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CORING TOOL
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Fig. 1

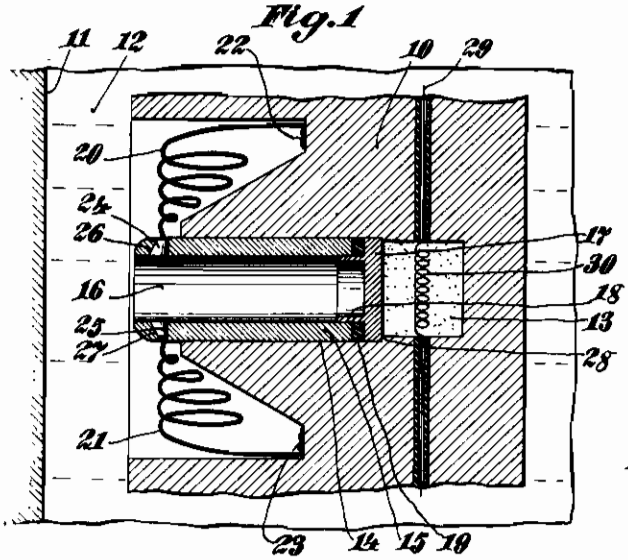


Fig. 2

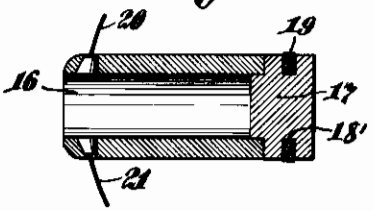


Fig. 3

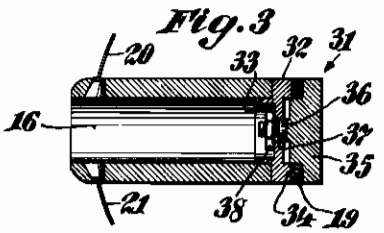


Fig. 6

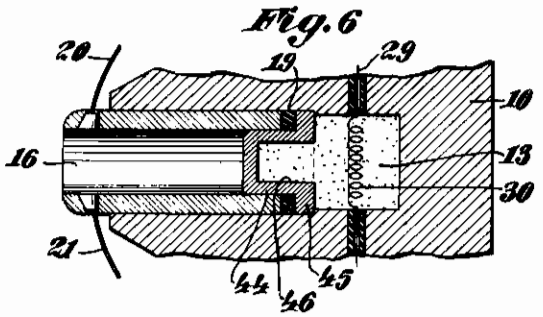


Fig. 4

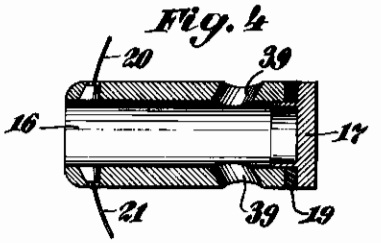


Fig. 7

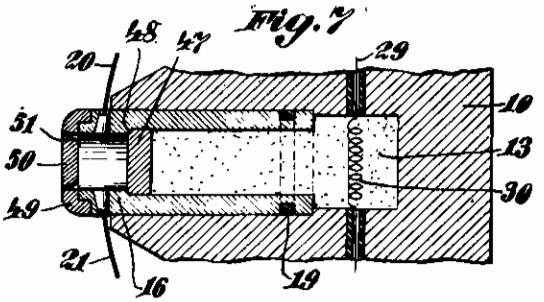
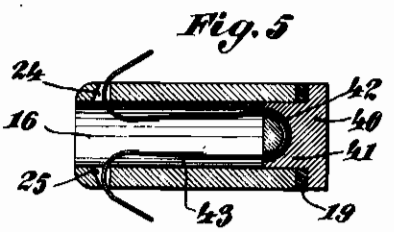


Fig. 5



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ALIEN PROPERTY CUSTODIAN

CORING TOOL

Marcel Schlumberger, Paris, France; vested in the Alien Property Custodian

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The present invention relates to coring devices, and more particularly to a new and improved coring tool for extracting a sample or core from a formation located beneath the surface of the earth. Formations of this character may include broadly those forming the side and bottom walls of a bore hole, and those forming the beds of lakes, seas, etc., for example.

More specifically, the invention relates to a new and improved coring tool of the projectile type, which is adapted to be projected into a formation by means of a special form of gun lowered to the level of the formation, for extracting a core therefrom.

