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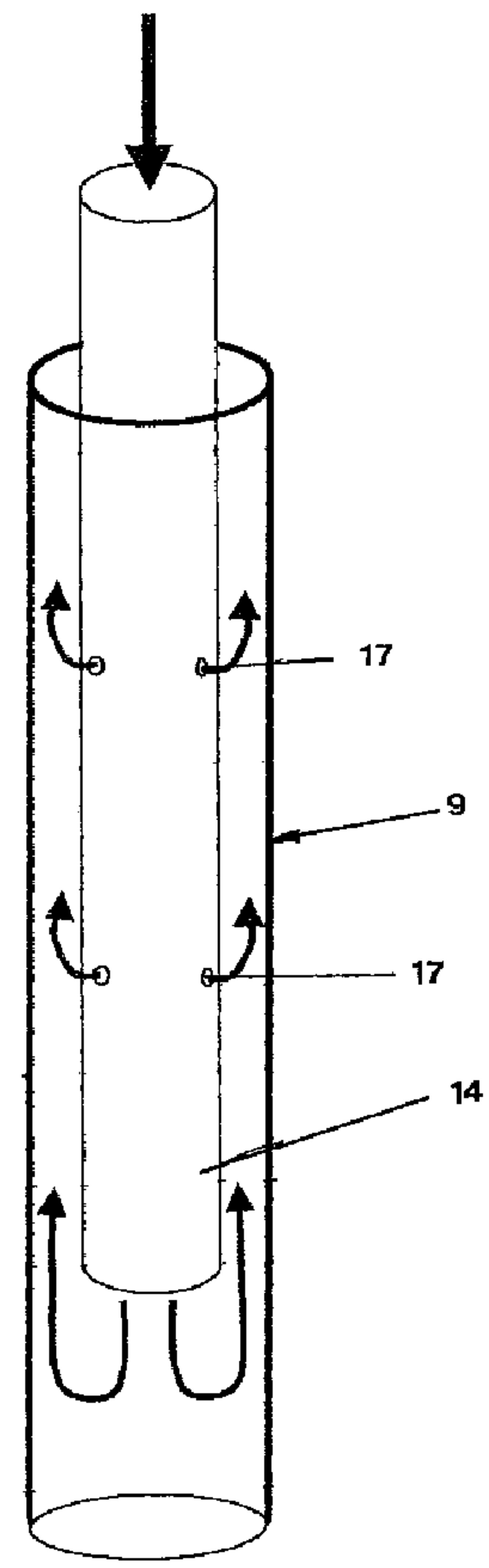
(54) **Titre :** SYSTEME DE GUIDAGE POUR LIGNES DE SIGNALISATION, DISPOSITIF POUR MESURER LES TEMPERATURES ET/OU LA CONCENTRATION, ET METHODE D'UTILISATION

(54) **Title:** GUIDE SYSTEM FOR SIGNAL LINES, DEVICE FOR MEASURING TEMPERATURES AND/OR CONCENTRATIONS AND USE



(57) **Abrégé/Abstract:**

The invention relates to a guide system for signal lines comprising a guide tube, through which the signal lines are guided, a cooling system which laterally surrounds the guide tube and comprises at least one coolant chamber and at least one inlet and at least one

(57) Abrégé(suite)/Abstract(continued):
outlet for the coolant, wherein the coolant chamber is tubular in construction and is hermetically sealed by a seal at least at one end face.

Abstract

The invention relates to a guide system for signal lines comprising a guide tube, through which the signal lines are guided, a cooling system which laterally surrounds the guide tube and comprises at least one coolant chamber and at least one inlet and at least one outlet for the coolant, wherein the coolant chamber is tubular in construction and is hermetically sealed by a seal at least at one end face.

Guide system for signal lines, device for measuring temperatures and/or concentrations and use

The patent application relates to a guide system for signal lines, to a device for measuring temperatures and/or concentrations, which contains these guide systems, and to the use thereof.

Systems of this type are known, for example, from JP 09-280960. That document discloses a guide tube for an optical fibre for taking measurements in molten metals. The optical fibre is air-cooled. US 5,853,656 discloses a carrier arrangement for a carburizing furnace, in which parts of the arrangement are cooled by air or water.

