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CORE SAMPLER COUPLER FOR CHURN DRILL BITS

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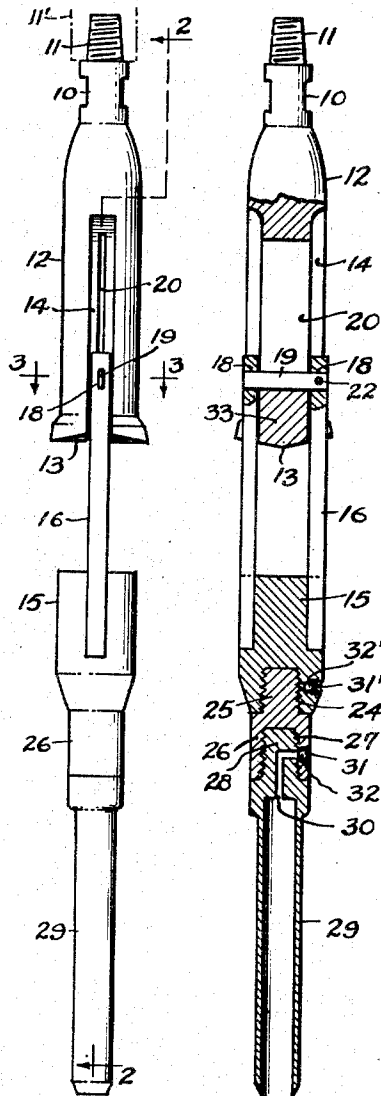


Fig. 1

Fig. 2

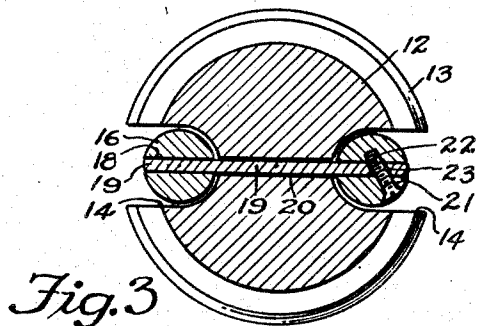


Fig. 3

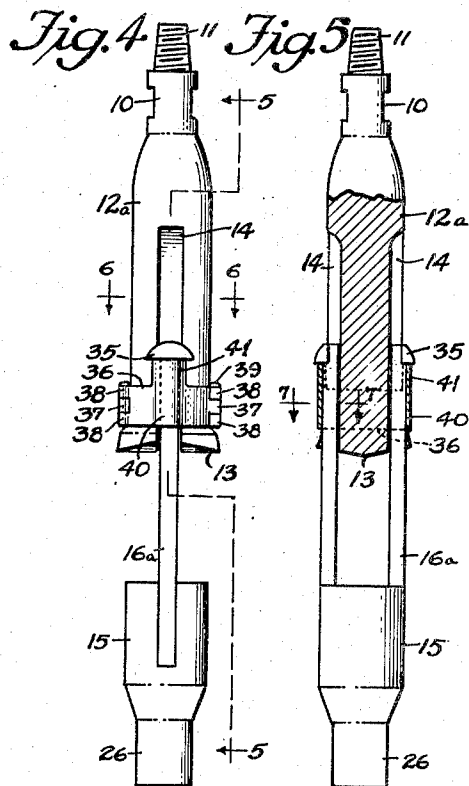


Fig. 4

Fig. 5

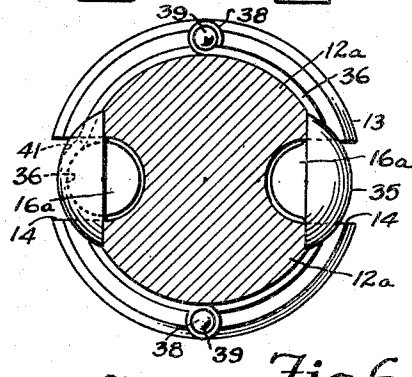


Fig. 6

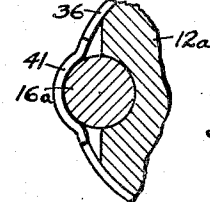


Fig. 7

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CORE SAMPLER COUPLER FOR CHURN DRILL BITS

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9 Claims. (Cl. 255—63)

This invention relates to devices for extracting cores or samples from wells or drillings for the purpose of scientific study and practical examination. Such devices are commonly referred to as core samplers. The invention has as its general object to provide a coupler for attaching a core barrel or sample tube to a churn drill bit. For convenience I will limit the discussion herein to its use in the drilling of oil wells, although it is, of course, understood that my invention is not thus limited and extends to all of the fields in which it can be used.

