

July 16, 1957

B. SCHNEERSOHN
APPARATUS FOR TAKING SAMPLES OF FLUIDS IN RELATIVELY
SOFT GEOLOGICAL FORMATIONS
Filed June 16, 1955

2,799,474

FIG. 1.

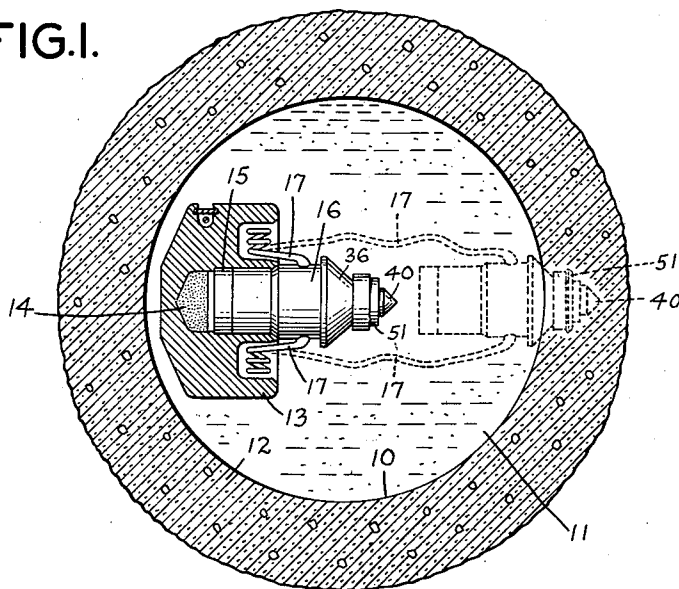


FIG. 2.

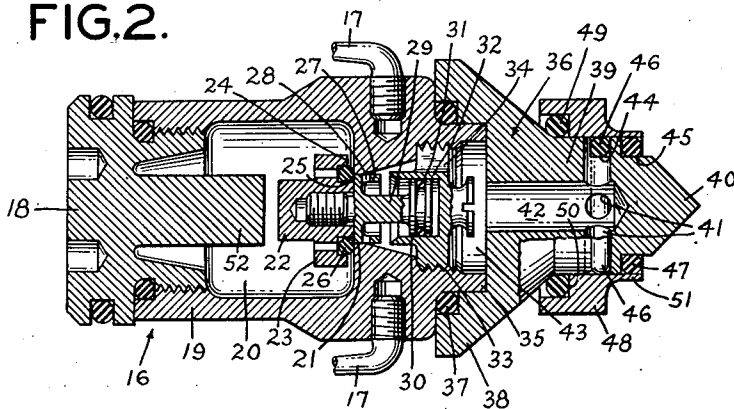
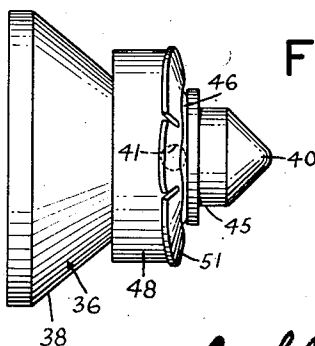


FIG. 3.



INVENTOR
BORIS SCHNEERSOHN

BY
Campbell, Munching, Macrae
HIS ATTORNEYS

1

2,799,474

APPARATUS FOR TAKING SAMPLES OF FLUIDS IN RELATIVELY SOFT GEOLOGICAL FORMATIONS

Boris Schneersohn, Paris, France, assignor to Societe de Prospection Electrique Procèdes Schlumberger, Paris, France, a corporation of France

Application June 16, 1955, Serial No. 515,812

Claims priority, application France June 18, 1954

5 Claims. (Cl. 255—1.4)

The present invention relates to apparatus for taking samples of earth formations traversed by a bore hole drilled into the earth, and more specifically to sample taker apparatus that is especially adapted for securing samples of fluid contained in relatively soft formations, particularly in sands.

