technically qualified men is properly attributable to their own lack of energy, or, say, want of the exercise of common sense in casting about for employment?

ANSWER.—We scarcely know what opinion to express in reply to your enquiry. We have talked this subject over a number of times with men occupying leading positions in the electrical business, and the general opinion appears to be that the outlook for young men in this calling is not as promising as a great many people appear to imagine If you look over the electrical field at the present time you will see that the number of really good positions, in this country at least, are very limited. We know of several qualified electricians formerly occupying good positions, who, having lost them, have found it impossible to secure others equally remunerative. We do not pretend to know all the circumstances in connection with these cases, and consequently are not able to say that these persons have not, in some degree, themselves to blame for the position in which they find themselves at present. The electrical business in this country appears to be at a point where it is very difficult indeed to estimate its future development, hence the difficulty of expressing an opinion on the subject of your enquiry. If the electric railroad continues to develop as it has done during the past five years, there should be a considerable number of openings for young men in that field. This applies also to the distribution of power by electricity over long distances. If the distribution of power in this manner is found to be commercially practicable and advantageous, it will probably lead to the establishing of quite a number of large power stations at certain points throughout the country, where water power is available, and in such power stations the services of one or two first class electricians will be indispensable. With regard to the electric lighting business, a great many of the men in charge of central stations at the present time have not had proper training for the position, and are consequently lacking in efficiency. Unfortunately, the owners of stations do not appear to realize, as they should, the necessity of employing properly qualified men and paying them satisfactory salaries. Until the owners of stations come to realize that a poorly qualified superintendent is dear at any price, there will be few openings in this direction for the services of properly qualified young men. We are not without hope, however, that the business will ultimately be placed on a proper footing and will be conducted more in accordance with the best known principles of business management. When that time arrives the number of openings for competent young men will be increased. This is the situation as it presents itself to us at the present time. What new developments in the use of electricity may be forthcoming in the near future it is impossible to know.

POWER DEVELOPMENT AT NIAGARA FALLS.

By F. C. ARMSTRONG.

THE delivery in Buffalo on the 15th of November last, of the first thousand horse power out of eight thousand which the Cataract Construction Company are under contract to supply to the Buffalo Railway Co., marks the completion of an important stage in this notable enterprise. No undertaking in recent years has attracted the attention of the engineering and industrial world to so great a degree as the now accomplished "harnessing of Niagara"; and no undertaking of a certainty has had to win its way to a signal success in the face of greater difficulties and more discouraging and persistent prophesies of failure. Although so much has been written from time to time during the progress of the work that the electrical public, at any rate, are pretty well conversant with its history, a brief recital of its main points may not be out of place at the present moment.

From the day when Father Hennepin in his Nouvelle Decouverte' first published to the world a description and sketch of the mighty cataract, the Falls of Niagara have held their place as the great natural wonder of America, the main objective point on this continent of the globe trotter and the wedding tourist. It was not to be expected, of course, that the utilitarian spirit of recent years would be satisfied to find scenery alone in what was plainly meant for water power. Some early attempts at utilization were made, and the present Niagara Falls Hydraulic and Land Company is a development from the first hydraulic canal constructed between 1853 and 1861. In both Canada and the United States, however, a strong and wide-spread feeling existed against any further disfigurement of the naturally charming surroundings of the Falls which culminated in the nationalization for park purposes of the lands enclosing them on both sides.

In 1889 the Cataract Construction Company was organized to carry out the plans for power development worked out by Thomas Evershed. These embraced mainly the taking of the necessary water supply from the river by a short canal at a point one-and-one-half miles above the Falls, its delivery at this point, where the erection of the necessary buildings would not be objectionable from an æsthetic standpoint, into a wheel-pit 178 feet in depth, and its discharge through an underground tunnel into the river at a point directly below the upper Suspension Bridge, the capacity of the tunnel being fixed at 120,000 horse power. The personnel of the company, of which Mr. E. D. Adams was president, Mr. W. B. Rankine secretary, and Messrs. D. O. Mills, J. Pierrepont Morgan, W. K. Vanderbilt and J. J. Astor, members of the Board of Directors, was a sufficient guarantee that the capital necessary for an undertaking of such magnitude would be readily forthcoming.

As general consulting engineer the company retained Dr. Coleman Sellers, the hydraulic and electrical portions of the work being placed respectively in the hands of Mr. Clemens Herschel and Professor George Forbes, of London, England.

In 1893 the International Niagara Commission, composed of Sir William Thomson (Lord Kelvin), Dr. Sellers, Col. Theodore Turrettini, Professor Mascart and Professor William Unwin, were invited to examine existing methods and select plans for the detail apparatus required in the development and transmission of the power. For the turbines the design submitted by M. M. Faesch & Piccard, of Geneva, Switzerland, was selected. For the transmission, as might have been expected, electricity was finally adopted, though not without a careful examination into the merits of compressed air, hydraulic tubes and rope transmission.

Regarding the position taken by Lord Kelvin, Prof. Rowland and other authorities consulted, toward the particular electrical system and type of generator ultimately used, a somewhat acrimonious discussion has since been carried on. It seems fairly clear, however, that to Professor Forbes is due the credit of insisting on the employment of alternating instead of direct currents—a choice of which no one would to-day gainsay the wisdom in view of the different uses requiring widely varying voltages for which the current is now being required. A second point on which Professor Forbes was exposed to attack was his advocacy of a comparatively low frequency. Here again the advantage obtained of greatly lessened inductive loss on the long distance transmission lines, added to the much greater suitability of the low periodicity for rotary transformer work, has been amply sufficient to demonstrate the correctness of his judgment. The umbrella shaped type of generator adopted, with an external revolving field and stationary armature, which has proved itself admirably suited for the requirements of a large fly-wheel effect and light revolving weight, is substantially the design submitted by him as consulting engineer to the manufacturing companies. In this connection it may be added that whatever estimate is to be placed on Professor Forbes' work for the Cataract Company, he is certainly entitled to respect for the courage with which he has always been ready to defend his convictions. The Parthian dart which he discharged at his critics and detractors in his famous article in "Blackwoods," affords sufficient evidence on this point.

The first of the three five thousand horse-power generators forming the original order given to the Westinghouse Electric Manufacturing Company, was started up on the 5th of April, 1895, and shortly afterwards the regular supply of current to the amount of 2,000 h. p. to the Pittsburgh Reduction Company for the manu-