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MATTER AS A MODE OF MOTION.

In his address as President of the British Science Association, in 1871, Sir William Thomson threw out two original suggestions, which prettily illustrate the different ways in which new ideas are popularly received. One of the suggestions was of no value whatever, yet it was immediately caught up and talked about the world over: we allude to the hypothesis that the earth might be indebted to a germ-bearing fragment of some exploded planet for its first beginnings of life. It was a brilliant fancy, and caught the popular eye at once; but being only a fancy, it vanished as suddenly as it flashed into light.

The other suggestion awakened no apparent response; it may be that it conveyed no meaning whatever to more than a dozen persons, in whose minds it germinated for years before it bore any fruit fit for transmission to the general public. Sir William had been discussing the question: "What is the inner mechanism of the atom?"—a question which must furnish the explanation not only of atomic elasticity but of chemical affinity and the difference of quality of the different chemical elements, at present mere mysteries in science—when he remarked that a fingerpost pointing the way to a full understanding of the properties of matter might be found in Helmholtz's exquisite theory of vortex motion.

This most pregnant suggestion fell, as we have said, without meaning on the ears of the multitude, and found no place in the popular discussion of the address which followed. At most—save among a few of the more advanced physicists and mathematicians—it may have given rise to the queries, what is vortex motion? and what is Helmholtz's theory? for which encyclopedias and textbooks furnished no answer. Even the latest and most scholarly of English encyclopedias makes no mention of vortex motion in its article on atomic theories. Thanks, however, to the speculations of the authors of "The Unseen Universe," a wider interest in Sir William's suggestion was aroused. Since then Professor Clifford has endeavored to remove the new theory from the narrow world of pure mathematics and make it intelligible to people of ordinary culture: and still later, Professor Tait, in his lectures on recent advances in physical science, has done still more to bring the subject within the range of popular science, so that most reading men have by this time at least heard of vortex motion, though they may but vaguely apprehend its nature or its bearing on the drift of scientific speculation.

Fairly good illustrations of vortex motion (under friction) may be seen in the cloud rings produced by the spontaneous explosion of bubbles of phosphoretted hydrogen escaping from water into air. Occasionally puffs of steam from the funnel of a locomotive will show vortex rings; and the same motion is also shown by the revolving ring of tobacco smoke sometimes ejected by clever smokers. By means of a simple apparatus made of a cigar box, with a round hole in one end and the other end closed with a tightly drawn cloth, Professor Tait produces vortex rings of great perfection and persistence. In the box, fumes of sal ammoniac are generated; and by striking smartly the cloth-covered end of the box, very beautiful and durable cloud rings are driven out of the circular opening at the other end. A more tangible illustration of vortex motion may be seen in a soft rubber ring made to revolve on a stick without advancing. In this case the friction of the stick as it is drawn through the ring causes the inner portion of the ring to move in the same direction; as the ring, as a whole, is kept from moving forward, the motion of the inner surface forward is counteracted by a motion of the outer surface backward, the two resulting in a revolution of the ring upon itself without any change in its form or in its position in space. In the case of the smoker's cloud ring, the friction of the lips holds back the outer portion as it makes its exit, while by the breath the inner portion is driven forward, and thus a vortex motion is created, which lasts until the cloud ring is dissipated or its motion is stopped by the friction of the air.

It seems a long way from a puff of tobacco smoke to a theory of the innermost constitution of matter; but the scientific imagination often finds the simplest things the most suggestive, and sometimes reason can follow its most ambitious flights with a perfect bridge of mathematical demonstration. It has not yet been able to do so in this case it must be admitted; nevertheless, the conditions seem very favorable for ultimate success.

While studying the equations of motion in an incompressible frictionless fluid, some fifteen or sixteen years ago, Helmholtz demonstrated among other things that in such a fluid a vortex motion would be indestructible. The case is purely hypothetical; we know of no such fluid, and if it existed vortex motion could not be originated in it, since friction is essential to its production. But it is perfectly legitimate in mathematics to assume any imaginable conditions and then investigate their properties and results; and having supposed a vortex motion to exist in a perfect fluid, it is demonstrable that it would continue for ever, preserving its peculiar individuality to all eternity.

Even in air and water, vortex rings behave curiously like atoms; they preserve their individuality to the end; they cannot be made to destroy each other, nor can they be divided. Though nothing more than a rotating cloud of smoke, the sharpest knife cannot sever a vortex ring; it simply wriggles around the knife and keeps its course unharmed. In a perfect fluid, vortex filaments might be of any shape or degree of complexity, yet that shape would persist for ever unalterable.

