder 101 by fluid pressure such as air pressure, water pressure, etc. via the overshot assembly 121 and the inward conveyor 122. Then, as well as the wire line sampler 120 being fixed to the outer cylinder 101, the overshot assembly 121 and inward conveyor 122 are recovered and sampling is performed.

FIG. 15 is an enlarged view of part of FIG. 13, and is a longitudinal cross section showing a state wherein the wire line sampler 120 is fixed in the outer cylinder 101. As shown in this drawing, the wire line sampler 120 comprises a sampling head 125, an inner bit 126 at the front end, an inner tube 127 connected the sampling head 125 and the front



end inner bit 126, etc. The sampling head 125, as well as maintaining two slide plates 128 which are movable in the up and down direction in the drawing, maintains a first plunger 129 slidably in its axial direction in the interior, and when the first plunger 129 is inserted between the two slide plates 128 the two slide plates 128 each slide in the up and down directions as shown in FIG. 16 and the vicinity of the outer edges thereof are stopped at a protruding portion 104a of the extension tube 104, whereby the wire line sampler 120 is fixed to the outer cylinder 101. The protruding portion 104a is formed by the end surface of the locking coupling 105.

Further, a piston 130 is fitted in the sampling head 125, and packing 130a is installed around the piston 130. This piston 130 and the first plunger 129 are connected by a spring pin 131, and are integrally movable. As shown by the chain line in FIG. 15, upon drilling fluid pressure being applied to a piston 130A located on the left side inside the locking coupling 105, the piston 130A is moved together with the first plunger 129 to the position indicated by the solid line in the same drawing, the first plunger 129 advances to between the two slide plates 128 as described above, and at the same time that the slide plates 128 are moved, a second plunger 132 is pushed toward the left in the drawing. Then, a shut ring 133 connected by the second plunger 132 and the



spring pin 131 is moved and the exit of the slide plate 128 opens.

Reference number 134 is a spring for continuously maintaining the second plunger 132 and the shut ring 133 at the left side of the drawing. 135 is a valve provided at the front end of the sampling head 125, and is provided for reducing resistance due to fluid when the wire line sampler 120 is conveyed inward. 136 is the fluid spill port thereof. Note that attainment of a predetermined position by the wire line sampler 120 is confirmed by a drop in the pressure of the fluid due to resistance between an inner tube stabilizer 112 and a large diameter portion 127a of the inner tube 127 (refer to FIG. 15 and FIG. 17).

FIG. 19 is a longitudinal cross-sectional view of the overshoot assembly 121 and inward conveyor 122 which serve as a conveying device for conveying the wire line sampler according to the present invention.

Two latches 140 forming the above overshoot assembly 121 stop a dummy spear 122a of the inward conveyor 122, one of the latches 140 being rotatably maintained by a spring pin 141 of the other latch 140, and one end of the rotatable latch 140 being urged upward in FIG. 19 by a spring 142 (so as to hold the dummy spear 122a). A spring holder 144 and a spindle guide 145 connected to the spring holder 144 via a spring 144a are slidably maintained in a latch case 143



connected to the latches 140. A spindle 146 is maintained in the spindle guide 145, and a through hole 146a is formed in the spindle 146. A piston 147 is connected to the spindle 146 and a through hole 147a connected to the through hole 146a is formed in the piston 147.

Also, a coupling 148 is connected to the piston 147, and a through hole 148a connected to the through hole 147a is formed in the coupling 148. A bearing cover 149 covers the coupling 148, and an eye shaft 150 is rotatably maintained by a bearing 149a in the interior of the bearing cover 149. A rope socket 152 is axially installed over the eye shaft 150 so as to be rotatable in a direction perpendicular to the surface of the paper in the drawing by a spring pin. A hole 152a for stopping a rope is formed in the rope socket 152. Note that the length of the above piston 147 is determined so that it extends across two expanding portions 110 and 110 formed in the above outer cylinder 1.

The overshoot assembly 121 is used both where the wire line sampler 120 is conveyed inward and conveyed outward as shown in FIG. 12 and FIG. 14, and when conveyed inward, the drilling fluid is released from the left to the right hand side in FIG. 12 and the overshoot assembly 121 and the wire line sampler 120 are conveyed inward by means of the drilling fluid pressure. When the wire line sampler 120 is being conveyed inward, the plunger 129 enters between the slide



plates 128 and 128 as shown in FIG. 15, and upon the these slide plates contacting the outer cylinder 101, there is the possibility that the wire line sampler 120 cannot be conveyed to the predetermined position. In order to prevent this, the inward conveyor 122, in which a pipe 122b is formed which covers a spear 129a of the plunger 129 and contacts the left end of the sampling head 125 at one end and a dummy spear 122a having the same shape as the spear 129a is formed at the other end, is used, and the latch 140 is stopped at the dummy spear 122a of the inward conveyor 122 and the wire line sampler 120 is conveyed inward via the inward conveyor 122. Reference number 140a is a locking screw of the latch 140.

Note that when the wire line sampler is conveyed inward, the spindle guide 145 and spring holder 144 slide the outer circumference of the spindle 146 leftward against the spring 144a as shown in FIG. 19 to cover the through hole 146a. As a result, the drilling fluid which is at the left side of the drawing cannot pass through the through hole 146a and move in the drilling direction (the right side of FIG. 19). Consequently, inward conveyance of the wire line sampler 120 can be readily performed.

When the wire line sampler 120 is conveyed outward, the latches 140 of the overshot assembly 121 are stopped at the spear 129a of the first plunger 129, a rope R stopped in a hole 152a of the rope socket 152 is pulled toward the left in



FIG. 14 and the first plunger 129 is moved toward the left, and thereby the wire line sampler 120 is conveyed outward from the outer cylinder 101. During this outward conveyance, the drilling fluid which is inside the outer cylinder 101 passes from the through hole 148a of the coupling 148 through the through hole 147a of the piston 147 and the through hole 146a of the spindle 146 and moves in the feeding direction (the right side of FIG. 19), and as a result the wire line sampler 120 can be readily conveyed outward from the outer cylinder 101.

FIG. 20 shows a deformation example of the third embodiment, and illustrates an example where a fixing tool which serves as a fixing device formed in the outer cylinder and wire line sampler of the above embodiment is deformed in a latch form. In this case, in the sampling head 125A, as well as two latches 161 and 161 which are continuously urged in an opening direction by a spring 160 being supported by a shaft 162, a stopping portion 105B for stopping front end portions 106a of the latches 161 is formed in the locking coupling 105A which forms the outer cylinder 100A. Also, in the sampling head 105A, two key plates 163 and 163 are supported by a shaft 164, a spring 165 is inserted between these key plates 163 and 163 and is formed movable in the up and down direction in FIG. 20 and FIG. 22, the outer edge vicinities of the key plates 163 are stopped at a protruding



portion 104a of the extension tube 104 to integrally fix the outer cylinder 101 and the wire line sampler 120A, and the power of the outer cylinder 101 is transmitted to the wire line sampler 120A in the interior to enable integral rotation.

Further, a spear 121B is formed in the front end portion of the overshot assembly 121A. Also, using a pipe, one end of which contacts the left end of the sampling head 125A, and an inward conveyor comprising a latch for stopping the above spear 121B, which are omitted from the drawing, the wire line assembly 120A is conveyed inward to the predetermined position shown in FIG. 20 by the overshot assembly 121A and the inward conveyor.

Where the above wire line assembly 120A is conveyed outward, a stopper plate 161b of a U-shaped latch 161 is stopped at the spear 121B of the overshot assembly 121A as shown in FIG. 21, and the wire line sampler 120A is conveyed outward from the outer cylinder 101A in the same manner as in the previously-described embodiments.

Since the structures of other portions are substantially the same as in the previously-described embodiments, the same reference numbers are used in the drawings and detailed descriptions thereof will be omitted.

Here, as the above-described drilling fluid, a fluid which can prevent the bit filling with earth such as water,



water mixed with bentonite, or air may be used, and where air is used as the drilling fluid, the pressure thereof should be approximately 10kgf/cm² and where water or the like is used, the pressure thereof should be approximately 20 to 30 kgf/cm².

Also, in the above-described embodiments, although a core wire line sampler is given as an example of an inner tool, various types of inner tools may be substituted for this wire line sampler, for example, by inwardly conveying an inner bit, a gyro or other type of measuring device, an air hammer, a bit with nozzle attached or an injection nozzle, a vibrator, a jack or the like to a predetermined position in the outer cylinder, the various types of operations described in the prior art can be rapidly performed with the outer cylinder as is.





What is claimed is:

1. A wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein:

the wire line sampler has a locking coupling provided at its upper end, and an inner cylinder, provided at its tip with a shoe formed from a hard material, concentrically provided at a lower end portion inside an outer cylinder having a drill bit at its lower end;

a core tube is inserted into the inner cylinder and an expandable/compressible latch is coupled to the core tube via a coupling member;

a sliding tube having a slit in its side surface is coupled to the coupling member so that it is slidable only within a predetermined range, and the latch is positioned within the sliding tube and is continually urged in an opening direction by a latch spring so as to protrude from the slit of the sliding tube and so that its tip abuts a lower end surface of the locking coupling;

the sliding tube is slidable within a predetermined range with respect to the latch, the sliding tube and the latch advance integrally, and the latch compresses against the latch spring with the sliding movement of the sliding





tube;

an engaging member is provided at the upper end of the sliding tube; and

the overshot assembly has a wire line connected thereto at one end and at the other end an engaging portion which engages with the engaging member of the wire line sampler is provided.

2. The wire line sampling device of claim 1, wherein the overshot assembly comprises a piston driven by a drilling fluid and an attachable/detachable push head or latch for pushing or engaging the engaging member of the wire line sampler.

3. A wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein:

an outer cylinder of the drill rod is constructed so that an expanded portion is formed on the inside of a screw connecting portion by connecting a plurality of pipes with screws; and

the wire line sampler which is inwardly and outwardly conveyed via the overshot assembly, which fits together with the expanded portion, is inserted into the inside of the outer cylinder, and when the wire line sampler is conveyed to





a predetermined position, fixed devices are relatively provided in the outer cylinder and wire line sampler so that the outer cylinder and wire line sampler rotate integrally.

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ABSTRACT

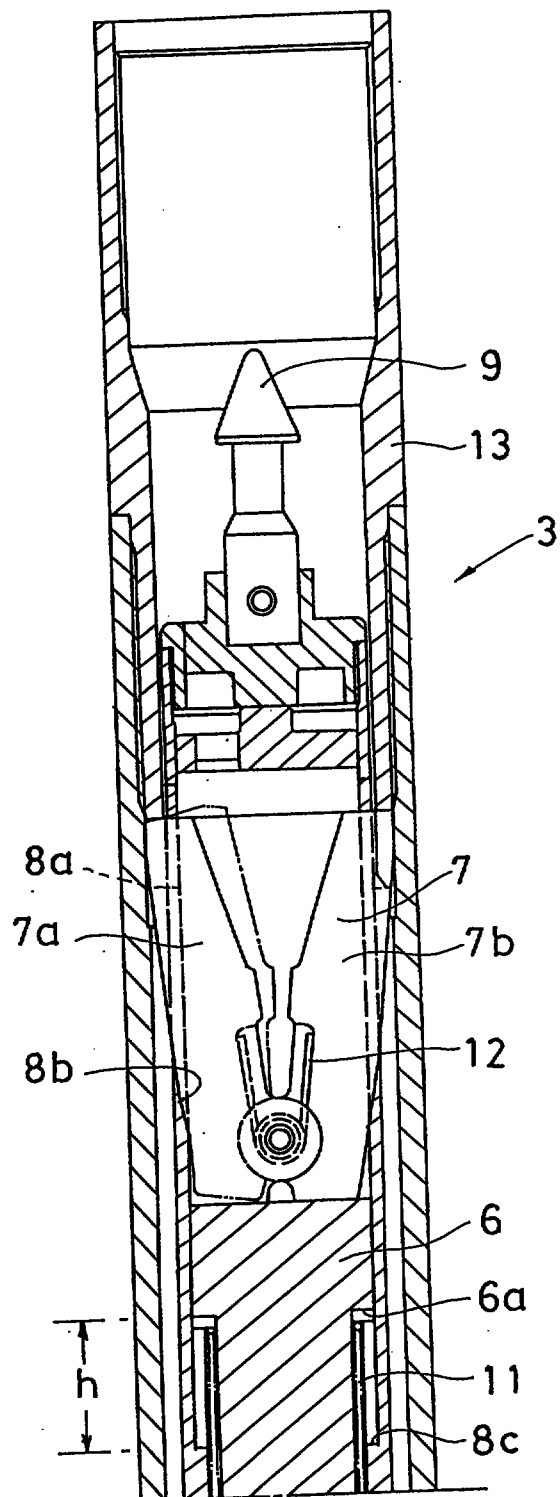
A percussion wire line sampling device applied to a rotary percussion drill which can sufficiently withstand percussion shock is provided. In a wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein the wire line sampler has a locking coupling provided at its upper end, and an inner cylinder, provided at its tip with a shoe formed from a hard material, concentrically provided at a lower end portion inside an outer cylinder having a drill bit at its lower end, a core tube is inserted into the inner cylinder and an expandable/compressible latch is coupled to the core tube via a coupling member, a sliding tube having a slit in its side surface is coupled to the coupling member so that it is slidable only within a predetermined range, and the latch is positioned within the sliding tube and is continually urged in an opening direction by a latch spring so as to protrude from the slit of the sliding tube and so that its tip abuts a lower end surface of the locking coupling, the sliding tube is slidable within a predetermined range with respect to the latch, the sliding tube and the latch advance integrally, and the latch compresses against the latch spring with the sliding movement



of the sliding tube, an engaging member is provided at the upper end of the sliding tube, and the overshot assembly has a wire line connected thereto at one end and at the other end an engaging portion which engages with the engaging member of the wire line sampler is provided.



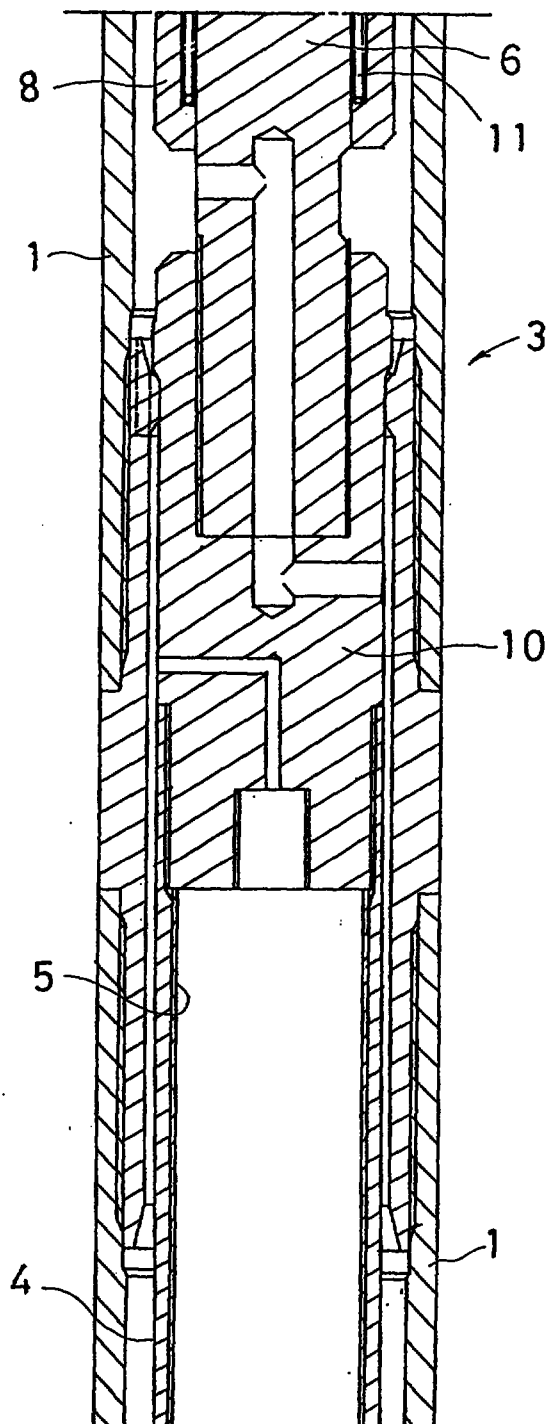
FIG. 1



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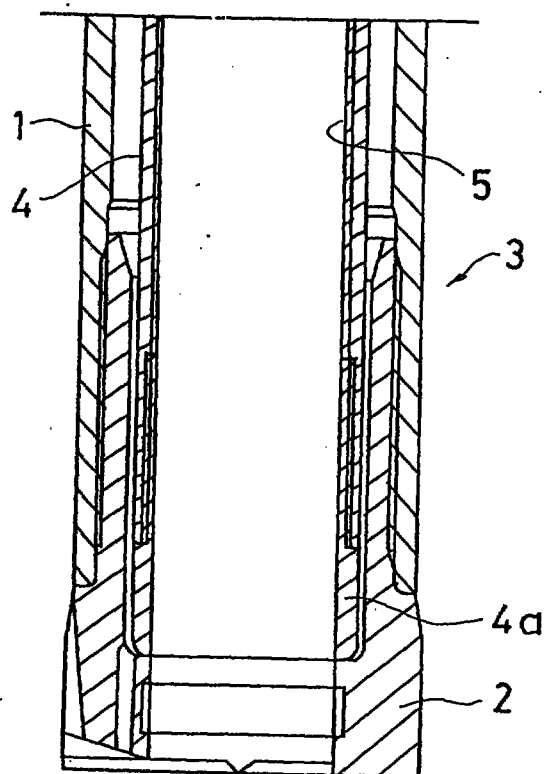
FIG. 2



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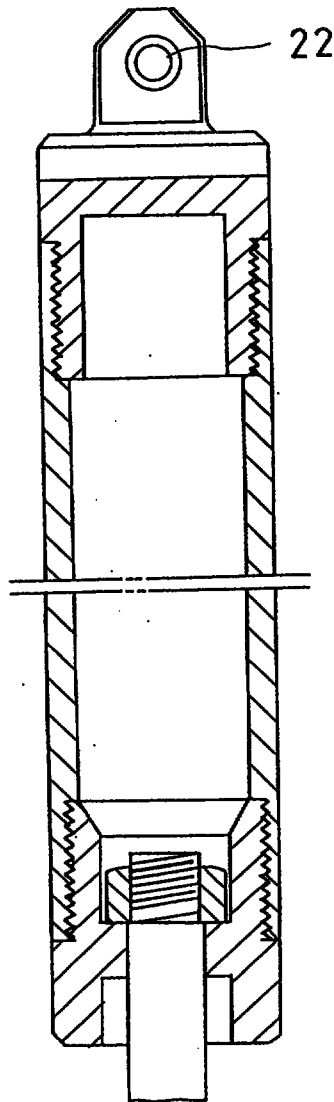
FIG. 3



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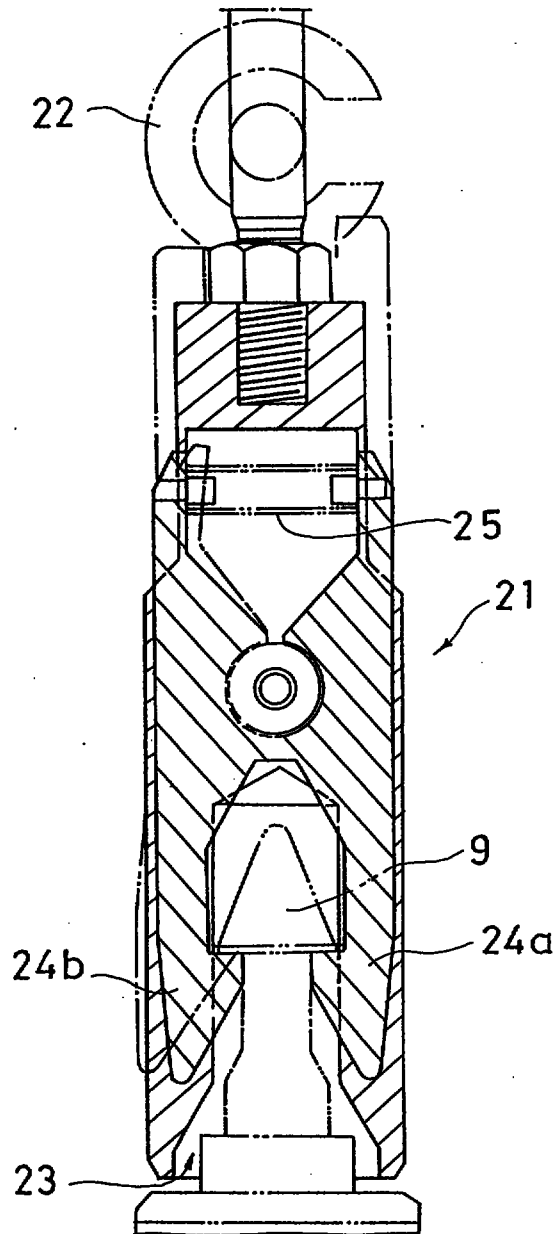
FIG. 4



