according to definite proportions of their weight, it follows that in the gaseous state these combining weights of bodies have either equal volumes or such as stand in very simple proportions. Now the amount of matter (measured by weight) in the same volume is called the density of a gas. It therefore follows, by putting Dalton's and Gay-Lussac's discoveries together, that the combining weights of gases are either directly proportional to their densities or to a simple multiple thereof. Some years after this discovery in 1809, Gay-Lussac extended his statement so as not only to embrace elementary gases, such as hydrogen, oxygen, and nitrogen, but also compounds, such as ammonia, carbonic acid, hydrochloric acid, and showed how, if they enter into chemical combination, they likewise do so in the simple proportions of one volume of one, to one or two volumes of the other.

Whilst chemists such as Gay-Lussac, Berzelius, and others[1] recognised in the facts discovered by the first a

[1] Dalton was the only person who doubted the correctness of Gay-Lussac's figures, although both Thomson and Berzelius pointed out to him the great support they afforded to the atomic theory. Berzelius also saw the usefulness of the law of volumes in fixing the smallest combining or atomic numbers in cases where the reference to weight alone left the matter undecided. Thus he correctly inferred that the formula of water should be H_2O, as we write it to-day, because two volumes of hydrogen combined with one of oxygen. But it was unfortunate that, through his want of appreciation of Avogadro's further expositions, he was unable to reconcile more completely the appeal to volume with that to weight, and that in consequence great uncertainty reigned for a long time in these matters. This induced L. Gmelin to disregard the volumetric relations in his system of equivalents, to the great detriment of those who in the middle of the century were brought up with very vague and unsatisfactory explanations on this subject—different numbers being used in books on organic and inorganic chemistry. A great confusion existed at that time, Gerhardt showing good reasons, based upon his observations of the substitution of hydrogen in organic compounds and the system of classification which he introduced, why several of Gmelin's figures should be doubled; but the matter was not cleared up till Cannizzaro