Facts like these suggested to Sir William Thomson the idea that maybe the ultimate atoms of matter are simply vortex rings or filaments in a frictionless fluid filling all space. The mathematical verification of this hypothesis involves enormous difficulties—with present means, insurmountable difficulties; but Sir William has pursued it far enough to show that it explains a great many of the physical properties of matter.

From this view the assumed solidity of the ultimate atoms of matter gives place to extreme fluidity, the vortex atom being persistent and indivisible, not by reason of its hardness or solidity, but because its motion is indivisible. The origin of such motion remains of course unexplained, and, like the origin of life or force, unexplainable.

Taken in connection with Lesage's theory of gravitation the vortex theory offers many advantages over every other theory of the nature of matter; and as Professor Tait has remarked, with a little further development it may be said to have passed its first trial, and, being admitted as a possibility, may be left to time and the mathematicians to settle whether it will really account for everything experimentally found.

Having arrived at the conception that what we call matter may be only more or less varied phases of vortex motion in a universal frictionless fluid, which fluid possesses in itself none of the attributes of matter, Professor Clifford goes further, and holds it to be a necessary supposition that even where there are no material molecules the universal fluid is full of vortex motion, the inter-material spaces differing from matter simply in having their vortices smaller and more closely packed. In this way the difference between matter and ether is reduced to a mere difference in the size and arrangement of their component vortex rings.

SPECIAL MACHINE WORK VERSUS MANIPULATIVE SKILL.

The mechanical manipulation practised in this country is distinguishable from that practised in Europe in that handwork is mostly displaced by machine work; and this is in every way desirable, because the labor of the mechanic is lightened, and he becomes less and less an exerter of brute force. Furthermore, our producing capacity is greatly increased, while the cost of production is proportionately diminished. That these are desirable elements, even in the face of the fact that their existence is operating to some extent to destroy the quality of our workmen, is undeniable; but that these elements exist, it would be folly to deny. The very object of special tools is, in nearly all cases, to take the place of the most skillful workmen; and the skill required to operate a special machine is as a rule insignificant compared with that necessary to perform its duties by handwork. "What matter," it may be asked, "when the necessity for skillful handwork no longer exists?" No matter, providing that such be the case; but unfortunately it is not, because special machine work, no matter how well performed, can never equal the most skillful handwork. It can produce a quantity of good work at infinitely cheaper cost, and therefore by almost exclude the finest of work from the market; and this is what, in many cases, it does. This is, no doubt, all things considered, a gain; but the detriment to manipulative hand skill remains. This condition of things, however, has its limits; and these will be found in the nature of the work. For example, a number of pieces of small work, such as watches, sewing machines, etc., may be made by special machinery of as good quality as an equal number of such articles could, in the ordinary course of things, be made by hand. A single watch or sewing machine may, however, be made by hand with a perfection that special machine work cannot approach. But when we come to treat of work of a larger size, such as the manufacture of a lathe or a locomotive, the term special machine work assumes an entirely new aspect. For instance, an axle lathe may be called a special tool, because in it nothing but axles are turned. The skill of the operator in this case requires to be just as great, since his operations are not performed by the machine, and there exists the same field for his manipulative skill. Upon all but small work, in fact, the special tools and appliances consist mainly of arrangements designed to assist in the chucking and holding of the work, and in machines intended for certain kinds of work respectively, such as planing, boring, turning, and slotting. These operations are performed with the same cutting tools as of yore. The reason of this is that the milling cutters, emery wheels, etc., which will answer well upon small work, cannot be relied upon for large, as they will not cut true, and any attempts hitherto made to adapt them to such work has resulted in inferior productions. Again, on small work three or four operations can be performed by one special machine without its being unhandy; but on larger work, the attempt to construct a machine for performing several operations produces unwieldiness, unhandiness, and usually failure.

Another element of consideration is that, while it is very easy to cast or forge small work uniform in size and shape (and it does not matter if an occasional piece is lost from a defect in its casting or forging), a defect or variation is much more liable to appear in a large casting; and as the loss would be a serious matter, it may, by a slight and often inconsiderable variation, be made to serve. We have also to remember that the greater part of the fitting of work depends for its truth upon the file, for machine tools do not as a rule cut the work sufficiently true. In lathe work, special tools are confined to appliances, chucks, standard reamers, gauges, etc.; and in work of a medium size, the use of these aids tends to make the operator more expert, and a more skillful workman. It is indeed to be remembered that in small and moderate sized lathe work, the duty performed by the tools is so great that it requires constant skill and attention to keep them in order; and the tools in use are in such continual motion as to render their employment one requiring skillful manipulation.

