

[54] **REMOTELY ACTUATED DEVICE FOR SURVEYING UNDERGROUND STRATA**

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Attorney, Agent, or Firm—Craig & Antonelli

[30] **Foreign Application Priority Data**

Dec. 17, 1971 France 71.45655

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[51] **Int. Cl.**..... **E21b 7/00, E21b 25/00, E21b 9/36**

[58] **Field of Search**..... **175/58, 60, 232, 233, 175/238-242, 248, 257, 87, 308, 175/317-319, 329, 330, 382, 404, 286**

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ABSTRACT

Device for taking cores of the ground formations at different levels of a well, adapted to be operated successively as a drilling apparatus and as a coring apparatus and comprising remotely controlled means for passing from drilling conditions to coring conditions and vice-versa by actuating a retractable plug member of the coring crown of the device by means of a variation of the flushing fluid pressure and/or a rotation of the device.

23 Claims, 10 Drawing Figures

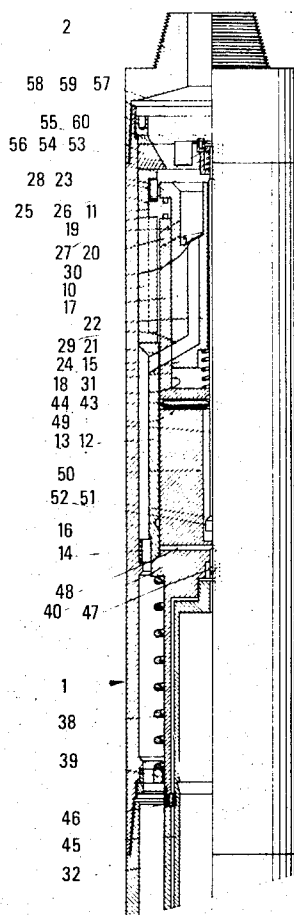


FIG. 1

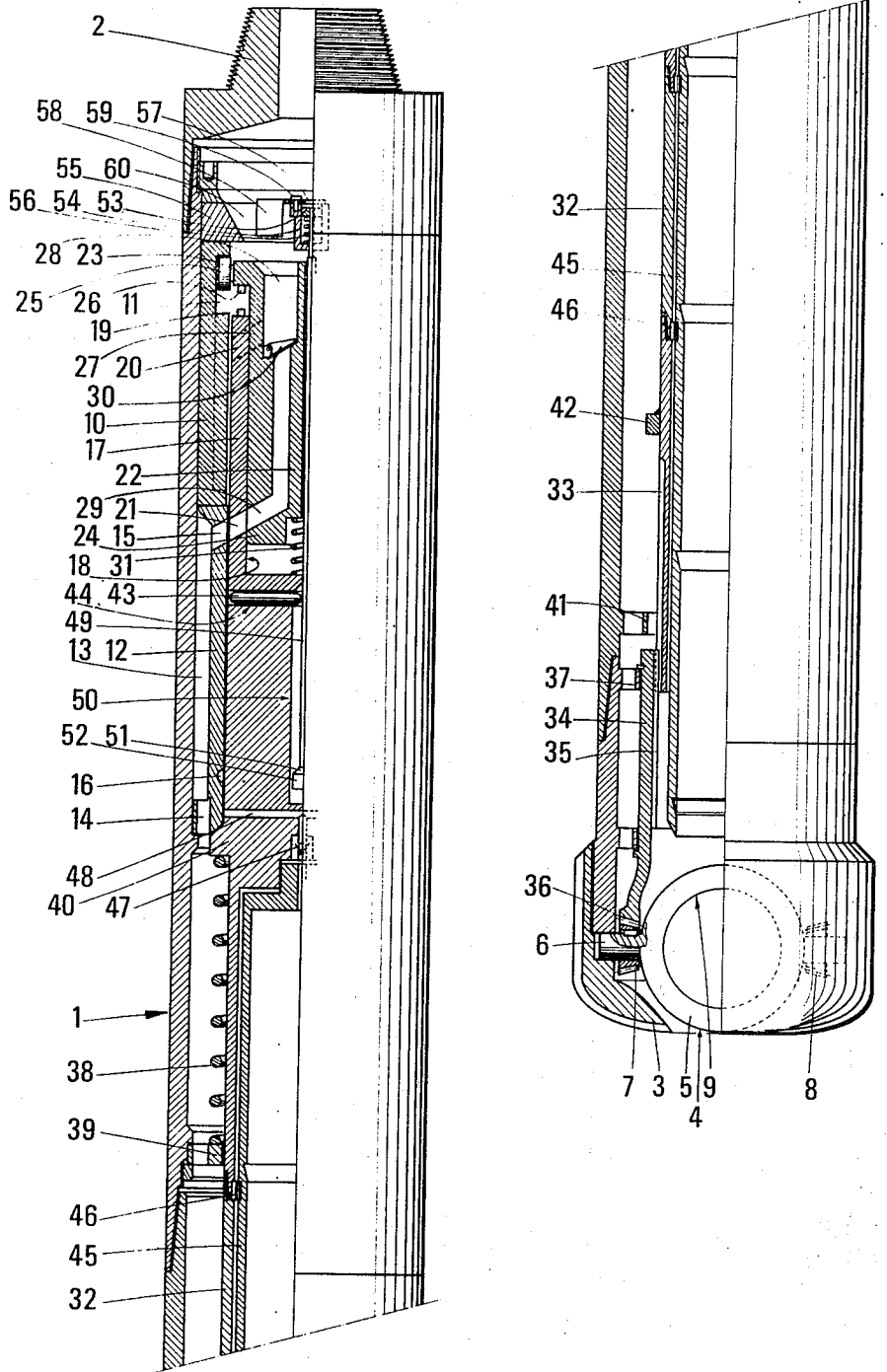


FIG. 2

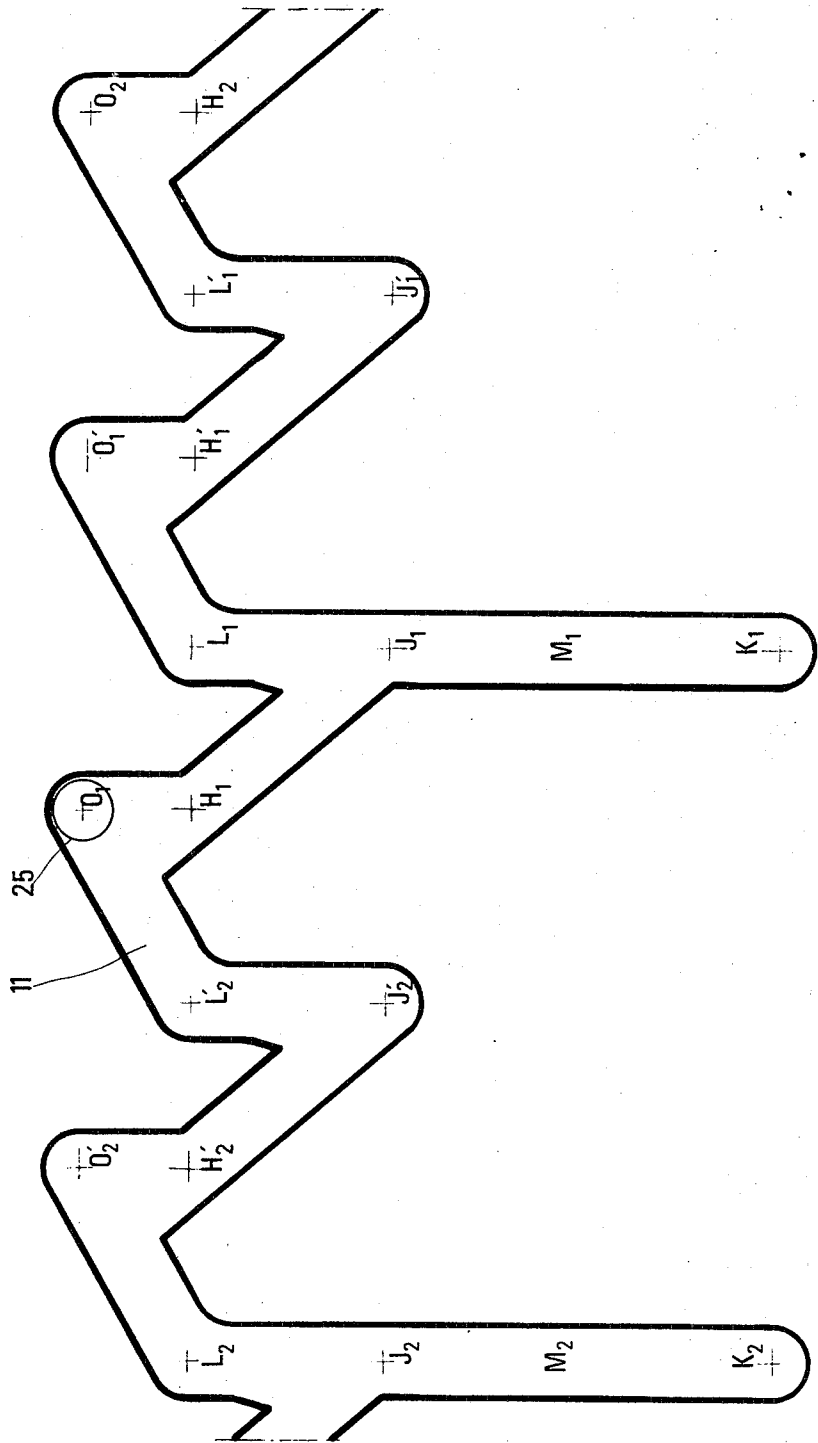


FIG. 3

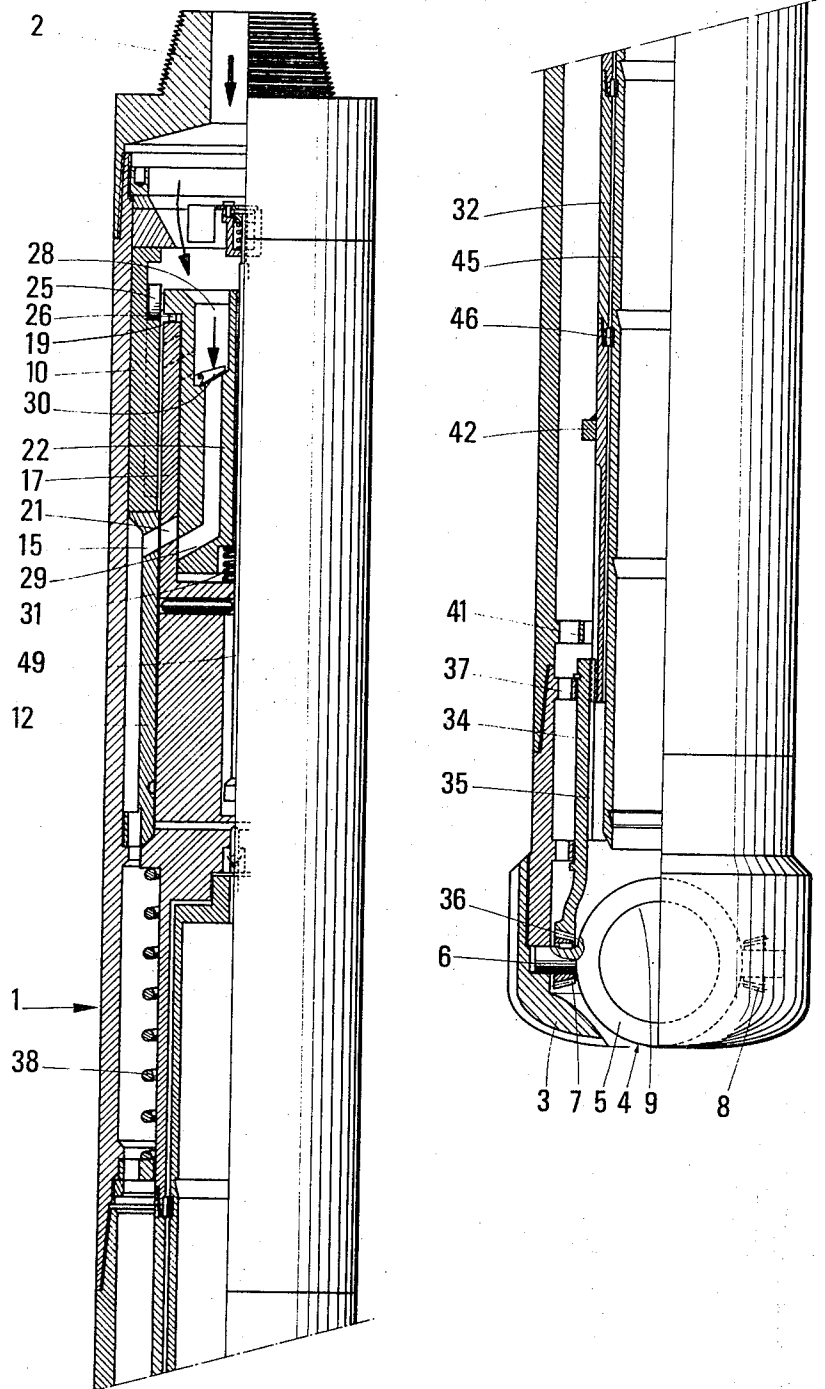
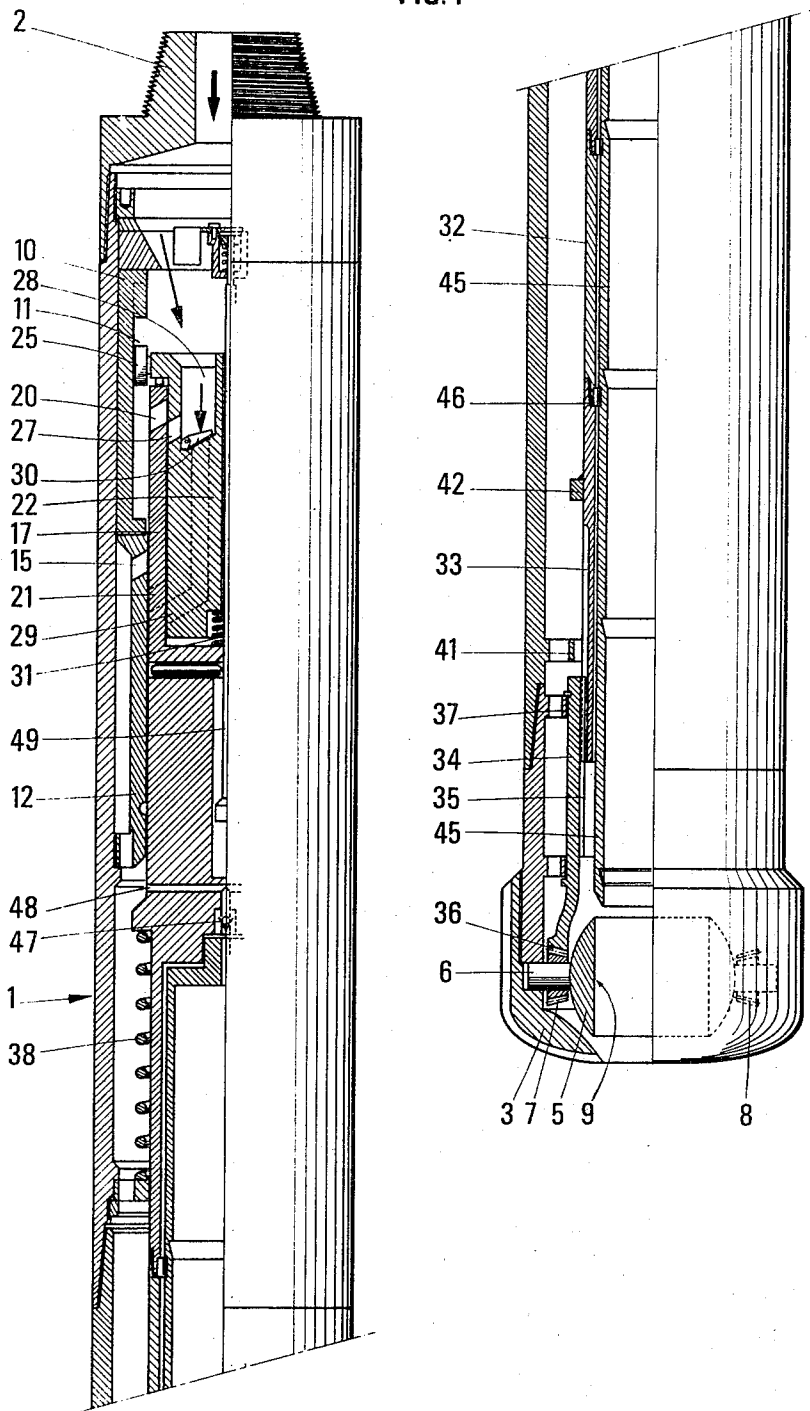


