THE AMERICAN CHEMICAL SOCIETY.

Cyprien M. Tessié du Motay.

By the death of Mr. Tessié du Motay, this Society has to deplore not only the loss of one of its most distinguished members, but also that of a *savant*, who will leave by his numerous works, discoveries and researches in all branches of technology, a lasting impression on the history of industrial science of our century. He died suddenly, in New York, from apoplexy, at the age of 61 years.

Born in Brittany, France, in 1819, of an old and aristocratic family, Tessié du Motay received in his youth an academical but not technical education. His studies were directed by the famous Abbé Lamennais—a friend of his family, from whom, it must be supposed, he derived his very liberal ideas in politics and philosophy. Gifted with a brilliant and passionate imagination, of a distinguished and at the same time romantic turn of mind, as well as of a superior intelligence, he could not but take an active part in the conflict between the "Romantic" and "Classical" Schools, as the two parties were called, which divided the young generation of *literati* in the first years of the monarchy of Louis Phillippe. Brilliantly endowed as a literary man, his first essays opened to him the doors of the most renowned salons of this period, where French art, literature and science made their abiding place. Even the most exclusive of these opened its doors to one so well fitted to do honor to it, and, in the salon of Mme. Récamier, young Tessié du Motay met with great success in his efforts in the drama, poetry and music. Chateaubriand and Victor Hugo were the familiars of this "Cenacle," and there Tessié du Motay became acquainted with Alfred de Musset, Vigny, Scribe, Theophile Gauthier, Méry, Gérard de Nerval, and all this pleiad of young authors, who have since acquired a prominent place in different branches of literature.

But science had also its fascination upon him: the frequenting of the society of such eminent chemists as Chevreul, Dumas, Berthelot, decided his calling; more especially Chevreul, who was an intimate friend of his father; Chevreul who, at the age of 8 years, held M. du Motay's father in his arms for baptism. Some early discoveries encouraged him to persevere, and finally, by continuous efforts in France and abroad, he conquered for himself a name well known and appreciated in the history of indus-

trial chemistry. Ardent to the task, never sparing the means he had been able to acquire in his professional career as consulting chemist, there has not been a single important subject in technical science developed within the last twenty years, in which Tessié du Motay was not directly or indirectly concerned. Of a generous and open nature, he often gave to manufacturers who consulted him new processes in industry, or happy modifications of old ones, which were applied by them and of which the origin cannot be publicly traced to him.

An ardent and radical republican, brought up in the midst of the liberal agitation of those times, a warm advocate of free speech, free press and free education, he has, in politics, a record that the friends of liberty and liberalism cannot forget. He took, as might be expected, a leading part in all the exciting events of the last years of the Monarchy of July, 1830. He participated, at the side of Ledru-Rollin, in the political movement of 1848, and the subsequent agitation.

Exiled from France, after what is known there as the "Bourgés Trial," in 1849, he went successively to Belgium, England and Germany. In England, he renewed acquaintance with the prominent exiles, Ledru-Rollin, Louis Blanc, Caussidière, Madier de Montjau, all of whom have since become well known.

When abroad, he completed many of his most important discoveries. He returned to France in 1860, and applied himself from that time entirely to industrial chemistry, which secured for him two gold medals and one silver one at the different International Exhibitions in Paris, in 1865 and 1878, and finally, the cross of the Legion d'Honneur. During the siege of Paris he directed the service of the ambulances, and all those who had occasion to know him then, and to see him at work, can testify with what devotion, what cheerful humor and, at the same time, with what patriotism, he took his part in the national defence. He was on the staff of the Governor of Paris, and was present at the most important battles of the siege, that of Champigny, and others.

