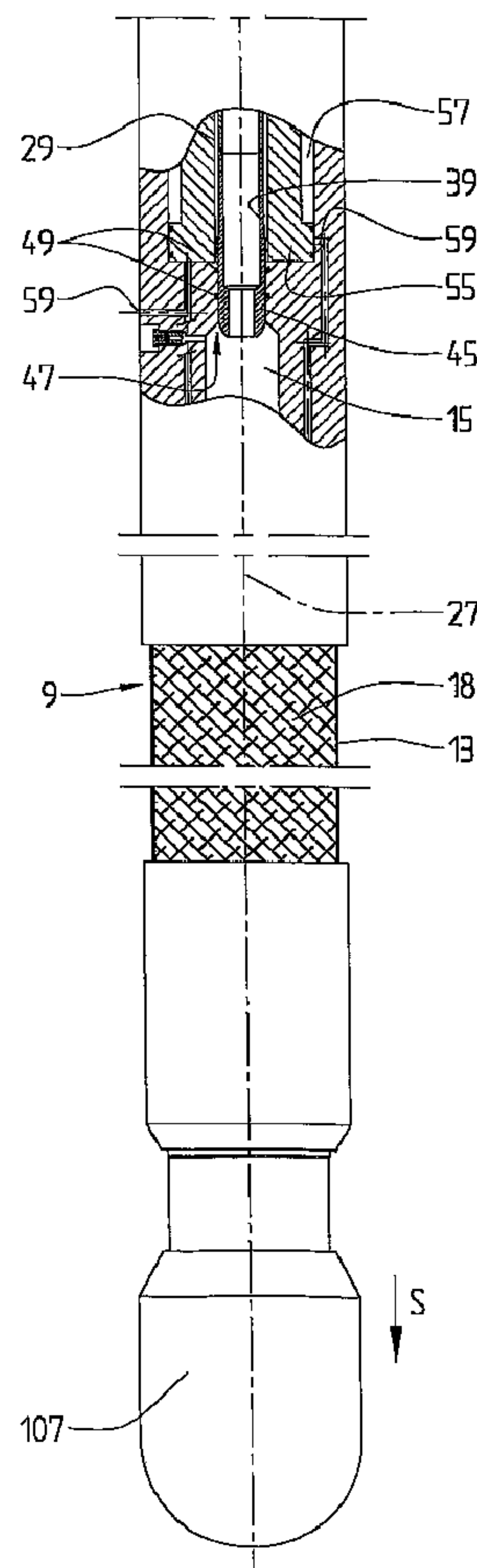




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(72) Inventeurs/Inventors:
FANUEL, PHILIPPE R., BE;
QUINTANA, LUIS E., BE;
MAGEREN, OLIVIER, BE
(73) Propriétaire/Owner:
HALLIBURTON ENERGY SERVICES, INC., US
(74) Agent: SIM & MCBURNEY

(54) Titre : SYSTÈME DE CAROTTAGE OU FORAGE DEVIE A UNE PASSE
(54) Title: ONE-STEP DIRECTIONAL CORING OR DRILLING SYSTEM



(57) Abrégé/Abstract:

The invention concerns an assembly designed for directional coring or drilling, in a wall of a borehole previously drilled or cored in a formation comprising a guide element (1) having a coaxial inner space (5) for housing therein a core barrel (7), an expandible



(57) Abrégé(suite)/Abstract(continued):

device (9) having an outer lateral surface (13) and which is designed, when the device (9) is expanded, to be supported immobilized against the borehole wall, a deflecting channel (19) drilled in the guide element (1) and whereof one base (23) and two lateral flanks (25) follow a sloping direction relative to the longitudinal axis (27) of the guide element (1), a longitudinal cavity (29) hollowed out in the guide element (1) and designed to allow a passage, an outer tube (33) of said core barrel (7) including a core bit (35) and designed to be slidable, after being released, in the inner space (5) and in the deflecting channel (19) and then advance into the formation, into the outer tube (33) or a removable tubing (39) designed to be releasably and tightly connected to selective actuating means (15) for circulating thereto a pressurized fluid, either an inner core barrel tube or a core bit top designed to enable drilling by the latter.

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LIBURTON ENERGY SERVICES, INC.** [US/US];
10200 Bellaire Boulevard, Houston, TX 77072-5299 (US).(21) Numéro de la demande internationale :
PCT/BE2003/000161(72) Inventeurs; et
(75) Inventeurs/Déposants (*pour US seulement*) : **FANUEL,
Philippe, R.** [BE/BE]; Rue du Bourgmestre 18, B-1050
Bruxelles (BE). **QUINTANA, Luis, E.** [ES/BE]; Rue
Schuermans 12, B-1090 Bruxelles (BE). **MAGEREN,
Olivier** [BE/BE]; Rue Hanoteau, 55, B-6060 Gilly (BE).(22) Date de dépôt international :
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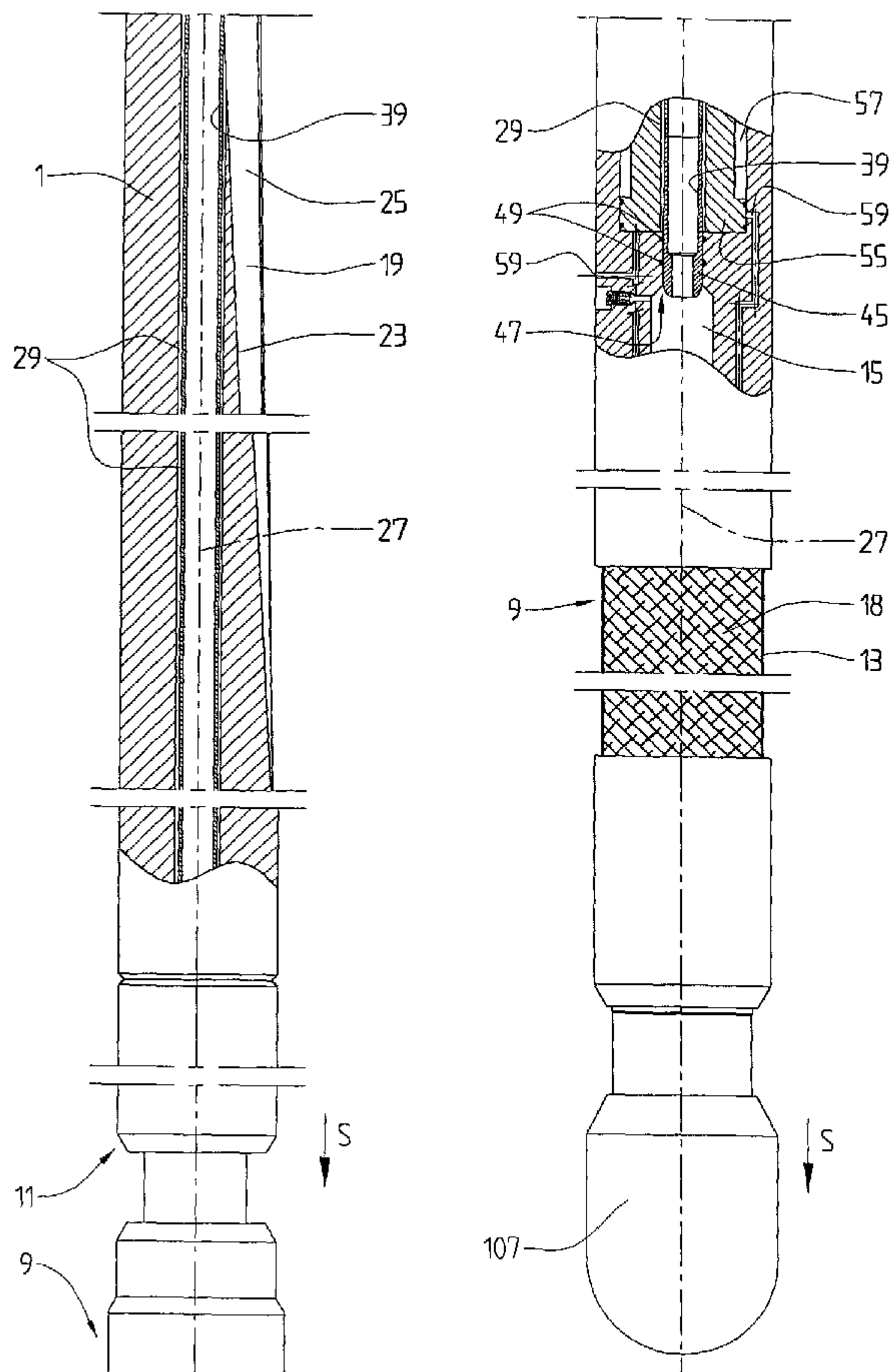
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(54) Title: ONE-STEP DIRECTIONAL CORING OR DRILLING SYSTEM

(54) Titre : SYSTEME DE CAROTTAGE OU FORAGE DEVIE A UNE PASSE



(57) **Abstract:** The invention concerns an assembly designed for directional coring or drilling, in a wall of a borehole previously drilled or cored in a formation comprising a guide element (1) having a coaxial inner space (5) for housing therein a core barrel (7), an expansible device (9) having an outer lateral surface (13) and which is designed, when the device (9) is expanded, to be supported immobilized against the borehole wall, a deflecting channel (19) drilled in the guide element (1) and whereof one base (23) and two lateral flanks (25) follow a sloping direction relative to the longitudinal axis (27) of the guide element (1), a longitudinal cavity (29) hollowed out in the guide element (1) and designed to allow a passage, an outer tube (33) of said core barrel (7) including a core bit (35) and designed to be slidable, after being released, in the inner space (5) and in the deflecting channel (19) and then advance into the formation, into the outer tube (33) or a removable tubing (39) designed to be releasably and tightly connected to selective actuating means (15) for circulating thereto a pressurized fluid, either an inner core barrel tube or a core bit top designed to enable drilling by the latter.

(57) **Abrégé :** Ensemble destiné ô un carottage ou forage dévié, dans une paroi d'un trou de sonde foré ou carotté préalablement dans une formation comprenant un élément de guidage (1) présentant un espace interne (5) coaxial pour y loger un carottier (7), un dispositif dilatable (9) présentant une surface latérale externe (13) qui est agencée pour prendre, dans un état dilaté du dispositif (9), un appui d'immobilisation contre la paroi du trou de sonde, un canal de déviation (19) creusé dans l'élément de guidage (1) et dont un fond (23) et des côtés latéraux (25) suivent une direction inclinée par rapport ô l'axe longitudinal (27) de l'élément de guidage (1), une cavité longitudinale

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(29) taillée dans l'élément de guidage (1) et agencée pour permettre un passage, un tube extérieur (33) du carottier (7) susdit comportant une couronne de carottage (35) et agencé pour pouvoir coulisser, après avoir été libéré, dans l'espace interne (5) et dans le canal de déviation (19) et progresser ensuite dans la formation, dans le tube extérieur (33) soit une tubulure amovible (39) agencée pour un raccordement libérable et étanche ô des moyens d'actionnement sélectif (15) en vue de communiquer ô ceux-ci un fluide sous pression, soit un tube intérieur de carottier soit un bouchon de couronne agencé pour que celle-ci puisse faire du forage. Figures 1, 2 et 3.

One-step directional coring or drilling system

The present invention concerns an assembly intended for sidetracked coring or drilling, in a wall of a borehole previously drilled or cored in a formation.

There exist many assemblies intended for this type of work but those which are known at the present time require a prior operation of fitting the guidance or sidetracking element, separately from the operation of lowering the core barrel and using the latter. This succession of operations takes a great deal of time which, as is known, is very expensive in this industry because of the particular specialisation of the individuals practicing it, the risks which they run, the dedicated equipment used, the technical complexity of the operations which have to be performed, etc. There are also the risks of losing expensive equipment in the ground in each lowering and raising operation and, often because of this, also losing access to the borehole.

In order to avoid these risks to the maximum, and to save on operating time, the aim of the present invention is to propose an assembly with which the guidance and sidetracking element and the core barrel are lowered in one operation.

To this end, the sidetracking coring or drilling assembly of the invention comprises a guidance element whose outside diameter is chosen so as to be able to enter the borehole up to a required depth for the sidetracked coring and which has, from a posterior end, in a direction of advancement of the boring or drilling towards the bottom of the borehole, a coaxial internal space with a diameter adapted to house a core barrel therein.

An expansible device, fixed to the front end of the guidance element, has an external lateral surface which, in an idle state, has a transverse section

less than that of the borehole and which is arranged to take, in an expanded state of the device, an immobilisation abutment of the said assembly against the wall of the borehole. The expansible device comprises selective actuation means arranged to receive a pressurised
5 fluid which causes an expansion of the expansible device beyond a given pressure of fluid, and a valve arranged so as to automatically oppose a discharge of this fluid at a given pressure out of the said actuation means.

A sidetracking channel is hollowed out in the guidance element in line with
10 the internal space, upstream of the expansible element in the said direction of advancement. The sidetracking channel has a posterior end coaxial with the said internal space, a base and lateral sides which, from this posterior end of the channel and in the direction of the expansible device, follow a direction inclined with respect to the longitudinal axis of the
15 guidance element, the base intercepting this axis. The channel extends until it opens out entirely from the guidance element, on the other side of the longitudinal axis, at a angle with respect to the above mentioned wall which is chosen for the sidetracked coring. The sidetracking channel has a transverse section adapted so that it can pass the said guided core
20 barrel through the base and sides.

A longitudinal cavity is cut in the guidance element parallel to the aforementioned longitudinal axis and is arranged so as to allow passage from the above mentioned internal space as far as the means of actuating
25 the expansible device.

In the internal space of the guidance element, possibly even in a posterior portion of the sidetracking channel, an external tube of the above mentioned core drill is arranged. This external tube has a coring bit fixed
30 to the front end of this external tube, is to be suspended from a string and is locked in a releasable manner in the guidance element, in particular so

that the bit is included inside an imaginary external envelope of the guidance element. The external tube is arranged so as to be able to slide, after having been released, in the internal space and in the sidetracking channel and then progress in the formation.