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FIG. 5



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FIG. 6

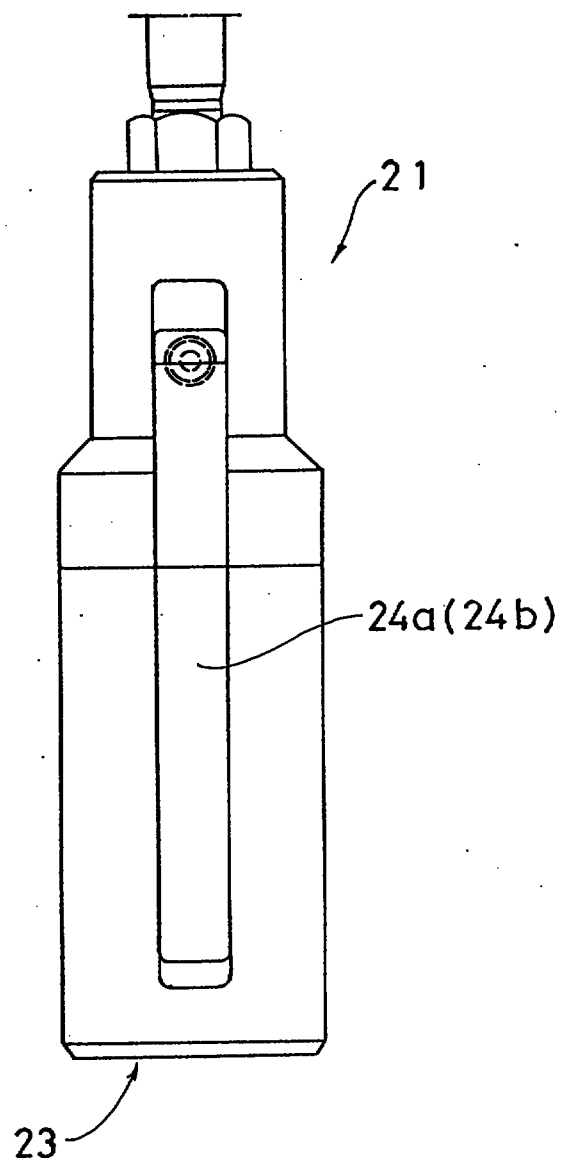
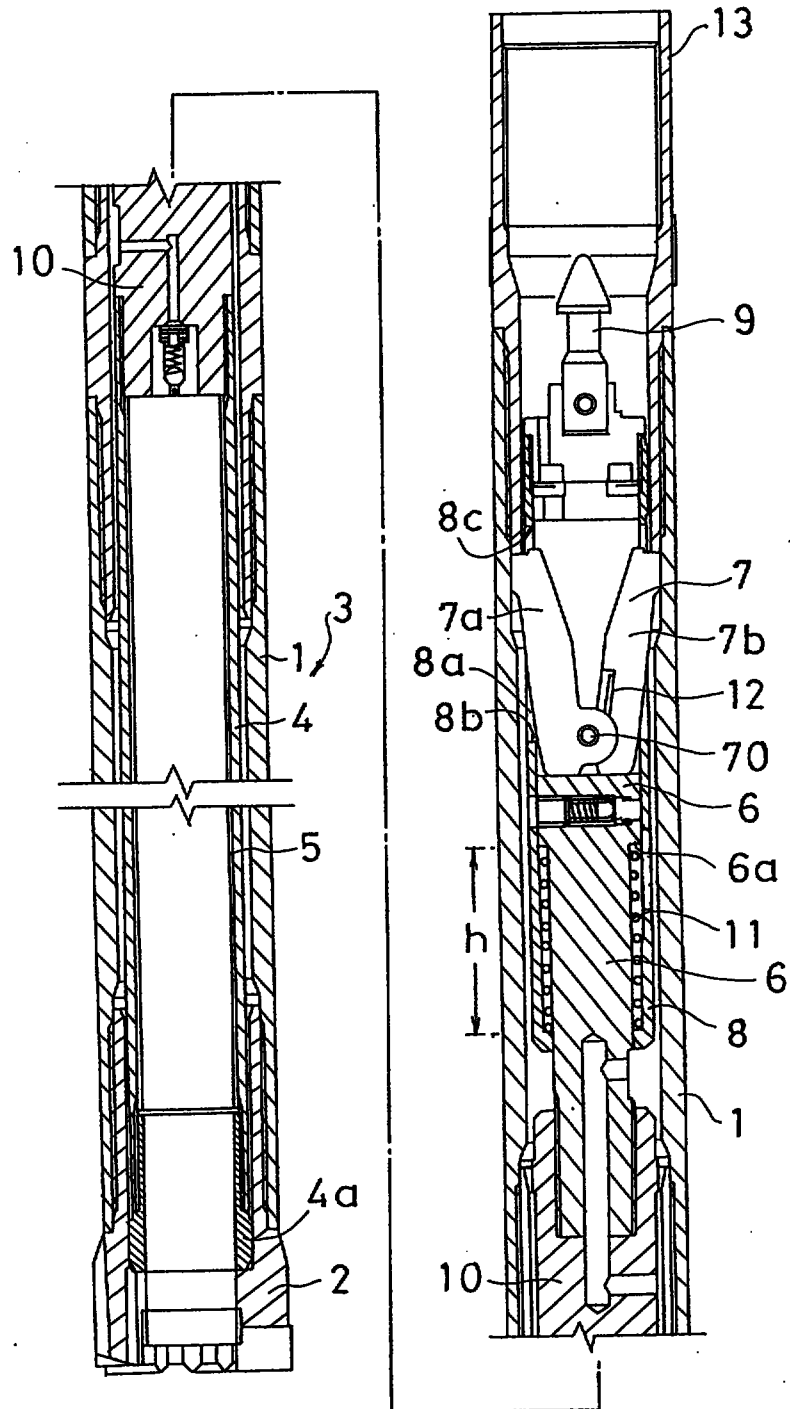


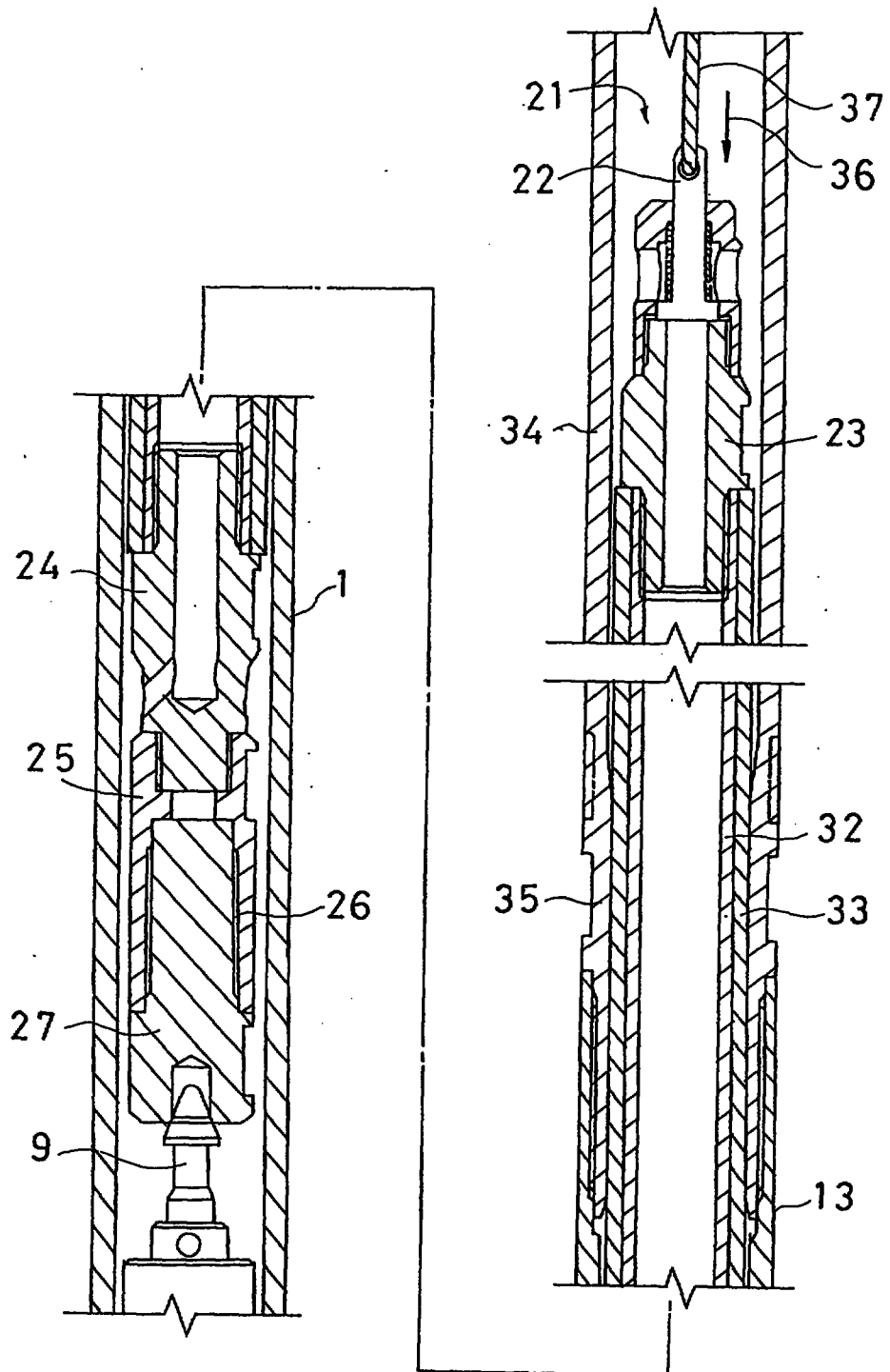
FIG. 7



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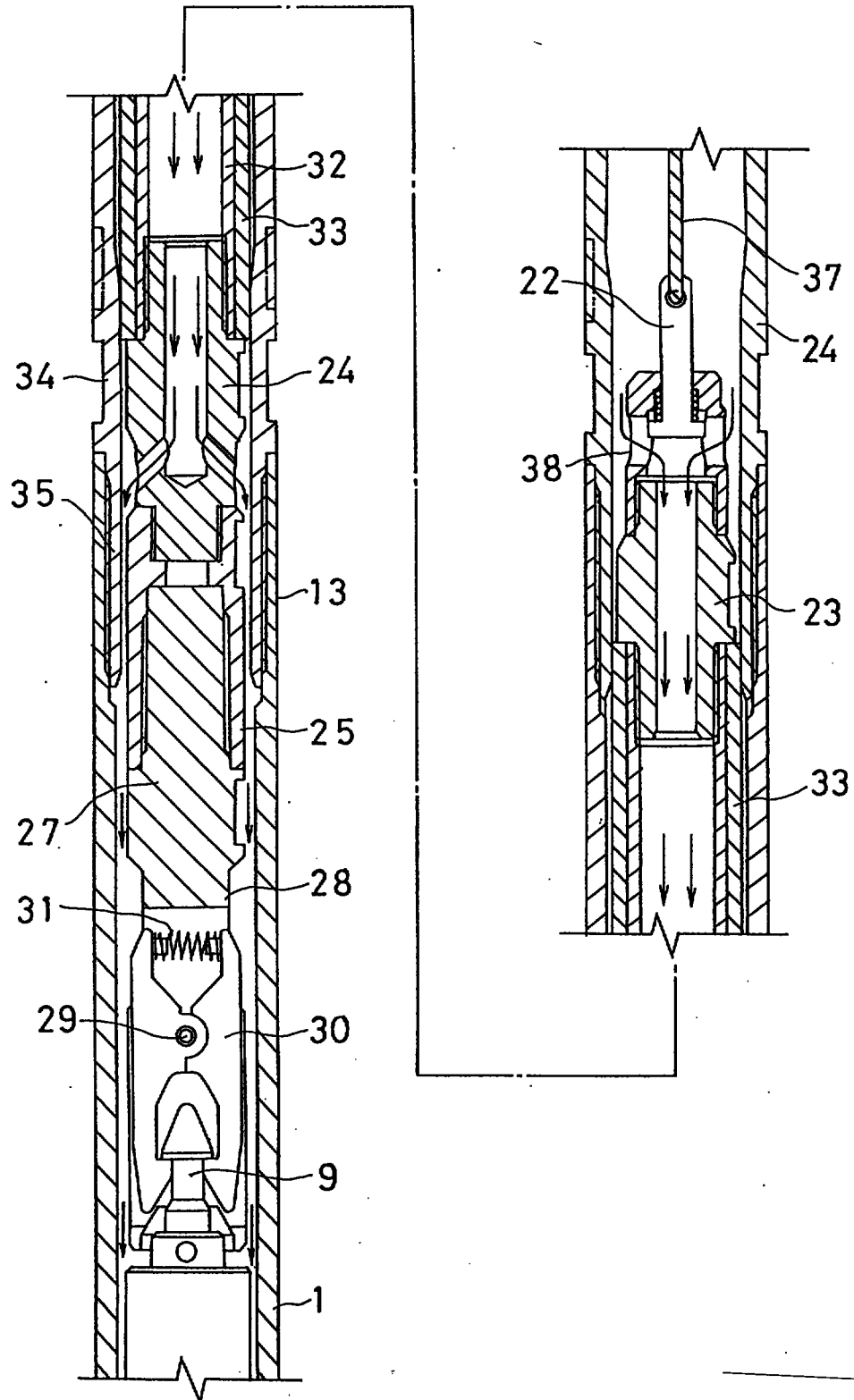
FIG. 8



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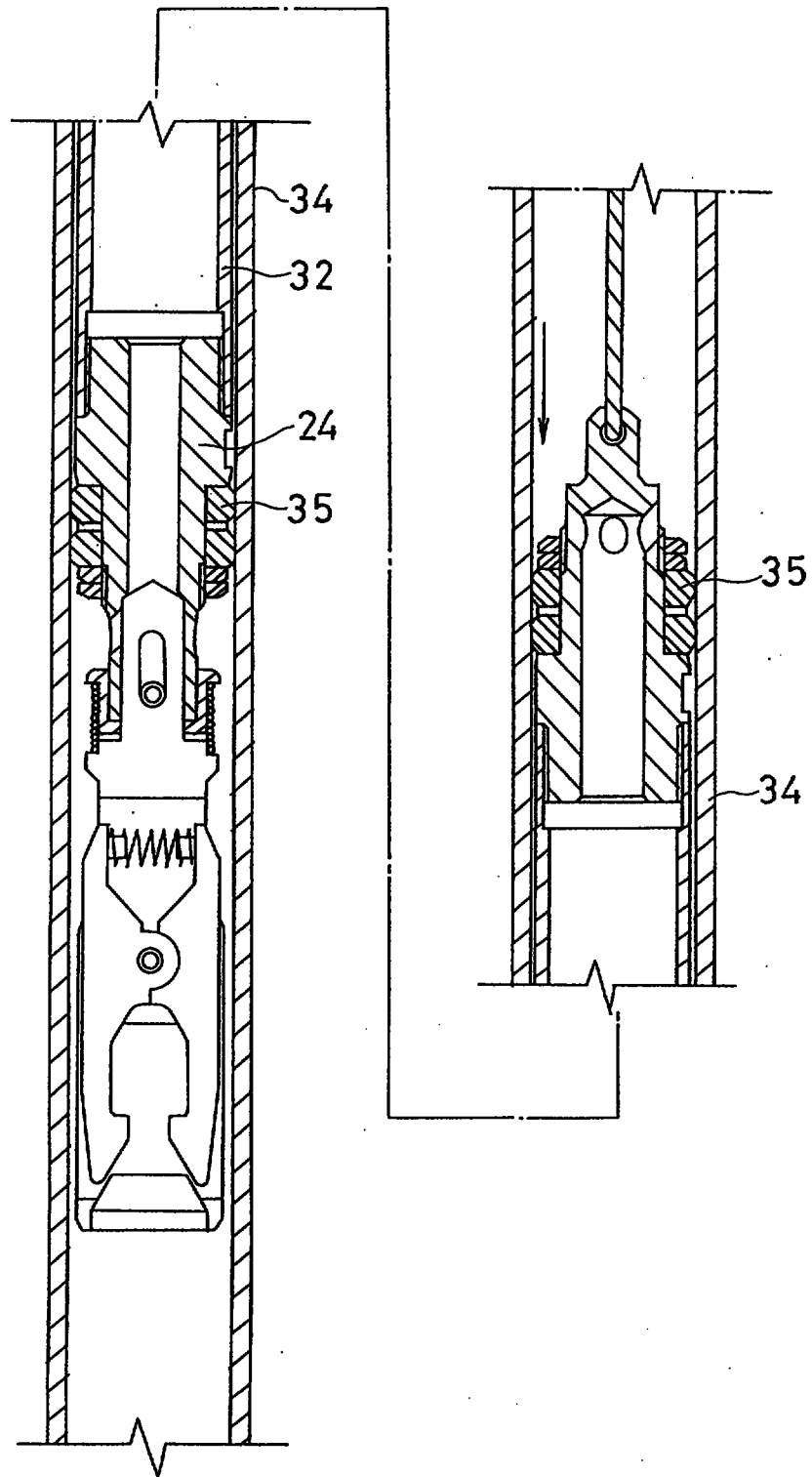
FIG. 9



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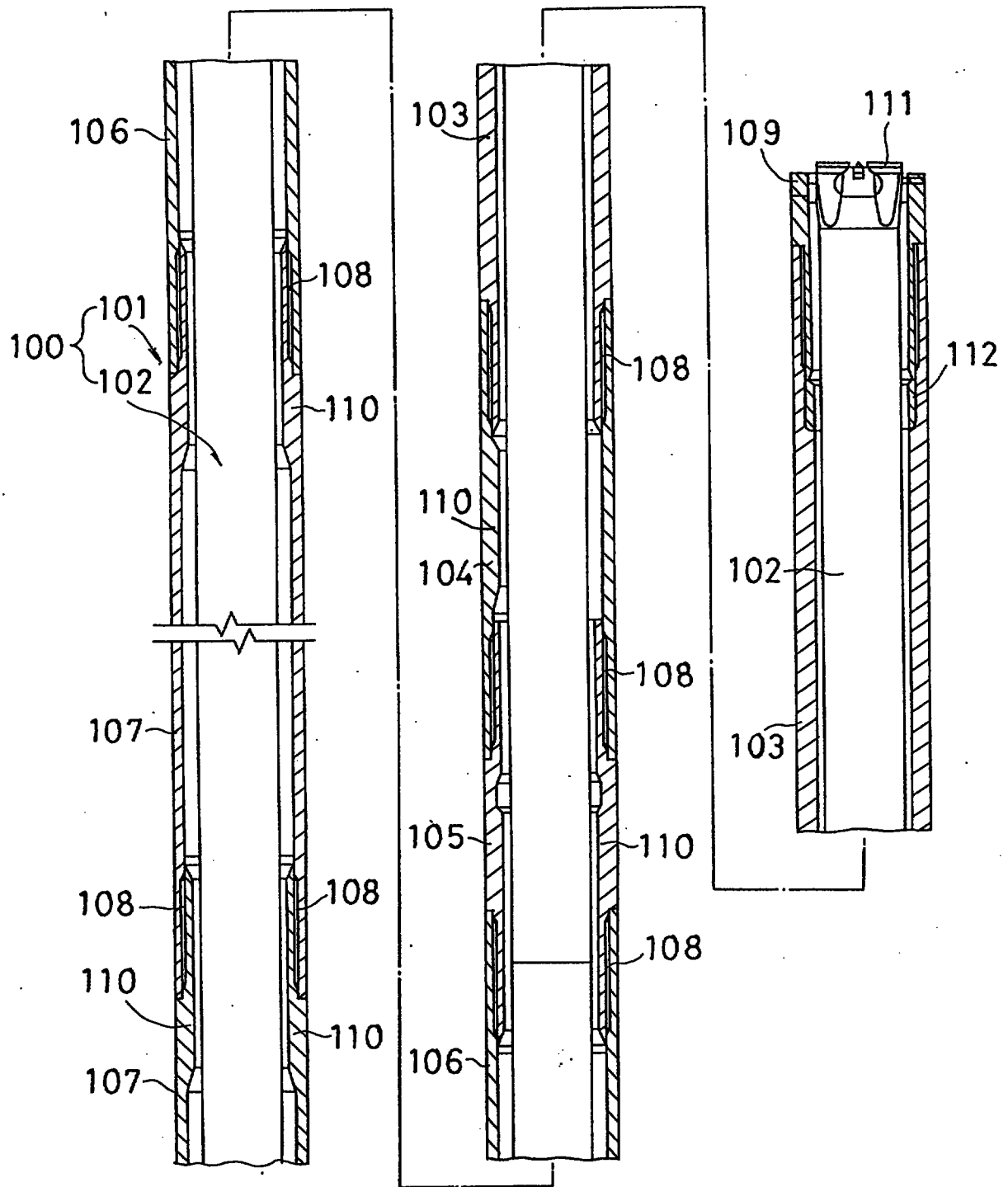
FIG. 10



