BARON VON LIEBIG.

A sketch of the life of the illustrious chemist and author, recently deceased at Munich, has already found place in our columns, so that in presenting the accompanying excellent portrait, reproduced from the pages of *La Nature*, we shall allude chiefly to the nature and importance of the discoveries by which his name has been rendered for ever famous.

A single illustration will render clear the fundamental idea which formed the basis of Liebig's labors in agricultural chemistry, and which he has developed through all his works. A field, for example, is cultivated and fertilized over a period of five years, and is required to produce successive crops of potatoes, wheat, clover, wheat again, and, during the last year, oats. The potatoes and wheat are sold; the clover serves to feed an ox, which similarly finds its way to market. Now it is clear that the potatoes and wheat contain phosphates and potash drawn from the soil, and that the ox has formed the constituents of his bones from similar matter in the clover. Consequently this total amount of mineral substance is absolutely withdrawn from the plot of land and not returned. Without doubt, in animal manure, a part of the phosphates in the wheat and oats will be regained if the latter be consumed on the farm; but of only a small fraction of the quantity will restitution be made, and therefore, if such a course be continued, the result will be impoverishment, and in the end sterility of the earth.

Against this system of cultivation, based on the production of manure, Liebig waged systematic war, pointing out in the strongest terms its despoiling nature, and stigmatizing it as "vampire agriculture." Not content merely with giving warning of the evil, he at once indicated a remedy, and first advocated the use, as fertilizers, of bones rich in phosphates. These he found resisted decomposition in the soil, and produced little effect; so he invented a mode of treating them before use with sulphuric acid, thus creating one of the most prosperous agricultural industries, the fabrication of superphosphates. The results at once obtained were marvelous. In England, the turnip crop doubled, and the employment of the new fertilizer became general; then it came into use in France, then Germany, and finally in this country. The consumption of superphosphates, however, increasing, bones failed to afford an adequate supply, and then the geologists, first Nesbitt in England and Delanoy in France, searched for and found new sources in the mineral deposits of the earth.

Liebig was an indefatigable worker, constantly advocating in his letters, his teachings, and his books, the necessity of utilizing the lost riches in sewage and waste refuse. He cited the example of China, which sustains a vast and dense population without importation of any fertilizing material for her land, and also of Holland and Alsace, where, by similar employment of waste, the soil is made to give abundant harvests, comparing both instances with the prodigality of English agriculture, for the sustenance of which vessels constantly are searching the world over for guano and similar materials. Liebig attached much greater importance to the mineral matters in manures than to the nitrogenous constituents, a view which involved him in many long discussions with English and French chemists, in many of which the extreme position, sometimes assumed by him, he found to be untenable.

To the precocity of Liebig's genius we have already alluded. At nineteen years of age he was a doctor of medicine, and at twenty one assumed a professorship in Giessen university. Two years later he founded his celebrated laboratory and school, which have since formed models for similar institutions throughout the world. If the motive which underlaid his writings can be expressed in a single sentence, we should say that it was the desire not only to be useful but to be useful immediately. Hence his works relating to practical agriculture, and hence the instruction written for the people and not for the *savans*. His was not the language of the theorist or student, addressed to his peers in learning, but rather the familiar argument or practical views calculated to interest the indifferent and forcibly enchain the attention of a general public. His attempts to base organic chemistry on the hypothesis of component radicals were not successful, and indeed, as Laurent remarked, seemed to be "the study of bodies which do not exist."

But where few have known the names of Kirchoff, of Bunsen, of Mayer, and of Helmholtz, the world has talked of Liebig; where the grand theories of the former need genius to insure their application, his plain words point the way to ready practice; and even though his labors, great as they are, be exceeded by the greater works of his gifted countrymen, still Justus von Liebig, his writings and his precepts, will be remembered and heeded even so long as man shall seek his sustenance from the bosom of his mother earth.

PULVERIZED charcoal sprinkled over dressed poultry, after the animal heat is expelled, will preserve it from spoiling for some time in hot weather.

Augmentation of the Induction Spark.

