March 9, 1965 M. M. KINLEY 3,172,486

EXPLOSIVE-ACTUATED APPARATUS FOR TAKING CORES

Filed July 11, 1963

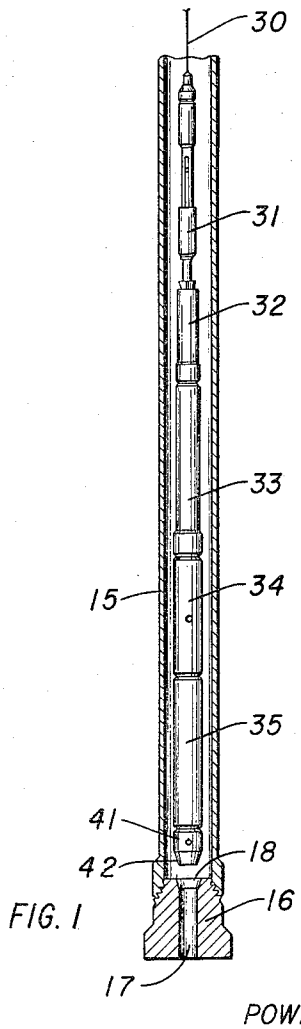


FIG. 1

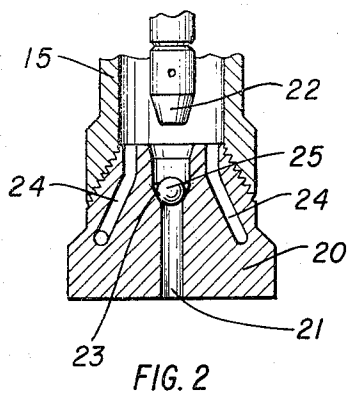


FIG. 2

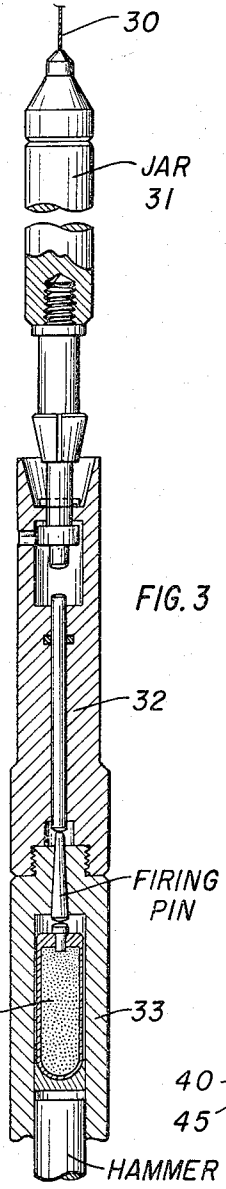


FIG. 3

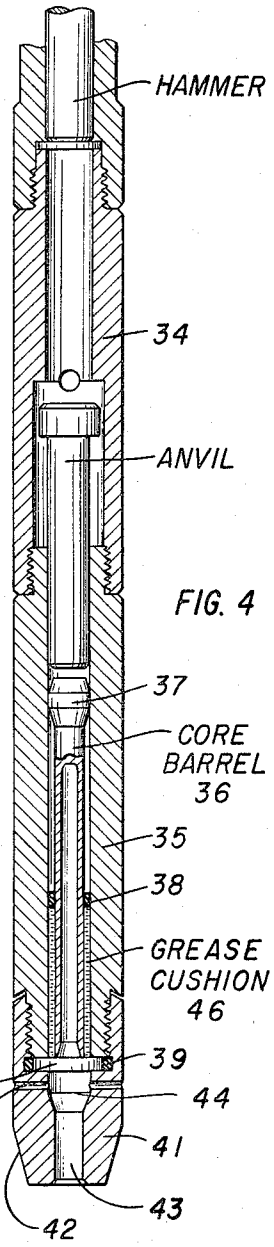


FIG. 4

INVENTOR.
Myron M. Kinley

BY
Earl Babcock

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EXPLOSIVE-ACTUATED APPARATUS FOR TAKING CORES

Myron M. Kinley, 103 Maple Lane, Chickasha, Okla.

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This invention relates to apparatus for taking cores or samples of rock from the bottom of oil wells or the like while the wells are being drilled or reworked or reconditioned.

In the drilling of wells, it is sometimes important to know the nature of the rock or soil through which the drill bit is passing. It is well known in the art to provide a core bit for this purpose, and, in general, core bits are used when exact knowledge of the formation being drilled is desired. Some of such bits are provided with retrievable core barrels, so that a sample of the rock can be obtained by fishing the barrel out of the well without removing the drill string and bit from the well. It is also well known to take samples of the rock in wells from the side of the bore hole, such devices being generally known as side wall samplers. Side wall samplers are usually operated by explosives.