5

In the external tube of the core barrel, disposed temporarily so as to actuate the expansible device, a removable tubing is mounted which extends from the inside of this external tube, through the longitudinal cavity, as far as the selective actuation means. The removable tubing
10 comprises a posterior end open so as to allow pressurised fluid to pass coming from the drill string. An attachment piece is fixed to this posterior end and is arranged for subsequent withdrawal of the tubing out of the above mentioned assembly. A front end of the said tubing is arranged for a releasable sealed connection between the tubing and the selective
15 actuation means with a view to communicating the pressurised fluid to these, through the said tubing.

In this same external tube, after having expanded the expansible device and having withdrawn the said tubing out of the assembly, it is possible to
20 dispose either an internal core drill tube or a bit plug arranged so that the latter can carry out drilling, the internal tube or the bit top having an attachment piece fixed to its posterior end and arranged for its lowering and subsequent removal from the above mentioned assembly.

25 As can be understood by a person skilled in the art from a reading of the above, the assembly described above, thus assembled, is lowered in a block into the borehole and can be oriented so that the bit attacks the wall of the hole in the required direction. Only a simple exchange between the removable tubing and either the internal core barrel tube or the said drilling
30 bit top must be effected before attacking the wall.

For their mutual fixing, the guidance element can comprise a sliding member and the expansible device can comprise a chamber in which the sliding member can slide between two stop positions, a position in which the sliding member closes an outlet passage for the fluid contained at the
5 given pressure in the expanded expansible device and a position in which this member opens this discharge passage. This mounting makes it possible to allow the fluid to escape selectively at a required time out of the expansible element, so that the latter can be released from the immobilisation with respect to the wall.

10

According to one embodiment of the invention, the tubing comprises through its wall an orifice, with several orifices at the same level. An annular piston, with an internal passage for the fluid, is mounted sealingly so as to slide in the tubing between a starting position upstream of the
15 orifice or orifices in order to enable fluid to enter the tubing through these, and another stop position in which it closes off the orifice or orifices.

On the upstream side, the annular piston can comprise a valve seat adapted to receive a valve, preferably a bore, intended to close at least a
20 large passage for the fluid in the tubing in the direction from upstream to downstream, and to leave this passage clear in the opposite direction. At least one bypass, with a transverse section reduced with respect to that of the said passage, can be arranged as a bypass for the valve seat and valve.

25

According to a particular embodiment, the assembly of the invention can comprise a known system for measuring the orientation in the ground of an object equipped with this system, this being able to be disposed under a guide nose or between the latter and the rest of the sidetracked coring or
30 drilling assembly.

Thus the assembly according to the invention is particularly well suited in the case where a borehole has been drilled and where a logging of this hole has been carried out. According to the data collected by this logging, it may be wished to carry out a sidetracked drilling and/or coring from this
5 hole in particular directions and at particular depths.

According to a particular embodiment of the invention, the actuation means are arranged so as to receive, as a pressurised fluid, a fluid of the drilling or coring fluid type. According to a particularly advantageous
10 embodiment of the invention, the actuation means are arranged so as to receive, as a pressurised fluid, an expansion fluid pressurised by a fluid of the drilling or coring fluid type by means of a separation piston.

Other details and particularities of the invention will emerge from the
15 secondary claims and the description of the drawings which accompany the present document and which illustrate, by way of non-limiting examples, particular embodiments of the assembly according to the invention. An assembly is depicted in sections on successive figures which, starting for example from the front end of the assembly, are to be
20 put following one another, the top of one being followed by the bottom of the following one. The various figures are elevation views with, where applicable, partial axial breaks and/or cuts.

For an assembly assembled in order to be lowered into a borehole, there
25 are depicted in

Figure 1 a front end of an assembly according to the invention, comprising in particular an expansible device,

30 Figure 2 a following section comprising a guide element and its sidetracking channel, as well as a removable tubing,

Figure 3 a following section comprising the guide element, the said tubing, the bit and an external core barrel tube,

5 Figure 4 a following section of the guide element with the said tubing and the external tube, and

Figure 5 a following section comprising the posterior end of the guide element and tubing, as well as the external tube.

10

The same assembly assembled for sidetracked coring in the borehole, are depicted in

Figure 6 the front end of the assembly according to the invention,
15 comprising in particular the expansible device,

Figure 7 the following section comprising the guide element and its sidetracking channel,

20 Figure 8 a following section comprising the guide element, the bit, an external tube and an internal core barrel tube,

Figure 9 a following section with the guide element and the external and internal core barrel tubes, and

25

Figure 10 a following section with the posterior end of the guide element and internal tube, the external tube being extended beyond the top of this figure.

30 For the same assembly again, but for a sidetracked drilling in the borehole, there are depicted in

Figure 11 a section with the guide element and the front end of the core barrel equipped with a drill bit top instead of an internal tube,

- 5 Figure 12 a following section with the guide element, the external tube and a bar extending the said bit top, and

Figure 13 a following section with the posterior end of the guide element and extension bar.

10

Figure 14 shows, in a view similar to that in Figure 3 but to a larger scale, an arrangement of a piston sliding in the removable tubing.

- 15 Figures 15 to 18 depict a variant embodiment according to the invention of an assembly intended for sidetracked coring or drilling, in a position on the surface, before lowering into the borehole.

Figures 19 to 22 depict this variant in the inflation position of the expansible device.

20

Figures 23 to 26 depict this variant after deflation of the expansible device.

In the various figures, the same reference notations designate identical or similar elements.

25

According to the invention, the sidetracked coring or drilling assembly comprises (Figures 1 to 5) a guide element 1 whose outside diameter is chosen so as to be able to enter the borehole (not shown) to a depth required for the sidetracked coring. The guide element 1 has, from a
30 posterior end 3, in a direction of advance S of the coring or drilling towards

the bottom of the borehole, a coaxial internal space 5 with a diameter adapted to house a core barrel 7 therein.

An expansible device 9 is fixed to the front end 11 of the guide element 1
5 and has an external lateral surface 13 which, in an idle state (depicted in Figure 1), has a transverse section less than that of the borehole and which is arranged so as to adopt, in an expanded state of the device 9, an immobilisation abutment against the wall of the borehole. The expansible device 9 comprises selective actuation means 15 which are arranged to
10 receive a pressurised fluid which causes an expansion of the expansible device 9 beyond a given pressure. The expansible device 9 also comprises a retaining valve (not shown in this embodiment) arranged to automatically oppose a discharge of this fluid at a given pressure from the actuation means 15. The pressurised fluid can in particular be a
15 coring/drilling fluid, known in the art, brought to there through the drill string 17 (Figure 5), to which the above mentioned assembly is connected during use.

The expansible device 9 can comprise, for the above mentioned
20 immobilisation abutment, a sleeve 18 made from impermeable elastic material arranged, in the said device 9, so as to be able to be inflated by the aforementioned pressurised fluid and thus to bear firmly against the wall of the borehole. When the pressure is released, the sleeve 18 can then resume its initial shape and release its immobilisation abutment.

25

A sidetracking channel 19 is hollowed in the guide element 1 in extension to and downstream of the internal space 5, upstream of the expansible device 9 in the direction of advance S. The sidetracking channel 19, a posterior end 21 of which is coaxial with the said internal space 5, has a
30 base 23 and two lateral sides 25 which, from this posterior end 21 and in the direction of the expansible device 9, follow a direction inclined with

respect to the longitudinal axis 27 of the guide element 1. The said base 23 intersects this axis 27. The channel 19 extends until it entirely opens out from the guide element 1, on the other side of the longitudinal axis 27, at a angle with respect to the above mentioned wall which is chosen for the sidetracked coring. The sidetracking channel 19 has a transverse channel adapted so that the said core barrel 7 guided by the base 23 and the sides 25 can pass therein.

A longitudinal cavity 29 is cut in the guide element 1, parallel to the aforementioned longitudinal axis 27, and is arranged so as to allow passage from the above mentioned internal space 5 as far as the actuation means 15 for the expansible device 9. This longitudinal cavity 29 and the guide element 1 are preferably coaxial.

In the internal space 5 of the guide element 1, possibly even in a posterior portion 31 of the sidetracking channel 19, an external tube 33 of the above mentioned core barrel 7 is arranged. This external tube 33 comprises a core bit 35 fixed to the front end of the external tube 33, is to be suspended from a drill string 17, and is locked releasably in the guide element 1, in particular so that the bit 35 is included inside an imaginary external envelope of the guide element 1. The external tube 33 can be carried (Figures 4 and 5) by two bearing sleeves 36 so as to be able, after having been released, to turn and slide in the internal space 5 and in the sidetracking channel 19 and then be able to progress in the formation.

25

In the external tube 33 of the core barrel 7, in order to actuate the expansible device 9, there is temporarily disposed a removable tubing 39 which extends from the inside of this external tube 33, through the longitudinal cavity 29, as far as the selective actuation means 15. The removable tubing 39 comprises a posterior end 41 open so as to allow the pressurised fluid coming from the drill string 17 to pass therein. An

30

attachment piece 43 is fixed to this posterior end 41 and is arranged for subsequent withdrawal of the tubing 39 out of the above mentioned assembly. A front 45 of the said tubing 39 is arranged for releasable sealed connection between the tubing 39 and the selective actuation means 15 with a view to communicating to the latter, through the said tubing 39, the aforementioned pressurised fluid. For example, the tubing 39 (Figure 1) is pressed into a passage hole 47 in the expansible device 9, two O-ring seals 49 producing the seal between the tubing 39 and the said device 9.

10

In this same external tube 33, having expanded the expansible device 9 and having withdrawn the said tubing 39 out of the assembly, it is possible to dispose either a normal internal tube 51 (Figures 8 to 10) for the core barrel 7 or a drill bit top 53 (Figures 11 to 13), which completes the bit 35 to form a drilling head. At its front end, which may project from the bit 35, the bit top 53 is then equipped with blades or abrasive elements. The internal tube 51 and the bit top 53 also each have an attachment piece 43 fixed each time to their posterior end and arranged for their descent into or subsequent withdrawal from the above mentioned assembly.

20

In order to fix them to each other, the guide element 1 can comprise (Figure 1) a sliding member 55 and the expansible device 9 can comprise a chamber 57 in which the sliding member 55 is guided and can slide between two stop positions, a position (shown) in which the sliding member 55 closes an outlet passage 59 for the fluid contained at the given pressure in the expanded expansible device 9 and a position (not shown) in which this standing member 55 opens this outlet passage 59.

25

The external tube 33 can have an external abutment face 61 (Figure 3) turned upstream and intended to cooperate with an internal stop face 63 (Figure 4) which the guide element 1 has, which is turned downstream and

30

against which the abutment face 61 can abut when the said external tube 33 is pulled out of the borehole.

5 In addition, the external tube 33 can advantageously be held fixed, in a releasable manner, in the guide element 1 by a pin 65 (Figure 3) calibrated so as to break during a controlled rotation and/or translation movement of the external tube 33 in the guide element 1 fixed to the wall of the borehole by the expanded expansible device 9.

10 In order to be used, the sidetracked coring/drilling assembly which has just been described is first of all assembled, equipped with the removable tubing 39 according to Figures 1 to 5 and is fixed to a drill string 17 by means of the external tube 33. The assembly is then lowered into the borehole and turned if necessary (see below), by acting on the drill string
15 17, so that the sidetracking channel 19 has its opening in the direction in which it is wished to core or drill in a sidetracked manner. The fluid sent from the surface, through the drill string 17 (Figure 5), passes into the external tube 33 and, through an annular space between this and the posterior end 41 of the tubing 39, this fluid arrives in the tubing 39 through
20 openings 67 which are formed therein. A sealing ring 69 made from soft metal can be provided between the tubing 39 and the external tube 33 and prevents the said fluid from escaping from the path described. The fluid arrives (Figure 1) at the front end 45 of the tubing 39 and, suitably pressurised, inflates the sleeve 18 so that the latter is firmly pressed
25 against the wall of the borehole. When the pressure is then reduced, the retaining valve (not shown in this embodiment) prevents the sleeve 18 from deflating. The guide element 1 is thus immobilised in the borehole. The removable tubing 39 can then be withdrawn from the external tube 33, in a known manner referred to as "wire line" ("cable working") in the industry, by
30 means of its attachment piece 43 through the drill string 17 as far as the surface.

If it is then wished to carry out coring, the internal tube 51 (Figures 7 to 10) can be loaded into position in the external tube 33 by the same "wire line" technique. The internal tube 51 can be held in place, stopped very close
5 to or in the bit 35 by the pressure of the fluid sent into the assembly for coring purposes. In order to start the sidetracked coring, it is necessary first of all to break the releasable locking, in particular by making the external tube 33 turn by means of the drill string 17 in the guide element 1 fixed to the wall of the borehole, as explained above. This rotation, or a
10 translation movement communicated to the external tube 33 with or without impact, breaks the pin 65 calibrated for this purpose. The controlled core barrel 7, driven in rotation and pushed by means of a drill string 17, is guided by the guide element 1 in order to attack the wall of the borehole at the planned angle.

15

If it is wished to carry out a sidetracked drilling in the adjusted direction, either before a sidetracked coring, or without consecutive coring, or after coring sidetracked in this direction, the said bit top 53 (Figures 11 to 13) is installed in the external tube 33 instead of the internal tube 51, using the
20 same "wire line" technique. The said bit top 53 can comprise (Figure 11), in a bar 73 which makes it up, a bolt 75 which is pushed home by a spring 77 in a position projecting out of the bar 73 and which can be pushed into a retracted position in the said bar 73 by an external action. The bolt 73 has, at each of its front and rear ends, an inclined face arranged so that,
25 when the bit top 53 is introduced into the external tube 33 or is withdrawn therefrom, the said bolt 75 automatically retracts into the bar 73.

