the normal surface of the metal in the bath and is so directed thereto that it will not enter or penetrate the body of the metal as in former processes, and so that practically no portion of the metal will be above the blast, and in such manner that only a small portion of the metal will be subjected to the action of the blast at any one time. Thus, as the blast passes inward through the tuyere at a point adjacent to the surface of the metal, its rapid forward motion, combined with the tendency to escape upward in the direction of least resistance, gives to the blast and to the portion of metal carried therewith a resultant diagonally upward direction away from the main body of metal, so that small portions only of the metal are thus acted upon and stripped off at one time; but as such small portions are subjected to the impact of the entire blast, a much more violent agitation is imparted thereto by a comparatively light blast than it would be possible to impart to the entire body by a blast of the most powerful character, and as a result of this agitation not only are the particles of impurities separated from the metal, but the latter is so atomized that it is spread or divided into small particles as to present the desired extended surfaces required to effect the speedy and thorough oxidation of all particles. The action of the blast in carrying a portion of the metal to the opposite side of the converter is to pile up the metal at that side, which, together with the impact of the blast on the exterior portion of the body of metal, results in the production of a circulatory or gyratory current in the direction of the arrows, which causes a flow of the metal downward and upward toward the area of violent action, while the metal is prevented from rising above the line of the blast by the impact of the latter, which strips or beats off the particles presented in its path, so that an inclined surface is imparted to the bath at one edge lower and at the other higher than the mouths of the tuyeres. As a result of the more perfect and rapid oxidation from the more thorough admixture of the atoms of air and metal, there is a higher temperature, inasmuch as there is a more complete and uniform conversion, and because, owing to the limited portion of metal acted upon at one time, every portion may be thoroughly oxidized. The temperature of the bath is therefore not only maintained as the result of the action of the blast, but is increased, so that the metal is rendered extremely fluid, thereby facilitating its movements under the action of the blast and preventing its rapid cooling when removed from the converter.

The blast must not be too deep or it will enter into the body of the metal, while on the other hand it must be deep enough to come into sufficiently extensive and intimate contact with the metal to produce the necessary reactions and conversion, or it will escape without producing the desired results; but it must be remembered that the bulk of the metal diminishes during the conversion by reason of the elimination of the impurities. Consequently the level of the surface of the metal falls during the process, and therefore the blast must be varied to maintain its position relatively to the metal. This may be done in various ways, two of which naturally present themselves—first, by bringing the blast down to the metal, and, second, by bringing the metal up to the blast. The former proceeding may be most conveniently accomplished by using a tilting converter and turning it upon its trunnions during the progress of conversion to different positions, as indicated in Figs. 1, 2, and 3, to vary the ferrostatic pressure against the blast as the process continues, or in a fixed coverter, by having the tuyeres movable and dropping them as required. By thus adjusting the relative positions of the blast and metal a continuous supply of new or fresh metal can be brought into the area or zone of conversion in such exactly regulated quantities as will maintain the proportion of the metal acted on relative to the volume of air as is necessary to the production of the best results. The raising of the level of the metal could be effected by adding more metal or by means of a false bottom, which would raise the whole of the metal, or otherwise, so as by occupying part of the space previously occupied by the metal to restore the surface level.

By tilting the converter or otherwise varying the amount of metal presented to the action of the blast, the extent to which the metal is divided or atomized may be regulated at the will of the operator, and by thus throwing the iron by a regulated action into a sort of spray, or minutely subdividing or atomizing it, the largest possible surface is presented to the atmosphere, and the particles of carbon, silicon, and phosphorus, or other combustible matter, are exposed and commingled with the oxidizing agent, and there is a rapid and intense combustion of said combustible elements and such a high temperature is imparted to the metal as renders it extremely fluid and mobile. The extent of the spraying action will depend on the extent to which the metal is presented to the spraying means. As this is regulated at the will of the operator by the means described, the feeding of the metal, the rapidity of the conversion and degree of heat, and the degree of the fluidity of the metal may all be controlled.

INAUGURATION OF THE STATUE OF LEVERRIER.

