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Nos. 214, 215, 216, 217, 218, 219, and 220

A COMPILATION OF ARTICLES REPORTING RESEARCH

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THE U.S. ATOMIC ENERGY COMMISSION

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U.S. Atomic Energy Commission
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Technical Report No. 214

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INSTRUMENTS AND METHODS

A device for releasing a piston corer and deactivating the piston*

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Abstract—A device is described for releasing a piston corer, holding the piston cable during free fall and penetration, and deactivating the piston by dropping the piston cable. Combined in the instrument are a cocking and triggering device, a safety catch, and a closed-system timing cylinder with a needle valve that controls circulation of oil and thereby regulates the time the piston cable is held. The device eliminates the complexity, unreliability and much of the time involved in the use of previous deactivators.

INTRODUCTION

WHEN total barrel penetration is not achieved with a Kullenberg-type piston corer (KULLENBERG, 1947), and the corer is extracted by hauling on the piston cable, the cored sediment can be badly disturbed by the resulting upward movement of the piston. Erroneous sequences and thicknesses of sediment layers may also be obtained, as demonstrated by BURNS (1963). Thus, in coring sediment where total barrel penetration is not possible, the piston should be immobilized at the level of penetration so that no alteration of the core can occur during retrieval.

Several piston deactivators and immobilizers have been tested at the Department of Oceanography, University of Washington. An automatic cable-clamping device termed a piston immobilizer was developed by BADER and PAQUETTE (1956). This device proved moderately successful, but, being an integral part of a special coring device, was not easily adaptable to other piston corers.

Variations of an unpublished design for a deactivator utilizing a water-filled timing cylinder with a retracting shaft that released the piston cable required an excessive amount of time to cock and often failed because the force on the piston cable would not allow the shaft to move.

The device of EMERY and BROUSSARD (1954) requires a messenger to obtain slackness in the piston cable. This design appears limited to shallow water use because of the difficulty of keeping the winch cable taut during a long period of time for the descending messenger in deep water, especially with the ship drifting.

Many malfunctions, the lack of versatility, and the excessive amount of time and complexity involved in the use of existing devices prompted the development of a deactivator that has proven completely reliable, fast, and simple to use.

DESCRIPTION AND USE

The deactivator (Fig. 1) is combined with the release mechanism and is affixed to the winch cable by a grooved clamping plate. The function of the combined unit is (1) to release the corer when the tripping weight makes contact with the bottom, (2) to hold the piston cable during free fall and penetration and (3) to release the piston cable after the corer has ceased to penetrate the sediment.

The timing mechanism of the deactivator is an oil-filled cylinder (Fig. 1) in which oil passes from the chamber on one side of a spring-actuated piston to the chamber on the other side through a duct in the body of the cylinder. The duct contains a needle valve that controls the flow of oil and thereby regulates the time the piston cable is held.

The deactivator is cocked by pulling down the cocking handle (Fig. 1) after the corer ring and piston cable ring (Fig. 1) have been inserted into their slots. The cocking handle pushes the shaft down and

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moves the triggering lever over onto the collar of the shaft. The spring-actuated safety catch snaps into place (Fig. 1) holding the cocking handle down, which keeps the tripping arm from moving up and prevents premature release of the corer.

In Fig. 1a the deactivator is cocked with the safety on for handling on deck. Figure 1b shows the safety off for lowering to the bottom. The safety release can be pulled at water level with a boathook or lanyard. Figure 1c shows the deactivator when the tripping weight reaches the bottom, releasing the corer. The shaft of the deactivator starts to move upward when the tripping arm moves the triggering lever off the shaft collar. The piston cable is held (Fig. 1d) until the shaft travels far enough to allow the cable release lever to rotate and drop the piston cable (Fig. 1e).

The needle valve is set so that the piston cable is held longer than the time required for free fall and penetration. The correct setting can be obtained in the shipboard laboratory. A weight of 10–20 kg is hung on the cable release lever and the needle valve is adjusted so that 10–15 sec are required for the deactivator to release the weight. It is estimated that a 5 m corer will free fall 2 m and penetrate fully in less than 3 secs.

Laboratory tests have also demonstrated the efficiency and reliability of the design. These tests consisted of raising the tripping arm which released a weight that fell 1 meter and exerted its force on the piston release lever. The magnitude of the weight was gradually increased to determine the relationship between the force on the piston release lever and the time the piston cable was held. From these tests was derived the procedure described above for setting the needle valve. Several hundred of these tests were conducted using a weight greater than the estimated force on the piston cable during the coring operation to ascertain the durability of the components of the deactivator. The deactivator has been used on four cruises by the Department of Oceanography, University of Washington. Corers of various lengths and weights have been employed, and no malfunctions were experienced.

Acknowledgements—The timing cylinder was designed by Mr. D. R. FENTON who also produced engineering drawings from the writer's model. The deactivator was constructed in the Developmental Laboratory of the Department of Oceanography, University of Washington. This work was supported by the Office of Naval Research under contract Nonr-477 (37), project NR 083 012, and by the Atomic Energy Commission under contract AT (45-1) 1725 (this report is RLO-1725-88).

