GALVANI.

The accompanying portrait of Galvani is taken from the beautiful work by Amédée Guillemin, entitled "L'Electricité et le Magnétisme."

Luigi Galvani was born at Bologna, September 9, 1737. Although it was his own wish in early life to enter the church, his parents educated him for a medical career. In 1762 he was appointed lecturer on anatomy in the University of Bologna, the city in which he practiced. He soon gained repute as a skillful teacher, and, chiefly from his researches on the organs of hearing and genito-urinary tracts of birds, as a comparative anatomist.

His celebrated theory of animal electricity he enunciated in a treatise, "De Viribus Electricitatis in Motu Musculari Commentarius," published in the memoirs of the Institute of Science of Bologna, in 1791, and subsequently in separate form at Modena.

The statement has often been made that Galvani, in 1786, had skinned some frogs to make a broth for his wife, who was in delicate health; that the leg of one of these, on being accidentally touched by a scalpel which had lain near an electrical machine, was thrown into violent convulsions; and that it was thus that his attention was first directed to the relations of animal functions to electricity. From documents in the possession of the Institute of Bologna, however, it appears that Galvani was already engaged in investigating the action of electricity upon the legs of frogs twenty years previous to the publication of his "Commentary." It is in this work that he describes the invention of his metallic arc, which was constructed of two different metals, one of which, when placed in contact with a nerve and the other with the muscle of a frog, caused contraction of the latter. In his view, the motions of the muscle were the result of the union, by means of the arc, of its exterior or negative electrical charge with positive electricity which proceeded along the nerve from its inner substance. Volta, on the other hand, attributed them solely to the effect of electricity having its source in the junction of the two dissimilar metals of the arc, and regarded the muscle and nerve simply as conductors.

After the death of Galvani very little was heard of animal electricity till 1827, when the study of the subject was resumed by Nobili.

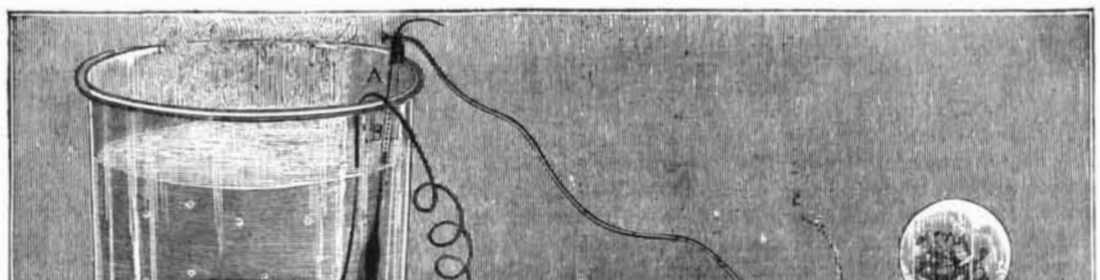
On Galvani's refusal, from religious scruples, to take the oath of allegiance to the Cisalpine Republic, on its establishment, he was removed from his professorship. Deprived thus of a means of livelihood, he retired to the house of his brother, where he soon fell into a decline. The government, in consideration of his great scientific fame, eventually, but too late, determined to reinstate him in his chair at the university. He died December 4, 1798.

We should add to the above note that Galvani studied with very great care the electricity of the torpedo, and that it was principally in that study that he found a confirmation of the theoretic ideas that he had conceived from the convulsions of the frog. He believed in the identity of the electric fluid produced by the organs of the torpedo with the fluid secreted by the muscular system of animals. He took much pains to ascertain that the nerves of the electric organs begin in the same manner as those of ordinary muscles. In his opinion, the electric organ of the torpedo was only a muscle enjoying to a high degree properties that are common to all others.

REGNARD'S TEMPERATURE REGULATOR.

Those persons who are obliged by the nature of their labors to work in the country, at the seaside, or, in a word, far from towns where there are gas works, experience great difficulty in keeping stoves at a constant temperature. All regulators of any precision that are used in laboratories require the use of illuminating gas, which some mechanism or other lights or puts out at the desired moment.

