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Contents:

(Illustrated articles are marked with an asterisk.)

THE TRANSMISSION OF POWER BY COMPRESSED AIR.

The subject is becoming more and more a question of importance, and some capitalists have even gone so far as to signify their willingness to risk their means in making the attempt, in two places where water power is abundant, as we mentioned on page 49, Vol. XXIV. It certainly would be a great convenience to obtain power, for driving machinery, from a pipe, in the same way as we do our gas and water; and the risk of fire and boiler explosions would be done away with. Le us consider whether the economy of the idea is equal to its other advantages.

Up to the present time, compressed air for obtaining or transmitting power, has been chiefly employed in tunnels and mines. At the Hoosac Tunnel, and that under Mont Cenis, it is and has been an invaluable servant. At the former, just now, the headings are, roughly speaking, one and a half miles from the points where the air is compressed; that at the east end being forced into the receivers and pipes by water power, every two drills requiring a four-foot turbine wheel to supply the necessary air, while the west end air is compressed by steam power, each pair of drilling machines requiring about twenty horse power. The air is compressed, into large receivers made like ordinary shell boilers, to about sixty pounds per square inch, and conducted thence into the tunnel, and up to the headings, by eight-inch cast-iron pipes, of twelve feet lengths, flanged into each other and bolted together, rubber rings or gaskets being used at the joints. These pipes are almost perfectly air-tight, and, in a distance of one and a half miles, do not afford more than four pounds of friction, per results, in pressure at the headings. The drilling machines have a reciprocal motion, the cylinders being from three and a half to four inches in diameter, by one and a half foot stroke, and, with fifty-six pounds pressure, ordinarily make two hundred and fifty strokes per minute.

So far as rock drilling is concerned, it appears that there is a loss of about sixty per cent of the power required to compress the air, as an engine of eight horse power, with sixty pounds pressure of steam, acting directly, would undoubtedly drive two machine drills. Separate compressing engines are used for supplying air for ventilation, which needs from three to four pounds pressure, through similar pipes.

The great question is, can air power be transmitted long distances with advantage? We are of opinion that it can, up to a certain distance, provided the compressing power costs comparatively nothing beyond its prime cost; but, for longer distances, we must shake our heads.

It is true that in a pipe ten miles long, closed at the further end, the pressure will be the same at the closed end as if it were only ten feet long; but when the air is in motion there will be friction. The result of calculations and observations afforded us, seems to indicate that the friction, for a constant velocity, is in direct proportion to the length, and inversely as the inner circumference of the conducting pipe.

A certain percentage of supply over consumption should be allowed in a long pipe, as there will be more or less leakage; but, with this exception, when the pipe and receivers are indicating the necessary pressure, no more air will need to be compressed at one end than is used at the other; and we see no reason why the question does not resolve itself into, "How much air must be compressed at one end to balance friction and leakage, in a given time, and to furnish a required amount, in the same time, at the other?" The practical answer to this is a mere matter for calculation, and can be readily arrived at; but there is, we think, a point at a certain distance (according to the size of the conducting pipe) from the compressing power, where the expenditure and supply would exactly balance, any less distance showing "profit," any greater, "loss," so that the distance it would be profitable to conduct compressed air depends on the bore of the conductor. The greater the bore, the greater the proportion of profit, as it were, up to a certain point, and beyond that the greater proportion of loss.

Suppose it would cost about $260,000 to furnish a pressure of sixty pounds, at the end of an eight-inch pipe twenty miles long. This pipe would supply certainly no more than 100 horse power, and it would certainly take 250 horse power to keep up the supply of air, which would have to move through the pipe at a high velocity, making the loss by friction very serious. Would 100 horse power, supplied continuously at $150 per annum per horse power, be a profitable investment on an outlay of $260,000?

Suppose we take the largest size pipe admissable, one of thirty-two inches diameter. This would cost, including compressing machinery, in round numbers, $1,550,000, and the compressing power required for full capacity of pipe would be not less than 2650 horse power. The effective result would be about 1000 horse power, which, at $150 per annum per horse power, would be $150,000. This would not be a profitable investment of capital, even without any risks, and no deduction has been made for keeping the pipe and machinery in order, or for running expenses, which, however, would not be very great.

