for depths from 25 to 100 fathoms a weight of 56 lbs. was used, whilst for depths less than 25 fathoms the weight of the bottle itself was sufficient. The velocity of descent at the depth where the water is to be collected should not exceed 12 feet per second. The mean velocity of descent for the interval between 75 and 100 fathoms from the surface was, with 56 lbs. 9 feet, and with 112 lbs. 11½ feet per second.

When once let go, it is essential that the line should run out to the required depth without a check; then, however, it is immaterial, as far as the water-bottle is concerned, what interruptions occur in heaving in. The fulfilment of the condition of running out without a check never presented any difficulty on board the Challenger, depending as it does on the care of those who tend the line. When, however, by accident a check does occur, the line is stopped, and the water-bottle brought up, reset and sent down again. In order to utilise any such accidents, it is usual to take the water from the greatest depth first, then if a check should occur, it may do so at one of the desired intermediate depths, and so no time would be lost.

Buchanan's Improved Stop-cock Water-Bottle with Depth Gauge.—During the whole of the cruise, when it was in daily use, Mr. Buchanan felt that the mechanism for relieving the pressure in the instrument as it came towards the surface ought to be made to register the depth at which it closed. It was at once obvious that if the volume of the instrument could be allowed to increase, and its increase could be measured, while no water was allowed to escape, a method would be found. If instead of the safety valve K, a calibrated plunger penetrated through a water-tight joint into the body of the instrument, then after closing at a certain depth, the plunger would be thrust out as the instrument rose. At the first glance this seems a simple and effective method, but when the actual dimensions, which the plunger must have, come to be considered, it is evident that the method is impracticable when dealing with water from any considerable depth. This will be seen from the following considerations. The absolute compressibility of sea water may be taken at 0·00085 per 100 fathoms, which means that one litre contracts by 0·85 c.c. for every hundred fathoms of depth; consequently, every litre of water collected below, expands by about 0·85 c.c. per hundred fathoms of ascent. In a water-bottle of two litres capacity, and to be used at no greater depth than 1000 fathoms, the plunger would have a play involving a volume of 16 c.c. As from the nature of the instrument it is important to have the ratio of the diameter of the stop-cocks to that of the cylinder as large as possible, there is no room for a wide plunger in the cover of the instrument, and if it is made narrow, its length puts it out of the question. Since the close of the cruise, experiments made by Mr. Buchanan on board the "Mallard," have resulted in a fairly satisfactory practical solution of the problem. The water-bottle as altered is shown in fig. 42. In it the spring safety valve is replaced by a nozzle K, screwed