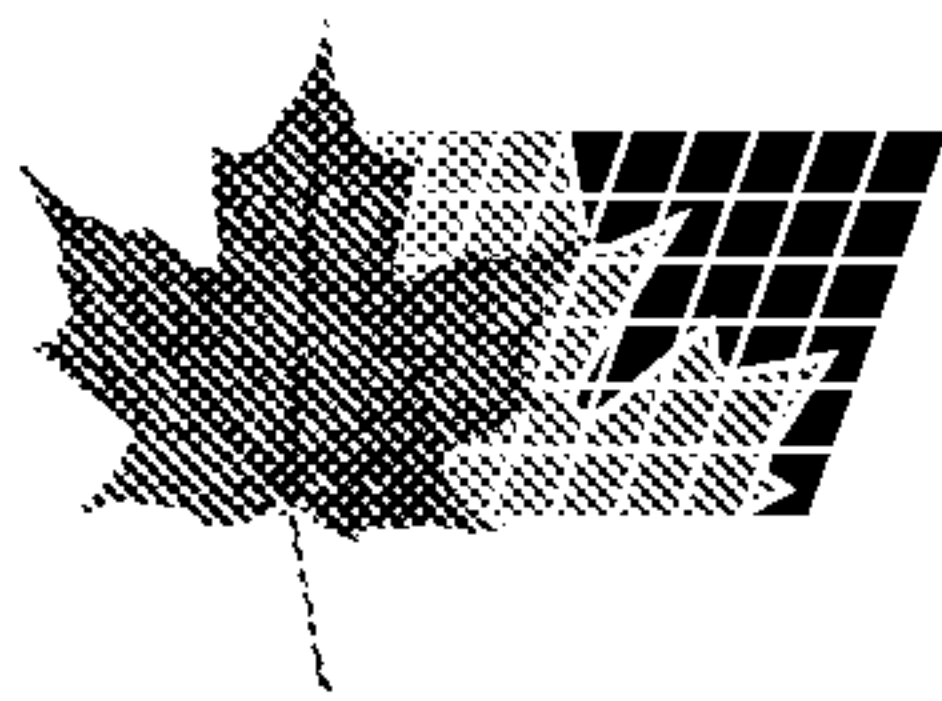




(72) MILNE, ALEX WATSON, GB

(72) SPENCER, MICHAEL CHARLES, GB

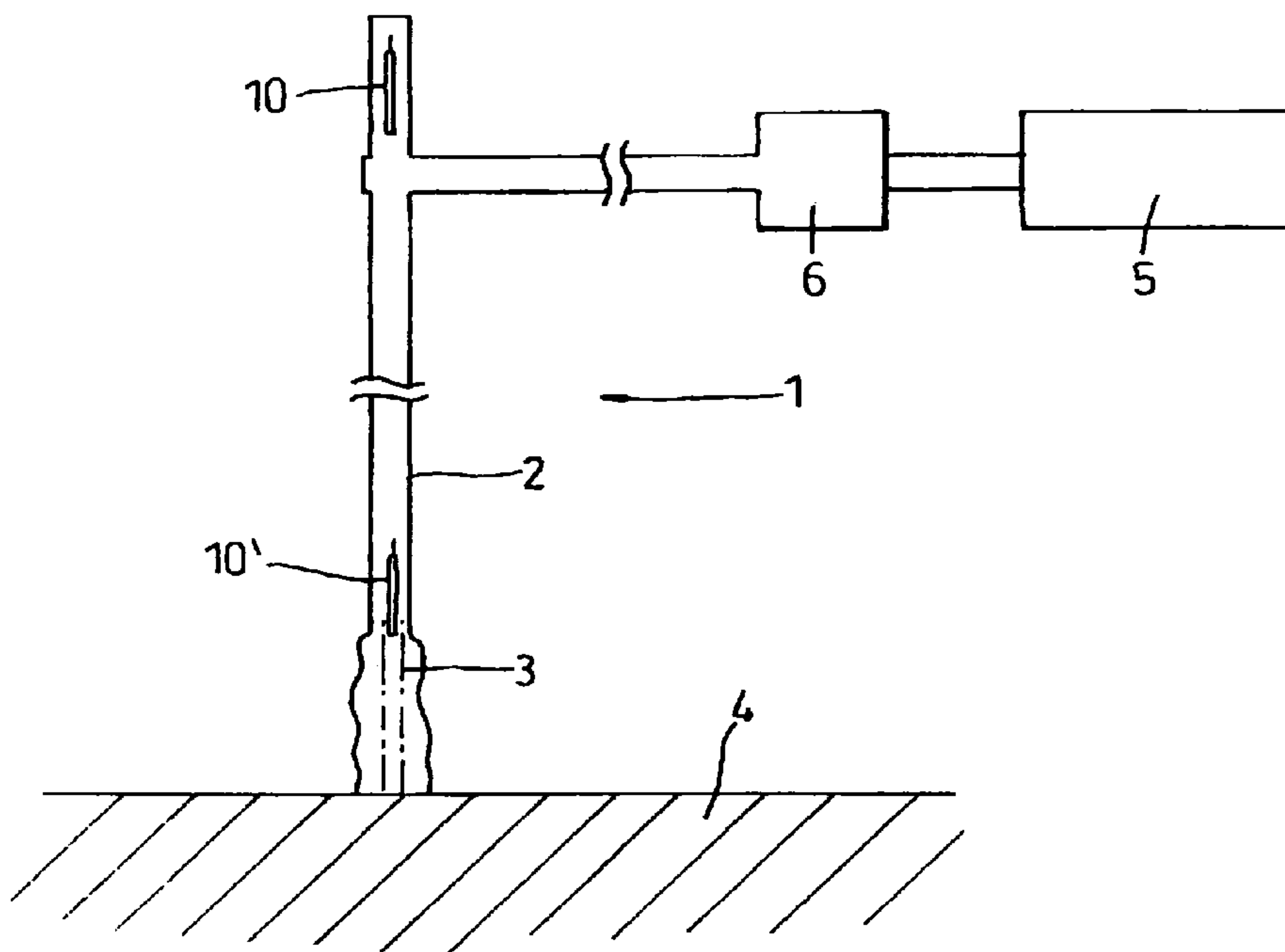
(71) REEVES WIRELINE TECHNOLOGIES LTD., GB

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(54) **METHODE ET APPAREIL DE DIAGRAPHIE DES SONDAGES
ET DE CONTROLE D'UN Puits**

(54) **METHOD AND APPARATUS FOR WELL LOGGING AND WELL
CONTROL**



(57) A well logging method and apparatus is described, which enables well logging to be conducted whilst still allowing passage of fluid mud within the well to maintain well control.



ABSTRACT
METHOD AND APPARATUS FOR WELL LOGGING
AND WELL CONTROL

- 5 A well logging method and apparatus is described, which enables well logging to be conducted whilst still allowing passage of fluid mud within the well to maintain well control.

Figure 1

METHOD AND APPARATUS FOR WELL LOGGING
AND WELL CONTROL

The present invention relates to a method and apparatus for well logging
5 and well control.

In order to maintain well control it is necessary for a well to be filled with
a fluid. Such fluids are usually mud mixtures and the density of the mud
is usually controllable to suit particular conditions within a well. Such
10 fluid is usually continuously pumped down a drill pipe and up the borehole
between the pipe and the side of the borehole and the drill pipe.

The type of mud, in particular the density of mud which flows within the
borehole may be carefully controlled to, for example, prevent escape of
15 gas. For some wells the mud density may require to be much higher than
for others. During the time that the well is in operation it may be
necessary to change the density of the mud mixture to, for example, cope
with additional gas pressure within the well.