In the copending United States patent application Serial No. 503,540, filed April 25, 1955, for "Devices for Taking Samples of Fluids in Geological Formations," there is disclosed formation fluid sample taking apparatus comprising a hollow projectile which is adapted to be fired from a gun-type device against the earth formation (bore hole side wall) from which a fluid sample is desired, the projectile being secured to the gun by means such as flexible cables so that it may be readily withdrawn from the bore hole. The hollow projectile features a temporary frangible closure at its front end which is adapted to be torn away on impact with the formation to provide access for information to provide access for formation fluid to a fluid receiving chamber through valve means which is adapted to close after the fluid sample has been taken and to remain closed while the projectile is being brought to the surface of the earth. Apparatus of this character is intended particularly for taking samples in relatively hard formations, and for this purpose it is provided with a relatively blunt forward portion which is designed to penetrate only slightly into the formation, while adhering strongly thereto.

It is an object of the invention to provide sample taking apparatus similar to that described above but which is of particular utility for taking samples of fluid in softer formations, particularly in sands traversed by the bore hole. In the attainment of this object several serious difficulties must be overcome. First, since sands are usually partially invaded by the bore hole liquid and it is desired primarily to obtain samples of liquid contained beyond the invaded zone, the sample taking projectiles must be capable of penetrating the formation to a relatively great lateral depth. Further, the sand comprising the formation tends to be drawn into the projectile with the fluid and there is a strong likelihood of its obstructing the fluid intake passages in the projectile. Ordinary screening devices cannot be used effectively to keep out the sand since sand particles collected on such devices tend to prevent the fluid sample from entering the projectile.

Another object of the invention, accordingly, is to provide new and improved formation fluid sample apparatus for securing samples from relatively soft formations in which the above-noted difficulties are overcome in a simple yet highly effective manner.

A further object is to provide new and improved formation fluid sample taking apparatus embodying means for preventing any substantial amount of formation sand from reaching the fluid intake passage without substantially preventing access of the formation fluid to the sample receiving chamber in the device.

2

According to the invention, the nose of the sample taking projectile has a base of relatively wide outside dimensions from which projects an elongated forward portion which is adapted to penetrate fairly deeply into the interior of sandy formations so that the fluid sample taken will be from the uninvaded formation beyond the mud cake and invaded zone. The nose forward portion is provided with orifices at the forward end thereof which communicate with a sample receiving chamber inside the projectile and are normally closed by frangible closure means which is adapted to be deformed to provide access to the orifices as the projectile nose is forced into the formation. The closure means includes sealing elements for the orifices which act to prevent sand from entering the orifices without effectively interfering with the penetration of the formation fluid into the projectile.

For a better understanding of the invention, reference is made to the following detailed description of a representative embodiment taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a view in transverse section through a bore hole drilled into the earth showing sample taking apparatus according to the invention in position in the well;

Fig. 2 is a view in longitudinal section through a sample taking projectile comprising part of the apparatus shown in Fig. 1; and

Fig. 3 is a side view of the projectile nose portion illustrating how it is deformed by penetration into the earth formation.

Referring first to Fig. 1, a bore hole 10 which usually contains drilling mud 11 is shown traversing earth formations 12 which may comprise, for example, sands saturated with fluid (liquid or gas) of which it is desired to take samples. Suspended in the bore hole 10 in the conventional manner is a conventional sample taker gun 13 having a powder chamber 14 formed therein communicating with a gun barrel 15 in which a sample taking projectile 16, according to the invention, is received. The projectile 16 is secured to the sample taker gun 13 by the usual flexible cables 17 by means of which it may be withdrawn from a formation when the apparatus is raised to the earth's surface.

In the interest of simplicity, only a single powder chamber 14 and gun barrel 15 are shown in Fig. 1. In practice, however, the sample taking gun 13 is usually provided with a plurality of superimposed gun barrels, each of which contains a sample taking projectile 16.

As shown in Fig. 2, the sample taking projectile 16 comprises a hollow, cylindrical projectile formed of two parts 18 and 19 threaded to one another to facilitate fabrication and assembly. The body has formed therein a sample receiving chamber 20 which is adapted to receive a sample of the formation fluid through a port 21. The port 21 is normally adapted to be closed by a slide valve 22 having a head member 23 provided with an upper surface 24 having a groove 25 in which is received a sealing ring 26. The sealing ring 26 is adapted to be pressed against the forward wall of the chamber 20 so as to form a fluid-tight joint.

