

pine beam was used, the wood was compressed till the knots stood out a tenth of an inch beyond the general surface, and on another the beam was crushed as if it had been passed between two rollers. Under such circumstances the dredge works better, but a trawl with a beam of hard wood of moderate length may be used freely down to 2500 fathoms. Our deepest haul with the trawl was 3050 fathoms (Station 250).

*The Alterations in the Ship.*—The CHALLENGER, the vessel selected by the Admiralty for the exploring voyage which was the natural issue of the successful preliminary cruises of the LIGHTNING and the PORCUPINE, is a spar-decked corvette of 2306 tons displacement, with auxiliary steam to 1261 horse-power, and usually mounting eighteen 68-pounders. Sundry changes were made in her fittings and arrangement to suit her special service. I will here only refer to those which have a direct bearing upon the collection and preservation of zoological specimens.

Sixteen of the large guns were removed to increase the accommodation on the main-deck, and the space for storage. In the central part of the ship on the upper deck before the main-mast, a dredging platform was built level with the hammock-nettings. This platform held the tubs and jars into which the specimens were placed when taken from the dredge, and thus we could sift the mud and observe the appearance and movement of animals during life, and sketch them if necessary, without much interruption from the seamen working the ropes. The dredge and trawl were usually emptied on this platform, which was provided with two large shoots through which the mud and refuse might be ejected without messing the deck (fig. 7).

The deck-engines for hoisting the dredging-gear were placed at the foot of the main-mast on the port side, directly under the dredging bridge. They consisted of a pair of direct-acting, high-pressure, horizontal engines, collectively of 18 horse-power nominal. Instead of a connecting-rod beneath, a guide was fixed to the end of the piston-rod, with a brass block working up and down the slot of the guide. The crank-axles ran through the centre of the blocks, and the moveable block, gaining a backward and forward motion from the piston-rod, acting on the crank as a connecting-rod would do. This style of engine is commonly used for pumping, the pump-rods being attached to the guide on the opposite side from the piston-rod. At one end of the crank a small toothed wheel was fixed which drove one thrice the multiple on a horizontal shaft extending nearly across the deck, and about 3 feet 6 inches above it. At each end of this shaft a large and small drum were fixed, the larger having three sheaves cast upon it of different sizes, the lesser being a common barrel only. The dredging line was led to these drums, two or three turns being taken round the drums selected. In hauling in, the dredge-rope was taken to a gin-block, secured to a spar on the fore-castle, then aft to the drum of the deck-engines on the port side of the quarter-deck, then to a leading-block on the port side of the quarter-deck, and across the deck to a block on the starboard side, then to the drum