

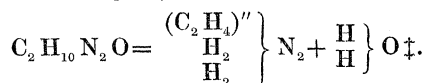
and hydrochloric acid, the latter producing, with the monamine liberated in the reaction, a salt which in its turn is likewise decomposed.

Thus the chloride of diethylammonium, for instance, together with chloride of ethyl and ethylamine, yields ethylene and chloride of ethylammonium which splits into chloride of ethyl and ammonia.

The idea naturally suggested itself, to attempt, by means of this reaction, the formation of the primary and secondary monophosphines, which are at present unknown. Experiments made with the view of transforming triethylphosphine into diethylphosphine have as yet remained unsuccessful, the chloride of triethylphosphonium distilling without alteration.

X. "Notes of Researches on the Polyammonias."—No. IX.
Remarks on *anomalous* Vapour-densities. By A. W. HOFMANN, LL.D., F.R.S. Received July 24, 1860.

In a note addressed to the Royal Society* at the commencement of this year, I have shown that the molecules of the diamines, like those of all other well-examined compounds, correspond to two volumes of vapour†, and I have endeavoured to explain the apparent anomalous vapour-densities of the hydrated diamines by assuming that the vapour-volume experimentally obtained was a mixture of the vapour of the anhydrous base and of the vapour of water. Thus, hydrated ethylene-diamine was assumed to split under the influence of heat into anhydrous ethylene-diamine (2 vols. of vapour) and water (2 vols. of vapour).



The vapour-density of ethylene-diamine referred to hydrogen being 30, and that of water vapour 9, the vapour-density of a mixture of equal volumes of ethylene-diamine and water-vapour $= \frac{30+9}{2} = 19.5$, which closely agrees with the result of experiment.

In continuing the study of the diamines, I have expanded these

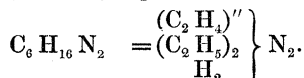
* Proceedings, vol. x. p. 224.

† $\text{H}_2\text{O} = 2$ vols.

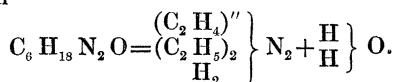
‡ $\text{H} = 1$; $\text{O} = 16$; $\text{C} = 12$, &c.

experiments. Without going into the detail of the inquiry, I beg leave to record an observation which appears to furnish an experimental solution to the question.

Ethylene-diamine, when submitted to the action of iodide of ethyl, yields a series of ethylated derivatives, amongst which the diethylated compound has claimed my particular attention. This body in the anhydrous state is an oily liquid containing



With water it forms a beautiful crystalline very stable hydrate*, of the composition



The vapour-density of the anhydrous base was found by experiment to be 57.61, showing that the molecule of diethyl-ethylene-diamine corresponds to 2 vols. of vapour, the theoretical density being $\frac{114}{2} = 57$.

On submitting the crystalline hydrate to experiment, I arrived at the vapour-density 33.2. This number is in perfect accordance with the result obtained in the case of ethylene-diamine. The legitimate interpretation of this number is that here again the hydrated base splits into the anhydrous diamine and water, and that the density observed is that of a mixture of equal volumes of diamine-vapour and of water-vapour, the theoretical density of which is $\frac{57+9}{2} = 33$.

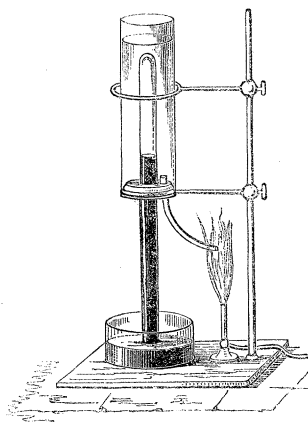
The correctness of this interpretation admits of an elegant experimental demonstration.

Having observed that the hydrate loses its water when repeatedly distilled with a large excess of anhydrous baryta, the idea suggested itself, to attempt the decomposition of the hydrate in the state of *vapour*. If the vapour obtained by heating this hydrate to a temperature 15° or 20° higher than its boiling-point actually consisted of a mixture of equal volumes of its two proximate constituents in a state of *dissociation* (to use a happy term proposed by Deville), it appeared very probable that the volume would be halved by the

* Proceedings, vol. x. p. 104.

introduction of anhydrous baryta. Experiment has verified this anticipation.

The upper half of a glass tube filled with, and inverted over, mercury, was surrounded by a second glass tube open at both ends and of a diameter about treble that of the former, the annular space between the two being closed at the bottom of the outer tube by a well-fitting cork. The vessel thus formed round the upper part of the inner tube was moreover provided with a small bent copper tube open at the top and closed at the bottom, which was likewise fixed in the cork. The



vessel being filled with paraffin and a lamp being applied to the copper tube, the upper part of the mercury-tube could be conveniently kept at a high and constant temperature, whilst the lower end, immersed in the mercury-trough, remained accessible. A glance at the figure explains the disposition of the apparatus. A small quantity of the hydrated base was then allowed to rise on the top of the mercury in the tube; and the paraffin bath having been heated to 170° , the volume of the vapour was observed. Several pellets of anhydrous baryta were then allowed to ascend into the vapour-volume, while the temperature was maintained constant. The mercury began immediately to rise, becoming stationary again, when a fraction of the vapour had disappeared, which amounted, the necessary corrections being made, to half the original volume.

XI. "Notes of Researches on the Poly-Ammonias."—No. X. On Sulphamidobenzamine, a new base; and some Remarks upon Ureas and so-called Ureas. By A. W. HOFMANN, LL.D., F.R.S. Received July 24, 1860.

Among the numerous compounds capable of the metamorphosis involved in Zinin's beautiful reaction, the nitriles have hitherto