At one of the recent sessions of the Société de Biologie, Mr. D'Arsonval presented a stove which was capable of operating without gas by utilizing the boiling points of volatile liquids. This leads me to describe a stove that I have made use of for some time past, and which operates very regularly, and with extreme sensitiveness.


REGNARD'S TEMPERATURE REGULATOR.

Into a water bath there dips an electric thermometer, B, that is to say, a thermometer open at the top, into whose tube runs a very fine platinum wire, A, that may be raised or lowered, or fixed definitely before any degree whatever of the scale. The mercury in the thermometer bulb communicates, through a wire soldered into the glass, with a Leclanché or Daniell pile. Since the upper platinum wire is in connection with the other pole, as soon as the mercury, by dilatation, touches the latter the current will be closed. Interposed in this current there is an electro-magnet, D, whose armature, E, provided with a long lever, carries a benzine lamp, G. When no current is passing the lamp is placed under the stove; but, as soon as the current begins, the armature of the electro-magnet is attracted and the lamp is removed to a distance. The thermometer, becoming cool almost instantly, causes the mercurial column to leave the platinum wire. As soon as the current is broken the electro-magnet becomes inactive, and a spring, H, draws the lamp back beneath the stove, and so on. The accompanying cut sufficiently explains the mechanism.

It will be seen that the temperature of the stove cannot vary, since, as soon as it rises, the source of heat is removed; and as soon as it lowers the source of heat is replaced. This stove, like another that we have already made known, has the further advantage of being instantly regulated at any desired temperature; to effect which it is only necessary to fix the platinum wire opposite the degree that it is desired to have. After that it will be always at such degree that the current will be closed and the lamp removed from beneath the stove.—*Dr. P. Regnard, in La Nature.*


GALVANI.

Sand for Glassware.

The sand from which the finest glassware, crown glass, French plate, and the like, is made, is seldom found in large deposits, in accessible places, and in strata free from impurities. Quartz in California, which yields $5 of gold to the ton, is called in miners' language "pay-rock," and yet the sand itself out of which French plate glass is made is worth $5 a ton delivered in the city market. A vein of glass sand was discovered over ten years ago near McVeytown, Mifflin Co., Penn., and is now being extensively worked. The sand rock occurs, for the most part, in irregular formation, with an occasional approach toward a stratified condition. The rock is hard and dry, yielding with difficulty to the drill, except where water penetrates it, forming crevices. These soft veins, made by the water, are much dreaded by the miners. A mass of this soft rock may fall at any moment and crush or bury the hapless workman.

The sand rock is mined by what is called "drifting," or excavating in a horizontal direction. The drift is made sixteen feet high and twenty feet wide, and extends about 500 feet in different directions from the mouth of the mine. With a force of sixty men, only about fifty feet of rock can be excavated in a year. An analysis of the sand shows almost pure silica, with slight impurities of cobalt, shale, and slate. Under the microscope, beautiful crystals in the sand are seen. The rock in the mine is of a marble white color, with a few tints of yellow and green. The air in the drift is cold and damp, and is kept pure by ventilators running up to the top of the ground. A temperature of about 40° prevails in the mine winter and summer.

The sand is taken out of the mine in small hand-cars by steam power and then dumped into the crusher. The crusher is something like a large coffee-mill, and breaks the sand rock up into coarse pieces, ready for the pulverizer. This consists of two large cast iron wheels, four feet in diameter and over a ton in weight, which roll around, like wagon wheels, in a circular pan. Water is kept constantly pouring into the pan, to help on the process of grinding and to carry the sand along to a sieve, which takes all coarse lumps that have escaped from the ponderous weight of the pulverizing wheels. The sieve is made of brass wire, in the shape of a cylinder, about three feet in length and a foot and a half in diameter, and revolves like a flour-bolting machine. After passing through the sieve, the sand is carried along a trough by the water into the washer. At the lower end of this the sand is forced up a trough by means of spiral conveyers, which act on the principle of the Archimedes screw. Thence the sand is washed down another trough filled with water, at the end of which there is an escape for the impurities. This operation is repeated three times, when the sand passes into another spiral conveyer, and is carried to a large room called the "drainer," where it is distributed over a large surface for draining off the water. The floor of the room is perforated with large holes. From the drainer the sand is carried to the drier, a large receiving chest containing a network of iron pipes through which steam passes. As the sand dries it drops into a funnel-shaped trough, and from that passes into a conveyer, and thence to an elevator. The sand comes from the drier fine and almost as white as flour. The elevator carries it up into a tower to facilitate the work of loading.