Everybody is acquainted with the experiment which consists in placing in communication the two coatings of a Leyden jar with the two ends of the secondary wire of an induction coil. The length of the spar is reduced considerably, but the brilliancy and noise are, on the contrary, increased.

I wished to see the effect of large insulated metallic surfaces, placed in contact with the two ends of the secondary wire, the two surfaces being separated from each other, so as not to produce the effect of a condenser.

For metallic surfaces I took frames having each about eleven square feet covered with silk, doubled with paper, upon which had been fixed plates of tin. The spark burst between two insulated points, which can be made to approach or recede from each other at will.

So long as one or more plates of tin communicate with one of the poles only, the spark is in no way modified; but so soon as the other pole of the secondary wire is in contact with the plates of tin of the same surface as the first, the brilliancy of the spark increases and its length diminishes. The increase of the surface produces an increase in the brilliancy and the noise of the spark, and a new diminution in its length. If one of the metallic surfaces be greater than the other, the effect does not surpass that which two surfaces equal to the smallest produce.

BARON JUSTUS VON LIEBIG.

The effect of the plate becomes more sensible by the drawing near of the points of the excitor, and the spark breaks out into a great number of tracks of fire; but if the distance of the points is reduced to about one and a half inches, the effect of the surface seems to disappear.

When in place of the large metallic plates, metallic wires or ribbons of tinsel are employed, three fourths to one inch in width, well insulated by means of glass supports or silk cords, we then obtain, by the use of equal surfaces, much more intense effects. Fifty-four yards of these metallic ribbons, placed in contact with each end of the secondary wire, making a total of 108 yards, greatly increase the brilliancy and the noise of the spark.

The stronger the induction, the more marked the effect; this is what I have proved lately, by means of a powerful apparatus, which M. Ruhmkorff has been good enough to place at my disposal. It is necessary to be careful, in order to obtain the greatest possible effect, to make the two ends of the metallic ribbon communicate with each point. If the ribbon be too long, it becomes necessary to establish a greater number of similar communications.

In general the effects are the much more intense when the insulated metallic surfaces are greater, more divided, and the different parts are more separated from each other.—*C. M. Guillemin, in Journal de Physique.*

Effects of Air upon the Condensation of Steam.

The conclusions which Professor Osborne Reynolds draws from a series of experiments are as follows:

1. That a small quantity of air in steam does very much retard its condensation upon a cold surface; that, in fact, there is no limit to the rate at which pure steam will condense but the power of the surface to carry off the heat.

2. That the rate of condensation diminishes rapidly, and nearly uniformly as the pressure of air increases from two to ten per cent that of the steam, and then less and less rapidly until thirty per cent is reached, after which the rate of condensation remains nearly constant.

4. That in consequence of this effect of air the necessary size of a surface condenser for a steam engine increases very rapidly with the quantity of air allowed to be present within it.

5. That by mixing air with the steam before it is used, the condensation at the surface of a cylinder may be greatly diminished, and consequently the efficiency of the engine increased.

6. That the maximum effect, or nearly so, will be obtained when the pressure of the air is one tenth that of the steam, or when about two cubic feet of air, at the pressure of the atmosphere and the temperature 60° F., are mixed with each pound of steam.

New Application of Electro-Plating.

Some three years ago, a working electro plater in London discovered a process by which a white metal having tin as its principal ingredient might be deposited by electricity upon iron and steel, as well as upon copper and brass. Most of our readers know that to plate steel and iron even with silver has hitherto been deemed impossible, without the intervention of copper as a coating; and the process of tinning thin sheets of iron so as to make them tin plates is a familiar one. But to cover any metal with tin by the use of the galvanic bath is new. The invention is now in practical operation in Victoria street, Birmingham, where the Electro Stanus Company, who own the process, have their works.

