

coral, a strain less than sufficient to break the dredge-rope breaks the stop, and the dredge alters its position, and probably sets itself free. In case of the dredge taking in a greater load of mud than the rope can bring up, the stop likewise gives way, and allows it to fall into such a position that a large part of its contents fall out.

The dredge-bag, which is of hand-made net of strong twine, the meshes  $\frac{1}{2}$ -inch to the side, was attached to strong welded iron rings, passed through holes perforated in the thick edges of the scrapers, at distances of about an inch. So open a net-work would let many of the smaller things wash through, and to avoid this, the bottom of the bag, to the height of about 9 inches, was lined with "bread-bag," a light open kind of canvas.

In many of our dredgings in the PORCUPINE at all depths, we found that while few objects of interest were brought up within the dredge, many Echinoderms, Sponges, and Corals came to the surface sticking to the outside of the dredge-bag, and even to the first few fathoms of the dredge-rope.

This suggested many expedients, and finally Captain Calver sent down half a dozen of the "swabs" used for washing the decks, attached to the dredge. The result was marvellous. The tangled hemp brought up everything rough and movable which came in its way, and swept the bottom as it might have swept the deck. After various experiments, we came to the conclusion that the best plan was to attach a long transverse bar to the bottom of the dredge-bag, and to fasten large bunches of teased-out hemp to the free ends of the bar (fig. 2). We have used the "hempen tangles" ever since, and we now regard them as an essential adjunct to the dredge, scarcely less important than the dredge itself, and often much more conspicuous in its results.

The length of the dredge-rope used in the PORCUPINE was 3000 fathoms. Of this, 2000 fathoms were "hawser-laid" of the best Russian hemp,  $2\frac{1}{2}$  inches in circumference, with a breaking strain of  $2\frac{1}{4}$  tons; the 1000 fathoms next the dredge were "hawser-laid," 2 inches in circumference.

The accompanying diagram (fig 6) will give an idea of the method of dredging adopted by Captain Calver, and the various relative positions of the dredge and vessel at different stages of the process of "paying-out."

On the 22d of July 1869, lat.  $47^{\circ} 38' N.$ , long.  $12^{\circ} 8' N.$  in the Bay of Biscay, the depth was ascertained by a careful sounding to be 2435 fathoms, with a bottom of grey ooze, and at about 4.45 P.M. the dredge was let go, the vessel drifting slowly before a moderate breeze (force = 4) from the N.W. The 3000 fathoms of rope were all out at 5.50 P.M.—A represents the position of the vessel when the dredge is let go, and the dotted line A B the line of descent of the dredge. When the dredge is going down the vessel drifts gradually to leeward; and when the whole (say) 3000 fathoms of rope are out, C, W, and D might represent respectively the relative positions of the vessel, the weights attached 500 fathoms from the dredge, and the dredge itself. The vessel