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FIG. 11



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FIG. 12

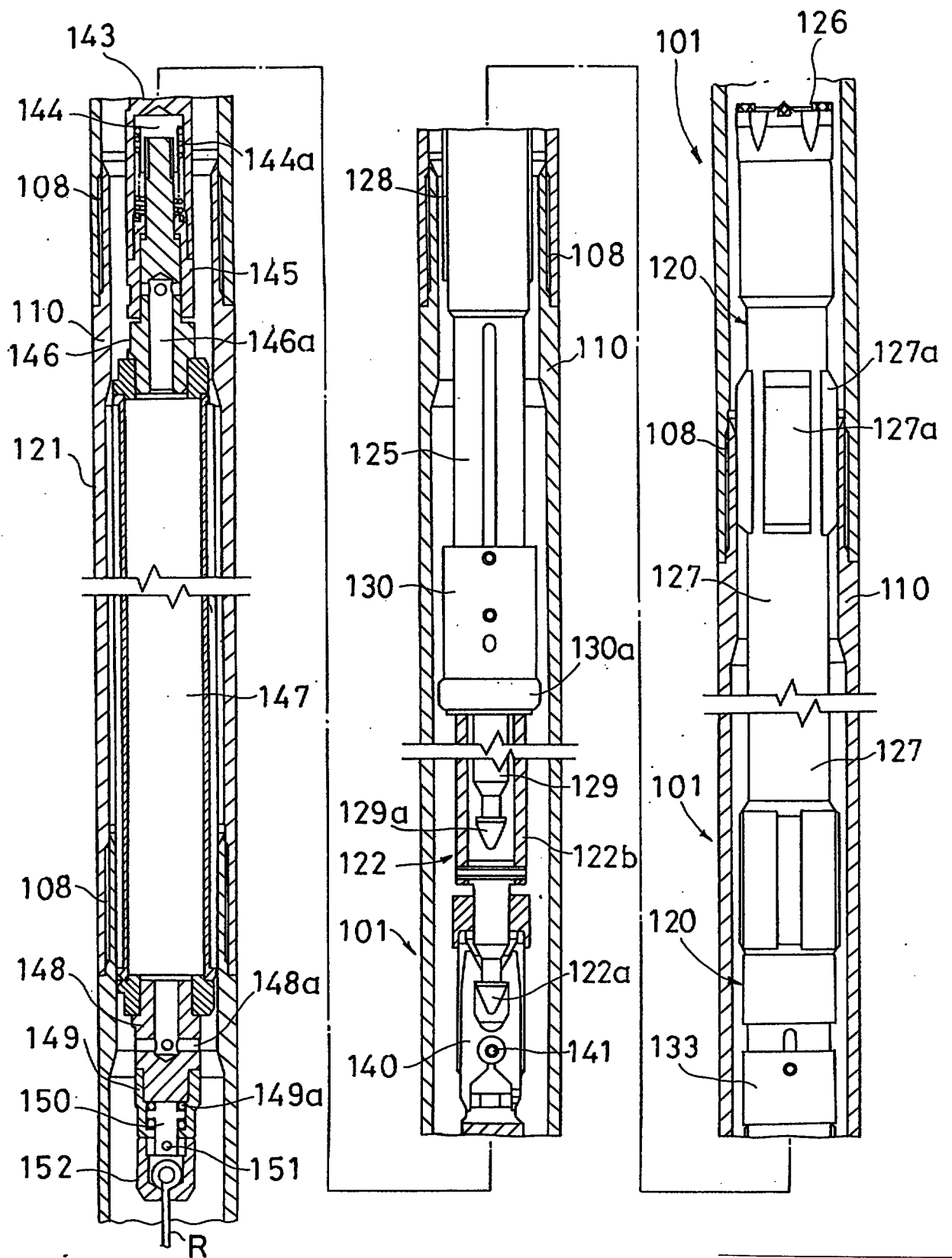
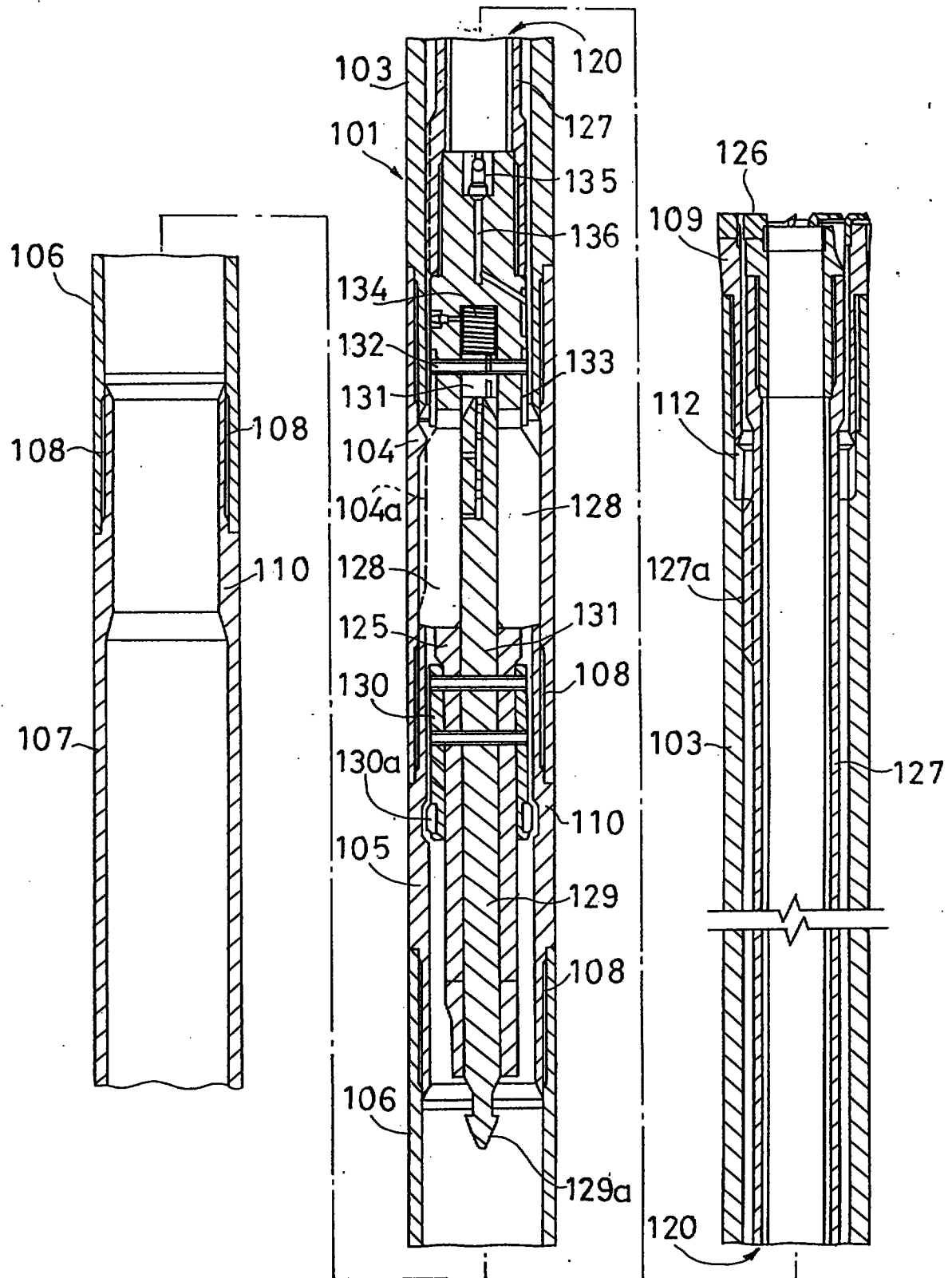


FIG. 13



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FIG. 14

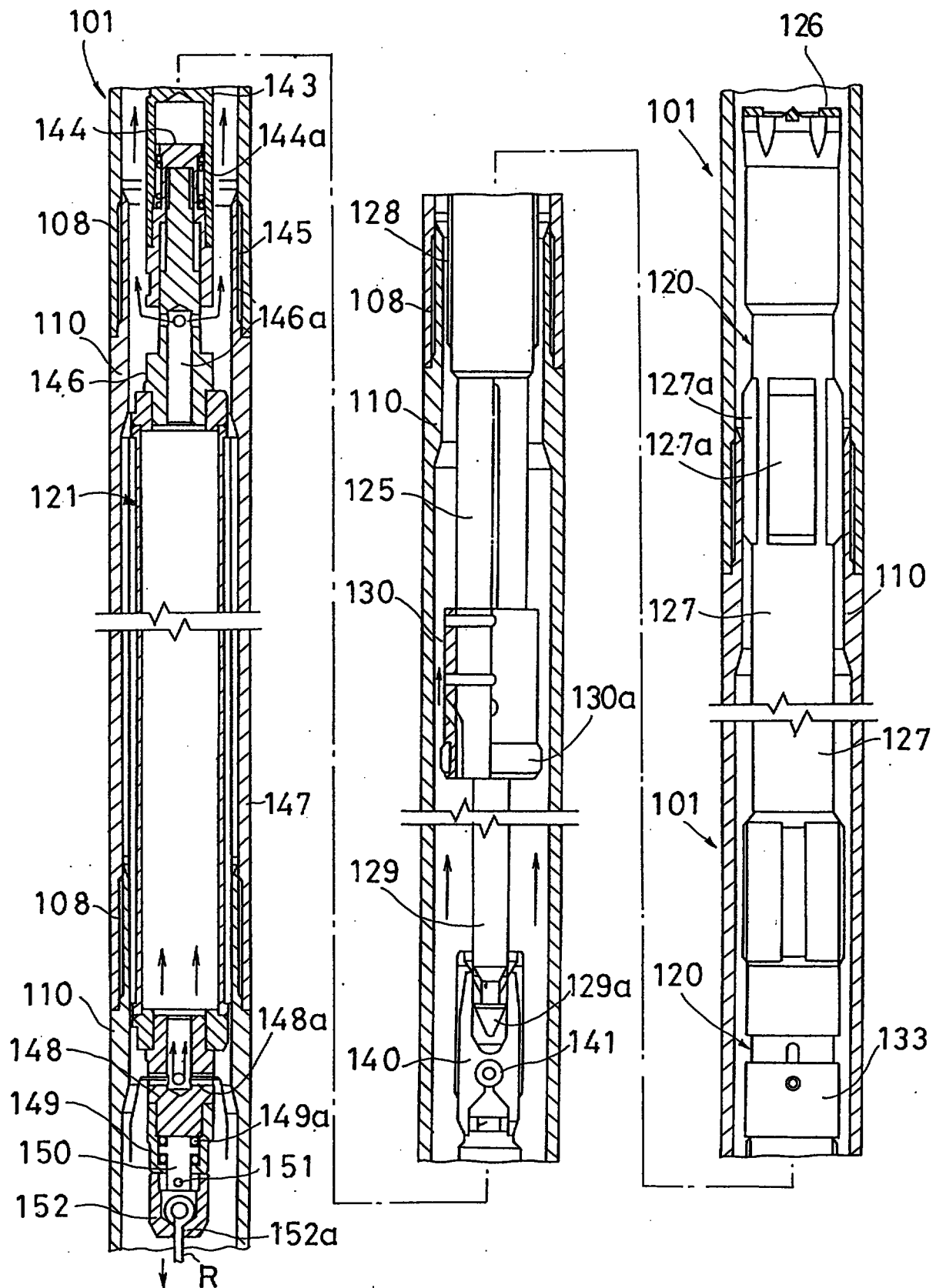
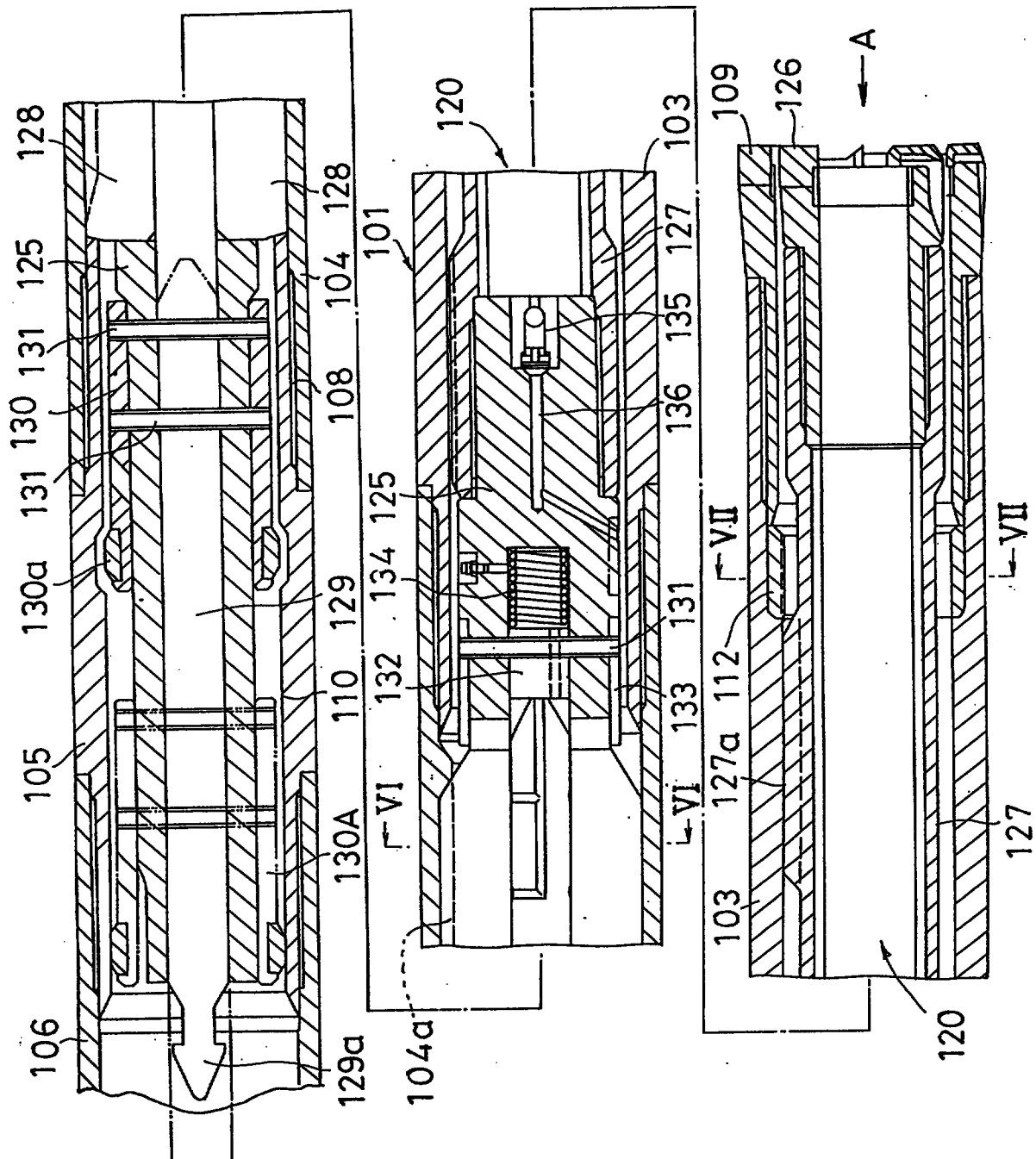


FIG. 15



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FIG. 16

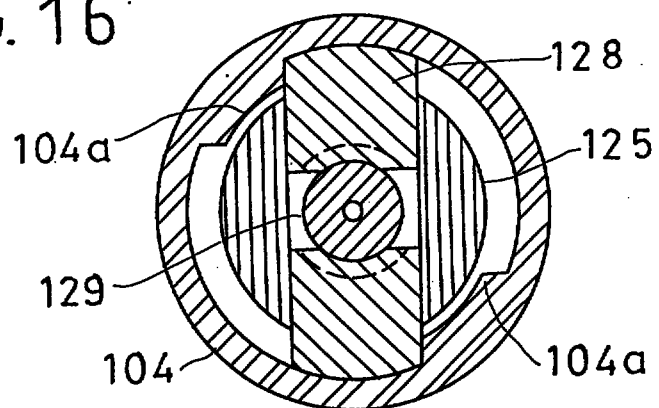


FIG. 17

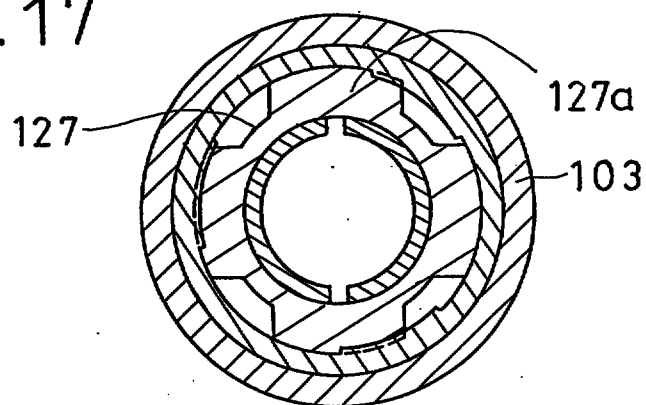


FIG. 18

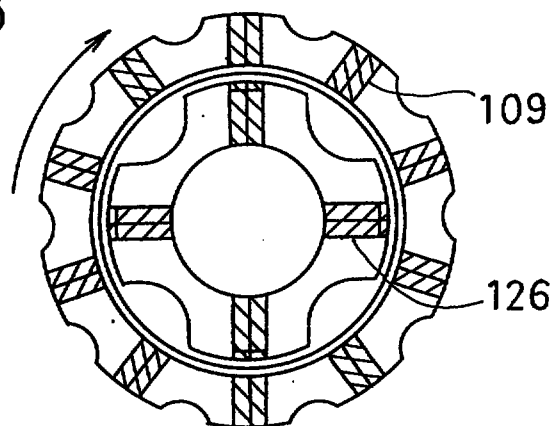
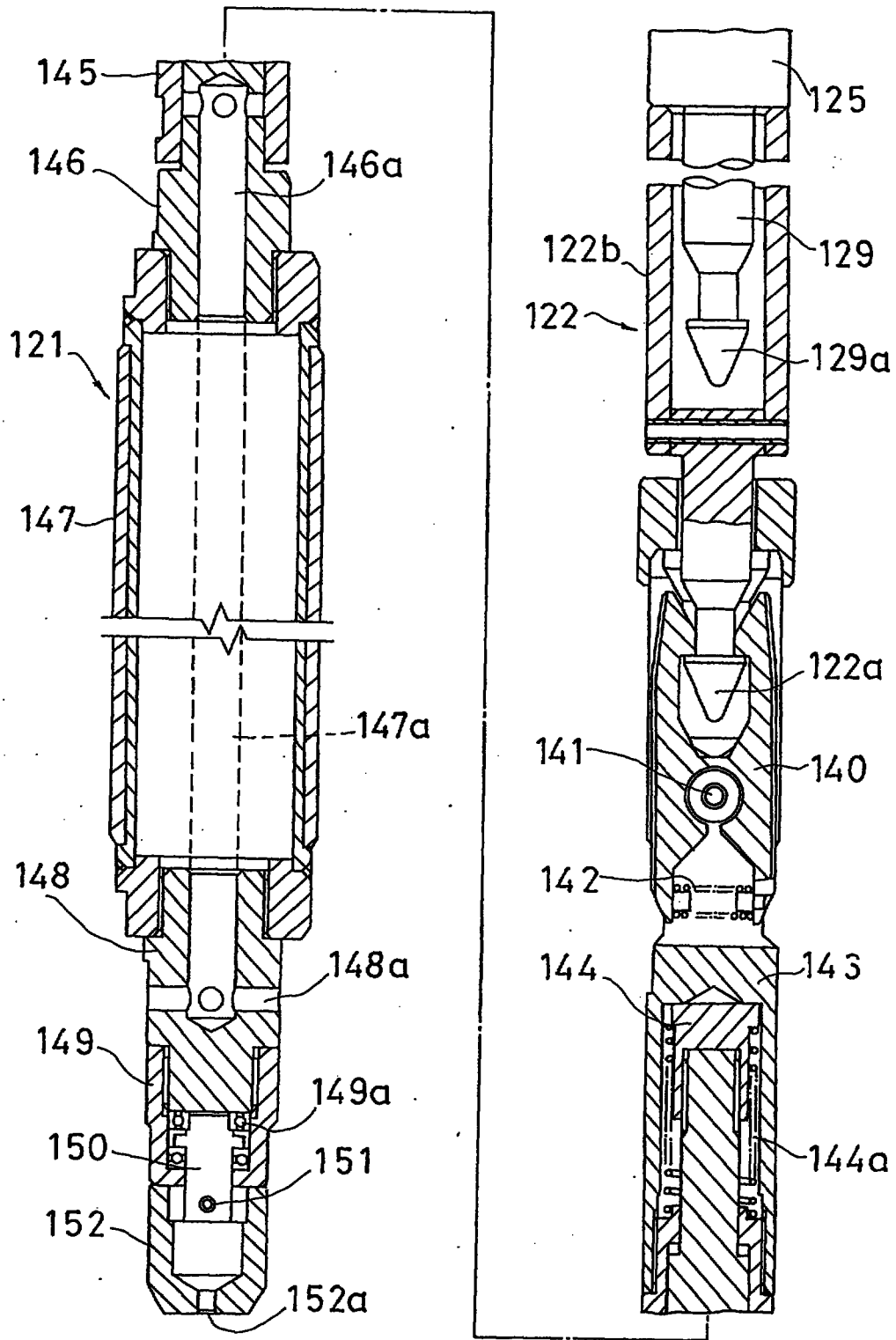


