critical point, the sudden fall in volume corresponding to the boiling line has disappeared, and although the curve does not coincide with the air curve, it is regular and shows no sign of liquefaction having occurred. Our experiments were made at temperatures further removed from the critical point than this, and as no sudden change in solubility could be detected in passing from the liquid state to these high temperatures, we conclude that, in these experiments, we have further proof of the perfect continuity of the liquid and gaseous states, and also a complete proof of the solubility of solids in gases.

II. "On the Artificial Formation of the Diamond." By J. B. Hannay, F.R.S.E., F.C.S. Communicated by Professor G. G. Stokes, D.C.L., &c., Sec. R.S. Received February 19, 1880.

(Preliminary Notice.)

While pursuing my researches into the solubility of solids in gases, I noticed that many bodies, such as silica, alumina, and oxide of zinc, which are insoluble in water at ordinary temperatures, dissolve to a very considerable extent when treated with water-gas at a very high pressure. It occurred to me that a solvent might be found for carbon; and as gaseous solution nearly always yields crystalline solid on withdrawing the solvent or lowering its solvent power, it seemed probable that the carbon might be deposited in the crystalline state. After a large number of experiments, it was found that ordinary carbon, such as charcoal, lampblack, or graphite, were not affected by the most probable solvents I could think of, chemical action taking the place of solution.

A curious reaction, however, was noticed, which seemed likely to yield carbon in the nascent state, and so allow of its being easily dissolved. When a gas containing carbon and hydrogen is heated under pressure in presence of certain metals its hydrogen is attracted by the metal, and its carbon left free. This, as Professor Stokes has suggested to me, may be explained by the discovery of Professors Liveing and Dewar, that hydrogen has at very high temperatures a very strong affinity for certain metals, notably magnesium, forming extremely stable compounds therewith.

When the carbon is set free from the hydrocarbon in presence of a stable compound containing nitrogen, the whole being near a red heat and under a very high pressure, the carbon is so acted upon by the nitrogen compound that it is obtained in the clear, transparent form of the diamond. The great difficulty lies in the construction of an inclosing vessel strong enough to withstand the enormous pressure and high temperature, tubes constructed on the gun-barrel principle (with a wrought iron coil), of only half an inch bore and four inches external diameter, being torn open in nine cases out of ten.

The carbon obtained in the successful experiments is as hard as natural diamond, scratching all other crystals, and it does not affect polarised light. I have obtained crystals with curved faces belonging to the octahedral form, and diamond is the only substance crystallising in this manner. The crystals burn easily on thin platinum-foil over a good blowpipe, and leave no residue, and after two days' immersion in hydrofluoric acid they show no sign of dissolving, even when boiled. On heating a splinter in the electric arc, it turned black—a very characteristic reaction of diamond.

Lastly, a little apparatus was constructed for effecting a combustion of the crystals and determining their composition. The ordinary organic analysis method was used, but the diamond crystals were laid on a thin piece of platinum-foil, and this was ignited by an electric current, and the combustion conducted in pure oxygen. The result obtained was, that the sample (14 mgrms.) contained 97·85 per cent. of carbon, a very close approximation, considering the small quantity at my disposal. The apparatus and all analyses will be fully described in a future paper.

Received February 25, 1880.

Extract from a letter from Mr. Hannay, dated 23rd February:—

"I forgot, in the preliminary notice, to mention that the specific gravity of the diamond I have obtained ranges as high as 3·5; this being determined by flotation, using a mixture of bromide and fluoride of arsenic."

Presents, February 5, 1880.

Transactions.

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