in proceeding from freezing to boiling water. This law was discovered by Dalton and M. Gay-Lussac independently of each other;[1] and is usually called by both their names, *the law of Dalton and Gay-Lussac.* The latter says,[2] "The experiments which I have described, and which have been made with great care, prove incontestably that oxygen, hydrogen, azotic acid, nitrous acid, ammoniacal acid, muriatic acid, sulphurous acid, carbonic acid, gases, expand equally by equal increments of heat." "Therefore," he adds with a proper inductive generalization, "the result does not depend upon physical properties, and I collect that *all gases expand equally by heat.*" He then extends this to vapors, as ether. This must be one of the most important foundation-stones of any sound theory of heat.

[2nd Ed.] Yet MM. Magnus and Regnault conceive that they have overthrown this law of Dalton and Gay-Lussac, and shown that the different gases do not expand alike for the same increment of heat. Magnus found the ratio to be for atmospheric air, 1·366; for hydrogen, 1·365; for carbonic acid, 1·369; for sulphurous-acid gas, 1·385. But these differences are not greater than the differences obtained for the same substances by different observers; and as this law is referred to in Laplace's hypothesis, hereafter to be discussed, I do not treat the law as disproved.

Yet that the rate of expansion of gas in certain circumstances is different for different substances, must be deemed very probable, after Dr. Faraday's recent investigations *On the Liquefaction and Solidification of Bodies generally existing as Gases,*[3] by which it appears that the elasticity of vapors *in contact with their fluids* increases at different rates in different substances. "That the force," he says, "of vapor increases in a geometrical ratio for equal increments of heat is true for all bodies, but the ratio is not the same for all. . . . For an increase of pressure from two to six atmospheres, the following number of degrees require to be added to the bodies named:—water 69°, sulphureous acid 63°, cyanogen 64°·5, ammonia 60°, arseniuretted hydrogen 54°, sulphuretted hydrogen 56°·5, muriatic acid 43°, carbonic acid 32°·5, nitrous oxide 30°."]

We have already seen that the opinion that the air-thermometer is a true measure of heat, is strongly countenanced by the symmetry which, by using it, we introduce into the laws of radiation. If we

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[1] *Manch. Mem.* vol. v. 1802; and *Ann. Chim.* xliii. p. 137.

[2] Ib. p. 272.

[3] *Phil. Trans.* 1845, Pt. 1.