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DISTILLATION APPARATUS FOR THE DETERMINATION
OF OIL AND WATER IN DRILLING MUDS

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FIG. 1.

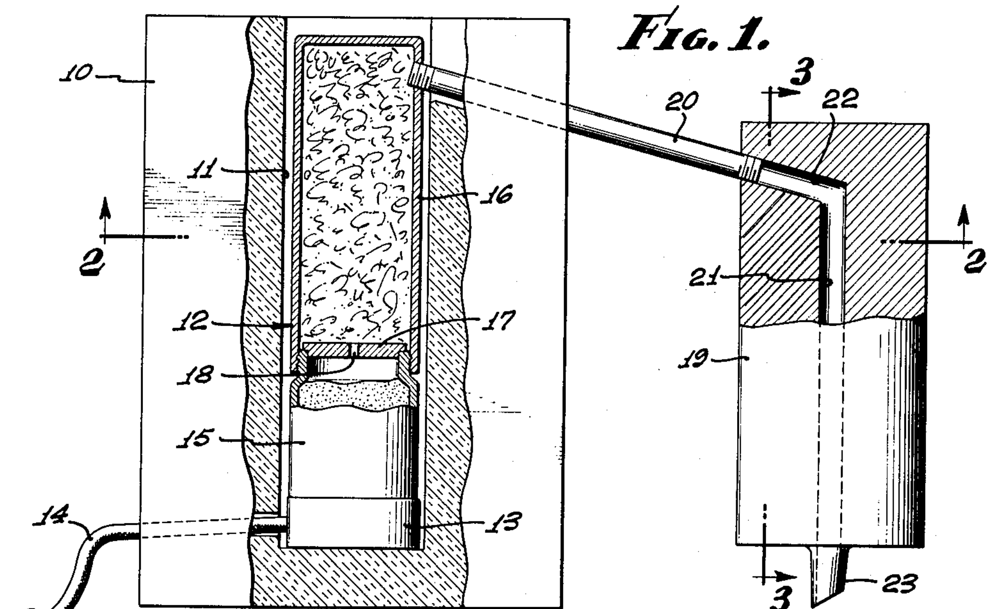


FIG. 2.

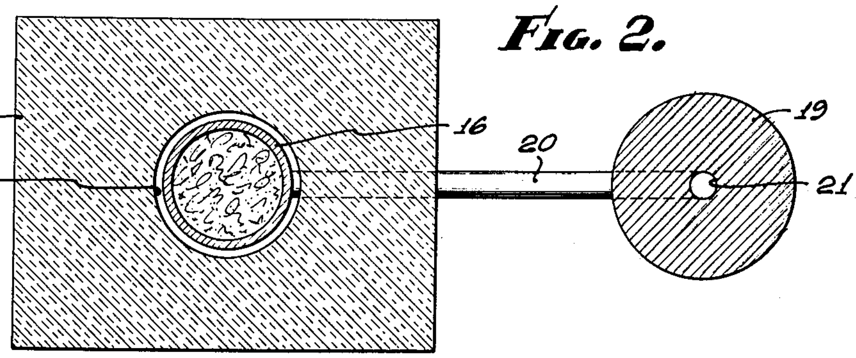
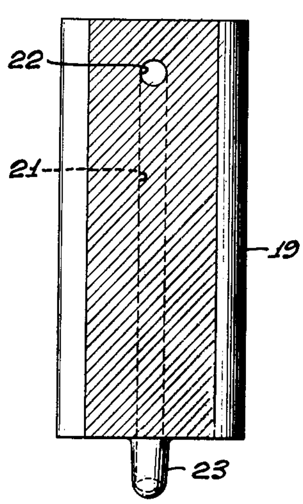


FIG. 3.



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DISTILLATION APPARATUS FOR THE DETERMINATION OF OIL AND WATER IN DRILLING MUDS

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4 Claims. (Cl. 202—189)

This invention relates to distilling equipment, and more particularly to retorts for use in the distillation of emulsions.