The sand is now ready for the market, as much of it as is to be made into fine glassware. That which is intended for ironstone chinaware, however, must go through another process before it is ready for the market. After leaving the drier the sand is put into a large drum made of wrought iron, about six feet in length and three feet in diameter, for the purpose of being repulverized. One ton of the sand and a ton and a half of what are here called "black diamonds," or "Russian pebbles," are put into the drum. Some of these pebbles come from Greenland, and resemble in luster Iceland spar. They are about as large as a hen's egg. Being harder than the sand, they pulverize it by constant friction. A portion of the black diamond is worn off in the process, but when the sand is made into chinaware and burned, it is of the same color throughout. Other pebbles could be used in pulverizing, but the dust that they give off in the process discolors the ware when burnt. The time required for reducing one ton of sand to this fine powder is generally ten hours.

A novelty of the McVeytown sand works is the way in which the water-power is communicated to the machinery at the mine. Steam is used for drying only, and the water of the old Pennsylvania canal, which is over one thousand feet from the works, is used for driving the machinery by a system of wire cables and band wheels. The wheels are set up in three small towers, thus preventing too much slack in the wire cables. Two turbine water-wheels are used at the canals. The sand shipped from this mine amounts to about 25,000 tons a year. Pittsburg, Wheeling, and Ohio cities are the principal markets.—*Glassware Reporter.*

Earthquakes in Panama.

The recent earthquake in Mexico has been followed by several less serious yet quite destructive disturbances in the Isthmus of Panama. The more notable occurred September 7 and 8. Traffic on the Panama railroad was suspended owing to damage to the sinking of the track in places and the damage to bridges. A freight building of stone at Aspinwall is reported to be destroyed. One man was killed and several injured there. No lives were lost at Panama.

Liability to disturbances of this character, or worse, is one of the difficulties which the canal enterprise has to encounter but cannot overcome.

SEVENTY-SIX courses of stone, making 152 vertical feet, have been laid since work recommenced in earnest upon the Washington Monument. Its height is now 302 feet.

Cigarette Smoking.

Scarcely less injurious, in a subtle and generally unrecognized way, than the habit of taking "nips" of alcohol between meals, is the growing practice of smoking cigarettes incessantly. We have not a word to say against smoking at suitable times and in moderation, nor do our remarks at this moment apply to the use of cigars or pipes. It is against the habit of smoking cigarettes in large quantities, with the belief that these miniature doses of nicotine are innocuous, we desire to enter a protest. The truth is that, perhaps, owing to the way the tobacco-leaf is shredded, coupled with the fact that it is brought into more direct relation with the mouth and air-passages than when it is smoked in a pipe or cigar, the effects produced on the nervous system by a free consumption of cigarettes are more marked and characteristic than those recognizable after recourse to other modes of smoking. A pulse-tracing made after the subject has smoked, say a dozen cigarettes, will, as a rule, be flatter and more indicative of depression than one taken after the smoking of cigars. It is no uncommon practice for young men who smoke cigarettes habitually to consume from eight to twelve in an hour, and to keep this up for four or five hours daily. The total quantity of tobacco used may not seem large, but beyond question the volume of smoke to which the breath organs of the smoker are exposed, and the characteristics of that smoke as regards the proportion of nicotine introduced into the system, combine to place the organism very fully under the influence of the tobacco. A considerable number of cases have been brought under our notice during the last few months, in which youths and young men who have not yet completed the full term of physical development have had their health seriously impaired by the practice of almost incessantly smoking cigarettes. It is well that the facts should be known, as the impression evidently prevails that any number of these little "whiffs" must needs be perfectly innocuous, whereas they often do infinite harm.—*Lancet.*

The Discoverer of Beet Sugar.

