and, by a simple but effective mechanism, the engine was made after each stroke to open automatically the suction valve of the pump, which was continually liable to become jammed when very high pressures were reached. The only defect of this arrangement was that some minutes elapsed (even when there was no air in the pressure cylinder) before a pressure of three or four tons was reached. Professor Tait therefore procured for his laboratory an additional but very much smaller apparatus, in which a couple of strokes of the pump sufficed to produce the full required pressure. The comparison of the effects produced on the same thermometers, by the same pressure, in these very different instruments was of great value in verifying some of the more important results of the inquiry.

Professor Tait had satisfied himself by calculation from the best data available, that the utmost *direct* effect of pressure on the protected thermometers could be only a small fraction of that assigned by Captain Davis,[1] and he verified this conclusion directly by trials with tubes of varied dimensions.

It only remained to ascertain why the large results of Captain Davis's experiments on the Challenger thermometers, which were closely reproduced by Professor Tait in the new apparatus, were so different from the theoretical amount; and it was found, after several trials with tallow and other plastic materials placed so as to surround the bulbs of the thermometers, that the slabs of vulcanite, on which the thermometers are mounted become heated by compression to an extent hitherto unsuspected, and fully competent to account for the discrepancy. Thus the greater part of the effect obtained by Captain Davis was shown to be due to heating produced by pressure, not to pressure directly.

But when the thermometers are let down into the sea, the circumstances are very different from those in the pressure cylinder, for the constant current of sea water which passes round the bulb of the instrument keeps it and its mounting steadily at the temperature of the sea:—the heat due to compression being (in consequence of the slow rate of increase of pressure) developed much more slowly than in the laboratory experiment, and being besides carried away by convection as fast as it is developed.

He concluded from these experiments, as well as from the experimental verification of his theoretical calculations, that had the tubes of the Challenger thermometers been free from "aneurisms" the utmost pressure correction required in deep-sea observations would have been for the minimum index (which is the important one) about 0°·05 F. only for each mile of depth. The aneurisms above spoken of are small distended parts of the tube. The only serious one, whose object is to prevent the recording index from being drawn into the main bulb if the instrument be exposed to too low a temperature, is close to the protected bulb, and ought itself to have been protected. The pressure effects due to this aneurism are usually greater than those due to the tube of the thermometer. Professor Tait has calculated, for each of the instruments he

[1] Davis, J. E., On Deep-Sea Thermometers, *Proc. Meteorol. Soc.*, vol. v. pp. 305–342, 1871.