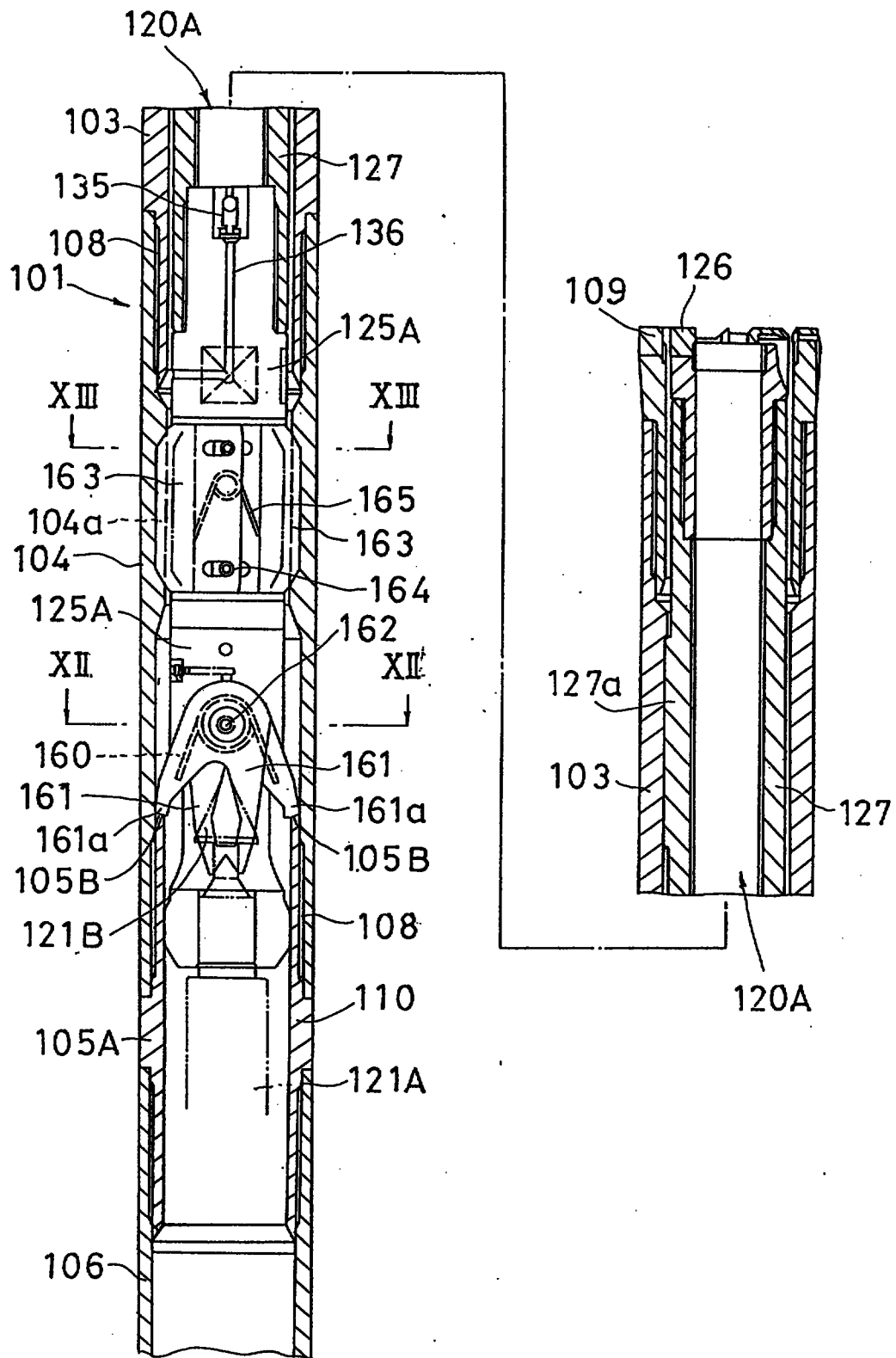
FIG. 19



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FIG. 20



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FIG. 21

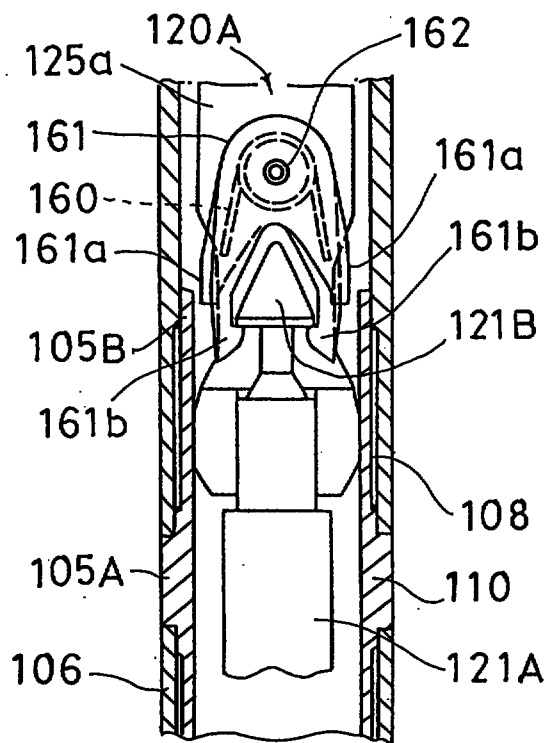


FIG. 22

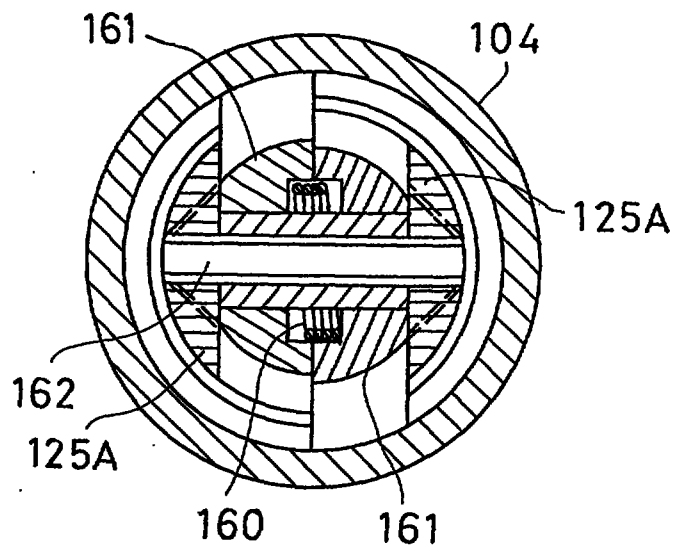
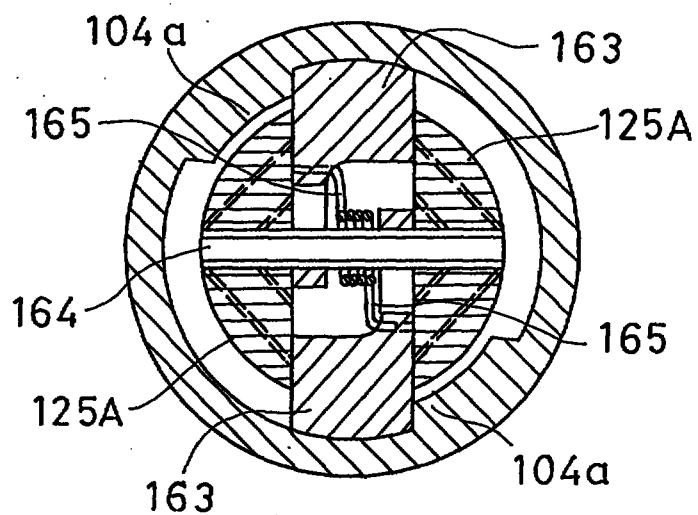


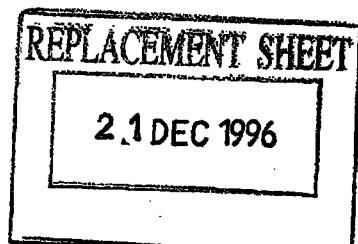
FIG. 23



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☐	Drawing(s) : paged	to paged
☒	Abstract : paged	to paged
DATE OF RECEIPT		

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REPLACEMENT SHEETS		SG
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WIRE LINE SAMPLING DEVICE

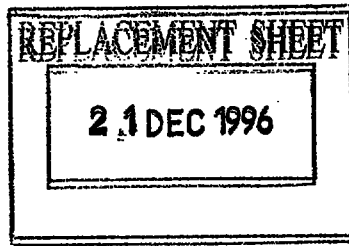
BACKGROUND OF THE INVENTION

The present invention relates to a wire line sampling device which, in the drilling of a rotary percussion drill, can be applied to the rotary percussion drill to perform core sampling of strata during drilling.

As a conventional strata sampling method, core sampling of strata has been performed utilizing a spindle-type boring machine and using a wire line core barrel such as a single core tube, double core tube, and etc.

However, this conventional method has had the following deficiencies.

- (1) Locations which do not require strata sampling must also be drilled with the above tools.
- (2) Core errors occur according to the stratum.
- (3) Because attachment/detachment of the drill rod and raising/lowering of the drill rod must be repeated, operation takes an extremely long time and requires a large amount of labor.
- (4) The drill progress rate is extremely bad in a drill hole made by a spindle-type boring machine, so that although strata core sampling is performed it requires a large amount of time and expense.
- (5) Since the rotary percussion drill is subjected to



extremely large shocks due to blows, it is extremely difficult to insert a wire line sampling device into a rotary percussion drill. For that reason in the prior art a sampling device in which the wire line sampling device is inserted in a rotary percussion drill has not yet been proposed.

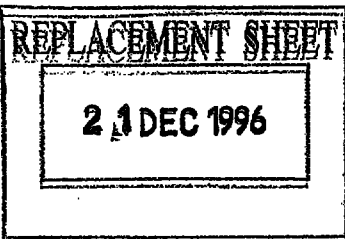
SUMMARY OF THE INVENTION

The present invention was devised in light of the above situation, and has as its first object to provide a wire line sampling device applied to a rotary percussion drill which can sufficiently withstand percussion shocks.

Also, in those rotary percussion drills which utilize gravity for inserting the wire line sampler, when drilling horizontally gravity does not work and insertion of the wire line sampler is not possible.

The present invention has as its second object to provide, in light of the above points, a wire line sampling device which makes possible insertion of a wire line sampler utilizing the introduced pressure of a drilling fluid in horizontal drilling using a rotary percussion drill.

Further, in drilling operations by means of a rotary percussion drill, there are cases where various responses due to other changes in strata are required. For example, core sampling is partly required in water extraction etc. In



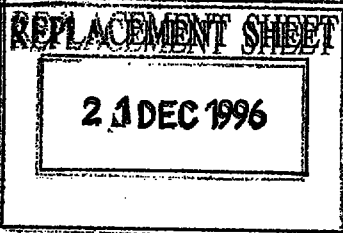
geological surveys it is necessary to measure the inclination and azimuth of strata. Where local drilling hindrances such as spring water, escaping water, collapsed strata, etc. occur, it is necessary to carry out foundation improvement work by introducing cement. When accidents within a hole such as the earth sticking to the tools or collapse etc. occur, recovery operations at the bottom of the hole must be carried out. Also, there are strata which do not require the inner cylinder of the drill.

In the prior art, in cases such as the above, for example where partial core sampling is required, the rotary percussion drill is replaced by a special machine according to each of the above cases, such as replacing the rotary percussion drill with a compact sampling device.

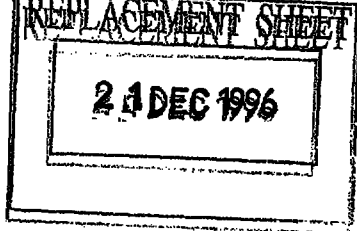
For this reason, in drilling operations with the conventional rotary percussion drill, there is the paradox that although the drilling itself is high speed, cases where the above countermeasures are necessary, much labor and time is required.

The present invention has as its third object, in light of the above points, to provide a wire line sampling device which can simply and easily perform the above various types of operations using a rotary percussion drill.

In order to achieve the above objects, the present invention is a wire line sampling device provided with a wire



line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein the wire line sampler has a locking coupling provided at its upper end, and an inner cylinder, provided at its tip with a shoe formed from a hard material, concentrically provided at a lower end portion inside an outer cylinder having a drill bit at its lower end, a core tube is inserted into the inner cylinder and an expandable/compressible latch is coupled to the core tube via a coupling member, a sliding tube having a slit in its side surface is coupled to the coupling member so that it is slidable only within a predetermined range, and the latch is positioned within the sliding tube and is continually urged in an opening direction by a latch spring so as to protrude from the slit of the sliding tube and so that its tip abuts a lower end surface of the locking coupling, the sliding tube is slidable within a predetermined range with respect to the latch, the sliding tube and the latch advance integrally, and the latch compresses against the latch spring with the sliding movement of the sliding tube, an engaging member is provided at the upper end of the sliding tube, and the overshot assembly has a wire line connected thereto at one end and at the other end an engaging portion which engages with the engaging member of the wire line sampler is

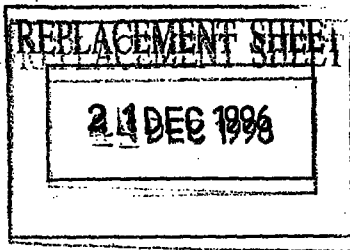


provided.

Also, the overshot assembly of the present invention comprises a piston driven by a drilling fluid and an attachable/detachable push head or latch for pushing or engaging the engaging member of the wire line sampler.

Further, the present invention is a wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein an outer cylinder of the drill rod is constructed so that an expanded portion is formed on the inside of a screw connecting portion by connecting a plurality of pipes with screws, and the wire line sampler which is inwardly and outwardly conveyed via the overshot assembly, which fits together with the expanded portion, is inserted into the inside of the outer cylinder, and when the wire line sampler is conveyed to a predetermined position, fixing devices are interactively provided in the outer cylinder and wire line sampler so that the outer cylinder and wire line sampler rotate integrally.

Because the wire line sampler device is incorporated in a rotary percussion drill to perform sampling, compared to drilling by means of a conventional boring machine, the drilling speed is five to six times faster and sampling at



the required depth is possible.

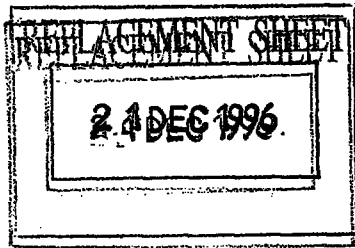
Since the tip of the latch abuts the lower end surface of the locking coupling, the impact in the upward direction of the drill bit can be received by the lower end surface of the locking coupling.

When the engaging member is drawn upward, the sliding tube slides slightly upward and compresses the latch against the latch spring, and engagement with the lower end surface of the locking coupling is released, whereby the wire line sampling device can be drawn upward from the outer cylinder.

Since a shoe formed from a hard material is provided at the end of the inner cylinder, shock due to the drilling of the rotary percussion drill can be sufficiently withstood.

Because the outer cylinder and inner cylinder form a dual-layer cylinder and the core tube is inserted into the inner cylinder and forms a dual tube structure with the inner cylinder, samples can be extracted in a close to natural state. Also because it is a bottom charge type sample outflow is minimal and the extraction rate is high.

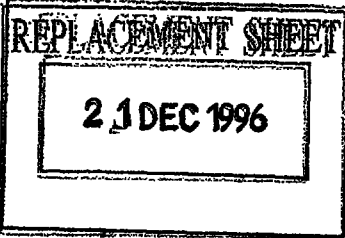
When performing horizontal drilling by rotation feeding and impact of the drill rod, a drilling fluid is supplied to the inside of the drill rod and pressure is applied to the piston of the overshot assembly, and the wire line sampler is pushed and the core tube set within the drill rod. The overshot assembly at this time serves as a push head. When



the core tube is set, the overshot assembly is recovered and core sampling performed. Complete filling of the inside of the core tube by the core sample is confirmed by the stroke of the drill being equivalent to a change in the pressure of the drilling fluid or the length of the core tube, whereupon an overshot assembly which has been replaced in the latch is again inserted, the engaging member is engaged by the latch, wire is wound, and the wire line sampler is recovered via the overshot assembly.

Further in a third aspect of the invention, the overshot assembly and wire line sampler which are fitted with an expanded portion are inserted into the outer cylinder in which the expanded portion is formed on the inside of a screw connecting portion by connecting a number of pipes, and the wire line sampler is conveyed inwards to a predetermined position via the overshot assembly. Then, the wire line sampler is fixed to the outer cylinder by fixing devices interactively formed with the outer cylinder and the wire line sampler, and both of these are rotated integrally to be able to perform a predetermined operation.

Upon completion of this operation as well as the fixture of the outer cylinder and the wire line sampler being released, the wire line sampler is conveyed outward from the outer cylinder by the overshot assembly so that another inner tool can be inserted into the outer cylinder and another



operation performed where necessary.

According to the present invention, because core sampling can be performed with fast drilling efficiency, as well as being able to perform strata sampling in a short time and economically, the following effects can be attained.

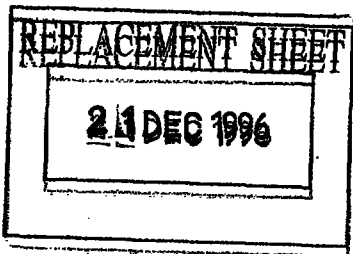
(1) Because a shoe made of a hard material is provided at the front end of the inner cylinder, impact by drilling with a rotary percussion drill can be sufficiently withstood.

(2) Since it is a dual cylinder type with an outer cylinder and inner cylinder, and the core tube is inserted into the inner cylinder to form a further dual cylinder structure with the inner cylinder, samples are extracted in a state close to their natural state.

(3) Because it is a bottom charge type, outflow of samples is slight, without the lower portions of samples being washed away by drilling fluid, therefore the extraction rate is high.

(4) Since it does not use drilling fluid to maintain the hole, it does not contaminate the environment.

(5) Also, in the second aspect of the invention, since an overshot assembly is inserted in the drill rod of the percussion drill, and the wire line sampler is inserted using the introduced pressure of a drilling fluid, wire line core sampling during horizontal drilling using a perpendicular sampling device is possible, and operational efficiency in



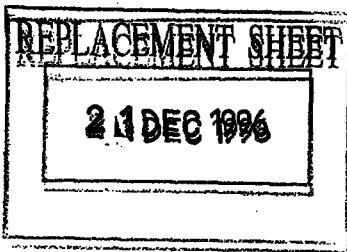
high speed drilling is improved. Also, because a device having a structure which can drill by imposing shock by means of a drilling fluid can be added, improvement of the operating efficiency in cases of difficult-to-drill strata, deep drilling, etc. can be realized.

(6) Further, in a third aspect of the invention, after conveying the wire line sampler to a predetermined position by means of an overshot assembly and fixing it to the outer cylinder, sampling can be performed with both of these rotating integrally.

Also, upon completion of this operation, as well as the fixture of the outer cylinder and the wire line sampler being released, the wire line sampler is conveyed outward by the overshot assembly, and a another inner tool can be inserted into the outer cylinder where necessary and another operation performed, therefore the disadvantage of the prior art wherein the rotary percussion drill is replaced by special device is eliminated and there is the advantage that various types of operations in the prior art can be rapidly performed.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will become better understood with reference to the following description, appended claims and



accompanying drawings, wherein:

FIG. 1 is an upper portion cross-sectional view showing an embodiment of the present invention,

FIG. 2 is a central portion cross-sectional view showing an embodiment of the present invention,

FIG. 3 is a lower portion cross-sectional view showing an embodiment of the present invention,

FIG. 4 is an upper half cross-sectional view of an overshot assembly,

FIG. 5 is a lower half cross-sectional view of an overshot assembly,

FIG. 6 is a partial side view showing an engaging portion,

FIG. 7 is a cross-sectional view showing a second embodiment of the present invention,

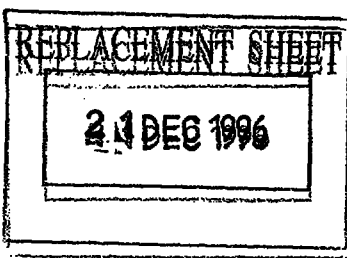
FIG. 8 is a cross-sectional view of the second embodiment when a wire line sampler is inserted,

FIG. 9 is a cross-sectional view of the second embodiment when the wire line sampler is recovered,

FIG. 10 is a cross-sectional view of the second embodiment showing a deformation example,

FIG. 11 is a longitudinal cross section of a third embodiment of the present invention during dual tube drilling,

FIG. 12 is a longitudinal cross section of the third



embodiment of the present invention when the wire line sampler is conveyed inward,

FIG. 13 is a longitudinal cross section of the above wire line sampler when it is fixed,

FIG. 14 is a longitudinal cross section of the above wire line sampler when it is conveyed outward,

FIG. 15 is an enlarged view of part of FIG. 13,

FIG. 16 is a cross section along line VI-VI of FIG. 15,

FIG. 17 is a cross section along line VII-VII of FIG. 15,

FIG. 18 is a view along the arrow A of FIG. 15,

FIG. 19 is an enlarged longitudinal cross-sectional view of part of FIG. 12,

FIG. 20 is a longitudinal cross-sectional view showing a deformation example of the third embodiment of the present invention when the wire line sampler is fixed,

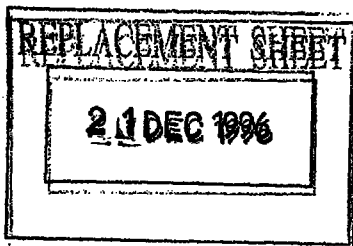
FIG. 21 is a longitudinal cross-sectional view of part of FIG. 20 when the wire line sampler is conveyed outward,

FIG. 22 is a cross section along line XII-XII of FIG. 20, and

FIG. 23 is a cross section along line XIII-XIII of FIG. 20.

DETAILED DESCRIPTION OF THE INVENTION

Herebelow, the present invention will be described in



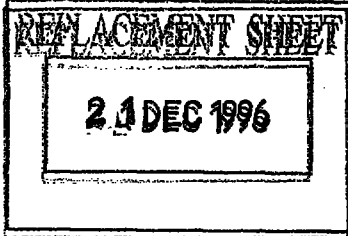
detail with regard to the embodiments show in the drawing.

FIGs. 1 through 3 are cross-sectional views illustrating a first embodiment of the present invention. In these drawings, 1 indicates an outer cylinder of a rotary percussion drill, a drill bit 2 being provided at the lower end thereof.

A wire line sampler 3 is incorporated into the outer cylinder 1 of the rotary percussion drill. This wire line sampler 3 comprises an inner cylinder 4, a core tube 5, a piston member 6, a latch 7, a sliding tube 8 and an engaging member 9 or the like.

The inner cylinder 4 is concentrically provided in the downward direction of the outer cylinder 1, the lower end thereof is connected to a connecting rod 10 by being screwed together, and a thick shoe 4a formed from a material of high hardness is provided at the lower end thereof. In the present embodiment a female thread is provided in the inner peripheral surface of the lower end portion of the inner cylinder 4, and this is attached by threading a male thread provided in the outer peripheral surface of the upper end portion of the shoe 4a. Thereby, the abrasion resistance of the inner cylinder 4 due to the drill bit 2 is improved and the end of the inner cylinder 4 is protected.

The core tube 5 is positioned upwards from the shoe 4a of the inner cylinder 4 and bonded to the inner cylinder 4.

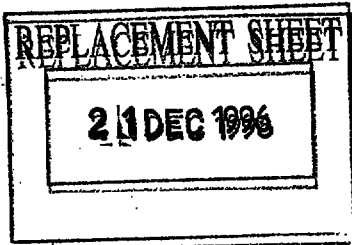


This core tube 5 is regulated at its upper end by a connecting rod 10 and at its lower end by the upper end of the shoe 4a.

The sliding tube 8 is provided concentrically with the outer cylinder 1 upwards of the inner cylinder 4, and the piston member 6 is provided in the sliding tube 8. The lower end of this piston member 6 is elongated downwards from the sliding tube 8 and the connecting rod 10 is connected to the elongated lower end thereof. The sliding tube 8 is slidable with respect to the piston member 6 within a range h in which a stopper step portion 8c provided in an inner wall surface of the sliding tube 8 is stopped at a step portion 6a of the piston member 6, although normally a gap h is maintained by a spring 11 interposed between the sliding tube 8 and the piston member 6.

An expandable/compressible latch 7 is provided at the upper end of the piston member 6. This latch 7 has latch hooks 7a and 7b which are pivoted by a pivot, is normally urged in an opening direction by a latch spring 12, and although the outside of the ends of the latch hooks 7a and 7b abut the inner wall surface of the outer cylinder 1 extracted from a slit 8a provided in the sliding tube 8, when the sliding tube 8 is slid upward they are compressed the sliding tube 8.

