

sledge, are fixed one at either end of the beam, and the runners are so weighted themselves, and so weight the beam, that they tend, if fairly launched, to keep beneath, with the trawl above them. A second bag or pocket, open at the bottom, hangs in the outer net reaching about three-fourths of its length, and acts as a valve preventing the washing out of its contents; and about a yard of the narrow end of the net is lined with "bread-bag," to give a chance of bringing up the more minute things, and a small sample of the bottom. The trawl is suspended by a bridle of rope, which is made fast to the runner at each end of the beam, and then continued down on each side and attached to the end of the trawl-bag.

The trawl was usually sent down with the additional weight of three 14-lb. hand-leads, and, and as in the case of the dredge weights, about  $1\frac{1}{2}$  cwt. were slipped to a toggle 400 to 500 fathoms before it on the line.

We expended during the voyage sixteen trawls, having been supplied with twenty-two.

*Dredging and Trawling.*—Dredging and taking deep-sea observations from so large a ship was altogether a new experiment, and it seemed to present some special difficulties, or at all events to require great management. The weight of the ship was so great that there could be no "give and take" between her and the dredge such as we have in smaller vessels. If there were any way on, the impulse to the dredge was irresistible, and it seemed to tend to jerk it off the ground. The roll of the ship and her height above the water, and her want of flexibility of movement compared with the vessels which had been previously employed for the purpose, raised many new questions as to the most advantageous method of working.

Dredging and trawling were carried on in the CHALLENGER from the yard-arm. The "accumulators" are india-rubber bands or springs  $\frac{3}{4}$ ths of an inch in diameter, and 3 feet in length, having at each end a thimble "seized in." They are used in dredging to measure the amount of strain on the dredge-rope, and to give warning of any undue strain, so as to give an opportunity of easing it and preventing the rope from breaking. The accumulators are capable of stretching to a length of 17 feet, when they each exert a force of 70 lbs.; beyond this they should not be stretched, as they are liable to carry away. When stretched 13 feet they exert a force of 56 lbs. For dredging purposes we used a combination of eighty accumulators; to stretch these 17 feet, a force of  $2\frac{1}{2}$  tons was required, that is, a force equal to the breaking strain of the rope. The accumulators, instead of being triced up to a block on the yard, as they were for sounding purposes, were secured to a pendant hooked on to the cap, which pendant was hauled out, or eased in by a burton on the end of the yard, as the dredge was required to plumb the sea or the dredging platform. Before fastening the dredge rope to the chain of the dredge, it was passed through two thimbles. One was used for a special purpose