In the drilling of oil wells, drilling fluids are used, which generally consist of a mixture of clay and water, together with other solids. More recently, oil has been incorporated in such muds, most frequently as an oil-in-water emulsion, but occasionally as a water-in-oil emulsion. In the testing of such muds for field control purposes, an accurate knowledge of the oil content and water content of such muds is essential. The usual method of determining oil and water content in such a system is by retorting the mud or fluid to dryness, and collecting the oil and water as a condensate, in which the volumes of the oil and water phases can be readily determined. The solids remaining in the retort can then be weighed and inspected where desirable.

In such retorting and condensation, a number of practical difficulties have arisen. In the first place, the use of a conventional condenser requires running water, which is often not available at the drilling site, at least in such form as may be readily adapted to a conventional condenser. Moreover, regulation of the flow of condensing water, heat applied and the like is necessary during the progress of the distillation, since all of the water must of course be condensed, necessitating reasonably cold water in the condenser, but on the other hand, the last portions of oil which come over should not be cooled excessively or they will tend to be retained in the condenser because of their thick, viscous, and sometimes even tarry nature.

Difficulties also arise because of the thick nature of the emulsion, making charging of the retort with an accurately measured volume of mud rather difficult.

An object of the present invention is to provide a retorting and condensing assembly which is especially adapted to the distillation and condensation of an emulsion.

Another object of the invention is to provide a retort which permits of accurate measurement of the charge.

A further object of the invention is to provide a condenser which does not require running water as a coolant.

Another object of the invention is to provide a condenser which condenses water driven over in the retorting of an emulsion at a relatively low temperature, but which provides for condensation of oily fractions of higher boiling point at a relatively high temperature, whereby such oily fractions are maintained fluid.

Other objects of the invention will appear as the description thereof proceeds.

In the figures, Fig. 1 shows the retorting and condensing assembly.

Fig. 2 is a cross-section taken horizontally through the assembly of Fig. 1, at the level shown by the line 2—2'.

Fig. 3 is a cross-section taken vertically through the right-hand, or condenser portion of Fig. 1.

Coming now to Fig. 1, 10 designates a block of drillable, coherent, insulating or refractory material, such as

compressed magnesium carbonate, compressed diatomaceous earth, molded "Transite" (a mixture of asbestos fibers and Portland cement), and the like. A gypsum-asbestos material is particularly suitable, such as "Marinite" of Johns-Manville. As will be seen from the figure, block 10 is penetrated vertically and substantially centrally by a hole 11, which receives a retort assembly 12. In the bottom of the hole, and in thermal contact with the retort assembly, is a heating element 13, electrically connected through a connecting cord 14. The retort assembly, which is shown in cross-section in Fig. 1, consists of a cylindrical cup portion 15 which screws into a cylindrical upper portion 16. Resting loosely on the inside of the top of cup portion 15 is a lid 17 which contains a central hole 18. The upper portion of the retort assembly is filled with a filamentary metallic baffle, such as steel wool, and this portion is connected to the condensing portion 19 by means of a tube 20. The latter is preferably made of stainless steel, and is threaded at both ends for insertion into correspondingly threaded portions in the upper retort portion 16 and condenser portion 19 respectively. The condenser portion consists of a solid block of metal of good thermal conductivity, which may be for example of brass or preferably of aluminum. I prefer aluminum and for convenience in machining, I prefer a block of cylindrical cross-section. The condenser portion 19 is penetrated centrally by a hole 21, which connects with a downwardly sloping hole 22. At the bottom of the condenser assembly, a portion of the block is machined away to provide a tubulation 23 which is adapted to allow condensate to drip into a suitable container, such as a graduated cylinder. It will be observed that the insulating block 10 holds the retort assembly in tube 20 securely, so that the condenser portion 19 can depend therefrom without the aid of additional support.

In operation, the cup portion 15 of the retort assembly is screwed from the upper portion 16 of the retort assembly, filled with mud or other emulsion to be tested, any excess exuding from hole 18 being wiped away so as to maintain a constant and reproducible volume of sample, then screwed back on the upper portion 16, and placed in the insulating block on top of the heating element 13, with the tube 20 and condenser 19 in position.

