This idea of the rectilinear motion of the particles of matter in a free, *i.e.*, a gaseous, state (the first attempt to explain the physical properties of matter by giving a numerical value to a molecular, not molar, quantity) was not regarded by chemists, for it was indeed of little use in explaining chemical combinations and reactions. It, however, very soon received an important addition under the treatment of Clausius.[1]

35. Clausius's first memoir.

The kinetic theory of gases had not been propounded for the purpose of explaining chemical phenomena; it had grown out of repeated attempts to explain the nature of heat, and the fact, established about ten years earlier by Mayer and Joule, that heat can be transformed into the mechanical energy of molar motion. The idea suggested itself that if heat can disappear and be replaced by the measurable motion of molar (measurably large) masses, and *vice versâ*, heat itself may be merely the energy of the directly immeasurable movements of molecular (immeasurably small) masses; and as every body

made their careful experiments, that if gaseous bodies were allowed to expand, without doing work, no change of temperature took place—*i.e.*, that heat neither appeared nor disappeared. This would mean that no work of either repelling or attracting forces was done. Joule and Thomson showed that there was indeed a very slight cooling, indicating that a small amount of heat or energy was used up in doing work against attracting forces—the forces of cohesion. Had repelling forces existed, their work would have shown itself in a rise of temperature. This line of reasoning will occupy us in a subsequent chapter (see O. E. Meyer, 'Theorie der Gase,' vol. i. p. 7, &c., also Joule's 'Scientific Papers,' vol. ii. p. 216, &c.)

[1] How little chemical and physical reasoning went hand in hand before the middle of the century is seen from the fact that only after Clausius had published his first paper (see note, p. 433), in which he came to the conclusion that the molecules or smallest physical particles of simple (elementary) substances consist of several atoms, was his attention drawn to the fact that some French chemists, notably Dumas, Laurent, and Gerhardt, had already, by different arguments, arrived at the conclusion that the molecules of simple (elementary) gases consist of several atoms (see Clausius, *loc. cit.*, p. 22, &c.)