A literary man, a musician, a philosopher and a *savant*, Tessié du Motay was also one of the most honorable and sympathetic of men. Nobody, better than he, knew how to ally to the genial courtesy and affability of the man of good society, the dignity and the seriousness of a perfect gentleman. The interest and charm of his conversation, the amenity of his intercourse, made him the most fascinating of men, as he was also the truest of friends. Generous, kind hearted, always ready to help misfortune wherever met, during a stay of

hardly eighteen months in this country, he had succeeded in creating around him a circle of appreciative and devoted friends, who held him in the highest regard. Young and old were attracted to him, fascinated, as it were, by the magical charm of his conversation. Even in his later years he did not give up his literary pursuits. He had great fondness for Oriental literature and the mythology and theogony of India. We were fortunate enough to have the privilege to hear him read his translation, or rather adaptation, in French verse (with many original and happy additions inspired by the subject), of some of the songs of Brahma and Vishnu. The enthusiasm of his diction, the genuine animation of his gestures, could well make one believe himself to be transported in reality, into the poetical fictions of Brahmanism and Buddhism. He also left a philosophical drama which he desired should not be published until after his death, which, under the name of the "Expiation of Faust," treats of an old subject in a novel and masterly manner.

HIS SCIENTIFIC WORKS.

It was said of him that he made perhaps more inventions than any other man, for it often happened that when he was consulted about some scientific subject, he would give expression to views so original, and make suggestions so practical, that his consulters often utilized them at once, without his receiving the credit of the suggestion or invention. About 18 months previous to his death, he had come to this country as Consulting Chemist and Engineer of the Municipal Gas Light Company, to superintend the building of retorts and furnaces, and the preparation of machinery for the introduction of the carburetted water gas, practically and on a large scale, for the lighting of this city. Everybody knows what success he has met with. The gas obtained has a much greater illuminating power than the ordinary gas, and can be produced at such reduced rates as to have forced many of the other companies to adopt the process.

Metallurgy.—Metallurgy greatly interested bim, and he was intimately connected for the last twenty years with the progress of this science. He patented in England a process for the treatment of arseniferous iron ores, and suggested or made several improvements in the manufacture of ferro-manganese. He was also the first to introduce and manufacture bricks of magnesia for metallurgical purposes. They were made for Mr. de Wendel, in Alsace, for the Siemens-Martins steel furnaces. The magnesia was brought from Eubœa, Greece, in the state of magnesite (magnesium carbonate). The earth was ground, worked in the shape of bricks, which were

compressed by hydraulic pressure of 100 tons. They were then burnt in a kiln at a very intense temperature, so as to prevent the magnesia from changing to carbonate on contact with the air. The best Dinas fire bricks, used at Mr. de Wendel's, lasted generally from 2 to 3 weeks, whereas the magnesia fire bricks of Tessié du Motay lasted 18 months. They were used by Mr. de Wendel in forty reheating furnaces for steel and iron, with great success.

In the fall of 1879, Mr. du Motay was engaged by certain capitalists to make an examination of, and report on, the iron and copper pyrites deposits of Lake Superior and Canada. He was to have undertaken the direction of the reduction of these ores by a new process of his own invention, when death struck him.

Etching on glass.—In collaboration with Maréchal he invented and introduced a very excellent method for etching on glass. The use of hydrofluoric acid is always attended with danger, especially when it is in the gaseous state. But while the solutions of this acid produce on glass brilliant surfaces, it is only by the use of the gas that it is possible to obtain unpolished surfaces, much finer and better adapted for delicate effects in decoration. By his process, excellent results have been obtained, and the dangers of the gas avoided. The hydrofluoric acid is disengaged in the nascent state from a bath composed of fluorhydrate of fluoride of calcium, water, and diluted hydrochloric acid. He recommended also the use of saccharate of lime as a counter-agent against the burns produced by fluorhydric acid.

Photography.—In photography he improved several processes, and, at the same time as Poitevin and Niépce, made several attempts for the production of colored photographs. In connection with Maréchal he invented a special process for the production of transparent vitrified photographic proofs. A glass plate having been covered with a solution of india-rubber in benzine, and, when dried, with a coating of ioduretted collodion, an image (positive by transparency) is obtained from the negative. After proper treatment by means of cyanide of potassium, platinum and gold baths, to develop and obtain the proper shades of black, the plate is placed in a muffle, and the organic matters burnt. It is then covered with a flux of borax, and vitrified.