A longitudinal groove 79 is cut in the internal wall of the external tube 33 so as to be able to receive the bolt 75, which engages therein under the thrust
30 of the spring 77. This may occur at the end of the descent of the bit top 53 in the external tube 33 when the bolt 75 is in line with the groove 79.

Otherwise, when the bolt 75 and groove 79 are not aligned whilst the bit top 53 is in place in the core bit 35, this occurs because there is a relative rotation possible between the bit top 53 and external tube 33 as soon as these come into engagement with the material to be drilled. The cooperation of the bolt 75 and groove 79 causes the coordinated rotational driving of the drilling bit 53 by the external tube 33, which drives the core bit 35 in the same way.

It is possible to see (Figure 11), at the level where the housing of the bolt 75 is situated, one or more longitudinal conduits 80 drilled in the wall of the external tube 33, parallel to the longitudinal axis 27 and open solely at their end so as to prevent the said bolt 75 being able to become attached thereto.

In the embodiment depicted, the bit top 53 is pushed longitudinally in abutment downstream, for example against an internal annular face 81 (Figure 13) of the external tube 33, by the pressure of the drilling fluid which passes therein.

It will be noted in Figures 13 to 11 that the bar 73 may be hollow between the attachment piece 43 and the housing of the bolt 75 and comprise outlet housing orifices so that fluid can circulate therein from upstream to downstream. Another tubular section can be provided in the said bar 73 between the housing of the bolt 75 and the front end of the bit top 53. Passages 82 (Figure 11) can be hollowed in the front end of the bit top 53 in order to bring, to front regulating nozzles 83 of the latter, fluid coming from the annular space provided between the drill bit top 53 and the external tube 33.

In one embodiment of the invention, the tubing 39 can comprise (Figures 3 and 14), through its wall, an orifice 87, or several orifices 87 at the same

level. An annular piston 89, having an internal passage for the fluid, is then mounted sealingly so as to slide in the said tubing 39 between a starting position (depicted in Figures 3 and 14) upstream of the orifice or orifices 87, so as to enable fluid to enter through these into the tubing 39, and another position (not shown) stopped downstream, in which the same piston 89 closes the orifice or orifices 87, the fluid then being channelled through the annular piston 89.

Associated with the annular piston 89, a valve seat 95 is disposed so as to receive a valve 97. The latter may preferably be a ball 97 installed on assembly or to be launched through the drill string 17, and is intended to close off at least a large section of the passage for the fluid in the removable tubing 39 in the direction from upstream to downstream, and to leave this passage clear in the opposite direction. In order to provide the required reduced passage from upstream to downstream, there may be formed, for example in the valve seat 95, at least one bypass 98, with a transverse section reduced with respect to that of the said passage, which is arranged as a bypass for the valve seat 95 and valve 97.

When the assembly described above, comprising the said removable tubing 39, is lowered into the borehole, the fluid contained in this hole must be able to escape to the surface without causing a force capable of dislodging the tubing 39 from its position of mounting in the assembly. When the orifices 87 are open as shown, fluid can enter through these into the tubing 39 and go back up to the surface without excessively pushing the tubing 39 towards the surface. When the assembly is disposed in the sidetracked drilling/coring position, it suffices to give a pressure shock of a predicable value at the required moment for the annular piston 89 to be pushed from its starting position shown as far as its stopped position downstream, in which it closes off the orifices 87 in order to force the fluid

to go as far as the selective actuation means 15 in order to inflate the sleeve 18.

Since the passage through the annular piston 89 has to be relatively large
5 to allow the fluid to pass effectively from downstream to upstream as explained above, the above mentioned pressure surge intended to move this piston 89 may have to be excessively large, at an undesirable level. In order to obtain a movement of the annular piston 89 safely at a reasonable pressure, the above mentioned valve or ball 95 is used. It then closes off
10 the said passage from upstream to downstream and offers the fluid a larger surface, so that the annular piston 89 is pushed effectively, by the combination with the ball 95, into its position of closure of the orifices 87. The bypass or bypasses 98 enable fluid to pass however from upstream to downstream in order to actuate the expansible device 9.

15

Advantageously, the annular piston 89 is kept in the starting position by the breakable element 91, such as a pin, calibrated to break at a thrust from the piston 89 subjected to a pressure beyond a given threshold.

20 It must be understood that the invention is in no way limited to the embodiments described and that many modifications can be made to these without departing from the scope of the claims.

Thus, in order to prevent a longitudinal movement of the removable tubing
25 39 in the external tube 33, there may be provided, for example on the upstream side on the tubing 39, a positioning stop 99 (Figure 5), in particular combined with the ring 69, which can abut against a suitable surface provided in the external tube 33. It is also possible to adapt a releasable bolt 100, in particular with two slides 101, which is mounted on
30 the tubing 39, where the two slide 101, formed accordingly, are automatically locked by the action of a spring 103 in longitudinal recesses

105 or other receptacles cut in the external tube 33. When there is a given traction on the said attachment piece 43 in order to withdraw the tubing 39 from the external tube 33, the two slides 101 are withdrawn from the recesses 105 in a known manner.

5

As shown by Figures 1 and 6, in front of the expansible device 9 a guide nose 107 can be arranged, the front end of which is preferably hemispherical.

10 A known system, not shown, for measuring the orientation in the ground of an object equipped with this system can be interposed for example in the said guide nose 107 or between it and the rest of the sidetracked coring or drilling assembly. This measuring system can be of the type which records data, accessible then after having returned the said assembly and the
15 system to the surface, or of the type which transmits orientation data in real time to an operator on the surface. According to the coring equipment used, the operator can possibly use these data transmitted in real time so as to act on the assembly and give it a particular orientation for drilling and/or coring.

20

In an other embodiment, the said orientation measuring system can be associated with the removable tubing 39, preferably at its posterior end 41. This system can be fixed thereto and is then raised only after the inflation of the elastic sleeve 18 and either it has transmitted in real time data on
25 the orientation of the guide element 1 or these data are taken from the system once returned to the surface. According to these orientation data for the assembly as positioned in the borehole, any deviation with respect to a required orientation can be deduced therefrom and the orientation can be modified accordingly by acting on the drill string.

30

In yet another variant, the measuring system can be associated detachably with the posterior end 41 of the removable tubing 39 and be raised to the surface as many times as necessary, before inflating the elastic sleeve 18, in order to take the orientation information recorded therefrom and to
5 check that the orientation of the assembly is correct or to correct it accordingly.

In either case, after having equipped the said assembly with the aforementioned system, and before lowering the whole into the borehole, a
10 calibration of the said system can be carried out in order to unequivocally know its orientation with respect to that of the sidetracking channel 19 for example and to be able to adjust the orientation of this channel in a sure manner.

15 For the inflation operation, a particular fluid, without solid particles, may also be preferred in order to ensure faultless functioning of the non-return valve. This particular fluid could be sent under pressure through the drill string 17 or be stored in the above mentioned assembly and pressurised by means of a coring/drilling fluid acting in particular on a piston 20 for
20 separating the two fluids.

A coring or drilling assembly allowing this functioning is illustrated in Figures 15 to 23.

25 In Figures 15 to 18, the assembly according to the invention is on the surface, before the descent into the borehole. The guide nose 107 of the this installation comprises a supply channel 108 which opens out at one end outside and can be closed there by a cock 109. In the position illustrated in Figure 15, the cock 109 is opened, which allows a supply of
30 particle-free fluid, for example water, into the channel 108, which communicates with an annular cavity 110, provided inside a support

cylinder 111 of the expansible device 9. This annular cavity 110 in its turn communicates with a cylindrical cavity 112, in the upstream part of which, in the direction of descent of the drilling assembly, there is arranged a retaining valve [?]22. This valve comprises a first part 113 and second part 114 both capable of making a reciprocal sliding movement.

In the position illustrated in Figure 17, the valve 22 is in the top position. The second part 114, under its own weight, bears on a seat 115 of the first part 113 and thus leaves clear an annular passage 116 between the first part 113 and the second part 114 of the valve 22. In this position, the valve 22 allows a passage of the fluid supplied from the cylindrical cavity 112 to the cylindrical chamber 117 in which the separation piston 20 is arranged.

In the position illustrated in Figure 18, the fluid supplied exerts an upward pressure on one of the surfaces of the piston 20, whilst the other surface is at atmospheric pressure, since no fluid has yet been injected into the pipe string. The piston is therefore driven upwards as soon as the product of this pressure and the first surface of the piston overcomes the resistance of the friction of the seals between the piston 20 and the external wall 118 of the chamber 117.

In the top position, the piston 20 can abut against the stop 119 and even cause a detachment of the non-return valve 120, thus allowing a drainage of the bottom compartment of the chamber 117.

As can be seen in Figure 16, the annular cavity 110 has outlet conduits 131 oriented radially towards the internal lateral surface 12 of the expansible device. However, the pressure applied to the liquid supplied, which will serve as an expansion liquid, it is not sufficient to overcome the inherent resistance of the expansible device 9 to an expansion.

In Figures 19 to 22, the assembly according to the invention has been lowered into the borehole and the expansible device 9 is being expanded.

5 The cock 109 has been closed.

As is clear from Figure 22, the removable tubing 39, as described in the embodiment illustrated in Figures 1 to 14, is pressed in a sealed manner in one end of the tubular throttling element 121. At its end, this throttling
10 element 121 is provided with a strangler 122 which puts the cavity of the throttling element in communication with the borehole through an outlet pipe 123 and which causes an increase in pressure upstream.

Upstream of the strangler, in the direction of flow of the fluid of the drilling
15 fluid type brought by the removable tubing 39, the throttling element 121 is provided with small orifices 124 which are directed radially outwards and thus enable part of the drilling or coring fluid to reach the compartment in the chamber 117 which is situated opposite to the one receiving the expansion fluid.

20

The throttling element 121 therefore separates the pressurised drilling fluid into two streams, a main stream at high flow which is discharged in to the borehole and a secondary stream at low flow which serves to act on the separation piston 20. When the product of the pressure of the drilling fluid
25 and the surface area of the separation piston 20 is greater than the sum of the pressure of the expansion fluid multiplied by the surface area of the separation piston 20 and the friction of the separation piston 20 on the internal wall 118 of the chamber 117, the piston is moved downwards.

30 In the bottom position, the piston 20 comes into abutment against the stop 125.

In the bottom position of the drilling or coring assembly according to the invention, the second part 114 of the retaining valve 22 has been immobilised in the borehole by known means. The first part 113 is then
5 lowered by sliding into the second part 114 and, as illustrated in Figure 21, the first part 113 in the bottom position bears on the seat 126 of the tubular part 114. In this position, the valve 22 closes off any passage of expansion fluid from the cylindrical cavity 112 to the chamber 117 of the separation piston 20.

10

In this position also, the radial holes 132 provided in the second part 114 of the retaining valve 22 come to be housed facing the radial holes 133 of a support tube 134 of the first part 113 of the valve 22. By known means, shearing screws are then passed through these holes 132 and 133 so as
15 to immobilise any movement of the second part 114 with respect to the rest of the drilling and coring assembly and therefore with respect to the first part 113.

As the pressure of the drilling or coring fluid is high, the pressure of the
20 expansion fluid in the chamber 177 becomes such that it drives downwards the bore 127 of the non-return valve integrated in the retaining valve 22, counter to the return spring 129. A passage of expansion fluid is then permitted from the chamber 117 of the separation piston 20 to the cylindrical cavity 112, where the pressure increases correspondingly. At
25 one moment, the pressure exceeds the given pressure making it possible to overcome the resistance of the expansible device 9. As shown in Figure 20, the expansible device is then expanded, which allows an immobilisation of the assembly according to the invention inside the borehole.

30

At a given moment, the pressure increases in the chamber 117 to the point that a safety valve 130 breaks and gives access to the outside to the fluid situated in the top compartment of this chamber (see Figure 26). The supply of pressurised drilling fluid could then be stopped or maintained for the requirements of cleaning the borehole. The expansible device 9 is during this time kept in its expanded position, without the possibility of upward return of the expansion fluid, which is prevented by the retaining valve 22 and the ball 127 of its non-return valve.

10 In the position depicted in Figures 23 to 26, the expansible device must be deflating to allow a movement, in particular a rising, of the drilling or coring assembly according to the invention in the borehole.

The supply of drilling or boring fluid is stopped and the removable tubing 15 38 (see Figure 22) is detached and raised again (see Figure 26).

A traction is also exerted upwards on the support tube 134 of the first part 113 of the retaining valve 22. This traction is sufficient to shear the screws 135, as depicted in Figure 25. The second part 114 of the valve 22 is then released and can slide in its low position, which once again releases a passage 116 from the cylindrical cavity 112 to the cylindrical chamber 117 (as described with regard to Figure 17).

The product of the pressure of the expansion fluid and the surface area of the separation piston 20 then becomes greater than the sum of the product of the pressure of the drilling or coring fluid remaining in the top compartment of the chamber 117 multiplied by the surface of the separation piston and the friction of the piston 20 against the external wall 118 of this chamber 117. The piston 20 slides upwards and the expansible device 9 returns by elastic return to its initial position in

application to the support cylinder 111, which allows the required movement of the drilling or coring assembly.

The latter drilling or coring assembly according to the invention, as
5 illustrated in Figures 15 to 26, has the advantage of use, at the retaining
valve and the expansible device, of a clean fluid, that is to say without
particles in suspension which are a source of fouling of the retaining valve.
Moreover, the division of the pressurised drilling fluid stream into main
current and secondary current with low flow rate makes it possible to act in
10 a controlled manner on the separation piston, and therefore on the
expansible device, without taking account of the drilling fluid flow rate. A
separate pumping of drilling fluid during the expansion operation is not
necessary, use can be made of the pumping installation required for
drilling or coring.

