REMINISCENCES OF THE EARLY DISCOVERIES IN ELECTRO-MAGNETISM.—INTERESTING ANECDOTE OF FARADAY.

The sublime discovery known as electro-magnetism is one of the wonderful outgrowths of the nineteenth century. It owes its origin to the great philosopher Franklin, who first really brought electricity into practical use. Although Franklin was content only with atmospheric electricity, yet his great achievement led other men of science to investigate, and finally to achieve greater and more useful results from this yet mysterious element.

It is well known that from the various phenomena of electricity proceed all those abstruse subjects, such as magnetism, electro-magnetism, magneto-electricity, etc.

Electro-magnetism has been employed more than any of the various modifications of electricity. Simply because it was more obedient to the aid of man. Hence the application of it to the working of the telegraph, to plating, and the various other uses now in existence.

In 1837, Thomas Davenport, of Brandon, Vt., obtained a patent and came to New York with a model of his electro-magnetic engine, the working of which astonished the scientific men of that day. It was predicted and fully avowed that he had wrought out the great discovery of the use of electro-magnetism as a motive power. His model was very simple, having two electro-magnets, placed within attractive distances of a revolving steel magnet. These magnets were so arranged that one was acted upon by the attractive power and the other by the repulsive. He declared that it was only necessary to increase the size of the magnets in order to produce any amount of power required. This led many inventors to turn their attention to the subject, and other models were soon brought forth. Not exactly on the principle of Davenport's, but more upon the power of direct attraction alone.

Various machines were made, all of which were pleasing and wonderful to behold, but they possessed no practical value from the fact that the power obtained was entirely inadequate for practical use.

Davenport engaged a Capt. T. and a Mr. P. to go to England with a model and secured a patent there. They were quite successful in engaging the interest of men of wealth in their patent. Having means at their disposal they built a large working machine, with four of the largest electro-magnets then known, each weighing about three hundred pounds. These magnets were charged from a battery of copper and zinc containing a solution of sulphate of copper which, when dissolved, was of the capacity of a barrel. With a cast-iron wheel six feet in diameter, weighing 600 pounds, a velocity was attained of seventy-five revolutions per minute.

To the eye of the unpracticed in electro-magnetism, and even to the scientific, this was a vast stride towards the final result. Men of science, and very many practical mechanics of London, were invited to witness this great model. Among the number were the three well-known and highly appreciated Professors—Wheatstone, of King's College, Daniel, the inventor of the Daniel's battery, and the great scientific man of England, Faraday. The interest these men evinced in their examination of the model is worthy of record.

Professor Wheatstone, who has since identified himself with the magnetic telegraph in England, was loud in his praise of the working of the model. Professor Daniel was also enthusiastic in its favor, and prophesied that the days of steam were numbered: that electro-magnetism would become the leading motive power of the world. He said ships would soon traverse the ocean with only a few sheets of zinc for fuel and a small supply of acid—yea, not even acid for the waters of the ocean could supply its place.

To-day where are all these predictions? No more realized than they were nearly thirty years ago when they were made.

Notwithstanding all the varied experiments made to utilize this sleeping power of the magnet, it has as yet baffled the skill of the most skillful, and is to-day no nearer its accomplishment than when these great men of science gave their opinion.

The opinion given by Professor Faraday, the man of all others whose word was most powerful for good or ill of the success of the Davenport machine, was quite remarkable. He saw the wheel revolve for several minutes and watched with an appearance of astonishment the large electric spark which was given off every time the current was broken, a spark so large that it emitted a light in the evening sufficient to illuminate the room so that a newspaper could be read.

He spoke not one word of its merits or demerits, but taking up a broom which happened to be in one corner of the room, he gently placed the handle of it on the periphery of the wheel, and with a slight pressure the wheel gradually revolved slower. He did not, however, quite stop the motion, yet he saw how easily it could be done. Then came that nobleness of spirit and heart which has so characterized the man since, and will ever keep his memory in sweet remembrance by those who came in contact with him: none more than the Americans who were interested in this machine. He walked into an adjoining room and kindly informed those most interested that his opinion expressed to the public would greatly injure the sale of the patent. So he preferred not to advance one then, yet he would if strongly urged. His pleasant voice and kindly words of cheer, and hope for some greater discovery in electro-magnetism by which the great wish would be gratified, made a lasting impression.

How true that sagacious man's words have proved, the recorded history of the many failures will most surely attest. Thousands of dollars, many thousands, have been spent in vain, and yet there are men now living who predict the final achievement by which electricity will become the motive power of the whole world: when in reality the lightning of heaven shall become obedient to man's will, and the shuttle be moved by its power, and along the iron rail no sound of steam shall be heard—no smoke, no explosions, nothing but simply the slight decomposition of metals, all of which can be recovered again, shall take place.

CONFECTIONERY—HOW IT IS MADE, AND WHAT IT IS MADE OF.