FIG.4



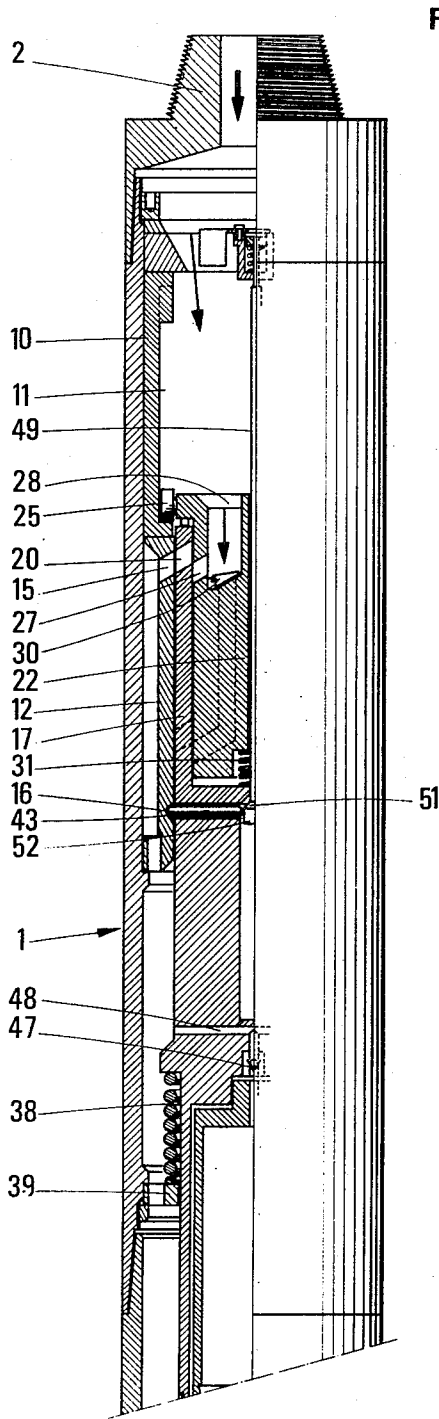
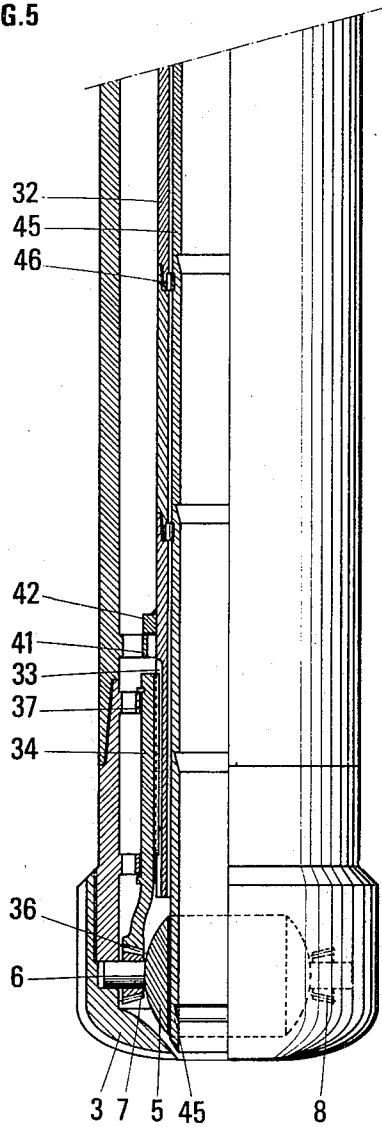


FIG. 5



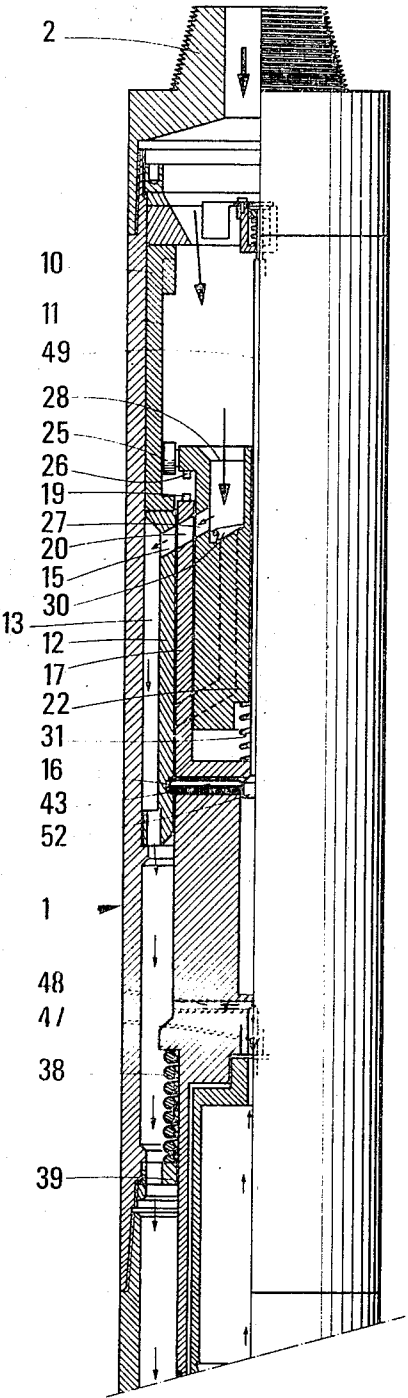
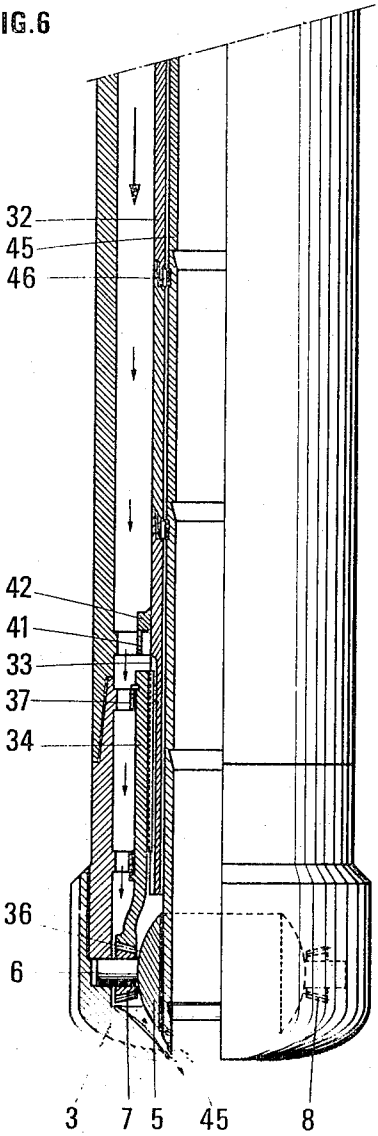
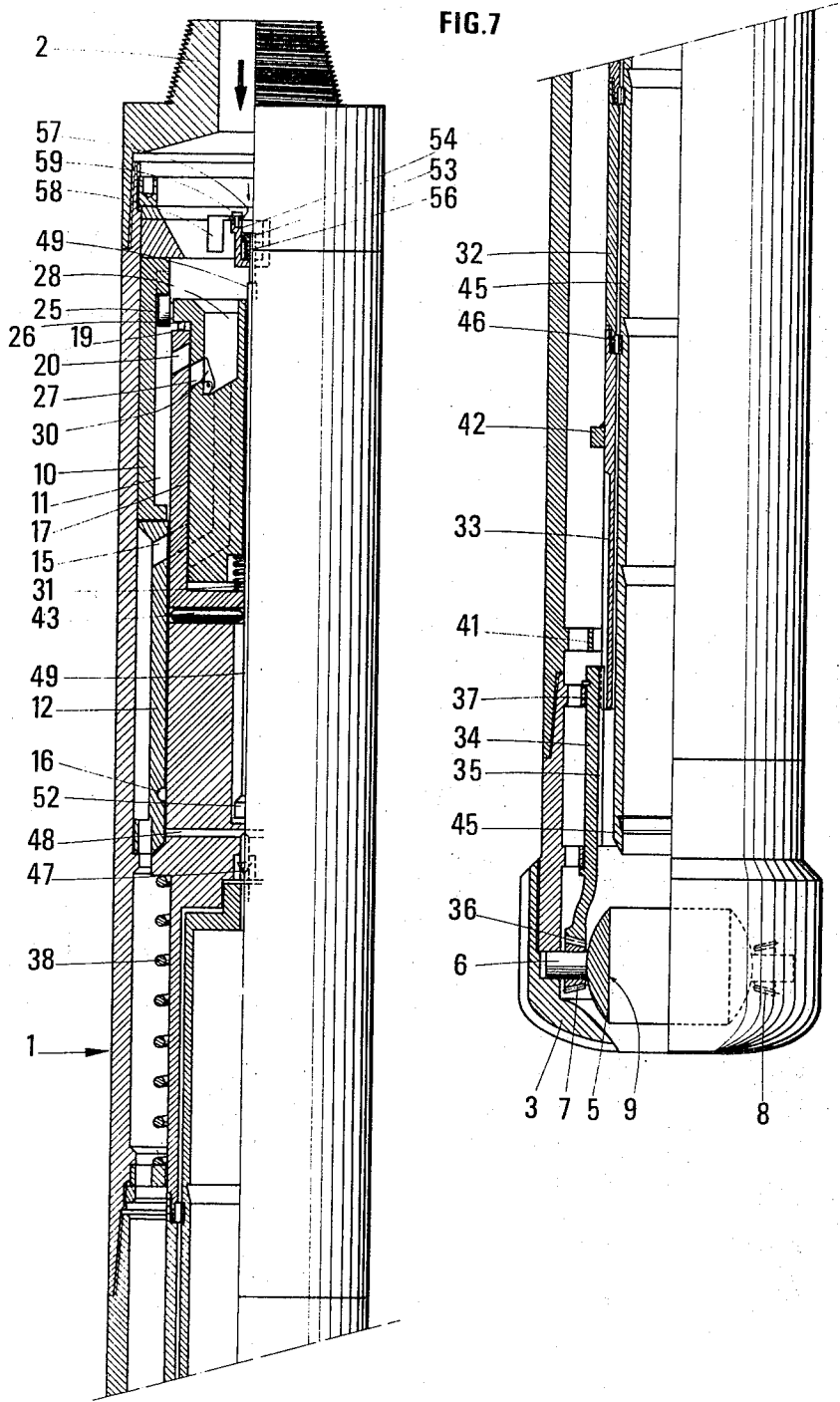


