

has the hole *a*, into which the eye of the sounding line is spliced. At the lower end it has three notches, *b*, *c*, and *d*. If it is not wished to detach the weight, the sling supporting it is hooked into the notch *d*, which is considerably below the suspending axis. Consequently, when the tube reaches the bottom and the sounding line above slackens, the tumbler still preserves its upright attitude, and on heaving up, the sinker is recovered along with the tube. If the sinker is not to be recovered, the sling is hooked in the notch *b*, which is above the axis. When the tube reaches the bottom and the sounding line slackens, the pressure of the sling upsets the tumbler, which falls over into the position fig. 46. In getting into this position the weight drags the sling out of the notch *b*, and it falls into the notch *c*. Here it remains as long as the tube is at the bottom, exerting all its weight in pushing it into the ground. On heaving in, the tumbler is drawn into an upright position, when the sling slips free and the tube is brought up without the sinker. When it has been brought to the surface,

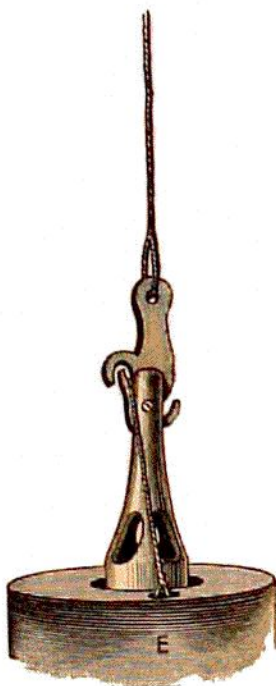


Fig. 45.

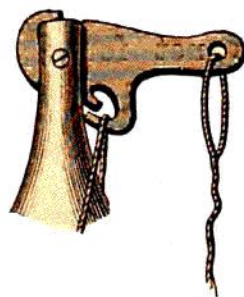


Fig. 46.

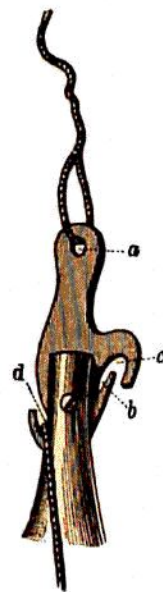


Fig. 47.

Disengaging Apparatus for Buchanan's Water Bottle.

it is found that the mud tube B is filled with a compact cylinder of mud, which by its weight has kept the india-rubber valves closed by drawing them tight down on their seats, and has therefore insured that the water enclosed at the bottom has not been contaminated by admixture with other water on the way up.

The localities, even in mid ocean, where the bottom is "hard ground" are by no means rare, and if the tube just described be dropped on it with a 50 lb. sinker, the mud tube will be much disfigured; but if there be any loose material at all, such as gravel or coral, a little of it will be nearly sure to get entangled behind the comb valve. In the absence, however, of a mud plug, the bottom water will be valueless. As a rule, the bottom of the sea, whether deep or shallow, consists of mud sufficiently soft and tenacious to fill the mud tube throughout the greater part of its length with a compact plug, and if the tube B be screwed water-tight into the lower part of the tube A, it is retained in it just as a liquid is retained in a pipette. In soft mud, clay, Globigerina ooze, and the like, it is better to discard altogether the comb valve L, because it always offers some resistance to the entrance of the mud, and