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2,678,804

SAMPLE TAKING PROJECTILE

Original Filed June 9, 1944

2 Sheets-Sheet 1

FIG. 1.

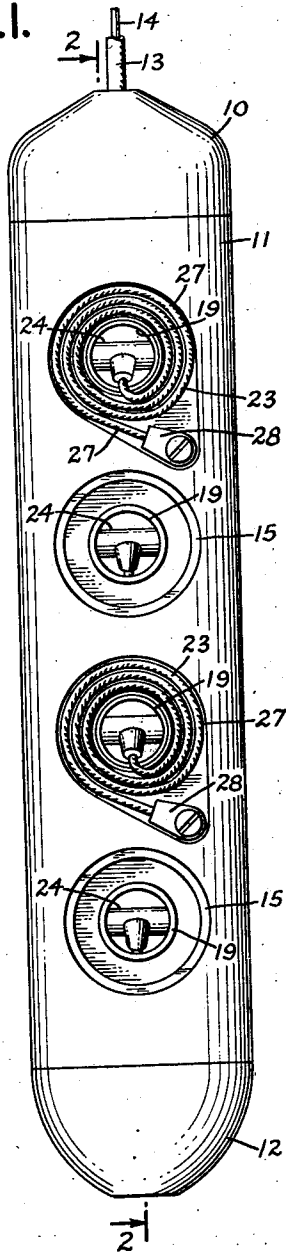
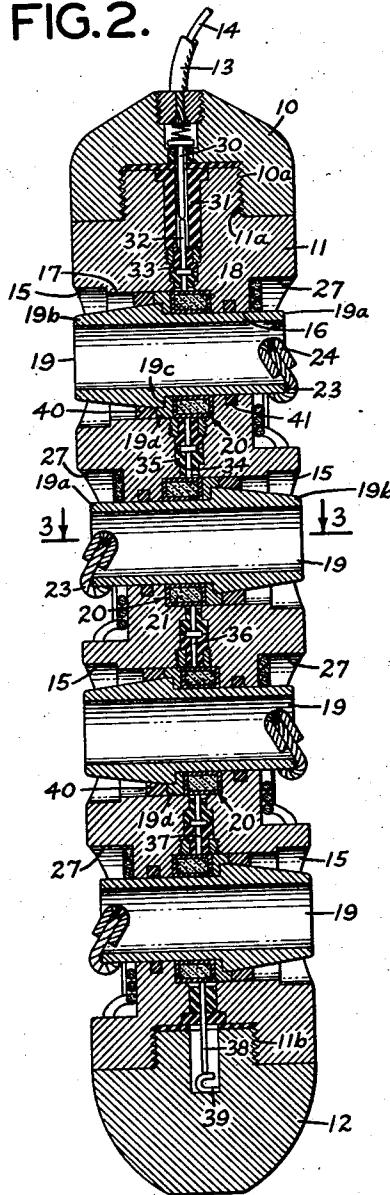


FIG. 2.



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FIG.3.

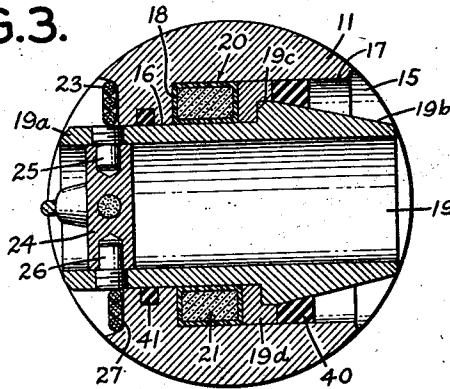


FIG.5.

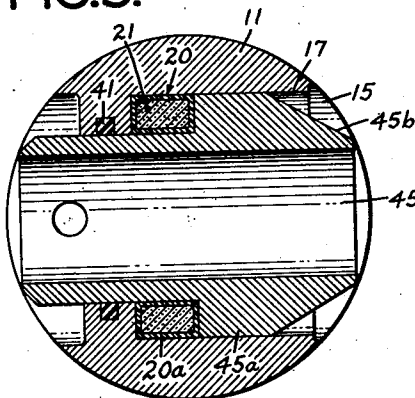


FIG.6.

