

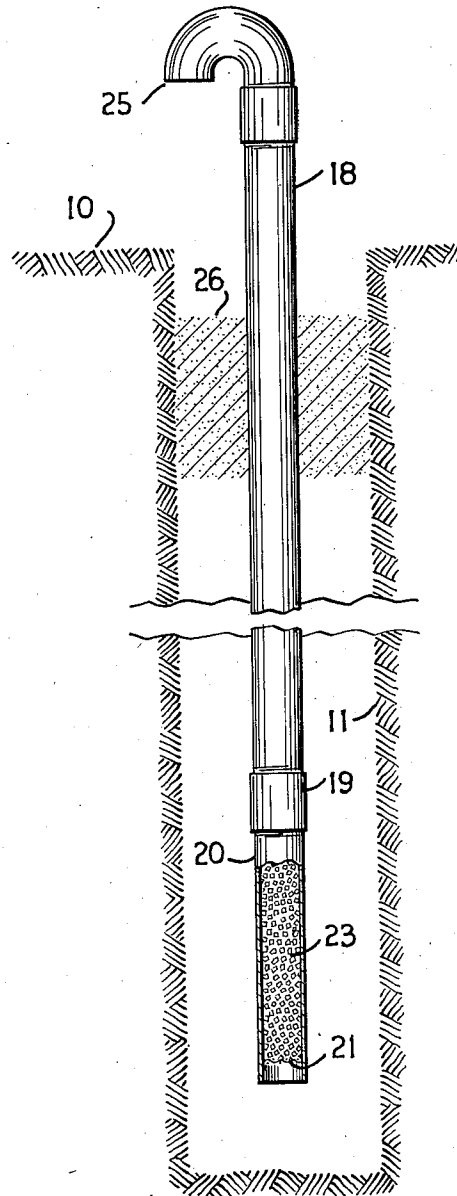
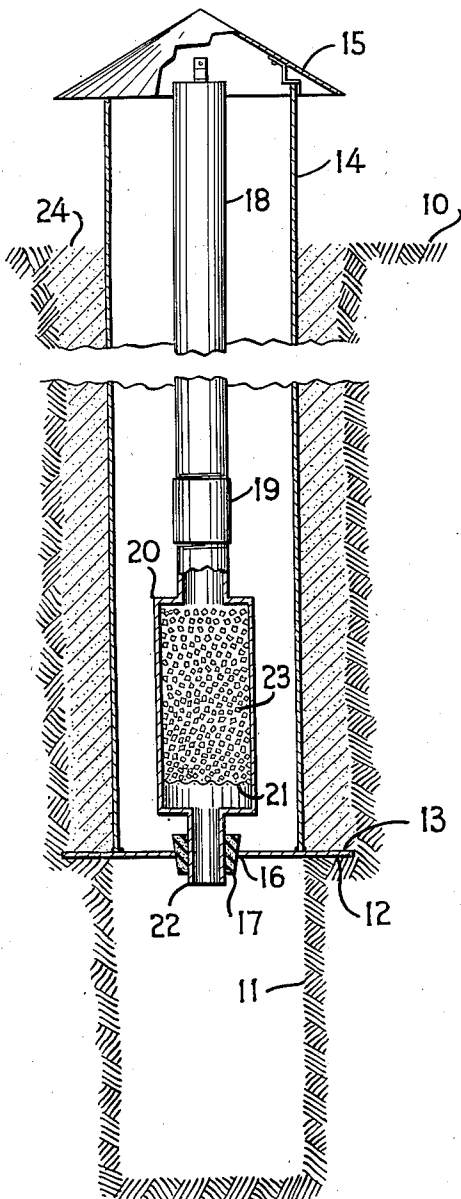
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METHOD AND APPARATUS FOR SOIL GAS ANALYSIS

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METHOD AND APPARATUS FOR SOIL GAS ANALYSIS

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7 Claims. (Cl. 23—257)

This invention relates to the location of deposits of hydrocarbon material such as petroleum, natural gas or the like beneath the surface of the ground and particularly refers to an improved method and apparatus for obtaining samples of hydrocarbon gases which diffuse upwardly through the earth at a very slow rate.

Heretofore samples of gases which diffuse upwardly through the soil have been obtained by forming a relatively shallow bore hole in the earth, sealing its upper end from the atmosphere and lowering the pressure therein, as by a vacuum pump, so that gases in the soil surrounding the bore will be drawn rapidly into an absorber for subsequent analysis. These installations required a continuously operating vacuum pump and only resulted in the accumulation of very small quantities of the desired hydrocarbons in the absorber. Because of the necessity for mechanical equipment connected to each sampling point, the investment in apparatus was high and required continuous attendance and source of power.

It is an object of this invention to provide a very simple and economical method and apparatus for obtaining samples of hydrocarbon gases from the soil which require no attendance or source of power and which will accumulate greater quantities of the desired hydrocarbons in readily recoverable form than those methods heretofore used.

Another object is to provide a method and apparatus for obtaining samples of soil gases which may be placed in position and allowed to remain for a relatively long period, accumulating hydrocarbon gases at their natural rate of effusion and collecting them in a form which is readily susceptible of analysis.

Another object is to provide a method and apparatus for collecting soil gases which utilize variations in the pressure of the atmosphere to cause a "breathing" of atmospheric air and hydrocarbon gases through an adsorption means so that the hydrocarbons will be selectively retained therein.

These and other objects of the invention will be further apparent from the following description and from the accompanying drawing which forms a part of the specification and illustrates two embodiments of apparatus suitable for practicing this method.

In the drawing:

Figure 1 is a vertical sectional view of a preferred form of collecting apparatus in place in a bore hole.

Figure 2 is a vertical sectional view of an alternative form of an apparatus suitable for practicing this method.