Electric light.—Tessié du Motay has been connected with the latest efforts made for the introduction of electric light, on an industrial scale, for illuminating cities. A professional friend of Jablockoff, Moncel and Jamin, and other celebrated electricians, he, with Jablockoff, was the first to suggest the use of carbon pencils coated with kaolin, to prevent their disintegration when burning.

Edison, in his latest electric lamps, realized this idea by using the carbon produced by the calcination of bristol boards; mistaking the true explanation of the case, he attributed to a fourth state of carbon, the peculiar properties of the carbon thus obtained.

Tessié du Motay (in an article which was published in the New York papers) explained that the qualities of durability of these new pencils were due to the presence of kaolin, used for sizing bristol paper, and that he and Jablockoff had many years ago anticipated the idea.

Permanganates.—He gave his attention to the preparation of alkaline permanganates on a large scale, having found an industrial use for them in his new method of preparation of oxygen gas. In the ordinary preparation of the permanganate, peroxide of manganese, chlorate of potash and caustic potash are heated together in an iron retort. After proper manipulations the mass is treated with water, which transforms the manganate into permanganate. Tessié du Motay proposed first to produce the transformation of manganate of potassium into permanganate, by means of sulphate of magnesia. He also obtained the alkaline permanganates by a completely new process, by the action of the oxygen of the air on sesquioxide of manganese in presence of caustic soda or potash. The mixture, introduced into cast iron retorts, is heated to 400° C., and a current of air is passed through the mass.

Preparation of oxygen.—One of his most original, ingenious and successful inventions was that of the preparation of oxygen gas on an industrial scale. His method is based on the following reactions: When the permanganate of sodium or potassium is exposed to a temperature of 450° C., in a current of superheated steam, the salt loses its oxygen, producing caustic alkali and peroxide of manganese. If now this mixture of these two substances, at this same temperature of 450° C., is exposed to the action of a current of air, the primitive salt is regenerated by absorption of oxygen, and can then furnish oxygen anew by the action of superheated steam. In consequence of these successive decompositions and revivifications, a given quantity of permanganate can furnish an indefinite quantity of oxygen. The operation is effected in cast iron retorts. The steam carried away by the oxygen gas is condensed, and the air from which oxygen is to be borrowed for the regeneration of the permanganate, is blown in the retorts after having been deprived of its carbonic acid. By this method one cubic meter of oxygen cost 0.40 francs.

Illuminating gas.—Having thus secured the means of obtaining oxygen cheaply and in great quantities, Tessié du Motay turned his attention to one of his favorite schemes, and one which has brought him a legitimate share of his fame—"a new method of illumination."

In the Drummond light, a mixture of oxygen and hydrogen gas, supplied by two different gasometers, is brought in contact with a cylinder of caustic lime, and lighted. A light, next in intensity to that of the sun or electric arc, is thus produced. Tessié du Motay and Maréchal have rendered this system applicable even to the lighting of cities, by the introduction of their industrial method for the preparation of oxygen gas. Tessié du Motay modified the process in preparing the hydrogen gas, by effecting the decomposition of hydroxide of calcium by carbon in iron retorts. A company, under the name of the New York Oxygen Co., has employed this system of illumination with success for large squares, public places, beacons, signals. It was very much used during the war of secession.

Guided by Caron, Tessié du Motay and Maréchal have since substituted for the calcium pencil a pencil of calcined magnesia, which withstands better the high temperatures which are reached. These pencils having sometimes the inconvenient property of breaking on cooling, they have substituted for them the "zirconia pencils" with much better results.

Tessié du Motay has also introduced a new system of illumination by using water gas (a mixture of hydrogen and carbonic oxide), which is burnt in the presence of a regular current of oxygen, obtained by his process. The flame is directed on cylinders of magnesia and zirconia. This system was tried in Paris, Place de l'Hotel de Ville, in 1868, with success.

In 1870, Tessié du Motay modified his methods in the following manner: He made his oxygen pass into the flame from a solution of naphthalene in petroleum ether. This liquid was called, in France, "carbolene." During the combustion, there are separated from the liquid substances of an intense lighting power. This kind of light is known in France as the "Oxy-carburetted light of Tessié du Motay." The combustion took place in lamps with a wick (Philipp's lamps), into the flame of which the oxygen gas penetrated horizontally.

