

brought about by the development of the so-called kinetic theory of gases in the second half of the century. This is a physical, not a chemical, theory.

The kinetic theory of gases, invented for the purpose of explaining the pressure which all bodies in the gaseous state exert on the walls of the containing vessels, will always be identified with the two names of Clausius in Germany and Clerk Maxwell in England.¹ But if we

¹ Before the atomic view of matter had, in the course of the last fifty years, closely and definitely allied itself with the kinetic view, it had been allied with the astronomical view of matter. In the last century and the earlier decades of the present century we frequently find the behaviour of a complex of molecules or atoms compared with that of a planetary system; but in addition to the forces of attraction, those of repulsion had to be resorted to in order to explain the expansiveness of gases. Heat was then considered to be a material substance, the particles of which repelled each other. Dalton favoured this view in the introduction to his 'New System of Chemical Philosophy'; so did Berthollet and most of the French physicists who were brought up in the school of Newton and Laplace. Lasswitz, in his 'Geschichte der Atomistik' (2 vols., Hamburg, 1890), has traced the 'Decline of Kinetic Atomism' in the seventeenth century under the influence of the 'Corpuscular Philosophy.' The kinetic view of matter was allied with the Cartesian physical philosophy, which was dispelled by Newtonianism in France and by Kant's philosophy in Germany. In consequence, when in Germany A. Krönig published his 'Grundzüge einer Theorie der Gase' in 1856, philosophers who had been speculating in the direction of a Newtonian

atomism (see Fechner's 'Atomenlehre,' 1855; Redtenbacher's 'Dynamiden System,' 1857; and other publications quoted by Rosenberger, 'Geschichte der Physik,' vol. iii. p. 536, &c.) were much taken by surprise. It had the immediate result of inducing R. Clausius, who had been occupied with similar researches since 1850, to publish his celebrated memoir, 'Ueber die Art der Bewegung welche wir Wärme nennen' (Poggendorf's 'Annalen,' vol. c., 1857). These two publications first called general attention to the subject. Joule's paper, which appeared in the 'Memoirs of the Lit. and Phil. Soc. of Manchester,' had remained unnoticed, but was reprinted by him, at the request of Clausius, in the 'Philosophical Magazine' (4th ser. vol. xiv.) in 1857. Subsequently, the researches of Paul du Bois-Reymond and others unearthed a whole list of authors who, in more or less definite ways, had resorted to the hypothesis of a rectilinear translatory motion of the molecules in order to explain the phenomena of pressure and other properties of gases. Among these, Daniel Bernoulli (in his 'Hydrodynamica,' 1738) seems to have expressed the clearest views, and he is now usually named as the father of the hypothesis. The fullest statement of the historical data will be found in the posthumous second edition of