The salammoniac requisite in the making of tin plates, and which increases the disposition of the iron to rust, if only the air can get at it through the tiniest of imperfections, is not called for in this process. If the metal required to be coated should be rusty, it is cleansed in a bath of sulphuric acid very much diluted; and when it has been immersed in a pot of potash and water, it is free from all grease. Now chemically clean, it is fit for the plating vat. Here, hanging by copper wire from the metal bars which connect the battery with the opposite pole, the articles to be plated are hung in the solution, which, while it is not exclusively tin, may be practically regarded as tin. Immediately that galvanic action takes place, the article is filmed with the white metal, and according as it is desired that the coating should be thick or thin, the time during which it is kept in contact with the solution is long or short. The article removed, it is found that it possesses a dull white color that is made to acquire tolerable brightness by the application of the customary metallic brush moistened with a cleansing fluid. If a higher polish is required, then that may be obtained by the ordinary method of burnishing. The process has evidently a wide field of application.—*The Engineer.*

Our readers will find the description of a process analogous to this in the SCIENTIFIC AMERICAN of July 15, 1871.

The American Paper Trade.

During the year 1872 there were in operation in the United States 812 paper mills, owned by 705 firms, and of an estimated value of over $35,000,000. In addition to this actual value of mill property, there is to be added the usual working capital, twenty-two and a half per cent of the value of the mills, thus making the total capital invested in paper making throughout the country about $43,500,000. The mills employ 13,420 male and 7,700 female hands besides 922 children, or a total of 22,042 laborers, whose wages amount yearly to the large sum of nearly $10,000,000 dollars. Their product amounted last year to 317,387 tuns, valued at $66,475,825. The total number of engines running is 3,293, besides 299 Fourdrinier and 689 cylinder machines.—*Paper Trade Journal.*

Forthcoming Exposition in Brooklyn, N. Y.

The success of the fair held, in the very limited space at the disposal of the managers, in Brooklyn last fall has induced a committee of influential men in that city to announce a more extended display, to be held at the rink on Clermont avenue. Adjoining this building is the large armory and drill hall of the 23d regiment, and we understand that negotiations are in progress by which these rooms may be added to the available space.

Especial attention was bestowed last year on the formation of an art gallery, and the result was one of the best collections of paintings ever seen in the neighborhood of New York. It is to be hoped that the fair will be similarly fortunate this year.

It is intended that the exposition shall remain open for one month, commencing September 15.

Full information can be obtained at the offices of the exposition, 39 Fulton street, Brooklyn, N. Y.

ENGINEERING NOTES.

[Extracts from papers read before the American Society of Civil Engineers.]

At a recent meeting of the American Society of Civil Engineers in this city, Mr. Joseph Whitney, C. E., of Cambridge, Mass., read a paper on the subject of

LEAKAGES IN WATER PIPES.

He stated that some years since his attention was called to this matter in Cambridge, Mass., where for a considerable period the water supply had been gradually decreasing, thus causing much inconvenience and insecurity in case of fire. In a particular house, the water scarcely rose to the second story at night or day. After enquiry, a series of observations were made with siphon pipe and pressure gage to determine the cause, and were conducted in the morning, when the consumption was nearly nothing. Numerous very serious leaks were quickly found and closed; and thus, without any increase of size in the main, an additional head of 35 feet was secured, insuring a full supply to each house in the locality. By continued experiments upon the pipes throughout the city, nearly two hundred leaks, of from 1,000 to 2,000 gallons each per hour, were found. The necessary repairs were made, and thereby the average daily consumption per head was reduced from 85 to 35 gallons, which is not more than one half that in most cities.

Leakage of this character may exist a long time without being known; thus, it may start when the water is first let on, and the water find a passage through some blind channel into the sewer; it will not be seen at the surface unless that upward and outward is the easiest course.

It is quite probable that this subject concerns other cities, and furnishes a satisfactory reason for the great increase in the consumption of water, and the corresponding growing demand for supply, which more or less embarrasses public authorities.

It is said that in the city of New York the consumption is about one hundred millions of gallons *per diem*; if so, the speaker was sure at least fifty millions were wasted through unrecognized leaks into the sewers and surrounding rivers. In Boston, more than seventeen millions of gallons are supplied, where eight millions should suffice.