In the drawing, reference numeral 10 designates the surface of the ground in which is formed a bore hole 11 which may be 10 to 20 feet in depth. In the embodiment shown in Figure 1, bore hole 11 may be made with a step or ledge 12 to receive a flange 13 at the lower end of a casing 14, the latter extending upwardly to a point somewhat above the surface 10 and terminating in a loose cap or cover 15.

Flange 13 is preferably provided with a central opening 16 which is adapted to receive a cork or packing means 17. The sampling tube consists of a length of pipe 18 at the lower end of which is a coupling 19 and a canister or container 20, the latter provided with a screen 21 near its lower end and terminating in a downwardly extending nipple 22, the latter adapted to be received in packing member 17.

Canister 20 is filled with a loosely packed adsorption medium 23 offering substantially no resistance to gas flow, which may be activated carbon, silica gel or other suitable material in which hydrocarbon gases may be collected. The bore hole 11 above step 12 is preferably sealed by means of sand or mud 24 which is introduced around casing 14 and retained on the outer extension of flange 13.

In operation this device is permitted to remain for a considerable period, for example several weeks or even months, the normal variations in atmospheric pressure serving to cause passage of soil gases upwardly through adsorption medium 23 whenever a decrease in pressure occurs. Increases in atmospheric pressure will obviously force air downwardly through the adsorption medium, but this will have no effect upon it or upon the hydrocarbon gases which may be retained therein. The rate of effusion of hydrocarbon gases from the soil is necessarily very slow but will be found to correspond generally with the rate of "breathing" of these gases through the collecting means by the atmospheric pressure variations. These latter include the diurnal variation which will be supplemented by the greater changes due to the passage of storms and the like.

Referring to Figure 2, the apparatus there shown includes a pipe 18 and coupling 19 at the lower end of which is a container 20 fitted with a screen 21 and open at the lower end to the space within bore hole 11. The upper end of pipe 18 may be provided with a U-shaped fitting

25 to prevent rain or foreign materials from entering the upper end of the pipe. A packing means 26, which may be a simple wrapping of cloth, a plug of soil or any easily available means, may be used to isolate the lower part of bore hole 11 from the atmosphere. Obviously the pressure drop through pipe 18 and adsorption material 23 will be very small under any normal variation in barometric pressure so that there is no necessity for making a particularly gas-tight seal between the upper end of the bore 11 and the atmosphere.

After the adsorption material 23 has been permitted to remain in bore hole 11 for the desired period, depending upon the amount of gas which may be diffusing upwardly through the soil, it is removed and the hydrocarbon gases driven therefrom by means of steam or other well known procedures and the composition of the gases determined.

This method and apparatus appear to differ from those previously known by the utilization of an adsorption medium exposed to gases withdrawn from an isolated portion of a bore hole in the earth by means of natural variations in the atmospheric pressure. Although specific means are shown for practicing this invention it will be understood that many modifications and variations could be made and it is understood that all those which fall within the scope of the appended claims are embraced thereby.

I claim:

1. An apparatus for collecting hydrocarbon gases from a shallow bore in the earth comprising an open-ended conduit adapted to be sealed in a bore hole in the earth, a container connected to said conduit, and adsorption means in said container, said adsorption means arranged to offer substantially low resistance to the passage of gas through said container and said conduit under the pressure differentials caused by variations in atmospheric pressure.

2. An apparatus for collecting hydrocarbon gases according to claim 1 in which said adsorbent material comprises activated carbon.

3. An apparatus for collecting hydrocarbon gases according to claim 1 in which said adsorbent material comprises silica gel.

4. An apparatus for collecting hydrocarbon gases according to claim 1 in which said sealing means comprises a casing concentric with said conduit, a closure for the lower end of said casing, a passage through said closure, said conduit adapted to extend through said passage to communicate with the bore hole beneath said closure, and sealing means between the wall of said passage and said conduit.

5. A method for collecting a sample of gas present in a body of porous material, which comprises substantially sealing an adsorbent material for the gas to be collected between gas in a space formed in said porous material and another gas at natural atmospheric pressure, said adsorbent material being open to gas in said space and to said other gas, subjecting the portion of said adsorbent material open to said other gas to the natural variations in atmospheric pressure to force a portion of said other gas into said adsorbent material on a rise in the natural atmospheric pressure and to force a portion of said gas within said space into said adsorbent material on a fall in the natural atmospheric pressure, whereby a portion of the gas within said space is adsorbed by said adsorbent material.

6. A method of collecting a sample of hydrocarbon gas present in the earth, which comprises substantially sealing an adsorbent material for the hydrocarbon gases to be collected between gas in a space formed in the earth and the atmosphere, said adsorbent material being open to gas in said space and in communication with the atmosphere, subjecting the portion of said adsorbent material in communication with the atmosphere to the natural variations in atmospheric pressure to force a portion of the atmosphere into said adsorbent material on a rise in the natural atmospheric pressure and to force a portion of said gas within said space into said adsorbent material on a fall in the natural atmospheric pressure, whereby a portion of the hydrocarbon gas within said space is adsorbed by said adsorbent material.

7. A method of collecting a sample of hydrocarbon gas present in the earth, which comprises substantially sealing an adsorbent material for the hydrocarbon gases to be collected between the atmosphere and a gas space formed in the earth by a lower portion of a shallow bore in the earth, said adsorbent material being open to the gas in said space and in communication with the atmosphere, subjecting the portion of said adsorbent material in communication with the atmosphere to the natural variations in atmospheric pressure to force a portion of the atmosphere into said adsorbent material on a rise in the natural atmospheric pressure and to force a portion of said gas within said space into said adsorbent material on a fall in the natural atmospheric pressure, whereby a portion of the hydrocarbon gas within said space is adsorbed by said adsorbent material.

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