The valve head member 23 is provided with a cylindrical skirt portion 27 slidably mounted in the port 21 and having a plurality of laterally directed apertures 28 formed therein. The valve 22 includes an upwardly extending rod member 29 carrying a piston 30 slidably received in a bore 31 formed in a disk-like member 32 secured in an opening 33 communicating with the port 21. The disk-like member 32 is provided with a plurality of longitudinally extending fluid passages 34.

At its forward end, the body portion 19 is provided with a shouldered portion 35 on which is tightly fitted a

3

nose member 36, a sealing ring 37 being provided to insure a fluid-tight joint. The nose member 36 is made of a hard and friable material such as Duralumin. According to the invention, it is provided with a rear conical portion 38 having a base wider than the body portion 19, an intermediate cylindrical portion 39 and a front conical portion 40. The two conical portions 38 and 40 preferably have the same apex angle, say 90°.

Formed in the intermediate portion 39 are a plurality of angularly spaced laterally directed orifices 41 communicating with an axial bore 42 leading to a chamber 43 above the disk-like member 32. The intermediate portion 39 has two grooves 44 and 45 formed therein, one at the level of the orifices 41 but preferably lesser in thickness than the size of the orifices, and the other located near the base of the conical portion 40. Sealing rings 46 and 47 are placed in the grooves 44 and 45, respectively, and an annular member 48 is tightly fitted over the intermediate portion 39, a third sealing ring 49 being provided in a groove 50 in the annular member 48 to insure fluid tightness. The forward portion 51 of the annular member 48 is considerably thinner than the rear portion thereof and it snugly engages the sealing ring 47 for reasons to be explained later.

In operation, the sample taking gun 13 (Fig. 1) is lowered to the desired level in the bore hole 10 and the sample taking projectile 16 is fired against the side wall by explosion of the powder charge 14 in the usual manner. The nose member 36 penetrates relatively deeply into the adjacent formation to the position shown in dotted lines in Fig. 1, for example, to a relatively short distance from the base of the conical portion 38. As a result, the cylindrical portion 39 is located in a zone in the formation 12 beyond the portion that has been penetrated by the drilling mud 11. The resistance encountered by the forward portion 51 of the annular member 48 as the nose member 36 penetrates the formation causes the forward portion 51 to open in the form of an umbrella, as shown in Fig. 3, while the base of the annular member 48 remains pressed against the conical portion 38 through the sealing ring 49.

Meanwhile, under the effect of the pressure of the liquid, the sealing ring 47 is torn away, while the sealing ring 46 moves slightly to the rear but still partially blocks the orifices 41. As a result, as shown by experience, the sand in the formation practically does not penetrate into the passage 42, while the latter is filled with the fluid contained in the formation.

The formation fluid passes from the passage 42 into the chamber 43 where its strong pressure pushes back the valve 22 which slides, guided by the piston 30 and the skirt portion 27 until it is brought to rest by a stop member 52 formed on the body portion 18. In this position of the valve 22, the formation fluid passes freely into the chamber 20 through the orifices 28 until the chamber 20 is completely filled. The rearward movement of the valve 22, which is checked by the stop member 52, creates a vacuum in the cavity above the piston 30 so that after the chamber 20 is filled, the valve 22 closes itself as a result of the pressure exerted in the chamber 43 on the piston 30.

When the projectile 16 is withdrawn from the formation 12 and enters the bore hole 10, the pressure of the drilling mud 11 continues to be exerted on the piston 30 and the differential effect between the pressure of the drilling mud and the pressure above the piston 30 is sufficient in all cases to keep the valve 22 closed tightly on its seat, thus preventing any rush of bore hole liquid to the interior of the chamber 20. The projectile 16 is then raised to the surface of the earth where the sample contained in the chamber 20 is recovered.

The invention thus provides novel and highly effective sample taking apparatus for securing fluid samples from relatively soft formations, particularly sands. By virtue of the novel projectile nose structure described above,

4

it is possible to obtain fluid samples from locations beyond the invaded zone without any likelihood of the device being stopped up by sand from the formation.

