April 30, 1940. G. A. HUMASON ET AL 2,199,225

PRESSURE SAMPLING DEVICE

Filed Sept. 17, 1937 2 Sheets-Sheet 1

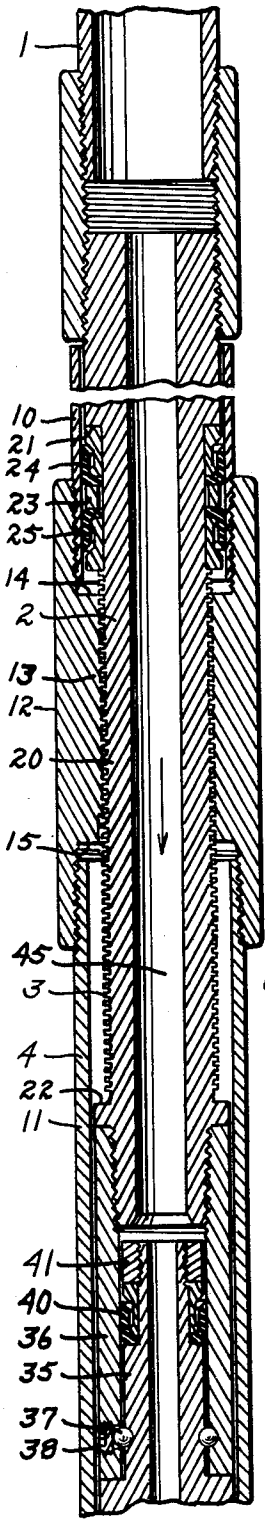

Fig. 1.

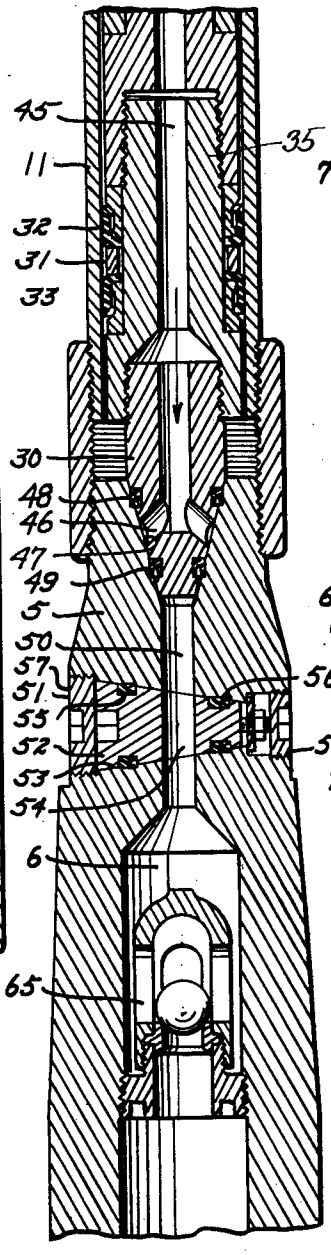

Fig. 2.

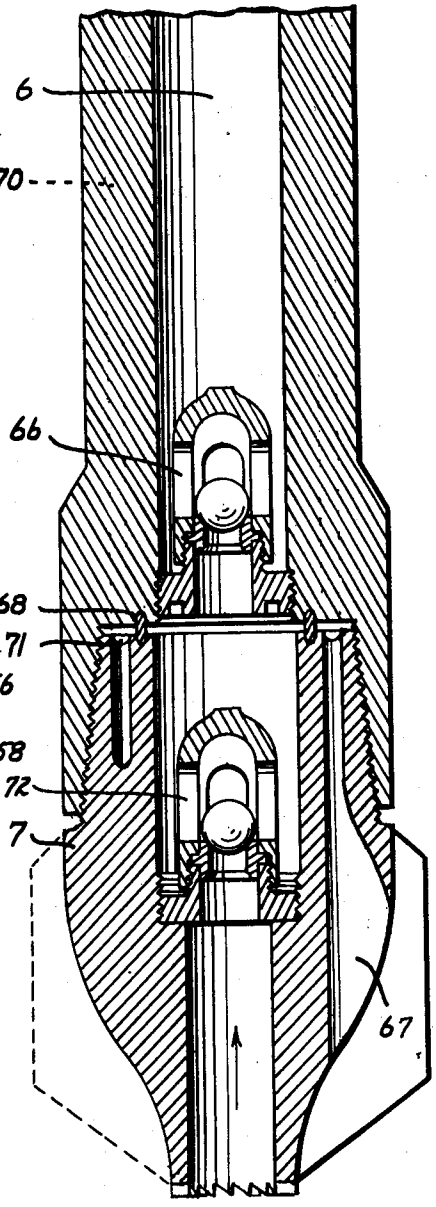

Fig. 3.

