Imponderable Agents.---No. 5.

[Second Series.]

LIGHT—FOUCAULT'S EXPERIMENTS—The principal phenomena of light, its reflection from polished surfaces, its refraction or deviation from its path when passing through media of varying density, its decomposition into several colors when passing through a prism of glass, can be very well explained by the emission theory of Newton. But this theory involves many difficulties which it cannot solve. It cannot explain, except by a dubious hypothesis, how part of an incident ray is reflected, and the other refracted. The undulatory theory solves difficulties which the emission cannot. If there is a subtle fluid in the universe, the vibrations of which produce the phenomena of light, then it is evident that the velocity of its motion must experience a certain modification according to the density of the media in which it occurs. Such is the question which Foucault undertook to prove by a series of beautiful experiments, in which he was entirely successful. It struck that eminent philosopher, recently deceased, M. Arago, that Prof. Wheatstone's revolving mirror, for testing the velocity of electricity, would answer well to test the velocity of light in passing through media of varying densities. The plan was to evolve an electric spark, direct it toward a revolving mirror —after having divided it—and cause one part to travel through air, and the other through a tube filled with water, then to receive and study the reflected images. If the water should *accelerate* or *retard* the motion of the light, the two rays could not arrive on the mirror simultaneously. The ray which was to arrive first was to fall on the mirror in a certain position, and the ray subsequently arriving would meet the revolving mirror in a more advanced position of its revolution.

Foucault, after much mental labor, devised a machine to accomplish this difficult problem of measuration. A beam of light was made to pass horizontally through a narrow aperture in a dark chamber, and was suffered to fall upon a revolving mirror. The rapid rotation of this mirror threw upon the sides of the chamber a slight luminous track, in which another mirror was so set that it reflected the rays thrown off by the revolving mirror. The rotary motion of the latter was very rapid—800 revolutions per second. The duration of the journey taken by the ray in passing from the revolving to the fixed mirror, and back again, was sufficiently long to allow the first mirror to change its position so that the ray, in return, would take the new direction given it by the altered angle of that mirror. M. Foucault succeeded in measuring this deviation, which he found to be proportional to the velocity of rotation as well as the length of space travelled over by the ray. He also found that this deviation was greater when the ray was passed through water than through air, and the former being a denser medium it was concluded that it presented an obstacle instead of favoring the transmission of light. Foucault's experiments were published in most of the foreign scientific journals, in 1851, and they attracted no small amount of attention. At the present moment almost every eminent man of science, believes in the undulatory theory.

We are totally ignorant of first causes; that is, we cannot explain why certain effects should be produced, when certain conditions are fulfilled—we can only tell that when these conditions are fulfilled certain effects will invariably follow. Why the three primitive colors should be developed in a ray of light by a prism, we cannot tell; we only know that such are the effects produced—the division of a white ray of light into three colors, when that ray falls on a prism of glass. The undulatory theory, no more than the emission theory, can explain this. Neither can the phenomenon of the sun beating like a huge heart upon the subtle ether, throwing out light from the center of our astral system, as the life blood is thrown from a human heart, be explained, any more than we can explain the principle of life.

"The laws of nature," be they relating to light or any other subject, is an expression employed to describe the operations of bodies or matter, and that is all.

Although light is, in the eloquent language of Milton, "the offspring of heaven's first dawn," we are still very ignorant of many of its phenomena. New discoveries are being continually evolved. In a lecture recently delivered before the Royal Institution of London, by Prof. Stokes he communicated some new and interesting observations on Internal Dispersion. He found that the blue flame of sulphur burning in oxygen is a source of rays which exhibit the phenomena extremely well. Letters written upon white paper, with a solution of chinin, immediately become visible when illuminated with this light, particularly when it is passed through blue glass, although such writing is invisible in gas light. By employing the light of the powerful galvanic battery of the Royal Institution, the Professor obtained, by lens and prisms of quartz, a spectrum from six to eight times as long as the ordinary visible spectrum, and it was crossed from one end to the other with bright bands. The interposition of a plate of glass shortened the spectrum to a small fraction of its original length, the highly refrangible portion being entirely absorbed. The discharge of a Leyden jar gave a spectrum which was about as long, but it was not similar to the others, as it consisted only of insulated bright bands. He also found that our atmosphere was not perfectly transparent for the very highly refrangible rays of the sun's light.

Introduction of the Potato into New England.