The statue raised to the memory of the eminent astronomer Leverrier was inaugurated on the 27th of June, in the court of honor of the observatory.

The Minister of Public Instruction and of the Fine Arts, after being received by Admiral Mouchez, director of the observatory, took his place under the tent raised opposite the monument. Among the distinguished spectators grouped around him were remarked all the notabilities of science. Several addresses were made: first, one by Mr. Fizeau, of the Academy of Sciences, who, addressing himself to the minister, offered through him to the state the monument raised by a national subscription begun by a number of scientists and friends of Leverrier.

Admiral Mouchez afterward thanked the committee, and especially Mr. Fizeau, the active president of it, for the monument.

Mr. Tisserand afterward spoke in the name of the Bureau of Longitudes, and finally Mr. Bertrand, perpetual secretary of the Academy, made the apology of Leverrier.

Mr. Fallieres, in a few words, responded to the eloquent and precise discourse of Mr. Bertrand, and, after this, delegations from all the academies and all of Paris' scientists came to salute the minister and the director of the observatory.

The beautiful statue, which stands on the avenue that leads to the central pavilion, is the work of Mr. Chapu. Leverrier is represented standing, with a celestial sphere in front of him. Upon the pedestal, which is of some little height, is engraved the following inscription:

U. J. J. LEVERRIER.
1811–1877.

The bass-reliefs sculptured on the stone represent, the one at the left, Astronomy tracing the orbit of the planets; and showing the planet discovered by Leverrier the one at the right, Meteorology, designating, with the hand, the observatory, whence proceed all discoveries.

This beautiful work has already been much remarked at the Salon, where it figured in 1883.—*Le Monde Illustre.*

LEVERRIER.

Urbain Jean Joseph Leverrier was born in St. Lo, March 11, 1811, and died in 1877. After a course of study at the colleges of St. Lo and Louis le Grand, he graduated at the Polytechnic School. Obtaining a place in the tobacco bureau, and finding that that occupation required some knowledge of chemistry, he pursued the latter science at leisure, and, in 1837, published two memoirs on the combination of phosphorus with oxygen and hydrogen. Mathematics, however, became the principal object of his study, and from his proficiency therein he soon obtained a minor appointment in the Polytechnic School. From this time on he directed his studies toward the elucidation of the highest problems in speculative astronomy, investigating, especially, the irregularities manifested in the course of the heavenly bodies.

Two memoirs on this subject, presented to the Academy of Sciences in 1839, attracted the attention of Arago, who, becoming his friend, induced him to study closely the orbit of Mercury and its perturbations. In 1844, he presented two important papers on comets to the Academy, and the importance of these contributions to science caused him to be elected to the astronomical section of that body. The success that had attended his calculations of the course of Mercury induced him to revise the still more imperfect tables of Uranus. After a thorough study of the subject, he became convinced that the movements of the latter planet could not be explained by the attraction of any known bodies, and he therefore sought further for the cause of its perturbations. At length, on June 1, 1846, he indicated to the Academy, within ten degrees, the place where a new planet might be seen January 1, 1847. This was, in fact, seen by the German astronomer Galle four months before the time indicated, viz., on September 23, 1846. Leverrier had erred, but by a difference of only two degrees.

This discovery caused an immense sensation, and Leverrier received abundant honor. Most of the learned societies of Europe inscribed his name on their lists; the King of Denmark sent him the Order of Dannebrog; Salraudy, the Minister of Public Instruction in France, had his bust erected in public with great ceremony; Arago declared that the new planet should be called Leverrier; a chair of mathematical astronomy was created for him in the Faculty of Sciences; the Royal Society of England sent him the Copley gold medal; and the Grand Duke of Tuscany sent him a splendid bound copy of the works of Galileo. The planet bore the name of Leverrier for but a short time, that of Neptune being subsequently bestowed on it.

