expressed in the first law, and the doctrine of the availability of energy as expressed in the second law. It was Thomson who first clearly saw that the axiom of the impossibility of a perpetual motion would be infringed if the first law of thermo-dynamics—the indestructibility of energy—was accepted without the second. For practical use, for doing work, it is not sufficient that energy be not lost; it must be available—get-at-able. Energy may be in a condition in which it is useless—hidden away—and to bring it forth again may either be for us impossible (if it be dissipated), or may require an expenditure of work—*i.e.*, of energy—to do so. The second law puts into mathematical language another very important and very striking property of the processes in nature. Let us dwell on this a moment.

The doctrine of the preservation of energy, of the equivalence of the different forms of energy, tended to put all the forms of energy on the same level. If they be convertible, they appear to be of the same value. If in doing work, energy was not consumed but only changed, it stood to reason that it might be changed back again, so that the work could be done over again. In other words, if all processes are purely mechanical processes—modes of motion—a supposition which very early forced itself with more or less clearness on the pioneers of the science of energy, they must be reversible: it must be possible to turn them round again, to undo what has been done, or to do what has been undone. Now the common-sense view of nature tells us at once that this is impossible; but it does not seem to have struck the earlier propounders of the doctrine of the