20 In such circumstances, logging of the well becomes dangerous because
circulation of fluid/mud is required and this is not achievable without
drillpipe in the hole. Thus, many wells are not logged and because of this
the full potential of the wells is not achieved.

25 Additionally, in a well which has a large wash-out at a depth below the
surface, the logging cannot proceed past this section.

It is an object of the present invention to provide a method and apparatus
for both well logging and simultaneous well control.

The present invention provides a method for well logging and well control comprising of a well:-

- a) inserting a well logging tool into the well,
- 5 b) transporting said well logging tool down to a desired position in said well inside drillpipe and out into openhole,
- c) transporting said well logging tool upwardly in said well and logging data from said well as said tool is transported by wireline or drillpipe,
- 10 d) continuing to supply fluid flow in said well, whilst said logging of data is taking place said fluid flowing through said data logging tool or around the outside if wireline conveyed,

Preferably said method includes the step of e) increasing the pressure of
15 the fluid flow in said well to energise said data logging tool to create a path through said tool for said fluid.

The present invention also provides apparatus for well logging and control said apparatus comprising fluid pump means for pumping fluid into a well,
20 a well logging tool situated within said well, said well logging tool comprising fluid valve contact means for allowing fluid to pass through said logging tool to allow fluid contact to be maintained in said well.

The present invention may also comprise drill pipe means situated in said
25 well, and drill pipe means extending over wash-out portions of said well.

In a specific embodiment the apparatus may include drill bit means said drill bit means comprising means for enabling said logging tool to protrude through said drill bit to enable logging to be completed without

withdrawal of said drill bit means, said logging operation also enabling well control. And use pumpdown and reverse circulating technique to deploy and recover the logging tools.

5 Embodiment of the present invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 shows an apparatus according to the present invention for well logging and simultaneous well control,

10 Figure 2 partially shows a well logging tool suitable for use in the present invention.

Figure 3 shows the fluid flow unit of the well logging tool of figure 1 in greater detail, .

15 Figure 4 shows the fluid flow unit of figure 2 in cross sectional elevation.

Figure 5 illustrates a logging tool protruding through a drill bit.

20 With reference now to figure 1, a well system 1 comprises a borehole 2 with a drill pipe 3 (shown dotted) positioned to cover part or all of the borehole. The well 4 is situated at the bottom of the borehole.

The well is supplied with well fluid comprising a mud mixture from a fluid supply system comprising a reservoir 5 and pumping system 6.

25 A logging tool is introduceable into the system via a catcher unit 8, the operation of which is more fully described in our co-pending UK patent application No. 9826017.7 filed on 28 November 1998.

The logging tool may be battery powered and therefore may operate freely within the well or may be operated more conventionally with a cable.

The logging tool is shown in a second position 10 towards the bottom of the well.

5 The logging tool may be of the type shown in figures 2, 3 and 4.

With reference now to figure 2 the well logging tool 10 comprises a generally elongate cylindrical construction including a first upper section 12 and a second lower section 14. The phrases upper and lower sections
10 are used to indicate the normal direction of insertion of the tool 10 into a borehole.

The first section 12 comprises a fluid flow unit, the operation of which will be explained in greater detail with reference to figures 3 and 4.

15

The second lower section 14 comprises a well data logging section which may include a battery and memory pack section 140 and a calliper/sensor section 142.

20 The battery/memory section 140 enables the logging tool to be free from any control cables. The logging tool could, however, be connected by a conventional cable arrangement should this be preferred. Normally, however, the logging tool will be battery powered.

25 The data logging sensors and calliper unit may be of conventional designs which are well known in this art and therefore they will not be described further.

With reference now to figure 3, the fluid flow unit comprises a first upper fluid entry/exit port 120 and a second lower fluid entry/exit port 122.

Adjacent to the upper fluid entry port 120 is a larger diameter section 124 and adjacent to the lower entry port 122 is a further larger section 126. A segmented landing collar 128 is preferably situated between the lower fluid entry part 122 and the larger diameter section 126. This would not be used if the tool is wireline conveyed.

