

ELECTRIC LIGHT IN PARIS

SUCCESS OF THE WERDERMANN SYSTEM.

EFFORTS OF DR. HERZ, OF CALIFORNIA, IN ITS BEHALF—IMPROVEMENTS IN DETAILS—TRIAL AT THE OPERA—THE JABLOCHKOFF CANDLE ECLIPSED.

PARIS, Dec. 12.—American enterprise has achieved another victory. The Werdermann electric light may not be an American invention, its discoverer may not be an American, but if one of our countrymen had not taken it in hand, it would have remained, so far as France is concerned, hidden under a bushel for evermore. The experiments of Dr. Werdermann, in his Regent's Park laboratory, had demonstrated to the entire satisfaction of scientists, as well on the Continent as in England, that the great problem, the divisibility of light, had been solved; the chief British authorities had expressed their opinion, in which Count du Moncel, the equally undisputed French arbiter, had concurred, that the lamp of Dr. Werdermann was, if not the perfection of electric illumination, at least, by far the nearest approach to it yet attained. There was the example of the successful lighting up of the South Kensington Museum and other great buildings in London to be pointed to, and still the Parisians hesitated. They had tried so many Yankee notions, they said—for everything originating off the Continent they consider to be the offspring of some Yankee mind—and had been tricked so often that they did not care to go into another, which probably was merely a delusion and a snare. Had they not the Jablochkoff candle, and was not that bright enough for their streets and public squares? They wanted nothing better there, for as to trying it in a dwelling-house, or in a theatre, no sane person would dream of such a thing after a visit to the Continental Hotel. The intermittent flicker, the disagreeable changes of color attendant upon the Russian engineer's system were too painful to the eye to make its adoption desirable elsewhere than in the open air. Routine and prejudice are very hard to vanquish, especially in France, and when these had for allies the influence of an already established company, and, still worse, that of the gas companies, who saw a serious diminution to their enormous profits should anything practical be presented, it must be confessed that the new innovator had 99 chances out of 100 against even getting a show. This was the situation when Dr. Cornelius Herz, of California, took up the matter in 1877, and proceeded to an exhaustive examination of the different systems previously in use in America and Europe.

The public had long before shown its desire to be furnished with an intense light. In consequence, the number of Jablochkoff candles sold or hired out in the different Continental capitals was considerable. But before long this same public was forced to acknowledge that something more than mere intensity was needed, and so began to murmur, because the light was neither white nor steady. Dr. Herz carefully inspected the so-called regulators of the voltaic arcs, and concluded that notwithstanding their name and supposed function, the regularity of the light was not thus realized, and that their extension was not possible, except where the amount, not the quality, of the illumination is the main desideratum. Similar criticisms may be applied to the candle, which, in common with the regulators, makes use of the voltaic arc, and is afflicted with violet and ultra-violet radiations, not positively dangerous to the sight, but extremely fatiguing and disagreeable. This objection has never been contested, but, on the contrary, all light-producers, if I may be permitted to use this term, have endeavored to absorb the rays by means of special glasses, even at the cost of a considerable loss of illuminating power. Perhaps future research may finally correct these defects, but, for the time being, the voltaic arc seems to be uncontrollable, and is subject to certain caprices of which scientists have not yet found the explanation. On the other hand, electrical incandescence is much more stable: it is the light produced by a substance of insufficient conduction, and, so long as its conditions be not changed, appears to remain constant. These are the conclusions at which Dr. Herz arrived, and in which he persisted inflexibly, notwithstanding the contradictions of many eminent specialists. His argument was and continues to be that, in the generality of cases, the only means of obtaining the effects of solar light is to increase the luminous field, by the multiplication of the luminous foci. Like Edison, he contended that instead of trying to correct the light of the voltaic arc, it was more logical to act directly upon the incandescence. But his opinion differed from that of the American inventor, inasmuch that, whereas Mr. Edison endeavors to make irreducible the substance from which he seeks to obtain the incandescence, Dr. Herz believes it more rational to take its consumption into account, and so arrange as to regulate it and insure its continuous replacement. Mr. Edison's aim is to prevent the splitting up and destruction of the platina, and he hesitates before no complication in order to achieve this object, in which, although it is exceedingly doubtful, it is possible that he may succeed. In the actual state of the question, however, the use of carbon seems preferable; it is very inexpensive, a rod 40 inches in length costing the manufacturer less than 1 cent of our money, and its waste is of no consequence, as it can be accurately regulated. Dr. Herz has been engaged already for five years in his researches upon electric illumination, when he and Dr. C. C. Sordages, of New-York, took up together Richard Werdermann's lamp and both gentlemen were particularly struck by the results produced by an infinitely short voltaic arc. I should mention that Werdermann was the first who patented the system of the two parallel blocks of carbon, which, two years later, led to the invention of the Jablochkoff candle.

