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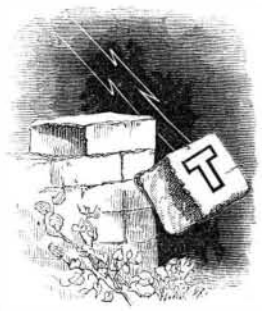
ARE GRAVITY AND ELECTRICITY THE SAME THING?



HERE is no question occupying more attention among the highest order of intellects than the question of the identity of the several invisible forces of nature. The relations of magnetism, electricity, chemical affinity, heat and light, are certainly very close and very complicated. Each one of these forces is capable of producing either or all of the others. They may also all generate mechanical power, and mechanical power, on the other hand, may generate all of these forces. Perhaps as good an illustration of this as any is to be found in the electric light invented by Professor Way, of London, which we described last week. First, the mechanical power of a *steam engine* turns a wheel which carries a number of permanent *magnets* at its periphery; these magnets, as they are carried past the ends of soft iron cores which have insulated wires wound around them in helical form, cause waves of *electricity* to flash through the helical wires. the electricity, darting along from drop to drop of an exceedingly slender stream of flowing mercury, produces an intense *light*; it also generates *heat*, by which the mercury is evaporated. But whence comes the mechanical power of the steam engine? That results from the expansion of steam caused by heat, and the heat is produced by the combustion of fuel, which is its chemical combination with oxygen; in other words, *chemical affinity*.

If we replace the steam engine by a water wheel, we have the several forces produced by *gravitation*. It is to be remarked, however, that gravitation cannot be generated, in its turn, by any of the other natural forces or by mechanical power.

It is known that sound is simply motion of the particles of the air. The vibratory theory supposes that light, also, is nothing but the vibration of the particles of a very subtle ether pervading all space. This theory is now almost—if not quite—universally adopted, and is regarded by many sound minds as absolutely demonstrated. There is also a plausible theory of heat which regards it as simply vibratory motions in a subtle ether or in the particles of the heated body. Iron may be heated red hot by simply pounding it. As the heat will generate motion, so the destruction of motion will generate heat. It is thought that one cause of the sudden heating of meteoric stones, as they pass through our atmosphere, is the destruction of a portion of their motion by the resistance of the air. Professor Newton, in his article in the last number of *Silliman's Journal*, on the great meteor of Nov. 15, 1859, goes into a calculation of the amount of heat that would be imparted to the meteor by the destruction of its velocity, and finds it sufficient to evaporate iron or any other known substance.

From these several facts, and others of the same kind—enough to fill volumes—the grand and simple idea has been suggested, that all the forces in nature are the same thing; merely *matter* in *motion*. This suggestion implies that all the countless phenomena of chemical combination—all the appearances produced by light, its endless variety of color and shade, its refractions, reflections and polarizations, with the miraculous revelations which these have given us through the telescope and the microscope—the tremendous power of heat, with its contractions, expansions, freezings and evaporations—all the swift and subtle operations of electricity in the galvanic battery, the lightning rod and the telegraph, and, finally, the growth and decay of plants and animals, the action of the muscles, the stomach, the lungs, the nerves; in short, all the phenomena of the universe—are produced merely by changes in either the velocity or the direction of the motions of matter.

Such is the doctrine of the homogenesis of forces. A sublime and comprehensive theory, whether true or false! A few pretty capable men have committed themselves to it fully; but most able philosophers regard it as unproved, though it seems to us that there is a general leaning towards it—a prevalent feeling that it will turn out to be true. As the relations of the natural forces to each other caused the conception of the theory, so the promulgation of the theory has led to a very close study of these relations; and the field is as rich in curious and wonderful facts as any that has ever been explored by the student of Nature.

A GREAT FIELD FOR CHEMICAL INVENTIONS.

Less than five per cent of all the patents issued are for chemical inventions. The first impression which this fact leaves is that the chemists are not so wide awake as the mechanics. And it seems, too, as if the chemists have the best chance, for they have the range of all the combinations, almost infinite in number, of all the sixty or more, simple substances or elements, while the mechanic is limited in all his inventions to the use of only five mechanical elements. But this course of reasoning is a little unfair for the chemist, i we wish to determine his real merit as a benefactor of mankind.