Legend to the figures

	S	direction of advance of coring/drilling
5	1	guide element
	3	posterior end of 1
	5	internal space of 1
	7	core barrel
	9	expansible device
10	11	front end of 1
	13	external lateral surface of 9
	15	selective actuation means of 9
	17	drill string
	18	sleeve of 9
15	19	sidetracking channel in 1
	20	separation piston
	21	posterior end of 19
	22	retaining valve
	23	base of 19
20	25	lateral sides of 19
	27	longitudinal axis of 1
	29	longitudinal cavity in 1
	31	posterior portion of 19
	33	external tube of 7
25	35	core bit of 7
	36	bearing brushes
	39	removable tubing
	41	posterior end of 39
	43	attachment piece of 39, 51, 53
30	45	front end of 39
	47	passage hole of 9

	49	O-ring seals of 9
	51	internal tube of 7
	53	drilling bit top for 35
	55	sliding member
5	57	chamber for 55
	59	fluid discharge passage of 9
	61	external abutment face of 33
	63	internal abutment face of 1
	65	calibrated pin, between 33 and 1
10	67	openings in 39
	69	sealing ring between 33 and 39
	73	bar of 53
	75	bolt of 53
	77	spring of 73
15	79	longitudinal groove in 33
	80	longitudinal conduit or conduits in 33
	81	internal annular abutment face of 33
	82	passages in 53
	83	front regulating nozzles of 53
20	87	orifices or orifices in 39
	89	annular piston in 39
	91	breakable element
	95	barrel seat in 39
	97	valve/ball
25	98	bypass of 95
	99	positioning stop of 39
	100	releasable bolt of 39
	101	slides of 100
	103	spring of 100
30	105	longitudinal recesses in 33 to 100
	107	guide nose

	108	supply channel
	109	cock
	110	annular cavity in 111
	111	support cylinder of 9
5	112	cylindrical cavity
	113	first part of 22
	114	second part of 22
	115	support seat for 113
	116	annular passage
10	117	cylindrical chamber receiving 20
	118	external wall of chamber 117
	119	stop
	120	non-return valve
	121	throttling element
15	122	strangler
	123	discharge conduit
	124	radial orifices in 121
	125	stop
	126	bearing seat for 113
20	127	ball of 128
	128	non-return valve
	129	return spring of 127
	130	safety valve
	131	radial discharge conduits of 110
25	132	radial holes of 114
	133	radial holes of 134
	134	support tube of 113
	135	shearing screw

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Assembly of sidetracked coring or drilling, in a wall of a borehole previously drilled or cored in a formation, the assembly comprising:

- a guide element

- with an outside diameter chosen so as to be able to enter the borehole to a required depth for the side-tracked coring, and

- having, from a posterior end, in a direction of advance of the coring or drilling towards the bottom of the borehole, a coaxial internal space with a diameter adapted to house a core barrel therein,

- an expansible device,

- fixed to the front end of the guide element,

- having an external lateral surface which, in an idle state, has a transverse section less than that of the borehole and which, in an expanded state of the device, takes immobilisation abutment against the wall of the borehole, and

- comprising selective actuation means arranged to receive a pressurised fluid which causes an expansion of the expansible device, beyond a given pressure, and a valve so arranged as to oppose a discharge of this fluid at a given pressure from the said actuation means,

- a sidetracking channel hollowed out in the guide element in line with the internal space, upstream of the expansible device in the said direction of advance, the sidetracking channel having

- a posterior end coaxial with the said internal space,

- a base and lateral sides which follow, from this posterior end of the channel and in the direction of the expansible device, a direction inclined with

respect to the longitudinal axis of the guide element, the base intercepting this axis, the channel extending until it opens out entirely from the guide element, on the other side of the longitudinal axis, at a angle, with respect to the above mentioned wall, chosen for the sidetracked coring, and

- a transverse section adapted so that the said core barrel guided by the base and the sides can pass therein,

- a longitudinal cavity cut in the guide element parallel to the aforementioned longitudinal axis and arranged to allow passage from the above mentioned internal space as far as the actuation means of the expansible device,

- in the internal space of the guide element, an external tube of said core barrell

- comprising a core bit fixed to the front end of this external tube,

- to be suspended from a drill string, and

- releasably locked in the guide element,

- arranged so as to be able to slide, after having been released, in the internal space and in the sidetracking channel and then progress in the formation,

- in the external tube of the core barrel, temporarily disposed so as to actuate the expansible device, a removable tubing which extends from the inside of this external tube, through the longitudinal cavity, as far as the selective actuation means, and which comprises

- a posterior end open so as to allow the pressurised fluid coming from the drill string to pass therein,

- an attachment piece fixed to this posterior end and arranged for a subsequent withdrawal of the tubing out of the above mentioned assembly,

- a front end arranged for releasable and sealed connection between the tubing and the selective actuation means with a view to communicating to the latter, through the said tubing, the pressurised fluid, and

- in said external tube, after having expanded the expansible device and having withdrawn the said tubing out of the assembly, either an internal tube of the core barrel or a core bit top arranged so that the core bit can drill, the internal tube or the bit top having an attachment piece fixed to its posterior end and arranged for its descent and subsequent removal out of the above mentioned assembly.

2. Coring or drilling assembly according to Claim 1, wherein, for their mutual fixing, the guide element comprises a sliding member and the expansible device comprises a chamber in which the sliding member can slide between two stop positions, a position in which the sliding member closes off a discharge passage for the fluid contained at the given pressure in the expanded expansible device and a position in which this member opens up this discharge passage.

3. Coring or drilling assembly according to Claim 1 or 2, wherein the external tube of the core barrel comprises an external abutment face turned towards the upstream side of the borehole and intended to cooperate with an internal stop face disposed on said guide element, which is turned towards the downstream side of the borehole and against which the abutment face comes to abut when the said external tube is drawn out of the borehole.

4. Coring or drilling assembly according to any one of Claims 1 to 3, wherein the external tube of the core barrel is held fixed in a releasable manner in the guide element by a pin calibrated so as to break, during a controlled rotation and/or translation movement of the external tube in the guide element fixed to the wall of the borehole by the expanded expansible device.

5. Coring or drilling assembly according to any one of Claims 1 to 4, wherein

- the tubing comprises an orifice, or several orifices at the same level, through its wall,

- an annular piston with an internal passage for the fluid, is mounted sealingly so as to slide in the tubing between a starting position which is located in the borehole and upstream side with respect to the orifice or orifices, in order to enable fluid to enter the tubing, and another stop position in which it closes off the orifice or orifices, the fluid being channelled through the annular piston.

6. Coring or drilling assembly according to Claim 5, wherein the annular piston is held in the said starting position by a breakable element calibrated so as to break under a thrust of the piston subjected to a pressure beyond a given threshold.

7. Coring or drilling assembly according to Claim 5 or 6, wherein the tubing comprises

- associated with the said annular piston, on the upstream side, a valve seat adapted to be able to receive a valve intended to close off at least one large passage full of fluid in the tubing in the direction from upstream to downstream in the borehole, and to leave this passage clear in the opposite direction,

- at least one bypass, with a transverse section reduced with respect to that of the said passage, arranged as a bypass for the valve seat and the valve.

8. Coring or drilling assembly according to any one of Claims 1 to 7, which further comprises, for preventing a longitudinal movement of the tubing in the said external tube

- towards the downstream side of the borehole, a positioning stop and

- towards the upstream side of the borehole, a releasable bolt which is mounted on the tubing, which is locked in the external tube and which is connected to the attachment piece of the tubing so that it is released when there is a given traction on the said attachment piece.

9. Coring or drilling assembly according to any one of Claims 1 to 8, wherein in front of the expansible device there is arranged a guide nose whose front end is preferably hemispherical.

10. Coring or drilling assembly according to any one of Claims 1 to 9, which further comprises a system for measuring the orientation in the ground of an object, said system, when provided on said object being of the type which records orientation data which can be analysed after having returned the system to the surface and/or of the type which transmits these data in real time to the surface during the operation in the borehole.

11. Coring or drilling assembly according to Claim 10, wherein the said measuring system can be disposed in a guide nose or between said guide nose and the rest of the sidetracked coring or drilling assembly.

12. Coring or drilling assembly according to Claim 10, wherein the said measuring system is associated with the removable tubing.

13. Coring or drilling assembly according to any one of Claims 1 to 12, wherein the actuation means are arranged so as to receive, as a pressurised fluid, a fluid of the drilling or coring fluid type.

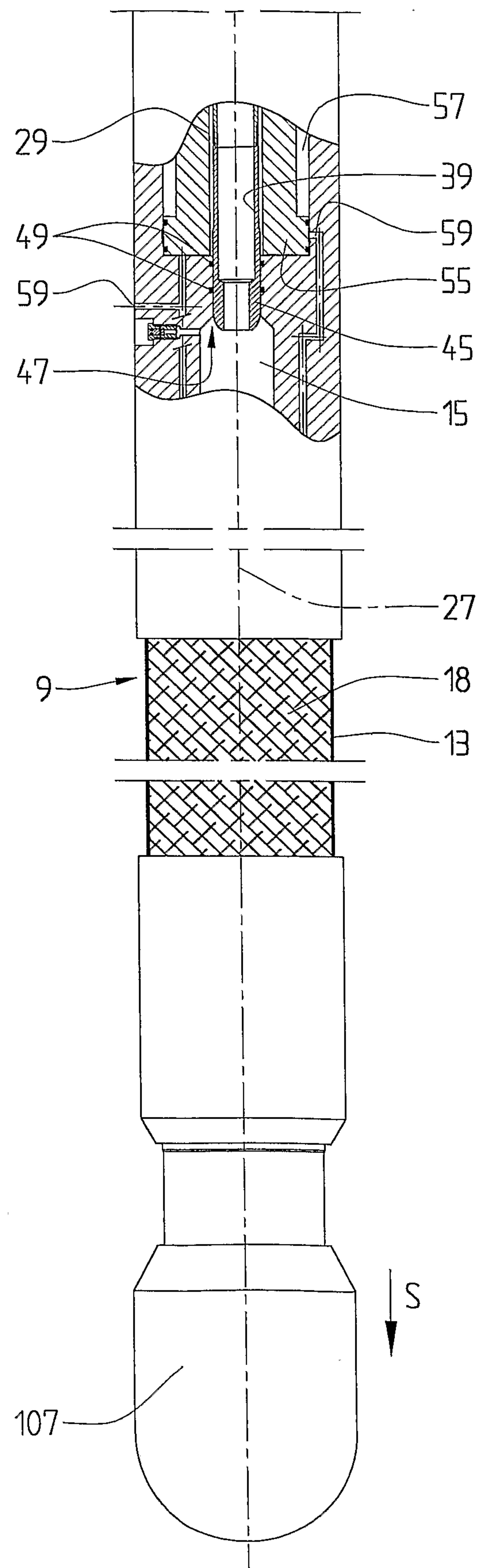
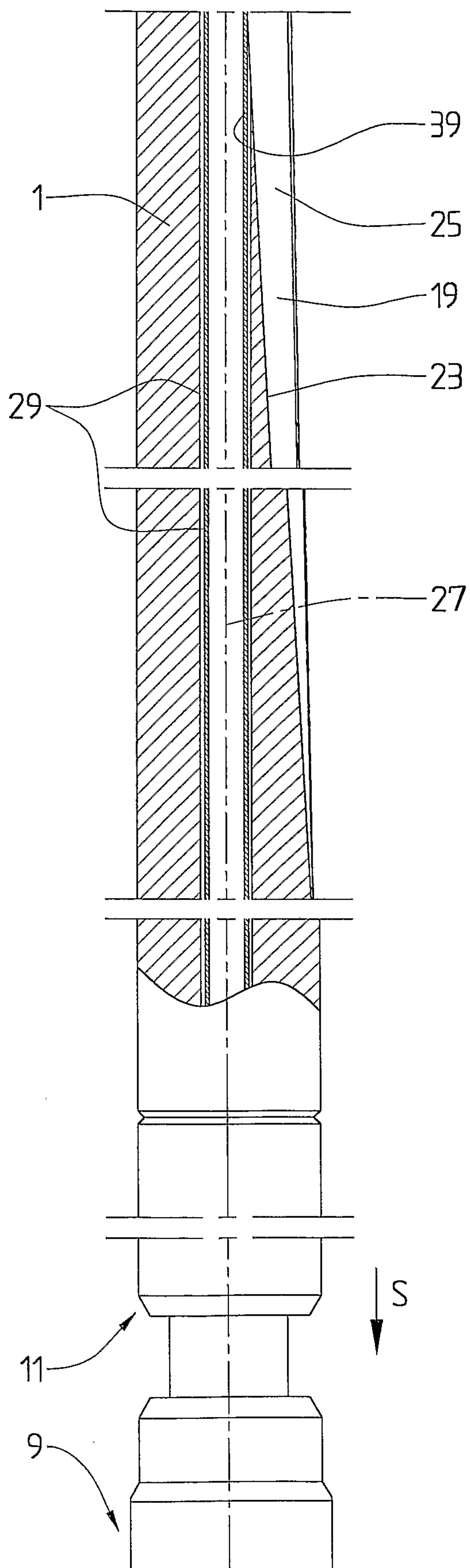
14. Coring or drilling assembly according to any one of Claims 1 to 12, wherein the actuation means are arranged so as to receive, as a pressurised fluid, an expansion fluid pressurised by fluid of the drilling or coring fluid type by means of a separation piston.

15. Coring or drilling assembly according to Claim 14, which further comprises a throttling element in which the removable tubing opens out and which puts the fluid of the drilling or coring fluid type under pressure and divides it into a main flow passing through the throttling element towards the inside of the borehole and secondary stream, with a lower flow rate than the main stream, which serves as a pressurised fluid capable of pressurising the expansion fluid.