Dr. Herz met with very little encouragement at the outset. It was objected that the expenses would be enormous; that it was impossible to obtain any positive regularity, and, above all, that the division of light was impracticable, which last Mr. W. H. Preece, the Chief Electrician of the British Postal and Telegraph Service, and, at present, one of the most zealous converts to the system, even demonstrated scientifically. Yet, with all the energy of an American, the promoter went on, deterred by no expense, and finally arrived at a most satisfactory result, to wit, a regular service, with a gas motor of 4-horse power producing 10 lights, equivalent to 25 carcel jets, for each lamp in which the carbon was 4.5 mm. diameter. These photometric measures were officially verified in the experiments ordered by the Administration of the City of Paris, before the Chief Engineer of the city, M. De Fontanges, and M. Le Blanc, the expert of the Gas-works. With this same 4-horse-power machine, and carbons of lesser diameter, 25 lights of five carcel jets can be furnished, and with a 10-horse-power machine, 100 lights.

In November, 1878, a year after Dr. Herz took the matter in hand, Count Du Moncel, a member of the Institute, and, perhaps, the greatest of all authorities in the matter of electric light, espoused Dr. Werdermann's cause, presenting the Inventor's memorial to the Academy of Sciences, with his own express adhesion to the theory therein set forth, of an infinitely short voltaic arc, to which several eminent scientists, among others, MM. Bequerel, also a member of the Institute, and Roig-y-Corres have since then rallied. From that time a belief in the system began to gain ground, until his colleagues smiled when they remembered M. Niaudet-Breguet's over-precipitate judgment, published in the *Nature*, "that the invention of Dr. Werdermann made a good deal of noise for a very little light."

M. Gramme, as soon as he had seen its working, was, however, of a very different way of thinking from M. Niaudet-Breguet, and at once affirmed that he could, without difficulty, construct machines with continued currents which

would feed not only 100 but 1,000 lamps of the Werdermann system on a single circuit. Two years have been employed in arriving at this point, and for the reasons which I have already set forth, it seemed almost impossible to obtain a thorough competitive trial of its merits. The inventor only asked for a trial; he and his supporters were quite confident of its issue, and Dr. Herz, who by his conduct during the war had made for himself hosts of influential friends, finally succeeded in getting authority for a public experiment in the foyer of the Opera, on condition that he would make use of a steam-engine loaned by the rival Jablochhoff Company, which system was to be tried at the same time. For many months, M. Garnier, the architect of the Opera, had insisted upon the necessity of applying some means of illumination more intense and less dangerous than the gas heretofore in use, which was not only insufficient, but had begun greatly to damage the admirable paintings by M. Baudry, which are the greatest ornament of the hall. M. Garnier addressed a detailed report to the Minister of Fine Arts, enumerating all the present inconveniences, and suggesting as a remedy either the addition of another circle of gas jets to the grand chandelier, provided with crystals and reflectors, in order to light up the lower parts of the stage, or the placing in the four medallions above the arches of electric lamps, covered with tinted globes, so as to modify the ordinary ghastly glare produced in these foci of illumination. M. Garnier furthermore stated that he would have made this experiment long ago, if practical means had not been wanting; that he has asked, during the last three years, for an appropriation of 10,000 francs, wherewith to make his experiments, and that it was urgent to do something immediately, as the pictures could not be seen at all unless all the gas was turned on at every point, and that if it was, at every performance, not only would these pictures be entirely ruined, but the current expenses would be rendered enormous. Great men, like great bodies, proverbially move slowly, but the desired permission was finally accorded, and Dr. Herz was invited to "bring on his bear," and show how his institution would compare with the one already in use in front of the building. The offer was made in a hurry, at the last moment, when the Jablochhoffs were put up in the very best conditions for them, that is, where their greatest defect—according to M. Janin—that of throwing the light upward only, was a virtue, since here they were only called upon to illuminate the ceiling; and although the Werdermanns had to be turned upside down, in order to attain the same result, as this system is usually intended to throw the light downward, in conformity with the ordinary needs of consumers, there was not a moment's hesitation in accepting these apparently unfavorable conditions.