In other words, the latch hooks 7a and 7b are provided

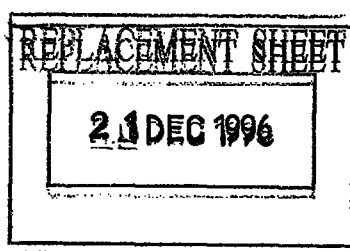


in fan shapes opening upward, and upon the sliding tube 8 sliding upward, they are compressed by an inclined surface 8b at the lower end of the slit 8a.

An engaging member 9 is provided at the upper end of the sliding tube h. This engaging member 9 is positioned within a locking coupling 13 provided at the upper end of the outer cylinder 1.

According to the structure of the above embodiment, although shocks during drilling by the rotary percussion drill are transmitted from the drill bit to the shoe 4a, inner cylinder 4, connecting rod 10, piston member 6 and latch 7 and received by the lower end surface of the locking end coupling 13, as shown in FIGs. 4 through 6, upon the overshot assembly 21 being lowered from above and engaging with the engaging member 9 and the wire line sampler 3 being raised, since the sliding tube 8 is moved upward, the latch 7 is compressed, and engagement with the lower end surface of the locking coupling 13 is released, the wire line sampler sampler 3 is raised upwards.

The above overshot assembly 21 has a ring 22 for hanging a wire line such as a hoist for the light in the upper portion thereof as shown in FIGs. 4 to 6 for example, and an engaging portion 23 is provided at the lower end thereof. This engaging portion 23 has pincer plates 24a and 24b corresponding to the above engaging member 9 and pivotably



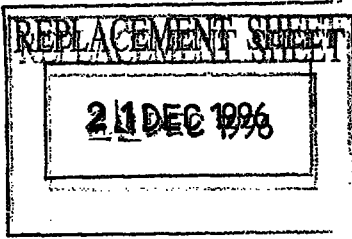
attached so as to be able to open and close, and continuously urged in the closing direction by a spring 25, whereby upon the overshot assembly 21 being lowered to the inside of the locking coupling 13, the engaging portion 23 automatically fits to the engaging member 9.

However, while incorporating the wire line sampler 3 in the rotary percussion drill and drilling a predetermined drill hole, if core sampling of another stratum is performed and the core sample completely fills the inside of the core tube 5, the overshot assembly 21 which has been raised to the wire line from an upper portion opening of the locking coupling 13 by a hoist is lowered, the engaging portion 23 is engaged with the engaging member 9 of the wire line sampler device 3, the wire line sampler 3 is raised and extracted, and the core in the core tube 5 can be recovered.

Since the wire line sampler 3 can be incorporated in a rotary percussion drill in this manner, core sampling can be performed with drilling efficiency of various levels compared to a conventional spindle-type boring machine. In this regard a drilling efficiency of five to six times of the prior art can be exhibited.

Next a second embodiment of the present invention will be described.

FIGs. 7 through 9 are cross-sectional views showing the second embodiment of the present invention. In these



REPLACEMENT SHEET

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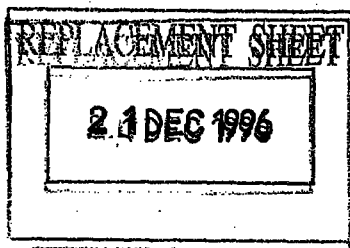
drawings one indicates the outer cylinder of the rotary percussion drill, a drill bit 2 being provided at the end thereof.

A wire line sampler 3 is incorporated in the outer cylinder 1 of the rotary percussion drill. This wire line sampler 3 comprises an inner cylinder 4, core tube 5, piston member 6, latch 7, sliding tube 8 and engaging member 9 or the like.

The inner cylinder 4 is concentrically provided in a forward position of the outer cylinder 1, the aft end thereof is connected to a connecting rod 10 by being screwed together therewith, and a thick shoe 4a is formed from a hard material is provided at the front end thereof. In this embodiment a female thread is provided in the inner peripheral surface of the front end portion of the inner cylinder core, and is attached by being screwed together with a male thread provided in the aft end portion outer peripheral surface of the shoe 4a. Thereby, the abrasion resistance of the inner cylinder 4 due to the drill bit 2 is improved and the tip of the inner cylinder 4 is protected.

The core tube 5 is positioned behind the shoe 4a in the inner cylinder 4 and bonded to the inner cylinder 4. This core tube 5 is regulated at its rear end by the connecting rod 10 and at its front end by the rear end of the shoe 4a.

Behind the inner cylinder 4, the sliding tube 8 is



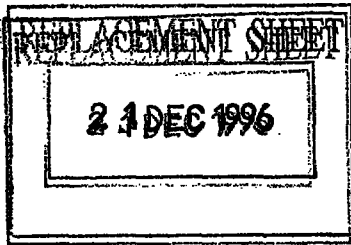
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concentrically provided with respect to the outer cylinder 1, and the piston member 6 is provided in this sliding tube 8. The front portion of this piston member 6 is elongated forward from the sliding tube 8, and the connecting rod 10 is connected to the elongated tip thereof. Although the sliding tube 8 is slidable with respect to the piston member 6 within a range h in which the stopper step portion 8a provided in the inner wall surface of the sliding tube 8 is stopped at a step portion 6a of the piston member 6, the gap h is normally maintained by the spring 11 interposed between the sliding tube 8 and the piston member 6.

A latch 7 comprising expandable/compressible latch hooks 7a and 7b is provided at the upper end of the piston member 6. These latch hooks 7a and 7b are pivoted by a pivot 70 and urged by a latch spring 12 in direction in which they open. Further, the outer sides of the top ends of the latch hooks 7a and 7b extend beyond the slit 8a provided in the sliding tube 8 and are in contact with the inner wall surface of the outer cylinder 1 but when the sliding tube 8 is slid upward, they are compressed inward by the sliding tube 8.

That is, the latch hooks 7a, 7b are fan-shaped with the rear portions thereof being made to open outward and when the sliding tube 8 is slid rearward, the latch hooks 7a, 7b are compressed inward by the front end face 8b of the slit 8.

Engaging member 9 is provided at the rear end of the

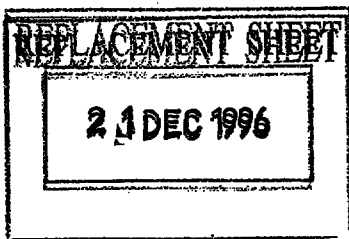


sliding tube 8. The engaging member 9 is positioned within the locking coupling 13 provided at the rear end of the outer tube 1.

In FIG. 8 and FIG. 9, 21 is an overshoot assembly, in which a pair of couplings 23 and 24 are attached to a valve shaft 22, a connecting member 25 is screwed into the foremost coupling 24, and a push head 27 (FIG. 8) or a latch case 28 (FIG. 9) is screwed into and fixed to an inner thread portion 26 of the connecting member 25. A pair of latches 30 and 30 are pivoted by a spring pin 29 in the latch case 28. These latches are urged in a direction in which their front end portions are continuously closed by a spring 31. A connecting tube 32 is attached between the couplings 23 and 24 and a rubber piston 33 is installed at the outer periphery of this connecting tube 32.

A drill rod 34 is connected to the locking coupling 13 of the rotary percussion drill, and the first overshoot assembly 21 is inserted into the drill rod 34. In the embodiment of Figs. 8 and 9 the drill rod 34 used is for a conventional rotary percussion drill, and although the inner diameter of the drill rod 34 in the connecting portion 35 is compressed, the rubber piston 33 in the inner peripheral surface of the connecting portion 35 is bonded.

FIG. 10 shows a deformation example of the second embodiment, the drill rod 34 being for percussion line wire



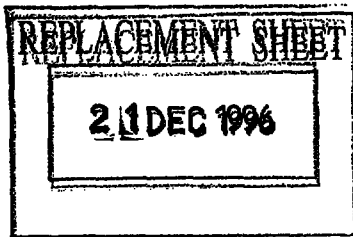
use, and because the inner diameter of the drill rod 34 is uniform, the rubber piston 33 is not used in the overshot assembly 21 and is constructed with a ring-shaped piston 35 is inserted in the couplings 23 and 24.

Next the operation of the above embodiment will be described.

When performing horizontal drilling by rotation of the drill rod 34, a drilling fluid is transmitted into the drill rod 34 in the direction of the arrow 36, pressure is applied to the piston rubber 33 or piston 35, and the wire line sampler 3 is pushed via the push head 27 and engaging member 9 to set the wire line sampler 3.

When setting of the wire line sampler 3 is complete, the wire is wound up and the overshot assembly 21 recovered, whereafter the core in the percussion drill is extracted.

When it is confirmed by a change in the pressure of the drilling fluid or by the drill stroke being equal to the length of the core cylinder that the core sample has completely filled the core cylinder 5, the push head 27 of the overshot assembly 21 is replaced in the latch head 28 and re-inserted, and as shown in FIG. 3 the head portion of the engaging member 9 is held by the latch 30 and the wire 37 is wound up, whereby the wire line sampler is recovered. At this time, by pulling the valve shaft 22, the valve 38 is disengaged, the drilling fluid flows into the interior of the



overshot assembly 21, and fluid resistance is eliminated.

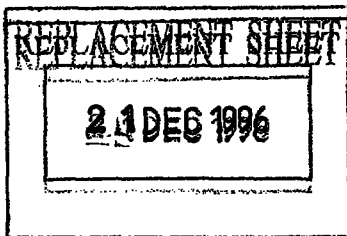
Note that in the present invention a device having a structure which can perform drilling by incurring impact by means of a drilling fluid can be added.

Next, a third embodiment of the present invention will be described with regard to FIGs. 11 through 23.

The drawings show a rotary percussion drill in a case where partial core sampling is performed using a wire line sampler, FIG. 11 being a longitudinal cross section during dual tube drilling, FIG. 12 being a longitudinal cross section when the wire line sampler is conveyed inward, FIG. 13 being a longitudinal cross section of the wire line sampler when it is fixed, and FIG. 14 being a longitudinal cross section of the wire line sampler when it is conveyed outward.

In FIG. 11, a drill rod 100 is constructed as a dual tube comprising an outer cylinder 101 and an inner cylinder 102 inserted into the outer cylinder 101, the gap between the outer cylinder 101 and the inner cylinder 102 serving as a through-path for drilling fluid. The outer cylinder 101 comprises an outer tube 103, an extension tube 104, a locking coupling 105, an outer rod 106, an upset rod 107, etc., connected in sequence by screw connections 108, while an outer bit 109 is provided at the front end portion thereof.

Also, an inner bit 111 is provided at the front end of

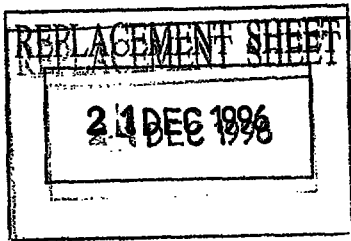


the inner cylinder 102.

Drilling is performed imposing rotation, feeding and impact on the drill rod 100.

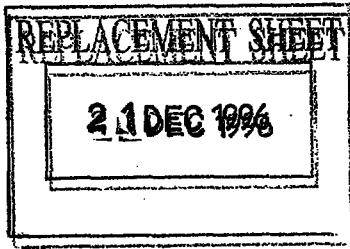
Once the above drilling has reached a predetermined core sampling point, the inner cylinder 102 is removed from the outer cylinder 101, and a wire line sampler 120 serving as the inner tool, an overshot assembly 121 for conveying the wire line sampler 120 inward and outward and an inward conveyor 122 provided between the wire line sampler 120 and the overshot assembly 121 and used only when the wire line sampler 120 is conveyed inward are inserted into the interior of the outer cylinder 101 as shown in FIG. 12. The wire line sampler 120 is conveyed inward to a predetermined position at the front end portion of the outer cylinder 101 by fluid pressure such as air pressure, water pressure, etc. via the overshot assembly 121 and the inward conveyor 122. Then, as well as the wire line sampler 120 being fixed to the outer cylinder 101, the overshot assembly 121 and inward conveyor 122 are recovered and sampling is performed.

FIG. 15 is an enlarged view of part of FIG. 13, and is a longitudinal cross section showing a state wherein the wire line sampler 120 is fixed in the outer cylinder 101. As shown in this drawing, the wire line sampler 120 comprises a sampling head 125, an inner bit 126 at the front end, an inner tube 127 connected the sampling head 125 and the front



end inner bit 126, etc. The sampling head 125, as well as maintaining two slide plates 128 which are movable in the up and down direction in the drawing, maintains a first plunger 129 slidably in its axial direction in the interior, and when the first plunger 129 is inserted between the two slide plates 128 the two slide plates 128 each slide in the up and down directions as shown in FIG. 16 and the vicinity of the outer edges thereof are stopped at a protruding portion 104a of the extension tube 104, whereby the wire line sampler 120 is fixed to the outer cylinder 101. The protruding portion 104a is formed by the end surface of the locking coupling 105.

Further, a piston 130 is fitted in the sampling head 125, and packing 130a is installed around the piston 130. This piston 130 and the first plunger 129 are connected by a spring pin 131, and are integrally movable. As shown by the chain line in FIG. 15, upon drilling fluid pressure being applied to a piston 130A located on the left side inside the locking coupling 105, the piston 130A is moved together with the first plunger 129 to the position indicated by the solid line in the same drawing, the first plunger 129 advances to between the two slide plates 128 as described above, and at the same time that the slide plates 128 are moved, a second plunger 132 is pushed toward the left in the drawing. Then, a shut ring 133 connected by the second plunger 132 and the

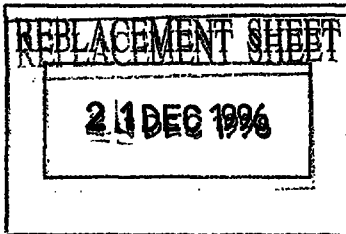


spring pin 131 is moved and the exit of the slide plate 128 opens.

Reference number 134 is a spring for continuously maintaining the second plunger 132 and the shut ring 133 at the left side of the drawing. 135 is a valve provided at the front end of the sampling head 125, and is provided for reducing resistance due to fluid when the wire line sampler 120 is conveyed inward. 136 is the fluid spill port thereof. Note that attainment of a predetermined position by the wire line sampler 120 is confirmed by a drop in the pressure of the fluid due to resistance between an inner tube stabilizer 112 and a large diameter portion 127a of the inner tube 127 (refer to FIG. 15 and FIG. 17).

FIG. 19 is a longitudinal cross-sectional view of the overshoot assembly 121 and inward conveyor 122 which serve as a conveying device for conveying the wire line sampler according to the present invention.

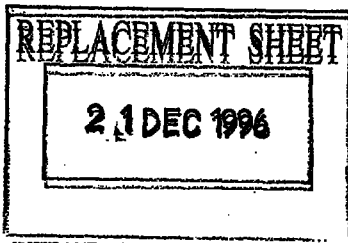
Two latches 140 forming the above overshoot assembly 121 stop a dummy spear 122a of the inward conveyor 122, one of the latches 140 being rotatably maintained by a spring pin 141 of the other latch 140, and one end of the rotatable latch 140 being urged upward in FIG. 19 by a spring 142 (so as to hold the dummy spear 122a). A spring holder 144 and a spindle guide 145 connected to the spring holder 144 via a spring 144a are slidably maintained in a latch case 143



connected to the latches 140. A spindle 146 is maintained in the spindle guide 145, and a through hole 146a is formed in the spindle 146. A piston 147 is connected to the spindle 146 and a through hole 147a connected to the through hole 146a is formed in the piston 147.

Also, a coupling 148 is connected to the piston 147, and a through hole 148a connected to the through hole 147a is formed in the coupling 148. A bearing cover 149 covers the coupling 148, and an eye shaft 150 is rotatably maintained by a bearing 149a in the interior of the bearing cover 149. A rope socket 152 is axially installed over the eye shaft 150 so as to be rotatable in a direction perpendicular to the surface of the paper in the drawing by a spring pin. A hole 152a for stopping a rope is formed in the rope socket 152. Note that the length of the above piston 147 is determined so that it extends across two expanding portions 110 and 110 formed in the above outer cylinder 1.

The overshot assembly 121 is used both where the wire line sampler 120 is conveyed inward and conveyed outward as shown in FIG. 12 and FIG. 14, and when conveyed inward, the drilling fluid is released from the left to the right hand side in FIG. 12 and the overshot assembly 121 and the wire line sampler 120 are conveyed inward by means of the drilling fluid pressure. When the wire line sampler 120 is being conveyed inward, the plunger 129 enters between the slide



plates 128 and 128 as shown in FIG. 15, and upon the these slide plates contacting the outer cylinder 101, there is the possibility that the wire line sampler 120 cannot be conveyed to the predetermined position. In order to prevent this, the inward conveyor 122, in which a pipe 122b is formed which covers a spear 129a of the plunger 129 and contacts the left end of the sampling head 125 at one end and a dummy spear 122a having the same shape as the spear 129a is formed at the other end, is used, and the latch 140 is stopped at the dummy spear 122a of the inward conveyor 122 and the wire line sampler 120 is conveyed inward via the inward conveyor 122. Reference number 140a is a locking screw of the latch 140.

Note that when the wire line sampler is conveyed inward, the spindle guide 145 and spring holder 144 slide the outer circumference of the spindle 146 leftward against the spring 144a as shown in FIG. 19 to cover the through hole 146a. As a result, the drilling fluid which is at the left side of the drawing cannot pass through the through hole 146a and move in the drilling direction (the right side of FIG. 19). Consequently, inward conveyance of the wire line sampler 120 can be readily performed.

When the wire line sampler 120 is conveyed outward, the latches 140 of the overshot assembly 121 are stopped at the spear 129a of the first plunger 129, a rope R stopped in a hole 152a of the rope socket 152 is pulled toward the left in

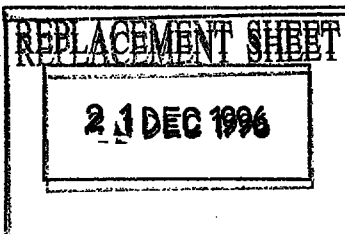
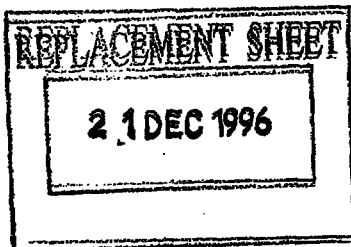


FIG. 14 and the first plunger 129 is moved toward the left, and thereby the wire line sampler 120 is conveyed outward from the outer cylinder 101. During this outward conveyance, the drilling fluid which is inside the outer cylinder 101 passes from the through hole 148a of the coupling 148 through the through hole 147a of the piston 147 and the through hole 146a of the spindle 146 and moves in the feeding direction (the right side of FIG. 19), and as a result the wire line sampler 120 can be readily conveyed outward from the outer cylinder 101.

FIG. 20 shows a deformation example of the third embodiment, and illustrates an example where a fixing tool which serves as a fixing device formed in the outer cylinder and wire line sampler of the above embodiment is deformed in a latch form. In this case, in the sampling head 125A, as well as two latches 161 and 161 which are continuously urged in an opening direction by a spring 160 being supported by a shaft 162, a stopping portion 105B for stopping front end portions 106a of the latches 161 is formed in the locking coupling 105A which forms the outer cylinder 100A. Also, in the sampling head 105A, two key plates 163 and 163 are supported by a shaft 164, a spring 165 is inserted between these key plates 163 and 163 and is formed movable in the up and down direction in FIG. 20 and FIG. 22, the outer edge vicinities of the key plates 163 are stopped at a protruding



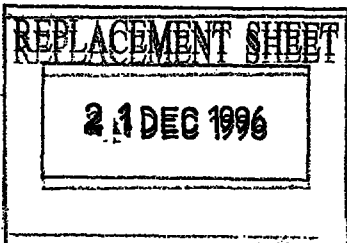
portion 104a of the extension tube 104 to integrally fix the outer cylinder 101 and the wire line sampler 120A, and the power of the outer cylinder 101 is transmitted to the wire line sampler 120A in the interior to enable integral rotation.

Further, a spear 121B is formed in the front end portion of the overshot assembly 121A. Also, using a pipe, one end of which contacts the left end of the sampling head 125A, and an inward conveyor comprising a latch for stopping the above spear 121B, which are omitted from the drawing, the wire line assembly 120A is conveyed inward to the predetermined position shown in FIG. 20 by the overshot assembly 121A and the inward conveyor.

Where the above wire line assembly 120A is conveyed outward, a stopper plate 161b of a U-shaped latch 161 is stopped at the spear 121B of the overshot assembly 121A as shown in FIG. 21, and the wire line sampler 120A is conveyed outward from the outer cylinder 101A in the same manner as in the previously-described embodiments.

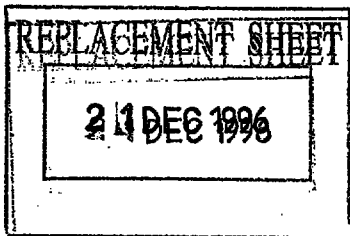
Since the structures of other portions are substantially the same as in the previously-described embodiments, the same reference numbers are used in the drawings and detailed descriptions thereof will be omitted.

Here, as the above-described drilling fluid, a fluid which can prevent the bit filling with earth such as water,



water mixed with bentonite, or air may be used, and where air is used as the drilling fluid, the pressure thereof should be approximately 10kgf/cm² and where water or the like is used, the pressure thereof should be approximately 20 to 30 kgf/cm².

Also, in the above-described embodiments, although a core wire line sampler is given as an example of an inner tool, various types of inner tools may be substituted for this wire line sampler, for example, by inwardly conveying an inner bit, a gyro or other type of measuring device, an air hammer, a bit with nozzle attached or an injection nozzle, a vibrator, a jack or the like to a predetermined position in the outer cylinder, the various types of operations described in the prior art can be rapidly performed with the outer cylinder as is.



