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XVI. *On the Heat of Vapours.*

By Sir J. Lubbock, *Bart., F.R.S.**

Let V be the quantity of absolute heat, considered as a function of the sensible heat or temperature θ,

$$\frac{dV}{d\theta}=\frac{dV}{d\rho}\frac{d\rho}{d\theta}+\frac{dV}{dp}\frac{dp}{d\theta} \qquad p=k\rho(1+\alpha\theta),$$

ρ being the density, p the pressure, k and α constants,

$$\frac{d\rho}{d\theta}=-\frac{\alpha\rho}{1+\alpha\theta} \qquad \frac{dp}{d\theta}=\frac{\alpha p}{1+\alpha\theta}.$$

If c is the specific heat of a gas, the pressure being constant, and $c_{\prime}$ its specific heat when the volume is constant, so that

$$c=\frac{dV}{d\rho}\frac{d\rho}{d\theta} \qquad c_{\prime}=\frac{dV}{dp}\frac{dp}{d\theta} \qquad \gamma=\frac{c}{c_{\prime}}$$

$$\rho\frac{dV}{d\rho}+\gamma p\frac{dV}{dp}=0.$$

Laplace evidently considered γ constant, and he integrated this equation upon that hypothesis, "En supposant cette quantité rigoreusement constante, &c.," *Méc. Cél.* vol. v. p. 127. Again, Poisson, in repeating the same theory, *Traité de Méc.*, vol. ii. p. 646, "En regardant γ comme une quantité constante, &c." If γ is constant,

$$V=A+B\frac{p^{\frac{1}{\gamma}}}{\rho}=A+B\frac{k}{\alpha}\left(\frac{1}{\alpha}+\theta\right)p^{\frac{1}{\gamma}-1},$$

(see vol. xviii. p. 507) which is identical with the equation given in the *Comptes Rendus, Séance* de 31 Mai 1847, p. 920,

$$q=m+n(a+t)p^{-z},$$

$$m=A, \quad n=\frac{Bk}{\alpha}, \quad a=\frac{1}{\alpha}, \quad t=\theta, \quad z=1-\frac{1}{\gamma}, \quad k=\gamma;$$

but if, as Professor Holtzmann maintains (see Taylor's Scientific Memoirs, vol. iv. part 14), z is variable, the integral of Laplace does not necessarily obtain, nor does the equation (*Comptes Rendus*, p. 920)

$$\frac{dq}{dt}=np^{-z}$$

obtain; because if z is a function of t,

$$\frac{dq}{dt}=np^{-z}-n(a+t)p^{-z}\log p\frac{dz}{dt},$$

* Communicated by the Author.

and

$$q-q_1=n(a+t)p^{-z}-n(a+t_1)p_1{}^{-z}{}_1.$$

It has not, I believe, been remarked, that the integral

$$V=A+B\frac{p^{\frac{1}{\gamma}}}{\rho}$$

will however still satisfy the differential equation

$$\frac{\rho \mathrm{d}V}{\mathrm{d}\rho}+\gamma p\frac{\mathrm{d}V}{\mathrm{d}p}=0.$$

If

$$\frac{1}{\rho}\frac{\mathrm{d}\gamma}{\mathrm{d}p}+\frac{1}{\gamma p}\frac{\mathrm{d}\gamma}{\mathrm{d}\rho}=0$$

or

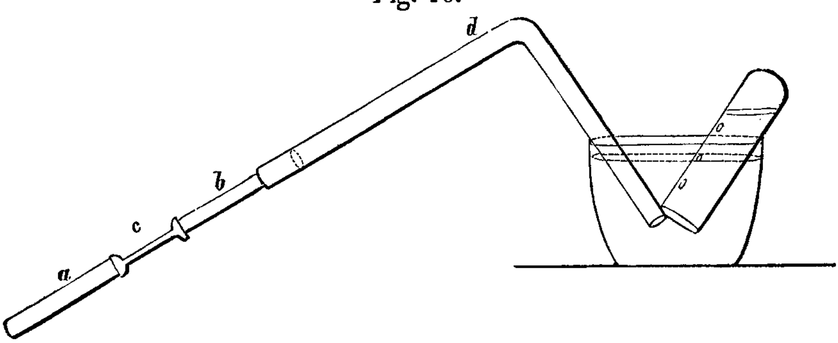
$$\gamma k(1+\alpha\theta)\frac{\mathrm{d}\gamma}{\mathrm{d}p}=-\frac{\mathrm{d}\gamma}{\mathrm{d}\rho}.$$

XVII. *On certain Phænomena of Voltaic Ignition and the Decomposition of Water into its constituent Gases by Heat.* *By* W. R. Grove, *Esq., M.A., F.R.S.*

[Continued from p. 35.]

I WAS now anxious to produce a continuous development of mixed gas from water subjected to heat alone, in other words, to succeed in an experiment which should bear the same relation to experiment fig. 9 as fig. 5 did to fig. 7; for this purpose the apparatus shown at fig. 10 was constructed: *a* and

Fig. 10.



b are two silver tubes 4 inches long by 0·3 inch diameter; they are joined by two platinum caps to a platinum tube *c*, formed of a wire one-eighth of an inch diameter drilled through its entire length, with a drill of the size of a large