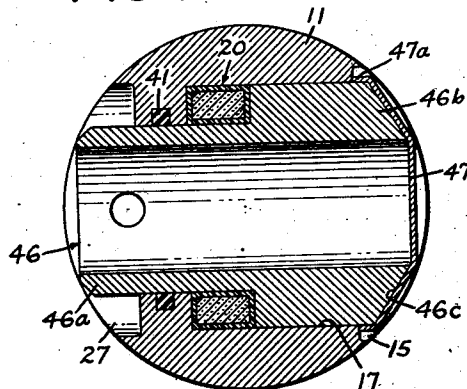
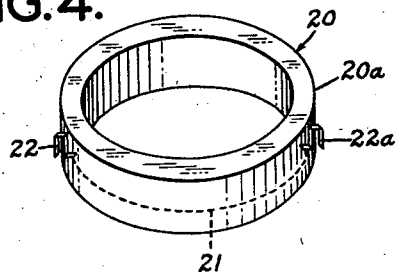


FIG.4.



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SAMPLE TAKING PROJECTILE

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3 Claims. (Cl. 255-1.4)

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This invention relates to devices for taking samples of the formations traversed by a bore hole, such as, for example, that produced in the drilling of an oil well or the like. More specifically, it has to do with new and improved projectiles for use in such devices.

In the applicant's copending application Serial No. 539,415, filed June 9, 1944, for "Side Wall Sample Taker," now Patent No. 2,511,408, granted June 13, 1950, of which the present application is a division, is disclosed a sample taking tool or gun with a powder chamber which is disposed between the ends of the sample taking projectile and at least partially surrounds the projectile. The pressure derived from the explosive charge is applied to a shoulder formed on the periphery of the projectile rather than to the end of the projectile. The bore or aperture for receiving the projectile preferably extends completely through the tool and the bore and projectile are so constructed as to provide opposed shoulders defining an annular space or chamber for receiving the explosive charge.

Sample taking tools of this type have the advantage that a sample taking projectile may be used therein that is substantially as long as the diameter of the sample taking gun and thus are capable of taking a sample 50 to 100% larger than is possible with the projectiles used in conventional sample taking guns of the same external dimensions.

In sample taking apparatus of the type described above, the projectile is secured to the sampling device by a retrieving means such as a cable or a spring which is preferably attached to the rear end of the projectile. With this construction, the outside diameter of the forward end of the projectile may be reduced and the projectile can penetrate into the formation more readily or a smaller explosive charge may be used to produce the desired penetration. This application is addressed specifically to projectiles of this character.

An object of the invention is to provide a sample taking projectile that can penetrate the formations more easily and can be withdrawn from the formations with less difficulty than prior types of sampling projectiles.

Other objects of the invention will become apparent from the following description of typical forms of projectiles embodying the invention, taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side view of a typical form of sample taking device embodying sample taking projectiles constructed according to the present invention;

Fig. 2 is a view in section taken in line 2-2 of Fig. 1;

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Fig. 3 is a view in section taken on line 3-3 of Fig. 2;

Fig. 4 is a perspective view of a typical form of explosive charge unit or cartridge used in the sample taking device;

Fig. 5 is a view in cross-section through the device showing a modified type of projectile for the device; and

Fig. 6 is a view in cross-section through the device illustrating another type of projectile for the gun.

The sample taking device illustrated in Figs. 1 and 2 of the drawings includes a cap member 10 provided with an internally threaded recess 10a which is secured to a tool or gun body 11 of generally cylindrical shape and of a size adapted to fit within a bore hole. The tool body 11 is provided with an externally threaded portion 11a which is adapted to be threaded into the cap member 10. The lower end of the body 11 is provided with an internally threaded recess 11b which is complementary to the externally threaded portion 11a and thereby permits a series of such tool bodies 11 to be connected end to end. As illustrated, the lower end of the tool body 11 may be provided with a bullet-nosed portion 12 which is threaded into the recess 11b.