FIG. 6





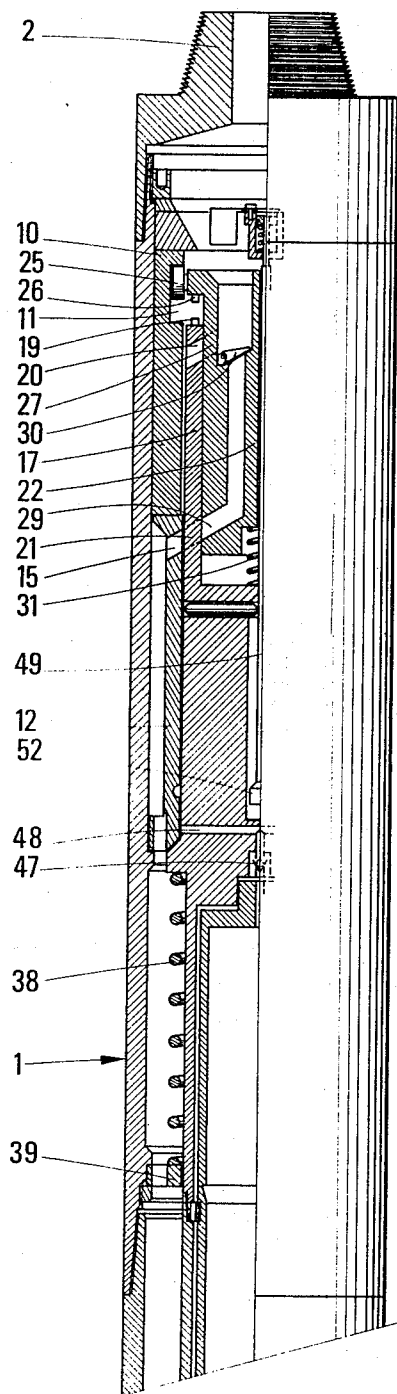
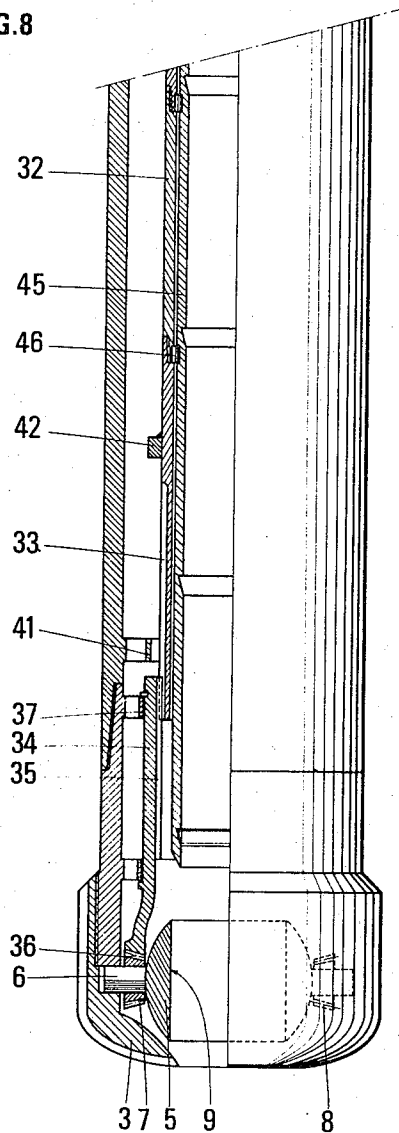


FIG. 8



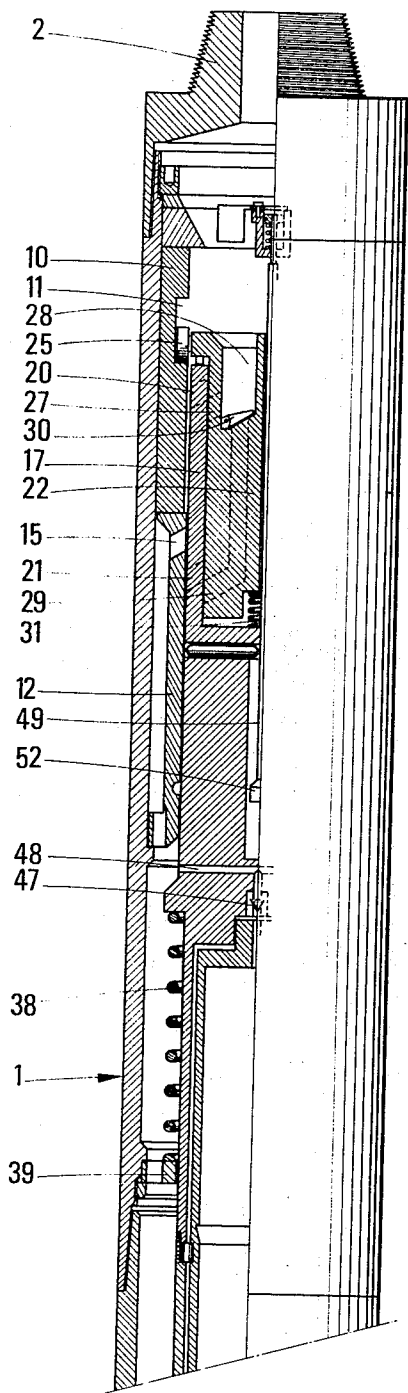
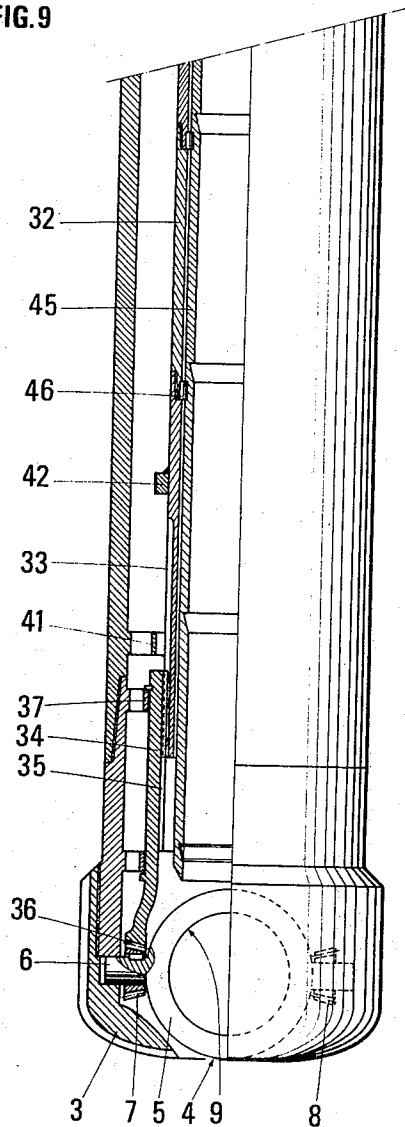