The interchangeability of parts is an excellent and valuable assistant in producing new machinery, but its usefulness is far from being universal, as it is commonly supposed to be; because in making repairs the new parts generally require to be larger than their original size, in order to compensate for the wear which has taken place in other parts, and hence it is that, as a rule, repairs are made by the users and not by the original manufacturers of machines. Repair shops for this reason are in general demand, and in view of this necessity, which calls for the highest manipulative skill, they generally contain the best of workmen and pay them the highest rates of wages.

STATE PATENT LAWS.

A bill now before the New York State Legislature, introduced by Mr. Lang and known as the patent right bill, is intended to protect the people of the interior of the State against the wiles of the swarms of patent right venders who perambulate the country, selling rights and taking promissory notes for bogus patents. It provides that the words "given for a patent right" shall be written or printed across the face of the note, and any person who shall take or sell a note without the above placed upon it shall be deemed guilty of a misdemeanor. The bill has been ordered to a third reading.

We suggest a slight amendment to this proposed law, to wit. strike out the words "patent right;" otherwise the law, if passed, would be void because in conflict with the Constitution of the United States.

The United States courts have more than once decided that no State has a right to legislate upon the subject of patents, nor to regulate, nor attempt to regulate, their sale. That power belongs alone to Congress.

In the case of M. J. Robinson, arrested by the local authorities of Indiana, 1870, for violation of the State law concerning the sale of patents, it was held by Judge Davis, of the United States Circuit Court, as follows:

"This is an attempt on the part of the Legislature to direct the manner in which patent rights shall be sold in the State, to prohibit their sale altogether, if these directions are not complied with, and to throw burdens on the owners of this species of property which Congress has not seen fit to impose upon them. I have not time to elaborate the subject, nor even to cite the authorities bearing on the question, and shall therefore content myself with stating the conclusion which I have reached.

It is clear that this kind of legislation is unauthorized To Congress is given by the Constitution the power "to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries." This power has been exercised by Congress, who have directed the manner in which patents shall be obtained, how they shall be assigned and sold.

The property in inventions exists by virtue of the laws of Congress, and no State has a right to interfere with its enjoyment, or annex conditions to the grant. If the patentee complies with the laws of Congress on the subject, he has a right to go into the open market anywhere within the United States, and sell his property. If this were not so, it is easy to see that a State could impose terms, which would result in a prohibition of the sale of this species of property within its borders, and in this way nullify the laws of Congress which regulate its transfer, and destroy the power conferred upon Congress by the Constitution. The law in question attempts to punish by fine and imprisonment a patentee for doing with his property what the National Legislature has authorized him to do, and is therefore void."

In the case of Anthony *vs.* Carroll, where a State law of Massachusetts was cited as a bar to a patent right suit, Judge Shepley held, 1875, as follows:

"The policy of the Government to provide a uniform system of rights and remedies throughout the United States upon the whole subject matter of patents for new and useful inventions and discoveries, by placing it under the control of Congress and the federal courts, would be frustrated if such State legislation could directly or indirectly limit, restrict, or take away the remedy."

RECENT STUDIES OF LUMINOUS FLAMES.

For a long time Sir Humphrey Davy's explanation of the luminosity of flames—that it was due to the presence of highly heated solid particles—sufficed for all observed phenomena. A serious blow to its sufficiency was given, however, when Frankland discovered that certain flames were luminous under conditions which left no reason for supposing that solid matter could be present. For instance, hydrogen and carbon monoxide, burned in oxygen under a pressure of ten to twenty atmospheres, yield a luminous flame giving a continuous spectrum. So likewise the non-luminous flame of alcohol becomes bright when the pressure is increased to eighteen or twenty atmospheres. Frankland inferred from experiments like these that the luminosity of flames was due rather to the presence of the vapors of heavy hydrocarbons, which radiate white light, than to incandescent solid matter.

Still further doubt of the prevalent theory was raised by the experiments of Knapp, which proved that the diminished luminosity of a flame on the admission of air could not be due, as had been supposed, to an oxidation of the carbon suspended in the luminous gas, since the same effect was produced when nitrogen or carbon-dioxide, or other indifferent gas, was used as a diluent.

