Dec. 30, 1969 H. J. RICHARDSON 3,486,570

ALLUVIAL PROSPECTING UNITS

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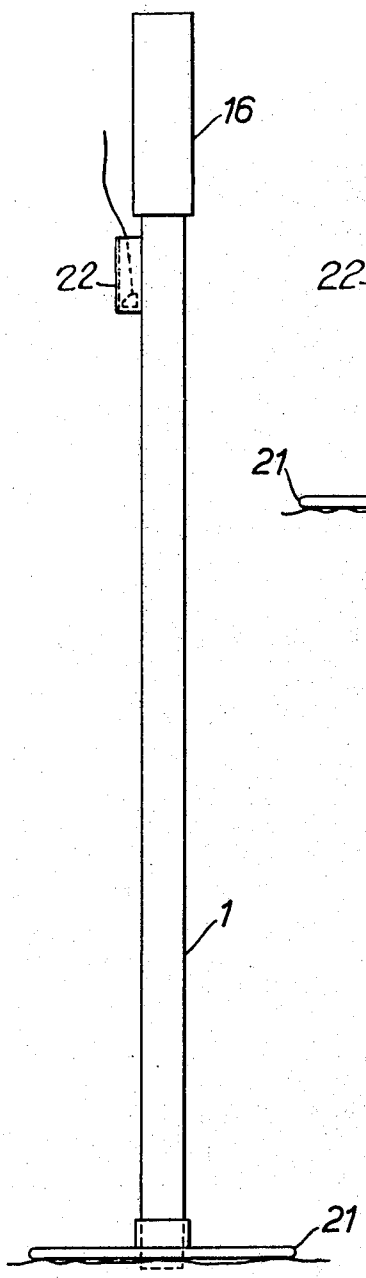


FIG.1.

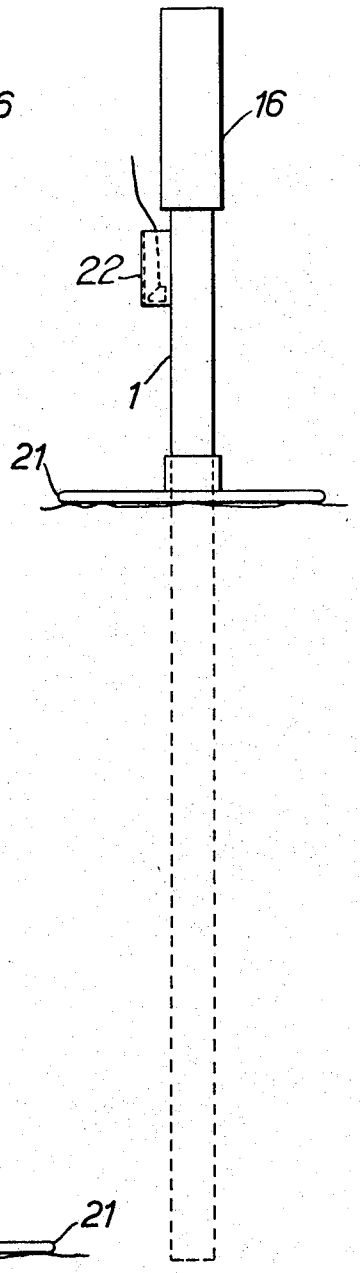


FIG.2.

FIG.5.

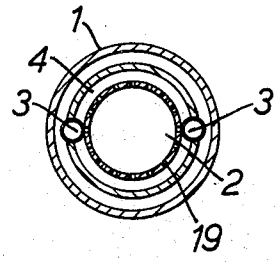


FIG.6.

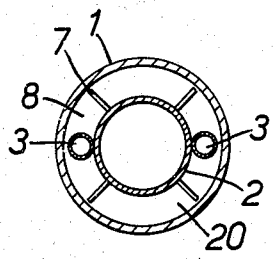
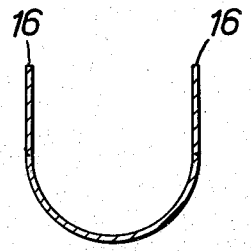


FIG.7.