Guide systems for signal lines, in particular if used in hot or corrosive environments, for example in molten metals, such as molten iron, cast iron or steel, have to be effectively cooled so as not to impede the reception and transmission of signals, for example test signals.

The aforementioned problem is solved by the subject of the independent claims. Preferred embodiments are described in the sub-claims. A guide system for signal lines comprising a guide tube, through which the signal lines are guided, a cooling system which laterally surrounds the guide tube and comprises at least one coolant chamber and at least one inlet and at least one outlet for the coolant, wherein the coolant chamber is tubular in construction and is hermetically sealed by a seal at least at one end face, is particularly suitable for guiding the coolant. In particular, the guide tube can be guided through the seal of the end face, or can end in the seal or in the coolant chamber, the signal lines being guided through the seal.

A further advantage is that a further tube, preferably constructed as a steel tube, is guided round the guide tube in the tubular chamber, the inlet (or the outlet) being arranged in the further tube and the outlet (or the inlet) being arranged in the wall of the tubular chamber. It is particularly expedient if the end of the further (additional) tube facing the sealed end of the tubular chamber comprises at least one orifice. It is also advantageous if the further tube comprises at least one orifice in its casing. It advantageously has a plurality of orifices which are preferably distributed uniformly in the circumferential direction and/or in the longitudinal direction of the further tube. Targeted guidance of the coolant can be optimally adjusted by means of this further (additional) tube.

It is expedient to arrange a mixture of air and water and/or steam in the coolant chamber. A coolant of this type is highly efficient during cooling. It is also expedient if the signal lines are constructed as electric lines or as optical fibres.

According to the invention, a device for measuring temperature and/or concentrations, in particular of molten metals, which comprises a measuring end, is characterised in that an above-described guide system is arranged at the measuring end of the device. This device is preferably constructed in such a way that a thermocouple, an electrochemical measuring cell and/or one end of an optical fibre is arranged at the measuring end or the sealed end of the guide system.

According to the invention, the device can be used for measuring temperatures and/or in molten metals, in particular in molten iron, cast iron or steel. Use as an immersion sensor is expedient.

According to the invention, steam and/or a mixture of air and water is used as the coolant in an above-described guide system.

An embodiment of the invention is described hereinafter with reference to drawings, in which:

Fig. 1 shows a device for measuring in molten steel and the arrangement thereof during measurement,

Fig. 2 is a section through a guide system,

Fig. 3 shows a detail of the guide system with the tube surrounding the guide tube.

The immersion sensor 1 is immersed with its immersion end through a lateral screen 2 of the melt container 3 into a steel melt 4. At the immersion end, the immersion sensor 1 comprises an outer protective sheath made of a mixture of aluminium oxide and graphite. There is slag 5 above the molten steel 4. The components of the coolant are introduced through an air supply line 6 and a water supply line 7 into a supply tube 8, through which the mixture of air and water or steam is supplied through an inlet 10 of the guide system 9 arranged in the outer wall of the guide system 9 limiting the coolant chamber. The spent coolant can issue from the guide system 9 through the outlet 11.

For the sake of clarity, the signal line guided through the guide system and the continuation thereof from the end of the guide system applied to the melt to a measuring device is not shown in the drawings. However, arrangements of this type are generally known from the prior art and are familiar to a person skilled in the art.

An optical fibre is used as the signal line. The immersion sensor has a total length of more than 3 metres. The air is supplied to the system at a pressure of 4 bars and flows through the system at 2,000 litres per minute. The amount of water may be varied as a function of the specific application, the flow rate of water being about 1 litre per minute. The water is drawn into the system by the air stream by means of a venturi pump (or a different type of pump, for example an electric pump) so water cannot enter the device if the air stream fails. In the process, the water is broken down into minute droplets so that steam is produced within the device. When taking measurements in steel melts (at temperatures from approx. 1500 to over 1700 °C), the temperature inside the sensor can be kept at approx 300 °C (measured 1 minute after immersion), merely by the air stream. As soon as the water is supplied, a temperature of about 130 °C is achieved inside the immersion sensor. This temperature could be maintained for the entire immersion period of about 13 minutes. The temperature inside the sensor can be controlled by varying the throughputs. However, it is not worth reducing this temperature to less than 100 °C because there is a risk of free water formation at temperatures of less than 100 °C.