16. Coring or drilling assembly according to Claim 15, wherein

- (a) the separation piston slides in a sliding chamber of the above mentioned actuation means between two extreme positions and has a first surface which comes into contact with the fluid of the drilling or coring fluid type and a second surface which comes into contact with the expansion fluid,
- (b) the separation piston slides in a first direction towards one of the above mentioned two extreme positions when the product of the pressure of the expansion fluid multiplied by the above mentioned second surface area is greater than the sum of the product of the pressure of the fluid of the drilling or coring fluid type multiplied by the above mentioned first surface and the friction between the separation piston and the sliding chamber,
- (c) the separation piston slides in a second direction towards the other one of the above mentioned two extreme positions when the product of the pressure of the fluid of the drilling or coring fluid type and the above mentioned first surface is greater than the sum of the product of the pressure of the expansion fluid multiplied by the above mentioned second surface area and the friction between the separation piston and the sliding chamber, and
- (d) during the sliding of the separation piston in the first direction, the expansion fluid does not attain the said given pressure beyond which an expansion of the expansible device takes place, whilst, during the sliding of the separation piston in the second direction, the expansion fluid attains the said given pressure and causes an expansion of the expansible device.

- 1/15 -



- 2/15 -

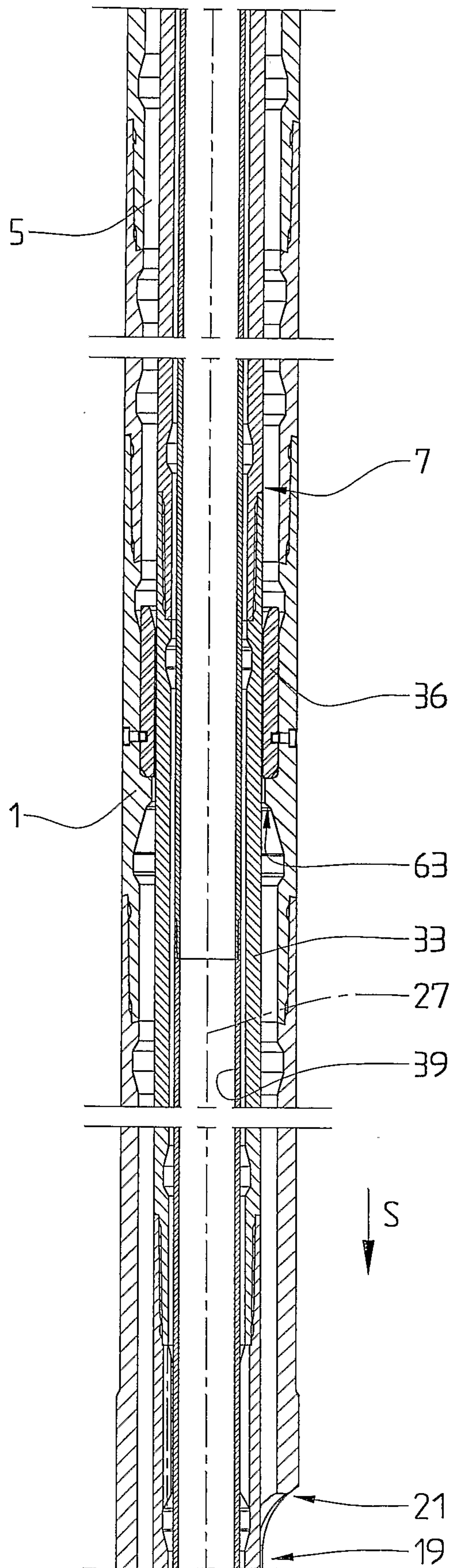


FIG 4

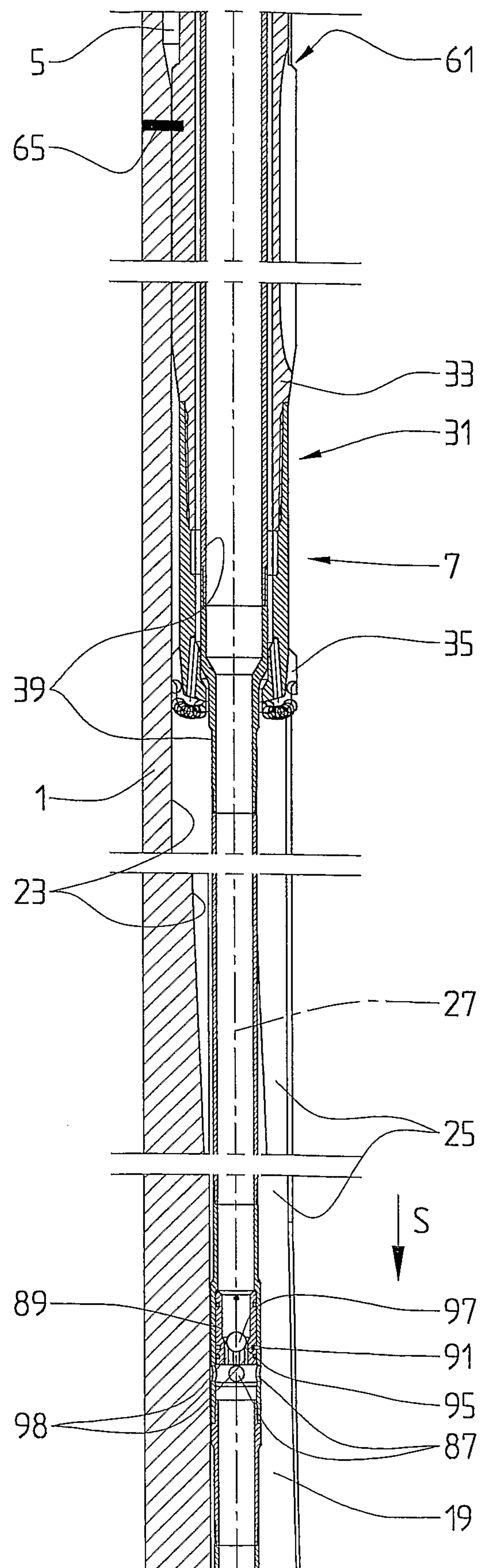


FIG 3

- 3/15 -

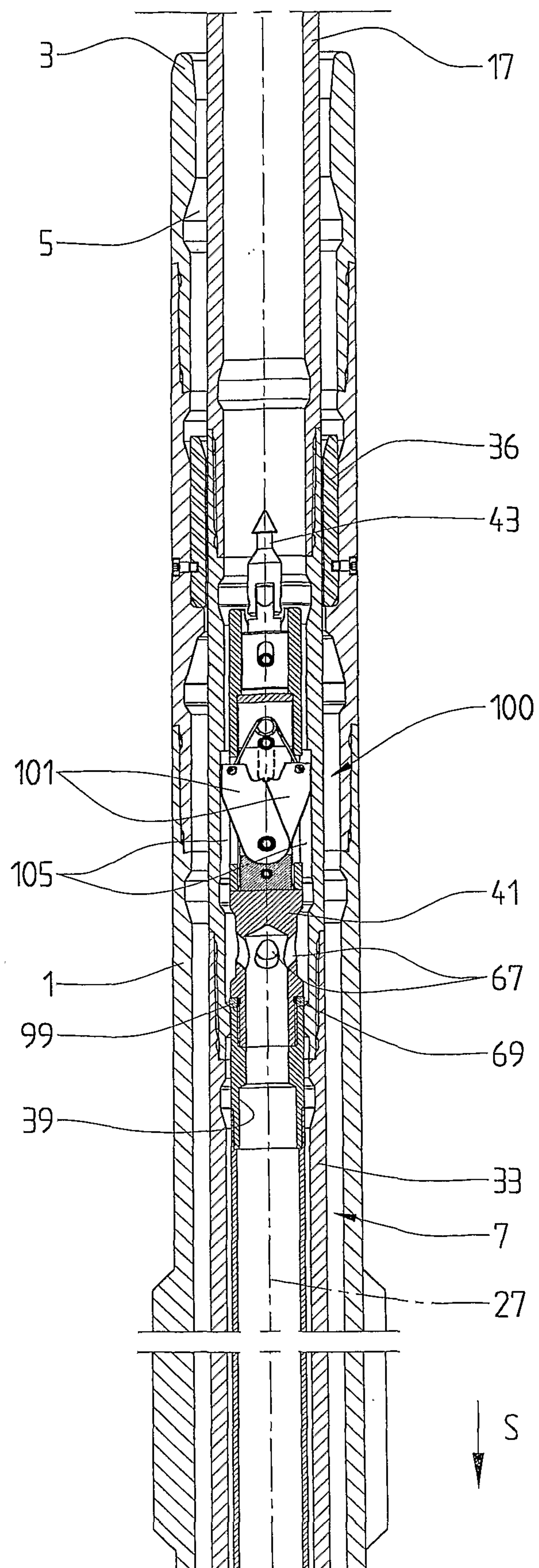


FIG 5

- 4/15 -

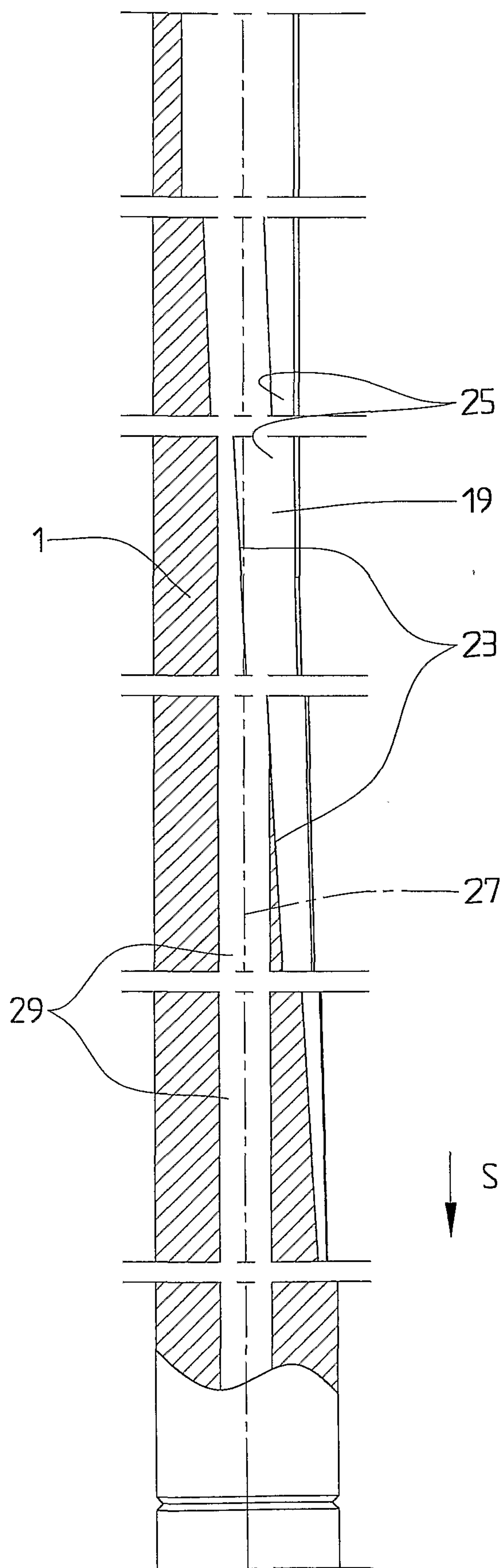


FIG 7

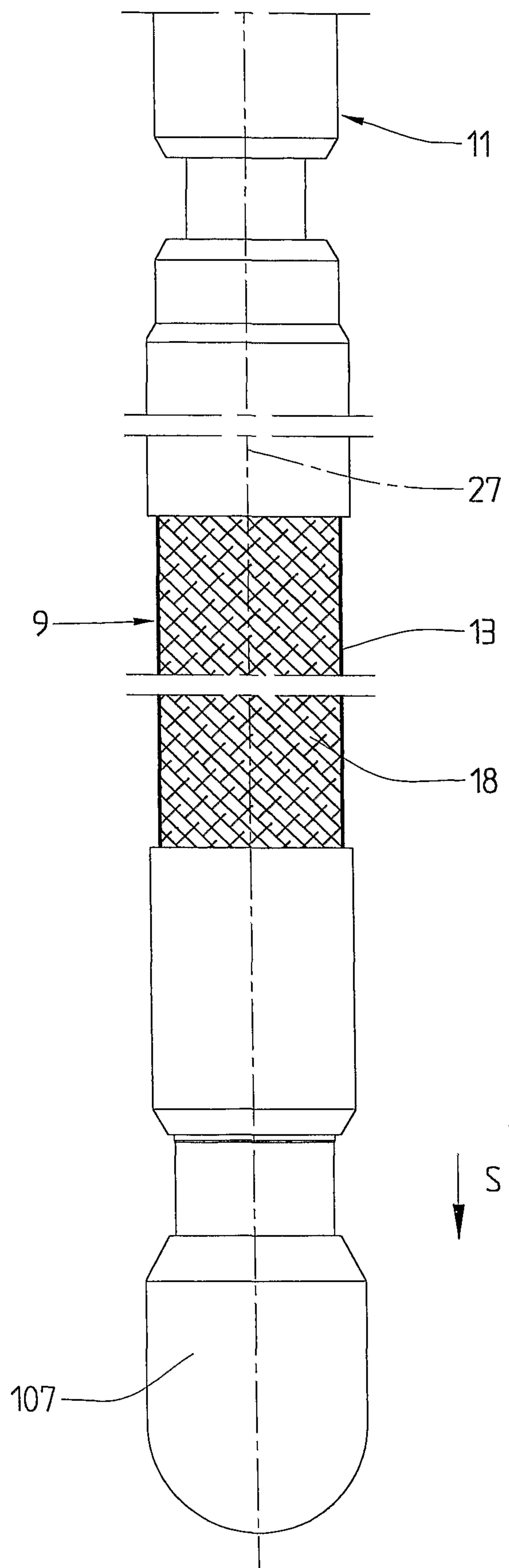


FIG 6

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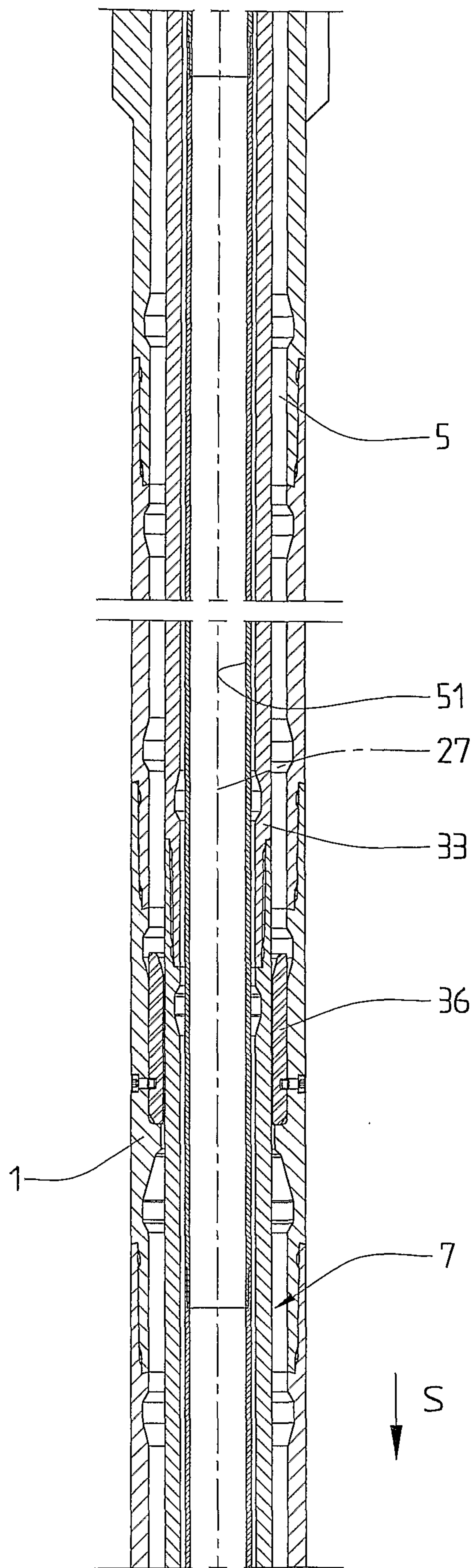


FIG 9

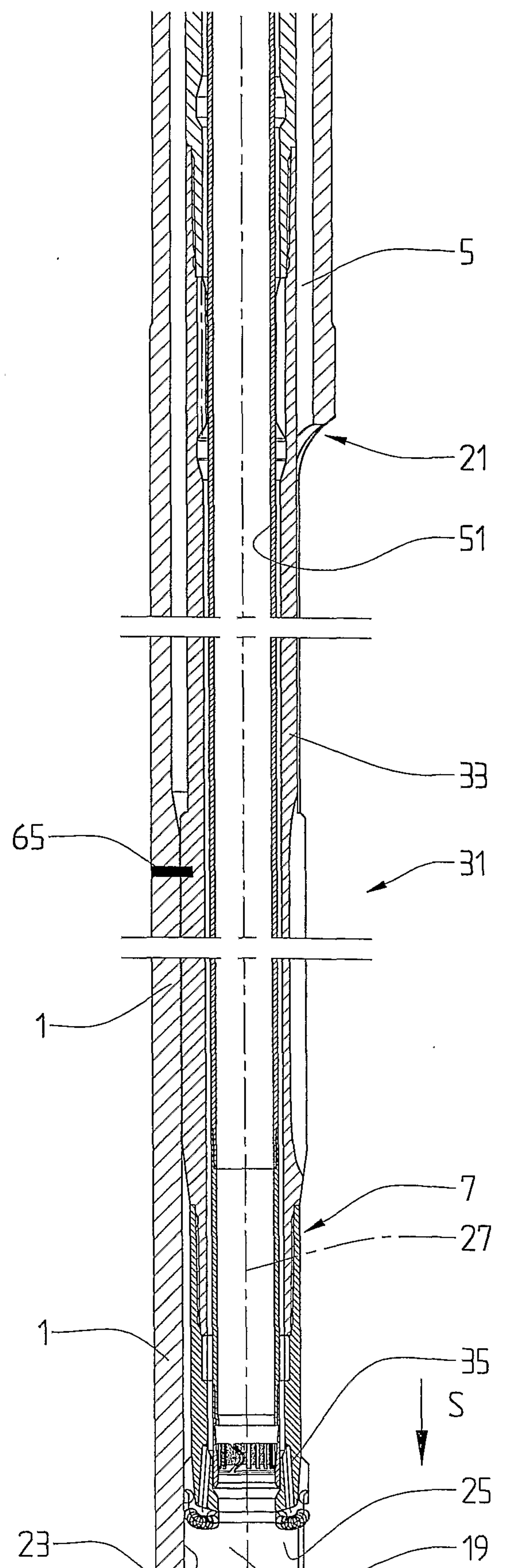


FIG 8

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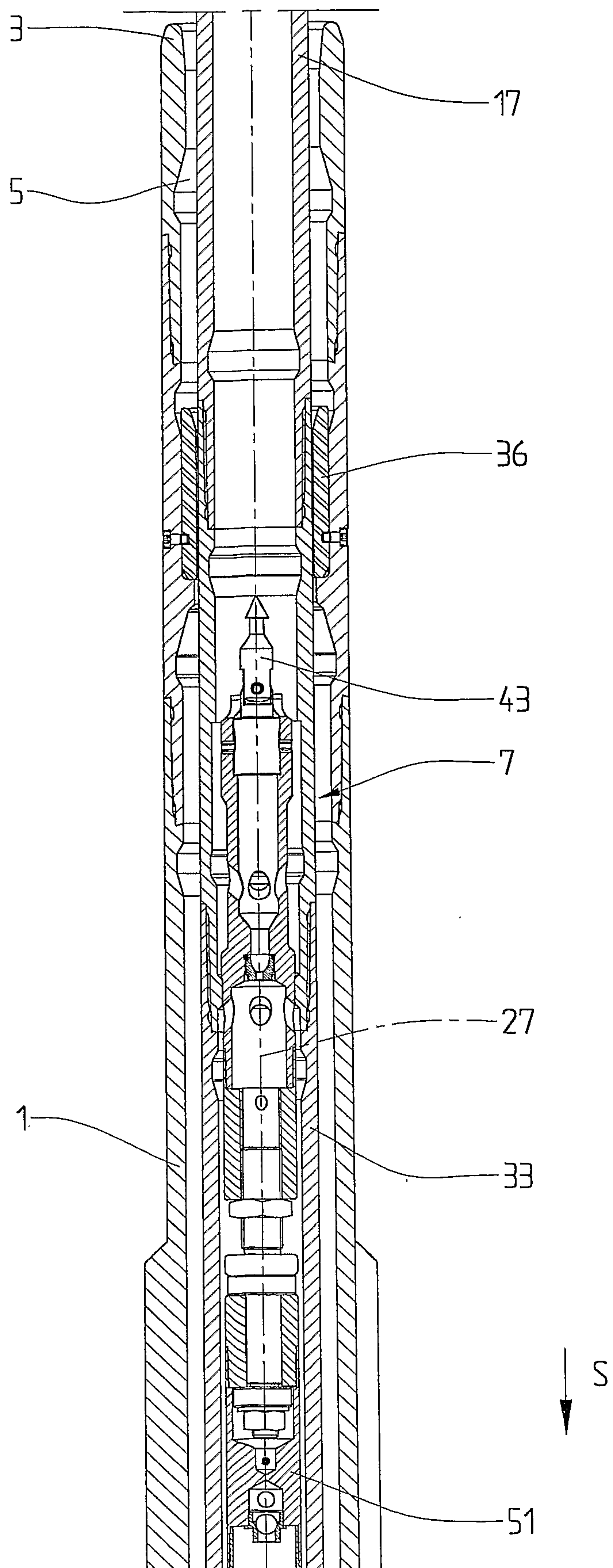


FIG 10

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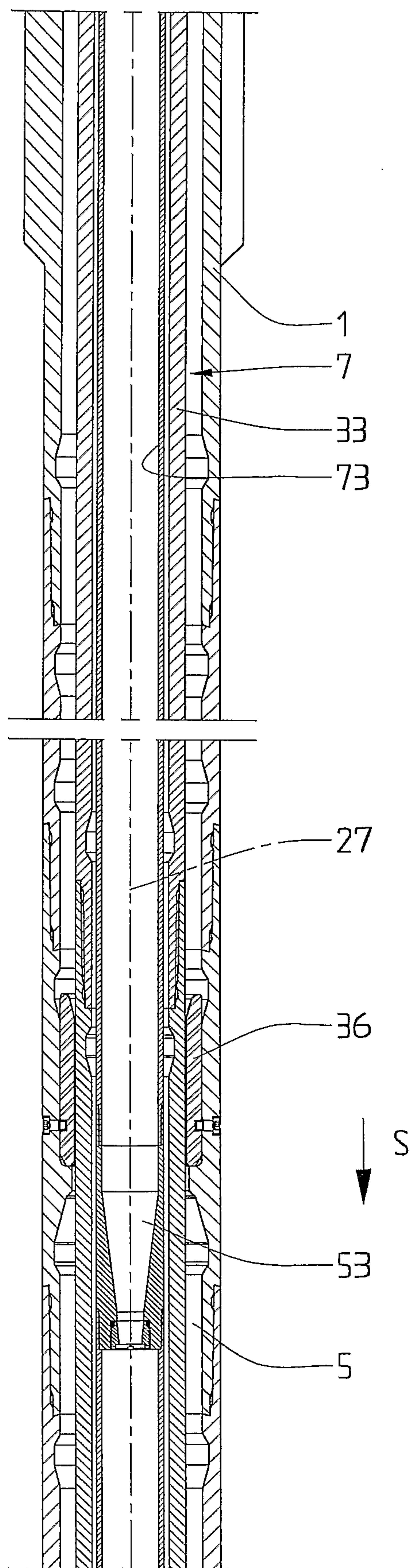


FIG 12

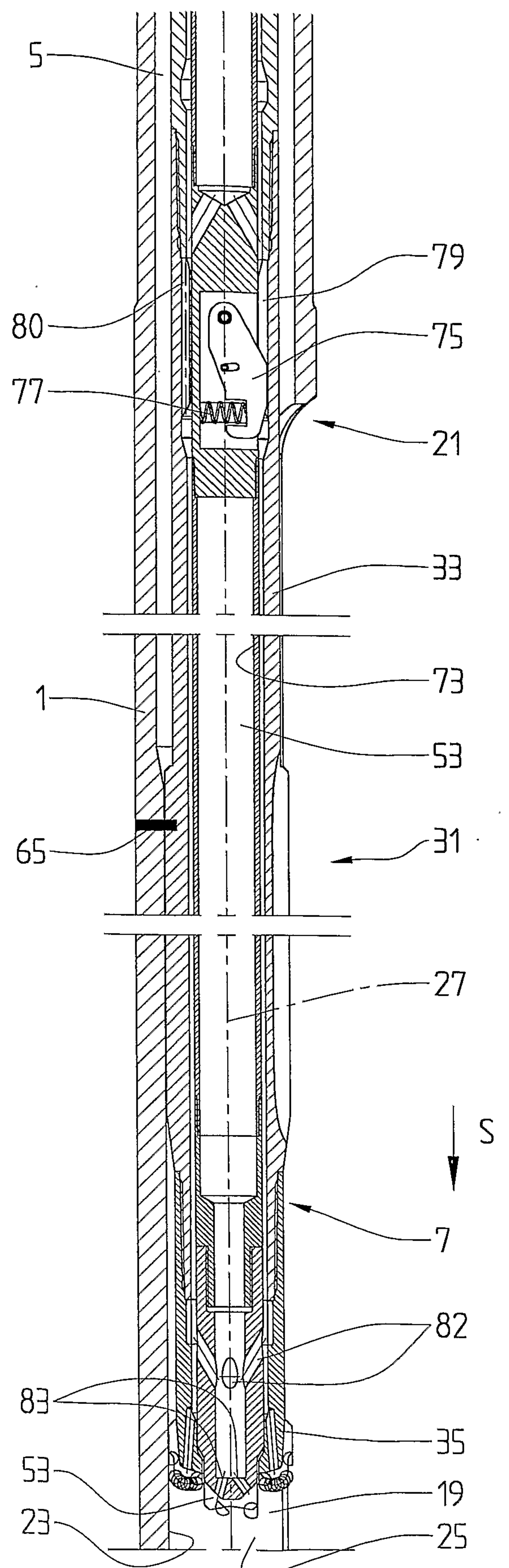


FIG 11

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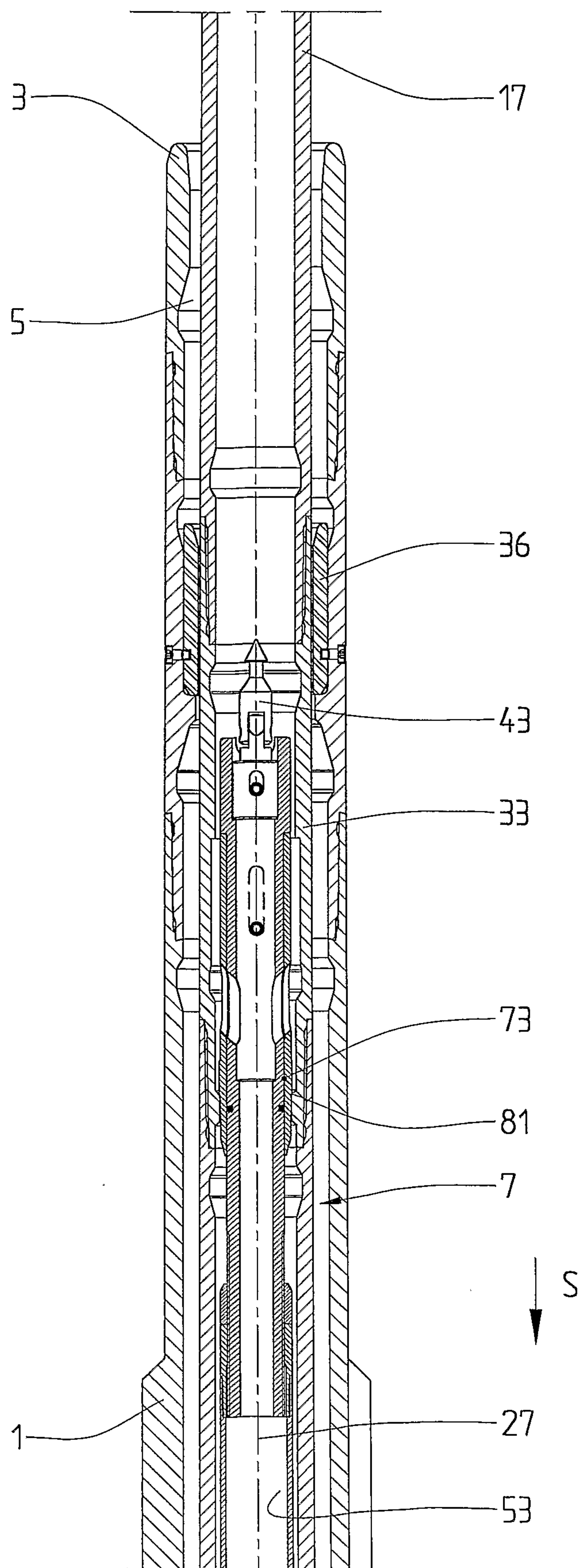


