June 22, 1948. V. B. ZACHER 2,443,781

APPARATUS FOR DETERMINING THE WALL BUILDING PROPERTIES OF WELL DRILLING FLUIDS

Filed Jan. 23, 1943

FIG. 1.

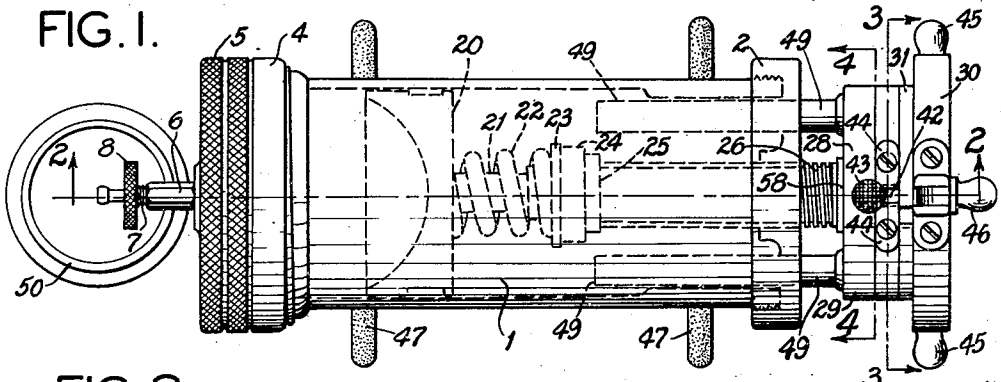


FIG. 2.

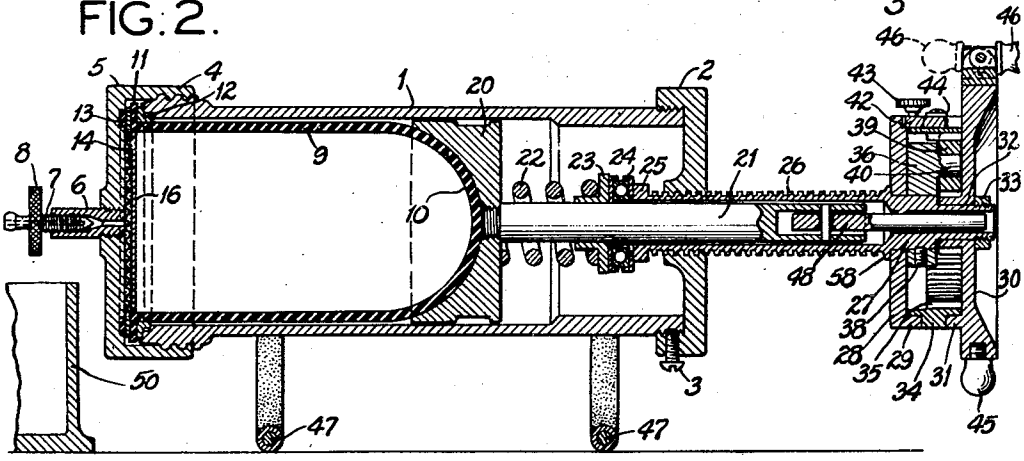


FIG. 3.

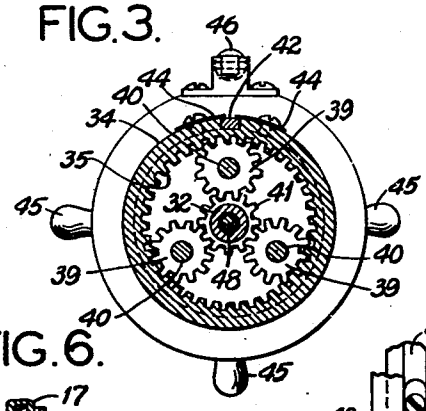


FIG. 4.

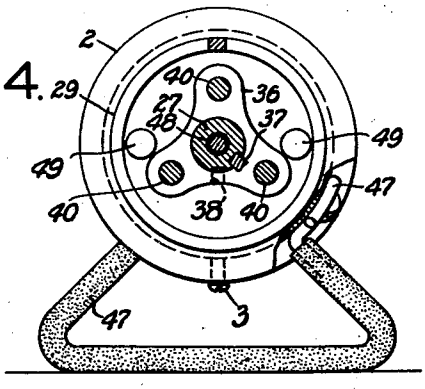


FIG. 6.