As this pipe is as large as could be reasonably used with safety, and, for other reasons, it follows, according to the above estimate, that the cost for transmitting air power a distance of twenty miles through a pipe of thirty-two inches bore, would be, in the case of 1000 horse power (its utmost capacity), about $1,550 per horse power, ten per cent of which would be $155, or $5 more than each horse power of steam would cost at present. But the large pipe pays better than a smaller one.

Therefore we are of opinion that twenty miles is too great a distance for transmitting compressed air, and, from above data, it is easy to find the point of limit to which it can be sent advantageously to supplier and consumer.

With respect to receivers at the distance of several miles from compressors, we would advise each consumer to have his own, as no general system of receivers would be sufficiently large to be of any service, besides adding enormously to the first cost and subsequent repairs.

An additional pipe alongside another of the same size would just double the cost, without any particular benefit accruing.

PAYNE'S ELECTRO-MAGNETIC MOTOR.

A wildly enthusiastic editorial in the *Journal of the Telegraph*, the organ of the Western Union Telegraph Company, on a new electro-motive power, said to have been discovered by H. M. Payne, and now in operation in Newark, N. J., has excited very great interest in the public mind, The article has been extensively copied, and widely read; and as it predicts the dawn of a new era in the mechanical world, and comes from a source which ought to be an authority upon such matters, many, no doubt, believe that really an immense advance has been made in electric science, and that the long desired cheap and economical electro-motor has at last made its advent.

The editor of the *Journal of the Telegraph* has had an advantage denied to us, namely, the opportunity to inspect the machine while in operation. It is understood that, because several scientific gentlemen, thoroughly versed in electric science, have seen it, and discredited the claims made for it, that the parties interested are not inclined to allow any further examination on the part of those whose opinions are not known beforehand to be likely to be favorable. We are, therefore, unable to speak from personal knowledge, in regard to this machine, but we can say that men whose judgment is considered reliable in electric science, pronounce the claims of Mr. Payne to be a humbug. It is but fair to say, however, that some believe Mr. Paine to be really doing all he claims to do, and that there is no kind of deception practiced.

The principal points of the construction of this engine, from what we are able to learn, seem to be the breaking of the circuit of each magnet successively, before it has drawn its armature to the center of attraction, and the making of the circuit in the next one of the series, so that the primary force, of the latter, acts together with the residual force in the former, and in the same direction, (instead of opposing each other, as in other electro-motors), besides keeping the battery current constantly unbroken; also, the peculiar form of the magnets, by which it is claimed their attractive power is enormously increased—so much so that, it is stated, a 50 pound magnet has been made to sustain 120 tuns, with a battery of four Daniell's cups, such as are ordinarily used for telegraphing. If these claims can be made good, the public will know it in due time.

We are informed that an engine, designed to develop 500 horse power, is either commenced or soon to be constructed.

These, in brief, are the facts in relation to this matter, so far as we can gather them from various sources, including the rhapsodical articles of the *Journal of the Telegraph*.

Now, a word as to the theory of the new motive power. It is claimed that the battery is merely the connecting link, so to speak, between the machine and some mysterious storehouse of magnetic energy, and that it is no more the source of the power than the trigger of a musket is the source of the power which projects the ball. This looks to us like sheer fudge. We are not prepared to believe that any power whatever is derived from any source but the battery, and we should expect to find the consumption bearing an exact relation to the power developed.

The *Journal of the Telegraph* states that the power developed was rated at two horse, yet "two gentlemen, weighing 170 pounds each, endeavored to stop the motion of the wheel by the pressure of a concave brake, having a surface six inches by four, bearing on the belt wheel, but *without visible effect*) The italics are ours.) Now, any mechanic knows that unless the power developed was much greater than the estimate, this statement cannot be correct, (unless the motion was enormously speeded down to the belt wheel), and some would even suspect that there was concealed battery power, which could be drawn upon in case of an emergency. Surely, a brake pressure of 340 pounds, directly applied, would produce *some* visible effect on an engine of only two horse power.

In a second article on this subject, the journal referred to says: "We have the data of an examination by an experienced engineer, who gives the result of his examination as follows: Number of cells of battery, 4; number of revolutions per minute, 340; diameter of pulley, 12 inches; pressure of brake, 65 pounds; developed in horse-power, 1·99 to 2."