On the 7th of last August a century had elapsed since the death of Andreas Sigismund Marggraf, the discoverer of beet root sugar. He was born March 3, 1709, in Berlin, and died August 7, 1782. At that day he ranked among the foremost of the chemists and physicists of his time. At the age of twenty-nine he was elected a member of the "Society of Sciences," at Berlin. In 1744 this society was reorganized under the title of the "Academy of Sciences and Fine Arts," and Marggraf was assigned to the physical section, and in 1760 became the director of that section.

In 1780 the Academy of Sciences, in Paris, nominated him as foreign member.

The domain of chemistry was enriched by him with a large number of important discoveries, and he it was who first appreciated the value of the microscope as an aid in chemical analysis and research. An investigation of the nature of the sap of plants led him to study those constituents to which it owes its sweet taste, and to the discovery of a substance present in different plants and exactly like the sugar obtained from the sugar cane of India. He obtained sugar from different plants, especially from the mangolds, now known and cultivated under the name of sugar beets. He also instituted numerous experiments regarding the best method of preparing pure sugar from these plants. Marggraf was a man of science; he never thought of making any practical use of his discoveries, even when he was convinced of their practical value.

His successor and pupil, Franz Carl Achard, who was born in Berlin, April 28, 1753, and died on his estate in Schlesia, April 20, 1821, converted Marggraf's discovery into a valuable agricultural reality, by devoting his mental and physical strength, as well as his means, to experiments on a large scale. He died before he saw the fruits of his labors ripen. Achard was the founder of the German beet sugar industry.

Fermentation of Dextrine.

Liebig, in his last essay on the subject, says: "A solution of dextrine will not ferment when mixed with beer yeast; if sugar is added to this mixture a large portion of the dextrine is decomposed just like sugar into alcohol and carbonic acid. The effect of the motion which is set up in the sugar atoms by the yeast, upon the dextrine, which is indifferent to the yeast alone, seems to be very evident; before the dextrine breaks up into alcohol and carbonic acid it must be converted into sugar."

There seems to be some connection between this and the remark of Brown and Heron, that the converting power of the comparatively inactive barley albuminoids (barley diastase) can be increased after it is separated from the grain, and hence without the aid of germination. Extract of barley exposed at a temperature of 30° C. (86° Fahr.) to the action of ordinary yeast for a few hours, has its power of converting starch into sugar considerably increased by such treatment. A mixture of yeast and pure cane sugar exposed to the very same process produces a liquid that does not possess the power of acting on starch. It is clear that the growth of the yeast cells is able to cause certain changes in the albuminoids, which are produced through the action of the living plant cells in germination.

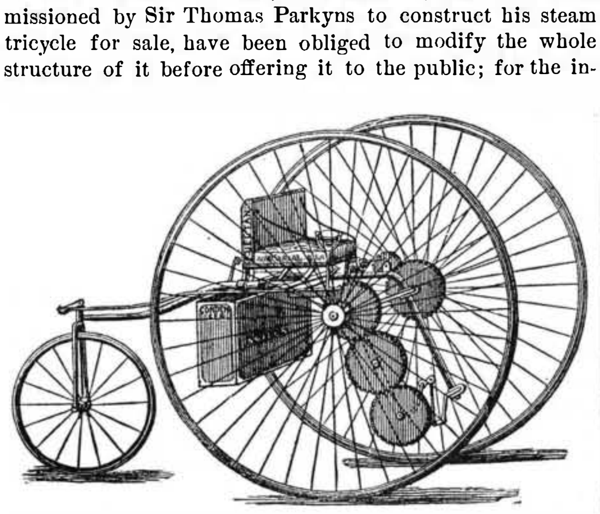
O'Sullivan also noticed something similar. In his essay on dextrines he says: "None of the dextrines herein described are fermentable by *Saccharomyces cerevisiæ*, but they produce alcohol, carbonic acid, etc., if active diastase (*i. e.*, malt extract made cold) and yeast are *both* added together. Malt extract alone does not hydrate the lower dextrines in the cold, nor does yeast alone effect any change; but when the two act together fermentation follows, and hydration evidently must have preceded. Boiled extract of malt is without any action in this respect.

With maltose, as with cane sugar, fermentation sometimes comes to a standstill when 50 or 60 per cent have disappeared. The slightest addition of active diastase sets it going, and the whole mass is finally decomposed in the second fermentation.—*Allg. Brau-Zeit.*

THE STEAM VELOCIPEDE.