A differential pressure release valve 130 is situated between enlarged diameter sections 124, 126. A fishing neck 132 is provided at the upper end of section 12.

In operation the well logging tool will normally not allow fluid flow therethrough. Thus when fluid pressure is applied within a drill pipe 100 (shown dotted in figure 1) in the direction of arrow 102 the logging tool will be propelled in that direction and indirection 104 when fluid pressure is applied in that direction.

The operation of the valve means is explained with reference to figure 4, which shows in cross section the operative part of the first section 12.

The valve means comprises two cylinders 142, 144 and a piston 146. Piston 146 is free to move within the cylinders, but is normally maintained in a central position as indicated by reference numeral 146 by two coil springs 148, 150.

Normally piston 146 closes the central portion 152 between cylinders 142, 144 and thus prevents any passage of fluid from grille 120 to grille 122.

Passage of fluid via internal passages 154, 156 is prevented by suitable seal means 158. Thus, in normal use fluid pressure in the direction of arrow 102 will push on the end of 12 of logging tool 10 and cause it, unless it is obstructed, to move in the direction of arrow 102.

5

If the logging tool becomes stationary then the fluid flow 102 will be halted.

10

In a preferred embodiment of the fluid pressure in drill pipe 100 remains the same as in the logging tool transportation mode, then piston 146 will not move substantially.

15

However, if pressure is allowed to build up on the side of inlet grille 120 then the differential pressure across piston 146 will increase and this will then force piston 146 downwardly until it is in position 146.

20

The fluid flow will then follow arrows 160, 162, 164, 166 allowing fluid to pass through grilles 120, 121, through cylinders 142, 144 and through grille 123 and outlet grille 122 to pass on down the drill pipe 100.

25

In like manner, if the fluid flow is reversed, piston 146 will move to the upper cylinder 142 and the fluid flow through the valve unit will occur in a reverse direction.

The valve unit therefore allows passage of fluid through the drill pipe at all times even when logging is occurring.

Well control is therefore achievable by increasing the pressure of the fluid within the well to ensure that the differential valve system in the logging

tool 10 opens to allow passage of the fluid. The well can be logged continuously whilst the gas/oil within the well can be kept under control.

5 The use of sections 3 (Figure 1) of drill pipe to "bridge" sections of the borehole where wash-out occurs is beneficial in control of the logging tool especially where the tool is free standing. The fluid flow can be monitored whilst the tool passes through such sections.

10 In a specific embodiment the apparatus may include drill bit means said drill bit means comprising means for enabling said logging tool to protrude through said drill bit to enable logging to be completed without withdrawal of said drill bit means, said logging operation also enabling well control. And use pumpdown and reverse circulating technique to deploy and recover the logging tools.

15

In Figure 5 the logging tool 10 is shown protruding through a hollow drill bit 50.

The tool is prevented from excess downward movement by a collar 501.

20

Thus the drill bit does not have to be returned to the surface in order to provide an open hole logging service.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method for well logging and control comprising of a well;-
 - a) inserting a well logging tool into the well,
 - 5 b) transporting said well logging tool down to a desired position in said well at a first fluid pressure level,
 - c) transporting said well logging tool upwardly in said well and logging data from said well as said tool is transported,
 - d) continuing to supply fluid flow in said well, whilst said logging
10 of data is taking place, said fluid flowing through or past said data logging tool.
2. A method for well logging and which is claimed in claim 1 which said method includes the step of e) increasing the pressure of the fluid
15 flow in said well to energise said data logging tool to create a path through said tool for said fluid.
3. Apparatus for well logging and control said apparatus comprising fluid pump means for pumping fluid into a well, a well logging tool
20 situated within said well, said well logging tool comprising fluid valve contact means for allowing fluid to pass through said logging tool to allow fluid contact to be maintained in said well.
4. Apparatus for well logging and which as claimed in claim 3 further
25 comprising drill pipe means situated in said well, and drill pipe means extending over wash-out portions of said well.
5. Apparatus for well logging and which as claimed in claim 4 in which the apparatus includes drill bit means said drill bit means

comprising means for enabling said logging tool to protrude through said drill bit to enable logging to be completed without withdrawal of said drill bit means, said logging operation also enabling well control.

