April 27, 1943. T. B. LOSEY 2,317,544

CORING TOOL

Filed Oct. 26, 1942

Fig. 1

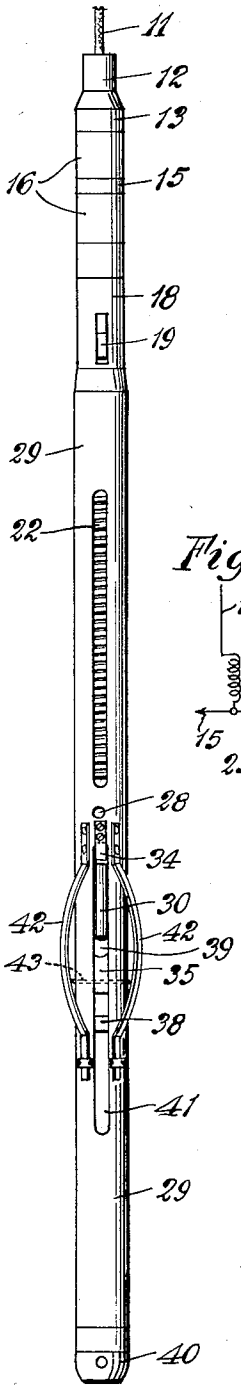


Fig. 2

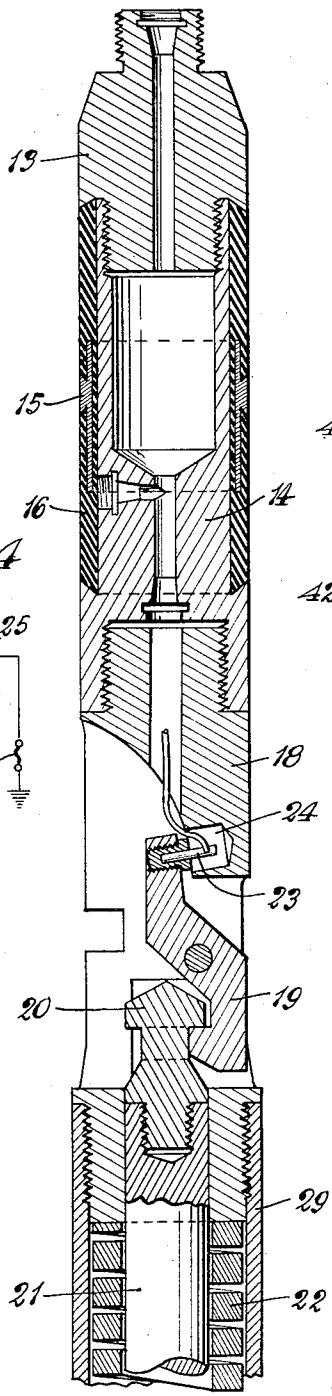
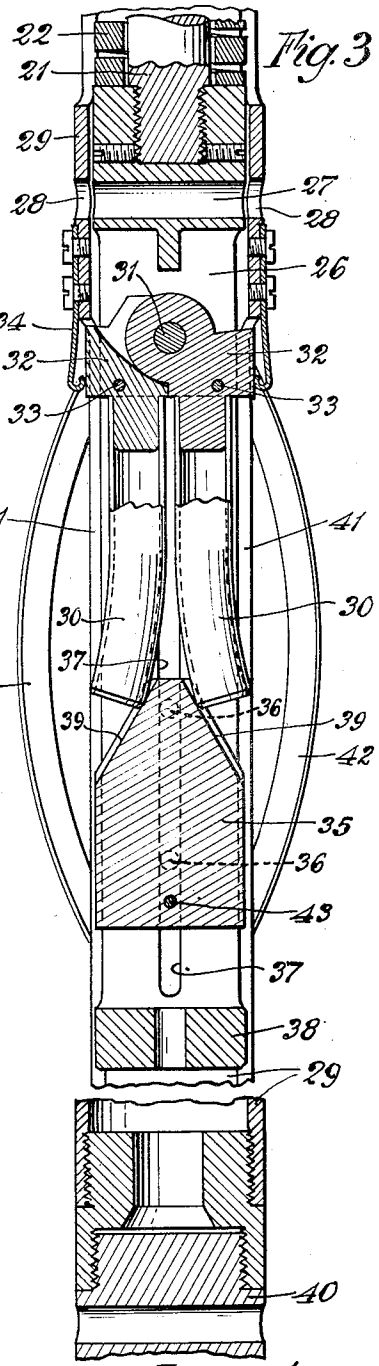