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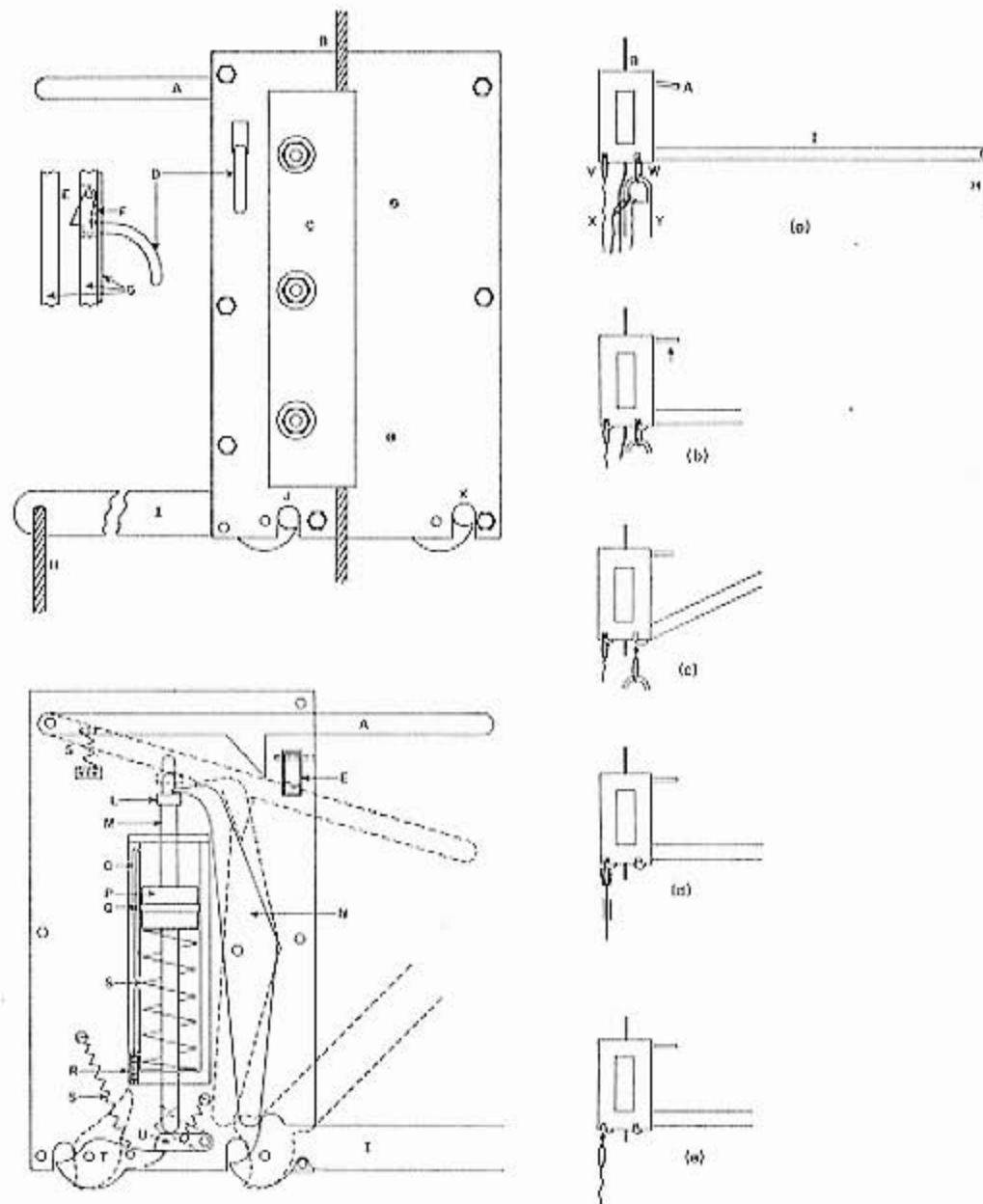


Fig. 1. External and internal views of deactivator (left-hand part of figure)

- | | |
|--------------------|-------------------------------|
| A. Cocking handle | K. Piston cable ring slot |
| B. Main cable | L. Collar of shaft |
| C. Clamping plate | M. Shaft of timing cylinder |
| D. Safety release | N. Triggering lever |
| E. Safety catch | O. Oil duct |
| F. Spring | P. Piston |
| G. Body plates | Q. O-ring of piston |
| H. Tripping cable | R. Needle valve |
| I. Tripping arm | S. Springs |
| J. Corer ring slot | T. Piston cable release lever |
| | U. Bearing lever |

Deactivator during use (right-hand part of figure)

- | |
|----------------------------|
| (a) Ready for lowering |
| A. Cocking handle |
| B. Main cable |
| V. Piston cable ring |
| W. Corer ring |
| X. Piston cable |
| Y. Corer |
| (b) During lowering |
| (c) Releasing corer |
| (d) Holding piston cable |
| (e) Releasing piston cable |