

when sunk to different depths (or conversely of determining the depth by the amount of compression). These piezometers are really nothing more than Six's thermometers open at the end. If such an instrument be sunk to any depth in the sea it will register the combined effect of temperature and pressure on its contents and the glass envelope. If the temperature be known the contraction due to pressure can be computed, and conversely, if the depth and so the pressure be known, the temperature to which it has been exposed can be computed. It occurred to Mr. Buchanan at the time to use the piezometers for this purpose, but as they were all filled with either water, sea water, or salt solution, liquids which at such low temperatures show hardly any thermal dilatibility, it was felt that no assistance could be got from them. It was not until much later that the idea occurred to open the end of an unprotected Six's thermometer, or to open the end and the secondary bulb of a protected one, and so obtain a record of the combined effect of pressure and temperature on the thermometric liquid usually employed, which could be cleared for effect of pressure by subsequent experiment. Several trials were made with an opened unprotected thermometer in the South Atlantic on the voyage between Sandy Point and Monte Video, and it was found to work well.

As the working of the Negretti & Zambra thermometers which were sent out was not considered satisfactory, a piezometer filled with mercury was constructed. It resembled an inverted Six's thermometer, the bulb filled with mercury and the bend of the tube filled with water, in which the magnetic index had free play. The bulb A (see fig. 33), of about 19 c.c. capacity, held about 250 grammes of mercury. The stem, through a considerable portion of its length BC, was filled with water, in which the index moved. The space between the end of the water column and the end of the stem was filled with mercury, and the end dipped into the bulb D filled with mercury, which communicated with the water or air outside. The instrument was fixed to a backing of vulcanite, principally by wire lashing across the bulb; the small brass clamps on the stem were there solely for steadying and bore no weight. It was fortunate that the possibility of having to do work of this kind was foreseen, and that the laboratory stores included several pieces of ebonite suitable for the purpose, and some graduated capillary tubes of the size used for the piezometers that were taken out. One or two spare indices were also taken, but the supply both of them and of capillary tubes was augmented by preserving the fragments of any thermometers that were broken. In this way an instrument can be constructed filled with a very large quantity of mercury and a very small quantity of water, after whose immersion the position of the index shows the apparent volume assumed by this mixture under the combined influence of temperature and pressure. As far as the effects of temperature are concerned, the amount of water in the instrument is almost wholly negligible; but when the effect of pressure is considered, the apparent compressibility of mercury is so small, being little more than one-fiftieth of that of water, that the presence of even so small a quantity