

THE LAW OF SUBSTANCE

energy" and the correlative idea of the unity of natural forces, on the basis of a common origin, are now accepted by all competent physicists, and are regarded as the greatest advance of physics in the nineteenth century. We now know that heat, sound, light, chemical action, electricity, and magnetism are all modes of motion. We can, by a certain apparatus, convert any one of these forces into another, and prove by an accurate measurement that not a single particle of energy is lost in the process.

The sum-total of force or energy in the universe remains constant, no matter what changes take place around us; it is eternal and infinite, like the matter on which it is inseparably dependent. The whole drama of nature apparently consists in an alternation of movement and repose; yet the bodies at rest have an inalienable quantity of force, just as truly as those that are in motion. It is in this movement that the potential energy of the former is converted into the kinetic energy of the latter. "As the principle of the persistence of force takes into account repulsion as well as attraction, it affirms that the mechanical value of the potential energy and the kinetic energy in the material world is a constant quantity. To put it briefly, the force of the universe is divided into two parts, which may be mutually converted, according to a fixed relation of value. The diminution of the one involves the increase of the other; the total value remains unchanged in the universe." The potential energy and the actual, or kinetic, energy are being continually transformed from one condition to the other; but the infinite sum of force in the world at large never suffers the slightest curtailment.

Once modern physics had established the law of sub-