The Scotch immigrants, who were the first to introduce the manufacture of linen in the American colonies, were also the first to introduce the potato on the shores of the New World. In referring to this fact, the Boston "Transcript" mentions the following interesting particulars:—

"These frugal and industrious persons were descendants of a Scotch colony, who settled in Ireland about the middle of the seventeenth century; but on account of religious persecution were obliged to flee to this country, where they arrived in 1718. They came over in five ships and landed in Boston, having previously sent over an agent to make necessary arrangements.

They introduced the culture of the potato, which they brought with them from Ireland. Until their arrival this valuable vegetable, if not wholly unknown, was not cultivated in New England. They passed the previous winter in Andover, before settling in Londonderry, and there left some potatoes, which were planted and came up luxuriantly. The family whoraised them cooked the balls instead of the vegetable, and after trying them in various ways, pronounced them unfit for use, and the mistake was not discovered until the plow turned up the real potato."

[By recent foreign papers we learn that two intelligent Irishmen, from the same part of Ireland as the above-mentioned New England settlers, have, in the potato line, put forth the theory that the potato can only propagate by cuttings for a certain number of years, when its propagating force, by such a plan, fails, and thus they account for the potato disease. To recruit or renew the propagating force of this apple of the earth, they propose to renew the new stock from the plumbs. This theory is not new, yet we think favorably of the recommendation to raise new seed potatoes from the balls. The cause of the disease, as set forth is not correct, in our opinion.

[For the Scientific American.]

The Governor.

The following remarks would probably have never been made, were it not that the Report of J. E. Holmes, in No. 15 "Scientific American," on the trial of steam engines in the Crystal Palace, would appear to attach more importance to the subject than I did at the time I made my experiments.

All the governors that I have ever seen applied to steam engines, are not governors, properly speaking; I might call them ameliorators, inasmuch as thay govern the variation of speed only partially. I discovered this fact at the time I made experiments with my Fan and Fly in 1849. I had a machine driven by a very powerful mainspring making six turns; it was governed by the usual fan with which I obtained these results. When the spring was entirely wound up, the machine made 34 revolutions per minute, and within the last turn it made 28 revolutions, variation 0·176. Removing the fan and substituting an ordinary governor, the latter intended to regulate the speed by the increased and decreased effect of inertia alone, consequent upon the convergent and divergent positions of the balls of the governor, I found that when the machine was fully wound up, it made thirty and in the last turn but 20 revolutions per minute, variation 0·333. At this I was somewhat astonished, but from repeated and careful experiments I invariably obtained the same results; and I was reluctantly constrained to doubt the efficacy of this simple and beautiful instrument that has been so long and universally applied, but finding that it did fail, I set about discovering the cause.

The action of the Governor, applied to a steam engine, depends upon two forces, "centrifugal" and "gravity," each tending to counteract the other; and it is as the one or the other predominates, that the balls attain their different attitudes. These forces act at right angles to each other: centrifugal force acts horizontally and gravity perpendicularly. Now the balls are, by the present arrangement, made to describe a circle. The question arises whether that is the proper curve to move in. I have tried all the known curves, and have found them to fail; so much so that I have kept no record of their performance. At length I found that the right angle was the proper plane for the balls to move in, which I proved to the satisfaction of myself and friends by two experiments. The one consisted in having a funnel, the sides of which inclose 90 degrees, it was made of common tin, having small strips, radiating from the vertex to the base, soldered inside, which cone or funnel I placed with the vertex fitting tightly upon the spindle of the machine in such a manner that the base was uppermost. I filled it partially with shot; then trying it as before, I discovered not the least variation between the two extremes of the mainspring. A mainspring making six turns exerts six times more power when fully wound up, than when run down to the last turn. It is hardly necessary to remark that the shot by the action of centrifugal force was thrown to a certain distance from the axis of the funnel proportionate to the power, and that by the variation of the inertia of the shot, my machine was kept at equal velocity. My other experiment consisted in making the arms with the balls of the usual governor, having slots cut in them (the arms), working in guide pins fixed upon the axis or spindle, and making the upper ends or present bearings by means of a pin to work upon a peculiar curve, which I discovered upon the occasion, which curve I have never been able to find described, and therefore I believe that I am the discoverer. I have called it the Eggoid, from its resemblance to an egg. I found the balls to move from the axes, at an angle of 45°, to the horizon, and the machine, as before, performed its revolutions in equal times. Now, notwithstanding the assurance of the satisfactory performance of the engines at the Crystal Palace, there was a variation of their revolutions per minute, for at the commencement of the experiments the Lawrence made 46 and the Corliss 37 revolutions per minute, and that when the pressure of steam had been reduced down to 10·2 pounds, the former made 10 and the latter 14 revolutions per minute, which is a variation for the Lawrence of 0·782 and for the Corliss of 0·621,—not so flattering as one might be led to suppose from the Report.