A common system of drilling oil wells is the churn drill system. A solid drill is suspended from a steel cable which passes over a walking beam to a reel. A vertical reciprocating motion is imparted to the cable by the walking beam and the drill is thus alternately lifted and then dropped, the length of the cable being so adjusted that the drill strikes the earth on each downward stroke. The system is efficient in cutting a hole through the rock, but the cuttings are pulverized or so finely divided that they are of little value for the purpose of study to determine the geological and physical characteristics of the strata through which the drill is passing. Since the character of these strata is one of the most important guides to the driller for estimating the probability of striking oil and the probable quantity of it when found, it is essential for him to obtain unbroken samples of sufficient size for proper examination. It is equally important for him to know positively that the samples have come from the bottom of the hole and are not simply fragments which have fallen from the sides of the hole to the bottom—a fact of which he can never be certain when relying upon the cuttings of the churn drill.

The present practice of removing a drill bit from its connection with a drill stem, in order to attach a sample tube to the drill stem, is time consuming and laborious. The present invention aims to provide a coupling which can be quickly attached to and detached from a churn drill bit, for connecting a sample tube thereto much more rapidly and easily than it has been in the past possible to attach a sample tube to a drill stem.

A further object is to provide an improved coupler for attaching a core barrel or sample tube to a drill bit, the coupler having means for providing vertical reciprocating movement of the drill bit with reference to the sample tube, whereby the drill bit, with the weight of the drill stem above it, may be used as a hammer to drive the core barrel into the formation being sampled.

Other objects will become apparent in the ensuing specifications and appended drawings in which:

Fig. 1 is a side view of an assembly of churn drill bit, core barrel, and my improved coupler connecting the two;

Fig. 2 is an axial sectional view thereof taken on the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view of the same taken on the line 3—3 of Fig. 1;

Fig. 4 is a side view of an assembly of churn drill bit, sampler core and coupler embodying a modified form of the invention;

Fig. 5 is an axial sectional view thereof taken on the line 5—5 of Fig. 4;

Fig. 6 is a transverse sectional view thereof taken on the line 6—6 of Fig. 4; and

Fig. 7 is a transverse sectional view thereof taken on the line 7—7 of Fig. 5.

The preferred form of the invention

As an example of one form in which the invention may be embodied, I have shown in Figs. 1, 2 and 3, a preferred form of my improved coupler, applied to a churn drill bit which comprises a squared neck 10 having a threaded shank 11 for attachment to a threaded socket 11' on the end of a drill stem, and having a body portion 12 terminating, in the end opposite shank 11, in a bit jaw 13. In body 12 are diametrically opposed mud channel grooves 14, for allowing the upward escape of particles that have been cut away by jaw 13. The present invention utilizes the channels 14 in adapting my improved coupler to the drill bit.

My improved coupler comprises a head 15 to which are secured a pair of diametrically opposed reins 16, extending parallel to the axis of head 15, in laterally spaced relation such as to be received in channels 14, closely embracing the central web portion of body 12 between channels 14.

In the upper ends of reins 16 are a pair of slots 18, extending through the reins in diametrically aligned relationship, whereby a key 19 may be inserted through the slots 18 and through an axial slot 20 which is provided in drill bit body 12. Slot 20 lies in the common median plane of grooves 14 and therefore opens into the bottoms of the respective grooves.

One of the reins 16 is provided with a small threaded hole 21 receiving a small set screw 22. Key 19 has an opening 23 adapted to align with hole 21, so that the screw 22 may pass through the key 19 to lock the same in a position in which its ends are flush with the outer sides of reins 16.

Drill bit body 12 has a solid lower end portion 33 defining the bottom of slot 20 and constituting an abutment means adapted to be engaged by key 19 to suspend the coupler from the drill bit. The key 19 is referred to broadly in the appended claims, as an abutment engaging means.