Not knowing the coefficient of friction of the brake and pulley, we, of course, cannot say positively that the above statement of power is not correct; but, allowing the highest coefficient of metals on wood, given by Mr. Rankine, in his work on "Machinery and Mill Work," page 349, *i.e.*, 0·6, a computation from the data given gives only 1·262 horse power, instead of 1·99 to 2, as claimed. The latter result can only be obtained by using the entire pressure of the brake as resistance, an error an experienced engineer would not be apt to make. Perhaps, however, what is printed "pressure" was intended to mean resistance; if so, the horse-power claimed is sustained by the data.

If, as the writer of the first article referred to asserts, the battery power is only an initial force, which opens some hidden valve for the entrance of an indefinite quantity of some other force, and the size of the battery, and its consumption, need not be increased, to obtain increase of power, then we may as well cease the search for a perpetual motion, for its existence is demonstrated.

We are inclined to regard these expressions of opinion as the hasty effusions of a too sanguine observer, rather than as the sober statement of solid judgment, based upon knowledge. Whether true or erroneous, such statements made in the present stage of the invention, can only induce skepticism in the public mind, a skepticism which we regard as entirely justifiable under the circumstances.

EFFECT OF COLD UPON IRON AND STEEL.

We publish in another column a condensed statement of experiments and opinions of some engineers of high standing, upon the effect of cold upon the strength of iron and steel, the sum of which was that these metals were not rendered brittle by low temperatures. Our readers' attention will scarcely need to be pointed to the fact that most of the experiments of Joule and others were made by steady pressure, and therefore cannot be considered reliable when percussive force is brought into play.

It seems almost superfluous to argue that power applied percussively produces very different effects from simple dead weight; but when men like Joule, Fairbairn, and Spence, ignore this difference, it is fair to suppose that less skilled engineers may also ignore it. That there is a difference in these effects, so great that no relation between them can be determined, any one may convince himself by contrasting the tensile strength of glass with its extreme frangibility under percussion. We maintain, therefore, that, in so far as they go toward settling the question whether rails and tires on railways are more liable to break in cold weather than in warm weather, their experiments and the opinions based upon them are alike valueless.

Mr. Brockbank, whose paper drew forth the opinions referred to, took the ground that iron and steel were more liable to break in cold weather, and based his opinion upon percussive experiments. It is obvious, therefore, that his opinion has no weight upon the subject of tensile strength as affected by cold, but it is of great value as confirming experiments previously made to ascertain the effect of cold upon iron and steel subjected to percussion, experiments of which Mr. Brockbank was apparently ignorant at the time his paper was prepared.

In 1869, a "Treatise on Iron and Steel," by Knut Styffe, was published in London, from a translation by Christer P. Sandberg. The translator, however, took issue with the author upon this very question, and denied the applicability of Styffe's deductions, from tensile experiments, to percussion in cold temperatures, founding his denial upon experiments performed by himself in Stockholm under the authorization of the State Railway Administration of Sweden, in 1867. The results of his experiments prove that at 10° Fah. rails will not sustain much more than one fourth the blow that they will at 84° Fah. The method of performing the experiments, as well as the details of each, are given in tabulated form in a voluminous appendix to the translation of Mr. Styffe's treatise.

Mr. Sandberg concluded from his experiments that the brittleness of iron and steel under low temperatures is due to phosphorus present in the metal, and that with purer metal, the results would have been different.

It is evident that this subject is imperfectly understood, even by the highest authorities, and further extended investigations, with all kinds of iron and steel, must be made before the general effect of cold, as inducing brittleness under percussion, can be affirmed. Meanwhile, it seems to be well settled, that the tensile strength of iron and steel when tested by stretching, is not lessened by low temperatures. On the contrary, it would seem from Mr. Spence's experiments to be increased rather than diminished.

MR. COOPER'S RECENT GIFT TO THE MECHANICS OF NEW YORK.

Mr. Peter Cooper has given one hundred and fifty thousand dollars to the trustees of the Cooper Union, in addition to the million dollars previously bestowed by him on the institution, to be expended in the purchase of books for a free reading room, and for such other purposes as the trustees may elect, for the benefit of the mechanics of New York. To call this act princely munificence, is a very inadequate expression of the appreciation in which the citizens of New York hold the last generous deed of Mr. Cooper. A prince who steals his wealth can easily afford to be liberal; one of nature's noblemen, who earns his money by the toil of his hands, when he bestows his wealth, gives what belongs to him, and is entitled to vastly more praise.