After these experiments, Tessié du Motay still further modified his system, and gave it a very practical form, by directing a jet of oxygen gas on ordinary illuminating gas from coal, made very rich in carbon by proper carburation, the combustion taking place in a slit burner of steatite. This process was tried in Paris, in 1870, on

the Boulevard de l'Opera, and at the Tuileries, under the auspices of Napoleon III., who was very enthusiastic on the subject. The light, it is said, was intense and really splendid. If it had not been for the complications which the war brought on, this system bade fair, at the time, to be thoroughly tested and employed in Paris. It was on this occasion that he received the cross of the Legion d'Honneur, he having refused it once before, on account of his political record, because it had been officially sent to him. The Emperor gave him an audience, and, having learned his reasons for refusal, took from his coat the cross he was wearing himself and attached it to the bosom of Tessié du Motay, adding that "science and politics had nothing to do together."

Though found objectionable on account of the double system of pipes required, this system of illuminating can be, and, in France, has been, applied in many cases. It has been applied to the lighting of mines, for photography, for sub-marine works, for lighting public places of meeting, theatres, etc. The industrial preparation of oxygen by the du Motay process constitutes certainly a progress very interesting and full of promise for the industry of illuminating gas.

Tessié du Motay still further modified the burner for his gas, by the introduction of his "differential burner." The ordinary illuminating gas, carburetted as before, arrives in two opposite directions by two tubes which are curved horizontally. The oxygen is supplied by a vertical tube reaching slightly below the level of the others, and placed between the two. This burner is formed of several jets of the same kind, placed in a ring. A vertical magnesia or zirconia pencil is slightly engaged at its base in the ring formed by the jets, and becomes incandescent.

Bleaching.—The name of Tessié du Motay is associated with several inventions for the bleaching of textile fabrics and fibers.

In 1874, Tessié du Motay proposed for the scouring of silk (to deprive it of the sericine) the use of a bath of hydrate of baryta (12 to 15 per cent. of the hydrate for 100 of the silk) heated to 80° C. The ordinary decolorizing agents having no action on what is called "gray silk," he proposed to use successively, to bleach these fibers, nascent oxygen gas and sulphur dioxide, sulphydric acid and sulphur dioxide.

The silk is dipped in a solution of permanganate of potassium, and then in a solution of sulphur dioxide, to eliminate the oxides of manganese. After repeated treatments in these solutions, the fibers are introduced into a solution of sulphydric acid, or of alkaline sulphides, washed, and again treated with sulphur dioxide solutions.

For bleaching flax, hemp, cotton, silk and wool, Tessié du Motay has introduced a new method based on the use of the alkaline permanganates. A solution of manganate of sodium is added to a solution of sulphate or chloride of magnesium, or chloride of calcium; by double decomposition, permanganate of sodium, sulphate of sodium, and hydrate of magnesium, or calcium, are produced. The fibers are dipped in the solution. 2 to 6 kgrms of manganate are said to be sufficient for 100 kgrms of cotton, flax or hemp. The fibers are then passed into an alkaline solution, in case of silk or wool in a solution of soap, and afterwards into a solution of sulphur dioxide, to dissolve the oxides of manganese.

The results obtained on a large scale at Comines, France, at the manufactory of Verlay, in 1867, showed that by Tessié du Motay's process, it is possible to bleach completely in a day the fibers of flax and hemp, and that but three days were required for tissues of flax and hemp, and it was claimed that the fibers were no more injured than by the other processes in use, which, moreover, necessitate a much longer time. For 100 m. of linen the cost was stated at six francs. The manganate of sodium could be obtained at one franc per kgrm.

He has also introduced a new method for bleaching wax and feathers, which is at present carried on in France, by Messrs. Viol & Duflot. It is based on the use of oxygenated oil of turpentine.