It is a fair presumption that one half these great amounts, being but waste, and a corresponding cost in the construction and operation of water works may be saved: surely examination, complete and exhaustive, should be made to determine whether this is presumption or fact.

Mr. T. F. Rowland, M. E., of Greenpoint, New York, presented a paper on the

ADAPTATION OF MECHANICAL POWER TO THE WORK OF CHARGING AND DISCHARGING GAS RETORTS,

in which it was proposed to take the coal from a pocket outside of the retort house, size, mix, transport and deposit it in proper quantities in the retorts and afterwards discharge therefrom the resulting coke into the coke barrows.

The apparatus consists, first, of an iron car, which traverses the retort house in front of a bench upon a railroad of twelve feet gage, and carries the mechanism for charging and discharging; and second, a series of buckets which, suspended from an overhead or "pendent" railway, conveys coal to the charging apparatus. The car is fourteen feet square, and is propelled by an engine and boiler upon it. It carries a meter which receives coal from the buckets and deposits it in the charger. The meter is a horizontal cylinder divided longitudinally into three compartments or cavities, such that each will contain enough coal for one retort. It revolves intermittently at the base of a hopper or coal pocket, which receives the coal from the buckets, each cavity therein in turn being filled with coal and emptied by discharge into shutes, severally, in connection with the three scoops of the charger. These shutes are placed one above the other, and, as the meter revolves, are automatically opened and closed, so that the coal is discharged into each in succession. The edges of the meter cavities and of the throat of the coal pocket are armed with hard, sharp, steel blades to cut or crush fragments of coal which, lodging between the surfaces, might clog the machine.

The charger is a carriage travelling on the top of the car, transversely; its three scoops are placed one above the other at distances corresponding to the vertical measure between the retorts; they are D shaped, like the retorts, and have movable bottoms. When the scoops are filled, by a transverse movement of the carriage they are thrust forward into the retorts; the motion being reversed, the bottoms and then the scoops are withdrawn: thereby the coal is deposited evenly over the retort, and the scoops made ready for another charge.

The discharger is a carriage similar to the charger. The two are placed at opposite ends of the car, and the meter between them. By an automatic device, three hoes or rakes are simultaneously thrust into three retorts, dropped until they rest on the retort bottoms, and then withdrawn, whereby the coke is removed and discharged on to the retort house floor, or into coke barrows. One tier of retorts may be charged and the adjacent one discharged at the same, and in a very brief, time.

The pendent railway consists of two single parallel rails, ten feet apart, suspended from the retort house roof over the railroad before mentioned, and connected at the ends by semicircular rails, thus together forming an endless line, from which is suspended a series of coal buckets, attached to a flexible steel belt by which they are separated at uniform distances apart. The belt passes around horizontal drums, ten feet in diameter, and placed one at each end of and below the line, their vertical shafts being in the center of the curved rails. One of these drums is an idler; the other, that at the receiving end, is in a tower outside the retort house. In its periphery are two openings, diametrically opposite, which, by two inclined chutes, are connected with a fixed cylindrical hopper or reservoir for coal above. The buckets are vertical cylinders with one half of the upper part cut away, so that when they are in contact with the drums their axial planes coincide with the periphery. The space between the buckets on the belt is equal to one half the circumference of the drums.

When this apparatus is in motion, the buckets pass along the pendent railway; their openings are brought successively in contact with the openings of the drums, so that the coal conveyed by the inclined chutes from the reservoir drops through them, the quantity being regulated by valves in the chutes, worked automatically.

The buckets have hinged bottoms to drop downward, and are opened when passing over the coal pocket on the car, at the will of the operator, by releasing a catch; they are mechanically closed just before reaching the drum, where they are filled.

The coal in the yard, after passing between sizing and mixing rolls, is lifted to the reservoir over the drum by elevators, similar to those used at Messrs. Hecker's flouring mills in New York.

The several parts of this apparatus can be worked independently, and thereby accommodated to the varying demands likely to be made upon it.

Ancient Construction.

