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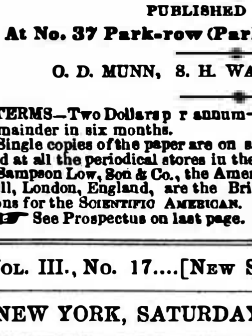
ARE GRAVITY AND ELECTRICITY THE SAME THING?



THERE 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 complicatea. 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 thought 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, but 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 would 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, bpt 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 contribute to our 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 measured 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 things, 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............	3	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 emlyoyed to cut 20 ares —minutes.	Quality of the work.
Wood......	Cranston	Peltier	1	1	31	Excellent
Wood......	Cranston	Claudon	1	2	32	Very good
Wood......	Cranston	Claudon	2	1	30	Very good.
Allen	Burgess	Burgess	2	1	29	Perfect
Allen	Burgess	Pied nue	2	1	20	Excellent
Allen	Laureut	Laurent	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.

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"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