The Drehstrom" Patent.

BY NIKOLA TESLA.

In the last issue of THE ELECTRICAL WORLD I find an article on my "Drehstrom" patent which appeared originally in *Industries*, and is, I believe, from the pen of the able editor of that journal. Some of the statements made are such as to cause an erroneous opinion to gain ground, which I deem it my duty to prevent—a disagreeable one I may say, as I do not like to express my opinion on a patent, especially if it is my own.

It may be, as the writer states, that the theory of the action of my motor advanced in my paper before the American Institute in May, 1888, is a clumsy one, but this theory was formed by me a number of years before the practical results were announced, the patents being applied for only after it was undoubtedly demonstrated that the motor could fairly compete in efficiency with the direct current motor, and that the invention was one of commercial value. These patents were taken out with the help of some of the ablest attorneys in the United States, well versed in electrical matters; the specifications were drawn up with great care, in view of the importance of the invention, and with proper regard to the state of the art at that period, and had the patents been carefully studied by others there would not have been various features of my system reinvented, and several inventors would have been spared at this late date a keen disappointment.

The writer apprehends that it might be difficult for a non-technical judge to decide whether a motor with two or more separate fields and armatures, coupled together mechanically, does or does not fall under my patent. I do not share his apprehension. Judges are highly educated men, and it does not require much technical knowledge to convince one that it is the same whether two belts driving a rigid arbor are close together or far apart. Nor do I think that it is necessary for the honorable judge to be a partisan of the armature reaction theory in order to recognize the identity of the two arrangements referred to by the writer of the article in question. Indeed, I would seriously doubt the sincerity of a man capable of clear conceptions were he to uphold that the arrangements are essentially different, even if the case should stand exactly as he assumes by way of illustration of "puzzles likely to arise." For where is there a difference? Take, for instance, a form of my two-phase motor. There are two sets of field magnets, one at the *neutral* parts of the other. One of the sets, therefore, might as well be removed and placed a distance sideways, but long experience shows that in output, efficiency, cost of construction and in general mechanical respects such an arrangement is inferior. The two sets are connected inductively through the armature body or the windings thereon. Part of the period one set of field magnets acts as a generator, setting up induction currents, which circulate in the field of force of the other set, which may be looked upon as a motor. Part of the period again, the second set becomes the generator and the first the motor, the action being at the same time such that the generated currents are always passed in a definite direction with respect to the field; they are commutated as it were, and a tendency to rotate in a given direction is imparted to the armature. Now place two fields side by side and connect properly the armature windings. Are not the fields again inductively connected? Do not the currents set up by one field cause currents to circulate in the other, and is the action not exactly the same in both cases? This is a fact, no matter what theory is adhered to. The writer says that in the case of two separate structures there is really nothing which may be called rotation of the field. But is there any such thing, when the two structures are merged in one? Is it not in accordance with accepted notions to conceive the imaginary lines as surging simply in the pole projections in exactly the same manner in both the arrangements? Irrespective of the view taken, be it even the more unfair to the inventor, no one is permitted to go so far as to make him responsible, in such a case, for theories and interpretations of his invention. Theories may come and go, but the motor works, a practical result is achieved and the art is advanced through his pains and efforts. But what I desire to point out principally is that in the article above referred to the writer is only assuming a case which cannot occur. He is evidently judging the state of things from my short paper before the American Institute. This paper was written in a hurry, a fact only shortly before the meeting of the Institute, and I was unable to do full justice even to those features upon which, as employé of company owning the invention, I was permitted to dwell. Allow me to observe that my patent specification as written up more carefully than my paper and the view taken in it is a broader and truer one. While the "chamsy" theory was adapted as the best in explanation of the action of the motor, the invention is not represented as dependent entirely on that theory; and in showing a three phase motor with six projections, where it was manifestly more consistent with the accepted popular ideas to assume the "lines of force" as simply surging in the projecting pole faces, this view was distinctly and advisedly taken, as the following quotation from my foundation patent will show: "The variations in the strength and intensity of the currents transmitted through these circuits (lines and armature) and traversing the coils of the motor produce a steady progressive shifting of the *resultant attractive force* exerted by the poles upon the armature and consequently keep the armature rapidly rotating." There is, in this instance, no question of a rotating field in the common acceptance of the term of the *resultant attractive force*: there is a question simply of a diagram of force, and it is immaterial for the operation whether the fields are close together or far apart, or even whether, or not, they are inductively connected.