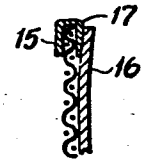
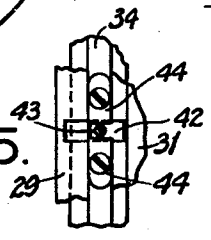


FIG. 5.



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APPARATUS FOR DETERMINING THE WALL BUILDING PROPERTIES OF WELL DRILLING FLUIDS

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6 Claims. (Cl. 100—44)

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This invention relates to an apparatus for determining the wall building properties of well drilling fluids.

In the drilling of wells, particularly oil and gas wells by the rotary system, a mud fluid is composed of water and a solid, such as clay, bentonite and the materials are entrained during drilling, the fluid being about the consistency of lubricating oil. One of the purposes of a drilling mud is to wall the bore hole. The mud should, therefore, have good wall building properties. The action of wall building is one of deposit of the solid on the walls with attendant passage of water to the formation. The greater the passage of water to the formation, the thicker will be the mud cake formed on the wall. It is desirable not only to have a mud fluid which will deposit a thin wall, but that the passage of water to the formation may be restricted in order not to adversely affect subsequent production of the well.

In order to test the properties of such a mud fluid, apparatus should be provided whereby testing may be performed outside of the well, but simulating the conditions in the well. This can be accomplished by forcing the mud fluid through a filter and observing the thickness of the filter cake deposited and the amount of water forced through the cake.

One of the objects of this invention, therefore, is to provide an apparatus of the character described which will be simple in its construction and operation, economical to manufacture and maintain, and efficient in its operation.

Further objects will appear from the detailed description taken in connection with the accompanying drawing in which will be illustrated and described an illustrative embodiment of this invention; it is to be understood, however, that this invention is susceptible of various embodiments within the scope of the appended claims, and that certain features are of utility and may be employed independent of other features.

In the accompanying drawing, Fig. 1 is a plan of an apparatus embodying this invention. Fig. 2 is a section on the line 2—2 of Fig. 1 with the follower retracted. Fig. 3 is a section on the line 3—3 of Fig. 1. Fig. 4 is a section on the line 4—4 of Fig. 1. Fig. 5 is a latch and Fig. 6 is an enlarged section of a part of Fig. 2 showing the filter.

Generally stated, and in accordance with the embodiment of this invention, the apparatus comprises a housing having a mud container, a filter substantially impervious to mud solids, mounted on the housing and communicating with the container, and a follower cooperating with the container to force the mud against the filter. In accordance with an embodiment, the housing contains a mud-receiving bag, preferably of rubber, which communicates with the filter, and means is provided, cooperating with the bag, in order to force the mud against the filter. The means for forcing the mud against the container preferably comprises a follower which has means cooperating therewith to subject the same to a substantially uniform pressure. For convenience the apparatus has at one end a removable cap over the filter, while the other end of the housing has a support in order to permit easier convenient filling of the apparatus with mud; however, the housing has supporting means on the side thereof to permit the same to be conveniently set.

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Referring now to the accompanying drawing, 1 designates the housing which is normally closed at one end by a cap 2, which may be screw-threaded on the housing and secured by lock-pin 3. The other end of the housing is provided with a cap 4, screw threaded on the housing by loose fitting threads of the fruit jar type, and this cap is knurled at 5 to permit manipulation. A nipple 6 is connected to the cap 4 and is provided with a needle valve 7, provided with a knurled head 8. The nipple and the shank of the valve are perforated so as to permit water to issue therethrough.