Heretofore, a coring tool has been used which comprises a hollow member, usually tubular in shape, open at its front end and closed at the rear. Experience has shown that in some cases there are certain disadvantages in using a coring tool of this type. For example, when a coring tool of this character is projected through a fluid such as water, for example, it becomes filled with the fluid, thus reducing the amount of space available for receiving the core which is to be extracted from the formation.

A primary object of the invention, accordingly, is to provide a new and improved coring tool which may be projected through a fluid without any possibility of fluid being trapped in the tool, thus making the entire core receiving space in the tool available for the core extracted from the formation.

Another object of the invention is to provide a new and improved coring tool in which means is provided for permitting the escape of any fluid which may enter the tool after its discharge from the gun.

A further object of the invention is to provide a new and improved coring tool of the above character having a closure member which is adapted to be rendered ineffective by the pressure of the fluid through which it is projected.

A still further object of the invention is to provide a coring tool of the above character which forms a portion of the powder chamber for containing the charge used in projecting the tool into a formation.

In accordance with the invention, a coring tool is provided which comprises a hollow member, preferably tubular in shape, having a closure member therein which is secured against forward motion within the hollow member, but which is capable of being moved rearwardly out of the hollow member by the application of force. The forces developed by the explosion of the charge in the gun are directed against the rear face of the closure member, imparting the requisite high velocity to the tool. In several modifications, however, as soon as fluid enters the hollow member, a fluid pressure is exerted against the closure member, pushing it rearwardly out of the hollow member and allowing the fluid trapped therein to escape.

The closure member may be located at the rear end of the coring tool, or it may be disposed adjacent the forward portion of the tool, in which case the space behind it may be used as a portion of the powder chamber for containing the charge of powder, as described in detail hereinafter.

Additional objects will become apparent from the following detailed description of several embodiments, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view in vertical section of a coring tool constructed in accordance with the present invention, shown in firing position in a gun;

Figure 2 is a view in vertical section of a modification of the coring tool shown in Figure 1;

Figure 3 illustrates another embodiment of the invention;

Figure 4 illustrates a further modification in which apertures are provided in the coring tool to permit fluid trapped therein to escape;

Figure 5 is a view in vertical section of a modification in which the removable rear closure member is secured to the cable for withdrawing the tool from the formation;

Figure 6 illustrates another modification in which the coring tool constitutes a part of the powder chamber; and

Figure 7 shows a further modification of the device shown in Figure 6, in which a temporary front closure member is provided.

The core taking tool of this invention will be described in connection wtih bore hole practice for the sake of simplicity, although it may be used with equal facility to obtain cores from the bed of a lake or the sea, as will be apparent to those skilled in the art.

Considering Figure 1, a portion of a gun 10 of a well known type is shown adjacent the lateral wall 11 of a bore hole containing fluid, such as for example, the liquid or mud 12. Apparatus for raising and lowering the gun 10 in the bore hole is well known in the art and need not be described in detail.

Located within the gun 10 is a powder chamber 13 communicating with a laterally extending barrel portion 14 within which is disposed a coring tool 15 constructed in accordance with the

present invention. The coring tool 15 comprises a hollow open ended member 16, preferably tubular in shape, and having a rear closure member 17. The rear closure member 17 is provided with a sleeve portion 18 which is adapted to be tightly fitted within the hollow member 16.

An annular ring 19 of flexible material such as rubber, for example, is disposed between the rear closure member 17 and the rear edge of the hollow member 16, which is adapted to be compressed, as described hereinafter, to provide a fluid tight joint between the hollow member 16 and the barrel portion 14 of the gun. The coring tool 15 is adapted to be withdrawn from the formation 11 by means of the flexible cables 20 and 21, which are secured to the gun 10 at the points 22 and 23, respectively. The other ends of the cables 20 and 21 are connected to the plugs 24 and 25, respectively, which are secured within the apertures 26 and 27, respectively, formed in the forward portion of the hollow member 16.

As is disclosed in my prior patent No. 2,055,506, the flexible connections 20 and 21 between the coring tool 15 and the gun 10 enable the coring tool 15 and the core contained therein to be withdrawn from the formation 11 merely by raising the gun 10 to the surface of the earth in the well known manner.

Before the gun 10 is lowered into the bore hole, the flexible annular ring is placed upon the rear edge of the hollow member 16 and the rear closure member 17 is lightly pressed into position with its sleeve portion 18 inserted within the hollow member 16. The diameter of the hollow member 16, the flexible ring 19 and the rear closure member 17 are so chosen that a slight air space exists between the coring tool 15 and the barrel portion 14 of the gun 10 when the coring tool 15 is inserted into the barrel portion 14. This air space permits the escape of any air trapped behind the coring tool 15 as it is inserted into the barrel portion 14 of the gun 10.

