

sections sent home in the preliminary reports continued, however, to be constructed with temperatures "corrected for pressure," in order that they might be comparable with those that had gone before, although thus far it had become evident that the thermometers, in so far as they were used as minimum instruments, were sufficiently protected by the outside bulb against the effects of pressure, and that in consequence their readings at great depths were not affected by any sensible error due to this cause.

With a view of finding out the true effect of pressure on the readings of the protected thermometers, Sir Wyville Thomson, on the return of the Expedition, requested Professor Tait to investigate the whole question, and handed over to him about thirty of the thermometers, which had been used during the cruise, and also the hydraulic pressure apparatus constructed in 1872, which had been on board during the voyage. The results of the investigation have been published *in extenso* in Appendix A to Vol. II. of this Narrative.<sup>1</sup>

Professor Tait commenced by remarking that a correction so large as that given by Captain J. E. Davis for the maximum index, if it were to be applied at all, must be applied with but little diminution to the minimum index also. So that the question is a serious one. He then tested the pressure apparatus, but found it to be in many respects unsuitable for the work he contemplated.

1. It was capable of holding only two thermometers at once; and, when two were inserted, there was no room for other necessary apparatus, such as pressure gauges, &c.

2. The Bourdon-gauge attached to it was graduated only to four tons weight per square inch, while it was desirable to carry the pressure to six tons at least.

3. When compared with an air-manometer inserted in the pressure cylinder, this gauge proved to be very inaccurate.

4. Even with the moderate pressures which had been applied to it, the cylinder was not deemed perfectly safe, and had in consequence been strengthened (?) by massive rings of Swedish iron clamped round it.

Professor Tait therefore informed Sir Wyville Thomson, that if the experiments were to be conducted in the Edinburgh University Buildings, it was essential that a stronger and much more capacious pressure cylinder should be procured; and suggested that it should be constructed on the principle of the Fraser gun.

In the spring of 1879 the new instrument<sup>2</sup> (weighing nearly three tons) arrived in Edinburgh from the Royal Gun Factory at Woolwich, and was erected on a mass of concrete embedded in the ground below the floor of one of the basement rooms in the College. As the gas-engine belonging to the Physical Laboratory happened to be fixed in a neighbouring cellar, the requisite shafting was put up to connect it with the pump;

<sup>1</sup> The Pressure Errors of the Challenger Thermometers, by Professor P. G. Tait, Narr. Chall. Exp., vol. ii., Appendix A.

<sup>2</sup> Described and figured in the above mentioned paper, where will be found a full description of the experiments and their results, also an account of the various new forms of gauges employed for the accurate measurement of pressure.