FIG. 9



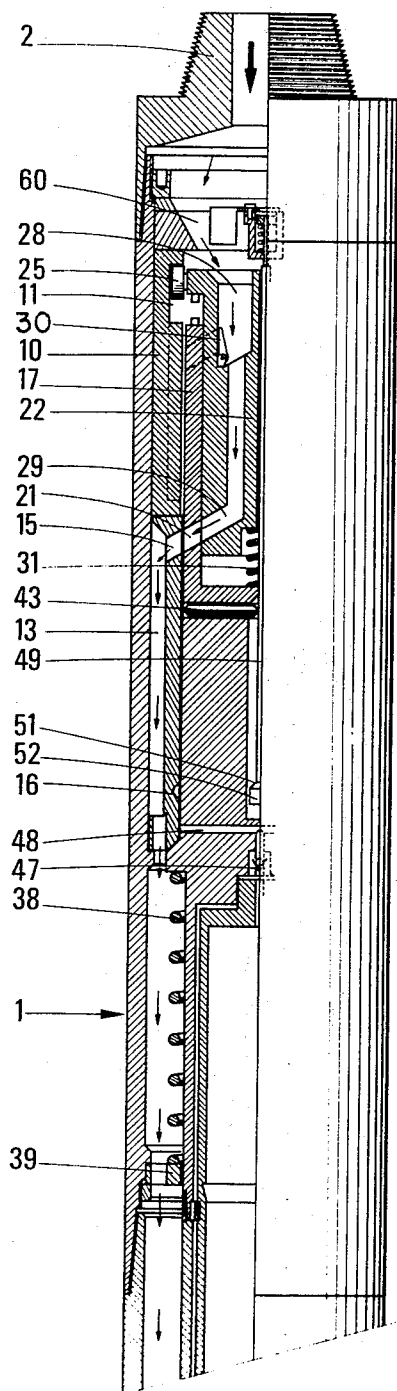
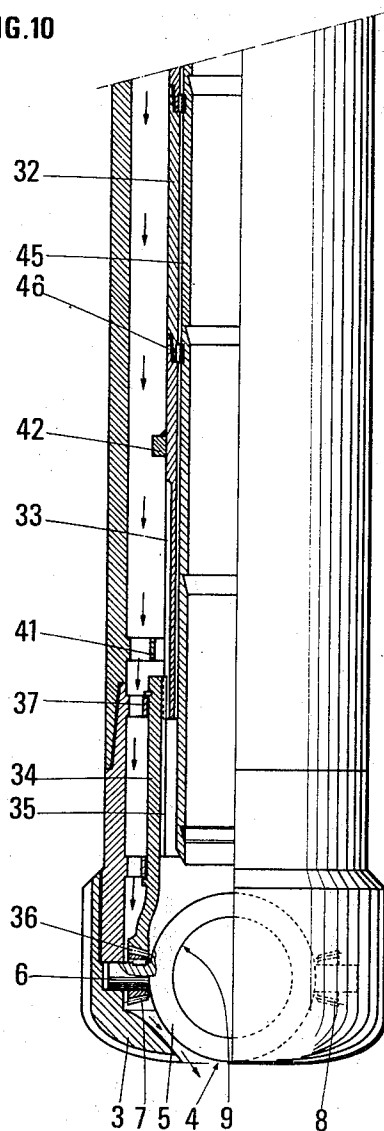


FIG. 10



REMOTELY ACTUATED DEVICE FOR SURVEYING UNDERGROUND STRATA

The present invention relates to a new remotely actuated device for surveying underground strata.

In the following reference will be made more particularly, by way of non-limitative example only, to a device for collecting ground samples or cores, suitable, in particular, for underwater coring, for surveying purposes.

One of the most serious difficulties encountered in the course of such operation, is the need to carry out in successively order drilling and coring operations for taking a core at a depth exceeding the useful length of the coring device, with in addition some risks of the borehole walls crumbling during the interval between said successive drilling and coring operations. Such crumbling due to drilling through unconsolidated formations makes difficult or impossible the identification of the cores taken subsequently.

The specification of the French Pat. No. 1,563,642, filed on Mar. 9, 1967, describes a remotely actuating coring device, enabling full diameter drilling of a bore, like a conventional drill tool, up to the depth selected for taking a ground sample, this device being then transformable into a coring tool, by remote control performed from the ground surface, once this depth has been reached.

A drawback of this prior device lies in the fact that only one sample can be taken. Thus, if a plurality of cores must be taken, corresponding to different depths, it is necessary, after the first coring operation has been achieved, to raise the device out of the borehole, then extract the core from this device and reset the device into its drilling position before lowering it again into the borehole.

This last operation requires the use of means for guiding the device so that it can be reintroduced into the borehole. During underwater surveying operations it is not always possible to install such guiding means and if a plurality of ground samples or cores must be taken at very different depths, it becomes then necessary to perform a number of drilling operations equal to the number of cores to be taken, which increases the duration and consequently the cost of the entire for underwater surveying operation.

The main object of the present invention is accordingly to provide a coring device capable of taking, successively, a plurality of ground samples or cores, at different depths, these cores being obtained by drilling a single bore, without requiring the raising of the coring device from the bore and its reintroduction therein after each ground sample has been taken.

In other words, the invention provides a device capable in the course of single run to drill at full diameter up to a first selected depth, to take a first core exclusively when said first selected depth has been reached, then to drill again at full diameter in a single drilling run up to a second selected depth, to take a second core exclusively at said second depth and so on for any number of cores to be taken.

The device according to the invention comprises a tubular body which is provided with a coring crown at its lower end, means for making said tubular body fast in rotation with driving means and for connecting said body with a source of flushing fluid under pressure, means for surveying the ground layers, said surveying

means being housed within said tubular body, a plug having a first position corresponding to drilling, wherein said plug prevents the building of a core in the central part of said coring crown, and a second position corresponding to surveying operations performed in the ground layers, wherein said plug is removed from the central part of said coring crown and actuating means for controlling the position of said plug.

In the device according to the invention, said actuating means are constituted by means for reversibly displacing said plug from said first to said second position, by means of a control device for said plug, said control device being axially displaceable along and rotatably mounted on guiding means, said actuating means being adapted to displace said plug from said first to said second position under the action of at least one pressure variation in the flushing fluid and to displace it from said second to said first position under the action of at least a rotation of said device, following a stopping of this device, said rotation being itself followed by at least one variation in the pressure of the flushing fluid.

The invention will be more fully understood and other advantages thereof will be made apparent in the following description of a non-limitative embodiment thereof, illustrated by the accompanying drawings wherein:

FIG. 1 is a diagrammatic sectional view of a device according to the invention;

FIG. 2 is a developed view of the guiding ring;

FIGS. 3 to 10 illustrate the operation of the device according to the invention.

FIG. 1 is a diagrammatically sectional view of the coring device according to the invention, ready to drill at full diameter.

This device comprises a tubular body 1 of substantial length, formed of a plurality of tubular elements connected end to end through any suitable means. At its upper end the body 1 is extended by an element 2 for connection to means (not shown) for driving the device in rotation and connecting this device to a source of flushing fluid under pressure. The device may in particular be connected to the lower end of a drill pipe. A crown-shaped drill bit 3 is secured at the lower end of the body 1.

During the core sampling operations, a core is formed in the central part of the crown bit 3.

In order to permit full diameter or full bore drilling, there is provided a plug indicated as a whole by reference numeral 4.

The plug 4, located substantially on the axis of the device and in the close vicinity of the drill bit, mainly comprises a substantially spherical ball 5. This ball is integral with a shaft 6 whose axis passes through the center of the ball 5. The shaft 6 journaled on bearings provided in the wall of the body 1 is perpendicular to the vertical axis of the device. The shaft 6 is provided, on both sides of the ball 5, with a toothed conical pinion (pinions 7 and 8 respectively). The pinion 7 is integral with the shaft 6 and the pinion 8 is idle on this shaft. The pinion 7 can drive in rotation the shaft 6 and the ball 5, as explained more fully hereinafter in the description of the operation of the device.

Through the ball 5 is provided a bore 9 having an axis at right angles to the axis of the shaft 6 and centered on the axis of the body 1 of the device. The object of this bore will be explained more fully hereinafter.

The external wall of the ball 5 is provided with cutting elements, constituted for example by a diamond concretion, which, for certain positions of the ball 5 permits the destruction of the core which would otherwise be formed in the central bore of the crown bit 3.

