water. The object of at first hauling in only a couple of fathoms or so, and letting the line go again, is to ensure the cocks being closed; for, supposing after the first hauling in they were not quite closed, by letting the instrument descend through the water, the flap E sets itself again, and, on heaving in, it shuts down the stop-cocks, which were before but partially closed; or, if they were closed before, it shuts them the tighter. When the water-bottle has been brought up, it is only necessary to substitute for the lowermost brass funnel a small nozzle, when the water may be tapped into any vessel destined to receive it. This done, the bottle may be at once lowered to any other required depth, much time being saved by not having to detach it each time. At the upper end of the bottle a small spring safety-valve K is introduced, in order that the considerably denser water from below may be able to make room for itself as the surface is approached. In order that the instrument may do its work properly, it is evident that, firstly, the stop-cocks should be so stiff that the weight attached to their levers be not sufficient to close them, and secondly, the spring H should be so strong as to ensure the shutting of the cocks before it gives way itself. These conditions are secured by the following means of adjustment. The stop-cocks can be made stiffer in the usual way, by tightening the screws which secure the "plugs" in the "barrels"; the tension of the spring H can be increased or diminished by means of a screw at the lower end of the tube containing it; and the mobility of the stop-cocks can be further regulated by means of the screws O, O. Although from this description the operation of adjustment may appear complicated, it is in fact, practically, very simple. After being once used, it is rare that any further adjustment is required than a turn of the screws O, O.

The diameter of the apertures at either end is necessarily smaller than that of the cylinder; it is therefore impossible for the water in it to be entirely changed while it descends through a distance equal to its own length. It became a question, therefore, for experiment to decide what actually was the rate of change of water. To this end, a few experiments were made in a freshwater lake. The bottle being filled with water containing some yellow prussiate of potash, was sunk in the lake, until the surface of the water was on a level with the upper stop-cock, when the stop-cocks were opened and the line let go. On being brought up again, the contents were tested with solution of perchloride of iron. It was found that when the bottle had been sunk to a depth of a fathom and a half the water had been entirely changed, the iron solution being wholly without action on it. It is certain, then, that the water obtained by this means is an average of the last two fathoms through which the bottle has passed.

The weight used as a sinker should be chosen so as to impart sufficient velocity not to lose time unnecessarily over the operation, and at the same time not to give an excessive velocity at the depth where the water is to be collected, because the rate of change of water depends on the friction of the water inside the bottle, and so on the velocity of descent. In practice, for depths over 100 fathoms a weight of 112 lbs. was used, and