water with sufficient rapidity for purposes of accurate ob­servation is so great that it is found impracticable to bring it up again without putting an undue

strain upon the rope or seriously pro­

longing the operation. Hence in 1854

Brooke, an American, devised an ap­

paratus by which the weight was de­

tached when it reached

the bottom and only a

small tube containing a

sample of the bottom

was brought up. This

was in fact a modifica­

tion of an apparatus

which had been devised

by Hooke in the 17th

century ; he made an

arrangement in which a

light sphere was sunk

by a heavy weight, but

was liberated on reach­

ing the bottom,—the

depth being then de­

duced from the time

which elapsed between

the sinking of the globe

and its reappearance at

the surface. Of the

various modifications of

Brooke’s sounding ma­

chine, perhaps the most

famous is that con­

structed by the black­

smith of H.M.S. “Hy­

dra,” and commonly

known as the “Hydra

sounding rod.” It was

used on the cruises of

the “ Lightning ” and

“ Porcupine ” and dur­

ing the earlier part of

the “ Challenger” expe­

dition. This apparatus is shown in fig. 1, where AB is the rod, terminating in a tube below so that it may bring up a sample of the bottom ; the weights F fit loosely round it and are supported by the wire E which passes over the stud D, where a spring presses against it, the strength of which is so adjusted that it is unable to displace the wire as long as the strain of the weights

is upon it, but so soon as this is relieved by their rest­ing on the bottom the wire is thrust off the stud, and

when the line is hauled in the weights and wire are left behind.

An improved apparatus has recently been invented by Mr J. Y. Buchanan, and used by him on board the tele­graph ships “ Dacia ” and “ Buccaneer,” which can be used either in shallow or deep water, and has the advantage of bringing up samples both of the water and of the mud from the bottom. It consists of a hollow cylinder A, fig. 2, at the top and bottom of which are india-rubber valves H, K, opening upwards, so that water passes freely through them during the descent but is retained as soon as a plug of mud occupies the tube B. The weight EE which sur­rounds the cylinder is supported by a wire F passing over a peculiar hook D, shown separately in figs. 3, 4, 5 ; when sounding in shallow water it is not necessary to detach the weight, and the wire is therefore placed as in fig. 3 ; when working at greater depths the wire rests on the other side of the hook, as in fig. 4,—the result being that on the bottom being reached it falls into the upper part of the notch, fig. 5, and continues to press the tube into the mud, but when hauling up commences the wire slips out alto­gether and the weight is left at the bottom. A valve L, M, N is sometimes used to retain the sample of the bottom.

At the present time deep-sea sounding is extensively practised for telegraphic purposes, and is almost entirely conducted by means of wire instead of rope, a method introduced by Sir William Thomson. The friction of the wire in passing through the water is of course very much less than that of rope, and hence it runs out and can be hauled in much more rapidly; a smaller sinker may be used, and in very many instances it can be recovered. It is customary in sounding for cables to make very frequent obser­vations (once in from 1 to 50 miles), for it is found that the laying can be accomplished with much less risk of accident if the contour of the ocean-bed be accurately known. The saving of time by the use of wire is very considerable ; but the advantage is not so obvious in running out as in hauling in, because a heavier weight is used to increase the rate, this of course involving a loss of iron sinkers. For instance, an apparatus similar to that mentioned above as being used by the “Challenger” took on an average *24* m. *22 s. to* sink 2000 fathoms, whilst in a recent sounding by the “Albatross” the weight ran out 2000 fathoms in 20 m. 30 s. and was hauled in in 21 m. 9 s.,—a rate which would have been quite unattainable by the aid of rope. The saving in the matter of sinkers is by no means inconsiderable; instead of 3 or *4* cwts*.,* only 50 to 60 lb are used, and Sigsbee has calculated that this difference is sufficient to pay for any extra loss there may be by the breaking of the wire. Captain Magnaghi of the Italian navy and Captains Sigsbee and Belknap of the American Survey have successfully developed the method of sounding with wire, and owing to its use the last-mentioned officer was able to survey the route from San Francisco to Japan, doing all his sounding by hand, which would have been quite impossible had hempen rope been used. When soundings are made for scientific purposes it is customary to ascertain the temperature, both at the bottom and at intermediate depths, by a thermometer of special construction.

For further information, see Sir Wyville Thomson, The Depths of the Sea (London, 1874); Narrative of the Cruise of H.M.S. "Challenger" (London, 1885) ; Sigsbee, Deep-Sea Sounding and Dredging (Washington, 1S8O) ; Wille, Norwegian North Atlantic Expedition, pt. iv., “Apparatus and how used,' 1876-78; Mill, The Scottish Marine Station (Edinburgh, 1880); and, for an improved apparatus used on board the “Talisman,” La Nature, xii. p. 120, 1884 ; also the annual Reports of the U.S. Fish Commission. (W. E. HO.)

SOUTH, Robert (1633-1716), one of the wittiest of English divines, was the son of a London merchant, and was born at Hackney, Middlesex, in 1633. He was educated at Westminster school, whence in 1651 he was elected to Christ Church, Oxford. He became B.A. in 1654, and the same year wrote several Latin verses to congratulate Cromwell on concluding peace with the Dutch, which were published in a collection of university poems. The following year he published a Latin poem, entitled *Musica Incantans.* After commencing M.A. in 1657 he was in the habit before obtaining orders in 1658 of preaching as the champion of Calvinism against Socinianism and Arminianism. He was also at this time a strong supporter of Presbyterianism, but on the approach of the Restoration his views on church government under-