When the flexible ring 19 and the rear closure member 17 have been placed in the proper position on the hollow member 16, as indicated above, the coring tool 15 is pushed into the barrel portion 14 of the gun 10 until the rear closure member 17 engages a small shoulder portion 28 adjacent the powder chamber 13. Then by applying additional force to the coring tool 15, the rear closure member 17 may be tightly driven into the hollow member 16, thus compressing the ring 19 of flexible material so that it increases its outer diameter to form a fluid tight seal.

The gun 10 may then be lowered into the bore hole to the level of the formation 11 from which it is desired to extract a core. When in the desired position, the charge of powder contained in the powder chamber 13 may be ignited in any known manner as, for example, by passing current from the surface of the earth through an insulated conductor 29 to a heater coil 30 in contact with the powder in the powder chamber 13. The forces developed by the explosion gases are directed against the rear closure member 17 so that the coring tool 15 is projected through the fluid 12 in which the gun 10 is immersed, into the formation 11 which is to be investigated.

As the coring tool 15 passes through the fluid 12, the fluid rushes into the hollow member 16, creating a relatively high fluid pressure against rear closure member 17. This fluid pressure acts to loosen the rear closure member 17 from the hollow member 16 so that its sleeve portion 18 is pushed out of the hollow member 16, permitting the fluid trapped therein to escape. The coring tool 15 is now open at both its front and rear ends, so that any water entering the hollow member 16 will be driven out through the rear opening by the core collected therein as the hollow member 16 penetrates the formation 11 which is to be investigated.

The gun 10 may then be raised to the surface of the earth in the usual manner, to withdraw the coring tool 15 and the core contained therein from the formation 11 through the flexible connections 20 and 21 between the coring tool 15 and the gun 10.

If desired, the annular ring 19 of flexible material may be inserted within a groove 18' formed in the rear closure member 17 as shown in Figure 2. Where this is done the ring 19 should be made larger in diameter than the outer diameter of the hollow portion 16 of the coring tool 15 in order to provide a fluid tight joint between the coring tool 15 and the barrel portion 14 of the gun 10. In this modification, air is necessarily compressed behind the rear closure member 17 as the coring tool 15 is inserted within the barrel portion 14 of the gun 10.

Accordingly, it is necessary to provide suitable means for retaining the coring tool 15 in position in the gun barrel against the pressure of the air compressed within the powder chamber 13. Any known means may be used for this purpose although it is preferred to coat the periphery of the rear closure member 17 with a suitable adhesive material, such as glue, for example, by means of which the coring tool 15 may be retained in the firing position until the charge of powder in the powder chamber 13 is ignited.

In the modification illustrated in Figure 3, a composite rear closure member 31 is provided which comprises a disc 32 having a sleeve 33 formed thereon which is adapted to be tightly fitted within the rear opening of the hollow member 16. The disc 32 is provided with an annular rim 34 on which the flexible packing ring 19 is adapted to be placed. The flexible ring 19 is held in position by a rear plate 35 having a central portion 36 which is adapted to extend through an aperture 37 formed in the disc 32. The end of the central portion 36 is threaded to receive a nut 38 by means of which the rear plate 35 may be tightened down on the flexible ring 19 to compress it between the disc 32 and the rear plate 35.

In this modification, the nut 38 is released until the diameter of the flexible ring 19 is substantially equal to the diameter of the hollow member 18 in order to provide an air space for permitting the escape of air entrapped behind the coring tool 15 as it is inserted into the barrel portion 14 of the gun. The coring tool is pushed into the barrel portion 14 until the rear plate 35 engages the shoulder portion 28 adjacent the powder chamber 13.

At this point the nut 38 is tightened up to compress the flexible ring 19 between the disc 32 and the rear plate 35. This causes the flexible ring 19 to expand radially to form a fluid tight fit for preventing the seepage of fluid from the bore hole into the powder chamber 13. This embodiment operates in exactly the same manner as the device disclosed in Figure 1, the entire composite rear closure member 31 being pushed out of the hollow member 16 by the pressure of the fluid collected within the coring tool 15 as it passes through the fluid 12 in which the gun 10 is immersed.