Stein and Blochmann attributed this effect to the direct influence of the diluting gases in separating the particles of carbon, so that the oxygen of the air might unite with them more quickly than under the ordinary circumstances of combustion. Wibel held, on the contrary, that the diminished luminosity was due entirely to the absorption of heat by the diluting gas, and supported his view by some very ingenious experiments. The correctness of this conclusion has been, in turn, controverted by the later experiments of Stein and Heumann, particularly the latter, which seem to show that the diminished luminosity consequent upon dilution is due not solely to dilution nor wholly to the cooling action of the added gases, but to both these causes acting together and frequently supplemented by a third cause—namely, the energetic destruction of the luminous material by oxidation. Heumann's experiments, which have been particularly ingenious and careful, lead to the following results: That hydrocarbon flames, which have lost their luminosity by the withdrawal of heat, become luminous again by the addition of heat; that flames rendered non-luminous, by dilution with air or indifferent gases, become luminous again on raising their temperature; that flames rendered non-luminous by excess of oxygen, which brings about energetic oxidation of the carbon, are rendered luminous again by diluting the oxygen with indifferent gases. In most cases of diminished luminosity two or all of these causes are at work.

Another unsettled question with regard to flames has been the cause of the non-luminous space between the opening of a gas burner and the flame, or between the wick of a candle and the luminous envelope. Blochmann attributed it to the inability of the surrounding air to mix at once with the stream of gas so as to make it combustible. Benevines, on the other hand, thought the dark space due to the mechanical action of the issuing gas, whereby the air is driven to a distance from the orifice of the burner—greater or less, according to the pressure on the gas, leaving a space wherein the gas is deprived of the requisite amount of oxygen and consequently remains unburned. Both these explanations are shown to be insufficient by the single circumstance that a flame never directly touches any cold body held within it. In all such cases Heumann finds an explanation of observed conditions in the cooling effect of its surroundings—burner, wick, cold iron, or what not—upon the gas. For a certain space around the cooling body the gas remains at a temperature too low for ignition.

Where the gas issues under high pressure, or is greatly diluted, the distance of the flame is attributed partly to this same cooling action of its surroundings, but more especially to the fact that the velocity of the stream of gas in the neighborhood of the burner is greater than the velocity of the propagation of ignition within the gas.

THE FLOWER TRADE OF NEW YORK.

On Broadway, Fifth and Sixth avenues, and the cross streets near them between Third street and Forty-seventh, there are thirty large florist concerns, each of which pays a rent from $1,000 to $4,500 a year, and does a yearly business of from six to forty thousand dollars. There are besides perhaps fifty smaller shops for the sale of flowers in different parts of the city. Many of the larger gardens and hot-houses were established during the flush times between 1860 and 1870, when large sums were lavished on floral decorations. At the wedding of Tweed's daughter, for instance, the floral designs, bouquets, and parlor decorations are said to have cost nearly $4,000. Since 1871 there has been no notable increase in the number of flower producers in this vicinity. The number of retail dealers, however, has increased, and with the greater competition and smaller demand the prices and profits have been materially lowered. Indeed, says a *Times* reporter, to whom we are indebted for a three-column review of the trade, it is only at holiday seasons that prices can be regarded as handsomely remunerative. For example, a shipment of roses and violets sent to Boston just before New Year's brought $15 a hundred for the roses and $1.50 for the violets; but by the 10th the same sorts of flowers were respectively worth only $4, and half a dollar a hundred.

At this midwinter season the assortment of flowers in the New York market embraces ten choice varieties of roses, four varieties of camellias, several varieties of carnations, violets in abundance, heliotropes, mignonettes, pansies, primroses, azaleas, forget-me-nots, the sweet alyssum, etc. The lilies of the valley seem to gain in popularity constantly; and notwithstanding the great number grown about New York, so high are they in favor that the price is always good. Roehrs, of Union Hill, N. J., grows 150,000 sprays of them annually. One day last year he sent to the city by one man 10,000 sprays, for which he received fifteen cents each, or $1,500 for a single back-load. Carl Jurgens, of Newport, Rhode Island, grows this winter 800,000 sprays of these little beauties. Roman hyacinths, which rival the lilies of the valley in popularity, are worth just now from seven to ten cents a spray, or from one and a half to two dollars a dozen. Orchids are always hard to get and very costly; sometimes as much as five dollars has been paid for a single flower. The finest collection of orchids grown for the trade in this country is believed to be that of George Such, of South Amboy, N. J.

Among foliage plants, ferns and smilax are most commonly used, and are justly prized for their effect in lighting up all floral decorations. Ordinary branches of ferns cost but three dollars a hundred, but some of the rarer kinds command as much as fifty cents each. The amount of smilax used here is enormous, experienced florists estimating that from 1,000,000 to 1,500,000 feet of this beautiful vine are made up annually in this city. Formerly it used to be imported entirely from Boston, at a cost of a dollar a yard for single strings; now that the local florists are growing it largely, the price is greatly reduced. This winter not more than three thousand dollars' worth of all kinds of flowers and foliage have been imported from Boston, while considerably more than that amount has been sent there, besides large shipments to Philadelphia, Baltimore, Albany, and other cities.