What is claimed is:

1. A wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshoot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein:

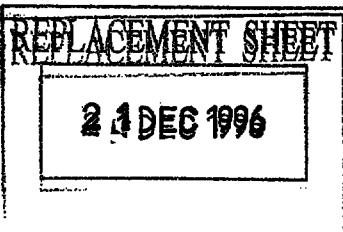
the wire line sampler has a locking coupling provided at its upper end, and an inner cylinder, provided at its tip with a shoe formed from a hard material, concentrically provided at a lower end portion inside an outer cylinder having a drill bit at its lower end;

a core tube is inserted into the inner cylinder and an expandable/compressible latch is coupled to the core tube via a coupling member;

a sliding tube having a slit in its side surface is coupled to the coupling member so that it is slidable only within a predetermined range, and the latch is positioned within the sliding tube and is continually urged in an opening direction by a latch spring so as to protrude from the slit of the sliding tube and so that its tip abuts a lower end surface of the locking coupling;

the sliding tube is slidable within a predetermined range with respect to the latch, the sliding tube and the latch advance integrally, and the latch compresses against the latch spring with the sliding movement of the sliding





tube;

an engaging member is provided at the upper end of the sliding tube; and

the overshoot assembly has a wire line connected thereto at one end and at the other end an engaging portion which engages with the engaging member of the wire line sampler is provided.

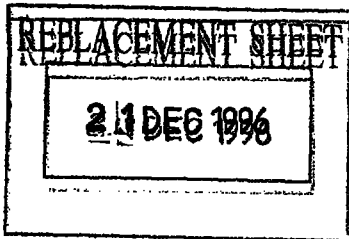
2. The wire line sampling device of claim 1, wherein the overshoot assembly comprises a piston driven by a drilling fluid and an attachable/detachable push head or latch for pushing or engaging the engaging member of the wire line sampler.

3. A wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshoot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein:

an outer cylinder of the drill rod is constructed so that an expanded portion is formed on the inside of a screw connecting portion by connecting a plurality of pipes with screws; and

the wire line sampler which is inwardly and outwardly conveyed via the overshoot assembly, which fits together with the expanded portion, is inserted into the inside of the outer cylinder, and when the wire line sampler is conveyed to





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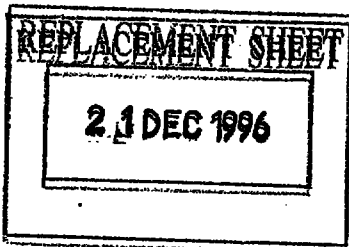
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a predetermined position, fixed devices are relatively provided in the outer cylinder and wire line sampler so that the outer cylinder and wire line sampler rotate integrally.

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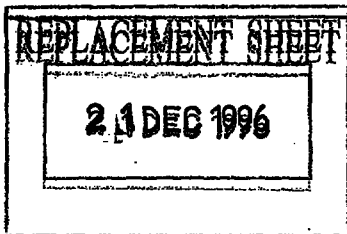
WIRE LINE SAMPLING DEVICE
ABSTRACT

A percussion wire line sampling device applied to a rotary percussion drill which can sufficiently withstand percussion shock is provided. In a wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein the wire line sampler has a locking coupling provided at its upper end, and an inner cylinder, provided at its tip with a shoe formed from a hard material, concentrically provided at a lower end portion inside an outer cylinder having a drill bit at its lower end, a core tube is inserted into the inner cylinder and an expandable/compressible latch is coupled to the core tube via a coupling member, a sliding tube having a slit in its side surface is coupled to the coupling member so that it is slidable only within a predetermined range, and the latch is positioned within the sliding tube and is continually urged in an opening direction by a latch spring so as to protrude from the slit of the sliding tube and so that its tip abuts a lower end surface of the locking coupling, the sliding tube is slidable within a predetermined range with respect to the latch, the sliding tube and the latch advance integrally, and the latch compresses against the latch spring with the sliding movement

No figure suggested

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of the sliding tube, an engaging member is provided at the upper end of the sliding tube, and the overshoot assembly has a wire line connected thereto at one end and at the other end an engaging portion which engages with the engaging member of the wire line sampler is provided.

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FIG. 1

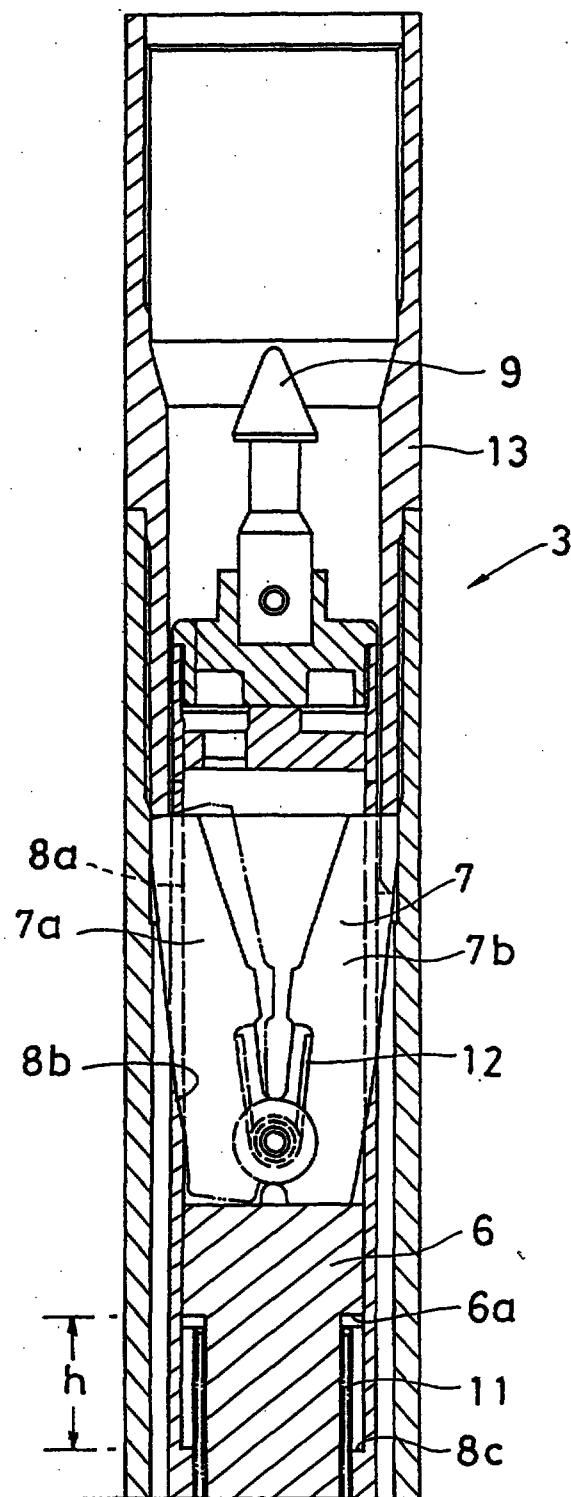


FIG. 2

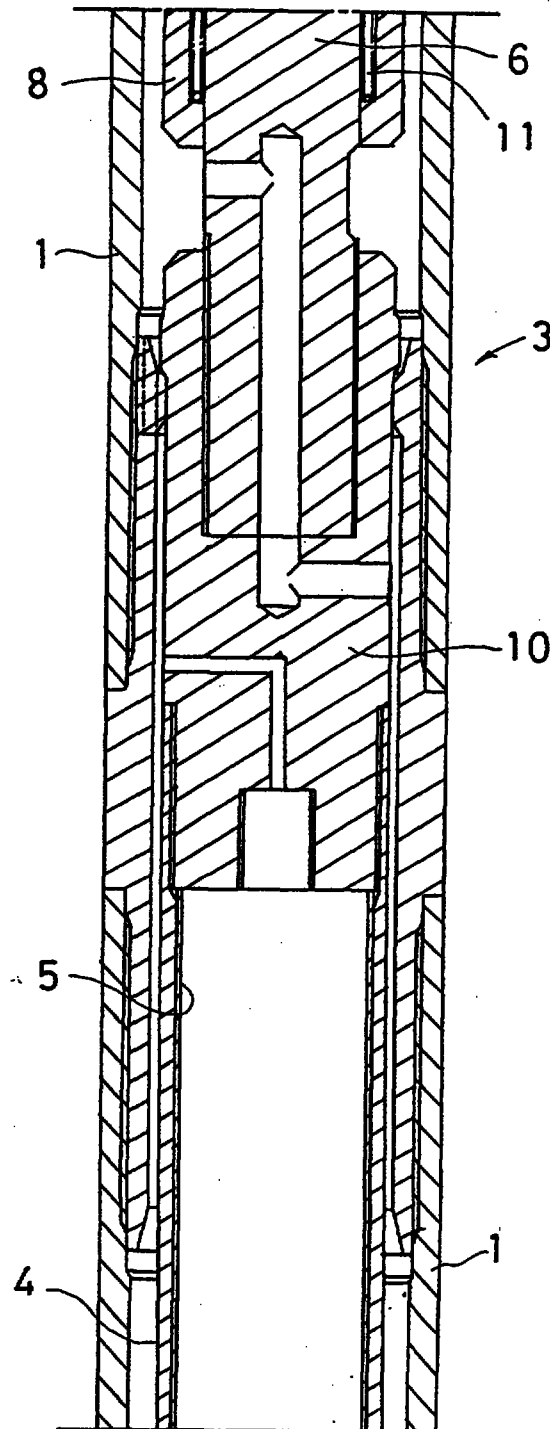


FIG. 3

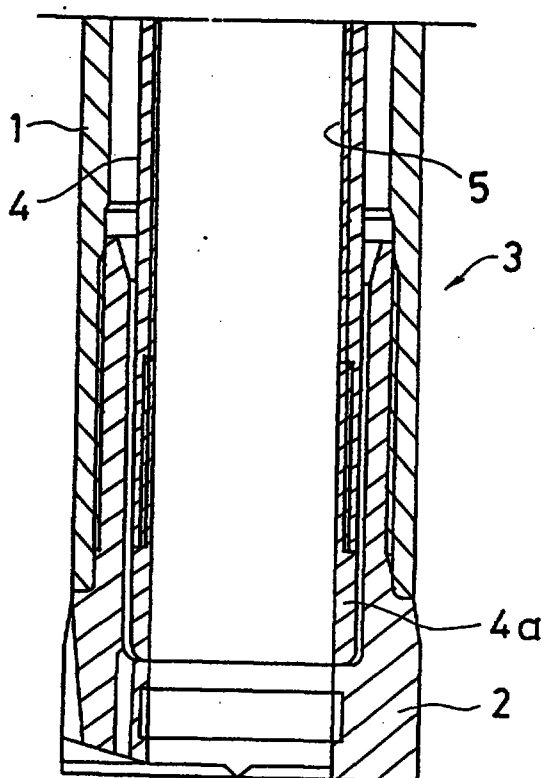
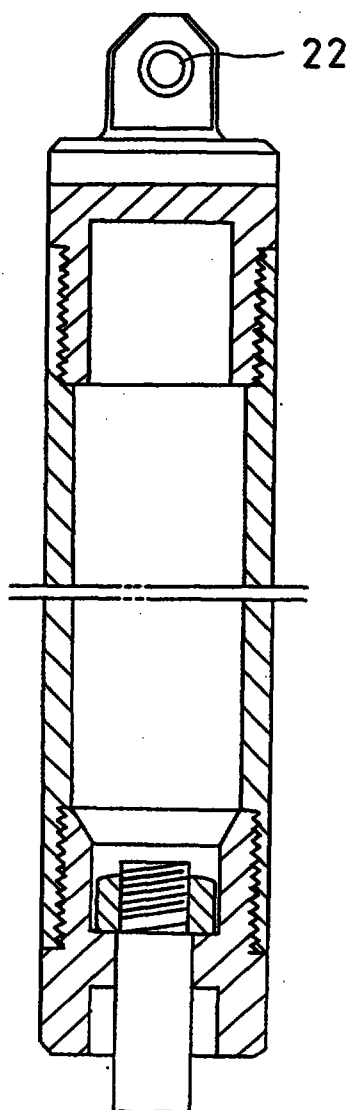


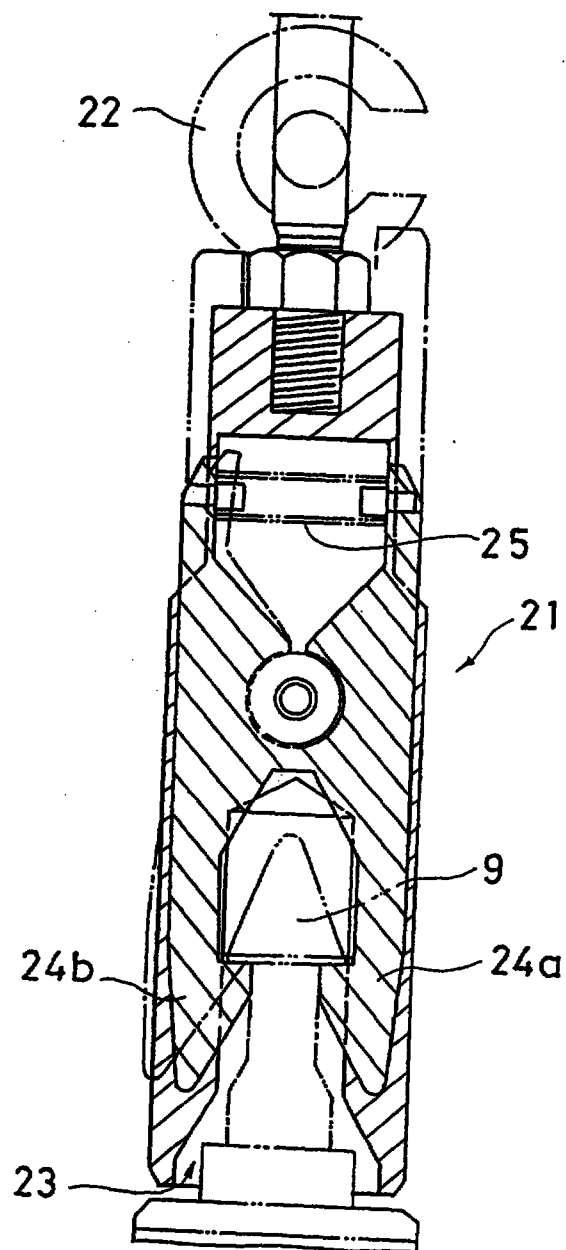
FIG. 4



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FIG. 5



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FIG. 6

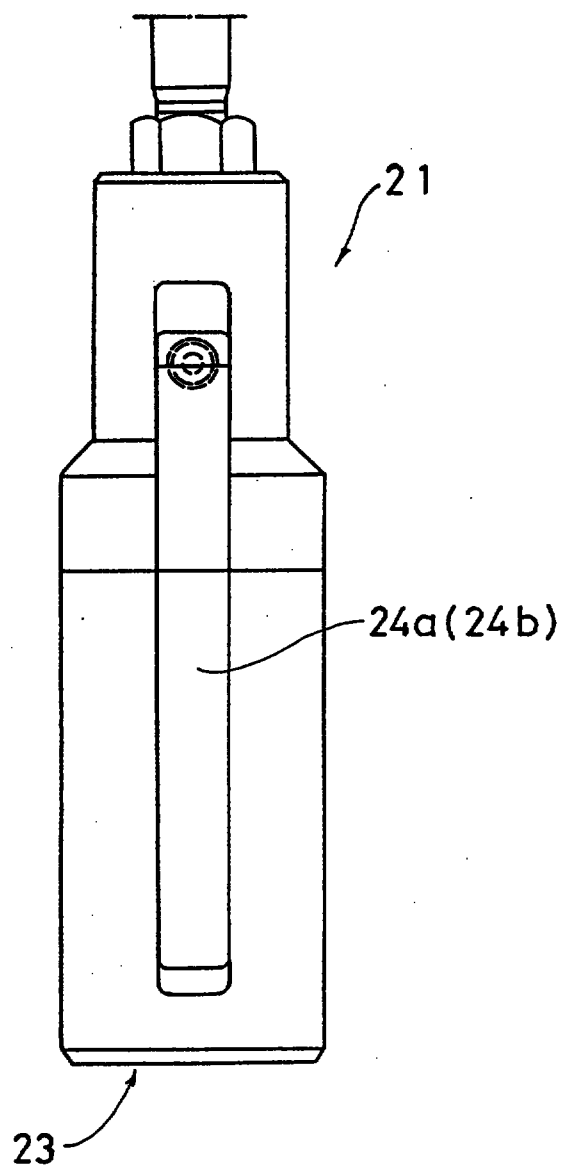


FIG. 7

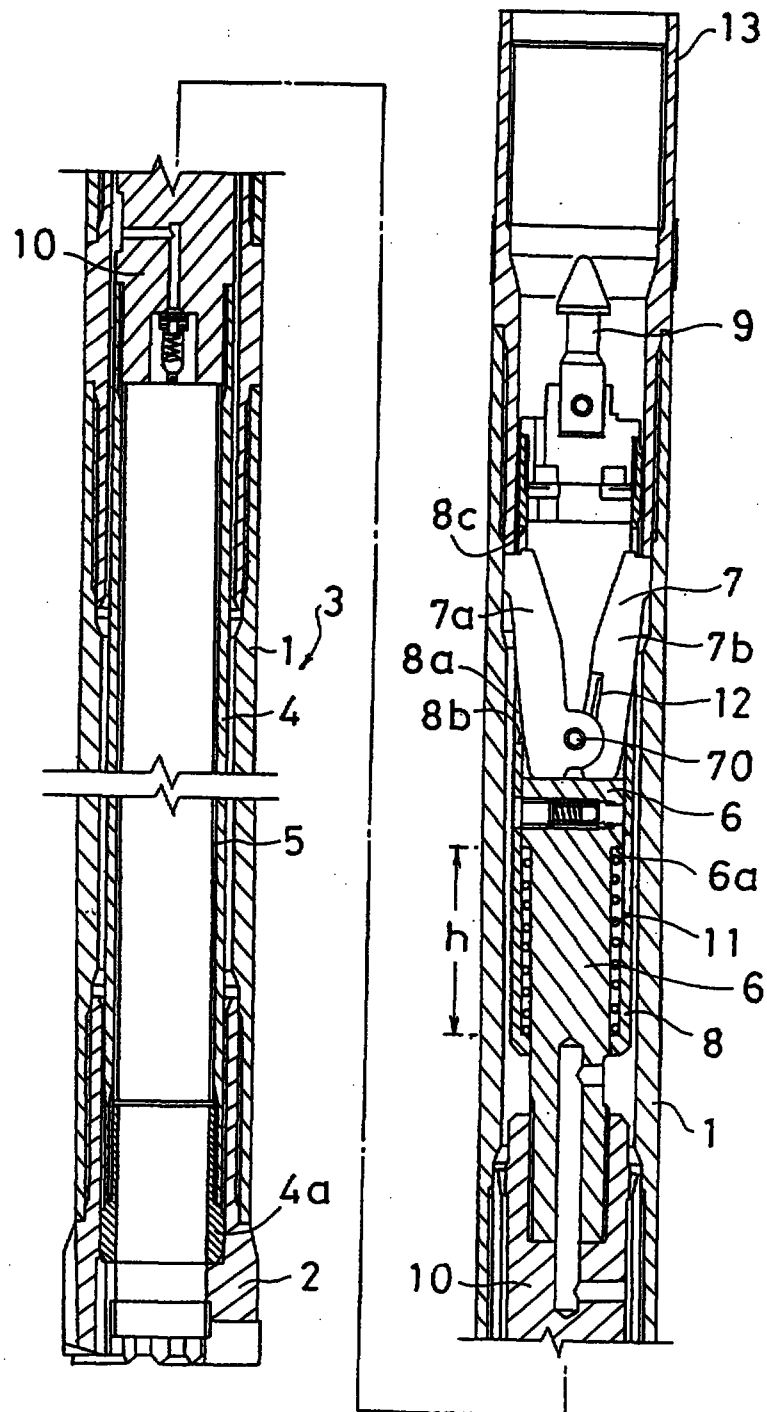
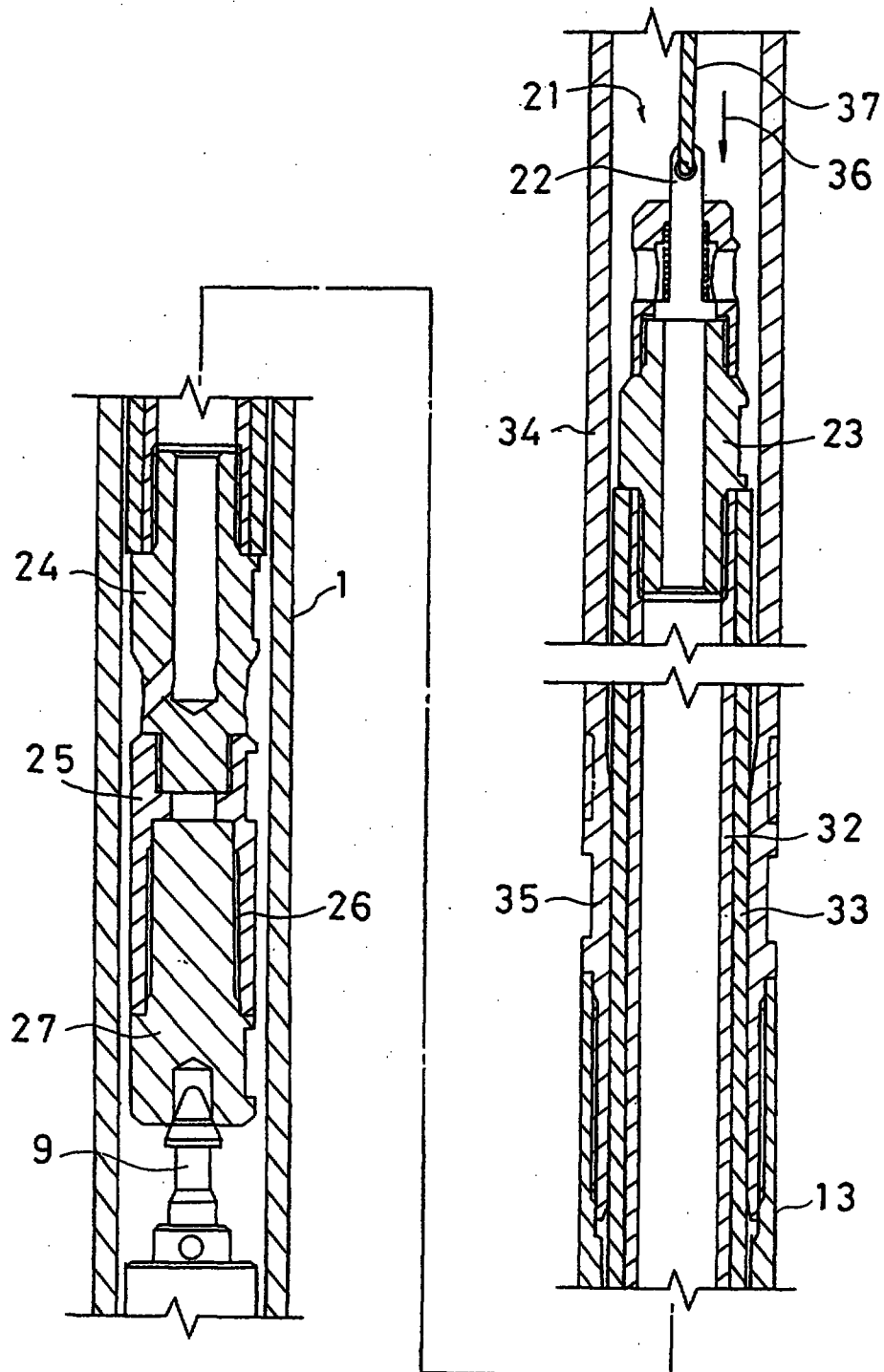
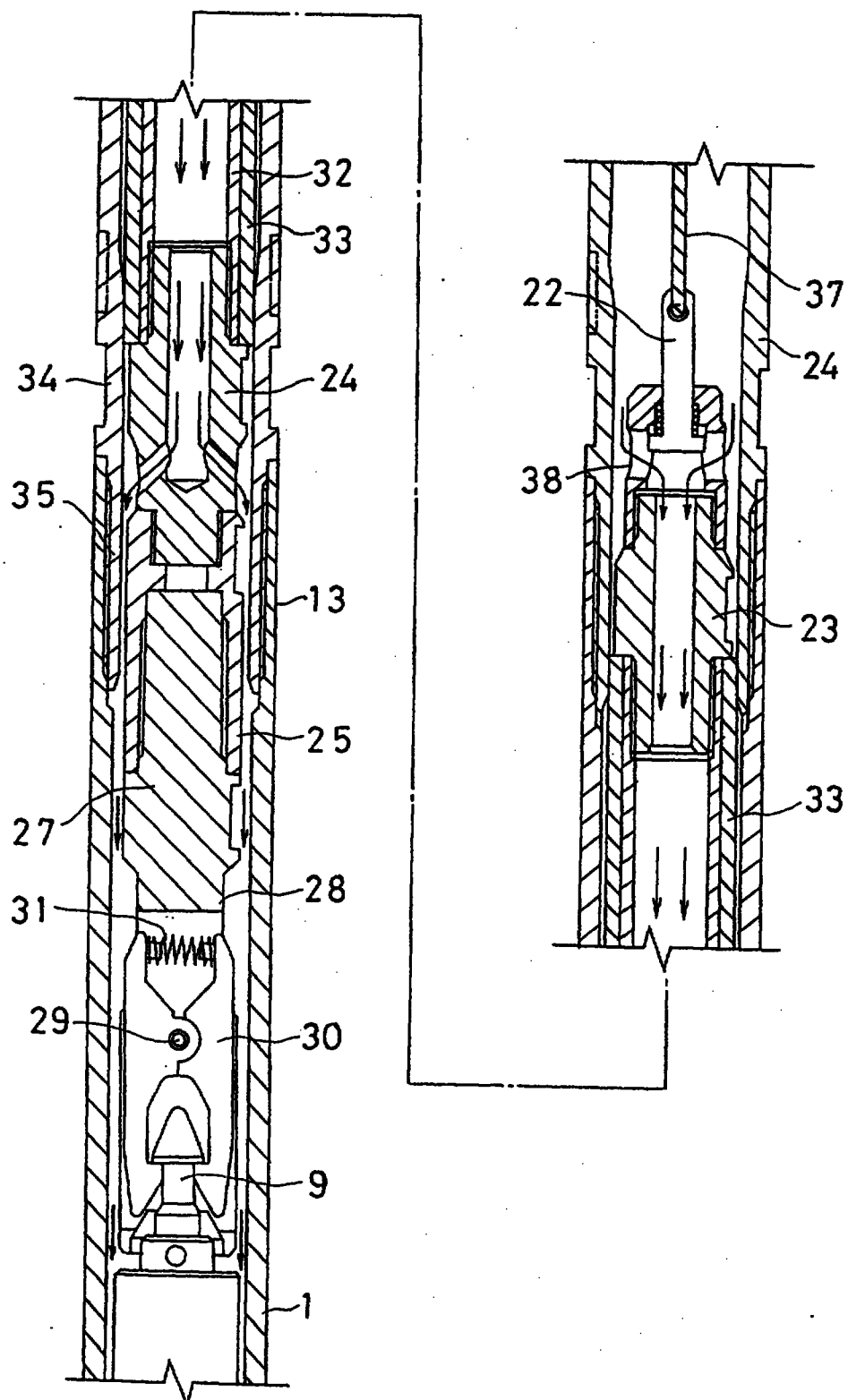