Fig. 4

Fig. 3



Inventor
Thomas B. Losey
by Earl Babcock,
Attorney

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UNITED STATES PATENT OFFICE

2,317,544

CORING TOOL

Thomas B. Losey, Dallas, Tex., assignor to Halliburton Oil Well Cementing Company, Duncan, Okla.

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3 Claims. (Cl. 255—1.4)

This invention relates to apparatus for use in oil wells to obtain samples of rock or earth formations, and more particularly, to coring tools for obtaining samples of rock from the side of the well bore.

It has already been proposed to lower a side wall core taking tool into an oil well on a cable. See, for example, the patent to Williston, No. 1,683,642, granted September 11, 1928, for "Side wall sampler." An arrangement exactly like that disclosed in the Williston patent has not come into general use, however, largely because of the danger of hanging the tool in the well.

It has also been proposed, as for example, in the patent to Hartson, No. 1,810,208, granted June 16, 1931, for "Core drill," to employ a spring controlled by suitable latching means to furnish the energy for driving a core taking tool into rock or earth in a well to obtain a sample.

In accordance with the present invention, side wall core taking tubes of the Williston type are provided, and adapted to be run into the well on an electrical cable. A heavy duty spring like that suggested by Hartson is employed to furnish the energy to take cores, the spring being controlled by latching mechanism actuated in response to electrical energy transmitted through the cable.

The important feature of the present invention resides in the mechanism for controlling the movement of the core taking tubes. This mechanism is such that the spring, when released, drives the core taking tubes downwardly against a deflecting block which directs them laterally into the earth formations, the deflecting block being so mounted that after the core taking tubes are deflected, the parts take such position that the core taking tubes may be removed from the earth formation by upward movement of the tool, with little danger of the tool becoming hung in the well.

It is one object of the invention to provide relatively safe and reliable side wall core taking apparatus for use in oil wells and in which core taking tubes are accurately guided and driven into the side wall of a well bore with considerable impact without interfering with the easy removal of the core taking tubes from the earth formation into which they are driven.

Other objects and advantages reside in certain novel features of the arrangement and construction of parts, as will be more apparent from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a side view of the complete assembly of a side wall core taking tool, constructed in accordance with the principles of the present invention;

Figure 2 is a vertical cross-sectional view of the upper portion of the side wall sampling tool shown in Figure 1;

Figure 3 is a vertical fragmentary view, mostly in cross-section, of the lower portion of the apparatus shown in Figure 1, Figures 2 and 3 illustrating contiguous portions of the tool; and

Figure 4 is an electrical diagram of apparatus (only some of which is shown in Figures 2 and 3) which may be employed with the sampling tool of Figure 1.

Referring to the drawing in detail, and first to the assembly shown in Figure 1, it will be seen that the side wall coring tool is there illustrated as suspended upon an electrical cable 11 by means of a coupling and strained relief member 12 threaded onto an upper nipple 13, which supports the remainder of the tool.

Just beneath the nipple 13, electrical logging apparatus is mounted. This may include a housing member 14, in which a transformer (not shown in Figures 2 and 3, but illustrated at 25 in Figure 4) or other electrical equipment may be placed. A cylindrical electrode 15 mounted on an insulating sleeve 16 on the housing constitutes means for electrically logging the well, the purpose being to enable an electric log of the well to be made while the core taking apparatus is in it, so that the core taking apparatus can be positioned at any desired depth and correlated with the electric log at the place where the core is taken.

Means and methods for electric logging are now well known in the art and need not be described here. An example of electric logging apparatus in which electric logs are made by means of a single conductor cable with a single electrode in the well is found in the patent to Rust et al., No. 2,132,807, granted October 28, 1938, for "Single cable electrical well logging."