Industry of sugar (baryta).—In the ordinary process of the treatment of sugar solutions, the sugar is separated from the impurities by the addition of lime and other substances, capable of forming with these impurities insoluble compounds, the sugar remaining in the solution. Dubrunfaut and de Massy have introduced in France a new method of treatment, which is the reverse of the preceding. It consists in separating the sugar from the impurities it contains, by forming with the sugar an insoluble compound, while the impurities remain in the solution. The substance employed is hydrate of baryta, which forms with cane and beet sugar, even at the temperature of ebullition, insoluble saccharate of baryta.

To render this method practicable, hydrate of baryta had to be obtained at a sufficiently low price, and on a large scale. Dubrunfaut and Liplay prepared it by the decomposition of witherite, (barium carbonate) by coal. But this decomposition to be complete, requires the highest temperature, which the kilns used were not able to stand.

Tessié du Motay, in connection with others, has contributed his part to the solution of the problem, and to the introduction of

another and much more economical process. This process has been successfully carried on in France, at Comines (Nord), at Asniéres les Paris, at Courriére (Pas de Calais), at Menu Tylloy Delaune. It is based on the decomposition of natural barium sulphate (barytes), by coke, and subsequent treatment with zinc oxide.

The mineral is ground, mixed with 20 per cent. of coke or soft-coal, and calcined in a Siemens-Martin furnace. Barium sulphide is thus formed. This sulphide is suspended in water, steam is admitted and the mass is thoroughly agitated. It is then allowed to settle. The supernatant liquid and the concentrated washings of the residue, are received in proper vessels. This liquid is of a complex composition; it contains diluted hydrate of baryta, barium proto and bisulphide, and baryta sulphydrate. The sulphur is eliminated by boiling the liquid, after an addition of zinc oxide (200 kgrms zinc oxide for 35 hectoliters of sulphurous liquid, at 25° B.), the mass being thoroughly agitated all the time. Insoluble zinc sulphide is formed, and baryta hydrate remains in solution. The solutions are concentrated, allowed to crystallize, and the crystals are dried in the "centrifuge." The product is hydrate of baryta with nine equivalents of water. The zinc sulphide is washed, roasted in ovens, and the zinc oxide is thus regenerated for another operation.

Binoxide of barium.—Tessié du Motay, starting from the baryta, has also modified and improved the ordinary process of preparation of bioxide of barium from this base.

Artificial ice.—In 1880, Tessié du Motay and A. J. Rossi patented two new processes for the artificial production of ice and cold, based on the power of absorption, which they find certain ethers and alcoholic radicals to possess, for gaseous sulphur dioxide and ammonia.

In one of them, a mechanical power is used to produce the volatilisation of both constituents of the binary liquid, the vapors of which are compressed under very small pressures in a condenser, where the ether liquifies easily, absorbing the vapors of sulphur dioxide, reconstituting the original liquid, and thus avoiding the high pressures necessary to liquify the sulphur dioxide by mechanical compression.

In the other, advantage is taken of the higher point of ebullition or less volatility of the absorbing ether. No mechanical power is required. The sulphur dioxide is disengaged by the action of heat (a water bath), from the absorbent contained in a boiler, and condensed to the liquid state, by proper cooling and the pressure the gas exerts on its own molecules.

The fire being removed from the boiler, and the latter cooled in its turn, the liquid dioxide evaporates under the partial vacuum thus produced, generating an intense cold, its vapors being absorbed as fast as they are formed by the absorbent in the boiler, working much in the same manner as the Carré ammonia solution machines, but with much less pressure, and with a water bath instead of a furnace.

In 1879, Tessié du Motay, in collaboration with L. F. Beckwith, took out in this country several patents of a mechanical character, for small rotary motors, for mechanical devices, for the application of the cold produced by refrigerating machines to the ventilation and cooling of mines, for improvements in steam condensers used on board of steamers, by using a very volatile liquid, such as sulphur dioxide, for condensing steam, instead of water, the volatile liquid being thereby volatilized under high pressures, the mechanical action of which could be utilized on a piston so as to restitute part of the mechanical power otherwise lost in the condensing water. He also took a patent with L. F. Beckwith, for the joint use in the same ice machine, of sulphur dioxide and choride of methyl, with the idea of using the former as an extinguisher of the latter.

New York, July, 1880. AUGUSTE J. ROSSI.