

board, so that no change of position can occur in the rest of the ascent from any cause. The case B is cut open to expose the scale of the thermometer, and is also perforated to allow the free entry of the water.

The new form of Negretti & Zambra thermometer is completely enclosed in a glass tube, and is therefore not exposed to errors due to pressure. Experiments made with it on board H.M.S. "Triton" during the summer of 1882, and by Mr. Buchanan on board the steam yacht "Mallard," showed that, as supplied by the makers at that time, it could not be depended on to turn the moment it was released, but would remain in its original position while being hauled through 10 or 15 fathoms. This defect, however, was very easily rectified by attaching an india-rubber band, so as to press lightly against the upper part of the thermometer when being sent down. As soon as it was released, the india-rubber spring pushed the thermometer out of the vertical, and it at once turned over. With this small but most important addition, the instrument acts satisfactorily, provided that there be no lateral motion of the water relatively to the thermometer. This may occur in one of two ways,—either by the motion of the ship or by currents. In either case the water moving past the instrument turns the screw fan, and sets the thermometer free before it is intended. In the Strait of Gibraltar, for instance, it is impossible to get satisfactory results with these thermometers, except at the periods of slack water.

Quite recently the method, adopted by Aimé, of allowing a weight to slide down the line so as to effect the registration of the thermometer, has been developed by Captain Rung of the Danish Meteorological Institute, by the U.S. Fish Commission, and also at the Scottish Marine Station at Edinburgh. The Danish instrument¹ consists of two pieces, one containing the thermometer which is pivoted to the other and turns over when the weight falls upon a catch, which retains it in position. The "messenger" is very ingeniously made in two pieces, so that it can be put upon the rope at any point. The Scottish instrument² is a modification of Captain Magnaghi's: the fan is removed and a pin fits into the slot in the upper part of the thermometer case, this is connected with a horizontal lever, one end of which embraces the sounding line, so that when the weight falls upon it, it lifts the pin out of the slot and the thermometer is released.

Electrical Thermometer.—The Challenger carried a deep-sea electrical thermometer, designed by the late Sir C. W. Siemens, F.R.S.,³ on the principle of the variation of the electrical resistance of a conductor with its temperature.

The apparatus consists essentially of a coil of wire T, which is lowered by means of a cable to the required depth, and is coupled by connecting wires to form one arm of a Wheatstone's bridge. The connections of the bridge are shown in fig. 32. The arm

¹ Rung, *Den tekniske Forenings Tidsskrift*, 1883.

² Mill, *Proc. Roy. Soc. Edin.*, vol. xii. p. 927, 1884.

³ *Proc. Roy. Soc. Lond.*, vol. xxxiv. pp. 89-95, 1883.