As shown in Figure 4, a plurality of apertures 39 may be formed in the hollow member 16 in order to permit any fluid collected therein to escape. The apertures 39 aid in permitting the escape of fluid from the hollow member 16, and they also provide an emergency exit for the fluid in the event that the rear closure member 17 for any reason fails to become detached from the hollow member 16.

It will be noted that in the embodiments described above, after the rear closure member is removed from the hollow member 16 by the pressure of the fluid therein, it can not be recovered. However, if desired, it is possible to connect the rear closure member to the hollow member 16 so that it may be readily recovered after the coring tool 15 has been discharged into a formation, as shown in Figure 5.

Referring to Figure 5, a rear closure member 40 is provided, having a plug 41 formed thereon which is adapted to be tightly fitted within the hollow member 16. Within the plug 41 is formed a U-shaped passage 42 through which a flexible cable 43 is adapted to be threaded. The ends of the cable 43 may be passed through the apertures 24 and 25, respectively, formed in the forward portion of the hollow member 16 and they may be secured to the gun 10 as indicated in Figure 1.

The flexible cable 43 is made sufficiently long so that the rear closure member 40 will remain separated from the hollow member 16 after the coring tool 15 has been projected into the formation 11 in order to permit any fluid trapped in the hollow member to escape. When the gun is raised to the surface, however, the tension in the cable 43 will hold the rear closure member 40 tightly against the rear portion of the hollow member 16 so that it may be raised to the surface of the earth with the coring tool 15.

Where desired, the coring tool 15 may be utilized as a portion of the powder chamber within which the charge of powder is contained, as illustrated in Figures 6 and 7. This may be accomplished by providing a rear closure member which comprises a cup-shaped portion 44 (Fig. 6) which adapted to be tightly fitted within the hollow member 16, and an annular flange 45 forming a tubular enclosure 46 communicating with the powder chamber 13. In this modification the effective powder chamber comprises the powder chamber 13 and the tubular enclosure 46.

In the modification illustrated in Figure 7, a transverse partition 47 is provided which is adapted to be snugly received within the hollow portion 16. The partition 47 is adapted to bear against a shoulder 48 formed within the forward portion of the hollow member 16, which prevents the partition 47 from being moved forwardly within the hollow member 16. Tightly fitted on the front end of the hollow member 16 is a cap 49, the central portion 50 of which has been mechanically weakened, as for example, by providing a circular groove 51 therein to facilitate its being shorn off from the cap 49 by impact with the formation 11.

After the coring tool 15 has been discharged from the gun 10, the cap 49 prevents any fluid from entering the hollow member 16, so that the partition 47 remains in position while the coring tool 15 passes through the fluid 12 in the bore hole. Upon impact with the formation however, the mechanically weakened central portion 50 of the cap 49 is shorn off and is pushed rearwardly against the parition 47. As the hollow member 16 penetrates the formation 11 the core contained therein pushes both the shorn off central portion 50 of the cap 49 and the partition 47 rearwardly out of the hollow member 16.

It will be evident that this last embodiment enables a considerable portion of the entire volume of the coring tool 15 to be utilized as a portion of the powder chamber of the gun 10. Accordingly, where this type of coring tool is used, the size of the powder chamber 13 may be considerably reduced without producing any substantial reduction in the magnitude of the force exerted in projecting the tool 15 into a formation. In some cases it may be dispensed with entirely, in which case the charge of powder would be disposed behind the partition 47 in the hollow member 16. This feature is of great importance in bore holes where there are definite limitations upon the size of the gun that can be used.

From the foregoing, it will be apparent that the invention enables cores to be readily and effectively extracted from formations in those cases where the coring tool is discharged from a gun immersed in a fluid, such as water, or mud. Furthermore, where the gun is not immersed in water, the partition in the hollow member will be moved rearwardly out of the hollow member in a similar manner by the pressure of the surrounding air through which the tool is projected, permitting any entrapped air to escape, and enabling the entire volume of the hollow member to be utilized for receiving the core.

Moreover, by using a detachable transverse partition in the coring tool, the coring tool may be utilized as a portion of the powder chamber, thus enabling the size of the powder chamber located within the gun to be substantially reduced.

As indicated above, it is to be clearly understood that the present invention is not to be limited to the extraction of cores from the lateral or bottom walls of bore holes. It will be evident that the coring tool can be used with equal facility for extracting cores from formations located beneath bodies of water, such as the beds of lakes, or seas, for example, and it is to be understood that all such uses are to be comprehended within the scope of the invention.

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