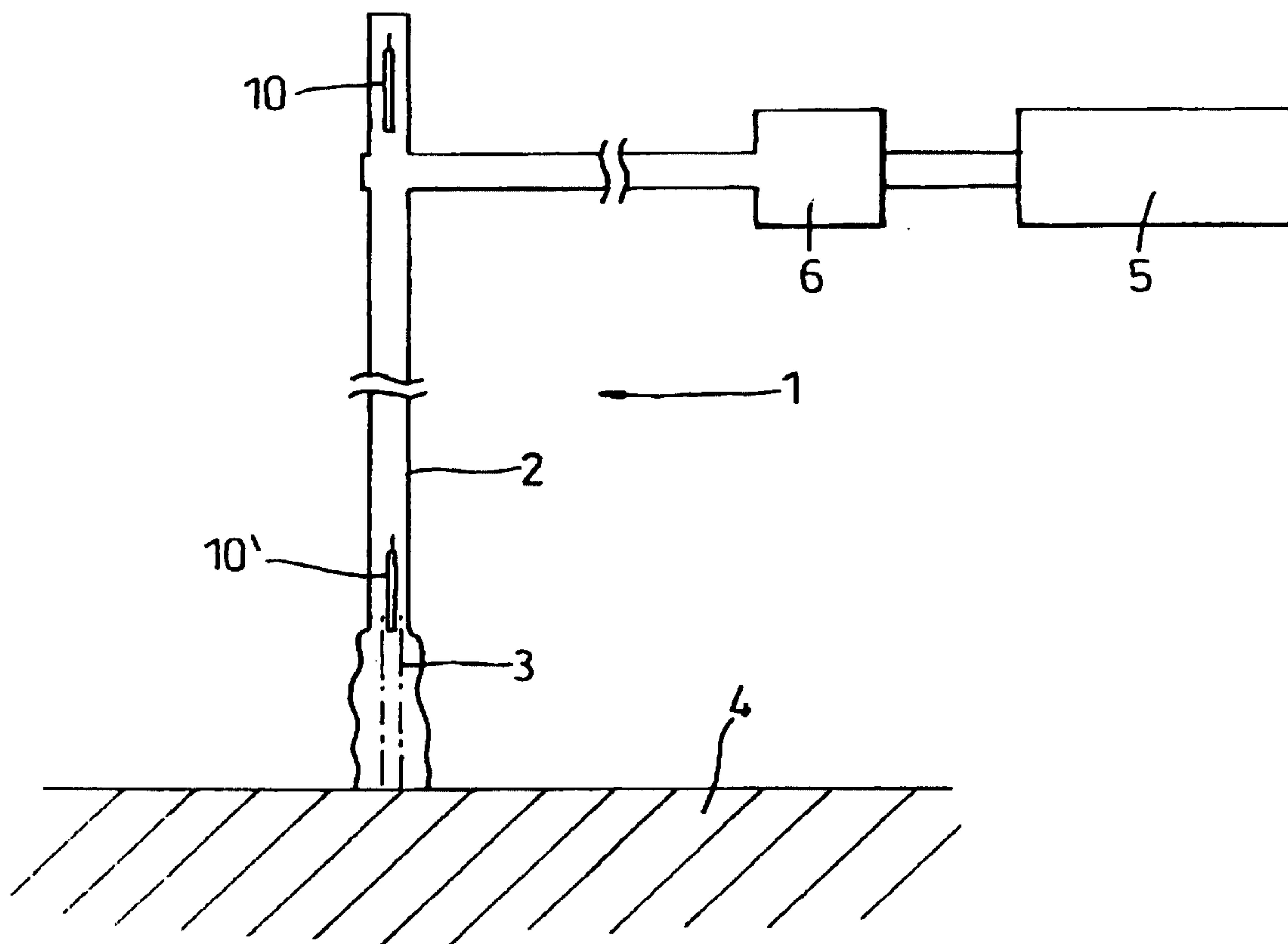


Fig. 1