The above-described assembly or a plurality of the tool bodies 11 may be lowered into or withdrawn from a bore hole by means of a cable 13 which is provided with one or more electrical conductors 14.

As shown particularly in Figs. 2 and 3, the body 11 of the tool is provided with a plurality of transverse apertures 15 extending completely therethrough forming gun bores for receiving sample taking projectiles. The third aperture 15 from the top in Fig. 2 faces in such a direction that the projectile therein will be discharged in the same direction as the projectile in the topmost aperture 15. The second and fourth apertures 15 from the top in Fig. 2 are faced in the opposite direction so that the projectiles therein are projected from the opposite side of the gun body 11. Inasmuch as all of the apertures 15 are essentially the same, only one of these apertures will be described herein. The aperture 15 is provided with a portion 16 of smaller diameter, a larger diameter portion 17 and an intermediate shoulder 18.

One type of sampling device suitable for use in the tool may consist of a tubular projectile 19 having a reduced cylindrical outer surface portion 19a fitting the portion 16 of the aperture. The forward end 19b of the projectile is tapered inwardly from a shoulder portion 19c extending circumferentially of the projectile at substantially a right angle to the axis of the projectile.

The projectile 19 also carries a detachable ring

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19d of substantially L-shaped cross-section which is adapted to abut against the shoulder 19c, overlies a portion of the tapered surface 19b and fit closely against the wall of the aperture portion 17.

When the projectile 19 is substantially centered in the gun body 11, an annular space for reception of an explosive charge device or cartridge 20 is left between the ring 19d and the shoulder 18 and between the enlarged diameter portion 17 and the reduced cylindrical portion 19a of the projectile 19.

The cartridge 20 for expelling the projectile 19 may be of a type disclosed in Fig. 4. The cartridge may have a casing formed of one or more arcuate sections, but preferably includes an annular casing 20a formed of Celluloid or a synthetic plastic or other thin destructible material. This casing is adapted to be partially or completely filled with a suitable explosive such as gun powder. Also disposed within the chamber and in contact with the explosive is an ignition filament 21 which is connected to suitable contacts 22 and 22a that are exposed externally of the casing 20a. The diameter of the filament or the material of which the filament is formed may vary and preferably the filaments of different cartridges will require currents of different values to cause the filaments to glow.

In order to retrieve the projectiles 19 after they have been driven into the side wall of the bore hole, the projectiles may be connected to the sample tool body 11 by means of a suitable flexible member such as, for example, the cable 23, illustrated in Figs. 1, 2 and 3. The projectile 19 may be provided with a cross piece 24 which is pivotally connected to the rear portion of the projectile by means of a pair of stud shafts 25 and 26 threaded through the wall of projectile 19, as shown in Fig. 3. One end of the cable 23 is connected to the cross piece in any suitable way and may be coiled in a recess 27 concentric with the aperture 15. The opposite end of the cable 23 may be provided with a lug 28 that is detachably fastened to the tool body 11.

The opposite end of the gun bore or aperture 15 may also be enlarged in order to facilitate insertion of the cartridge 20 and the projectile 19.

In order to actuate the gun from the surface of the earth, the conductor 14 may be led into the cap 10 and connected to a pin 30 which is insulated from the cap and is received in an insulating bushing 31 in the upper end of the body 11. The pin 30 makes contact with another conducting pin 32 that is carried in the upper end of the body 11 and is insulated therefrom by a suitable bushing 33. The lower end of the pin 32 is adapted to engage one of the contacts 22 or 22a of the cartridge 20. The other contact of the cartridge is adapted to engage another pin 34 that is insulated from the gun body by a suitable insulating bushing 35, this latter pin engaging a contact of the next lower explosive charge device 20. Similar insulated contact pins 36 and 37 are provided along the axis of the body 11 depending upon the number of powder chambers therein. At the lower end of the body 11 is disposed an elongated pin 38 which is insulated from the body 11 and can make contact with a spring contact 39 in the bullet-nosed end 12 of the device or with a contact pin, such as the pin 32, of another sample taking tool.