The steam tricycle shown in the accompanying engraving, which we borrow from *La Nature*, was invented and constructed by Sir Thomas Parkyns, who called it "The Baronet." The apparatus consisted of an ordinary tricycle, to which was adapted a small tubular boiler placed horizontally a little to the rear of the seat, between the two large wheels, and which was heated with petroleum; of a water reservoir, which served at the same time for condensation, by means of a worm; and of a cylinder with truck actuating three gearings, which, in controlling one another, gave motion to the wheels of the tricycle. The apparatus was arranged so as to be actuated with the feet alone, with the engine alone, or by the combined action of the feet and engine. Moreover, it required the action of the feet to start the tricycle going.

Messrs. Bateman & Co., of Greenwich, who were commissioned by Sir Thomas Parkyns to construct his steam tricycle for sale, have been obliged to modify the whole structure of it before offering it to the public; for the inventor, although he possessed excellent ideas and knew how to apply them, was lacking in the special knowledge necessary for the construction of a machine practically adapted for working.



SIR THOMAS PARKYNS' STEAM VELOCIPEDE.

These engineers began by studying the steam tricycle very closely, and, by modifying the form of certain parts and strengthening them, and by replacing the horizontal boiler with a recently invented very powerful rotary motor, they hope in about six months to be able to offer the trade a steam tricycle which shall be perfectly irreproachable as to construction, security, and speed.

Sir Thomas Parkyns' velocipede could scarcely exceed a speed of seven to nine miles an hour, but the new manufacturers desire to make it attain a speed of thirteen miles, and to thus give it the power of ascending declivities of a certain grade, so that it will not be necessary to combine the action of the feet with that of steam. They will retain the mode of heating by petroleum, as this has the advantage of giving a fire easy to keep up, of giving out no smoke, and of permitting a large amount of fuel to be carried within little space.

Messrs. Bateman & Co. would have carried their studies of the new steam tricycle much further ere this had they not been overburdened with urgent work, and especially had there not been a law in England forbidding the use of any steam motor on the streets unless it was preceded by a person on foot and ran at a maximum speed of three miles per hour.

The inventor hopes, however, before long to obtain permission for the steam tricycle to run without restriction, seeing that it emits no smoke, gives off no steam (owing to its condenser), will make but little noise, and will have the appearance of one of those ordinary tricycles that are met with in so great number in the streets of London.

Anthracite Coal Wanted in London.

Dr. Frankland says that if the average daily consumption of coal for domestic purposes in London in winter is taken at 33,333 tons, one product of the combustion of this enormous weight of coal, as ordinarily consumed imperfectly in open fire-grates, is 667,460,000 cubic feet of steam at 0° C. This large formation of aqueous vapor is the great basis of all fogs; and when the steam produced from coal is accompanied, as invariably obtains, with tarry particles from the same source, the tar, by coating the particles of condensed steam, renders the fogs more persistent. Dr. Frankland has made many experiments on the retardation of evaporation by films of coal tar. He has found that the evaporation of water in a platinum dish placed in a strong draught of air was retarded in one experiment by 84 per cent, and in another by 78·6 per cent, when a thin film of coal tar was placed on its surface. To show the thinness of the obstructive film, it was proved by another set of experiments that by merely blowing coal smoke on the surface of water for a few seconds, the evaporation was retarded by from 77·3 to 81·5 per cent. The experiment was afterward made crucial as regards the analogy with fogs, by observing the rate of evaporation of drops of water suspended in platinum loops. When such drops were subjected to the action of coal smoke their rate of evaporation was found to be much retarded. Hence arise the so-called "dry fogs," which have been observed by Mr. Glaisher in balloon ascents, and by other observers on the ground level. Thus the worst effects of town fogs are due to domestic fires burning bituminous coal. Dr. Frankland thinks that if all manufacturing operations in London were suspended the fogs would be as bad as ever. He is also of opinion that the substitution of a sufficient number of smoke-consuming grates (assuming a smoke-consuming grate to have been invented) for all the 1,800,000 fireplaces now in London is quite hopeless. Dr. Frankland does not hesitate to express the opinion that only one remedy—the prohibition of the importation of bituminous coal—would be of any appreciable service. He considers that this proceeding would not materially raise the price of fuel, for the deliveries of anthracite would make up the deficiency, helped by the increased production of coke from the gas works.

