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The Conservation of Force.

This is the title of a paper read in the month of February last, by the world-renowned Professor Michael Faraday, before the Royal Institution, and recently published from a corrected copy by himself. It has created considerable sensation among British philosophers, and has not only been made the subject of editorial criticism by every English periodical devoted to science, but numerous correspondents—some under their own and others under fictitious signatures—have through these periodicals been wrangling and jangling over the subject ever since. The meaning of the term "conservation of force" is simply the indestructibility of force. In other words, there is a certain quantity of force in the universe which can no more be destroyed nor increased than matter itself. With this idea of force in the universe, the common idea of gravity, according to Professor Faraday, is at variance. The received idea of gravity is, that an attractive force is exerted between any two or all the masses of matter, at every sensible distance, but with a strength varying inversly as the square of the distance. He points out where apparently this contradiction lies in the following very clear and specific manner:—

"Assume two particles of matter A and B in free space, and a force in each or in both by which they gravitate towards each other, the force being unalterable for an unchanging distance, but varying inversely as the square of the distance when the latter varies Then, at the distance of 10 the force may be estimated as 1; whilst at the distance of 1, that is, one-tenth of the former, the force will be 100; and if we suppose an elastic spring to be introduced between the two as a measure of the attractive force, the power compressing it will be a hundred times as much in the latter case as in the former. But from whence can this enormous increase of the power come? If we say that it is the character of the force, and content ourselves with that as a sufficient answer, then it appears to me we admit a *creation* of power, and that to an enormous amount; yet by a change of condition so small and simple as to fail in leading the least instructed mind to think that it can be a sufficient cause:—we should admit a resu lt which would equal the highest act our minds can appreciate of the working of infinite power upon matter; we should let loose the highest law in physical science which our faculties permit us to perceive, namely, the *conservation of force*. Suppose the two particles A and B removed back to the greater distance of 10, then the force of attraction would be only a hundredth part of that they previously possessed; this, according to the statement that the force varies inversely as the square of the distance would double the strangeness of the above results; it would be an *annihilation* of force; an effect equal in its infinity and its consequences with *creation*, and only within the power of Him who has created."

This extract clearly shows the difficulty under which Professor Faraday labors in reconciling the common idea of gravity with the "conservation of force." Is the doctrine of "conservation of force" true in mechanical philosophy? This is not denied; it is admitted. Is the doctrine of gravitation, as expressed, true also? It is. But both cannot be true and contradictory. How, then, has the idea of a contradiction between these arisen in Professor Faraday's mind? To us it appears that he has simply been confounding a cause with an effect. He has supposed an impossible case to explain his views of the contradiction referred to, and this never should be done in discussing a scientific question. All we know about gravity is simply the operation of matter. When we see a body of water falling down a precipice, we say it falls by gravity, but we do not know what gravity is. We know it is a force, but we do not know what force is. At the same time, when we say "this body of water falls by gravity," we know that the power of the water is as the hight of the fall, and that it moves faster and faster every second—so that of a fall, like Niagara, of 144 feet, the water would leap from the top to the bottom in three seconds—whereas, if it were only 64 feet, (not the half,) it would take two seconds to descend to the bottom; and if it were 257 feet, it would leap that distance in four seconds—that is, 113 feet the fourth second. These are the varying velocities of falling bodies; but, then, there is no contradiction between this method of their operation (gravitation) and the "conservation of force." To account for the cause of this operation of moving bodies is an entirely different question, and here is the point where, in our opinion, Professor Faraday mingles an effect with a cause, and hence the apparent contradiction between the two doctrines mentioned as belonging to mechanical philosophy.

There is no creation of force by a body of water falling down a precipice in the manner described, with varying velocities, nor would there be an annihilation of force if the same body of water were lifted back from the pool to the top of the fall. It would just require as much force to lift it up as it exerted in falling, and it would produce the same effect over again. The weight employed to give motion to clockwork, by falling, is a familiar example of this kind. There is no force lost, and none gained, by the raising and falling of the weight.