When the gun body is very long, drilling the axial holes for insulating bushing 35 may become a tedious operation. In this case, it is

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sometimes advisable to make the electrical connection between adjacent powder cartridges by passing insulated conductors through holes drilled transversely of the body, making the electrical connections on the periphery of the gun body.

Inasmuch as the bullet-nosed end 12 is in contact with the conductive liquid in the bore hole, a circuit through the various filaments 21 of the cartridges can be completed by grounding one pole of a source of electrical energy or connecting it to a conducting sheath on the cable 13 and connecting the other pole to the conductor 14.

Preferably, the filaments 21 of the cartridges 20 require different current values to cause them to glow. Therefore, by applying a current to the series of charges which is sufficient only to cause the lowermost filament to glow, only the lowermost powder charge is caused to explode. After the gun has been fired, the conductive fluid in the bore hole will rush into the lowermost aperture 15, for example, again completing the circuit and permitting the next higher powder charge to be exploded by application of a greater current thereto.

The tool may be prepared for use by placing the cartridge 20 in the aperture 15. The projectile 19 with a ring 19d thereon is then inserted into the aperture 17 and a sealing ring 40 formed of rubber or "neoprene" pushed into the space between the tapered portion 19b and the wall of the enlarged aperture 17 to prevent liquid from coming into contact with the powder charge. Also, a second sealing ring may be disposed in a groove 41 in the reduced diameter portion of the aperture 16 to prevent leakage of the bore hole liquid around the projectile 19. The cable 23 is then coiled around the end of the projectile 19 and secured to the gun body 11, as described above. This procedure is repeated until all of the bores, or as many thereof as desired, are loaded. The whole assembly may then be lowered into the bore hole so that the lowest gun bore or aperture 15 is adjacent the formation of interest. The location of this formation can be determined in any suitable way such as, for example, by means of the method disclosed in the Schlumberger Patent No. Re. 20,120.

A current of sufficiently high value is then supplied to the cartridge ignition circuit to cause the filament in the lowermost cartridge to glow, igniting the powder and causing the projectile 19 to be discharged into the formation. The tool may then be raised and the next higher projectile discharged into another formation of interest.

The retrieving cable 23 in each instance will exert a strain on the projectile as the tool is moved along the bore hole and will withdraw the projectile from the formation together with a sample of the formation therein.

It has been found that different types of formations require different types of projectiles for taking a sample therefrom. Different types of projectiles, therefore, may be provided for use in a device of the type described above.

As shown in Fig. 5, for example, a projectile 45 of tubular formation may be used which has an enlarged diameter flange portion 45a thereon fitting the enlarged diameter portion 17 of the aperture. The function of the enlarged flange 45a is similar to the function of smaller shoulder 19c and the ring 19d illustrated in Figs. 2 and 3, namely, to provide a shoulder against which the explosion pressure can act to propel the pro-

jectile. The forward end portion 45b of the projectile 45 is tapered to facilitate its penetration into the formation.

A modified form of projectile is shown in Fig. 6. This projectile 46 includes a smaller diameter tubular portion 46a and a larger diameter portion 46b and an abruptly tapered forward portion 46c. The large diameter portion 46b fits the interior of the large diameter portion 17 of the aperture. Inasmuch as this type of projectile would tend to be retained tightly in a formation, the leading end of the projectile is provided with a cap 47 formed of sheet metal or the like which corresponds in shape to the leading end of the projectile and has a flange 47a encircling and disposed outside the periphery of the projectile.