At the upper end of and inside the body 1, is secured a guiding ring 10 the wall of which is provided with a slot or guide path 11 having the shape illustrated by FIG. 2, which is a developed view of the guiding ring 10.

The guiding ring 10 is extended at its lower end by a discharge ring 12, integral with the body 1. The diameter of the bore of ring 10 may be identical to or greater than that of ring 12. The ring 12 and the internal wall of the body 1 define an annular space 13 which, on the one hand, communicates at its lower part, with the internal bore of the body 1 through vertical ducts 14 and, on the other hand, communicates at its upper part with the internal bore of the ring 12 through four openings 15 located at one and the same first level and regularly distributed, i.e., at an interval of 90°.

The internal wall of the ring 12 is provided below the openings 15 with an annular slot 16, whose object is explained more fully hereinafter.

A cylindrical distributor 17 is slidably and rotatably mounted in the bore of the ring 12.

The upper part of the distributor 17 is provided with a bore 18 whose wall is provided on its upper face with locking teeth 19.

Eight openings 20 located at one and the same level and regularly distributed, i.e. at an angular interval of 45° from each other, are provided through the wall of the distributor 17, opening out in the bore 18. Eight openings 21 are provided at a second level below said first level and offset by 22°30' with respect to the openings 20, these orifices 21 opening in the bore 18.

A piston 22 is placed along the axis of the device. This piston 22 has an upper part 23 of greater diameter which may slide within the bore of the guiding ring 10, and a lower part 24 of smaller diameter which may slide in the bore 18 of the distributor 17.

The upper part 23 of the piston 22 is provided with two lugs or guiding fingers 25 and 25', only one of which is shown in FIG. 1 and which cooperate with the slot 11 of the guiding ring 10 for determining the movements of piston 22. The part 23 of piston 22 is provided with locking teeth 26 which can cooperate with the teeth 19 of distributor 17.

At a first level of the lower part 24 of piston 22, four openings 27, regularly distributed, communicate with vertical ducts 28 of piston 22 opening into the upper face of this piston. At a second level of the part 24 four openings 29 regularly distributed at an angular interval of 45° with respect to the openings 27, communicate with the ducts 28.

Flap valves 30 provide for a selective communication between the ducts 28 and the openings 27 and 29.

A spring 31 is placed between the piston 22 and the distributor 17.

The distributor 17 is integral with an extension member 32 constituted by a tubular element whose lower end is provided on its outer surface with grooves 33 parallel to the axis of the device. These grooves cooperate with a tubular element 34 provided with complementary grooves 35.

The tubular element 34 is provided with a toothed crown 36 which is in mesh with pinions 7 and 8 provided on the shaft 6.

The tubular element 34 is held in position by bearings 37 integral with the body 1 with respect to which this tubular element 34 is rotatable.

The element 34 thus constitutes a telescopic coupling between the pinions 7 and 8 and the extension member 32 which is axially displaceable.

The extension member 32 is held in position within the bore of the body 1 by bearings (not shown) and a spring 38 located between a shoulder 39 integral with the body 1 and a shoulder 40 integral with the extension member 32.

Other elements such as the stops 41 and 42 carried by the body 1 of the device and the extension member 32 respectively, limit the axial movements of the extension member 32.

Cotter pins 43 are housed in radial slots 44 provided in the distributor 17 below the bore 18.

Within the extension member 32 is housed a core barrel 45 constituted, for example, by a plurality of elements connected end to end.

The core barrel 45 is held in the extension member 32 through bearings 46, such as ball bearings, allowing a relative rotation of the extension member and the core barrel.

At its upper end, the bore of the core barrel 45 communicates with the internal bore of the tubular body 1 through a non-return flap valve 47 and ducts 48.

The flap valve 47 only permits a fluid flow from the core barrel 45 towards the bore of the body 1.

The core barrel is provided with conventional devices, called "catchers," well known to those skilled in the art, to hold in place the samples or cores.

As its lower end, the core barrel 45 has an outer diameter slightly smaller than the diameter of the bore 9 of the plug 4.

An actuation rod 49, which passes through the piston 22 and between the pins 43, penetrates at its end into a recess 50 provided in the distributor 17.

The rod 49 is provided at its lower part with a conical shoulder 51 connecting this rod 49 to cylindrical part 52 of greater diameter.

At its upper end, the rod 49 is integral with a piston 53 which is displaceable in a cylindrical recess 54 provided in a support member 55 integral with the body 1. The rod 49 and the piston 53 are supported by a spring 56 provided between the piston 53 and the support member 55, so that, at rest, the piston 53 be in its uppermost position.

The cylindrical space 54 is obturated at its upper end by a shutter 57 connected to a small mass 58 which, under the action of the centrifugal force, can rotate about a shaft 59 integral with the support member 55.

Ducts 60 are provided through the support member 55, for the passage of the flushing fluid therethrough.

FIG. 2 illustrates in a developed view the slot or guide path 11 provided in the ring 10.

This slot comprises vertical parts O_1H_1 , L_1K_1 , $O'_1H'_1$, $L'_1J'_1$, O_2H_2 , L_2K_2 , $O'_2H'_2$ and $L'_2J'_2$ provided on generatrices regularly spaced on the ring 10, i.e. limiting eight ring portions corresponding to arcs of a circle of 45°.

These vertical parts are interconnected through identical inclined parts of the slot H_1J_1 , $H'_1J'_1$, H_2J_2 and $H'_2J'_2$.

The points O_1 , O'_1 , O_2 and O'_2 are located at one and the same first level, the points H_1 , L_1 , H'_1 , L'_1 , H_2 , L_2 , H'_2 and L'_2 being located at a second level, below said first level. The points J_1 , J'_1 , J_2 and J'_2 are located at one and the same third level, below said first and second levels, while the points K_1 and K_2 are located at a fourth level below the preceding ones.

The operation of the device will be indicated hereinunder with reference to the drawings.

During the drilling operation, the plug 4, the piston 22 and the distributor 17 are in the position illustrated by FIG. 1, i.e., the bore of the crown bit 3 is obturated by the ball 5. The centrifugal force resulting from the rotation of the device during a drilling operation causes the valve 30 to assume a position closing the opening 27 whereby only the openings 29, 21 and 15 of the piston 22 and of the distributor 17 of the discharge ring 12 register with one another so as to allow the flow of drilling fluid.

When after a drilling operation at full diameter the device reaches the depth at which a coring operation has to be carried out, the rotation of the device is stopped, as well as its feeding with flushing fluid and the flap valve 30 assumes the position illustrated in FIG. 1.

The device is then in its position illustrated by FIG. 1, the flap valves 30 interrupting any communication between the ducts 28 and the openings 29. The lugs 25 and 25' are respectively located at points O_1 and O_2 (FIG. 2) on the guide path 11.

For sake of clarity, reference will only be made hereinafter to the displacement of the lug 25 along the guide slot 11, the number of lugs being obviously non limitative, provided that the guide slot comprises at least as many times a part such as $O_1H_1K_1L_1O'_1H'_1J'_1L'_1O_2$ as there are lugs integral with the piston 22.

Flushing fluid under a pressure P_1 is then supplied to the device. The pressure acts on the upper face of piston 22 which moves downwardly and vertically guided by the lug 25 which is displaced in the slot 11 until point H_1 (FIG. 2).

In this position the spring 31 is compressed and the teeth 19 and 26 cooperate so as to make fast in rotation the piston 22 and the distributor 17 (FIG. 3).

By increasing the pressure up to a value P_2 greater than P_1 , the displacement of the piston is continued. The lug 25 is moved along the part H_1J_1 of the slot (FIG. 2), thus producing a determined rotation of the piston 22 together with a downward displacement of this piston.

As indicated hereinabove, since the piston 22 and the distributor 17 are connected to each other, this displacement is also imparted to the distributor 17, thus causing a downward displacement and a rotation of the extension member 32 while partly compressing the spring 38. This displacement has two effects:

a. The rotation of the extension member 32 results, through the grooves 33-35, in the rotation of the element 34 and of the crown 36.

The number of teeth of the crown 36 and of the pinion 7 has been so determined that the ball 5, under the action of this rotation, rotates by 90° about its shaft 6, so that the axis of the bore 9 comes into registration

with the axis of the device, thus making free the bore of the tool 3.

b. The vertical displacement of the piston 22 brings closer to each other the lower end of the core barrel 45 and the plug 4.

The device is then in the position illustrated by FIG. 4, without any communication between the openings 15, 21, 29, 20 and 27.