In the London *Mechanics' Magazine*, sneers and ridicule have been directed against the Professor for discussing such a subject. It is said "he is no mathematician, and he cannot discuss it." But ridicule is not argument, and mathematicians are not immaculate. The most eminent mathematicians of Europe disputed for thirty years over the question "how to measure force," without agreeing, and, at last, "sheathed their swords for lack of argument." The mathematicians of England appear to have got into a like snarl with Professor Faraday's paper.

Madame Rumor on Duty—The Rumored Changes in the Patent Office.

The *Daily Times* of Monday the 18th, contained a telegraphic announcement that Dr. Gale had resigned as examiner in the Patent Office, and that four other examiners were to be removed for political cause. This was followed the next day by the fuller statement through the same channel, that "Dr. Gale, who yesterday resigned his office as examiner in the Patent Office, has held the office for some years with reputation. It was alleged against him that he was in some way concerned in the establishment of a school here for the education of female colored teachers. He was, I believe, appointed a Director of this intended institution, which ex-Mayor Lenox recently demolished. He tendered his resignation when he found that he would be removed. Mr. Moss, another examiner, who resigned yesterday, was to have been removed. Three others are to be removed from the Patent Office on account of alleged political reasons. One of them was complained of by the Vice President, who demanded his removal. Judge Mason, the Commissioner of Patents, is said to be indignant at this interference with his assistants, without consulting him. But whether he has remonstrated against it I have not heard."

At the time of our going to press Dr. Gale has not resigned, nor does he intend to, but report says that he and also Messrs. Lane and Schaeffer will be removed, which is doubtful. There are no indications that Judge Mason is indignant or objectionably interfered with. He is actively engaged at his post, and all business goes on precisely as usual throughout the office.

Mr. Moss, late assistant examiner in the civil engineering and mill-work department, has resigned, but for no political reasons as far as we can learn.

Dr. Breed, late assistant, and acting chief examiner in the chemical department, has resigned, and established a laboratory at Washington, where he proposes to devote himself to the procuring of chemical patents, new processes, etc. Dr. Breed studied in Germany, under the famous Liebig, and is an experienced chemist. The series of articles lately published in our paper, presenting the features of all the chemical patents granted for two or three years past, were from Dr. B.'s pen. His resignation will be a loss to the Patent Office.

Tapioca.

Many persons are familiar with this as an article of diet, who do not know how it is obtained, or really what it is. It is the product of the Cassava root. There are two varieties of the cassava plant, both natives of South America; the one is the bitter and the other is the sweet cassava, but both are used for food. The first in its natural state is highly poisonous, and the Indians use its juice for poisoning their arrows. It is from this cassava that *tapioca* is made, but with all the poison removed. The poisonous principle has been found to be very volatile, hence by submitting the roots to the action of heat, it is all driven off; it is only when eaten raw that it is highly dangerous. The roots are first washed, then reduced to pulp, and the juice allowed to drain out. The pulp is then heated in a pan until it becomes slightly roasted; when in this state it forms cassava bread, the principal food of the natives. The juice which has been allowed to filter from the pulp is of a milky color, and is allowed to settle for some time in wooden dishes. A deposit of starch then falls to the bottom; the poisonous juice is now run off, the starch washed, and all the moisture driven off by putting it on hot plates until it is dry. It is afterwards granulated in sieves, and in that state forms the *tapioca* of which very excellent puddings are made. The heating of this starch on the hot plates drives off all the poison.

Recent experiments have been made in France by distilling the cassava root and condensing the vapors, for the purpose of ascertaining the nature of its poisonous properties. A very small quantity of prussic acid was thus obtained, about 0·004 per cent of the vapor, but the roots employed in the experiments were not fresh, hence it is reasonable to suppose that they contain more of this volatile poison when fresh dug from the ground, as cows have instantly dropped down dead from eating them. No other poisonous substance was found. Cassava contains a great amount of starch, no less than 23 per cent, and 5 per cent of sugary matter.

Pure Air and Sleep.

Dr. Arnott, in his Physics, states that a canary bird suspended near the top of a curtained bedstead where persons are sleeping, will generally be found dead in the morning from the effects of carbonic acid gas, generated in respiration. He set forth this as a fact, to show the necessity of breathing pure air in sleeping apartments, and a sweeping argument against the old fashioned high-curtained bedsteads. A healthy man respires about twenty times in a minute, and inhales in that period about seven hundred cubic inches of air; this he exhales again in the form of carbonic acid gas and water, which vitiates the atmosphere. Three and one-half per cent of carbonic acid gas in the air renders it unfit for the support of life; this shows how necessary it is to provide a supply of pure air for the support of respiration.