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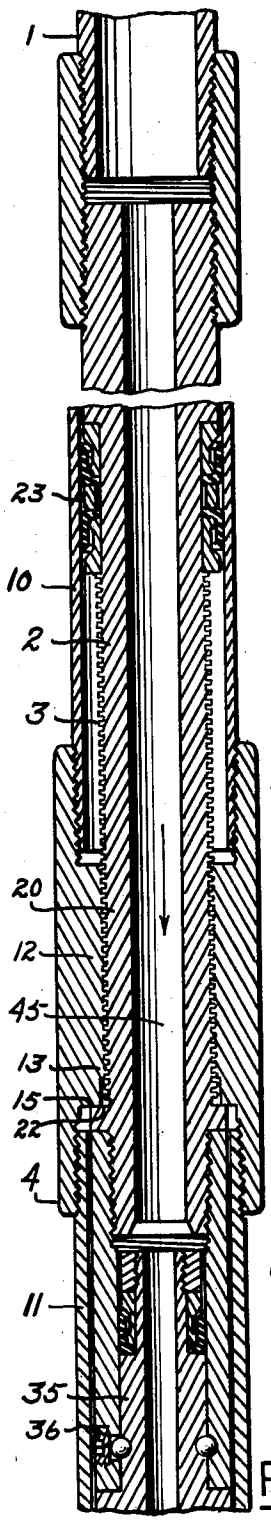

Fig. 4.

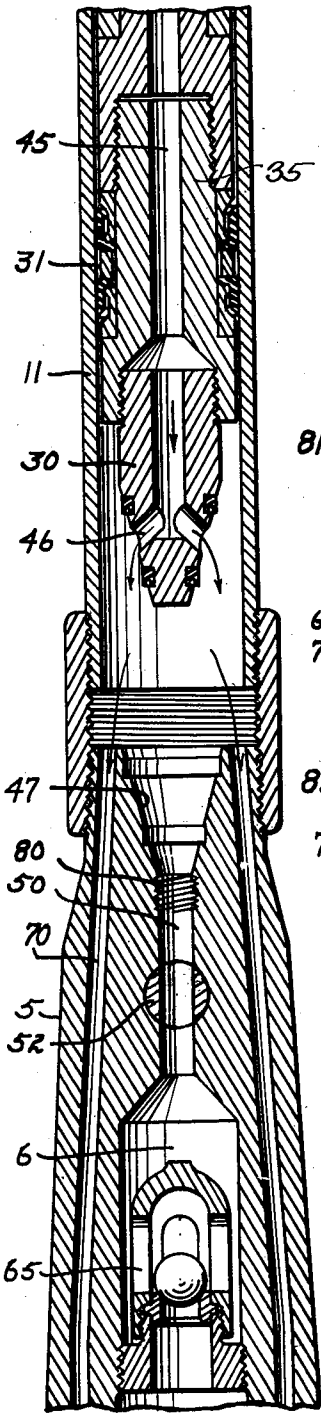

Fig. 5.

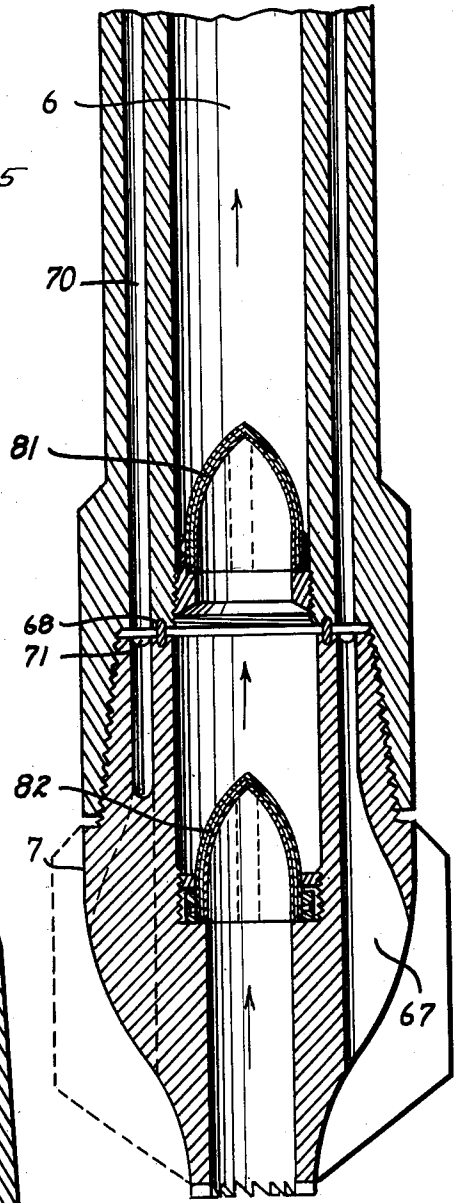

Fig. 6.