Fig. 2 shows a guide system in detail. The guide system can be more than 3 metres long in total, the inlet 10 or the outlet 11 itself being able to be more than 3 metres from the immersion end. A guide tube 12 made of stainless steel is guided centrally through the guide system. An optical fibre (not shown in the drawings) is arranged in this guide tube 12. The guide tube 12 ends inside the stopper 13 made of refractory material and sealing the guide system at the immersion end. The optical fibre is expediently guided through an orifice, which is small as possible, within the stopper 13, so it makes direct contact with the molten steel and can absorb radiation from the molten metal by the full radiator principle and supply it to a measuring and evaluating system.

After the coolant has been introduced through the inlet 10 into the guide system 9, it is conveyed relatively closely round the guide tube 12 through a further tube 14 coaxially surrounding the guide tube 12. This tube can also be formed from special steel. It ends above the stopper 13, so the coolant will issue from the lower orifice 15 of the tube 14 and is guided within the guide system 9 to the outlet 11 and through the outlet 11 from the guide system 9. The tube 14 comprises a plurality of orifices 17 (Fig. 3), which are uniformly distributed in the circumferential direction and in the longitudinal direction of the tube 14. Cooling can therefore be carried out more effectively. The diameter and number of orifices 17 depend on the length of the hot zone, in other words on the depth of immersion into the molten steel 4 and on the depth of the slag layer 5. A diameter of approx. 1 to 4 mm and a number of two to six orifices 17 (more may even be possible) provide a good cooling capacity. The arrows in Fig. 3 designate the direction of flow of the coolant.

Inside the guide system 9, the stopper 13 made of steel has a deflecting element 16 made of steel, by means of which the coolant stream issuing from the tube 14 is diverted and conveyed into the space between the tube 14 and the wall 9 of the cooling chamber. The stopper 13 is welded to the guide system 9. The deflecting element 16 simultaneously fixes the guide tube 12 and forms a hermetically sealed connection between the guide tube 12 and the stopper 13, to prevent the penetration of water into the guide tube 12. The material of the deflecting element 16 is heat resistant relative to the temperature of the molten steel, and is provided with a small orifice for the passage of the optical fibres at the immersion end.

CLAIMS

1. A guide system for optical fibers comprising:

a guide tube (12);

an optical fiber guided through the guide tube;

a cooling system laterally surrounding the guide tube (12), the cooling system comprising at least one coolant chamber and a coolant in the coolant chamber, at least one inlet (10) and at least one outlet (11) for the coolant to be supplied to and from the coolant chamber, the coolant comprising a mixture of an air stream and water droplets;

a further tube (14), having an end and a plurality of orifices (17), being arranged around the guide tube (12) in the coolant chamber; and

an apparatus configured to draw the water droplets into the guide system;

wherein the coolant chamber is tubular in construction and is hermetically sealed by a seal (13) at least at one end face of the chamber;

wherein the coolant achieves and maintains a temperature of about 130°C inside the guide tube;

wherein the apparatus prevents the water droplets from entering the guide system if supply of the air stream fails; and

wherein the plurality of orifices (17) are distributed in a longitudinal direction of the further tube (14).

2. The guide system according to claim 1, wherein the guide tube (12) is guided through the seal (13) of the end face.

3. The guide system according to claim 1, wherein the guide tube (12) ends in the seal (13), and the optical fibers are guided through the seal (13).

4. The guide system according to claim 1, wherein the guide tube (12) ends in the coolant chamber.

5. The guide system according to claim 1, wherein the inlet (10) is arranged in the further tube (14) and the outlet (11) is arranged in a wall of the tubular chamber.

6. The guide system according to claim 1, wherein the further tube (14) comprises a steel tube.

7. The guide system according to claim 1, wherein the end of the further tube (14) facing the sealed end of the tubular chamber comprises at least one lower orifice (15).

8. The guide system according to claim 1, wherein the plurality of orifices (17) are also distributed uniformly in a circumferential direction of the further tube (14).

9. The guide system according to claim 1, wherein the coolant is introduced through an air supply line (6) and a water supply line (7) into a supply tube (8), through which the coolant is supplied to the guide system through the at least one inlet (10).

10. The guide system according to claim 1, wherein the apparatus is a pump.

11. A device for measuring temperatures and/or concentrations comprising a measuring end, wherein a guide system (9) according to claim 1 is arranged at the measuring end of the device.

