

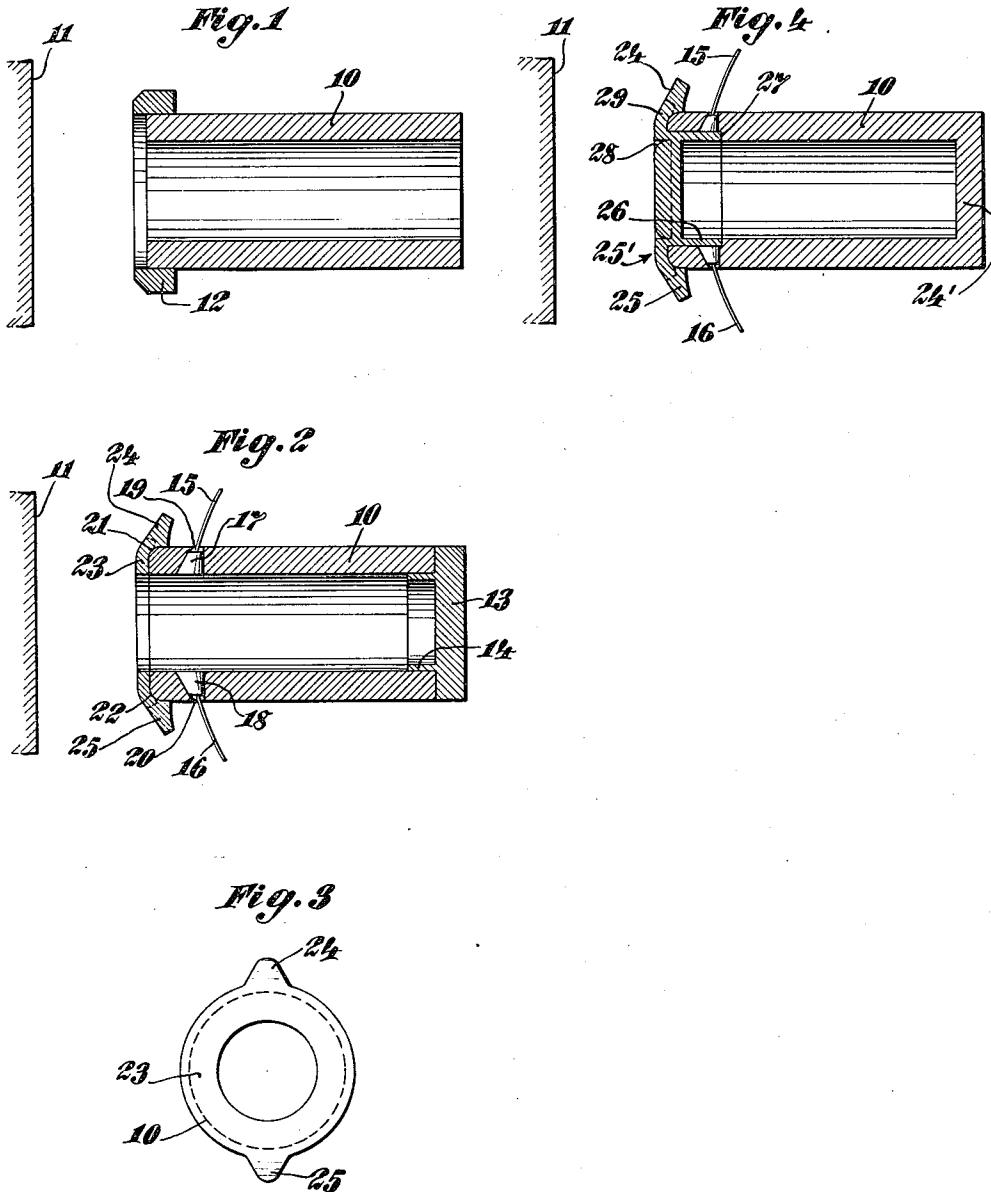
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CORE TAKING PROJECTILE

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## CORE TAKING PROJECTILE

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The present invention relates to devices for extracting cores from rock walls and other geological formations located below the surface of the earth, such as the bottom and side walls of a bore hole drilled into the earth or formations located beneath bodies of water such as the beds of lakes, seas, etc., for example.

More specifically, it relates to a new and improved core taking device which is adapted to be projected into a formation to be investigated for the purpose of obtaining a sample or core therefrom.