The best informed of our large flower-growers estimate that not less than $10,000,000 are invested in the wholesale florist's business, in land, greenhouses, and stock in this vicinity. The hot-houses cover over forty-five acres. At Union Hill, N. J., there are perhaps twenty acres under glass for the cultivation of flowers for the New York market. The general average of prices at the present time is, for loose roses, $1 a dozen, except for choice specimens, which command fifty cents, or even a dollar apiece; calla lilies, 25 cents each; smilax, 30 cents a yard; heliotropes, carnations, bouvardia and other small flowers, about 50 cents a dozen; hand bouquets from $5 to $25, according to size and composition; table designs from $5 to $100; funeral designs from $3 to $150.

For permanent house decorations, grasses, *immortelles* and pressed leaves are in great favor; the most beautiful grasses being the magnificent "pampas grass" plumes from California, which sell from 50 to 75 cents each, or $1 a pair for handsome specimens. *Immortelles*, of natural color and dyed, are brought from France, but not in large quantities.

PUTTING IN COAL.

We are in receipt of a letter from a correspondent in this city regarding the annoyances to which householders are subjected in putting in coal during the winter season. When a heavy snowfall blocks the streets, and coal carts cannot back up to the coal shoots, the drivers often carelessly dump their loads on the snow heaps, and quantities of coal are thus lost by becoming imbedded in the snow.

The remedy which will at once suggest itself to many is the adoption of the English system of delivering coal in sacks, each containing a given amount, say 200 lbs. This, in London, is obligatory; and in order to protect the purchaser against short weight, wherein, by the way, he is often woefully cheated by the system of delivery in vogue here, every cart in which the sacks are carried is provided with scales, so that the sacks may be weighed singly if the buyer makes the demand. In England, however, this is regulated by laws, and any similar statutes we do not possess. Hence there is no way of compelling coal dealers to deliver their coal in sacks; and besides there yet remains the trouble of emptying the bags into the cellar shoot. For this work, the extortion would undoubtedly be as great as for shovelling the coal by hand. Besides, the coal sacks must in some way interfere with the profits of the business, judging from a sign (now posted on a prominent thoroughfare in this city, before the office of a dealer in the commodity) to the effect that "coal will be delivered in 100 lbs. bags at 50 cents per sack." That is $10 per ton, or about double ruling prices based on bulk delivery.

The best way, we think, to introduce a reform is to make it profitable in a legitimate way to the persons on whom it is to act. To this end, we suggest making the bags themselves an article for sale; and instead of using hemp or other cloth in their manufacture, use paper. There is no question but that coarse brown paper can be made strong enough to hold 100 lbs. of coal during its transit from yard to cellar. Let this paper be well soaked in resinous material and it will constitute a firstrate kindling, possibly as good as the "fire lighters" of similar composition now sold. It will only be necessary then to lift the filled bags from the cart and toss them bodily down the shoot. Of course, it is immaterial if they break while sliding into the cellar. Coal thus transported would be protected from the weather, and would obviate the necessity of moistening to prevent dust while it was being deposited in the cellar; and even if abandoned by the cart driver on a snow bank, the coal would hardly suffer the fate of our correspondent's fuel. We live in an era of reform. It remains to be seen what enterprising coal dealer will adopt our suggestions.

Slate Roofs.

A very economical system of slating buildings with large slates is as follows: The rafters are placed at a clear distance apart about 1½ inch less than the width of the slates. Down the center of each rafter is nailed a fillet, thus forming a rebate on each side, in which the edges of the slates rest, being secured by black putty, or—as this looks smeary and uneven—by a second fillet 2 inches wider than the first, nailed over it so as to cover the edges of the slates and hold them down. Each slate laps about 3 inches over the one below it. Only half the number is required in this as compared with the ordinary method of slating, and no boarding or battens are necessary.—*Notes on Building Construction.*

IN our description of Mr. Guardiola's sugar evaporator, on page 82 of our last issue, we stated that the apparatus is calculated to produce defecated juice from, say, 8° to 25° Baumé. It should read: "The apparatus is calculated to produce, in about five minutes, syrup of about 25° Baumé in a continuous stream, from defecated juice of 8°," etc.

A LAWSUIT has been commenced by one firm of pianoforte makers against another, for damage caused by the latter's misrepresenting the nature of the Centennial awards, and claiming to have received a premium higher than that given to any other maker.