12. The device according to claim 11, wherein at least one of a thermocouple, an electrochemical measuring cell and an end of the optical fiber is arranged at the measuring end.

13. The device according to claim 11, wherein at least one of a thermocouple, an electrochemical measuring cell and an end of the optical fiber is arranged at the sealed end of the guide system (9).

14. The device according to claim 11, adapted for measuring temperatures and/or concentrations in a molten metal selected from molten iron, cast iron and steel.

15. The device according to claim 14, wherein the device comprises an immersion sensor (1).

16. A guide system for optical fibers comprising:

a guide tube (12);

an optical fiber guided through the guide tube;

a cooling system laterally surrounding the guide tube (12), the cooling system comprising at least one coolant chamber and a coolant in the coolant chamber, at least one inlet (10) and at least one outlet (11) for the coolant to be supplied to and from the coolant chamber, the coolant comprising a mixture of an air stream and water droplets;

a further tube (14), having a plurality of orifices (17), being arranged around the guide tube (12) in the coolant chamber; and

means for preventing the water droplets from entering the guide system if supply of the air stream fails;

wherein the coolant chamber is tubular in construction and is hermetically sealed by a seal (13) at least at one end face of the chamber;

wherein the coolant achieves and maintains a temperature of about 130°C inside the guide tube; and

wherein the plurality of orifices (17) are distributed in a longitudinal direction of the further tube (14).