Screw threaded into the lower portion of the housing 14 is a second housing member 18 for suitable latching mechanism. This latching mechanism includes a pivoted trigger 19 adapted to engage a head 20 connected to the upper end of a mandrel 21. The mandrel 21 is urged downwardly under the influence of a heavy duty compression spring 22.

The trigger 19 is released by means of a squib 23 mounted in a chamber 24 in the housing member 18. The squib 23 is fired electrically, a suitable circuit for this purpose being shown in Figure 4.

The electrical characteristics of the transformer 25, shown diagrammatically in Figure 4, may be such that the squib will not be fired while the well is being logged (during which time an alternating current, say, of 250 cycles, may be sent down through the conductor of the cable 11 and the primary of the transformer 25 to the electrode 15) but is such that if a higher frequency than that used to log, or a higher voltage is sent through the primary of the transformer 25, there will be enough current through the squib 23 to fire the same.

As shown in Figure 3, the lower end of the mandrel 21 is screw threaded into a yoke member 26. The upper end of this yoke member is provided with a transversely extending hole 27, adapted to be aligned with holes 28 in an outer housing member 29, the outer housing being screw threaded onto and integral with the lower portion of the housing 18. The purpose of the holes 27 and 28 is to provide means for placing a safety bolt therethrough to hold the mandrel 21 up and the spring 22 compressed, while the tool is being transported or started into the well.

The yoke 26 carries the core taking tubes. In the arrangement illustrated, two core tubes 30 are shown pivotally mounted upon a shaft 31 by means of clevis members 32. Each core taking tube 30 is slightly curved outwardly, as illustrated in Figure 3. Shear pins 33 may be provided in the clevis members 32 to hold the core taking tubes in the position shown in Figure 3 until the spring 22 is released. Alternately, or in addition, leaf springs 34 may be used to engage the clevis members, as illustrated, to urge the core taking tubes inwardly. At some selected point in the yoke 26 beneath the core taking tubes 30, the deflector block 35 is mounted.

The yoke 26 is provided with vertically extending slots 37 and the deflector block 35 is provided with co-acting guide pins 38. Thus, the deflector block is mounted for limited longitudinal movement in the yoke 26, a lower limit of movement of the block in the yoke being provided by the transverse portion 38 of the yoke.

As illustrated at 39, the upper portion of the deflector block 35 is tapered and grooved to provide guides for the core taking tubes 30.

As shown in Figures 1 and 3, the outer housing member 29 extends downwardly to make connection with a nose 40 at the lower end of the tool. This housing member 29 is provided with slots 41 through which the core taking tubes 30 may extend.

It will be seen that the yoke 26 and the parts which it carries are adapted to move vertically within the housing member 29.

The housing 29 may be provided with drag springs 42 adapted to center the tool in the well bore.

When the parts of the tool are in the cocked position shown in the drawing, the deflector block 35 may be secured by a shear pin 43 (Figure 3) to the outer housing 29. If desired, several longitudinally spaced holes may be provided in the housing 29 to accommodate the shear pin 43 and permit adjustment of the deflector block to any desired position with respect to the core taking tubes 30. With this arrangement, the deflector block may be said to be semi-floating.

Before the pin 43 shears, the deflector block is held stationary in the housing 29. As soon as the spring 22 is released and the yoke 26 moved downwardly thereby to throw the core taking tubes 30 outwardly, the downward component of the force of the tubes 30 against the deflector block 35 is probably sufficient to shear the pin 43, or if this component is not sufficient to shear the pin 43, the clevis members 32 strike the deflector block and shear the pin 43 by impact. In either case, the deflector block 43 is thrown downwardly until it strikes the abutment 38 on the yoke 26, at which time it is below the core taking tubes 30 and out of the way when the core taking tool is lifted upwardly to draw the core taking tubes 30 back into the bore hole after the samples have been taken.