If a mechanic is making an invention, he has a definite object in view; he knows also precisely the effect of any combination he may make of the resources he has at hand. A skillful mechanical inventor may fully complete his invention in his head, and a few calculations and drawings on paper may accurately represent and demonstrate it to others of equal intelligence. An intelligent mechanic often needs only to be told the new thing to be accomplished, and the means suggest themselves spontaneously; the thonght is father of the dee .d The search of inventors is rather of things to be done than how to do them.

But great chemical inventions are made in quite a different way. The chemist has not such certain data for reasoning as the mechanic; he cannot predict the effect of new combinations; if he have an end in view, the way to reach it is not so apparent. The chemist, before trying the experiment, might suspect that chlorine and sodium would unite with each other, bnt he could not, by any process of reasoning, be able to say that the compound would have the properties of common salt: if it were proposed, as a problem, to produce salt, no chemist by reasoning alone wonld attempt to solve it, and an attempt to solve it by empirical trials would be quixotic.

It is easy enough to make new combinations of matter, bnt it is not so easy to find a use for them. New chemical preparations increase at a rate which is almost bewildering to ordinary people; the mere names of definite compounds which have been discovered in the present century would fill a whole volume of the SCIENTIFIC AMERICAN. The chemists who make these new substances are generally men who labor for fame, or from an irrepressible love of their science, which is akin to the enthusiasm of the naturalist. Their laboratories are a manufactory and a museum of scientific curiosities, made and labeled only to be looked at and admired. The men who find usefulness in these inventions are quite a different class, for they are matter of fact men who care about nothing which does not contribnte to onr well being; and it is the discoverer of the utility, quite as much as the original inventor of the process, who confers the substantial benefit on mankind and reaps the reward of money. We all respect science for its intrinsic worth, but it is only practical and useful results of science which the people care about seriously. Let abstract science be measnred by fame and honor, and applied science by money.

We have introduced these speculations chiefly in order to suggest to practical men that, among the myriad of chemical substances for which no use is yet known, they will find very promising opportunities for the exercise of their peculiar sagacity. Thus far, the introduction of new substances has been too slow and too much the result of chance. Illuminating gas was known as a chemical product for centuries before any use of it was made; iodine, bromine, chloroform, aniline, and a hundred other thiugs, now common, were for a very long time only rare specimens on the shelves of the chemist's curiosity shop, before they were found to be of the greatest value to men, and we cannot have a doubt that much more of the same kind of wealth is soon to be developed. May we not reasonably expect that virtues may be discovered in things now neglected, which will directly lead to the invention of arts more wonderful and more useful than photography or electro-telegraphing?

GREAT TRIALS OF MOWING AND REAPING MACHINES IN FRANCE.

Two great trials of these important implements have been made in France this summer; a trial of mowing machines on the imperial farm of Vincennes on the 18th, 19th, 20th and 21st of June, and a trial of reaping machines on the imperial domain of Fouilleuse on the 31st of July and the 1st and 2d of August. We think our readers will be interested in the following extracts from the reports of the juries in the two cases, which we translate from *L'Invention*. The jury appointed to decide on the mowing machine essays say:—

"The following table presents the results in the cases of all the machines exhibited which were able to accomplish their tasks:—

FRENCH MACHINES.

Names of the inventors.	Number of horses attached.	Number of men employed to each machine	Time employed for cutting 20 ares — minutes.	Quality of the work.
Mazier	1	2	57	Good.
Legendre	2	2	40	Pretty good.
Roberts	2	1	26	Passable.
Lallier	2	2	50	Ordinary.

FOREIGN MACHINES.

Names of the inventors.	Names of the constructors.	Names of the exhibitors.	Number of horses attached.	Number of men employed to each machine	Time employed to cut 20 ares —minutes.	Quality of the work.
Wood	Cranston	Peltier	1	1	31	Excellent
Wood	Cranston	Claudon	1	2	52	Very good
Wood	Cranston	Claudon	2	1	30	Very good
Allen	Burgess	Burgess	2	1	29	Perfect
Allen	Burgess	Piednue	2	1	20	Excellent
Allen	Laureut	Laureut	2	1	30	Good
Brigham & Richerton	The same	The same	2	1	22	Pretty good

"In order that the essays at Vincennes should be complete, the jury determined to multiply the experiments. They also caused the machines to operate in the rain, and on parts of the meadow in which the grass was badly lodged. Several machines have triumphed over all the obstacles, and have given the most satisfactory results; so that it was manifest that the prizes proposed by government were very justly won, and the only doubt that arose was in reference to the machine to which the prize of honor should be awarded.

