

disadvantages in this form, namely, the indications are not continuous, but by jerks, depending on the size of the mercury drops, and they require to be constantly set, the maximum at a higher and the minimum at a lower temperature than the one to be observed; and they also require constant comparison with a standard. They are, therefore, not suitable for use where many observations have to be made expeditiously.

In the year 1782, Six¹ published a description of the combined maximum and minimum thermometer which bears his name, and which has since continued to assert its place among meteorological instruments as, perhaps, the best self-registering thermometer for sea temperature observations. The instrument is too well known to require particular description. It may, however, be noted that Six himself did not use a hair for a spring to keep his indices from falling down, but a fine glass thread soldered to the top of the index, and sticking up in a direction very slightly inclined to that of the length of the index, so that it pressed gently against the sides of the tube. The advantage of the glass over the hair is that it does not lose its elasticity; but, on the other hand, the index takes up more room, and requires a thermometer with a longer stem.

Maximum and minimum thermometers such as Cavendish's and Six's, when used for deep-sea exploration, show only the maximum and minimum temperatures to which they have been exposed in any one excursion, and a single observation with such a thermometer does not give with certainty the temperature of the water at the depth to which it has been sunk. Hence, if it were possible for the temperature of a sea or lake to vary in any conceivable way with the depth, these instruments would be valueless. There is, however, no justification for this assumption; it is known, on the contrary, that in all seas where the surface is not exposed to a freezing temperature, the temperature of the water, as a rule, diminishes as the depth increases; and therefore that the minimum temperature, as shown by the self-registering thermometer, is, in fact, the temperature at the greatest depth attained by the instrument. Hence, in such cases, this instrument is to be relied on, and more especially when *series* of temperatures are taken—that is, when the temperatures at different depths in the same locality are taken, so that the evidence of the decrease of temperature with increase of depth is rendered as strong as possible. In order to render an account of the state of the sea as regards temperature, it is absolutely necessary to have such serial observations; hence, for such investigations, the maximum and minimum thermometer is not only perfectly trustworthy, but a most valuable and, indeed, indispensable instrument, for it has the great advantage that, as it is in the strictest sense *self*-registering, any number can be attached to the same line, and so at one haul the temperature can be observed at a number of different depths.

The instrument used for almost all the observations made on board the *Challenger*, was Six's thermometer with a double bulb, of the pattern made by Mr. Casella for deep-sea

¹ *Phil. Trans.*, vol. lxxii. p. 72, 1782.