In the present practice, cores or samples of formations of the above character are usually obtained by projecting a hollow core taking tool into a formation by means of a gun of a well known type, lowered to the level of the formation to be investigated. After it has been discharged into a formation, the tool and the core or sample contained therein are withdrawn from the formation and raised to the surface of the earth in order that the core may be examined. To this end, the core taking tool is sometimes secured to the gun through a flexible connection, as disclosed in my prior Patent No. 2,055,506, for example, in order that the tool may be withdrawn from the formation merely by raising the gun to the surface of the earth.

It sometimes happens, however, that the core taking tool becomes so firmly embedded in a formation that it cannot be withdrawn therefrom, and the flexible connection, by means of which it is secured to the gun, must be broken in order that the gun may be raised to the surface of the earth. In such case, the core taking tool cannot be recovered.

An object of the present invention, accordingly, is to provide a new and improved core taking tool which may be readily and effectively withdrawn from the formation into which it has been projected.

Another object of the invention is to provide a core taking device which is adapted to bore a hole in a formation of greater diameter than the core taking tool itself, whereby the latter may be withdrawn from the formation by the application of relatively small force.

A further object of the invention is to provide a core taking tool having means for boring a hole of greater diameter than itself, which means is adapted to become disengaged from the tool after the latter has been discharged from a gun, whereby the tool and the core or sample contained therein may be readily withdrawn from the formation.

In accordance with the invention, a composite core taking tool is provided which comprises a hollow portion for receiving a core and a removable forward portion of slightly greater diameter than the hollow portion, which is adapted to bore a hole in a formation of greater diameter than the hollow portion when the tool is discharged from a gun. The forward portion of the tool is so connected to the hollow portion that the two form a unitary device until the gun is fired, when the forward portion separates from the hollow portion due to the forces of impact arising when the device is projected into a formation.

It will be apparent that even though the larger forward portion should become so firmly embedded therein that it cannot be withdrawn, the inner hollow core taking tool can always be readily removed from the forward portion with a relatively small force, since it is disengaged from the forward portion by the forces of impact.

The invention may be better understood from the following detailed description of several specific embodiments taken in connection with the accompanying drawing, in which:

Figure 1 is a view in longitudinal section of a core taking tool constructed in accordance with the present invention;

Figure 2 is also a view in longitudinal section of a modified form of core taking tool constructed in accordance with the invention;

Figure 3 is a front view of the tool illustrated in Figure 2; and

Figure 4 is a view in longitudinal section of another embodiment of the invention in which means is provided for preventing the flow of liquid into the core taking tool.

Referring to Figure 1, a hollow core taking tool is shown at 10 in position adjacent the wall 11 of a formation to be investigated. The gun, together with the apparatus for lowering it to the level of the formation are well known in the art and need not be described in detail.

It will be understood that when the core taking tool of this invention is used to investigate the bed of a lake, for example, the gun will be immersed in water, and the tool will be projected through the water into the formation. Likewise, when the tool is used in a bore hole containing fluid, it will be projected through the fluid into the formation.

Tightly fitted on the forward portion of the core taking tool 10 is an annular ring 12 of slightly larger diameter than the outer diameter of

the hollow core taking tool 10. When the core taking tool 10 is projected into the geological formation 11, which may be the wall of a bore hole for example, it bores a hole in the formation, the diameter of which is substantially equal to the outer diameter of the annular ring 12. At the same time, a portion of the formation 11 is forced into the hollow core taking tool 10.

As a result of force created by the impact between the ring 12 and the wall of the formation 11, the ring 12 becomes slightly deformed and is loosened from the core taking tool 10. Hence, even if the ring 12 becomes so tightly embedded in the formation 11 that it cannot be removed, the core taking tool 10 and the core contained therein can be readily withdrawn from the ring 12. It will be evident, therefore, that the invention enables the core taking tool to be readily and effectively withdrawn from a formation, even under the most difficult conditions of operation.

In the modification of Figure 2, the core taking tool is provided with a rear closure portion 13 on which is formed a ring portion 14 which is adapted to be tightly fitted within the hollow core taking tool 10. The rear closure member 13 provides an extended area over which the force of the explosion gases may be developed, in order to give the core taking tool 10 a high initial velocity after it has been discharged from the gun. In operation, the fluid pressure exerted on the rear closure member 13 as the tool 10 is projected through the fluid adjacent the formation 11 pushes it out of the core taking tool 10. This construction enables the fluid to flow freely through the rear end of the core taking tool 10, thus making the entire volume of the core taking tool 10 available for containing the core cut from the formation 11.