The chief material in the manufacture of confections is sugar. There are two principal kinds of sugar. Cane sugar, and grape sugar, differing from each other in the following particulars. Cane sugar has a specific gravity of about 1·6. Water at 60° dissolves one third its own weight of it. Upon concentration of its solutions it deposits in small brilliant crystals, which if the sugar be pure are perfectly white. Absolute alcohol dissolves one eightieth of its own weight of cane sugar. Its solutions by long continued boiling become modified in character so that crystallization will not take place on cooling. Alcoholic fermentation takes place in its solutions only when a portion has become converted into grape sugar by the presence and chemical action of another substance—yeast.

Cane sugar is obtained by the concentration of the juices of the sugar cane, beetroot, sugar maple, and some other plants. Its chemical composition is by weight: carbon 72 parts, hydrogen 9 parts, oxygen 72 parts, water 18 parts. These proportions are expressed by the chemical formula: $C_{12}H_9O_9,2HO$.

Grape sugar is less soluble in water, and more soluble in alcohol. It is not so sweet, two parts of cane sugar being equal in this respect to five of grape sugar. Cane sugar crystallizes in prisms. Grape sugar either forms tubercular concretions, or fibrous acicular groups. It contains carbon 72 parts; hydrogen 14 parts, oxygen 14 parts; its formula being $C_{12}H_{14}O_{14}$ or $C_{12}H_{12}O_{12}+2HO$. Cane sugar loses its water at a temperature of 400° and becomes brown, deliquescent, and slightly bitter, in which state it is called caramel, used largely as a coloring for factitions wines. Grape sugar is converted into caramel at 284°. When strong sulphuric acid is poured into a concentrated sirup of cane sugar, and the mixture stirred, it turns brown, then black, heats, boils up and passes into a black and bulky mass—charcoal. When a solution of grape sugar is treated in like manner, a brown compound is formed having acid properties. Grape sugar is obtained from fruits, and by the action of dilute acids upon starch.

There is still another variety of sugar called fruit sugar, it is uncrystallizable but it becomes grape sugar by combination with water. Cane sugar is converted into grape sugar by yeast. Honey is probably nearly identical with the uncrystallizable fruit sugar.

We have seen that only cane sugar will produce well defined prismatic crystals and as an admixture of either fruit or grape sugar would render the crystallization imperfect, and as the change of cane sugar into grape sugar is facilitated by the presence of impurities, the sugar employed in the manufacture of candy should be cane sugar of a good and pure quality. Maple sugar is seldom made in so perfect a manner, that it will make a solid undeliquescent candy.

The perfect crystallization of sugar may be partly prevented by stirring while its solutions are cooling, or by the sudden cooling of a hot mass of melted sugar, and working it while still in a plastic state. The "white rock candy" of the shops is a good example of pure crystallized sugar. This candy is made by suspending in a very concentrated sirup, strings which act as nuclei for the formation and attachment of the crystals. [See article entitled, The Phenomena of Supersaturation, on page 323 of the current volume of the SCIENTIFIC AMERICAN]. It is perfectly pure sugar.

The ordinary hard stick candy is an example of the amorphous condition produced in sugar by working it while in a plastic state. In order to aid in producing this condition of sugar, a little cream of tartar is added which has the effect to prevent crystallization. The sugar while in a plastic mass, is pulled. A portion of it being taken in the hands of the workman, is drawn out partially by the hands. The middle of the mass is then thrown over a hook provided for the purpose and the ends being still grasped the workman steps backward thus drawing the mass into a sort of rope. This rope is doubled and the process repeated until the proper consistency is attained when the sugar is divided into sticks and allowed to become cold and hard. The soft candies are variously made, corn starch, being often an ingredient.

We have room in this article for only a very brief description of the special manipulations employed in making the different styles of candies. Stripes are put on sticks by laying upon a plastic roll of sugar while still hot, colored bars of cold sugar, which becoming soft in contact with the hot sugar, are drawn out with it to the proper size. Candies designed to be very clear and transparent are not worked by kneading or pulling. To make lozenges the plastic sugar is rolled into a sheet of the proper thickness and the lozenges are cut out like crackers from dough. These are placed when hard and cold in a jar and a quantity of whatever essential is desired to flavor them is put into the jar. The jar being closed, the volatile nature of the oil enables it soon to equally permeate the entire mass. The coating of seeds or meats of nuts is done by rolling or shaking them in a copper pan in contact with a small quantity of melted sugar. The sugar is added gradually until the coating has reached the required thickness.

The use of poisonous colors is not so frequent at present as formerly. Red and yellow candies are very rarely colored with poisonous matter. The greens are most liable to be poisonous, especially the light shade called apple green which sometimes consists of arsenite of copper, a very poisonous substance.

Attempt to Demolish a Lighthouse.