"Although the mechanical mowers have operated only drawn by horses, and although they have been constructed up to the present time for regulating the quickness of the motions of the scythe only by the pace of the horse, there appears to be no doubt that, by simply modifying the gearing, the constructors will be able to make the machines proper to be operated by oxen.

* * * * * * *

"The machines which have incontestibly operated the best are those of the American systems of Wood and of Allen. The jury have placed in the first line the system of Wood, and in the second line the one of Allen. They have put in the third rank the machine of Messrs. Brigham & Richerton. The machine invented by Mr. Wood at Hoosic Falls, N. Y., is remarkable for its small dimensions, for the facility with which the scythe is dismounted, and for the narrowness of the track in which it can pass; requiring scarcely a wider road than a horse. Its price is only 500 to 600 francs, and it can, without doubt, be reduced to 400 francs. But what distinguishes it above all is the very ingenious disposition of its parts.

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"The jury have deemed it their duty to decree the

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first prize for foreign machines—consisting of a medal of gold and 1,000 francs—to the machine of the American system of Wood, exhibited and brought to perfection for transportation on roads by Mr. Peltier, Jr., living at Paris, No. 45 Rue Marais-Saint-Martin. The prize of honor—consisting of a large medal of gold—has been also awarded to the same machine, the best of the international meeting. A medal of gold has been demanded of the Minister of Agriculture for Messrs. Claudon & Co., of Clermont (Oise), second importers of the Wood machine.

"The jury also believe it a duty to make known that the machine of Wood has not been patented in France; that the construction of this machine belongs to the public domain, and that our constructors will be able to imitate and perfect it."

REAPING MACHINE TRIAL.

Foreign Machines.—"In the first line is placed the machine of Burgess & Key; the jury have decreed to it the first prize and the prize of honor. It is known that this machine is none other than the American machine invented by McCormick. It has been improved by Messrs. Burgess & Key, who have added to it three helices, ingeniously disposed to gather the cut grain and throw it on the soil in parallel swathes in the track passed over by the horses. This operation is effected perfectly when the machine cuts barley properly ripe and dry. Only a small number of these machines have come into France; but Mr. Laurent, of Paris, who has bought of Messrs. Burgess & Key the right of manufacturing them, has delivered 150 to our agriculturists, of which three were for Algeria.

"The machine exhibited by Mr. Cuthbert is a happy improvement on the American system of Hussey, and although of a moderate price, is one of the best constructed reapers which have appeared at the concourse of Fouilleuse. It has merited to this exhibitor the second prize for foreign machines.

"The machine invented and constructed by Mr. Wood, of the United States, has been imported into Europe by Mr. Cranston, who charged himself with operating it before the jury. It has experienced some modifications since the exhibition of last year. The jury have decreed to Mr. Cranston the third prize for foreign machines."

The jury also make honorable mention of the Manny reaper, imported by Roberts, and of the celebrated Bell machine, which, they say, was the first mechanical reaper that ever actually operated; having been in use in Scotland since 1828. It is pushed before the horses.

French Machines.—"Dr. Mazier remains at the head of French inventors. He does not cease to make improvements in his machines, which are more simple and less cumbersome than the foreign reapers, and are, therefore, better adapted to the general conditions of French agriculture. He has lowered the price of his machines from 1,050 to 800 francs, and has delivered 90 to French agriculturists. Mr. Mazier declared to the jury, with great loyalty, that he owed part of his success to the persevering aid which he has received from his foreman, Mr. Emile Ruffrey. The agriculturists are happy to find occasions to encourage the workman employed in developing their industry. They know well the master is obliged to count on the laborer. It is by benefits on the part of the chief that are maintained those long attachments so frequent now between the masters and the rural agents. The jury have sympathized with the sentiment which actuated Mr. Mazier in his declaration, and have demanded of the minister a bronze medal and 200 francs for Mr. Emile Ruffrey. They are happy to recompense a worthy co-operator in the invention of French mowing machines."

