

limited. By a simple mechanical contrivance vertical motion may be made to produce one of rotation, and, in fact, the assistance thus afforded by the observer to the thermometer to enable it to register its own temperature consists in his turning it either upside down or through a whole circle when it has reached the desired depth. The first observer who made use of such a device was Aimé. By allowing a weight to slip down the line the upper attachment of his thermometer was set free and it fell over. The change thus produced was the means of registering the temperature at the depth.¹ His *thermomètre à bascule*, along with a number of ingenious modifications of existing forms, is described in the same journal.² It was unfortunately only after he was obliged to leave the Mediterranean, which had been the scene of his labours, that he invented the very elegant combination of thermometers by which he was enabled to ascertain the temperature at any depth, no matter what the intervening distribution might be. It is described in the memoir just cited. It consists of two outflow thermometers, so constructed that one of them registers the sum of the rises of temperature, and the other the sum of the falls of temperature, to which it is exposed in any excursion. When they have reached the required depth they are inverted, and on their way back to the surface they register, as above described, the rises and falls of temperature to which they are exposed. If r be the sum of the rises of temperature, f the sum of the falls, and s the temperature of the surface, then the temperature at the depth where they were inverted will be $d = s + r - f$. If they are allowed to register on the way down, and then inverted at the greatest depth, so as not to register on the way up, the effect will be precisely the same, though the functions of the thermometers will be reversed. Beautiful and ingenious as Aimé's thermometers are, they have the disadvantages common to all outflow thermometers; they are neither simple enough nor handy enough for work involving many observations.

During the course of the voyage Messrs. Negretti & Zambra patented an instrument which promised to fulfil the conditions required of a thermometer for isolated observations. Staff-Commander Tizard made an extensive series of experiments with it under various conditions, of which he gives the following account:—

“Messrs. Negretti & Zambra's instrument for ascertaining temperatures is a mercurial thermometer (see fig. 29 C), the tube of which is contracted at the point D, so that when the instrument is held upside down the mercurial column separates at that point and falls to the bottom in the enlarged part of the tube E. If a complete revolution of the thermometer be slowly made, the portion of mercury separated falls over into the tube F, which is graduated so as to register the exact amount separated when the instrument is reversed. By attaching this thermometer to machinery which reverses it at a certain time, or at a certain depth, the temperature at that time or depth is registered. To readjust the instrument all that is required

¹ *Ann. d. Chim.*, sér. 3, t. vii. p. 497, 1843.

² *Ibid.*, t. xv. p. 5, 1845.