The keeper of Minot's Light had retired to rest for the night on Wednesday, and his assistant was proceeding to the top of the structure, when a great crash was heard, resounding through the whole substantial building. The lighthouse keeper supposed his assistant had, by accident, broken some glass vessel or other, but the latter, with alarm on his countenance, soon reported that the plate glass constituting one side of the great lantern at the top of the lighthouse had been smashed in, perhaps by a rifle ball. Examination was immediately begun to ascertain the cause of the occurrence, and after a little time the discovery on the ledge of the lighthouse of a dead shell-drake duck, with nearly every bone in its body broken, explained what would otherwise have been a very mysterious affair. The little winged wanderer was probably flying at a great speed, and being attracted by the light precipitated itself against the glass, and the concussion brought its career to a sudden and untimely close. The glass broken was more than a quarter of an inch in thickness, and it is impossible to replace the pane that was thus summarily displaced with glass, equally thick, purchased in Boston. The duck which achieved this feat, although his bones were broken, had no contusions on the exterior of his body. He was cooked, eaten, and pronounced excellent by the lighthouse keeper and his family.—*Boston Transcript of Nov. 14th.*

The attraction of light for birds as well as insects is so well established that the above occurrence need not be deemed incredible. We recollect a case where a gull broke the glass of the lantern of one of our light-houses on the South Carolina coast, during the war, and fell to the rock, instead of passing through the glass, and serving as boned turkey for the light-house keeper, as in this case.

Editorial Summary.

WE regret to be compelled to record the death of our late carrier, Carlisle McKee, who has served us faithfully for many years. He was a man who, although occupying a humble position in life, was possessed of singular intelligence and large information. He spoke several languages with fluency, and it was his pride to keep thoroughly posted on current events of interest, political and otherwise. He was obliging and prompt in the performance of his duties, and in his connection with us made many friends among our city readers, by whom he will be missed, and who will regret to learn of his decease.

A REMARKABLE combination of physical forces, applied to purposes of war has lately been made the subject of experiment at Antwerp with a view to the defense of the passes of the Scheldt. Torpedoes are placed in the river, and cameras similar to those used by photographers are adjusted, so that an object directly over one of them will present its image in the instrument situated upon the shore at any convenient distance. As soon as the image of an approaching hostile vessel appears in the camera, an electric current is sent through a wire to the torpedo which underlies it, and the explosion takes place.

IMPROVED CHINA INK.—A correspondent of the *Building News* gives an account of a new preparation of China ink. The preparation is a solution of the ink in a chemical liquid which renders the glue used to agglomerate the carbon particles insoluble when it becomes dry on the paper in the usual way. The lines made by this ink will not wash in coloring a drawing. The preparation has the advantage over other solutions of China ink, that it will not decompose by long keeping.

THE American Institute announce a course of scientific lectures at Steinway Hall, beginning on the evening of the 25th inst., on which occasion Professor Barnard will lecture upon the microscope. We shall announce the other lectures in order.

WATER is a cheap and useful lubricant in the machine shop. Oil is costly and not always so effectual.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

AMERICAN MANFACTURE OF CALICO.—The calico interest of the United States is an important one. The total product of printed goods in 1826 was about 3,000,000 yards. In 1836 it reached 120,000,000. In 1855 there were twenty-seven print works in the United States, which produced in the aggregate 350,000,000 per year. This amount, at an average of ten cents per yard, was worth $35,000,000. In 1854 our exports of printed goods amounted to $3,000,000 Our imports of printed cottons in 1856 reached $19,110,752. Our exports in 1857 were only $1,785,685 worth. The total production of printed goods in 1860, according to the census of that year, was $7,748,644. There are 6,000,000 cotton spindles now in operation in the United States, of which over 2,000,000 are running on cloths for printing, and produce 450,000,000 yards.

A single locomotive and machine company of Paterson, N. J., turns out seventy locomotives and about $300,000 worth of cotton machinery yearly. Employment is given to about 700 hands.

The Spathic Iron Company is at work in the steel mine in South Plymouth, Vt., night and day, with two sets of hands. The ore grows richer as they go down.

The British Government have spent in experiments upon firearms at Woolwich $140,000 during the last five years.

The Louisville and Nashville Railroad have recently negotiated a loan with a view, it is said, of purchasing several smaller roads.

St. Louis refused by a majority of 8,336 to make an appropriation of $2,000,000 in aid of the projected railroad to Chilicothe.

The directors of the Hudson River Railroad have ordered their stock transfer books closed until the 1st of December.

The Cerro de Pasco Railroad Company has been formed in Lima and the greater part of the capital subscribed. This will be the first railway made in the interior of Peru.

The Baltimore and Potomac Railroad is progressing as rapidly as it is possible. The right of way in most cases has been secured and paid for.

Great activity is said to prevail now in the mines of the granite distric in Colorado.