INVENTOR

HENRY JOHN RICHARDSON

BY Robert K. Bellamy

ATTORNEY

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ALLUVIAL PROSPECTING UNITS

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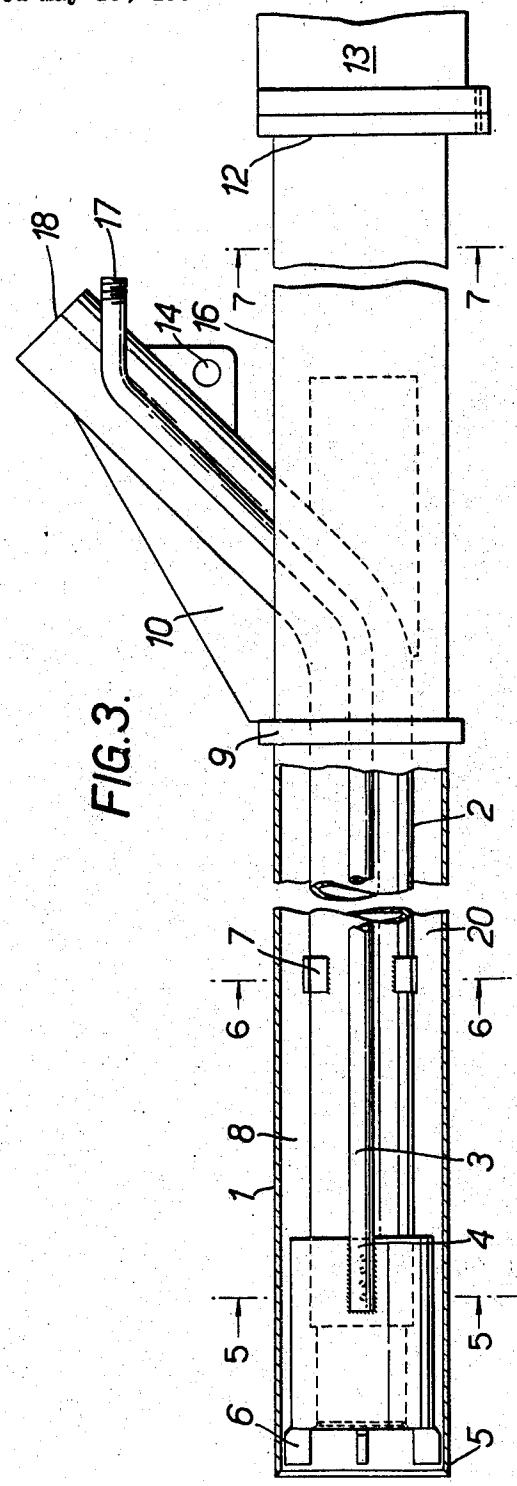


FIG. 3.

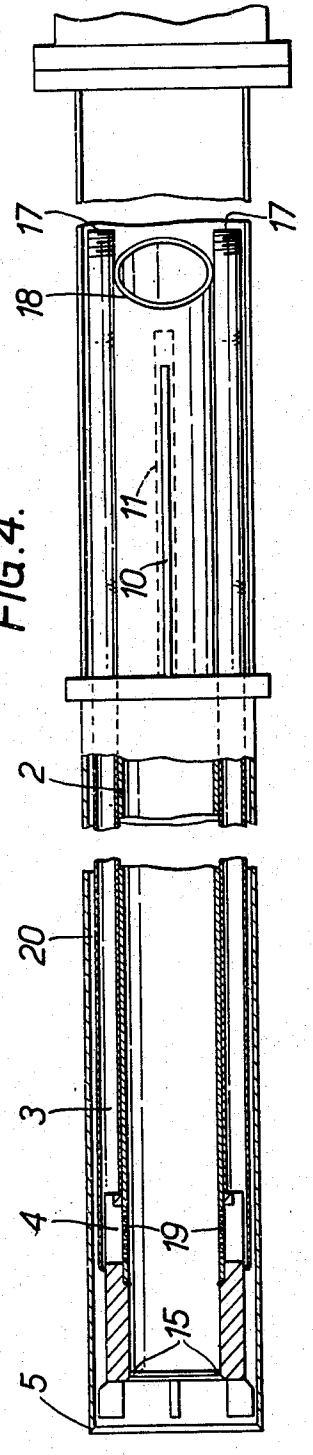


FIG. 4.

INVENTOR
HENRY JOHN RICHARDSON
BY Peter H. Bollendorf
ATTORNEY

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ALLUVIAL PROSPECTING UNITS

Henry John Richardson, Basildon, England, assignor, by mesne assignments, to Alluvial Mining and Shaft Sinking Company Limited, London, England, a British corporation

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ABSTRACT OF THE DISCLOSURE

An alluvial prospecting unit for use with a vessel rising and falling with the swell comprises an outer casing driven into an underwater layer and a production pipe movable longitudinally within the outer casing and having its lower end open to receive the spoil. The production pipe is directly supported from the vessel and movable therewith while a lost motion connection exists between the pipe and the outer casing. Air or water is supplied under pressure to the lower end of the production pipe to provide an air lift or jet pump action to lift the spoil through pipes to the vessel.