THE STEAM PLOW—FAWKES' AND OTHERS.

We find the following reflections on the steam plow in the New York *World*. We see that this important matter continues to attract a great deal of attention in England:—

A year ago, at some of the large agricultural exhibitions, particularly at the National, held in Chicago, a demonstration was had on this new invention, to test its applicability, as an actual plow, in superseding, by the use of steam and machinery, the ordinary plow now used in cultivation. The trial was not conclusive—not satisfactory even to the committees appointed to try the machine, although the large premium offered for a successful one of the kind was claimed by the inventor. There were defects in its principle, and still greater defects in its mechanism. These were all to be remedied and overcome. So said the inventor. It has been again tried this Fall at the late Illinois State Fair, at Jacksonville, but with no better success, as we learn, than before. What the alleged impediments to success may be, we do not know; we do not much care, even; for a steam plow, or a machine to drag behind, or drive before it a gang, be it three, five, or ten veritable plows, of the shape and kind now used on our farms, we believe will prove no achievement, either in economy or expense, or excellence of work, over that which it is intended to supersede.

The expression of such opinion may be thought the very essence of "fogyism" in this day of invention and improvement. Yet, we so believe. It will take too many words to give all the reasons for our belief, but a few we will name, even admitting the thing to finally prove successful:—

1. The expense of the machine will exclude it from all small farms, and gardener's uses, in the contracted area of their premises.

2. Its size and cumbrous working will require fields of great size, and a long stretch of "lands" to range upon, without frequent turnings. The soil, too must be of a level surface, or, if undulating at all, in such regular undulations that the "dip" and positions of the several plows composing the "gang" can be uniform.

3. Leaving out several other objections, the fatal one exists, that the plow itself, as now constructed—no matter how good it be—is an imperfect implement, founded on a false principle for the perfect breaking up and movement of the soil, and fitting it to receive the seed for a crop. Such being the fact, as we assume it, the "plow" is not worth the pains of applying it to steam use, and the same skill and invention had better be applied to some other kind of machine.

Why is the plow imperfect? Simply, for the reason that soil, to be perfectly prepared to receive the seed and produce a crop, should be thoroughly pulverized, deeply dug, and rest on a soft bottom underneath, which last, though not penetrated by the instrument which has worked above it, shall still admit the roots of whatever grows above to enter and run down, if they choose to do so, and draw whatever nutriment they can from below. In short, if land is plowed six, eight or ten inches deep, and its upper strata be lifted and turned over to either of those depths, the lever power which raised it is exerted to the same extent to press down still more compactly than before the soil beneath it. That is, the plow, in its work, presses both ways—down as well as up; whereas, the work, for the benefit of cultivation, should be lifting only. The pressure down is all wrong, and, so far, does a positive injury to the sub-soil, let the comminution of that above be ever so perfect. In light soils, we admit that the downward pressure is not always prejudicial to the future crop. But in clay, or heavy soils, it must be so. The sub-soil surface of the furrow below is as polished, from the pressure of the bottom of the plow upon it, as the top of the inverted earth which is lifted from it, and turned over into the adjoining furrow; so, unless the roots of the growing crop be very strong, they must seek their food only near the surface, or within such depths as the plow may have penetrated, and thus be liable to be cut short by drouth. For perfect cultivation, these difficulties must be obviated.

Well; and how? By the invention of a rotary digger. That is to say, a cylinder revolving a shaft supported at each end on a frame, on the principle of a common form or garden roller; that cylinder to be filled with spiked or claw-formed teeth; and, by its rapid revolutions, these teeth must dig up the ground, six to twenty inches deep, as may be desirable, leaving the ground light, free, and thoroughly pulverized, to receive the seed of whatever kind. A drill may be attached behind it, for the purpose of sowing or planting the seeds, if necessary. This, in short, is the grand desideratum which we look for in the perfect cultivation of the soil. The earth, by this operation, will be loosened as far down as the machine goes, and the sub-soil, beneath what is loosened, will not be packed still harder than it laid before, as with the plow. It will be readily seen that, in this proposition, the plow is superseded entirely, as it should be in all free soils, and an instrument of altogether another kind has to take its place.