New Mode of Obtaining Oxygen from the Air.

P. Margis, in Paris, prepares oxygen for technical purposes by the dialysis of atmospheric air, using a peculiar form of dialyzer. Atmospheric air is pumped or forced through an India-rubber membrane several times. After passing the air once through the membrane it consists of about 40 per cent oxygen and only 60 of nitrogen, an increase of 20 per cent of oxygen. If passed again through the membrane it will contain 60 per cent of oxygen and 40 of nitrogen. A third membrane raises the percentage to 80 per cent; while a gas consisting of 95 per cent oxygen is obtained by the fourth passage.

The dialyzing membrane used by Margis is prepared by dissolving 50 parts of caoutchouc in 400 parts by weight of carbon disulphide or light petroleum ether (naphtha), specific gravity of 0·65, 20 parts of normal alcohol, and 10 parts of ether. A strip of taffeta is dipped in this solution, and after the solvent has all evaporated it is covered with a very thin and pliable coating of rubber. One or more of these strips of prepared taffeta are pressed between two pieces of wire gauze and form the dialyzing membrane.

The gas obtained by a single dialysis contains enough oxygen to increase the illuminating power of a rich gas or hydrocarbon ten times, if we accept the statement of the inventor. It also possesses all the properties needed for metallurgical purposes.

Like Mallet's process of making oxygen from the air by passing it through water, the exposure is not limited to the power required, but includes keeping several air pumps in order and preventing leaks of all kinds.

On the Digestibility of the Albuminoids in various Kinds of Food.

Drs. Stutzer, Fassbender, and Klinkenberg have been examining the digestibility of various kinds of food. The method employed is that of Stutzer, who extracts the ferment from the digestive organs of slaughtered animals, the membranes of the stomach and the pancreas, and allows a solution of it to act upon a weighed quantity of the food at the temperature of the blood. The amount of albumen left undigested is compared with the total amount previously present as found by special analysis. Indigestible albuminoids were found in blood, yolk of egg, meat, etc., but could not be detected in milk or in egg albumen. From the very extended series of results as given in the *Chemiker Zeitung*, we select the following examples in tabular form:

	Digestible Albumen.	Fat.	Carbo-Hydrates.	Phosphoric acid.
Nestle's Children's food....	9·9	5·1	79·3	0·4
Wahl's " "	1·8	1·2	86·3	0·1
Fresh white bread...........	7·2	0·3	60·7	0·2
Fresh black bread..........	4·2	1·1	52·1	0·5
Du Barry's Revalesciere....	19	1·5	65·6	0·9
Link's Malt extract........	2·5	—	63·0	0·3
Hoff's " (alcohol 1·2)	0.3	—	71·0	0·1
Lean beef (extract 2·6).......	18·5	3·4	—	0·5
Beef soup (" 2·3).......	1·5	0·5	—	0·3
Fowl (" 2·8).......	16·5	2·8	—	0·4
Extract of meat (extract 53·8)	3·4	—	—	8·6
Smoked ham (" 5·4).	18·9	36·0	—	0·5
Cow's milk	4	3·5	—	—
Condensed milk, Cham......	8·8	10·4	—	0·5
Caviare (extract 2·0)..........	25·8	15·4	—	1·1
Oysters (" 8·6)	5·7	1·2	—	0·3

A dozen oysters weighed 86 grammes, or about 3 ounces, so that 14 oysters contain as much digestible albumen as one hen's egg. Meat that had been used for soup still retained 17 per cent of albumen, but only 0·3 per cent of extractive matter.

Rapid Raising of Coal.

On Saturday, August 9, the Briggs Shaft Colliery at Scranton, Pa., hoisted 612 mine cars in 5 hours. During that time it was stopped 15 minutes, but for which delay 32 more cars would have been raised. Each car was lifted 450 feet, emptied and lowered again. During the same time the colliery prepared and shipped 1,200 tons of coal. This record, it is claimed, is unprecedented, either in Europe or America.