

## THE RIDDLE OF THE UNIVERSE

the mechanical kinetic energy of its motion and convert it into heat. We have to furnish it with fresh mechanical energy by a spring (or, as in the pendulum-clock, by the drag of a weight). Hence it is impossible to construct a machine that would produce, without external aid, a surplus of energy by which it could keep itself going. Every attempt to make such a *perpetuum mobile* must necessarily fail; the discovery of the law of substance showed, in addition, the theoretical impossibility of it.

The case is different, however, when we turn to the world at large, the boundless universe that is in eternal movement. The infinite matter, which fills it objectively, is what we call *space* in our subjective impression of it; *time* is our subjective conception of its eternal movement, which is, objectively, a periodic, cyclic evolution. These two "forms of perception" teach us the infinity and eternity of the universe. That is, moreover, equal to saying that the universe itself is a *perpetuum mobile*. This infinite and eternal "machine of the universe" sustains itself in eternal and uninterrupted movement, because every impediment is compensated by an "equivalence of energy," and the unlimited *sum* of kinetic and potential energy remains always the same. The law of the persistence of force proves also that the idea of a *perpetuum mobile* is just as applicable to, and as significant for, the cosmos as a whole as it is impossible for the isolated action of any part of it. Hence the theory of *entropy* is likewise untenable.

The able founder of the mechanical theory of heat (1850), Clausius, embodied the momentous contents of this important theory in two theses. The first runs: "The energy of the universe is constant"—that is one-