I do not think that in Germany, where the Patent Office is proverbially strict in upholding the rights of the inventor, an illegitimate and unfair appropriation of the invention by others will be tolerated by the courts.

Meeting of the American Institute of Electrical Engineers.

The American Institute of Electrical Engineers held its first meeting after the summer holidays at its rooms at 12 West Thirty-first street on Sept. 27, 1892. The meeting was called to order by President F. J. Sprague. The paper of the evening was "On the Law of Hysteresis, Part II.," by Chas. P. Steinmetz, which was listened to with great interest. The discussion of the paper was participated in by Messrs. Kennelly, Stanley, Emery and others. The report of the committee on revision of the rules regarding the election of officers, which was published in full in THE ELECTRICAL WORLD of Sept. 24, 1892, was adopted. The following were elected associate members of the Institute:

H. Fleetwood Albright, Western Electric Company, Chicago, Ill.; Charles G. Armstrong, Chicago, Ill.; Romaine Callender, Brantford Electrical Laboratory, Brantford, Canada; Chester B. Crandall, Western Electric Company, Chicago, Ill.; George E. Fisher, Commercial Electric Company, Detroit, Mich.; Charles Flesch, Melbourne, Australia; J. P. Jackson, assistant professor of electrical engineering, Penn. State College; Frank E. Kinsman, Plainfield, N. J.; Jas. P. Magenis, editor the *Adams Freeman*, Adams, Mass.; Carl K. MacFadden, Chicago & Northwestern Railway Company, Chicago, Ill.; James McBride, New York & Boston Dyo Wood Company, Brooklyn, N. Y.; Augustus Nell, New York Insulated Wire Company, New York City; Wm. D. Ray, Northern Pacific Railroad Company, Chicago, Ill.; Howard S. Rodgers, Thomson-Houston Electric Company, Lynn, Mass.; Robert A. Ross, Edison General Electric Company, Peterborough, Ont.; Frank Stuart Smith, Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

The Manufacture of Carbons at Nuremberg.

The French Vice-Consul at Nuremberg, M. Leon Duplessis, has recently made a lengthy report on the electric carbon industry of that town, from which the following extracts are taken:

"The manufacture of electric light carbons occupies six large factories, belonging respectively to C. Conradty, Ch. Shmelzer, Carl Braun, J. G. Meier, Emile Mahla, and Jules Fuchs. To these may perhaps be added a seventh, namely, that of Dr. Albert Lessing, though the latter does not produce carbons for electric lighting, but only battery carbons.

"The raw material employed in this manufacture is 'retort graphite.' As far as the Vice-Consul was able to discover, this material only is used when homogeneous carbons are required; but when cored carbons are to be made a softer substance is added. Before they are ready for use homogeneous carbons pass through twelve, and cored carbons through sixteen, different processes. The first operation is to break the graphite into small nuts. For this purpose a three-stamp mill is used. The stamps in falling crush the graphite placed over movable steel gratings that allow the broken material to pass between their bars. These bars are placed nearer to one another, or further apart, according to the size of the pieces required. Having passed this grating the pieces are collected by hand and passed through a sieve. The coarse particles are submitted to a vertical crushing, and the fine are passed on to a rolling mill. The vertical crushing is intended to reduce the pieces of graphite to about the size of semolina grains. The graphite thus treated is directed a second time into a sifting machine. Then follows more rolling. The sixth operation is to damp and mix the graphite obtained from the rolling mill, as well as the powder gathered in the sifting machines, with a binding substance. The mass delivered from this machine being too soft, it is necessary to render it plastic and capable of taking a shape, and with this object it is consigned to a sort of pudilling machine which produces a species of paste. This paste is pressed through a machine fitted with dies. These produce coarse rods or other pencils, according to the diameter of the cylinders. The rods so prepared are introduced into steel hydraulic cylinders and submitted to a pressure of about 25 atmospheres. Some of these hydraulic presses—the construction of which the Nuremberg manufacturers have only attained by successive steps—can deliver 500 metres of carbon per hour or from 2,000 to 3,000 are light carbons of average size. All these operations terminated, the carbons obtained are baked in a blast furnace where the temperature occasionally attains as much as 2,000° centigrade. When homogeneous carbons are withdrawn from the furnace they have only to be passed on to an automatic cutting machine. This machine is in direct communication with a ventilator which draws off the powdered carbon produced in cutting.