There are also certain facts which go to prove that more danger exists—that there is a greater proneness to disease—during sleep than in the waking state. In Turkey and Hindostan, if a person falls asleep in the neighborhood of a poppy field, over which the wind is blowing towards him, he is liable to "sleep the sleep which knows no waking." The peasants of Italy who fall asleep in the neighborhood of the Pontine marshes are invariably smitten with fever. Even travelers who pass the night in the Compagna du Roma inevitably become more or less affected with the noxious air, while those who pass through without stopping escape the marsh fever. Those who have traveled in tropical climes, and who have been attacked with bilious fevers, uniformly ascribe the cause of their sufferings to night exposure in the open air.

An English traveler in Abyssynia has asserted that he could live in health in that sickly climate, by a proper selection of the situation where he slept every night. There is abundant evidence, it would appear, which goes to prove that by proper attention to the place where, and the circumstances under which persons sleep, many diseases may be avoided.

Expansion of Cast Iron.

In a letter from P. D. Beckwith, of Dowagiac, Mich., a practical iron moulder, he states that "iron castings invariably shrink and become smaller in solidifying." In another letter received from W. B. Seward, of Bloomington, Ind., he says "cast iron shrinks about one-eighth of an inch to the foot in becoming solid." He has had many years' experience in the foundry business. Allowance is made in making patterns for this amount of shrinkage. Both of these letters refer to the statement on page 285 regarding the adaptability of iron for receiving exact impressions of the mold. Mr. Seward states that iron does take the impression of the mold with great exactness. On page 33, in the last edition of Graham's *Elements of Chemistry*, volume 2, there occurs this expression, "cast iron expands in becoming solid." Our practical correspondents are no doubt correct in this matter.

English India Rubber Goods.

We have received from Mr. H. H. Day a copy of the decision of Judge Grier, of Philadelphia, in the case of an application for an injunction by the Congress Rubber Company, to restrain the sale of india rubber goods of English manufacture, alluded to in the SCIENTIFIC AMERICAN of the 16th inst. In this decision the defendants are enjoined from making, selling, using or causing others to use india rubber shirred goods of English manufacture as a violation of Goodyear's patent. In Great Britain the sale of American vulcanized india rubber goods has been prohibited as an infringement of Hancock's patent; and it is perfectly just and right that the sale of English india rubber goods should not be allowed here, Goodyear being the original inventor. There is a defective term in the decision—it is the word "English" manufacture, which should have been "British" manufacture.

Anti-Divining Rod.

Several letters have been given in our columns from correspondents who believe in the efficacy of the divining rod, asserting that in the hands of certain persons it never fails to indicate the presence of water under the surface of the ground. We have received a letter from L. P. Summers, of Cobalt, Conn., in which he states that he has seen the divining rod used by a person who believed in its efficacy, and who had confidence that in his hands it really would divine where water was, but which utterly failed to do so. He asserts that the motions of the rod are produced by the strain upon the muscles of the arms, owing to the manner in which it is held. To prove that he is right he says:—"Let any person procure a divining rod which has grown in the form in which it has to be held when used, so that there will be no strain upon it, and consequently no tendency to spring back, and he will find that it will not work, thus proving that the strain of the muscles upon the common divining rod is the cause of its movements."

Shipbuilding.

The total number of vessels built in the United States during the past year was 1,703, the total tunnage of which was 469,393. Maine, Massachusetts, and New York are by far the greatest shipbuilding States, more especially the first, no less than 316 of the vessels, amounting to 149,907 tuns burden, having been constructed in Maine ports.

Sugar and Molasses.

No less than $22,400.353 were expended for imported brown sugars last year, and $4,334,-668 for molasses. This, however, is only equal to about one dollar for each inhabitant.

A little dilute liquid ammonia poured upon a hot iron plate in a greenhouse has a wonderful effect in developing flowers and leaves.