Explorations at Nineveh have shown that, except for paving purposes, stone rarely entered into the construction of the walls and buildings. They consisted of clay only, which had evidently been molded in the shape of bricks, and put together without the aid of mortar or cement of any kind. In the few examples in which stone was found to be employed the joints were made in the same manner, that is, by simple juxtaposition. Mortar and cement appear to have been rarely or never employed. The size of the stones was considerable, so that mere weight would, to some extent, render superfluous the employment of any adhesive substance at the joints. But this was not the case with the bricks, which were nearly of a square form, 1 foot 4 inches on the sides by 2 inches in thickness. The question which remains unsettled is: In what degree of consistency were these bricks at the time they were put together? Were they sufficiently plastic to adhere together, or were they wetted before being used, so as to soften the mere surfaces which were in contact? Upon this supposition there would be an appreciable difference between the appearance of the body of the bricks and that of the joints, which does not exist. There is nevertheless, a slight difference in color at these points, which looks like lines. The Assyrians had two varieties of baked bricks; the one was regularly shaped, with parallel faces, and the other of a trapezoidal form. These latter were intended for arches or vaults, and the inclination of the sides varied with the position which the particular brick was intended to occupy in the curve. The dimensions and proportions of the Assyrian bricks differ from those of modern manufacture. Those employed in paving were of two sizes. One class was 1 foot 4 inches by 1 foot 4 inches by $2\frac{1}{2}$ inches in thickness, and the other 13 inches by 13 inches by $4\frac{1}{2}$ inches thick. A peculiar feature in these old bricks is that they are, with few exceptions, covered with inscriptions in the cuneiform character. Two remarkable features in the construction of ancient cities were, first, that either the diagonals or the direction of the sides pointed exactly towards the cardinal points, and, secondly, the enormous thickness of the walls of the principal buildings. It is probable that astronomical reasons dictated the former of these, and climatic exigencies the latter. In the case of Nineveh, there can be little doubt of this, as the Assyrians were celebrated for their skill in astronomy, and their partiality for the science. The thickness of the internal walls is scarcely ever less than 10 feet, and that of some of the external varies from 16 feet to 25 feet. Some consideration must be given to the fact, with regard to thickness of the walls, that the mode of building them with bricks merely dried in the sun required this dimension to be disproportionately great.

In the building of their domes and vaults the Assyrians employed a more brittle description of brick than in their walls and pavements, and the joints were made by grouting them with semi-fluid clay. The *voussoir* shape of these bricks prove that the theory of the arch must have been known at that time, and some considerable progress made in the preparation of artificial stones. There is no evidence of timber being employed as a material of construction by the people under notice. It was used only in small quantities, and for the purposes of ornament. It seems that iron was altogether unknown as a constructive material. Copper was turned to account for the pivots or hinges of doors, and lead was also rendered serviceable. Enamelled bricks were common, and stucco was largely employed, as with us, for the double purpose of protecting the brickwork from the effects of the air, and hiding the roughness of the surface. There is one ceremony which appears to have existed at the time of the Assyrians, which is common to modern times as well. It is that of laying the first, or foundation, stone of a building. A recent French explorer, M. P. Place, discovered in a layer of fine sand underneath one of the monoliths of the gates of Nineveh, a variety of different objects in marble, agate, and cornelian, which were cut and engraved, and were, moreover, all pierced with a hole, as if they had originally formed part of a bracelet or necklace deposited at the laying of the stone as coins are deposited with us. While well versed in the practice of earthwork, brickwork, and even masonry, the Assyrians were totally ignorant of the art of construction considered in the light of an assemblage of pieces of timber or iron. They could heap up materials so as to cause the structure so composed to resist any outward force by its sheer weight or inertia, but they knew nothing whatever of the distribution of pressures, or how to proportion a structure so that it should be equally strong in all parts. Both the labor and the material were too abundant to call for economy in either one or the other.—*The Engineer.*

Steam Power on the Canals.