Mr. Cooper, in early life, was too poor to pay for instruction, and was compelled to acquire knowledge in the intervals of toil and at great disadvantage. He resolved that if fortune should favor him, he would found an institution in which the poorest mechanic could obtain gratuitous instruction in the evening, in such departments of learning as would add to his usefulness and chances of success in his career. Having felt the want, he knew how to apply the remedy; and, in after years, as fortune smiled upon him, he did not, as many others have done before him, forget the promise of humbler days, but set too work to carry out his intentions in his life time, and under his own energetic supervision. The Cooper Union was founded and dedicated to science and art. It has prospered under his hand. Competent teachers have been engaged to give instruction to the thousands of mechanics and women who have applied for admission. The free reading room has been thronged by persons who have gone there to prepare articles for the press,or to snatch a little information in the intervals of their work.

The School of Design for women has opened up a field of usefulness to a large class of society which has very limited opportunities for earning a support. The large hall of the Union has been the theater of popular scientific lectures before immense audiences, and thus the seed sown is scattered in every direction; and the beneficent influences of the Cooper Union are felt in the workshop and family circle by a class of persons who would otherwise have been excluded from these advantages.

There is something grand in the conception and execution of a plan of such magnitude as this; and it is rarely that the privilege is accorded to any one in his lifetime to do so much good.

The occasion of the new gift by Mr. Cooper was the anniversary of his eightieth birthday. He has "by reason of strength," attained four score years, but this strength cannot be "labor and sorrow" to one who has called down so many blessings on his head. The gratitude of the poor is a rich inheritance, and our mechanics know how to thank those who have helped to lessen their toil and to elevate their condition.

Mr. Cooper has long been anxious to see the whole of the Institute building devoted to the purposes of the foundation, but it has been necessary to provide an income to meet expenses; and to do this, the various stores and rooms of the lower floor have been let. The room thus taken up for the purposes of trade is greatly needed for the collections of apparatus, minerals, ores, and drawings required by the pupils; and it would be a handsome mode of expressing their appreciation of what Mr. Cooper has done, if the wealthy manufacturers of the city were to contribute a fund, the interest of which would equal the rent to be derived from the stores. We should like to see the whole edifice swarming with persons in search of knowledge, while the money changers find a resting place elsewhere.

It would be a just recognition of Mr. Cooper's claim upon the respect of the community, if our citizens were to raise a fund for the endowment of the institution which he has established at an expense of a million dollars. We dare say that every mechanic in the city of New York would cheerfully give a dollar towards such a testimonial fund, if the movement could be organized by responsible persons. It would be a beautiful thing to see the declining years of the good old man sweetened by these evidences of regard, and, as he has taken care, during his life time, to accomplish all this good, it would be well for the recognition of it to come while he is yet able to understand and appreciate it.

DEATH OF THOMAS BRASSEY, THE GREAT ENGLISH RAILWAY CONTRACTOR.

The subject of the present obituary notice, whose death is announced in our latest foreign exchanges, was one of the great men of his time. His field of labor was one that does not generally attract the attention of the world, yet Mr. Brassey was widely known in both hemispheres, as the most extensive railway contractor in the world. He is said to have left the largest personal estate ever administrated upon in England, and this wealth was not acquired by stock jobbing and speculation, but in the legitimate business to which he devoted his life.

Mr. Brassey was born at Baerton, England, in 1805. At the age of sixteen he was apprenticed to a surveyor, and was taken into partnership by his instructor at the end of his term.

His first contract of importance was ten miles of the line of the Grand Junction Railway from Liverpool to Birmingham, in 1835. This contract proved profitable to himself and satisfactory to the company.

His next great contract was on the London and Southampton Railway, exceeding in amount four millions of pounds sterling. One would think such a contract as this was business enough for one man, but not content, Mr. Brassey undertook at the same time portions of the Chester and Crewe, and the Manchester and Sheffield Railways, besides entering into partnership with Mr. W. McKenzie, o execute the Glasgow and Greenock line. These gent'emen, still remaining partners, undertook in 1840 the construction of a French railway from Paris to Rouen.

Between 1844 and 1848, Brassey and McKenzie contracted to construct five other French railways, and Mr. Brassey, on his own account, contracted to build three lines in Scotland and two in England and Wales. It is stated that Mr. Brassey had at this time 75,000 men in his employ, and that the weekly wages paid by him amounted to from fifteen thousand to twenty thousand pounds sterling.

