

volume, being kept itself full of water. From the volume of the overflow as compared with that of the bottle the depth at which it closed can be readily calculated.

The same principle has also been applied in the construction of a sounding machine for ascertaining the depth. A straight brass tube A (fig. 43) is closed at the lower end by a stop-cock B, and at the upper end by a nozzle C, to which the india-rubber tube D is attached inside the tube A. D is closed by a valve E, opening downwards. As this instrument sinks, water enters through C, D, and E into the brass tube A. When it begins to ascend, the water cannot get back through the valve E, and in expanding it crushes the tube D. On arrival at the surface, the excess of water is tapped off through B, and the depth calculated, regard being had to the temperature.

A water-bottle of peculiar and ingenious construction, used by Jacobsen in the German North Sea Expedition in the "Pommerania" in 1872,¹ was supplied to the Challenger, but was unfortunately mislaid at the fitting out, and notwithstanding repeated searches was not found till the ship returned. It is described by Dr. Jacobsen in the report of the above voyage, and also in Liebig's Annalen for May 1873.

Buchanan's Combined Sounding Tube and Water-Bottle.—Figs. 44, 45, 46, 47, represent a sounding tube with detaching weight, suitable for ordinary sounding with wire. With it good samples of the mud and of the bottom water are obtained without trouble. The instrument consists of the "water bottle" A, a tube about 18 inches long and 2½ inches in diameter, of about one litre capacity. It has at each end a valve H, K, made of india-rubber, on a metal seating, opening upwards. Above the upper valve H, the shank C is screwed into the tube A, and below the lower one K, the mud tube B, which is 12 inches long and 1 inch in diameter, is screwed to A. Into the lower end of the mud tube B can be inserted the valve L, which consists of a piece of thin sheet brass, cut out like a comb, and bent round into a cylindrical shape. It is soldered to a stouter piece of brass tube, which fits into the end of B and is retained by a bayonet-joint. At the upper end of the shank C the tumbler D supports the weight E by the sling F, and is in its turn supported by the sounding line M.

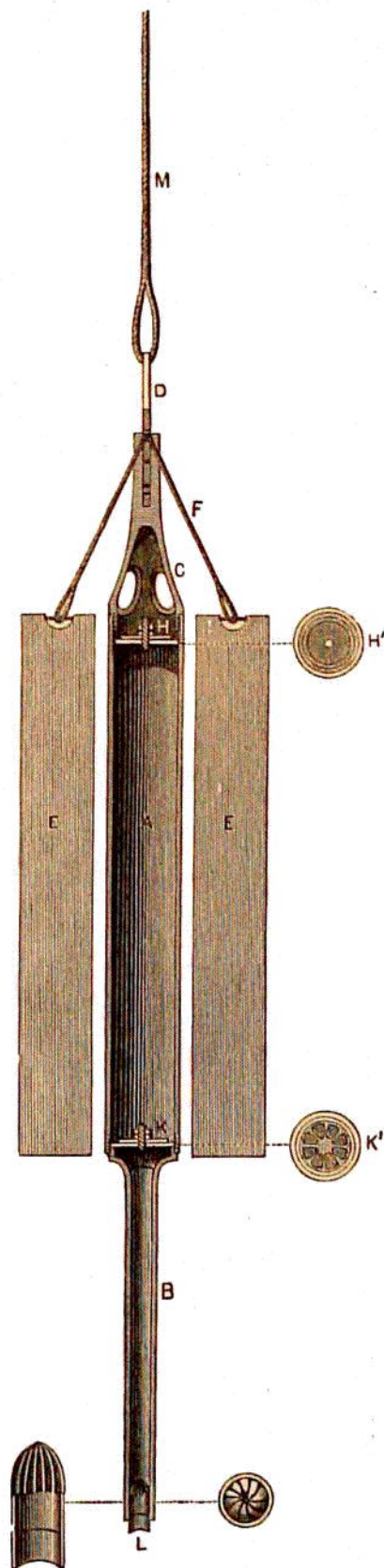


FIG. 44.—Buchanan's Combined Sounding Tube and Water-Bottle.

The details of the tumbler are shown in figs. 45, 46, 47. It will be seen that at its upper end it

¹ Die Expedition zur physikalisch-chemischen und biologischen Untersuchung der Nordsee im Sommer 1872, Berlin, 1875.