Slot 20 provides for lost motion between the coupler and the drill bit, the length of the slot being such that the lost motion has an amplitude slightly greater than the distance of the coupler head 15 below the bottom of the drill when suspended therefrom. Thus the bit may be utilized to strike a hammer blow against the coupler by engagement of the lower end of the bit with the top of the head.

Head 15 has a threaded socket 24 to receive the threaded shank 25 of an adapter 26 forming part of my improved coupling. Adapter 26 in turn has a threaded socket 27 to receive the threaded shank 28 of a core barrel or sample tube 29. Sample tube 29 has the conventional bleed outlet 30 for bleeding air from the sample tube. Adapter 26 has a bleed port 31 in which is a spring urged ball check valve 32 adapted to allow egress of fluid from the upper end of core barrel 29 but adapted to close so as to prevent the inflow of air into the upper end of the sample tube, thereby procuring the retention within the core barrel of a sample which has been received therein, such retention being through a suction action, the valve 32 relieving the upper end of the sample barrel of the pressure of atmosphere.

Where the core barrel has a threaded shank that will fit the threaded socket 24, the core barrel may be directly attached to head 15 without the intervention of adapter 26. For fitting the core barrels of various sizes and

shapes to the head 15, a number of adapters 26 with differing threaded sockets therein, may be provided.

Head 15 has a bleed port 31', closed by a spring-urged ball check valve 32', port 31' being positioned to register with bleed outlet 30 when core barrel 29 is directly attached to head 15.

Operation

In the operation of the invention, a driller, using the churn drill bit for drilling an exploratory hole, whenever he desires to take a sample of the material at the bottom of the hole, may simply draw the drill string, leaving the drill bit in place at the lower end thereof, remove the key 19 from the slots 18, and simply slip the reins 16 upwardly into the grooves 14. When the upper ends of the reins have passed the solid lower portion 33 of the drill body 12, and the slots 18 are registered with slot 20, the key 19 is simply slipped through slots 18 and slot 20 and the screw 22 is inserted to lock the key in place.

The drill string may then be lowered into the drill hole until the core barrel 29 engages the bottom of the hole. By then dropping the drill string until the jaw 13 makes impact against the head 15, a blow will be struck which, transmitted through head 15 to core barrel 29, will drive the latter down into the earth. Several such blows may be struck in order to fill the core barrel with a sample of earth. The drill string is then simply withdrawn, the key 19 is removed, the coupler is detached from the drill bit, and the drill string may be immediately lowered back into the well.

In the modified form of the invention shown in Figs. 4-7, the drill body 12a need not be provided with a central slot 20. In this case, the coupler comprises a head 15 having a pair of reins 16a formed at their upper ends with cross heads 35. As hereinafter noted, cross heads 35 constitute abutment engagement means, having the same function as key 19 of Figs. 1-3. Cross heads 35, in cross section, are shaped to lie within the extended periphery of the drill body 12 as indicated in Fig. 6.

To attach the coupler to the drill bit, I provide a bracelet 36 in two sections each having at its respective ends, sleeves 37 and 38, the sleeves 38 of one section being adapted to interleave with the sleeve 37 of the other section, and vice versa, whereby coupler pins 39 may be inserted through the aligned sleeves, to lock the bracelet sections into a bracelet snugly embracing the drill body 12. The sleeves 37, 38 are sufficiently small in diameter so as to be disposed within a circumference no larger than the circumference of the cutting jaw 13.

Each bracelet section has its mid-portion arched outwardly to define a yoke portion 40 snugly embracing a respective rein 16. Each yoke portion 40 has an upward extension 41 constituting an abutment for engagement by a corresponding crosshead 35.

In the operation of this modified form of the invention, the heads 35 are adapted to engage the extensions 41 when the core barrel is being suspended from the drill bit. For taking a sample, the jaw 13 is adapted to engage head 15 in the same manner as described in the preferred form of the invention.

In the sampling which is provided for in the use of my improved coupler, a solid core can be extracted for scientific examination whereas the washed or bailer samples may and usually are always contaminated by foreign particles from the upper walls of the hole.