By increasing the pressure up to a value P_3 greater than P_2 , the lug 25 is displaced along the part J_1K_1 of the slot (FIG. 2) and the downward displacement of the assembly is continued without rotation. The lower end of the core-barrel penetrates into the bore 9 of the ball. When the lug 25 reaches the point K_1 of the guide slot 11, the pins 43 register with the slot 16 whereinto they are urged by the conical abutment 51, on which they bear. The lower end of the core barrel which has penetrated the bore 9 of the ball 5 is located in the vicinity of the working face of the crown bit 3, as shown in FIG. 5. The distributor 17 is locked in this position by the pins 43. In this position only the openings 20 communicate with the openings 15 of the discharge ring 12.

The flow of flushing fluid is then interrupted. Under the action of the spring 31, the piston 22 rises back, the lug 25 being displaced along the part K_1M_1 (FIG. 2) of the slot. In this position, which is the coring position, the openings 27 of the piston communicate with the upper openings 20 of the distributor 17 and the openings 15 of the discharge ring 12.

A flushing fluid is then circulated which maintains the flap valves 30 in the illustrated position and flows along the working face of the drill bit while following the path indicated by the arrows in FIG. 6. In order to carry out a coring operation the device is then driven in rotation. The pressure of the flushing fluid keeps the flap valve 57 in its position wherein it covers the piston 53, thus preventing any downward displacement of the actuation rod 49 by the flushing fluid.

The core which is formed within the bore of the crown bit 3 penetrates the core barrel 45 in which this core is kept unbroken and is not destroyed by friction on the internal wall of the core barrel 45 since the latter is not driven in rotation by the extension member 32, due to the presence of ball bearings 46 between these two elements.

When the length of the so-formed core is deemed sufficient and that another coring operation is to be carried out at a very different depth, the rotation of the device and then the fluid supply thereto are discontinued.

The device is then again rotated. Under the action of the centrifugal force, the weight 58 rotates about its shaft 59, driving the flap valve 57 which then uncovers the upper part of the space 54. Under the action of the centrifugal force, the flap valves 30 obturate the upper openings 27 of the piston 22, establishing the communication between the ducts 28 and the openings 29 of the piston.

The flushing fluid is then circulated. The fluid pressure acts on the piston 22, thereby compressing the spring 31, so that the teeth 26 and 19 engage each other, thus coupling the piston 22 with the distributor 17.

The fluid pressure has a value P_4 which is sufficient for displacing the piston 53 against the action of the spring 56 and moving downwardly the actuation rod 49.

The pins 43 are no longer held in the slot 16 by the cylindrical part 52 of the rod 49 and, under the action of the spring 38, the assembly rises again, without rotating, guided by the pin 25 which is displaced in the slot 11 from point M₁ to point L₁ (FIG. 2). The device is then in the position illustrated by FIG. 7, i.e., the core barrel 45 is in its upper position uncovering the bore of the ball 5 of the plug 40.

The circulation of flushing fluid is then discontinued. The actuation rod 49 comes back to its initial position and, under the action of the spring 31, the piston 22 moves upwardly thereby releasing from each other the teeth 19 and 26 which connect the distributor 17 and the piston 22.

Guided through the pin 25, which is displaced in the slot 11 from point L₁ to point O'₁, the piston alone is subjected to a rotation during its upward movement. The device thus reaches the position illustrated by FIG. 8, the plug 4 still leaving free the central bore of the crown bit 3.

The flushing fluid is again circulated until its pressure reaches the value P₁ for which the piston 22, guided by the pin 25 displaced from O'₁ to H₁ (FIG. 2), moves downwardly and vertically while the teeth 19 and 26 engage each other, thus making the piston 22 fast in rotation with the distributor 17. When the pressure is increased up to the value P₂, the pin 25 is displaced from H₁ to J'₁ (FIG. 2), thus producing, together with a downward displacement, a rotation of the piston 22, transmitted to the distributor 17, to the extension member 32, to the tubular element 34 and to the toothed crown 36, which, being in mesh with the piston 7, rotates the ball 5 by 90°, thus obturating the central bore of the drill bit (FIG. 9).

By decreasing the pressure to the value P₁, the pin 25 is displaced from J'₁ to L'₁, thus producing an upward movement of the assembly constituted by the distributor 17 and the extension member.

Upon releasing the pressure and under the combined action of the spring 31 and the pin 25 displaced from L'₁ to O₂, the piston 22 is moved back upwardly and rotates alone, in the position illustrated by FIG. 10, i.e., in the position wherein the openings 29, 21 and 15 communicate.

The device is then back in its drilling position. The drilling operation may then be performed. For this purpose, the device is rotated, the flap valves 30 establishing the communication between the ducts 28 and the openings 29. The flushing fluid is then circulated so as to wash the working face of the drill bit, through the ducts 60, 28, the openings 29, 21 and 15 which register with each other, the annular space 13 and the bore of the body 1, as indicated by the arrows in FIG. 10.

The part O₂H₂K₂L₂O'₂H'₂J'₂L'₂O₁ of the guide slot is identical to the part O₁H₁K₁L₁O'₁H'₁J'₁L'₁O₂ followed by the pin 25 during the preceding operative steps and the same operations may be repeated so as to successively perform a coring operation, a drilling operation, then again a coring operation etc ...

Of course the length of the core barrel will be at least equal to the sum of the lengths of the cores to be taken.

The flap valve 47 and the ducts 48 described with reference to FIG. 1 are well known devices used in the art, to permit the penetration of the core into the core barrel while avoiding the building of an overpressure at the upper part of the core barrel.

The abutments such as 41, 42, 39 and 40 provide for the fixation of the uppermost and lowermost positions of the extension member. Their number and arrangement will be chosen by those skilled in the art in accordance with the size of the device.

In the case where, as a result of a wrong operation, the operator wants to know the state or position of the device, it is necessary to perform successive pressurizations of the flushing fluid, while this device is not driven in rotation, until a normal circulation of the flushing fluid is obtained. When a circulation of flushing fluid is obtained while the device is not rotated, this means that the device is in its coring position.

Modifications can be made without departing from the scope of the present invention.

It will, for example, be possible to change the number of openings through the different elements provided they can register with one another, as indicated hereinabove, during the operation of the device.

It will also be possible to select the value of the angle of rotation of the piston 22 for which the device passes from its coring position to its drilling position and vice-versa.

The shape of the plug can be modified. It will for example be possible to substitute for the spherical ball 5 a cylindrical element having a bore perpendicular to the rotation axis of this element.

It will also be possible within the scope of the present invention to substitute for the core barrel a measuring element such as a penetrometer in order to measure the resistance of the ground layers to the penetration of a metal pin thereinto.

What I claim is:

1. A device for surveying the ground layers, comprising: a tubular body, a crown-shaped drill bit having a substantially central opening therein disposed at the lower end of said tubular body, a driving mechanism for rotatably driving the device, means for connecting said tubular body with said driving mechanism, means for connecting said tubular body to a source of pressurized flushing fluid, means disposed inside said tubular body for surveying the ground layers including a selectively displaceable plug means for selectively opening and obturating said central opening, said plug means having a first position corresponding to drilling conditions with said plug obturating said central opening to prevent the building of a core therein and a second open position corresponding to surveying conditions, and actuating means for controlling the position of said plug means including guiding means, and at least one control means for reversibly displacing said plug means from said first to said second position, said control means being axially displaceable and rotatable with respect to said guiding means.

2. A device for surveying the ground formations, comprising: a tubular body, a crown-shaped drill bit having a substantially central opening therein disposed at the lower end of said tubular body, a driving mechanism for rotatably driving the device, means for connecting said tubular body with said driving mechanism, means for connecting said tubular body to a source of flushing fluid, means disposed inside said tubular body for surveying the ground formations, said last-mentioned means including a selectively displaceable plug means for selectively opening and obturating said central opening, said plug means having a first position corresponding to drilling conditions with said plug

means obturating said central opening to prevent the building of a core therein and a second open position corresponding to the surveying conditions, and actuating means operatively connected with the source of flushing fluid and responsive thereto for controlling the position of said plug means, said actuating means including means for reversibly displacing said plug means from said first to said second position, control means operatively connected with said last-mentioned means for controlling the displacement thereof, and guiding means, said control means being axially displaceable along and rotatably mounted on said guiding means, said actuating means selectively displacing said plug means from said first to said second position in response to at least one variation of the flushing fluid pressure and displacing said plug means from said second to said first position by rotation of said control means, following a stopping of said control means, said rotation being itself followed by at least one variation of the flushing fluid pressure.