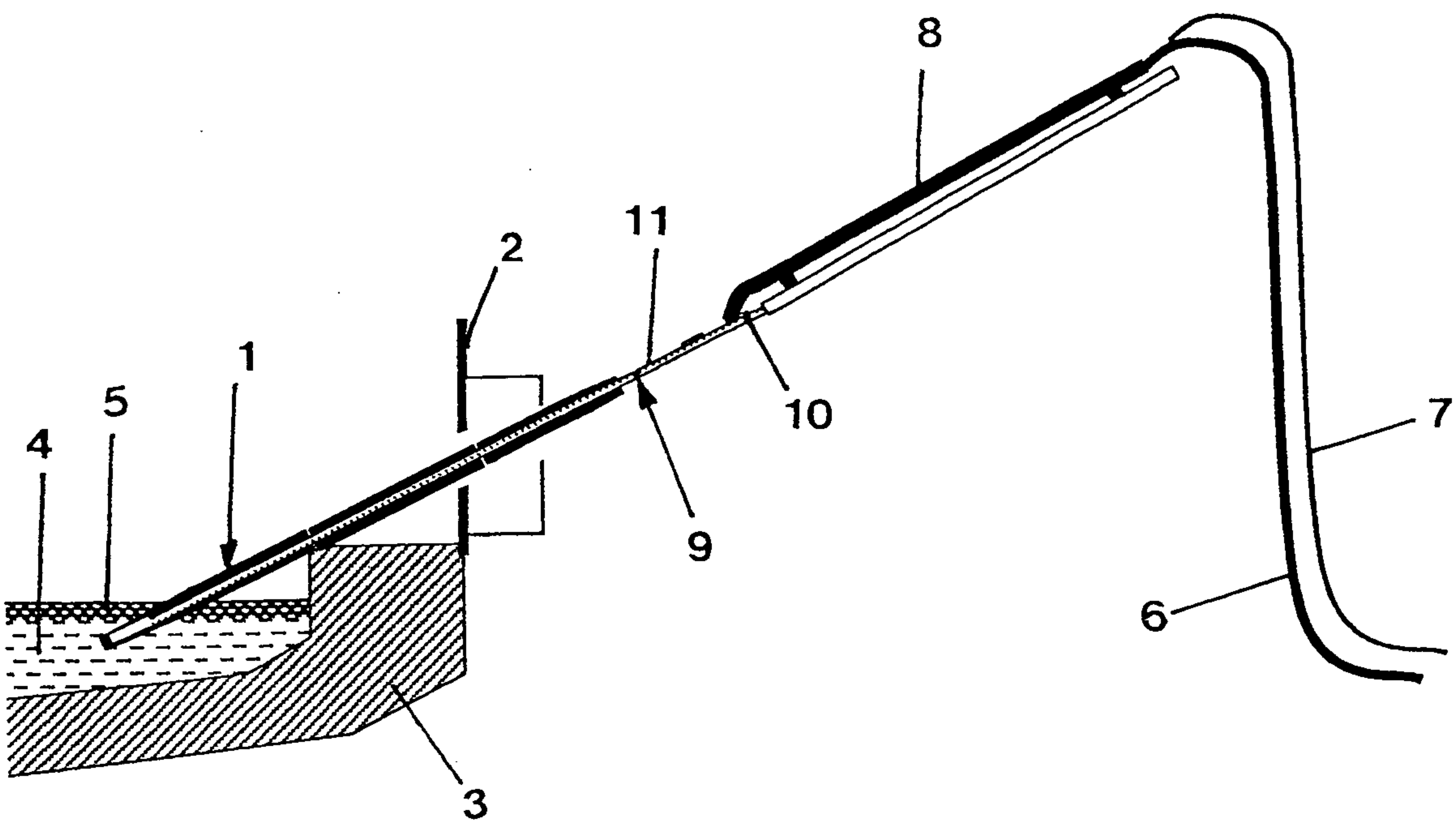


Fig. 1

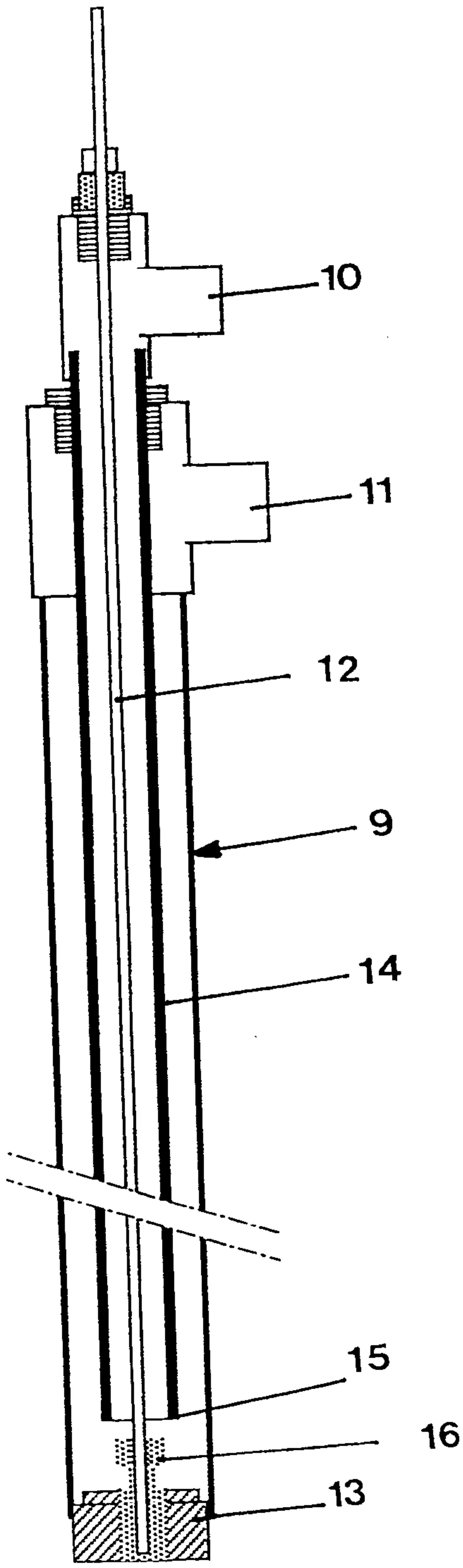


Fig. 2