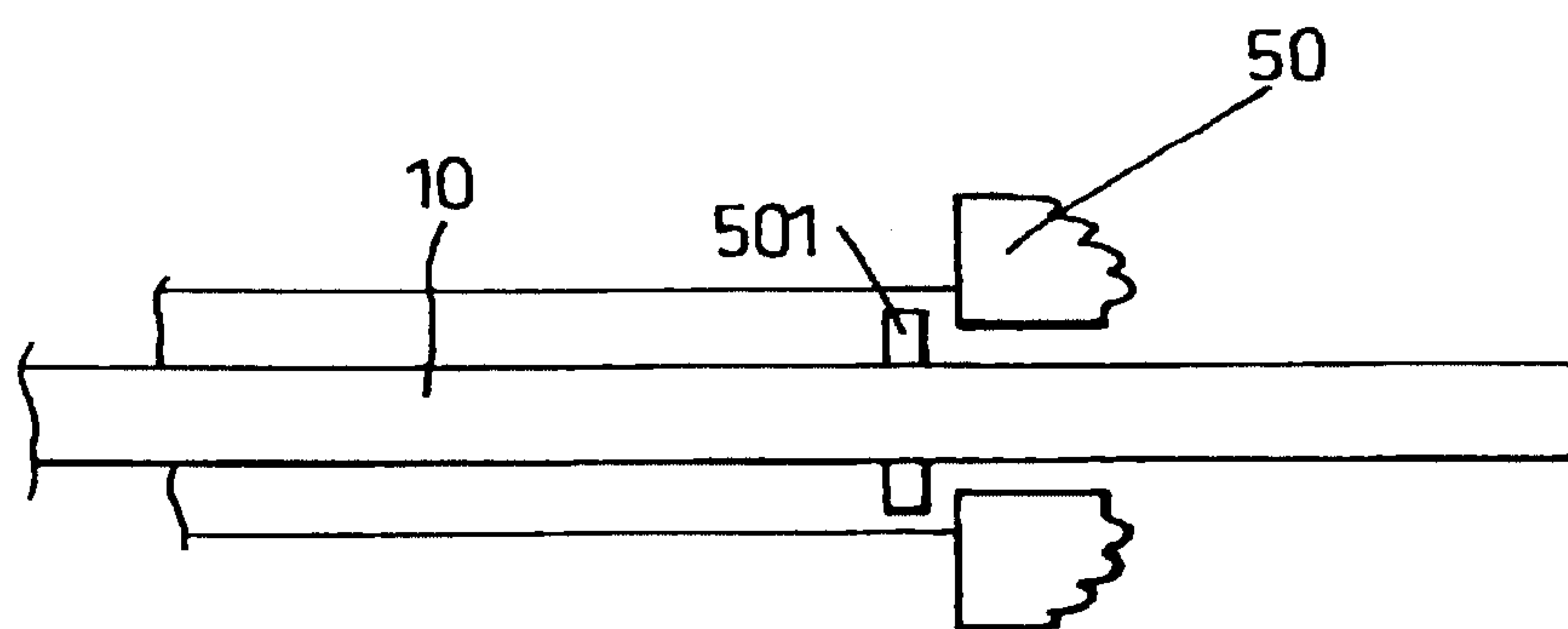


Fig. 5

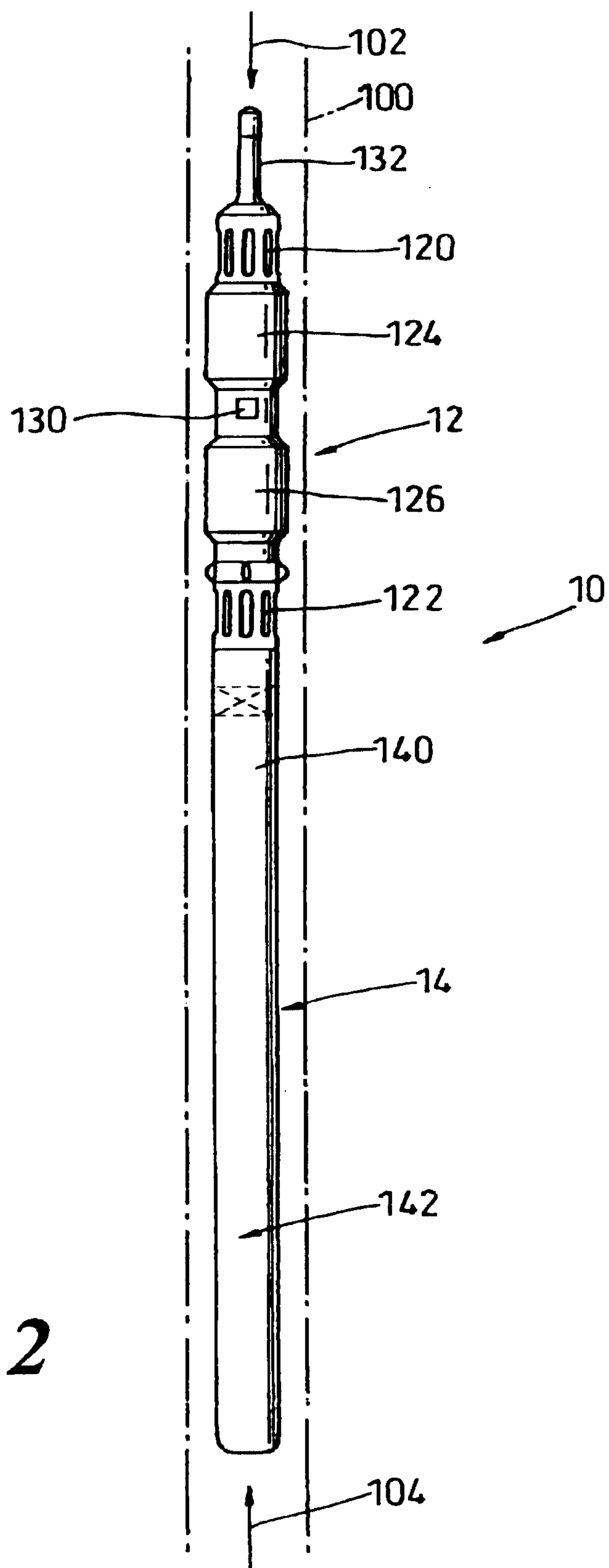