FIG 13

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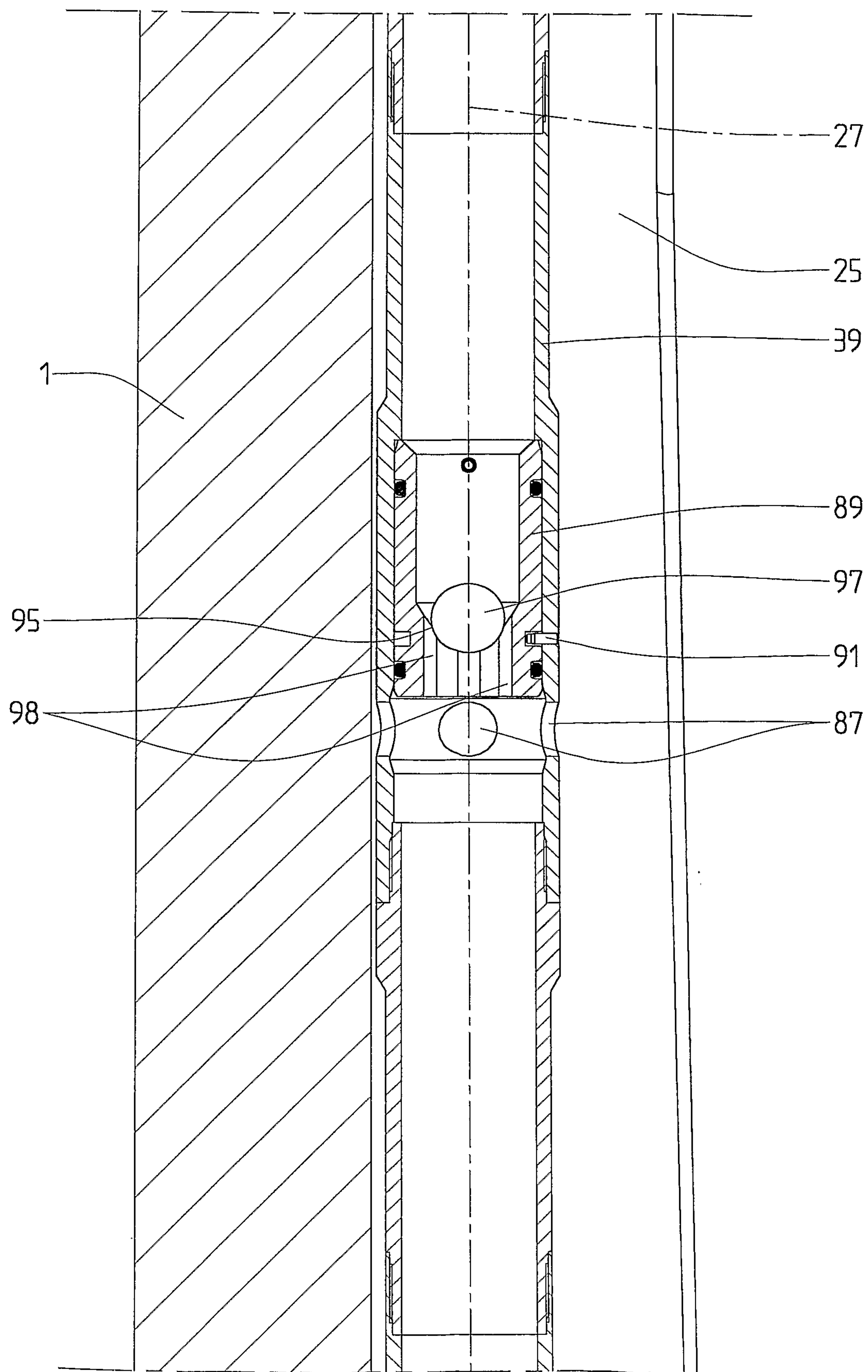


FIG 14

- 10/15 -

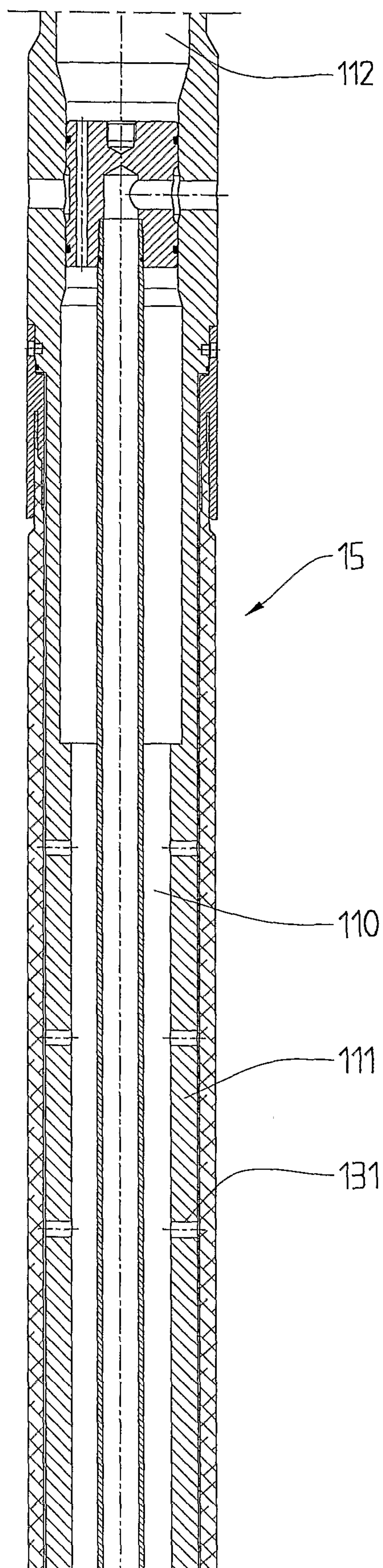


FIG 16

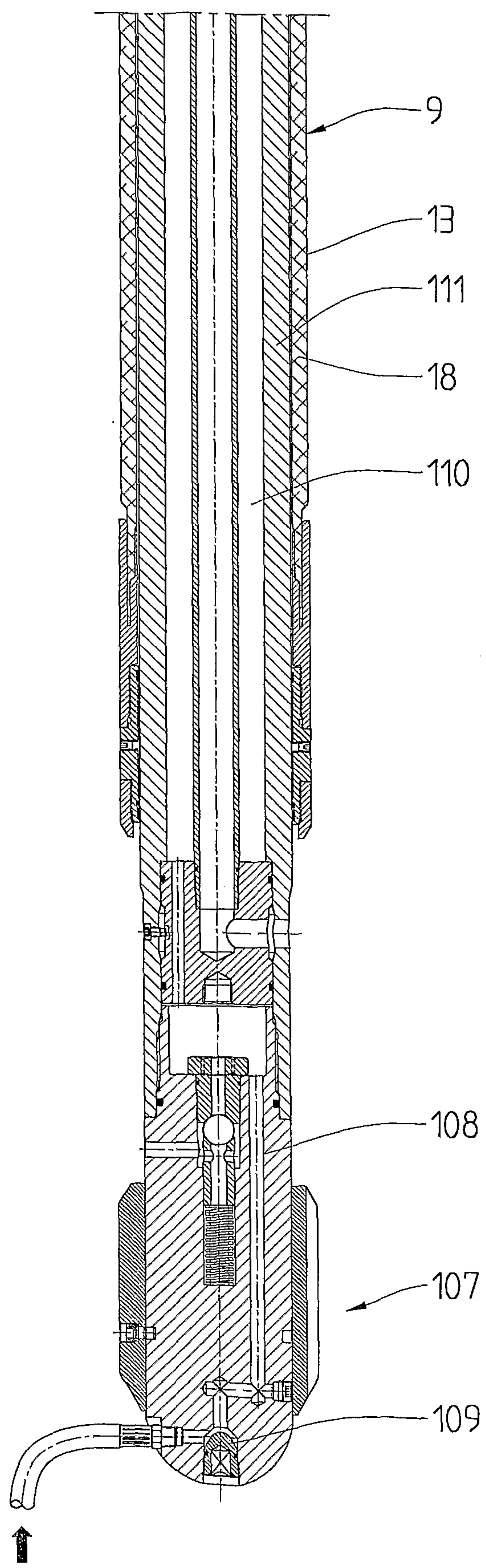


FIG 15

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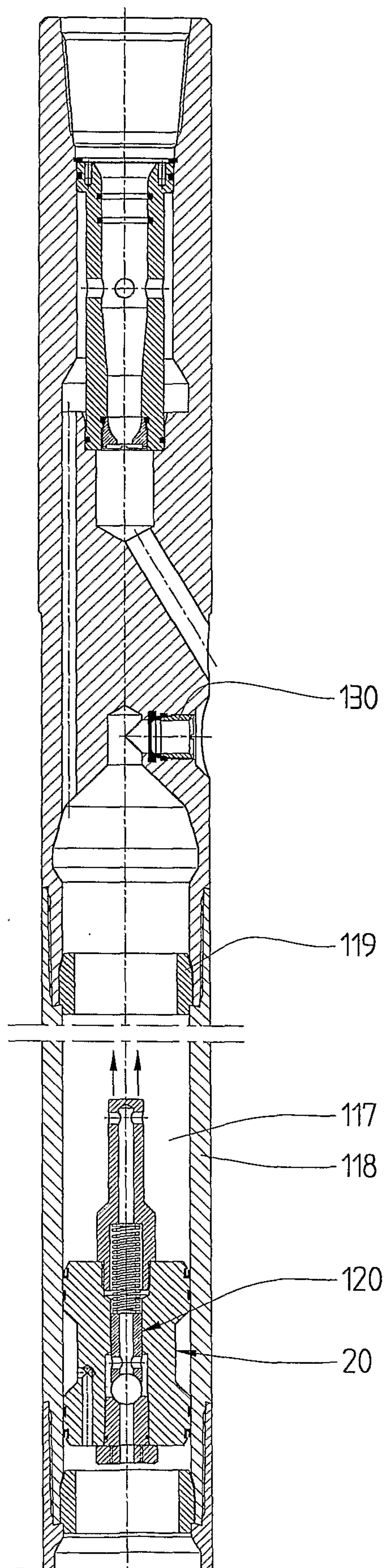