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Patented Apr. 30, 1940 2,199,225

UNITED STATES PATENT OFFICE

2,199,225

PRESSURE SAMPLING DEVICE

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Application September 17, 1937, Serial No. 164,318

6 Claims. (Cl. 255—72)

The invention relates to a device for obtaining samples from oil wells and more particularly to a device for obtaining uncontaminated samples at bottom hole pressure, and a device which may be readily disconnected from allied operating equipment transported to the laboratory for determination of the nature of the formation penetrated and the sampling pressure.

A general object of the invention is to provide a sampling tool which may be lowered by means of an operating string into a well bore to obtain a sample therein.

A further object is to provide a device of the class described in which materials in the bore hole are not permitted to enter the device until the sampling level is reached.

Still another object is to provide a device for obtaining samples by encasing such samples therein at the pressure at the level of the sampling.

Still another object is to provide a device which permits the circulation of drilling fluid therethrough during a core taking operation and without contamination of the sample obtained.

Various other objects, together with the foregoing, and advantages of the present invention, will be understood from the following description of an embodiment of the invention illustrated in the drawings, in which:

Fig. 1 is a vertical sectional view of the upper portion of a device embodying the invention.

Fig. 2 is a vertical sectional view of the central portion of the device and is a continuation of a view shown in Fig. 1.

Fig. 3 is a vertical sectional view of the lower portion of the device and is a continuation of the view shown in Fig. 2.

Figs. 4, 5 and 6 are views similar to those illustrated in Figs. 1, 2 and 3 but taken at right angles thereto and showing certain modifications in construction.

Figs. 1 to 3 show successive sections of the device of the invention with parts in their relative position when the device is being lowered into a well preliminary to the taking of a sample. These figures show the device comprising as major elements an operating string 1, attached to a composite valve stem 2 provided with coarse left-handed threads 3 which engage complementary threads in a surrounding sleeve 4 which is secured at its lower end to a barrel 5 having a sampling chamber 6 therein. Core bit 7 of a suitable type is threadably attached to the lower end of the barrel 5. Sleeve 4 comprises tubular end portions 10 and 11 which are interconnected by means of a coupling 12 having a central portion 13 of reduced internal diameter which is threaded for engagement with the threads 3 on the valve stem 2. This construction provides shoulders 14 and 15 in the sleeve to serve a function which will be apparent as the description progresses.

The upper portion of the valve stem 2 comprises a mandrel 20 having a reduced central portion whereby shoulders 21 and 22 are formed thereon. Abutting the upper shoulder 21 is a sealing assembly generally designated as 23 and comprising upwardly and downwardly facing sealing rings 24 and 25 which make a sealing engagement with the adjacent sleeve 4 whereby liquid is restrained from entering or leaving the annular space between the valve stem 2 and the sleeve 4. Below the sealing assembly 23 the reduced portion of the mandrel is provided with the coarse left-handed threads 3 which extend downwardly to the shoulder 22.

The lower portion of the valve stem 2 carries a valve head 30 and a bottom sealing assembly 31 having upwardly and downwardly facing sealing rings 32 and 33 to prevent the passage of liquid between the lower end of the valve stem and the sleeve 4.

In order to provide for slight angular movement and for rotation of the valve head 30 relative to the mandrel 20 the upper end of the sealing assembly 31 is reduced in cross section at 35 to enter a hollow downward extension 36 on the lower end of the mandrel 20. End portion 35 of the sealing assembly 31 is provided with a peripheral groove to cooperate with a complemental internal groove in the extension 36 by receiving a plurality of balls 37, thereby forming a bearing between these parts. The balls 37 are introduced into the raceway provided by the complemental grooves through a radial opening which is closed by a threaded cap 38, after the bearing is assembled. End portion 35 is further reduced at its upper end to receive a sealing ring 40 which is held in position thereon by means of a threaded ring 41. This construction provides a seal which prevents fluid from entering the bearing connection between the parts of the valve stem.