"The construction of machines employed in the manufacture of electric light carbons is also a Nuremberg specialty, and the house of Justus Christian Braun has a monopoly of the business, and supplies machines in Europe and America. The cost of an outfit for a factory is put at 20,435 marks, irrespective of packing, transport, and customs charges."

Electricity and the World's Fair.

LITERATURE on the World's Fair has been reasonably copious, but the following information with regard to the Electricity Building, extracted from an article on "Architecture at the World's Columbian Exposition," by Henry Van Brunt, in *The Century*, will be of interest:

"The north front, toward the picturesque lagoon, being, by its position, relieved to a certain extent from strict conformity to the classical ideal, seemed to invite a greater freedom of treatment than was admissible elsewhere. Here, therefore, the order of the façades, after passing the point of demarcation furnished by the corner pavilions, is made to sweep around two apsidal projections, 115 feet in diameter, between which is recessed the north porch, composed of two towers, similar to those of the east and west porches, flanking a broad, central pavilion, pierced with a great arched window, corresponding with the arch lines of the steel trusses in the long nave, and divided by transoms and mullions. The sky line between these towers is made horizontal, and the spandrel panels of the arch are occupied by gigantic reclining figures typifying Investigation and Discovery. The porch is formed by the Ionic order of façades, which is extended between the apses in the form of an arcade of five arches supporting a wide terrace or balcony.

"Up to this point, for the reasons stated, the design of the Electricity Building is characterized by an emphasis of vertical expression unusual in academical architecture, the sky line being fretted by 10 campaniles, varying in height from 154 to 190 feet, and by the four square intermediate domes, which mark the position of the posterns. But, on the south front, it was necessary to make a concession to that spirit of grandeur and ceremony which should prevail

PORCH OF THE ELECTRICITY BUILDING, SHOWING POSITION OF THE FRANKLIN STATUE.

around the great court of the Exposition. Accordingly, the vertical line, predominant elsewhere in the building as a foil to its long, low, horizontal mass, is here subordinate to the spirit of repose. To this end the campaniles on the corners are set back from the front, but connected with it by gabled pavilions, 23 feet wide, and the principal entrance of the building on this side is treated as a triumphal arch, 60 feet wide and 92 feet high, of which the archivolt springs from the main cornice, as an impost, the jambs being formed of coupled full columns of the main order with corresponding pilasters. This arch is crowned with a classic pediment containing an escutcheon, which bears the electromagnet as a symbol of electricity, and is supported on each side by a female figure representing the two principal industries connected with this science—electric lighting and the telegraph. Above, in contrast with the somewhat fantastic movement of the sky lines elsewhere, rises a solid elevated attic, forming a severe horizontal outline against the sky. This central mass is buttressed on each side by great consoles, supporting emblematic statues and resting on pedestals, continuous with the clearstory of the nave, and embellished with medallions of Morse and Vail, the American discoverers of the electric telegraph. The most famous and most cherished association of America with the history of the science of electricity is the discovery of the electric properties of lightning by Franklin. The architects determined, therefore, that a statue of the patriot-philosopher should stand under this great arch, and that to him the main porch on the court should be dedicated. This work was intrusted to the Danish-American sculptor, Mr. Carl Rohl Smith, whose conception of the subject is happily realized in a spirited figure, 15 feet high, representing Franklin as the philosopher, with the historic kite and key, observing the storm clouds. This noble statue is elevated on a high pedestal in