

expand more than either liquids or solids, and liquids more than solids. Of all solid bodies, the metals are most expanded with heat, and lead is more susceptible than any other metal. But the expansion is small under all circumstances, and it is consequently difficult to construct instruments by which to determine the amount. Lead, for instance, only expands one part in three hundred and fifty, when raised from the temperature of melting ice to that of boiling water. But this is not the only practical difficulty, for a solid expands equally in every direction, in its breadth and width as well as length. We have, however, no means of measuring an increase in volume, but must deduce the expansion of the whole from the increase in one direction. Another difficulty is, that an equal increase of temperature, at different temperatures, does not produce in solids the same expansive effects.

To prove that solid bodies do expand when their temperatures are raised, allusion might be made to the instances in which the principle is applied in the arts. The cooper surrounds his casks with iron hoops at a red heat, that they may, when cold, bind the tighter; and the smith must always bear in mind the same result. In some instances, it is necessary to guard very carefully against those errors which may arise from the dilatation of metals, and especially in the use of delicate philosophical instruments. The astronomer is peculiarly exposed to erroneous results from this cause; for a ray of light, a current of air, or the heat of the hand, may be sufficient to derange an observation, and to increase or decrease a distance or a diameter.

This effect must have some influence upon the solid mass of the earth itself, causing it to expand as its temperature is raised, and to contract as it cools. The variation of temperature on the surface is too small, in all probability, to produce any effect of importance; but the constant decrease of internal heat, a fact recently determined, must occasion contractions of no small amount; and it is probable that some of the phenomena observed on the surface of the earth may be attributed to this cause. We shall not attempt to defend the very ingenious theory of volcanic action proposed by M. Cordier, but the mention of it will prove the importance of considering the expansion of solids by heat, and their consequent contraction in cooling.

As the result of experiment, we know that the temperature