T e last of the various works named, the Great Northern Railway, was finished in 1851. From this date up to the time of his death, Mr. Brassey was engaged, for the most part singly, but at times in partnership, on the following works: Works in Shropshire, Somersetshire, and the county of Inverness; the lines of the Sambre and Meuse, the Dutch Rhenish, the Barcelona and Mataro, and the Maria Antonia Railways, in Belgium, Holland, Prussia, Spain, and Italy; the Grand Trunk Railway, in Canada, 1,100 miles in length; six more railways in France; six more in Italy; the Bilbao and Miranda line in Spain; arious contracts in Norway, Sweden, Denmark and Switzerland, and the temporary railway over the Alps at Mont Cenis, which he built and maintained, at considerable loss; contracts in Turkey, still unfinished; the greater part of the East India Railway, the Calcutta and South-Eastern Railway, and other works in India; severa: hundred miles of railway in Australia; contracts for the first railways constructed in South America, and docks at Callao, in Peru; contracts for making, extending, or widening thirty-one English and Welsh railways; the construction of the Barrow Docks, and the Runcorn Viaduct.

The contracts performed by Mr. Brassey and his partners, from 1848 to 1861, comprised over 2,374 miles; and amounted to twenty-eight millions of pounds sterling.

This astonishing record leads the reader naturally to ask what manner of man this was, who could manage successfully a business, whose ramifications embraced the entire civilized world? The various obituary notices which have appeared in our foreign exchanges, unite in attributing to Mr. Brassey modest tastes, liberality in his views, large but unostentatious charity, the utmost keenness and sagacity in looking out for his own interests, extreme caution in preliminary examination before entering upon a contract, with remarkable boldness in making large contracts when his judgment was formed, and strict integrity in fulfilling the spirit as well as the letter of his agreements. He was extremely systematic in everything, and remarkably clear in all his statements. These qualities, united with an untiring energy and a physical constitution that enabled him to endure an amount of labor sufficient to break down three ordinary men, exactness in the minutest details of business, unruffled calmness under all circumstances, kindness of heart, and justice in his treatment of subordinates, make up a character rarely met with, and which might safely be predicted to win in almost any occupation. The greatest prosperity did not seem to elate him, and the heavy losses he sometimes sustained affected his composure as little as his gains.

One of the principal elements of success in his career, was his reliability in the performance of work as agreed. This character, established in his earlier contracts, was maintained in all his subsequent works.

In 1866, Mr. Brassey lost a sum larger, it is said, than any one business man of his time could have lost without bankruptcy, yet he died one of the richest men of the period.

In another column will be found an anecdote of Mr. Brassey, which illustrates the character of the man very forcibly.

THE PRESENT AND THE PAST.

NUMBER IV —TRANSPORTATION

To moisture, either as affected by changes of temperature, or as containing in solution corrosive gases, as the chief agent in disintegrating rocks, we must add the chemical and mechanical agency of plants, and even the wear and tear of the surface, produced by the movements of animals upon it. The volcano, also, from the loose ashes and scoriæ which it ejects, readily contributes a share to the burden of the rain-flood; and as the materials thus set loose travel downwards, they receive constant additions from the beds of the rapid streams, in which the incessant fretting of the pebbles and grit gradually wears away the hardest rock. Thus the water of a river must contain material derived from every part of its course; and the greater the variety of rocks in the region which it drains, the more varied will be the character of its sediments. Nor does it contain matter merely "in suspension," such as will, when movement ceases, settle to the bottom as sediment; but, being a great solvent, it always contains substances "in solution," which will only be deposited, or "precipitated," by some change in the chemical condition of the water, or be withdrawn by the agency of the plants and animals that inhabit it. The mud that settles at the bottom of a tumbler of dirty river water, is an example of a sediment; the fur that is deposited in a teakettle, on boiling the same river water, is carbonate of lime that was held in solution. Our readers must forgive us for lingering upon such elementary facts; we do so because people, generally well informed, will use these terms with the greatest inexactitude. Thus we have, even while writing this article, chanced upon the phrase, in a leading newspaper, "the sediment was held *in solution*" in the flooded waters of the Tiber, the words evidently referring to matter existing, mechanically divided, in suspension therein.