In 1848, Leverrier made some ineffectual efforts to become distinguished as a democratic leader, but it was not till 1849 that he was elected to the legislative assembly from La Manche. Modifying his liberal views, he devoted himself to questions of public instruction and laws relative to scientific discovery. Upon a division of the parties in the Assembly, he joined the Imperialists. After the *coup d'etat*, in 1857, he became senator, and subsequently inspector-general of public instruction. In 1849-50 he read to the Academy the result of his new investigations into the movements of the planets, and in 1853 he presented to the same body tables of the sun's rotation, with the complete system of the small planets situated between Mars and Mercury.

On the death of Arago, in 1853, Leverrier succeeded to the title and authority of director of the observatory. In 1859 he communicated to the Academy a movement of the perihelion of Mercury, which could only be accounted for by supposing another planet, or a series of small bodies, moving between it and the sun. This brought out Dr. Lescarbault's assertion of his discovery of a planet in 1859, and which he named Vulcan. Subsequent researches, however, have failed to establish the existence of such a planet. In 1870 Leverrier withdrew from the office of director of the observatory, and was succeeded by Delaunay; but the latter having lost his life by drowning, Leverrier was reappointed in 1872.

During the Franco-German war Leverrier offered his services to the Government of National Defense, which employed him in perfecting a system of optical telegraphy which he had invented, and which was intended to render communication possible with Rouen or Orleans by using the light of the sun reflected from a mirror, and astronomical telescopes sweeping the horizon in a given direction. The illustrious astronomer succeeded, after a few months, in devising a complete system, but the Prussian invasion had driven the French forces to such a distance that the curve of the earth opposed an insurmountable barrier to the working of the signals. This system was afterward presented to the Academy, and has since been used with great success by the British army in Afghanistan and Central Africa.

One of the creations of the latter days of the great French astronomer was the system of transmitting the hour by electricity, so as to obtain a uniformity of time in public clocks.

A Warning for the Bathing Season.

A writer in one of our contemporaries, in summing up the causes for so many bathing accidents, concludes that most of them are mainly or entirely personal, and so far preventable. Chief among these, we need hardly say, is cramp. To a large extent this is practically identical with fatigue, for it is not the fresh and vigorous muscle which most readily passes into spasm. It is that which is wearied with over-action, in which effete products are in excess, nutrition consequently impaired, all molecular changes languid; where, finally, the movement of contraction, once initiated, gives way but slowly, and tends to linger and become tetanic. The numbing influence of cold is another well known obstacle to muscular activity, and for this reason it is not as a rule advisable to remain more than a few minutes in the water. Malnutrition of muscles is a factor which ought not to be forgotten. It supplies a reason why bathing very soon after a meal is not advisable, much of the blood required for muscular exertion being then diverted to the digestive organs. So likewise must it impose a check upon the rashness of those, adult and youth alike, who after a period of town life, with little physical exercise, find themselves at the coast, and insist on trying whether with jaded energies they cannot safely accomplish feats of swimming. Yet one more caution. This is that every bather should know the state of tide, the currents, and the ground. Unless he is thus careful, he may find himself at any time confronted by unexpected dangers, the end of which it is impossible to foresee. It may seem ridiculous to urge that only those who really can swim should bathe in deep water, yet neglect of even this precaution is by no means uncommon.

A Water Spray Electrical Influence Machine.

At a recent meeting of the Physical Society, London, the above instrument was described by Mr. George Fuller. The apparatus is made up of four similar sections, each consisting of a nozzle, a metal ring, and a metal dish or receiver, arranged about a vertical axis. Pressure water issues from perforations 1-100 in. in diameter in the nozzles, and passes through the rings into the insulated receiver below. The rings are placed at such a distance below the nozzles as to be about the point where the streams break into spray, and the receivers empty themselves automatically. Calling the consecutive sections 1, 2, 3, 4, respectively, the rings of 1 and 3 are connected to the receiver of 4, and those of 2 and 4 to the receiver of 1. The discharge points are connected with the receiver 2 and 3, and a rapid succession of sparks passes when the water is turned on. Professor S. P. Thompson inquired whether the length of the spark was limited by leakage along the glass rods or by the spray passing between the receivers, and in reply Mr. Fuller said he thought the former leakage the most important.