In the U.S. patent to Bannister, No. 1,955,166 granted April 17, 1934 for "Device for Taking Cores or Samples From Wells," it was proposed that a drill bit be provided with a sort of a repeating gun which would drive hollow core takers into the earth formation ahead of the bit, the gun being operated from the surface of the ground. Because of its complicated firing mechanism, or for other reasons, this device has not come into general use.

In accordance with the present invention, it is proposed to improve upon the Bannister invention by an arrangement of drill bit and retrievable, explosive actuated core taker which is very rugged in construction and simple to operate.

The objects of the invention will be apparent to those skilled in the art from what has been said above, and from the following description of preferred apparatus when taken in connection with the accompanying drawing, in which:

FIG. 1 is a vertical cross-sectional view of drill pipe or tubing and a bit, with an explosive actuated retrievable core taker being lowered therein;

FIG. 2 is a fragmentary cross-sectional view of drill pipe or tubing with a modified type of bit for use with a retrievable core taker like that illustrated in FIG. 1;

FIG. 3 is an enlarged and more detailed view, partly in cross-section, of the upper part of the retrievable core taker of FIG. 1; and

FIG. 4 is an enlarged and more detailed view, partly in cross-section and partly cut away, of the lower part of the retrievable core taker of FIG. 1, FIGS. 3 and 4 being contiguous.

Referring to the drawing in detail, and first to the general assembly shown in FIG. 1, it will be seen that the pipe **15**, which may be either drill pipe or tubing, is fitted with a drill bit **16** at its lower end.

The drill bit **16** has a central passageway **17** extending vertically therethrough. In accordance with known practice, the passageway serves to conduct drilling fluid through the bit in rotary drilling. The bit may have ordinary "fishtail" teeth, or it may be a roller or cone type bit, but it must be provided with the passageway **17** so as to permit the movement of a core barrel therethrough, as will presently be described. At the top of the passageway **17**, the bit **16** of FIG. 1 is provided with a conical seat **18**.

In FIG. 2, a modified and preferred form of bit is illustrated. Here again the bit **20** is shown as being of the "fishtail" type, but it will be understood that it may be a roller bit or a cone bit or any other known type provided it has a central passageway **21** extending vertically therethrough.

In the bit **20** of FIG. 2, the passageway **21** is not only provided with a seat **22** at its upper end, but there is a second seat or shoulder **23** located a short distance below the seat **22**. In addition to the passageway **21**, there are two water courses **24** in the bit **20** of FIG. 2. These water courses are of conventional design and direct the drilling fluid into the proper relation with respect to the teeth of the bit. There is also a ball **25** or other object which prevents the flow of fluid through the passageway **21** when it is seated on the second seat **23** as illustrated. The ball **25** thus serves as a check valve preventing downward flow through the passageway **21**. It may be so designed as to break when struck by the core barrel, as described hereinafter, or it may be provided with a fishing neck to be retrieved before a core is taken. Of course, it may also be removed from the bit by reverse circulation. When the ball is seated on the seat **23**, fluid can flow downwardly through the bit through the water courses **24** and the bit thus operated in the conventional way.

The retrievable core taker of the present invention can be used with the simple type of bit shown in FIG. 1 or with the more specially designed bit of FIG. 2. In either case, it is lowered down through the pipe **15** on a wire line **30**. This line is preferably a single strand of strong steel such as the Halliburton measuring line commonly used in the measuring of oil wells.

In accordance with known practice, there may be a stuffing box and "lubricator" at the surface of the ground, so that the core taker can be run into the pipe **15** while the well is under pressure.

The upper portion of the retrievable core taker consists of an explosive jar, and will not be described herein in detail. It may be constructed as shown and described in the co-pending application for U.S. patent of Myron M. Kinley, Serial No. 166,734 filed January 8, 1962 for an Explosive Jar.

When the explosive jar is manipulated by means of the wire line **30**, a mechanical jar **31** causes the trigger section **32** to fire a powder charge in the section **33**, and this drives a hammer downwardly to strike an anvil in the section **34**.

It is within the purview of the invention to dispense with the hammer and anvil entirely and have the powder charge operate directly upon the core barrel, but the hammer and anvil arrangement are here illustrated because it may be desired to employ the additional impact which they afford.

As illustrated, there is a cylinder **35** attached to the lower end of the anvil section **34** of the retrievable core taker. The anvil projects into the upper part of the bore of the cylinder **35** and is located just above the core barrel **36**, as shown in FIG. 4.

The core barrel **36** has an enlargement or head **37** at its upper end which serves as a sort of guide, being approximately the same diameter as the bore of the cylinder **35**. The head **37** also serves as means to receive the downward thrust of the anvil when the explosive jar is fired, and it also limits downward movement of the core barrel.

As shown in FIG. 4, the core barrel **36** is hollow for a major portion of its length, and its lower edge may be provided with an inner bevel, as illustrated.

