

about a quarter of an inch away from the index, the position of which had to be determined in reference to it. In order to remedy this defect, Professor Wyville Thomson ordered two thermometers to be sent out specially constructed to show low temperatures with accuracy. They were of the ordinary type but longer, and the upper portion of the minimum limb was contracted to a small diameter, so that the degrees between 30° and 40° F. occupied 0.3 inch each, instead of 0.05 inch as in the ordinary ones. Unfortunately these thermometers only reached the ship near the end of the cruise, and in both of them there was a defect about the fitting of the indices in consequence of which they stuck in the tube and allowed the mercury to pass them.

Since the termination of the cruise, Mr. Buchanan has had constructed, and has largely used, an improved form of thermometer of the protected Six type. The size of the instrument is increased so that the degrees are wider apart, a degree Fahrenheit on the minimum leg occupying about three millimetres of its length. Besides the scale of degrees which is attached on enamelled slips to the vulcanite at the sides of the stem, there is an arbitrary (millimetre) scale etched on the stem itself. The values of the divisions of this scale are ascertained by a careful comparison with a standard thermometer. It is thus possible to read with certainty to a quarter of a millimetre or a twelfth of a degree Fahrenheit. The errors due to the scale not being rigidly attached to the thermometer, and to the difficulty of determining the height of the index by reference to a scale at the side of, instead of over, it, are thus eliminated. Finally, by having the ordinary scale at the sides, the instrument can be used independently of the stem-scale, and even where the scale is principally relied on, the scale of degrees at the sides enables the observer to know very approximately the true temperature at the moment of observation without reference to tables; and further, by noting on every occasion the reading on *both* scales, the chance of errors from misreading is greatly reduced.

The maximum leg, which is only rarely used, is of larger bore than the minimum; the degrees, therefore, are closer, and the temperature of the instrument may rise as high as 100° F. without the index entering the terminal bulb. This is a detail of considerable practical importance, for it is impossible always to protect the thermometers when on deck from the direct rays of the sun, which would speedily disable the maximum side of the thermometer if its range were as limited as that of the minimum.

For isolated observations the Six thermometers just described are not so satisfactory, and a very great amount of ingenuity has been displayed in the invention of instruments for registering the actual temperature of the water at any depth independently of that of the water above it. None of the instruments devised for this purpose have been strictly *self*-registering; they have all required some assistance from the observer, who, by various forms of mechanical appliance, brings about a change in the condition of the instrument. It is obvious that any control which an observer may have over an instrument separated from him by, it may be, three or four miles of line, is very