As an alternative to the shear pin 43 which connects the deflector block 35 to the outer housing 29, one or more shear pins might be located beneath the deflector block and be secured to the yoke 26 instead of the outer housing 29. The shear pins would then serve only as a support or rest for the deflector block, in which case the deflector block might be said to be full-floating. With such a construction, as the spring 22 is released and the yoke 26 and core taking tubes 30 are moved downwardly, the inertia of the deflector block 35 is sufficient to cause the core taking tubes to move outwardly, after which the deflector block will move downwardly to rest upon the abutment 38 as before.

In either the arrangement shown in the drawing or in the alternative embodiment not illustrated, the pins which support the deflector block will shear.

In operating the tool shown in the drawing, it is first necessary to compress and latch the spring. For this operation the nose 40 of the tool is removed and a screw jack (or hydraulic jack) is connected to the lower portion of the housing 29, the head of the screw jack engaging the bottom of the abutment 38 of the yoke 26. By manipulating the jack, spring 22 is compressed, so that trigger member 19 may be engaged and a safety bolt placed in the openings 27 and 28. The shear pin 43 may then be passed through the housing 29 into the deflector block 35. The tool is then ready to be run into the well. Preferably in running the tool, the assembly is partially lowered into the wall bore before the safety bolt is removed from the openings 27 and 28.

When the tool has been lowered to the depth to which it is desired to take the core, as indicated by the electric log being made during the same run, for example, sufficient current of the proper frequency is sent through the conductor of the cable to fire the squib 23. This releases the spring 22 causing downward movement of the mandrel, yoke and core taking tubes while the deflector block 35 temporarily remains stationary, as indicated above.

As soon as the core taking tubes 30 are deflected, the deflector block 35 moves on downwardly, as indicated above. The tool may then be removed from the well merely by pulling upwardly on the cable.

While only one embodiment of the invention has been shown and described, it is obvious that various 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. A side wall coring tool adapted to be run in an oil well on an electrical cable, comprising a housing member, a heavy duty core spring located in said housing member, a mandrel mounted for longitudinal movement in said member and adapted to be driven downwardly by said spring,

electrically releasable latching means for holding said mandrel suspended and said spring compressed, core taking tubes pivotally mounted on said mandrel, a deflector block, means for mounting said deflector block beneath said core taking tubes for limited longitudinal movement within said housing member, means for causing said deflector block to remain substantially stationary beneath said core taking tubes temporarily, as the latching means is released, thereby causing lateral deflection of said core taking tubes as the mandrel is driven downwardly by said spring, and means for moving said deflector block on down beyond said core taking tubes immediately after said tubes have been deflected laterally.

2. A side wall coring tool adapted to be run in an oil well on an electrical cable, comprising a housing member, a heavy duty core spring located in said housing member, and a mandrel mounted for longitudinal movement in said member and adapted to be driven downwardly by said spring, electrically releasable latching means for holding said mandrel suspended and said spring compressed, core taking tubes pivotally mounted on said mandrel, a deflector block means for mounting said deflector block beneath said core taking tubes for limited longitudinal movement within said housing member, shearable means for supporting said deflector block and causing the same to remain substantially stationary beneath said core taking tubes temporarily as the latching means is released, thereby causing lateral deflection of said core taking tubes as the mandrel is driven downwardly by said spring, and means for breaking said shearable means to move said deflector block on down beyond said core taking tubes immediately after said tubes have been deflected laterally.

3. A side wall coring tool adapted to be run in an oil well on an electrical cable, comprising a housing member, a heavy duty core spring located in said housing member, a mandrel mounted for longitudinal movement in said member and adapted to be driven downwardly by said spring, electrically releasable latching means for holding said mandrel suspended and said spring compressed, core taking tubes pivotally mounted on said mandrel, a deflector block, means for mounting said deflector block beneath said core taking tubes for limited longitudinal movement within said housing member, shear pins connecting said deflector block to said housing member to hold said deflector block stationary with respect to said housing as the latching means is released, thereby causing lateral deflection of said core taking tubes as the mandrel is driven downwardly by said spring, and means carried by the mandrel for striking said deflector block and shearing said pins immediately after said tubes have been deflected laterally.

THOMAS B. LOSEY.