Arranged within the housing is a bag 9 of rubber, or other suitable material, so as to be substantially impervious to the mud fluid. The closed end of the bag is preferably rounded, as shown at 10, while the open end is preferably provided with a flange 11. A metal ring 12 is preferably provided between the end of the housing and the flange 11, while the cap is preferably provided with a gasket 13 of rubber or any other suitable material, and which projects somewhat beyond the inner face 14 of the cap 4. A metallic filter screen 15 of suitable mesh to be substantially impervious to mud solids, is adapted to receive against it a sheet of filter paper 16, such as Whatman No. 52 Filter Paper. The filter comprising the screen and the filter paper are placed, as shown in Fig. 2, between the flange 11 of the bag and the gasket 13, so that an effective seal is formed which can be effectively made water tight and to give stability to the filter assembly. The edge of the screen may have a metallic binding as shown at 17.

A follower 20 is mounted in the casing so as to bear against the end of the bag and this follower

is provided with a stem 21. A coil spring 22 on the shank 21 bears at one end against the follower and the other end against the collar 23 on the stem. A ball or roller bearing 24 is disposed between the collar 23 and the end 25 of a hollow threaded shank 26 meshing with a thread in cap 2. The end of the threaded shank 26 has a reduced part 27 on which is mounted a part of a casing 28 bearing against a shoulder 58 on the shank and provided with a flange 29. Another housing part 30 has a flange 31 and is mounted on a further reduced part 32 of the shank 26 and is secured thereon by a nut 33. Completing the housing is an intermediate part 34, T shaped in cross section and interiorly provided with gear teeth 35. Mounted on the reduced part 27 is a carrier 36 splined thereto at 37 and secured in position by a screw 38. This carrier has a series of pinions 39 loosely mounted on shanks 40 and meshed with gear teeth 41 formed on an inward projecting hub of the casing part 30, and also with the teeth 35. A latch 42 provided with a knob 43 slides in aligning slots on the casing parts 29, 31 and 34 and is held therein by clips 44. The housing part 30 is provided with projecting knobs 45 and with a handle 46 pivoted to swing from full to dotted positions, Fig. 2.

The housing 1 is provided with legs or supports 47 which may be rubber covered. The shank 21 has an indicator in the form of a pin 48, which passes through the end of the perforated shank, so as to provide a pressure indicating means as hereafter described. The casing part 28 is guided and prevented from turning by shanks 49 moving in guides in the cap 2.

When the follower is retracted, as shown in Fig. 2, the bag is fuly extended. At this time, therefore, the cap 4 and the filter assembly may be removed, as well as the bag. This bag can now be filled with the mud fluid to be tested, the bag having a capacity of about 500–600 cc. At this time the handle 46 may be moved to dotted position, so that the apparatus may be set on end with the housing part 30 as a support. The filled bag can now be inserted with its flange 11 against the ring 12 which is, in turn, seated against the end of the housing. The filter paper 16 and the screen 15 can now be placed on the end of the bag and secured by the cap 4. The aparatus is now ready for operation which is conveniently accomplished by setting it on its legs 47, so that the end of the needle valve 7 will be over a suitable measuring glass 50. The follower is now moved to the left from the position shown in Fig. 2 to the position shown in Fig. 1, so as to collapse the bag. This causes the water in the fluid to issue through the filter into the measuring glass, while a filter cake builds up on the screen. The test can be performed in the usual way, for instance, at the expiration of say a thirty minute test period under a pressure of say one hundred pounds per square inch. The follower is then again protracted and the apparatus can then be set on its end as before. The cap 4 is now removed with its filter cake attached to the filter assembly. If there is still some pressure on the bag, this will serve to separate the flange and the ring 12 from the housing, so that the whole can be readily removed.

The construction is such that the mud is subjected to a substantially uniform pressure. This is accomplished by the spring 22 between the follower and the mechanism for moving it, this constituting tensioned means cooperating with the bag to force the mud against the filter. The

spring can be so constructed in connection with the indicator 48 that when the end of this indicator is flush with the end of the shank part 32, there will be a predetermined pressure on the bag, for instance 100 pounds per square inch. This pressure will be maintained for a substantial period as the building up of the filter cake proceeds. If, however, the pressure should drop by expansion of the spring, the indicator will be retracted which can be readily observed and compensated for by applying additional pressure by the mechanism described. The indicator 48, in connection with the end of the shank 32, therefore, provides a convenient pressure gauge without requiring a complicated mechanism.