Of the issue of the experiment, I can speak knowingly, as I was present, and in a few words this is what I witnessed for myself on the 21st of November. A very few invitations had been issued, but the spectators, if not numerous, were personages of considerable importance, as they consisted of celebrities in the scientific and official world, among whom were several Under Secretaries of State, Senators, and a Cabinet Minister, and I have only to mention the names of MM. Turquet, Hebrard, Herold, Alphand, Vaucorbeil, Janin, Mascart, Garnier, Baudry, Sellière, Lecocq, Bertora, Jaudas, Honoré, Cabanellas, Hôpitalier, Napoll, and Chrétien to show that the jury was competent to form a judgment. Four of the ten chandeliers in the foyer were assigned to the Jablochhoff candle, the other four, at the opposite end of the room, to its rival system, the Werdermann lamp. *Par parenthèse*, I will remark that, for the first time since they were placed upon the lofty ceiling was I able to get even an idea of what M. Baudry's *chefs d'œuvre* resembled. The ball opened with a brilliant explosion of light from the Jablochhoffs, which were several minutes in advance of their competitors, owing to the delay of their company in handing over the promised steam-engine, and were in full blaze when the others began to show. The first impressions were very favorable to the Russian system, which had been provided with roofs of yellow tinted glass, so as to conceal the violet hues characterizing the light furnished by the arc. But these impressions did not last long; the candles soon exhibited all their usual defects, which were as apparent as their good qualities. There could be no question that they were bright enough, but the variations of color commenced instantaneously, there was a change of intensity, a flicker, increasing in proportion as the candle was consumed, and the whole accompanied with an unpleasant crackling noise, reproducing the vibrations of the generating machine, which somebody facetiously called "the ballet of beetles." "That will never do," remarked a distinguished artist who was present; "those alternations of intensity make the Jablochhoff candles utterly unfit for the illumination of any work of art." "An hour of such lighting as that," thought another spectator, "would give nine-tenths of an audience the delirium tremens." Five minutes after the Werdermann lamps began to burn not a single person remained at the Jablochhoff end of the foyer, everybody turned to the other extremity, and, without one dissenting voice, admired the soft light, with just the faintest imaginable yellow tint, which needs the interposition of no colored glass to mellow its garish effulgence. There never was a moment's hesitation in the verdict of those who went there to form an opinion, although among them were several who were strongly prejudiced in favor of the candles, which have been in use for more than a twelvemonth on the Place de l'Opéra and along its avenue. But the superiority of the system was even greater than mere eyesight could appreciate. The 12 Werdermann lights—3 for each chandelier—were fed by a Hermann-Lachappelle engine of only 6-horse power, whereas the 8 Jablochhoffs—2 for each chandelier—were worked with a Calla machine, nominally, of from 15 to 23 horse power, but capable of producing as much as 33-horse power, and, knowing this, it is impossible to estimate what power the Jablochhoff people really did use in their trial. The Werdermann lamps worked, as always, with one continuous current on a single circuit; the Jablochhoff candles, which, to insure success, were on four distinct circuits, needed, as usual, a series of alternate currents, produced by their so-called "lighting machine," besides a continuous current from a second machine to excite the magnets of the first one.

I cannot say that I was in the least surprised by the results, as I had already witnessed at a number of previous experiments, in one of which five Werdermann lights, equivalent in power to between 25 and 30 gas-jets, were put in motion by a dynamo-electric machine of so small size that it can be carried under a man's arm, and also by an engine of 1-horse power. Satisfactory, however, as all these public and private experiments have been, Dr. Herz does not pretend to say that the question of artificial illumination is closed, or that he is anything more than in the advanced guard of progress. But if we look back to the first discovery of Humphry Davy in 1813, and consider the giant strides made by science during the last quarter of a century, we have some reason to be proud that our epoch has turned to profit the lessons of Ersted and Ampère, of Arago and Faraday.