Now, can this implement be invented and perfected for practical and easy operation? We think so. It need be no more complicated than a reaper or a mowing machine. It may be made to work by either horse or steam power; and, without divulging a secret, we are of opinion that there is now in progress, in western New York, a machine possessing the right principle of a rotary digger, and that it will soon be in operation. That it will be perfect in its first movements we do not say, but we believe that a practical machine of the kind will, in due time, be accomplished.

Can the small farmer use such a machine economically, even it be invented and perfected? We believe so, if his land be free from stones and roots. Its portability and compactness will render it easy to manage, and the celerity with which he can get in his crops by its aid will enable him to clear his land from impediments to its working, which the dilatory and only partial labor performed by the plow would not. The great advantage of such a machine, however, would be in the vast prairie cultivation of the western States, on broad river bottoms, and in large fields, where the surface lies smooth, free from stones or other impediments and where a timely cultivation and deposit of the seed is indispensable to successful cropping. Sugar and cotton lands, as well as those for corn, wheat and other grains, will be immensely benefitted by this rapid cultivation. The present season, by its continuous Spring weather, so timely for plowing, seed-sowing and germination, as well as for the after-growth of the plants for several weeks in succession, in several of our States, most fortunately rendered a service not often witnessed. The same genial action of the element, in a much briefer time, by the aid of a rotary digger, would enable the cultivator to get his seeds well into the ground, and secure a favorable crop during ordinary seasons, unlike the present through which we have passed.

We could discourse further on this subject—hardly, perhaps, to the edification of our readers; and this must suffice for the present. We trust that, before the autumn agricultural and mechanical exhibitions are ended, we shall learn that something better than a steam plow has been attempted, if not effected; and that an implement, on the principal of the rotary digger, may be placed before our farmer friends, to give them a more thorough cultivation of their soils than ever before.

FACING FORTS WITH IRON PLATES.

The numerous experiments in England and France having proved that a solid wrought-iron plate, 4½ inches thick, is absolutely cannon proof, resisting even the elongated bolts of the Armstrong gun, the suggestion naturally occurs that these plates would be the proper facing for the walls of fortifications. As the battering down of the walls of a fort with siege guns, once placed in range, is a mere question of time, which may be counted on with almost as much certainty as the time required to dig a cellar, the question has been seriously propounded by the London *Times*, and other journals of character, whether walled fortifications should not be abandoned altogether, and resort be had to earth-works alone for defense. But if forts can be made impregnable, the question of their utility will be settled. There would seem to be, at least, no doubt about the propriety of facing the embrasures with iron.

NEW BOOKS AND PERIODICALS RECEIVED.

CAMILLE, OR THE CAMELIA LADY. From the French of Alexandre Dumas, the younger.

This work we have not read, and therefore cannot speak of its merits or demerits. We have generally thought our time could be more profitably employed than in the reading of fictitious works. They are ordinarily of but little account, and do more harm than good. If any one wishes to procure the work, he can obtain it from those well-known publishers, Messrs. T. B. Peterson & Bros., Philadelphia, Pa.

We have received from Messrs. Crosby, Nichols, Lee & Co., publishers, Boston, Mass., the following new publications:—

THE KANGAROO HUNTERS. OR ADVENTURES IN THE BUSH. By Ann Bowman. JACK IN THE FORECASTLE, or Incidents in the Early Life of Hawser Martincale, Author of "Tales of the Ocean," "Salt Water Bubbles," &c. THE ADVENTURES OF JAMES CAPEN ADAMS, Mountaineer and Grizzly Bear Hunter, of California. By Theodore & Hittell. These works are all profusely illustrated and will supply instruction and amusement for many happy fire-side circles. They may be obtained of R. Lockwood & Son, New York.

THE TINMAN'S MANUAL AND BUILDER'S AND MECHANIC'S HANDBOOK. By I. R. Butts; published by I. R. Butts & Co., Boston, Mass. 204 pages. A very useful little book.

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