

must be allowed that hitherto nothing decisive has been offered on the subject; and that conjectural modes of action have in this instance too often usurped the place of those to which a careful examination of facts alone can lead us.

(372.) Philosophers had long been familiar with the effects of electricity above referred to, and with those which it produces in its sudden and violent transfer from one body to another, in rending and shattering the parts of the substances through which it passes, and, where in great quantity, producing all the effect of intense heat, igniting, fusing, and volatilizing metals, and setting fire to inflammable bodies; even its occasional influence in destroying or altering the polarity of the magnetic needle had been noticed: but as heat was known to be produced by mechanical violence, and as magnetism was also known to be greatly affected by the same cause, these effects were referred rather to that cause than to any thing in the peculiar nature of the electric matter, and regarded rather as an indirect consequence of its mode of action than as connected with its intimate nature. In short, electricity seemed destined to furnish another in addition to many instances of subjects insulated from the rest of philosophy, and capable of being studied only in its own internal relations, when the great discoveries of Galvani and Volta placed a new power at the command of the experimenter, by whose means those effects which had before been crowd-

tion, as to the disposition of its material parts, and the whole quantity of heat it contains remains unchanged. But it is evident that the distribution of this heat within it is now very different from what it was before; for the air in its sudden expansion cannot re-absorb in an instant of time all the heat it had parted with to the metal: it will, therefore, have a temperature *below* that of the general atmosphere, while the metal yet retains one above it. Thus, a subversion of the equilibrium of temperature has been *bonâ fide* effected. Heat has been driven from the air into the metal, while every thing else remains unchanged.

We have here a means by which, it is evident, heat may be obtained, to any extent, from the air, without fuel. For if, in place of withdrawing the piston and letting the *same* air expand, within the reservoir, it be allowed to escape so suddenly as not to re-absorb the heat given off, and fresh air be then admitted and the process repeated, any quantity of air may thus be *drained* of its heat.