

The Condensation of Helium.

I HAVE just read with great interest of Prof. Onnes's experiments with helium, and as one who has carried out investigations at very low temperatures, and to a certain extent in the same direction, I must congratulate him on having overcome difficulties of no ordinary nature. At the time of my departure for India I was engaged in an attempt to measure temperatures below the temperature of solid hydrogen, with the ultimate object of determining thermal constants for helium, but the work was broken off when I left Bristol, and it is not likely that I shall be able to resume it for some time. However, it is possible that brief information as to the method I intended to employ may be of use to others.

The measurement of low temperatures by any means other than by the gas thermometer appeared to me to be mere waste of time, and I decided to employ in these experiments a constant volume helium thermometer. Following the method of Olszewski, I proposed to compress helium to about 100 atmospheres in a vessel cooled in solid hydrogen, and containing the thermometer, and to measure the fall of temperature on expanding the gas. The only obvious difficulty lay in the construction of the apparatus.

The apparatus shown about natural size in the figure was made for me by Messrs. A. Hilger. The outer vessel was of thin steel, and had a capacity of about 40 c.c. Within were three concentric test-tubes, made as light as

possible, and separated one from the other and from the steel vessel with fragments of cork. In the centre is a very light bulb of steel, to which was soldered a capillary steel tube such as is used for hypodermic needles. This bulb was intended to serve as a thermometer, the steel tube communicating with the manometric portion of one of the thermometers which I employed in the measurements of the temperatures of liquid and solid hydrogen (Phil. Trans., cc. A, 105, 1902). A steel tube connected the steel vessel with the pump, &c. A steel gasometer floating on mercury, and a steel pump working with mercury as a lubricant, had also been constructed for me by Messrs. Brin's Oxygen Co. Sir William Ramsay had placed a large quantity of helium at my disposal.

Preliminary experiments with oxygen led me to the conclusion that by this method it would be possible to attain to, and measure temperatures far below, the melting point of hydrogen. I may point out that for very low temperatures the reading of the manometer attached to the thermometer would give a direct measurement of the temperature, as the dead space correction would be very small.

MORRIS W. TRAVERS.

Indian Institute of Science, Bangalore, March 29.