Fig. 2

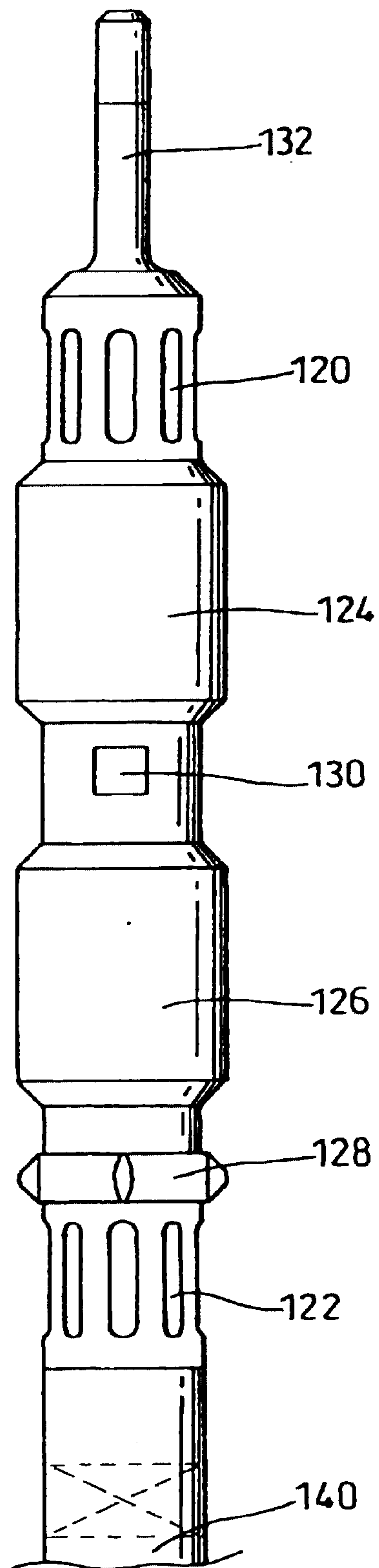