The mechanism for moving the follower is one which provides for a variable mechanical advantage. If the latch 42 is moved to the right of Fig. 2, and as shown in Fig. 5, so as to connect casing parts 30 and 34 together, the gearing will be interlocked and the driving part 30 will then be connected directly to the shank 26. By thereupon turning the driving part 30 by means of the handle 46 a quick movement can be given to the follower. As soon as the back pressure rises the latch 42 can be moved to the left to the position shown in Fig. 2, so as to break the direct connection between parts 30 and 34, leaving them simply connected through the planetary gearing so as to increase the mechanical advantage. In the specific proportions shown the mechanical advantage will then be four times that as when there was a direct connection. The required pressure can, therefore, be readily applied to the bag.

It will, therefore, be seen that the invention accomplishes its objects, for the apparatus is one which is not only simple in its construction and operation, and economical to manufacture and maintain, but is efficient in its action. There is practically no deterioration of the bag, as it is confined like an automobile tube, and hence will withstand pressure. Not only can the bag be readily filled, but it can be placed and replaced, and when in position completely seals the bag to the filter. This bag can moreover be readily washed. The apparatus not only eliminates the pressure gauge, but all holes, fittings or other connections which can leak, there being only one seal, namely, directly between the bag and the filter. Since the bag is firmly sealed against the filter, there is no danger of mud fluids spilling from between a cylinder and a head.

Having thus described the invention, what is claimed is:

1. An apparatus of the character described comprising a housing adapted to receive mud, a mud filter substantially impervious to mud solids cooperating with said housing, a follower within said housing and cooperating therewith to force the mud against said filter, a stem to move said follower, a collar on said stem, a compression spring bearing against said follower and said collar, a hollow threaded shank about said stem and projecting through an end of said housing, said housing having a thread to register with the thread on said shank, and means to move said threaded shank.

2. An apparatus of the character described comprising a housing adapted to receive mud, a mud filter substantially impervious to mud solids cooperating with said housing, a follower within said housing and cooperating therewith to force the mud against said filter, a stem to move said follower, a collar on said stem, a compression

spring bearing against said follower and said collar, a hollow threaded shank about said stem and projecting through an end of said housing, said housing having a thread to register with the thread on said shank, means to move said threaded shank, and pressure-indicating means comprising a member mounted for movement within and longitudinally of said shank.

3. An apparatus of the character described comprising a housing adapted to receive mud, a mud filter substantially impervious to mud solids cooperating with said housing, a follower within said housing and cooperating therewith to force the mud against said filter, a stem to move with said follower, a collar around said stem, a compression spring bearing against said follower and said collar, a hollow threaded shank about said stem and projecting through an end of said housing, said housing having a thread to register with the thread on said shank, and means to move said threaded shank.

4. An apparatus of the character described comprising a housing adapted to receive mud, a mud filter substantially impervious to mud solids cooperating with said housing, a follower within said housing and cooperating therewith to force the mud against said filter, a stem to move with said follower, a collar around said stem, a compression spring bearing against said follower and said collar, a hollow threaded shank about said stem and projecting through an end of said housing, said housing having a thread to register with the thread on said shank, means to move said threaded shank, and pressure-indicating means comprising a member mounted for movement within and longitudinally of said shank.

5. An apparatus of the character described comprising a housing adapted to receive mud, a mud filter substantially impervious to mud solids cooperating with said housing, a follower within said housing and cooperating therewith to force the mud against said filter, a stem to move with said follower, a collar around said stem, a compression spring bearing against said follower and said collar, a hollow threaded shank about said stem and projecting through an end of said housing, said housing having a thread to register with the thread on said shank, means to move said threaded shank, and pressure-indicating means comprising a member connected to said stem and similarly mounted for movement within and longitudinally of said shank.

6. An apparatus of the character described comprising a hollow housing, a compressible bag mounted in said housing and adapted to receive mud, a mud filter substantially impervious to mud solids cooperating with said housing and said bag, a follower within said housing and cooperating therewith to move against said bag and force the mud against said filter, a stem to move with said follower, a collar around said stem, a compression spring bearing against said follower and said collar, a hollow threaded shank about said stem and bearing against said collar and projecting through an end of said housing, said housing having a thread to register with the thread on said shank, and means to move said threaded shank.

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