After the core taking tool has been projected into the formation 11, it may be withdrawn therefrom by applying force to the flexible cables 15 and 16. The cables 15 and 16 terminate in enlarged portions 17 and 18, respectively, which are secured within the apertures 19 and 20, respectively, located in the forward portion of the core taking tool 10. In this embodiment, the forward edge of the core taking tool is curved at 21, and is adapted to be driven into a corresponding curved portion 22 formed in the under surface of an annular flange 23 to form a tight fit. The flange 23 is made of slightly larger diameter than the diameter of the tool 10, so that it will bore a correspondingly larger hole in the formation 11 after being projected from a gun.

This modification operates in essentially the same manner as the device shown in Figure 1, except that the closure portion 13 is removed from the core taking tool 10 when the tool 10 passes through the water adjacent the formation 11. In order to protect the flexible cables 15 and 16 during the penetration of the formation 11, the annular flange 23 is provided with a pair of radially extending lugs 24 and 25, as shown in Figure 3.

The modification of Figure 4 is similar to that shown in Figure 2, except that it is provided with a permanent rear closure member 24'. Ordinarily, where such a core taking tool is used in a gun which is immersed in fluid, it is difficult to obtain a useful core because after the core taking tool 10 has been discharged, it tends to fill with fluid, thus preventing the core from entering the tool.

In order to avoid this, the core taking tool 10 is provided with a forward closure member

25' on which an annular sleeve 26 is formed, which is adapted to be tightly fitted within a shoulder 27 formed within the core taking tool 10. The closure member 25' is mechanically weakened in its central portion, as for example, by providing a circular groove 28 therein so as to facilitate its shearing off when the core taking tool 10 engages the wall of the formation 11. The forward closure member 25' is also provided with a flange 29 of slightly greater diameter than the outer diameter of the core taking tool, so that it will bore a hole of greater diameter than the outer diameter of the tool when the latter is projected into the formation 11.

In this modification, the forward closure member 25' prevents any fluid from entering the tool 10 after it has been discharged from the gun. However, when the closure member 25' strikes the wall of the formation 11, the mechanically weakened central portion thereof is shorn away and is pushed rearwardly into the tool 10, so that the rocks forming the core can freely penetrate into the core taking tool 10. As the flange 29 on the forward closure member 25' penetrates into the formation, it bores a hole of diameter slightly greater than the outer diameter of the tool 10 and the force of impact releases the core taking tool 10 from the forward closure portion 25'. Hence the core taking tool 10 may be readily removed from the formation 11 after the core has been taken, as indicated above.

While I have in the above description disclosed what I deem to be practicable and efficient embodiments of the invention, it should be well understood that I do not wish to be limited thereto, as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

I claim:

1. A coring tool comprising a hollow member adapted to be driven into a formation, and an element detachably secured to the hollow member, said element having means extending outwardly from the said hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to be loosened by the impact of the tool with the formation in order to facilitate the removal of the hollow member from the formation.

2. A coring tool comprising a hollow member adapted to be driven into a formation, and an apertured element detachably secured to the hollow member at the forward portion thereof, said element having means extending outwardly from the said hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to be loosened by the impact of the tool with the formation, in order to facilitate the removal of the hollow member from the formations.

3. A coring tool comprising a hollow member adapted to be driven into a formation, and an annular element detachably secured to the hollow member at the forward portion thereof, said annular element having means extending outwardly from the hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to be loosened by the impact of the tool with the formation in

order to facilitate the removal of the hollow member from the formation.

4. A core taking tool comprising a hollow member adapted to be driven into a formation, and a detachable annular ring tightly fitted on the hollow member at the forward portion thereof, said annular ring being of greater diameter than the outer diameter of the hollow member, and being adapted to be loosened by the impact of the tool with the formation, in order to facilitate the removal of the hollow member from the formation.

5. A core taking tool comprising a hollow member adapted to be driven into a formation, and an outwardly extending flange on the hollow member, detachably secured at the forward portion thereof, said flange being adapted to remain imbedded in the formation after the hollow member has been detached therefrom, in order to facilitate the removal of the hollow member from the formation.