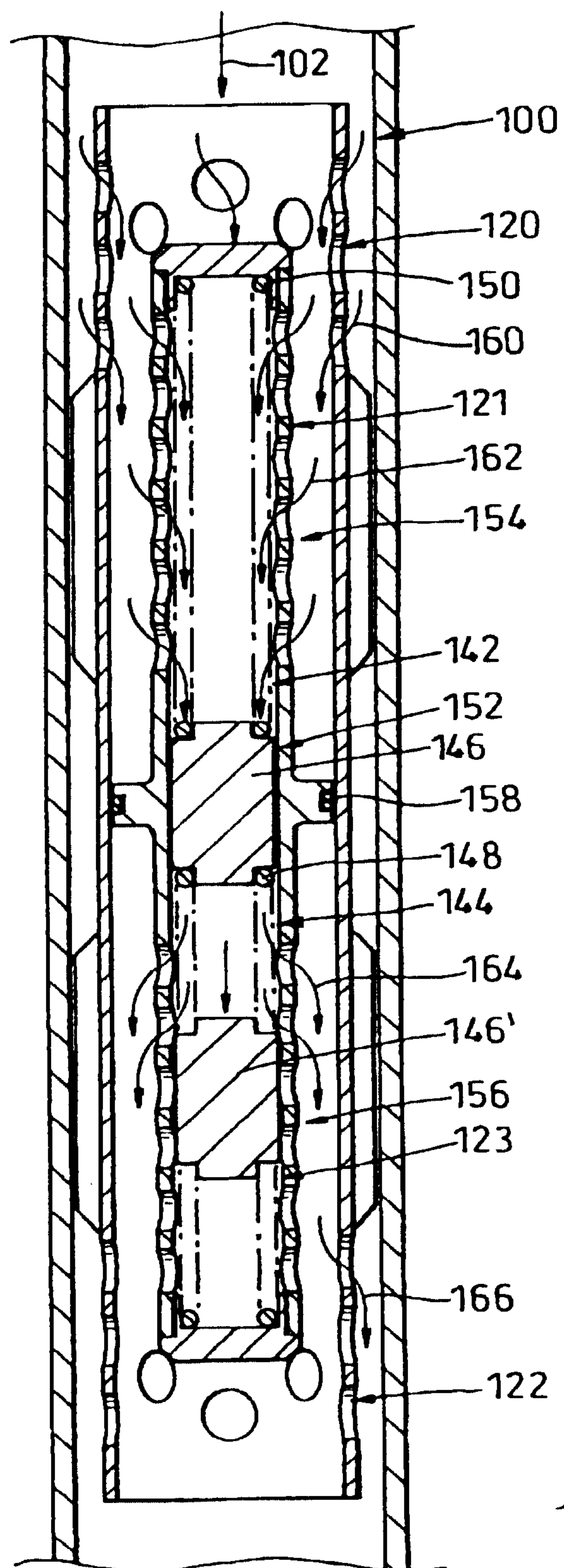


Fig. 3

**Fig. 4**