

MOLECULAR MACHINES.

BY PROFESSOR DOLBEAR.

If one of the functions of a machine be to transform the kind of motion it is supplied with into some other kind of motion,—translatory into rotary or vibratory, any one into either of the others,—one may be prepared to follow mechanical processes from masses of visible magnitude into those of molecular magnitudes, and thus note the antecedents of the new phenomena that appear.

When a gas is condensed by pressure the individual molecules have less free space to move in, and they consequently collide with each other more frequently. Being elastic, their average amplitude of vibration is increased proportionally, and a greater number of them will strike with greater velocity upon the walls of the containing vessel per second than before. Thus the temperature and the pressure of the gas are increased. We say that mechanical energy has been converted into heat energy, or sometimes simply into heat, though what has really happened has been the transformation of external translational motion into internal vibratory motion, which the elasticity and mobility of the molecules permit. When by friction or percussion a body is heated, the same thing precisely has happened—translatory motion has been transformed into vibratory, through the agency of the molecules, which have, therefore, acted as machines for transformation.

In like manner the reverse transformation may take place in several ways. When the increased vibratory motion of the molecules produces an increased pressure upon the movable head of a piston in an engine, the piston as a whole may move and do work. Also, when the molecules strike harder upon one side of a surface than upon the other side, the surface moves toward the side of less pressure, as with the radiometer, so that both engine and radiometer are machines for transforming vibratory molecular motions into translatory mechanical motion.

When the temperature of steam is raised to about 5,000 F., the amplitude of vibration is so great that the atoms can no longer cohere in the molecules, and they become separated into the gases hydrogen and oxygen; and again vibratory motion is transformed into translatory, which in gases is called free-path.

Heat is also largely derived from the chemical properties of coal, wood, oil, gas, and other substances called fuel. As the heat is derived from some antecedent condition which is not heat, it follows that the stove or furnace is a machine for transforming into heat motions those motions which constitute and are the measure of chemism.

When heat is applied in any way to the face of a thermo-pile, electricity may appear which may be made to do work in many ways. The vibratory motion disappears as such,—that is, it is annihilated,—while an electric

current
machin
a kind
kind of

When
is devel
of the a
when it
sents th
and an
machin
One is
heat.

On t
electric
there is
transfor
motion,
duct, he
unlike,
which, v
appear a

An ele
passes.

same ser
cussion a
tion into

So far
by the in
raise the
ousness.

electricit

the cond

carbon re

hence to

Ether

falling on

in consec

by heated

and spir

affecting

much the

Given

origin.

thinking

then be p