FIG. 8



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FIG. 9



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FIG. 10

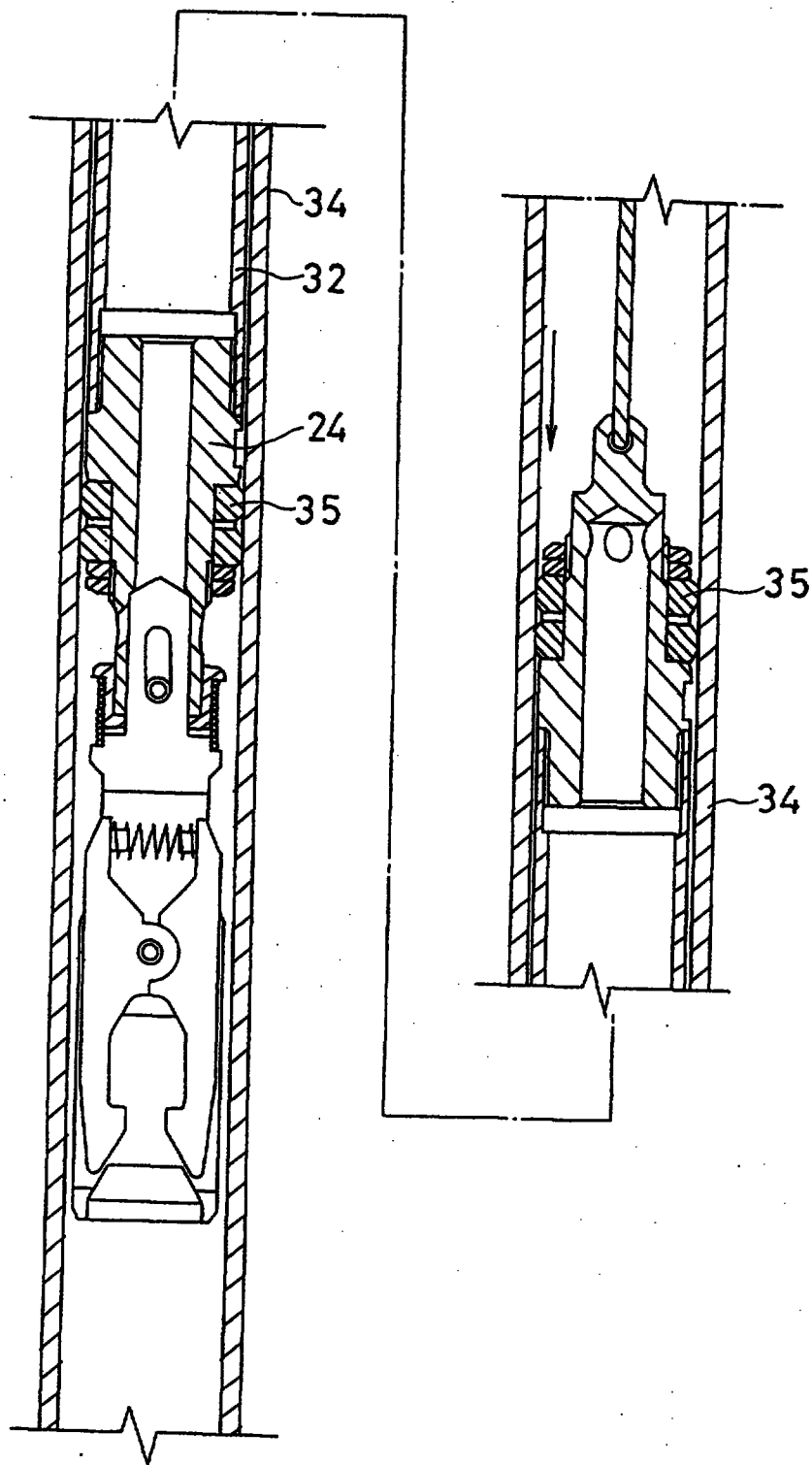
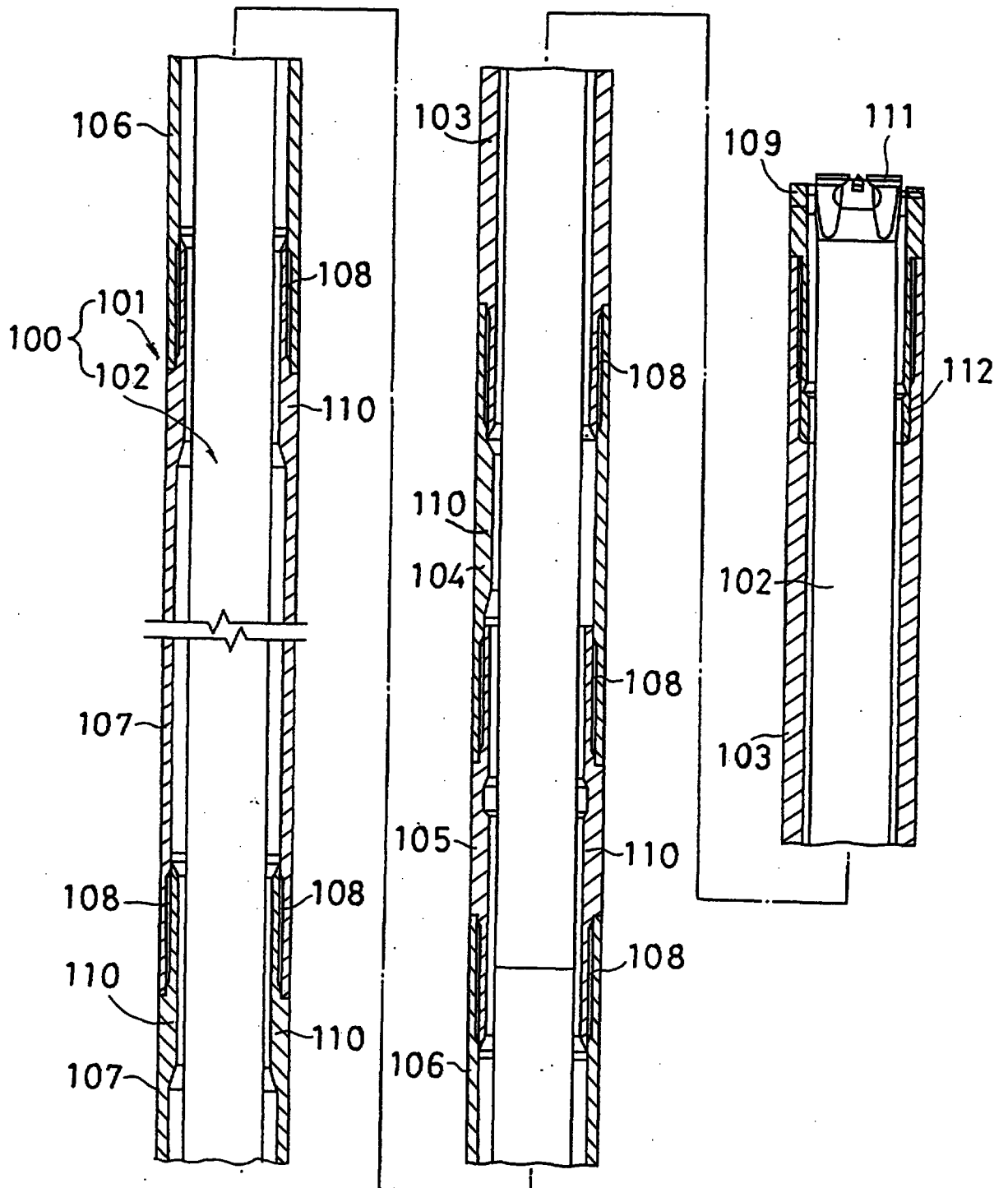