The specific embodiment described herein by way of illustration is obviously susceptible of modification in form and detail within the spirit of the invention. The invention, therefore, is not to be limited to the exact structures shown but comprehends all modification thereof falling within the scope of the appended claims.

I claim:

1. Apparatus for sampling the fluid contents of geological formations and the like comprising, a hollow tubular projectile adapted to be driven into a formation, a forwardly tapered nose portion tightly fitted on said projectile and having fluid passage means in the side walls thereof communicating with the interior of said projectile, frangible closure means normally preventing communication between said fluid passage means and the exterior of said nose portion and adapted to be rendered ineffective when said projectile is driven into a formation, and means interposed between said closure means and said fluid passage means for keeping solid matter out of said fluid passage means.

2. Apparatus for sampling the fluid contents of geological formations and the like comprising, a hollow tubular projectile adapted to be driven into a formation, said projectile being closed at one end and having a port at its other end, valve means in said port, a forwardly tapered nose member tightly fitted on said projectile other end, means forming fluid passages in the side wall of said nose member communicating with said port, frangible closure means normally preventing communication between said fluid passages and the exterior of said nose member and adapted to be rendered ineffective when said projectile is driven into a formation, and means interposed between said closure means and said fluid passages for keeping solid matter out of said fluid passages.

3. Apparatus for sampling the fluid contents of geological formations and the like comprising, a hollow tubular projectile adapted to be driven into a formation, said projectile being closed at one end and having a port at its other end, valve means in said port, a forwardly tapered nose member tightly fitted on said projectile other end, said nose member including a rear conical portion having a base of greater width than said projectile, a substantially cylindrical intermediate portion and a forward conical portion, means forming fluid passages in the side wall of said nose member intermediate portion communicating with said port, frangible closure means normally preventing communication between said fluid passages and the exterior of said nose member and adapted to be rendered ineffective when said projectile is driven into a formation, and means interposed between said closure means and said fluid passages for keeping solid matter out of said fluid passages.

4. Apparatus for sampling the fluid contents of geological formations and the like comprising, a hollow tubular projectile adapted to be driven into a formation, said projectile being closed at one end and having a port at its other end, valve means in said port, a nose member tightly fitted on said projectile other end, said nose member including a rear conical portion having a base of greater width than said projectile, a substantially cylindrical intermediate portion and a forward conical portion, means forming in said nose member intermediate portion a plurality of laterally directed fluid passages communicating with said port, a sleeve member tightly fitted on said nose member intermediate portion and having a frangible forward portion, said sleeve member forward portion normally preventing communication between said fluid passages and the exterior of said nose member and adapted to be rendered ineffective when said projectile is driven into a formation, and fluid sealing means cooperating with said sleeve member to form closure means for said fluid passages.

5

6

5. Apparatus for sampling the fluid contents of geological formations and the like comprising, a hollow tubular projectile adapted to be driven into a formation, said projectile being closed at one end and having a port at its other end, valve means in said port, a nose member tightly fitted on said projectile other end, said nose member including a rear conical portion having a base of greater width than said projectile, a substantially cylindrical intermediate portion and a forward conical portion, means forming in said nose member intermediate portion a plurality of laterally directed fluid passages communicating with said port, means forming an annular groove in said nose member intermediate portion and traversing the entrances to said fluid passages, sealing ring means in said groove, a sleeve member tightly fitted on said nose member intermediate portion, said sleeve member having a relatively thick rear portion over a

substantial part of each fluid passage and extending towards said rear conical portion and a thinner forward portion extending towards said front conical portion over said sealing ring means, said sleeve member forward portion normally preventing communication between said fluid passages and the exterior of said nose member and being adapted to be rendered effective when said projectile is driven into a formation, and means cooperating with said sleeve member at locations on opposite sides of said sealing ring means for providing fluid tight joints thereat.

References Cited in the file of this patent

UNITED STATES PATENTS

2,055,506	Schlumberger	Sept. 29, 1936
2,288,210	Schlumberger	June 30, 1940