The core barrel **36** is empty when being lowered into the pipe **15**. Well fluid is prevented from entering it by the O-ring **38** located in the annular space between the outside of the barrel and the wall of the cylinder **35**. A frangible disk **40** holds the core barrel in place until the explosive jar is fired, and until the disk **40** gives

way, it is also maintains a seal excluding well fluid from the core barrel, being provided with an O-ring 39 at its outer periphery.

There is a guide head 41 screw-threaded on to the bottom of the cylinder 35. This clamps the disk 40 in position. It also serves to guide the barrel to its proper seat in the bit. For this purpose, it is tapered at its lower end, as shown at 42 to conform to the shape of the seat 18 in the bit shown in FIG. 1 or the seat 23 in the bit shown in FIG. 2, so that the core taker is properly located when lowered slightly more than is illustrated in FIG. 1 and FIG. 2.

The guide head 41 is provided with a vertical passageway 43 of slightly larger diameter than the outside diameter of the core barrel 36, and this passageway is tapered at its upper end, as shown at 44, so that the core barrel is guided when it is driven downwardly through the passageway 43.

The guide head 41 has laterally extending holes 45 to permit escape of fluid when the core barrel enters the passageway 43. The holes 45 may also serve to accommodate a spanner wrench when screwing the head onto the cylinder 35.

To cushion the core barrel at the end of its travel, the annular space between the O-ring 38 and the disk 40 is filled with a heavy grease as shown at 46 in FIG. 4.

In operation, let it be assumed that the well has been drilled to the depth at which it is desired to take a core. The retrievable core taker, with the parts in the relative position shown in FIGS. 3 and 4, is then lowered down through the pipe 15 and placed in position on the seat 18 if the bit of FIG. 1 is used or the seat 23 if the bit of FIG. 2 is used. The seating of the core taker does not break the ball 25 of FIG. 2, assuming that it is still in position when the core taker is lowered into the pipe, but the ball 25 will break when the core barrel strikes it.

With the core taker in place, the wire line is manipulated to fire the powder charge. When this happens, the core barrel will be driven downwardly, as explained above, until the core barrel extends down through the passageway 43 in the guide head 41 and on down through the passageway in the drill bit. The core barrel will thus be driven down into the earth formation below the drill bit.

As the core barrel moves downwardly, its movement at the end of its travel is cushioned somewhat by the grease 46, but eventually the enlargement 37 will come to rest in the tapered portion 44 of the passageway 43 if the core barrel has penetrated the earth formation sufficiently to permit full extension of the telescopic movement of the core barrel in the cylinder 35 and head 41.

It will be observed that the core taker is not latched to the pipe 15 or the bit. The recoil or kick of the explosive jar does not place any stress upon the pipe 15 or the drill bit.

After the core is taken by the barrel, the entire core taker assembly may then be removed from the well by the wire line 30 without removing the pipe 15 and the bit from the well bore. A sample of the earth formation immediately below the drill bit can thus be obtained, and the drilling can then be completed. If the bit of FIG. 2 is being employed, another ball 25, or the like should, of course, be dropped or pumped into position.

The invention is not to be regarded as limited to the particular arrangements shown and described herein. It is obvious that many changes may be made in the arrangement and construction of parts without departing from the spirit of the invention or the scope of the annexed claims.

I claim:

1. Apparatus for taking cores from the bottom of a well while it is being drilled including, in combination, a pipe with a drill bit thereon, said bit having water courses and, in addition, a vertical passageway centrally thereof, said passageway having a seat at its upper end and a second seat located therein beneath the first mentioned seat, an object which is adapted to break when struck resting on said second seat and serving as a check valve until broken, a core taker located in said pipe above said bit and having a guide head at its lower end adapted to rest on the upper seat of said passageway, said core taker including a jar, a powder charge, means for firing the powder charge when actuated by said jar, a core barrel, and means for driving the core barrel down through said passageway, thereby breaking said object, when said powder charge is fired, and a wire line connected to said core taker for lowering the same down through said pipe and for retrieving the same.

2. A core taker for use in oil wells or the like including, in combination, a wire line, an explosive jar secured to the line and having means for firing the same by manipulation of the line, a cylinder attached to and located below said explosive jar and having a core barrel mounted for vertical movement therein, a grease cushion located between said core barrel and said cylinder, means for driving the core barrel downwardly in said cylinder when the jar is fired, a head attached to the lower end of said cylinder having a vertical passageway therethrough in axial alignment with said core barrel whereby said core barrel may move downwardly therethrough when the jar is fired, said head also having means for seating in a drill bit and for positioning the core taker with respect to the bit so that the core barrel may move vertically downwardly out of said passageway and through the bit, and means for keeping said core barrel empty until the jar is fired.

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CHARLES E. O'CONNELL, *Primary Examiner.*