Everything tells us that the river, though a great destroyer, is no restorer. When a mountain brook, brawling riotously over its rocky bed, whirling along, in its quietest times, pebbles and sand, and, in the excitement of a flood rolling down even vast boulders, subsides to the majestic river, carrying along only the finest sediments, it may, from time to time, spread layer upon layer of alluvial soil over its banks, or gradually silt up its deep pools; but, sooner or later, geological changes will occur; its outlet will be lowered, it will become rapid, its course will change—now cutting here, now there, and thus itself, eventually, removing the same soil that it had laid down, and transferring the materials a stage further towards their ultimate goal. The extensive new-made lands, that form the deltas existing at the mouths of so many of the largest rivers, can scarcely be said to be the work of the river, since they are due to the action of the tides and marine currents, that prevent it from sweeping its burden out into the ocean. But even these, if we may judge from the infrequency of such deposits in geological formations, have but small chance of being permanently preserved. Being generally loose aggregations, bordering on, and even extending out into, the sea, they are the first to be devoured when a change of level, or an alteration in the direction of the currents, gives them over as a prey to the waves. Not that deposits from fresh water do not occur frequently, and of great extent, in the geological series, but these appear to have been formed mostly in lakes. Thus the river, in its geological aspect, is the link between the continents of the Past and those of the Future, a striking emblem, even from the scientific point of view, of the ever lapsing Present.

When the substances, swept down by the river, at last reach the sea (which they do in a very finely divided condition, as silt, or the finest grained sand), they become mingled with the materials abraded by its waves. The depth to which the action of the waves extends is, as we have said before, limited, so that the abrasion of the land only takes place in comparatively shallow waters. Violent storms, however, disturb sediment that has temporarily subsided at greater depths, and tides and other currents sweep finely-divided materials far out into the depths of the ocean. As, however, marine currents are never sufficiently violent to carry heavy materials, the movements of pebbles, boulders, and even of coarse gravel, can only be accomplished in the neighborhood of coasts, within the breaker action, where, as shingle, they will be tossed and retossed, continually rounding and being rounded, polishing and being polished. At each returning wave, the grating sound, as the pebbles are thrown forward and sucked back, tells you that every stone moved has lost some almost infinitesimal portion of its substance, just as surely as your grindstone wears, by being used, or your knife, by being constantly cleaned.

Thus most of the pebbles we see on a beach are ground to sand and dust, which, when reduced fine enough, will be borne off to sea; and we also learn from this history that pebbles can only accumulate permanently by being drawn back by the waves, in violent storms, into deeper waters, or by such a rapid change of level of the coast-line as shall raise or sink them out of reach of the waves, more rapidly than the latter can grind them up. It is essential to recollect those facts in studying the history of the conglomerate rocks that occur so frequently in geological formations; at the same time, however, we must not forget that it has been suggested of late that some of such conglomerates, containing large boulders, may have been accumulated by the agency of icebergs and glaciers, and may, therefore, indicate the recurrence of several glacial periods in the world's history; periods such as that, of which we have conclusive evidence, which, over a large part of the northern hemisphere, intervened between the Tertiary period and the Recent.

Excluding, however, these possible exceptional cases, pebble beds in a geological formation indicate to us, just as certainly as shingle in an existing sea does to a navigator, a coast near at hand; that, in fact, the geologist is somewhere near the dry land that bordered the ancient sea whose deposits he is studying. The navigator would, moreover, tell us that, as a general rule, the further from land, within soundings, the finer the nature of the deposit on the sea bed. Outside the pebbles he may reasonably expect to find gravel; outside the gravel, sand; beyond the sand, gritty mud; and still further at sea, impalpable ooze. This is precisely what we should infer from the carrying powers of waters; as the strong currents, originating in the confined channels near the shores, expend themselves in the open sea, they will deposit first sand, then mud; while finally, where no off-shore currents prevail, the very finest particles will subside. The same effect virtually takes place if you agitate a mixture of gravel, sand, and dirt, in a tumbler, and leave it to settle; excepting that, instead of the sustaining power dying out in time, as within the limits of the tumbler, it continues to exhaust itself contemporaneously over the range of the current. In this rule of the distribution of sediments, we have the true key, as we shall show, to one portion of the history of geological formations; a key that, pointed out long since, has, strangely enough, never been made to serve its real purpose until very recently, and remains even now unappreciated by the majority of geologists.

The general rule of the distribution of deposits is often obscured in areas where currents are numerous and constantly shifting; and we may there find a difficulty in tracing out upon a chart, such an exact disposition as above described.