The invention relates to alluvial prospecting units of the kind wherein a casing is driven into an underwater layer.

In order to be able to assess for example the mineral potential of a particular alluvial deposit the thicknesses of strata must be accurately determined even where this thickness is substantial. Furthermore it is essential that the prospecting unit should avoid any significant dilution of material from one layer with that of another. The volume and nature of the material excavated should correspond closely with the cross sectional area of the cutting shoe of the casing coupled with the penetration depth attained.

Alluvial prospecting units hitherto used have suffered from a number of disadvantages particularly when used at sea. The main object of the invention is to provide a unit which is relatively simple to manufacture and use and at the same time gives reasonably accurate results even in adverse conditions.

According to the invention, therefore, there is provided an alluvial prospecting unit comprising an outer casing having a cutting shoe at its lower end, means for driving the casing into an underwater layer, and means for excavating and transporting spoil lying within the outer casing while the vessel supporting the unit rises and falls without this movement affecting the outer casing.

In operation the outer casing, as it penetrates the underwater layer, will cut and segregate the material lying within its area for subsequent elevation and sampling. To achieve penetration a vibratory motion may be imparted to the casing by means of an air hammer, vibratory motor or similar device.

The means for excavating and transporting the spoil may comprise a production pipe movable longitudinally, within the outer casing and having its lower end open to receive the spoil. The production pipe may have means, such as a lifting lug, for suspending it from the supporting vessel, and may have a lost motion connection with the outer casing. Air or water may be supplied under pressure to its lower end, to provide an air lift or jet pump action on the spoil; the air or water may be supplied by pipes between the outer casing and the production pipe, or by a central pipe.

Where the spoil is lifted by a combination of air and water providing an airlift for transportation, or where water alone is used to provide a jet pump action, it will

be necessary for additional water to be admitted for efficient operation: this may be obtained by leaving an opening at the top of the outer casing allowing water to flow down the annular space between the casing and the production pipe and be drawn into the lower end of the production pipe.

The lower end of the production pipe may carry disintegrating bits so that where compacted material is encountered the rise and fall of the production pipe due to swell will break or dislodge such material thus rendering it amenable for transport. Where swell conditions do not exist the production pipe can be raised and lowered independent of the casing by means of a supporting hawser.

One embodiment of the invention is illustrated by way of example with reference to the accompanying drawings showing an alluvial prospecting unit employing an airlift pump arrangement for the transportation of spoil. In the drawings:

FIGURE 1 is a general side view of the unit prior to drilling;

FIGURE 2 is a similar view of the unit partially buried in the sea bed;

FIGURE 3 is a side elevation of the unit with a part of the outer casing cut away to show the production pipe;

FIGURE 4 is a side view of the unit seen in a direction at right angles to that of FIGURE 3, with parts cut away and sectioned;

FIGURE 5 is a cross section on lines 5—5 of FIGURE 3;

FIGURE 6 is a cross section on lines 6—6 of FIGURE 3, and

FIGURE 7 is a cross section on lines 7—7 of FIGURE 3.

Referring to the drawing, the unit comprises an outer casing **1** which is cylindrical over the greater part of its length but has an upper section **16**, termed a "compensator section" which is U-shaped. The lower end of the outer casing **1** is formed as a cutting shoe **5**: its upper end carries a hammer or vibrator **13**, which may be air-actuated.

A production pipe **2** has its lower cylindrical part mounted slidably within the outer casing **1**; four guides **7** secured to the pipe **2** maintain it substantially coaxial with the casing. The upper part of the production pipe **2** is bent to extend out of the casing **1** through the U-shaped compensator section **16** and carries a lifting lug **14** by which the whole unit can be supported by a hawser from a suitable vessel. The production pipe **2** can move up and down in the casing **1** within the length of the compensator section **16**, between the limits set by contact of the upper and lower stop plates **11**, **10** on the pipe respectively with the lower and upper stop rings **9**, **12** of the casing.

The lower end of the production pipe **2** carries a set of disintegrator bits and a restrictor ring, **15** to prevent over size material from entering the pipe and choking it. A pair of air supply pipes **3** are secured to the outside of the production pipe **2** and lead into an annular air muff **4**: a series of air inlet holes **19** lead air from the muff to the interior of the production pipe. The arrangement will be understood to provide an air lift for transport of spoil up the production pipe **2**. Water reaches the lower end of the production pipe **2** from the opening in the compensator section **16** through the annular space **8** between the pipe and the outer casing **1**.