I claim:

1. In combination, a deep well churn drill bit for attachment to the lower end of a drill string, said bit comprising a body having diametrically opposed mud channels in the lateral wall thereof, extending parallel to the axis thereof; a coupler comprising a head having means for attaching a core barrel thereto; a pair of reins attached to and projecting upwardly from said head in diametrically opposed, parallel, spaced relation such as to be receivable in said mud channels; abutment means on said drill bit near the lower end thereof; and abutment

engaging means projecting laterally from the upper ends of said reins and engageable with said abutment means for suspending said coupler from the bit, whereby said bit, with the weight of the drill string superimposed thereon, may be dropped so as to make impact against said coupler for driving said core barrel into the bottom of a drill hole for obtaining a sample.

2. For attachment to a deep well churn drill bit having radially spaced side portions defining a diametrically disposed through slot, and having lower and upper end portions joining said side portions, said upper end portion having means for attaching the drill bit to a drill string, said bit having diametrically opposed mud channels communicating with respective sides of said slot; a coupler comprising: a head having at its lower end means for attaching a core barrel thereto; a pair of reins attached to said head in diametrically opposed, parallel, spaced relation such as to be receivable in said mud channels; and a key attachable to and extending between the upper ends of said reins and adapted to extend through said slot and to engage with said lower end portion of the bit for suspending said coupler from the bit, said slot providing for relative longitudinal lost motion between said drill bit and coupler, whereby said bit, with the weight of the drill string superimposed thereon, may be dropped so as to make impact against said coupler for driving said core barrel into the bottom of a drill hole for obtaining a sample.

3. For attaching a core barrel to a deep well churn drill bit having a body with diametrically opposed mud channels in the lateral wall thereof, extending parallel to the axis thereof and having abutment means at the lower ends of said channels, a coupler comprising: a head having at its lower end means for attaching the core barrel thereto; a pair of reins attached to and projecting upwardly from said head in diametrically opposed, parallel, spaced relation such as to be receivable in said mud channels; and abutment engaging means projecting laterally from the upper ends of said reins and engageable with said abutment means for suspending said coupler from the bit, said mud channels being arranged to provide for relative longitudinal lost motion between said drill bit and coupler, said lost motion being of an amplitude slightly greater than the distance between the lower end of said bit and said coupler head when the coupler is suspended from the bit, whereby said bit will strike a hammer blow against the coupler when moved downwardly while the core barrel is resting on the bottom of a drill hole.

4. The combination defined in claim 1, wherein said drill bit body has an axial slot joining said mud channels and a solid lower end portion bridging the bottom of said slot and constituting said abutment means; said abutment engagement means comprising a key extending transversely through said slot and said reins having means releasably engaging the ends of said key.

5. The combination defined in claim 1, wherein said drill bit body has an axial slot joining said mud channels and a solid lower end portion bridging the bottom of said slot and constituting said abutment means; said abutment engagement means comprising a key extending transversely through said slot and said reins having transverse apertures in which the ends of said key are releasably engaged.

6. The combination defined in claim 1, wherein said abutment means comprises a bracelet detachably secured to and girdling the lower end of said drill bit, and wherein said abutment engaging means comprises integral cross heads at the upper ends of said reins, projecting laterally therefrom for engagement with said bracelet; said bracelet having portions bridging said mud channels to provide spaces in which said reins are slidably embraced between said bracelet portions and said coupler body.

7. The combination defined in claim 1, wherein said abutment means comprises a bracelet detachably secured to and girdling the lower end of said drill bit, and wherein

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said abutment engaging means comprises integral cross heads at the upper ends of said reins, projecting laterally therefrom for engagement with said bracelet; having outwardly arched portions bridging said mud channels to provide spaces in which said reins are slidably embraced between said bracelet portions and said coupler body, said outwardly arched bridging portions having extensions projecting axially toward said cross heads to provide abutment seats for engagement by said cross head.

8. The combination defined in claim 1, including an adapter having means for detachably connecting the same to said coupler head and to said core barrel respectively, with said adapter interposed therebetween.

9. The combination defined in claim 1, including an adapter having means for detachably connecting the same

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to said coupler head and to said core barrel respectively, with said adapter interposed therebetween, said coupler head and adapter having correspondingly positioned laterally opening bleed ports and outwardly opening check valves normally closing said ports, said core barrel having a bleed outlet with a laterally extending terminal portion position to register with either of said ports.

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