magical, showing that this fine wood possesses within itself a richness that renders it quite independent of any artificial coloring.

The architects of the Parliament House are Messrs. Fuller and Jones; of the Departmental Buildings, Messrs. Stent and Laver. The entire work reflects the highest credit, not only on the able designers, but also on the skilful artisans who have given it a tangible shape; and long may it remain as a land-mark in the history of art in Canada. It is to be expected, however, that a work so extensive and comprising so many details will provoke criticisms of all kinds; such has been the fate of the finest models and of the works of the greatest masters. Thus the *Tuileries* drew all sorts of animadversions on the devoted head of the architect, M. Viconti; and the new Houses of Parliament in London, which are among the most finished specimens of art, have been attacked with more or less violence. The cause of this apparent divergence of opinion is to be found in the spirit of emulation which, in all times, has animated the professors of the fine-arts, and the Canadian architects must be content to submit to the common lot of all artists.

SCIENCE.

Pleasant ways in Science.

No. I.—Curiosities of Motion.

(*Concluded.*)

If light only takes a trifle more than eight minutes to come nearly ninety-two millions of miles from the sun, the time occupied by its passage across an ordinary room would seem too small for possible appreciation, and yet M. Foucault experimentally determined its velocity by operating in such a limited space. His proceedings illustrate the important results that may flow from the employment of accurate means of measuring very small quantities of motion. Before attempting to explain the use made by M. Foucault of Mr. Wheatstone's revolving mirror, let us call attention to a well-known electrical experiment, in which a number of spokes set in a circle are made to revolve rapidly in a dark room. They are then illuminated by an electric spark, and found to *appear* at rest. The light has come and gone so fast that the spokes have not had time to make any appreciable change of position. We need not be surprised at this when Wheatstone found that the spark light "does not last the millionth part of a second of time," yet this minute time sufficed to make the light vibrations to excite the optical apparatus of the human eye, by communicating to it a quantity of motion sufficient to cause the sensation of light.

As a step towards understanding Mr. Wheatstone's measuring apparatus, let the reader take a small looking-glass in both hands, holding it up by the middle of the frame, and gently spin it round so that the bottom shall be where the top was, and *vice versâ.* Let a candle be placed in front of this mirror, so that at the moment it stands upright it shall throw a reflection of it upon the wall. The reflected image will then occupy a certain spot on the wall, and as often as the mirror comes round to the same place, it will throw the reflection on the same spot. If, however, immediately after one reflection has been thrown on the wall, the candle is moved before the mirror comes back to its place, the second reflection will be on a different spot to the first, and the distance between the two reflections will enable an experimenter to tell how much the candle has been moved. If, moreover, the time occupied by the mirror in rotating is known, it will become evident that in that time the candle's motion was effected.

Let us now suppose a mirror rotating with great velocity, that a ray of light falls upon it, and is reflected by it on a given spot. Let this same ray of light, after traversing a certain number of feet, be a second time thrown upon the mirror, and a second time reflected by it. If during the time occupied by the ray of light in the journey it made between the first reflection and the second was sufficient to allow the mirror to perform any appreciable part of its rotation, the light ray must, on its second arrival at the mirror's surface, have struck that surface at an angle differing from the first. It is evident that as light moves so quickly, the mirror must be very quick for the faintest difference of position to have occurred; but by making a rotation of 600 to 800 turns in a second, and by viewing the image through a magnifying eye-piece, M. Foucault obtained a sensible distance between the first and second reflections, although the light only passed through a space of twenty-seven feet. (1)

In the present state of science, we seem justified in regarding light, heat, and elasticity as modes of motion, and we may suppose that they all exhibit the two kinds of motion we have described—the oscillations of particles in limited space, and the indefinite propagation of the wave form. Heat is also a mode of motion, and a continual cause of motion in every substance and particle that it acts upon. Heat performs two functions, which are evidenced in a different manner to our senses; it expands bodies by forcing their particles further apart, and it makes bodies hot by communicating to their particles a particular kind of motion. If a certain quantity of heat is added to various substances, it will not make them all equally hot; but the heat which does not make itself cognizant to our senses in the form of augmented warmth, is occupied in internal work, and produces a movement of particles that may become known to us in some other way. "To raise a pound of water one degree would require thirty times the amount of heat necessary to raise a pound of mercury one degree." (2)

When chemical attractions operate powerfully, as when a mixture of oxygen and hydrogen is ignited by an electric spark, the atoms of the gases rush together with inconceivable velocity, and out of this intense development of motion a sudden heat ensues.

Heat, magnetism, and electricity are ceaselessly occupied in generating motion, so that no substance we are acquainted with is absolutely still. As a mass it may be at rest; that is, it may only partake of its necessary share of the common motion of the globe and the system to which it belongs; but its molecules are never quiet. The least change of temperature moves them more or less, the least change of position places them in a different relation to the magnetic axes of the earth, and then again a change is produced, at any rate, in most bodies. Every house affords an illustration of the way in which internal motions occur in substances that might be thought free from detrimental disturbance. Bell wires become rotten because the particles of the copper have rearranged themselves in a new form, by which cohesion is lessened; and iron has a tendency to grow brittle, apparently under the influence of continued concussions, though this is not perfectly clear. A piece of glass tube might be thought a settled thing, so far as its internal structure is concerned, but thermometer makers tell us that if newly made tubes are exactly graduated, sufficient changes are likely to occur in the course of a few months to affect the accuracy of the instrument. Metallic substances, such as gold and German silver, are employed to make the vacuum chambers used in the construction of aneroid barometers, and these, too, are subject to molecular motions, which change the elastic power of their delicate walls, and no one has yet arrived at the art of making these vacuum chambers so as to insure this action being so small as to have no practical effect in lessening their accuracy. Those which stand tests for six or more months are likely to remain good; but a new instrument, good to-day, may be worth little next year.

From the internal motions to which all bodies are subject, it is very difficult to make a good standard measure of length, and such a standard can only be perfectly right at the exact temperature to which it was adjusted. Instruments have been contrived by which motions of expansion and contraction can be measured to infinitesimal portions of an inch, and by which the exact length of any object can be taken, or the minutest deviations from a true plane surface detected. As a specimen of this class of instrument we may mention a *planometer,* and our description is taken from one constructed by Mr. Browning. An aluminium circle stands upon three legs, arranged at equidistant points of its circumference, and of precisely the same length. In the centre of the circle is another leg, which can be elevated or depressed by a delicate screw, and the extent of this movement read off on the edge of the circle by a vernier. If all four legs are exactly of the same length, and the instrument is placed on a plate of glass, or any other substance which is not a true plane, one or more of the legs will not touch the surface when the others do, and if a slight angular shove is then given to the instrument it will revolve about the central leg if that leg touches any point, which it can easily be made to do. We took a plate of glass which all four legs touched, and then we expanded a portion of the glass by the heat of one or two fingers imposed upon it for a minute. The particles of the glass experienced sufficient motion to lift some legs of the instrument higher than the others, and this extremely slight movement allowed us to rotate the

(1) *Ganot's Physics,* already referred to, contains a description, with diagrams, of this experiment.

(2) *Tyndall's Heat as a Mode of Motion.* Second Edition, p. 146.