When this type of projectile is fired into the formation, the diameter of the hole produced corresponds to the outside diameter of the cap 47a, and thus is larger than the largest diameter of the projectile 46. The central portion of the cap 47 is of course frangible to permit the entry of the sample into the body of the projectile. When a strain is exerted on the projectile 46 tending to withdraw it from the formation, the projectile is freed from the peripheral remains of the cap 47 and can be withdrawn readily from the formation leaving the cap 47 in the formation.

It will be understood, of course, that the projectiles can be modified considerably, as for example, by providing a closure or a partial closure for the rear end of the projectile in order to prevent the sample from being washed from the projectile during its withdrawal from the bore hole. The projectiles may be corrugated internally or provided with core catching devices, the construction and use of which are well known in the art.

The electrical connections between the igniting filaments of the explosive charge 20 need not be made along the axis of the gun body 11. If desired, the electrical connections can be made by means of insulated conductors extending along the side of the gun body and connected to suitable terminals on the sides of the gun body. The contacts 22 and 22a on the explosive charge may be positioned wherever convenient for making such connections.

When a plurality of the sample taking devices are connected in series, it may be desirable to provide separate firing conductors for each sample taking device or for groups of one or more of the sample taking devices. Such multiple connections may be necessary for the reason that there is a practical limit to the number of igniting filaments that may be successfully operated when connected in series. Thus, instead of connecting a great number of filaments in series, one conductor may be used to fire 8 or 10 projectiles, another conductor may be used to fire still another group and so on.

From the above description it will be apparent that a device has been provided which is capable of being operated to take larger samples of the formations traversed by a bore hole without increase in over-all size of the sample taking device. Moreover, the device is highly flexible in use, permitting any desired number of samples to be taken during a traverse of the bore hole. In addition, it will be understood that the device may be provided with various types of projectiles depending upon the types of formation from which samples are to be taken and the de-

vice may be modified in so far as the firing circuits and the size and dimensions of the parts of the device are concerned without departing from the invention. Therefore, the form of the invention described above should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. A projectile for sampling formations traversed by a bore hole comprising a tubular member adapted to receive formation samples through its forward end and having a forward portion adjacent one end, a cylindrical opposite end portion, a circumferential shoulder intermediate said end portions extending outwardly from the cylindrical end portion, the diameter of the cylindrical end portion not exceeding the inside diameter of the circumferential shoulder, a ring of greater external diameter than said forward portion slidably mounted on said cylindrical portion and engageable with said shoulder to afford an enlarged projecting surface for impelling the projectile, said ring being initially movable with the projectile, and means attached to said cylindrical end portion whereby said projectile may be withdrawn from a formation after a sample has been obtained.

2. A projectile for sampling formations traversed by a bore hole comprising a tubular member adapted to receive formation samples through its forward end and having an externally tapered portion adjacent one end, a cylindrical opposite end portion, a circumferential shoulder intermediate said end portions, the outside diameter of the cylindrical end portion being equal to or less than the inside diameter of the shoulder portion, a ring detachably mounted adjacent said tapered portion and having a greater external diameter than the greatest diameter of said member to afford an enlarged projecting surface for impelling the projectile, said ring being initially movable with the projectile, and means attached to said cylindrical end portion whereby said projectile may be withdrawn from a formation after a sample has been obtained.

3. A projectile for sampling formations traversed by a bore hole comprising a tubular member having a first cylindrical portion terminating in a relatively blunt externally tapered portion adjacent one end, a second cylindrical opposite portion of lesser diameter than said first portion and forming a shoulder therebetween, said second cylindrical portion comprising the trailing end of the projectile, a cap member detachably fitted on said tapered portion, said cap member having a peripheral portion exceeding the largest outside diameter of the projectile, and means attached to said second cylindrical portion whereby said projectile may be withdrawn from a formation after a sample has been obtained.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
424,442	Wood	Mar. 25, 1890
1,892,158	Matthews	Dec. 27, 1932
2,044,648	Stevens	June 16, 1936
2,281,870	Cole	May 5, 1942
2,288,210	Schlumberger	June 30, 1942
2,410,435	Evans	Nov. 5, 1946
2,441,894	Menecier	May 18, 1948