A correspondent, W. J. B., of Ind., expresses his belief that any means of propelling canal boats in which the water is used as a fulcrum would produce so great an agitation of the water as to prevent their use. He proposes two continuous rails on the bed of the canal, one for boats going in each direction. The boats are to be fitted with driving wheels in the center, with deep flanges, the axles of the wheels resting on frames which could be moved up and down in curves concentric with the main shaft of the engine. In addition to the weight of the wheel, pressure on the rail might be given by steam cylinders which would slightly raise the boat in the water. The boat could be guided by rudder wheel with flanges, which should also work in a frame, variable to suit the draft of the boat. Thus both wheels could be raised from the rail to allow the boat to be drawn by horses in the ordinary way.

"As to the power required, considering the great disadvantage under which horses work at the end of a long tow line, from the oblique direction at which the force has to be applied (this being also considerably augmented by the necessity of steering the boat from the tow path and running it obliquely through the water), the boats on the Erie canal, now drawn by two horses at $1\frac{1}{2}$ miles per hour, would attain a speed of three or four miles per hour, by the means I have suggested and the application of the power of six or eight horses; and the cost of running canal boats, per mile, would be one third of what it is now.

But the consideration that must have the greatest weight is the increase of the freighting capacity of the canal. Almost any plan that certainly secures this must have the preference over all others, regardless of the cost of construction. When the plan I propose first occurred to me, it was seen that its cost would then be an insuperable objection, and, for the time, I let it rest; but at last my anticipations are realized, and now the cost should not, in my judgment, be any objection. The whole expense would not probably exceed five millions dollars for the entire length of the Erie canal. Generally I would think it best to drive piles, say 1,000 to the mile, for each track; and as five or six tuns is all each rail would have to bear, iron of forty pounds to the yard would be sufficient. Five tuns would give a traction force of 1,000 pounds, equal to the draft of twelve horses. My estimate of the power required is derived from the consideration of the great loss of power as usually applied in drawing boats by horses, and the unavoidable disadvantage of using paddle wheels, acting as they do against a yielding fulcrum. One may appreciate this loss of power by walking over a sandy road.

A boat necessarily drives the water to some extent ahead of itself; and then, if power is applied by wheels to force the boat forward, a depression in the water level at the boat must result, bringing the vessel nearer the bottom of the canal and materially increasing the draft. The boat is settled down into a trough, as it were, and is constantly climbing a hill that sinks or is driven before it. In the plan I propose, only the necessary swell in front of the boat is produced, and this is slightly reduced by the lifting of the vessel by the driving wheel being pressed down on the track on the bottom of the canal."

The Work of a Circular Saw.

Ninety thousand feet of lumber were recently sawn at the mill of John McEwan, Bay City, Mich., in $34\frac{1}{2}$ hours, besides slabbing for a gang, with two sets of cutting teeth, 36 in each set, without sharpening in any way, each tooth cutting more than 1,200 feet of lumber. The saw never made an imperfect run, and the lumber was sawn much smoother than by any other method. The saw in question is five and a half feet in diameter and No. 7 gage. This, in all probability, is the greatest feat ever performed with a saw with the same number of cutting points without sharpening in any way, so says the *Lumberman's Gazette.* This saw is provided with J. E. Emerson's improved bits or teeth. Their points are alleged to be tempered so hard that they will cut glass; and they weigh less than one sixth of an ounce. The saw is a novelty in its way, very simple in construction, the bits being changed in about five to eight minutes and never working loose. The saw cuts six inches to each revolution, dropping from six to eight boards per minute. Manufactured by Emerson, Ford & Co., of Beaver Falls, Pa.

THE METALS OF THE SUN.—The latest researches by many distinguished physicists have shown that the following terrestrial elements are present in the vaporous condition round the sun:

1. Sodium.	6. Chromium.	11. Cobalt.
2. Calcium.	7. Nickel.	12. Hydrogen.
3. Barium.	8. Copper.	13. Manganese.
5. Magnesium.	9. Zinc.	14. Aluminum.
4. Iron.	10. Cadmium.	15. Titanium.

SELF PROPELLING FIRE ENGINES.—C. A. M., of Ohio, suggests that fire engines be fitted with cylinders containing compressed air sufficient to run the engine till steam is gotten up.