6. A coring tool comprising a hollow member adapted to be driven into a formation, a closure member for the hollow member, and an element detachably secured to the hollow member at the forward portion thereof, said element having means extending outwardly from the outer surface of the hollow member for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to remain imbedded in the formation after the hollow member has been detached therefrom, in order to facilitate the removal of the hollow member from the formation.

7. A core taking tool comprising a hollow member adapted to be driven into a formation, a removable closure member for the hollow member, an element detachably secured to the hollow member at the forward portion thereof, said element having means extending outwardly from the hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to be loosened by the impact between the tool and the formation, and means for withdrawing the hollow member from the formation.

8. A core taking tool comprising a hollow member adapted to be driven into a formation, a removable closure member for the hollow member, means for preventing forward movement of the closure member relative to the hollow member, an element detachably secured to the hollow member at the forward portion thereof, said element having means extending outwardly from the hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to remain imbedded in the formation after the hollow member has been detached therefrom, and means for withdrawing the hollow member from the formation.

9. A core taking tool comprising a hollow member adapted to be driven into a formation, a removable rear closure member for the hollow member, means for preventing forward movement of the said closure member, an annular element detachably secured to the hollow member adjacent the forward portion thereof, said annular element having means extending from the outer surface of the hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional

area of the hollow member, and being adapted to be loosened by the impact between the tool and the formation, means for withdrawing the hollow member from the formation, and means on the annular element for protecting said withdrawing means from damage by impact with the formation.

10. A core taking device comprising a hollow member adapted to be driven into a formation, and a detachable front closure member for said hollow member, said closure member having means extending beyond the outer surface of said hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to be loosened by the impact of the tool with the formation, in order to facilitate the removal of the hollow member from the formation.

11. A core taking device comprising a hollow member adapted to be driven into a formation, and a detachable front closure member for the hollow member, having means extending beyond the outer surface of said hollow member, for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, said closure member having a mechanically weakened portion adapted to be shorn off by the impact of the closure member with the formation, and said closure member being adapted to be loosened by the impact of the tool with the formation, in order to facilitate the removal of the hollow member from the formation.

12. A core taking device comprising a hollow member adapted to be driven into a formation, a rear closure member for the hollow member, a detachable front closure member for the hollow member, having an outwardly extending flange thereon, the central portion of said front closure member being mechanically weakened to facilitate its being shorn off by the impact of the tool with the formation, and said front closure member being adapted to be loosened by the impact of the tool with the formation, and means for withdrawing the hollow member from the formation.

13. A coring tool comprising a hollow member adapted to be driven into a formation, and an element detachably secured to the hollow member for making a hole in a formation, of greater cross-sectional area than the outer cross-sectional area of the hollow member, and being adapted to be loosened by impact of the tool with the formation, in order to facilitate the removal of the hollow member from the formation.

14. In apparatus for obtaining samples of earth formations surrounding a bore hole, the combination of a hollow core-receiving projectile, adapted to be fired from a gun into a formation, a member detachably secured to the forward end of said projectile for making a hole in the formation which is of greater cross-sectional area than the outer cross-sectional area of the projectile, and means for applying a pulling force to the projectile after it has been fired into a formation to pull it away from the said member, leaving said member in the formation, whereby the withdrawal of the projectile from the formation may be facilitated.

15. A coring tool for obtaining samples of earth formations surrounding a bore hole, comprising a hollow core-receiving projectile, adapted to be fired from a gun into a formation, and a detachable member secured at the front

end of the projectile, for making a hole in a formation which is of greater cross-sectional area than the outer cross-sectional area of the projectile, said projectile being detachable from the member, after the tool has been driven into a formation, by the application of a pulling force thereto, and the said detachable member being adapted to remain in the formation after separation of the projectile therefrom, whereby the extraction of the projectile from a formation may be facilitated.

16. A coring tool for obtaining samples of

earth formations surrounding a bore hole, comprising a hollow core receiving projectile, adapted to be fired from a gun into a formation, and a detachable member secured at the front end of the projectile, for making a hole in a formation which is of greater cross-sectional area than the outer cross-sectional area of the projectile, said detachable member being adapted to remain embedded in the formation after the projectile has been detached therefrom by the application of a pulling force thereto.

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