FIG 18

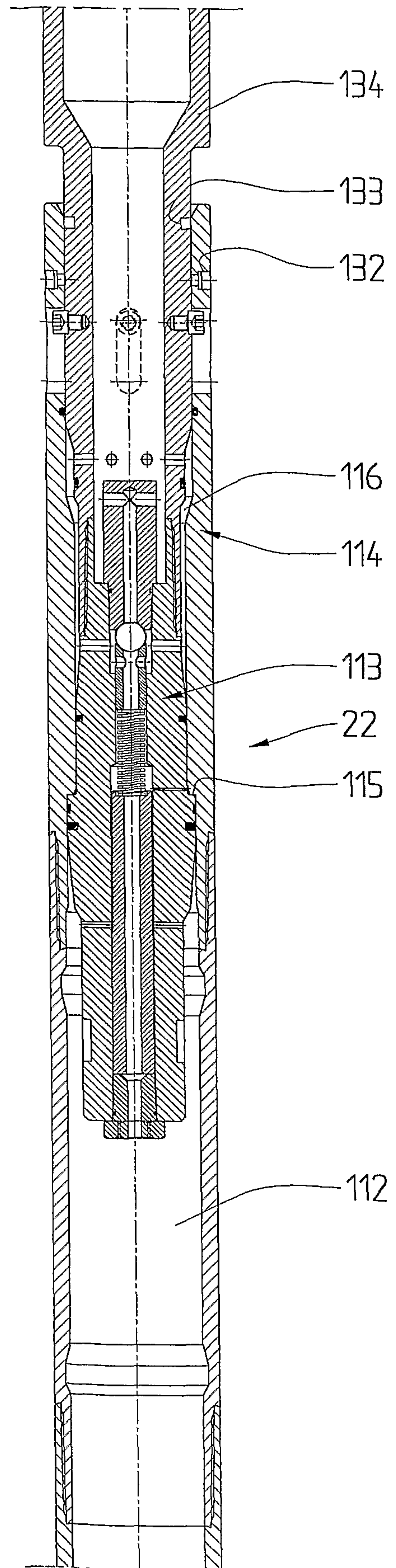
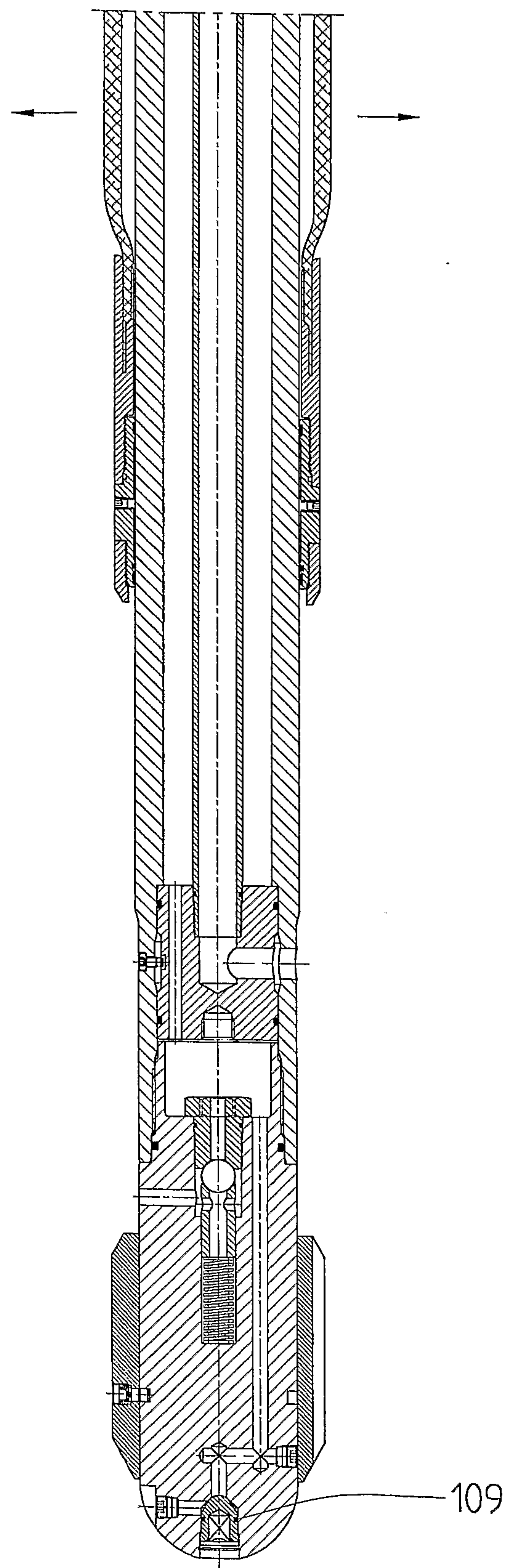
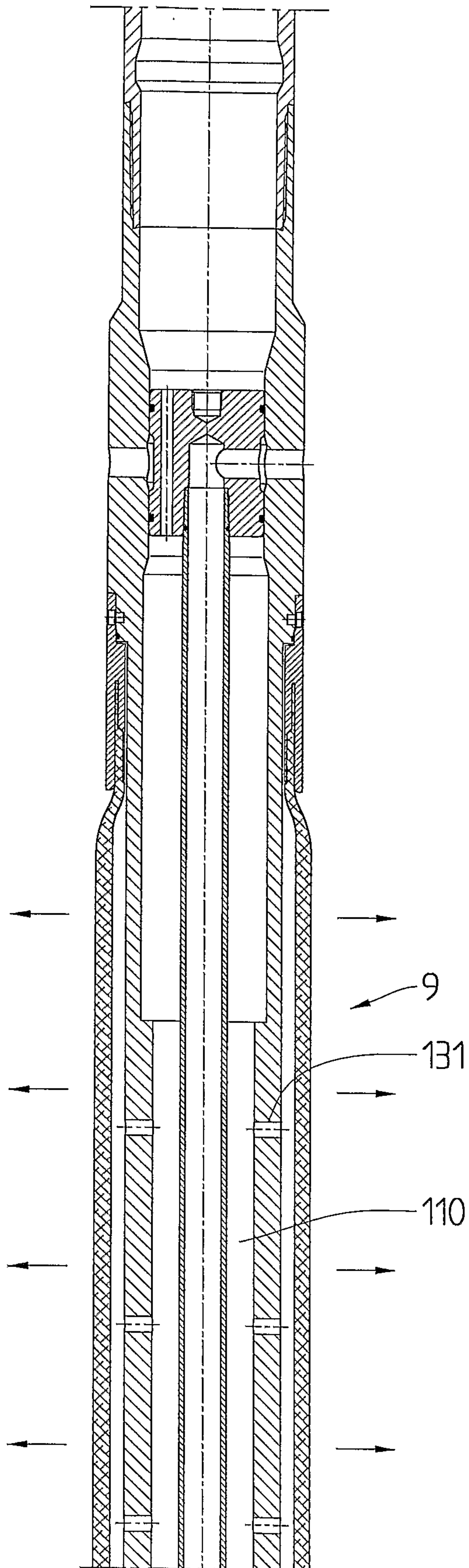


FIG 17

- 12/15 -



- 13/15 -

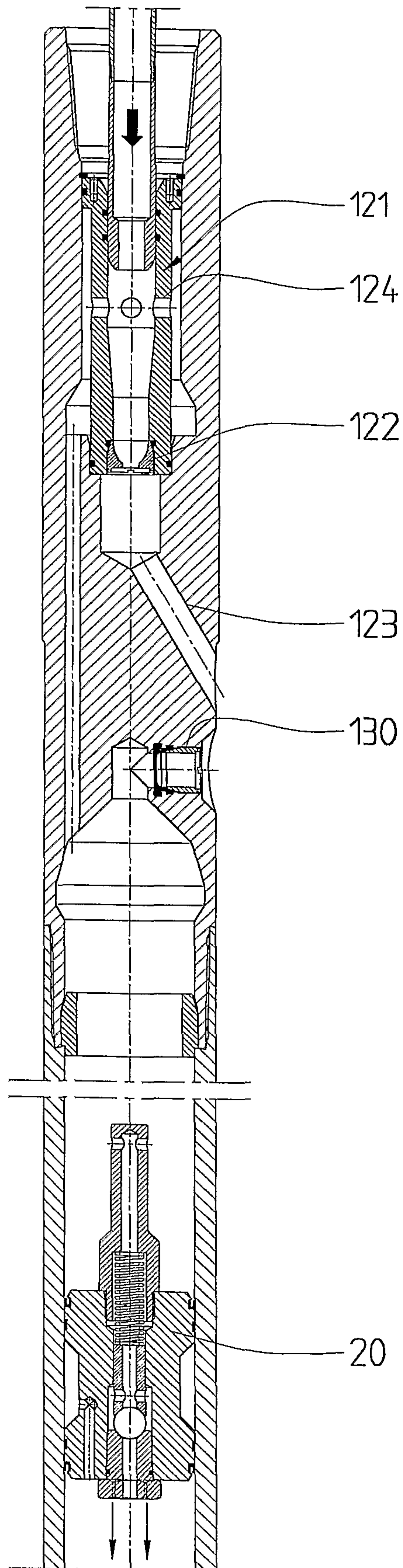


FIG 22

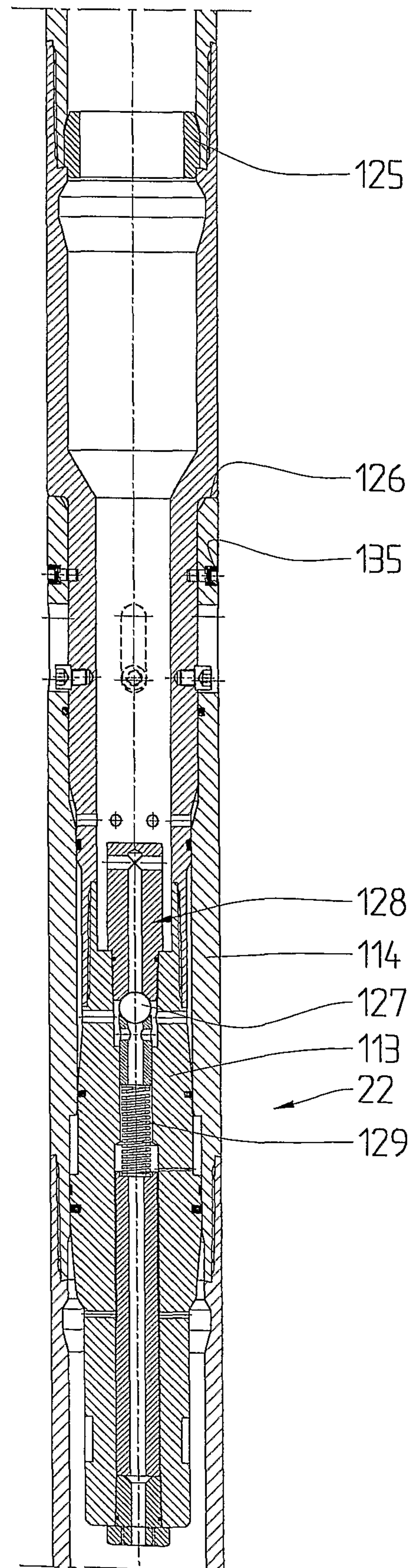


FIG 21

- 14/15 -

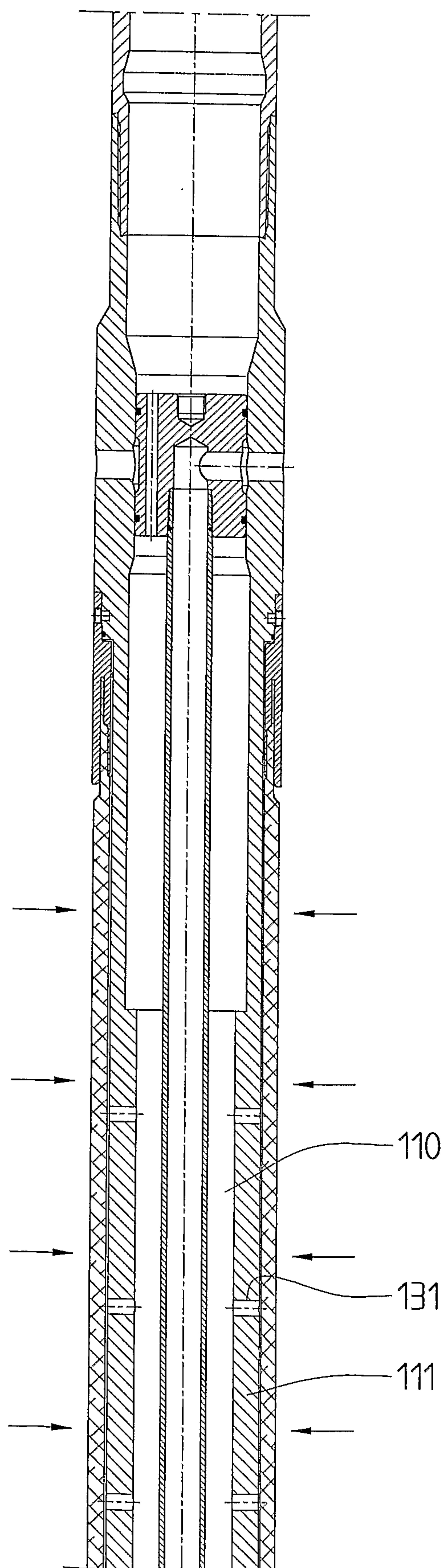


FIG 24

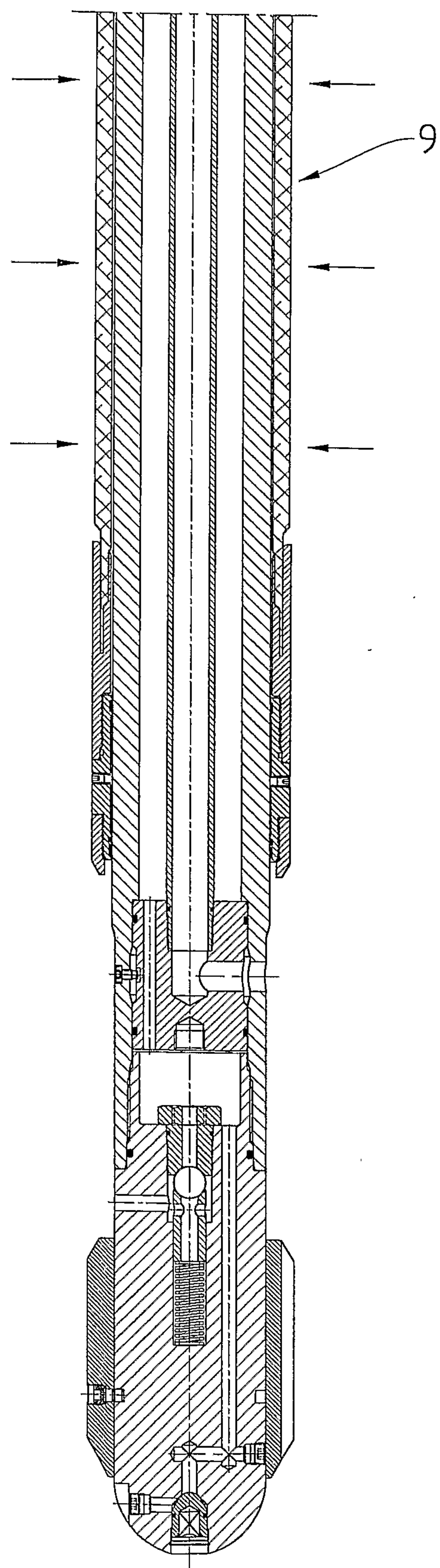


FIG 23

- 15/15 -