The relative dimensions of the parts of the device as thus far described are such that the volume of the space between the valve stem 2 and sleeve 4 is constant, regardless of the relative longitudinal position of these parts. It is therefore apparent that the construction permits the enclosure of a desired lubricant in this space so

that all moving parts are lubricated at all times and long life and ease of operation of these parts are assured.

The valve stem 2 is provided with an axial bore 45 throughout its length. This axial bore terminates in the valve head 30, which is provided with passages 46.

The upper end of the barrel 5 is channeled to form a housing for certain essential elements of the invention and includes a downwardly tapering valve seat 47, which is adapted to receive the downwardly tapered surface of the valve head 30. The surfaces of the valve head 30 and the valve seat 47 are carefully ground to obtain close fitting engagement of these surfaces. As an added precaution to assure sealing engagement of the valve with its seat, lipped sealing rings 48 and 49 are provided on the tapered surface of the valve head 30, both above and below the ports of the passages 46 in the valve head.

Below the valve seat 47 the central bore 50 which leads downwardly to the chamber 6 is provided with a stop cock generally designated as 51 and comprising a tapered plug 52 positioned within a transverse opening 53 in the walls of the barrel 5. A passage 54 transversely of the tapered plug 52 may be brought into mating relation with the bore 50 to provide an unobstructed passage as is clearly shown in Fig. 2. It is obvious, however, that the tapered plug 52 may also be rotated in a manner well known in the art to close the passage through the bore 50.

The valve plug 52 is in close fitting engagement with the walls of the passage 53 and, to further assure sealing engagement between these parts, lipped sealing rings 55 and 56 are placed in grooves in the valve plug on opposite sides of the passage 54 therethrough. The transverse opening 53 in the barrel 5 is cylindrical at its ends, these cylindrical portions being threaded to receive threaded caps 57 and 58 to completely enclose the valve plug 52 within the walls of the barrel.

Below the stop cock 51 the axial bore 50 merges into the sample chamber 6. Upwardly opening check valves 65 and 66 are provided in the chamber 6 and in spaced relation to prevent downward movement of fluid therein.

As above indicated, the core bit 7, secured to the lower end of the barrel 5, may be of any suitable type which is shown herein, by way of illustration, as being of the fish tail type and having fluid passages 67 for discharging fluid to the cutting edges. A sealing ring 68 is provided between the adjacent faces of the core bit 7 and the barrel 5 to prevent drilling fluid from entering the central bore of the bit and the chamber 6 in the barrel 5. The drilling fluid is conducted downwardly to the core bit 7 through passages 70 in the walls of the barrel 5, as best shown in Fig. 5. To assure a continuous channel between the passages 70 and the passages 67 in the bit 7, the latter is provided with an upwardly facing annular groove 71 whereby the channel is assured, regardless of the relative rotational position of the barrel 5 or the bit 7.

The central passage through the core bit 7 is enlarged at its upper end to receive a check valve 72 which supplements the check valves 65 and 66 in the barrel 5 to prevent downward movement of fluid therein and also to retain fluid within the device above these respective valves.

In Figs. 4 and 5, the parts of the device are shown in the relative positions that will be assumed during the taking of a sample. These figures, together with Fig. 6, show certain modifications in the device as will now be pointed out. As shown in Fig. 5, the bore 50 may be provided with threads 80, the function of which will be apparent from the description of the operation of the device. Also, in Fig. 6 the device is shown as modified by a substitution of core catchers 81 and 82 for the check valves 66 and 72 as shown in Fig. 3. Use of this last mentioned feature is desirable where the penetrated formation is of such nature that satisfactory sampling cannot be effected when using check valves. It is to be understood that under some circumstances check valve 72 only may be replaced by the core catcher 82 whereby a core may be received between the core catcher 82 and the check valve 66.

In the operation of the device the annular space between the valve stem 2 and the sleeve 4 is filled with a suitable lubricant and preferably the sample taking chamber 6 is filled with a suitable liquid before the barrel is secured to the sleeve 4. The parts are then brought into firm threaded engagement and the valve stem 1 is turned left-handedly in order to bring the valve head 30 upon its seat 47, as shown in Fig. 1. The device is then lowered to the bottom of the well where a sample is to be taken. If the bore 50 in the barrel 5 is closed and the barrel was previously filled with suitable liquid, fluid within the bore hole will not enter either the barrel 5 or the operating string 1 during the lowering of the device into the well. When the bottom of the well is reached, the operating string 1 is rotated right-handedly to produce rotation between the valve stem 2 and the remainder of the device whereby the valve head 30 is lifted from engagement with its seat 47 and bottom hole fluid is permitted to enter the barrel 5 and the operating string 1.