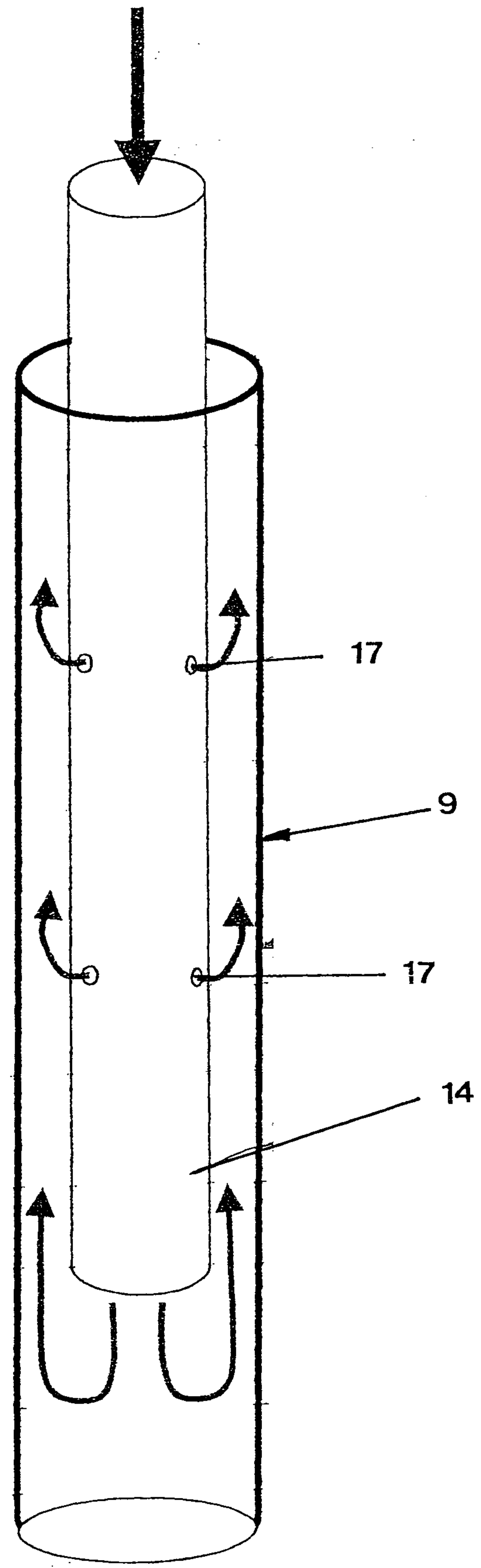
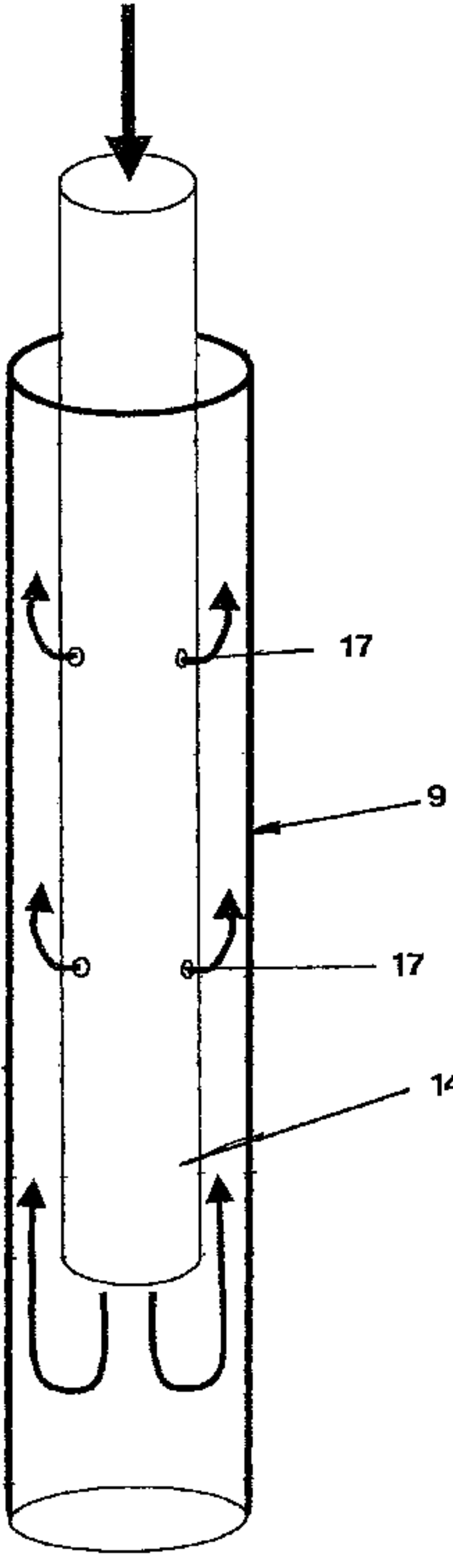


Fig. 3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