3. A device according to claim 1, wherein said plug means includes a substantially spherical element, a rotatable shaft means for mounting said spherical element in close proximity to said crown-shaped drill bit, said shaft being rotatable about a rotation axis substantially perpendicular to the axis of said tubular body, said rotation axis passing substantially through the center of said substantially spherical element, said central opening including a bore extending perpendicular to said rotation axis, said bore having a diameter at least equal to the internal diameter of said crown-shaped drill bit, said bore in said second position being coaxial to said tubular body, said spherical element being provided with cutting means on an external wall thereof for destroying the core formed in said central opening when said plug means is in said first position.

4. A device according to claim 1, wherein said means for surveying the ground formations further includes a core barrel, and wherein said plug means in said second position permits the formation of a core within said central opening.

5. A device according to claim 4, wherein means are provided for displaceably mounting said core barrel within said tubular body between a first position and a second position, said first position corresponding to the drilling conditions with the lower end of said core barrel spaced from said plug means, said position corresponding to the coring conditions with said core barrel displaced toward said plug means.

6. A device according to claim 5, wherein said plug means includes a substantially spherical element including an internal bore, and wherein said core barrel includes an internal bore, said last-mentioned bore in said second position of said core barrel being in close extension of said bore of said spherical element.

7. A device according to claim 5, wherein said plug means includes a substantially spherical element having an internal bore, and wherein said last-mentioned bore has a diameter at least equal to the external diameter of the lower portion of said core barrel, the lower end of said core barrel in said second position thereof penetrating said bore of said substantially spherical element and coming to a position in close proximity to said central opening.

8. A device according to claim 5, wherein said means for displaceably mounting said core barrel includes resilient means for suspending said core barrel inside said

tubular body, and wherein means for locking said core barrel in a coring position are provided, said locking means being releasable by changing the rotational speed of the device and subsequently modifying the pressure of the flushing fluid.

9. A device according to claim 8, wherein at least one radial slot and an annular groove are provided, one of said slot and said annular groove being carried on said tubular body and the other being solid with said core-barrel, and wherein said means for locking said core-barrel in coring position includes at least one cotter-pin disposed in said radial slot.

10. A device according to claim 9, further comprising means for displacing said cotter-pin in said groove when said core barrel is in coring position.

11. A device according to claim 10, wherein a control rod is provided and wherein said means for displacing said cotter-pin includes a conical shoulder provided on said control rod.

12. A device according to claim 11, wherein a piston is provided, said control rod being solid with said piston, and wherein resilient means for suspending said piston is provided interposed between said tubular body and said piston, said piston being displaceable by the action of the flushing fluid pressure to release said core-barrel from its coring position.

13. A device according to claim 12, further comprising an articulated shutter for protecting said piston against the action of the fluid pressure when the flushing fluid is circulated and before the rotation of the device.

14. A device according to claim 13, wherein a small mass solid with said shutter is provided for driving said shutter about its articulation axis as a result of the centrifugal force generated by the rotation of the device preceeding the pressurization of the flushing fluid.

15. A device according to claim 5, further comprising remotely controlled means for imparting to said core-barrel successive axial displacements and rotations relative to said tubular body.

16. A device according to claim 15, wherein said means for actuating said plug means includes at least one toothed conical pinion provided on said rotatably mounted shaft, a toothed crown cooperating with said pinion for driving said shaft in rotation, a tubular element solid with said crown, said tubular element being disposed inside of and coaxial with said tubular body with respect to which it is rotatable, and means for selectively connecting said tubular element with said core barrel to permit selective rotation of said tubular element therewith.

17. A device according to claim 16, wherein said connecting means includes longitudinal grooves provided on said core barrel and longitudinal corrugations provided on said tubular element, said grooves and said corrugations being disposed substantially parallel to the axis of said tubular body.

18. A device according to claim 16, wherein said remotely controlled means includes a discharge ring having an internal bore solid with said tubular body, said discharge ring defining with the bore of said tubular body an annular space, duct means provided at the upper part of said discharge ring for selectively communicating said annular space with the internal bore of said tubular body, and at least one orifice arranged through the wall of said discharge ring at the upper portion thereof for selectively communicating said annular

space with the internal bore of said discharge ring, a distributor member having a bore therein solid with said core barrel, means for displaceably mounting said member in the bore of said discharge ring, at least one bore provided at the upper portion of said distributor member along the axis of the device, said last-mentioned bore including a wall having at a first level at least one first orifice communicating with said annular space in the position of drilling condition, at least one second orifice at a second level above said first level and shifted with respect to the first orifice for communicating said bore with said annular space in the position of coring condition, and wherein said control means includes a control piston displaceable in said bore of said distributor member, said piston including a lateral wall, at least one first orifice provided in said lateral wall at a first level, at least one second orifice provided in said lateral wall shifted with respect to the first orifice in said lateral wall and at a second level with respect thereto, a duct arranged in the body of said control piston and opening into the upper face thereof, and wherein said remotely controlled means includes a remotely controlled member for selectively establishing communication exclusively between said duct and said first or second orifice of said control piston, said duct of said control piston, said first orifice of said control piston and said orifice of the discharge ring being simultaneously in communication only in the position of drilling condition, said duct of the control piston, said second orifice of the control piston and said orifice of the discharge ring being simultaneously in communication only in the position of coring condition, resilient means interposed between said control piston and said distributor member, means for sequentially connecting in rotation said control piston to said distributor member and wherein said guiding means includes a member for guiding said control piston.

19. A device according to claim 18, wherein said remotely controlled member includes a flap valve means for establishing a communication exclusively between said duct of said control piston and said first orifice of said control piston, said flap valve means being displaceable from a first position to a second position by the effect of the centrifugal force resulting from the rotation of the device occurring before the increase in pressure of the flushing fluid.

20. A device according to claim 12, wherein said sequentially connecting means includes teeth carried by said control piston and said distributor member, said teeth selectively meshing with one another when, under the action of the flushing fluid pressure, said piston moves to a position closer to said distributor member against the bias of said resilient means interposed between said piston and said distributor member.

21. A device according to claim 18, wherein said guiding member includes a closed guiding path, at least one guiding finger displaceable along said guiding path, at least one of said guiding finger and said guiding path being solid with said tubular body and the other being solid with said control piston.

22. A device according to claim 21, wherein said guiding member consists of a guiding ring solid with said tubular member and disposed in the bore thereof, said guiding ring including a slot defining said guiding path, said guiding finger being solid with said control piston, and wherein a resilient means is interposed between said tubular body and said core barrel, said slot

being formed of successive portions with said guiding finger being guided therealong by predetermined variations in the pressure of the flushing fluid, said successive portions including at least:

- a first portion imparting to said control piston, when the flushing fluid pressure is increased up to a first value, a vertical displacement from a first value corresponding to drilling conditions of the device, to a second level below said first level with said control piston being connected with said distributor member through said connecting means,
 - a second portion imparting to said control piston, when the flushing fluid pressure is increased up to a second value greater than said first value, a rotational movement with a simultaneous vertical displacement from said second level to a third level below said second level said rotational movement and said vertical movement being imparted through said means connecting said core barrel to said distributor member, the rotational movement being imparted through said actuating means to said spherical element to rotate the same by 90° about its axis to a position corresponding to coring conditions;
 - a third portion imparting to said control piston a vertical movement from said third level to a fourth level below said third level when the flushing fluid pressure is increased from said second value to a third value greater than said second value, and a vertical movement from said fourth level to said second level, when the flushing fluid pressure is reduced from said third value to said first value under the action of said resilient means interposed between said tubular body and said core barrel;
 - a fourth portion imparting to said control piston, in the absence of a flushing fluid pressure and by the action of said resilient means interposed between said piston and said distributor member, a rotational together with a vertical displacement from said second level to said first level;
 - a sixth portion imparting to said control piston, when the flushing fluid pressure is increased up to said second value, a rotational movement together with a vertical displacement from said second level to said third level, said rotational movement being imparted through said connecting means by said distributor member and said actuating means to said spherical element to rotate the same by 90° about its axis to a position of drilling conditions;
 - a seventh portion imparting to said control piston, when the flushing fluid pressure is decreased from said second value to said first value and by the action of said resilient means interposed between said tubular body and said core-barrel, a vertical displacement from said third level to said second level; and
 - an eighth portion imparting to said control piston, in the absence of a flushing fluid pressure and by the action of said resilient means interposed between said piston and said distributor member, a rotational movement together with a vertical displacement from said second level to said first level whereby the device is placed in the drilling condition.
23. A device according to claim 21, wherein a tubular extension member is provided, and wherein said core-barrel is disposed in said tubular extension member, and wherein bearing means are provided for fixing said tubular extension member to said distributor member and for permitting the relative rotation of the core-barrel with respect to said extension member.

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