The transducer **22** (FIGURES 1 and 2) of a depth recorder is fixed to the upper part of the casing **1** so that samples of material brought up by the production pipe can be correlated with the depth from which they are excavated.

In use, the unit is suspended vertically from the vessel by means of a steel rope attached to the lifting lug **14**. A sliding stand **21** is fitted to the bottom of the outer cas-

ing 1 to assist in keeping the unit in a vertical position at the commencement of a borehole. When the unit touches the sea bed a degree of penetration will occur due to its own weight (but depending on the nature of the sea bed material) and once this point has been reached the air hammer or vibrator 13 will be started thus driving the cutting shoe 5 and the outer casing 1 into the sea bed. At the same time the air supply will be started furnishing compressed air through a flexible hose to the air supply connection 17 and thus to the air supply pipes 3 into the air muff 4. The air will pass through the air inlet holes 19 into the production pipe 2 and by so doing will lower the specific gravity at this point causing the water to rise and creating a suction at the production pipe inlet orifice and thus elevating material which has entered the outer casing 1. The material will pass up through the production pipe 2 to the outlet connection 18 and then continue through a flexible hose to the carrying vessel for sampling or other purposes. The necessary supply of water enters through a flexible hose to the carrying vessel for sampling 16 and flow down the water annulus 20; this helps to prevent water and material entering from outside the area of the cutting shoe 5 and thus degrading the sample.

When the carrying vessel is rising and falling under the influence of swell conditions, the production pipe 2 will rise and fall accordingly since it is attached to the vessel, but since the production pipe is free to slide within the outer casing 1 the latter will not be affected by such conditions within the limits of the length of opening in the swell compensator guide section 16. The length of this guide section opening can be determined beforehand to suit the known conditions in a particular drilling area.

As the production pipe rises and fals the disintegrating bits 6 will, on the downward movement, disturb and break up the material entrained in the outer casing thus freeing it so that it can come under the influence of the suction of the production pipe orifice.

The embodiment illustrated uses the airlift principle for transportation. Provision can be made for high pressure water to be supplied, thus utilising the jet pump principle for transportation or auxiliary water pipes can be attached to the production pipe in the same manner as the air supply pipes 3. These auxiliary water pipes would furnish water to jets placed adjacent the disintegrating bits 5 and thus assist in the breaking up of compacted material.

I claim:

1. An alluvial prospecting unit for use with a floating vessel such that swell will result in the vessel moving vertically, said unit comprising an outer casing having a cutting shoe at its lower end, means for driving the casing into an underwater layer, and means for excavating and transporting spoil lying within the outer casing while the vessel supporting the unit rises and falls without this movement affecting the outer casing, said means for excavating and transporting the spoil comprising a production pipe directly supported from the vessel and movable therewith, the pipe being movable longitudinally within the outer casing and having its lower end open to receive the spoil.

2. A unit as claimed in claim 1, wherein the production pipe has its upper end portion attached to a cable for supporting said pipe from the vessel, and a lost motion connection with the outer casing providing the sole mechanical connection between said casing and the vessel.

3. A unit as claimed in claim 1, wherein the lower end of the production pipe carries disintegrating bits so that where compacted material is encountered the rise and fall of the production pipe due to swell will break such material thus rendering it amenable for transport.

4. A unit as claimed in claim 1, wherein the means for excavating and transporting the spoil includes means to supply air to the interior of the outer casing adjacent the lower end thereof to provide lift for the spoil.

5. An alluvial prospecting unit comprising an outer casing having a cutting shoe at its lower end, means for driving the casing into an underwater layer, a production pipe having its lower end within the outer casing, means for supporting the production pipe from a vessel the pipe being arranged for longitudinal up-and-down movement with respect to the outer casing, so that the pipe rises and falls with the vessel while the outer casing is unaffected, means to supply fluid adjacent the lower end of the production pipe to lift spoil up the production pipe for conveyance to the vessel, and means providing for flow of water into the outer casing and down around the production pipe to the lower end.

6. A unit as claimed in claim 5, wherein the upper end of the production pipe is bent and extends out through a longitudinal slot in the upper part of the outer casing.

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CHARLES E. O'CONNELL, Primary Examiner

R. E. FAVREAU, Assistant Examiner

U.S. Cl. X.R.

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