The heating element is then connected to a source of electricity, whereupon the emulsion in cup 15 is gradually brought to ebullition, heat being applied until all of the liquid phases of the emulsion have been driven from the retort in vapor form and out through tube 20. The steel wool or other like filamentary baffle means in the upper portion 16 of the retort serves to entrain mud solids and keep them out of the condenser, so that only liquids and vapors enter condenser 19.

It is to be noted that the volume contained in the cup portion 15 is substantially less than one-tenth of the total volume of the metal block of condenser 19, but not less than one-thirtieth. By the choice of a metal for condenser block 19 having good heat conductivity, the entire block warms up as vapors enter through tube 20 and condense in tube 22 and 21. With the relative volumes within the limits just stated, we achieve complete condensation of the liquids originally placed in cup 15, and yet we have a condition of appreciably elevated temperature of condenser 19 towards the end of a distillation run. Thus the objects of the invention are achieved; the liquids from the accurately measured charge originally placed in cup 15 are recovered in readily measured form, and because of the warming up of condenser 19, the last portions of oil to be distilled over are quite fluid and run out of tubes 21 and 22 readily. Moreover, the necessity of supplying running water is completely obviated. If the volume ratio is less than about $\frac{1}{10}$, the condenser block heats up too much and water may be lost as vapor; on the other hand, if the volume ratio is greater than about 1/30, then the condenser block is not warm enough towards the end of the run to insure fluidity of the heavy oil fractions.

We are aware that so-called air-condensers have been previously described and used, in which running water is not used, but cooling fins generally of metal surrounding the condensing tube serve to carry away the heat liberated in the condensation process. It will be observed that our arrangement is quite different from that just described; cooling fins would not be desirable in our apparatus because they would make the final temperature of the interior of tube 21 towards the end of a distillation run too much dependent upon ambient temperature and in particular ambient wind velocity. Instead, we provide sufficient heat capacity in the form of a mass of metal of good heat conductivity to take care of the latent heat of condensation of the liquids distilled. Thus, we achieve relative independence of exterior conditions. It is only necessary to have condenser 19 at ordinary temperatures at the beginning of a run, which is readily achieved automatically, since the disassembly and cleaning of the retort at the end of a distillation run give sufficient time for the condenser 19 to cool down to room temperature in the majority of cases. We prefer a metal having a thermal conductivity of at least 0.20 calories per centimeter per second per square centimeter per degree centigrade. Brass varies from 0.21 to 0.26, and aluminum about twice that.

It will be understood that the invention is a broad one and various modifications may be made in the apparatus and the manner of using within the scope of the invention and the appended claims.

What is claimed is:

1. In a distillation apparatus, a retort comprising a cup-shaped lower chamber and an upper chamber, attaching means securing said lower chamber to said upper chamber, means for supplying heat to said lower chamber, a metal block, a passageway disposed within said metal block and leading downwards and a connecting tube means intermediate said retort and the upper portion of said passageway.

2. In a distillation apparatus, a retort, means for supplying heat to said retort, a block of metal of thermal conductivity at least 0.20, a passageway disposed within said metal block and leading downwards, and connecting tube means intermediate said retort and the upper portion of said passageway.

3. In a distillation apparatus, a retort comprising a cup-shaped lower chamber and an upper chamber, screw thread engaging means securing said lower chamber to said upper chamber, means for supplying heat to said lower chamber, a block of metal of thermal conductivity at least 0.20 and having a total volume at least ten times but not more than thirty times that of the volume of said lower chamber of said retort, a passageway disposed within said metal block and leading downwards, and a connecting tube means intermediate said retort and the upper portion of said passageway.

4. In a distillation apparatus, a retort comprising a cup-shaped lower chamber and an upper chamber containing a filamentary metallic baffle means, screw thread engaging means securing said lower chamber to said upper chamber, means for supplying heat to said lower chamber, a block of metal of thermal conductivity at least 0.20 and having a total volume of at least ten times but not more than thirty times that of the volume of said lower chamber of said retort, a passageway disposed within said metal block and leading downwards, and a connecting tube means intermediate said retort and the upper portion of said passageway.

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