FIG. 11



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FIG. 12

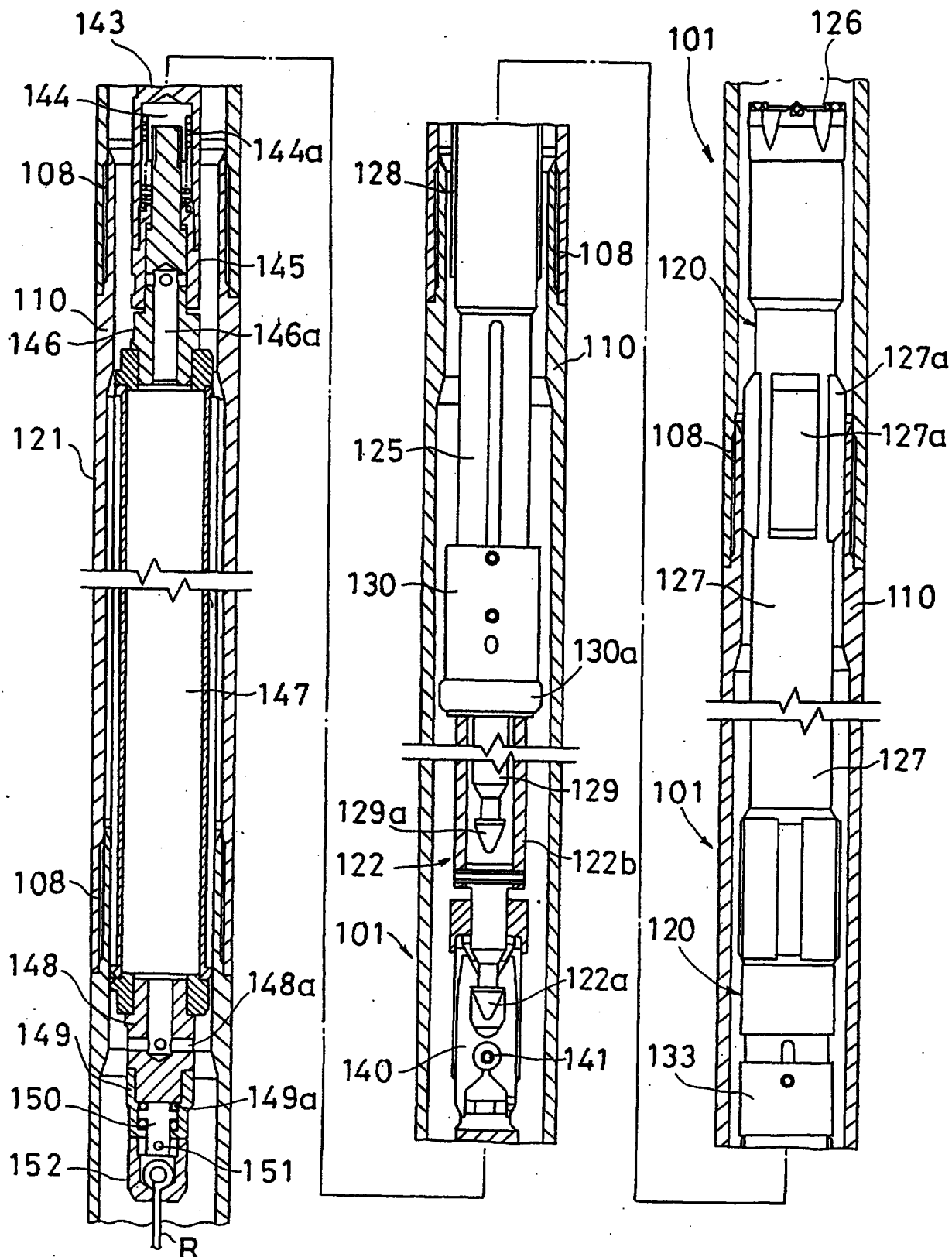


FIG. 13

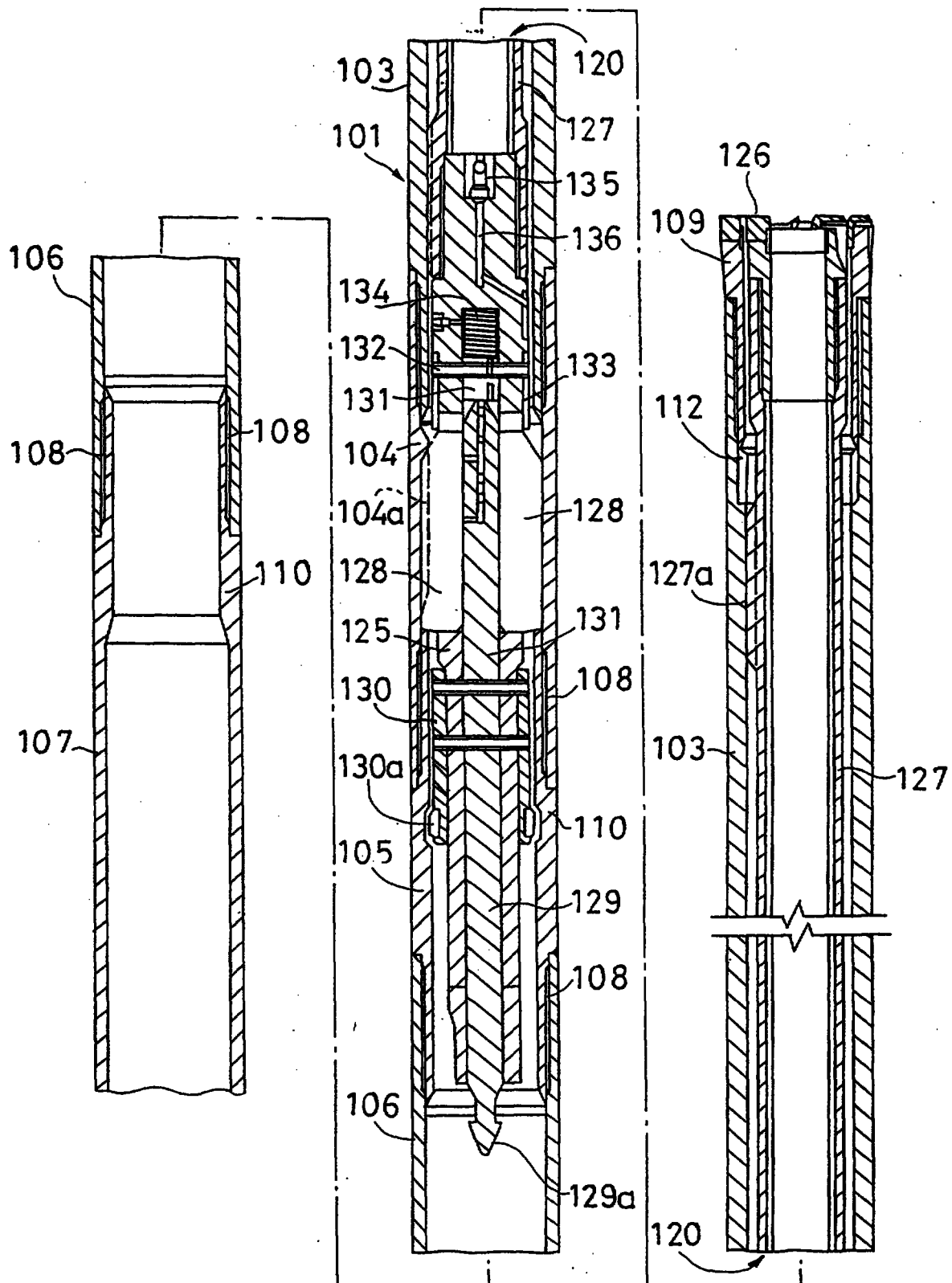


FIG. 14

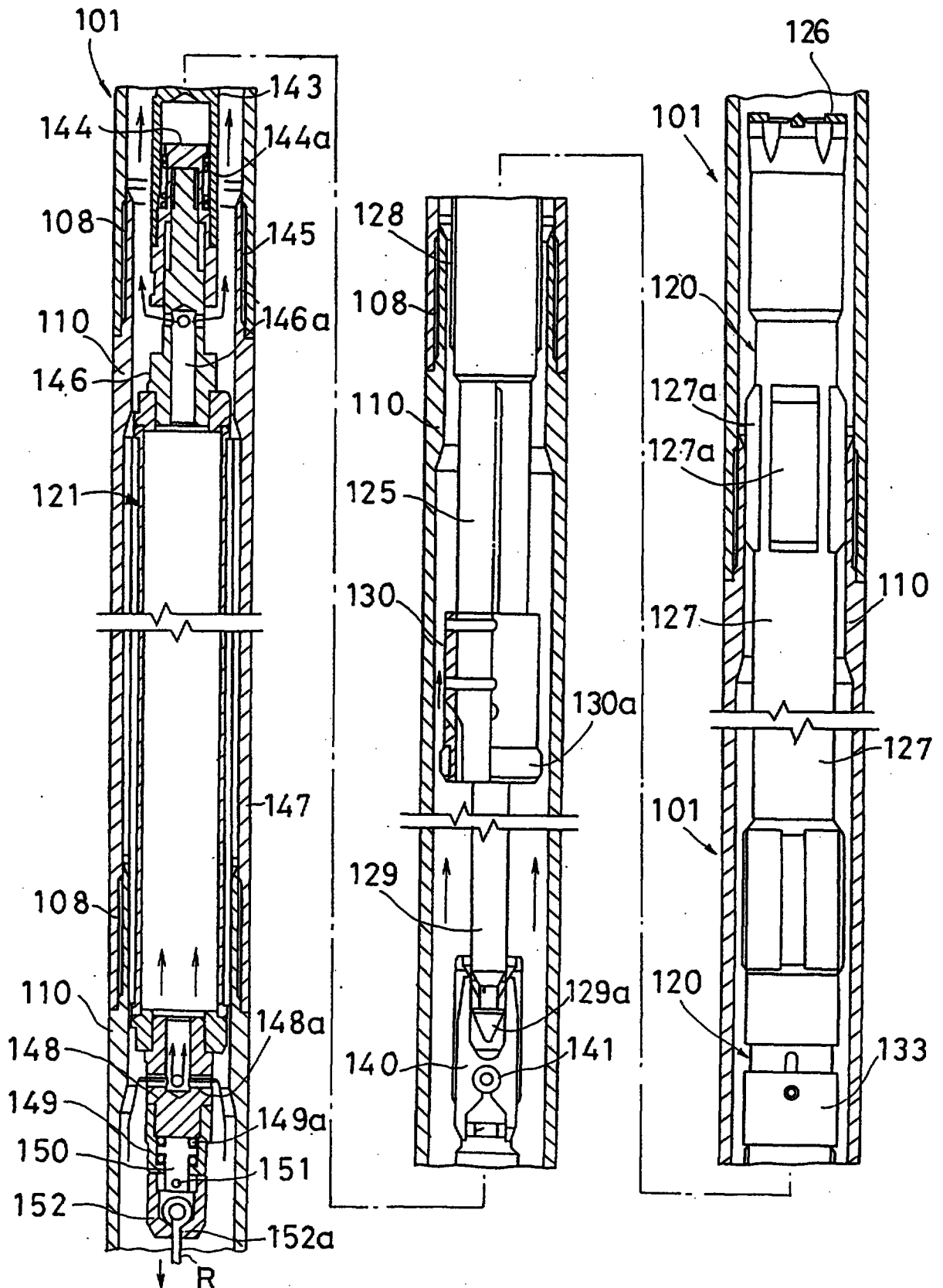


FIG. 15

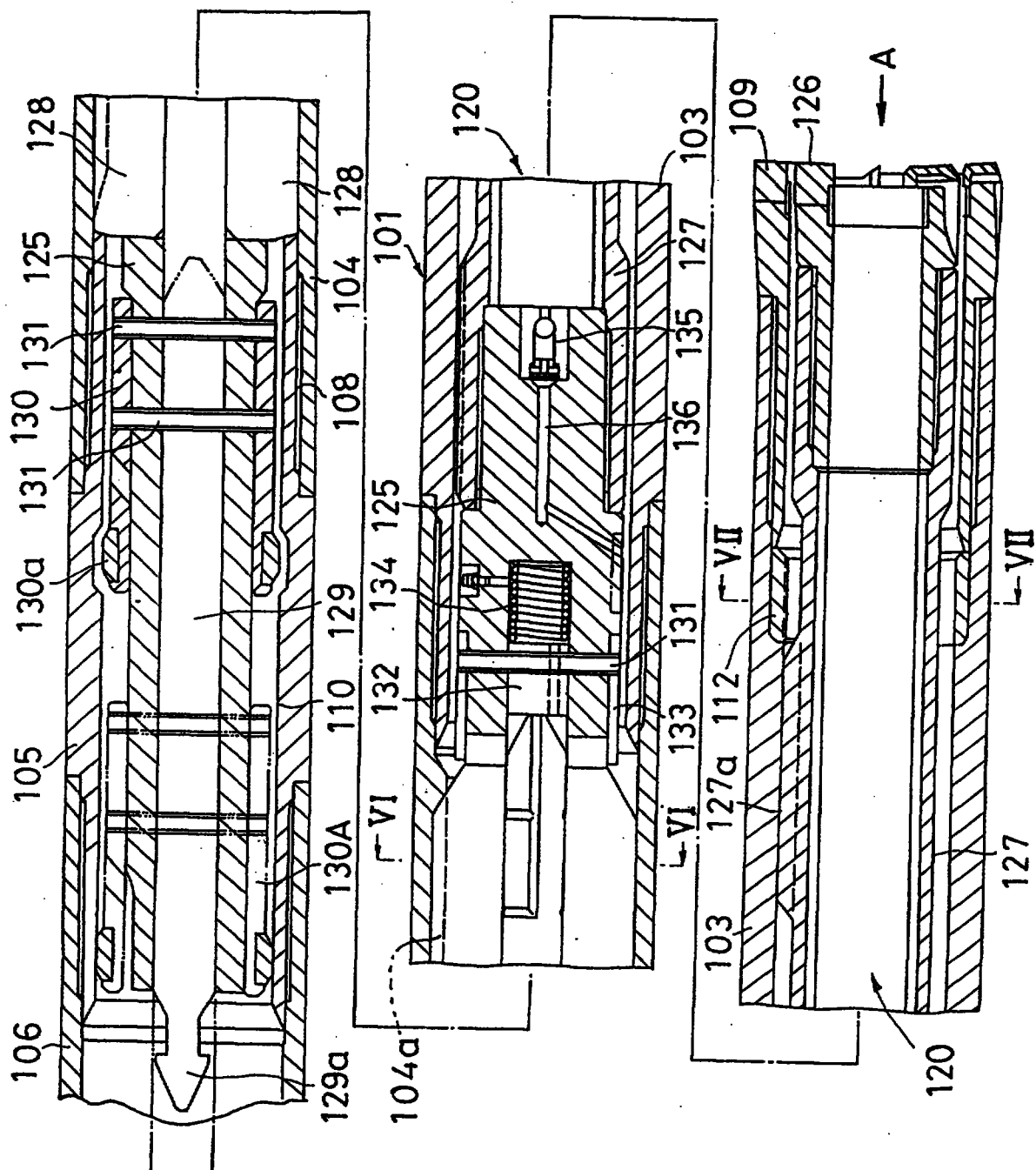


FIG. 16

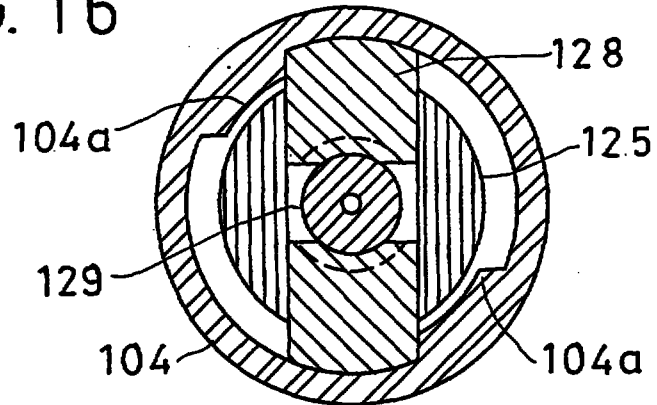


FIG. 17

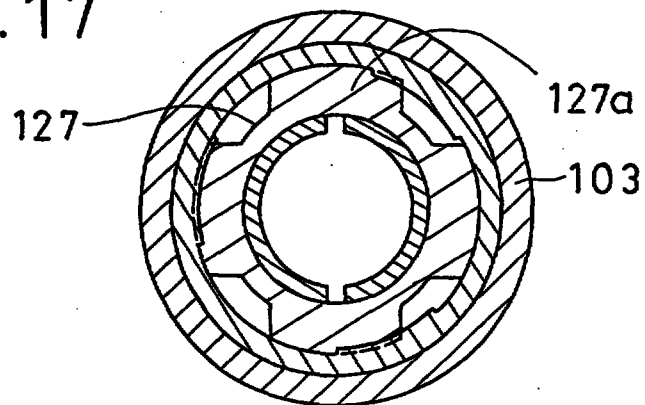
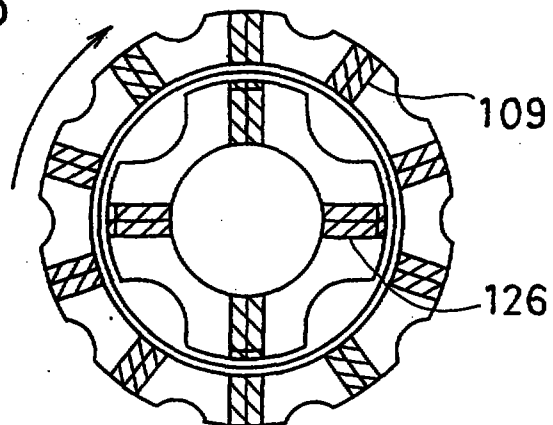
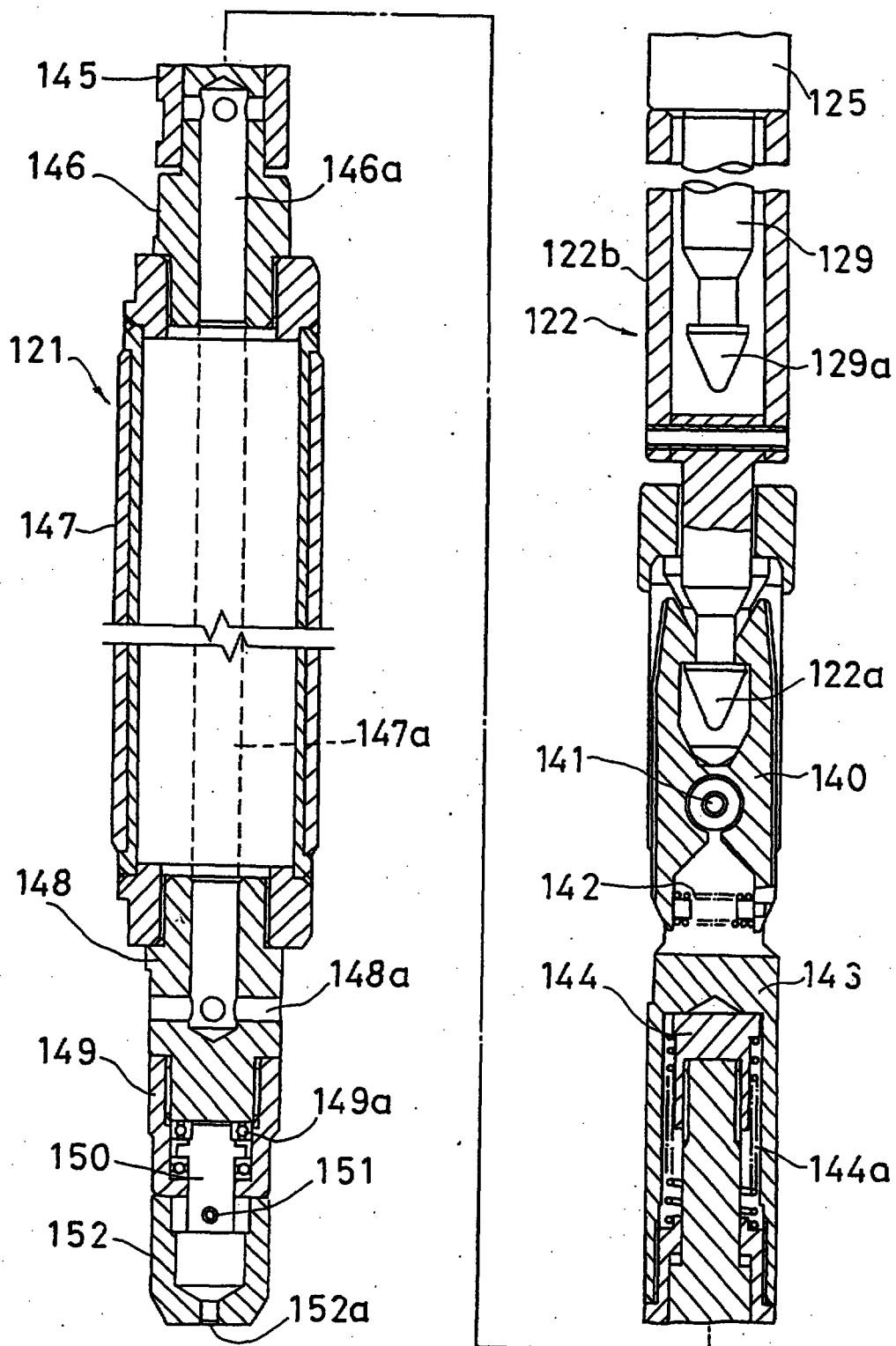


FIG. 18



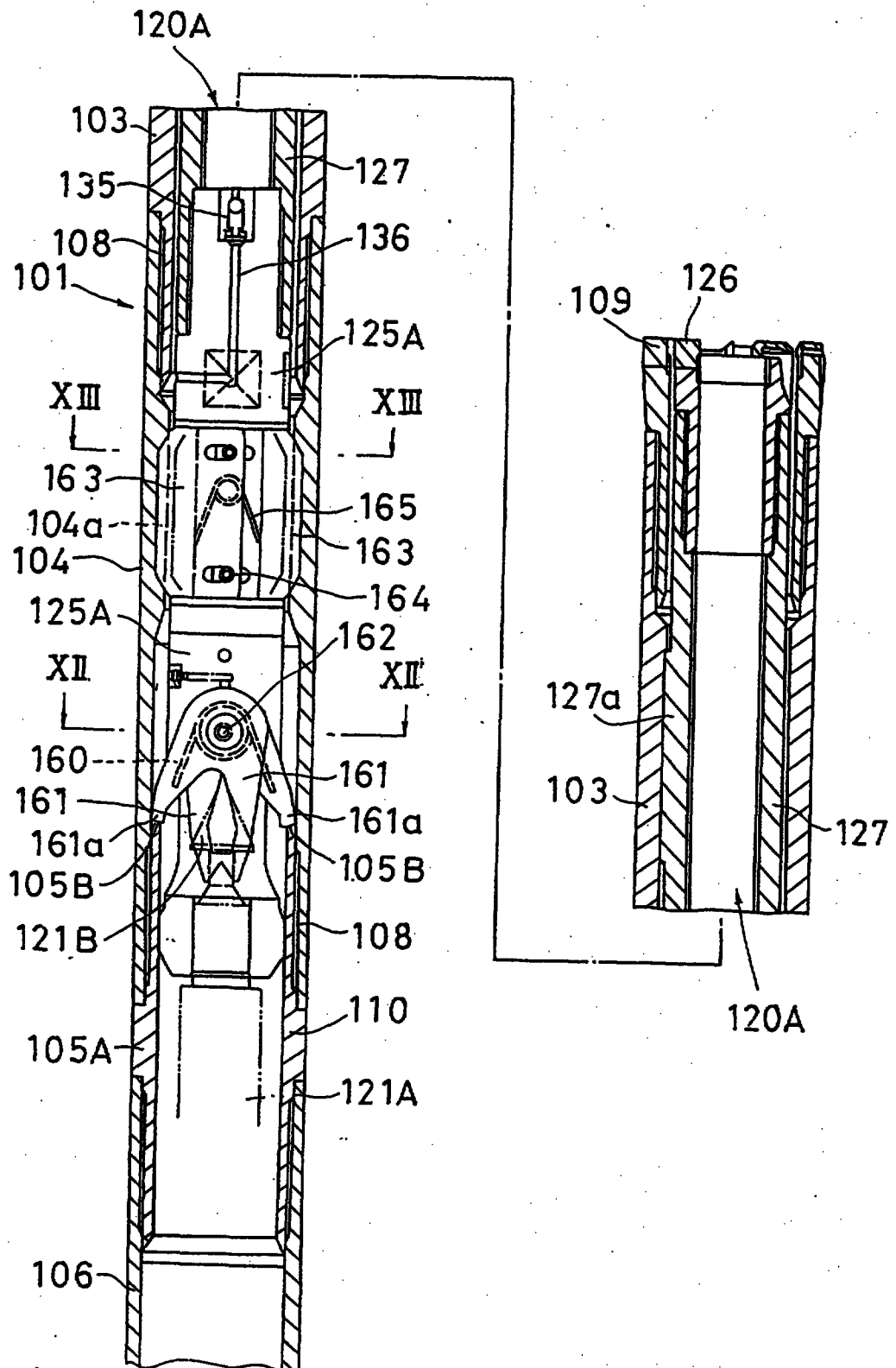
21 DEC 1996

FIG. 19



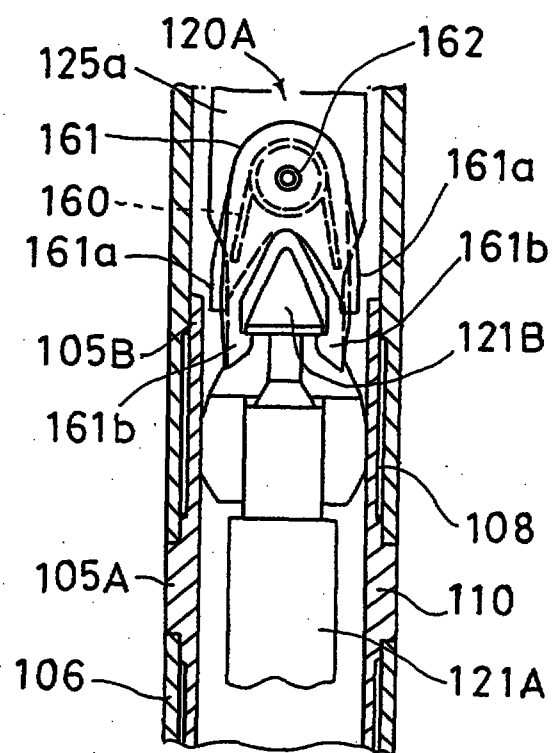
21 DEC 1996

FIG. 20



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FIG. 21



21 DEC 1996

FIG. 22

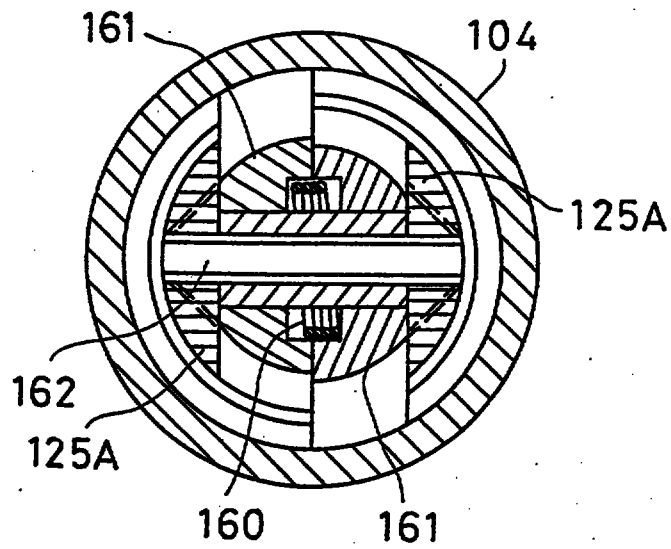
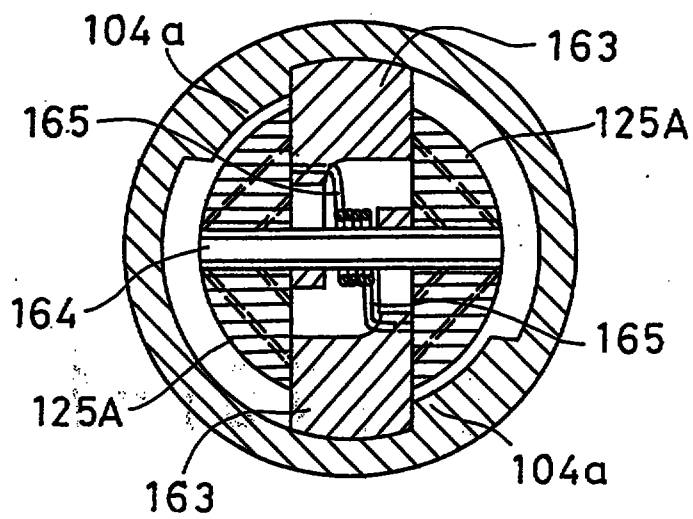


FIG. 23



SEARCH REPORT

Application No.:
9610751-1

TEXT OF THE ABSTRACT

WIRE LINE SAMPLING DEVICE

A core sampling at the time of horizontal excavation by using a device for perpendicular operation by inserting an overshot assembly into a drill rod and setting a sampler by utilizing the sending-in pressure of an excavating fluid.

When horizontal excavation is conducted by rotating a drill rod (34), an excavating fluid is forwarded into the drill rod (34), pressure is applied to a piston rubber (33) or a piston (35), and a wire line sampler is set through a push head (27) and a coupling member (9). A wire is wound and an overshot assembly is recovered, and a core is sampled in a percussion drill. The filing of the inside of a core tube with a core sample is confirmed, the push head (27) of the overshot assembly is replaced with a latch head (28) and the latch head (28) is inserted again, the head section of the coupling member (9) is gripped by a latch (30), and the sampler is recovered.

THIS SHEET HAS BEEN
REPLACED

REPLACEMENT SHEET

28 SEP 1998

This Sheet Has Been Replaced





What is claimed is:

1. A wire line sampling device provided with a wire line sampler incorporated in a drill rod of a rotary percussion drill and an overshot assembly inserted in the drill rod for inwardly and outwardly conveying the wire line sampler into/out from the drill rod, wherein:

an outer cylinder of the drill rod is constructed so that an expanded portion is formed on the inside of a screw connecting portion by connecting a plurality of pipes with screws; and

the wire line sampler which is inwardly and outwardly conveyed via the overshot assembly, which fits together with the expanded portion, is inserted into the inside of the outer cylinder, and when the wire line sampler is conveyed to a predetermined position, fixed devices are relatively provided in the outer cylinder and wire line sampler so that the outer cylinder and wire line sampler rotate integrally.

REPLACEMENT SHEETS		80
☐	Description : paged	to paged
☒	Claim(s) : paged	to paged
☐	Drawing(s) : paged	to paged
☒	Abstract : paged	to paged
DATE OF RECEIPT		

WIRE LINE SAMPLING DEVICE

ABSTRACT

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No figure suggested