If desired, the operating string may then be rotated left-handedly to close the valve head 30 upon its seat and the device may be withdrawn with its entrapped sample. When the device is brought to the surface, stop cock 51 may be closed, whereupon the operating string 1 and associated elements may be disconnected from the barrel 5, and the core bit 7 may likewise be removed. The barrel 5 with its entrapped sample is thus disconnected from other operative elements of the device and may be transported to the laboratory for examination of the enclosed sample.

Alternatively, when the device is at the bottom of the well bore and the parts in position as shown in Figs. 4 to 6, coring operations may be pursued by rotating the operating string 1 and pumping drilling fluid downwardly through the device. At such time relative rotation of the operating string and the tool is prevented by contact of shoulders 15 and 22 on the sleeve 4 and the mandrel 12, respectively. When this mode of operation is pursued it is understood that when the desired amount of core has been cut the operating string will again be rotated left-handedly to retain the valve head 30 upon its seat 47, whereupon further procedure will be that above described.

After the device has been removed from the well the pressure within the barrel 5 may be determined by attaching a suitable pressure indicating instrument to the external threads at the upper end of the barrel and in the modification illustrated in Fig. 5 such instrument may be connected to threads 80 within the bore 50.

Stop cock 51 may then be rotated to admit pressure to the instrument.

After such determination has been made the pressure may then be released and the encased material removed from the barrel 5 for examination. If the formation penetrated is of relatively hard material core catchers may be utilized as illustrated in Fig. 6 and by means of this arrangement core material may be entrapped below the check valve 65 while there will be enclosed above this check valve fluid and other entrapped materials at bottom hole pressure. In this manner a suitable core may be obtained and at the same time information may be obtained as to the pressures existing at the level of coring.

It is apparent that not only is the device so constructed as to obtain the maximum of information relative to conditions at the point of sampling but that the construction is of a nature that the body of the tool may be detached from allied operating elements to thus facilitate transportation of the encased sample to a suitable point for analysis whereby the desired information may be obtained effectively and secretly.

While the device of the invention has been described in detail, the invention is not confined thereto, but is limited only by the appended claims as considered in the light of the prior art.

What is claimed as new is:

1. A pressure sampling device comprising an operating string, a sample taking barrel having a tapered valve seat at the upper end thereof, a valve member adapted to engage said valve seat, an axial bore in said valve member communicating with the bore of the operating string and terminating in ports in the seating surface thereof, a threaded connection between the valve member and said barrel whereby the ports from the operating string may be opened and closed, a core bit attached to the lower end of said barrel and passages in the walls of the barrel for conducting fluid from said valve member to the core bit.

2. In a device of the class described an operating string, a sample taking barrel attached thereto, a valve at the upper end of said barrel, means for opening and closing said valve by relative rotation of said string and barrel, and manually operable valve means below said valve for closing the passage in the sample taking barrel to retain a sample therein when said first mentioned valve is removed.

3. In a device of the class described, a barrel adapted to be attached to an operating string, a core bit attached to said barrel, a valve in the lower end of said barrel, a valve seat in the upper end of the barrel, a valve on said seat and a threaded connection between the operating string and said barrel, said connection being so constructed and arranged that the last mentioned valve will be lifted from its seat upon relative rotation of the string and barrel.

4. In a device of the class described, a sample taking barrel having a tapered valve seat at the upper end thereof, a sleeve extending upwardly from said barrel, a plunger assembly threadably connected to said sleeve for limited longitudinal movement relative to said sleeve, a valve member connected to said assembly and adapted to engage said valve seat, an upwardly opening valve in said barrel, a core drill connected to the lower end of the barrel, and core attaching means at the lower end of said barrel.

5. In a device of the class described the combination of an operating string, a tapered valve member at the lower end of said string, a passage through said string and valve member and terminating in the seating face of said valve member, a sample taking barrel threadably connected to said string, a valve seat in the upper end of said barrel adapted to receive said valve member, and a manually operable valve in said barrel below said valve seat.

6. In a device of the class described, an operating string, a sample taking barrel attached thereto, a valve at the upper end of said barrel, means for opening and closing said valve by relative movement of the string and barrel, and manually operable valve means below said valve for closing the passage in the sample taking barrel to retain a sample therein when the first mentioned valve is removed.

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