I wonder what a "calico singer" would think were he to be interrupted in the midst of his operations by the engine making even one-quarter of that variation? The governor of the "Southern Belle" works upon a different but equally erroneous principle with the other engines. The balls move upon circular ways, but the ways are segments of a circle, whose diameter is much larger than that described by the balls of the other governors. I am sorry that we have not the Report upon this engine also, for it is my opinion that this governor governs perhaps just as much *too much* as the others govern too little. I am very glad that this report emanating from such a distinguished source has been made, and hope that it, with these few remarks, may stimulate our machinists to obviate these glaring defects, so that at the next World's Fair we may not have these living monuments reproaching us for our ignorance.

JNO. F. MASCHER.

Large Ships---Conflagration.

MESSRS. EDITORS.—I noticed your interesting article of the 24th inst. on "Large Ships—Ancient and Modern."

I have a friend, who frequently said, "Some how I happen always to be right in my opinion." I have frequently thought you might, if disposed to be egotistic, use the same language.

Your opinion, however, "that we shall yet see much larger ships in our harbor than any which now float there," I think is an error of yours for once.

I once heard of a ship carpenter who wanted to surprise his competitors by building a fine boat. He constructed and finished it in the garret of his house; but when thus finished, the thought occurred to him for the first time, "How am I to get it out?"

The "Great Republic" when laden cannot be got out of our harbor, neither could it be got into the Liverpool docks.

My opinion is, the builder of the Great Republic will forever have the unenviable reputation of building "the largest ship in the world."

Yours truly, G. B. Jr.

Brooklyn, Dec. 26, 1853.

[Our correspondent may be right, but "time will try all better far than tongue can tell."—The vessel which called forth our article and the above letter will never pass out of our harbor. On the night of the 26th ult., her rigging caught fire from the sparks of a conflagration of buildings at a short distance from where she was lying, and the flame spread from spar to spar, until in a short time she was enveloped in a sheet of living fire. On the next evening all that was left of this once magnificent vessel —the wonder of the world—was that part of the hull which was sunk beneath the surface of the water. It was a sad sight to us. Two other ships—the "White Squall" and "Joseph Walker"—were also burned to the water's edge.

The "Great Republic" was loaded with a valuable cargo, it consisted of the following articles, eight hundred tierces of beef, 97 tierces lard, 53 barrels of lard, 20,406 bushels of wheat, 33,500 bushels of corn, 6,630 barrels of flour, 1,023 bales of cotton, 639 boxes of tea, 4,046 barrels of resin, 14 hogsheads of tobacco, 70 casks of argola, and 367 pieces maple and cedar wood, all valued at $250,000.

This great cargo of provisions might have supplied the Turkish army for a month. She was ready to sail for Liverpool, and it it is said would have left her dock the previous evening, but could not get over the bar on account of low water. All the great ships which have yet been built have been unfortunate—is the finger of fatality pointed in anger against them? We do not know whether or not Mr. McKay will ever build such a large ship again, but to us it seems very discreditable to large cities like New York, that a depth of water cannot be maintained in the harbor, greater than will float a vessel drawing but about 21 feet. If the size of ships is to be restricted by such considerations, let the disgrace rest where it should. As we have said before, a large ship is the most profitable for long voyages, because it can carry 4,000 tons as easily as one of half the capacity can carry 2,000 tuns the same distance in the same time. In one voyage to Australia, a large ship will save 140 days sailing by this method of computing advantages. It may indeed be said that two small ships—half the size—will effect the same object. Not exactly, for upon that principle of reasoning, we would still have been navigating the Atlantic with 100 tun brigs, and 60 tun "smacks."

We invite the attention of our readers to the advertisement of D. W. Whiting. In the shipment of machinery it is very important—where it is possible to do so—to consign it to some agent who has had experience in handling it. Mr. Whiting has every facility for doing this.