

## ELECTRIC DISCHARGE IN VACUUM TUBES.

BY

Nikola Tesla

IN THE ELECTRICAL ENGINEER of August 12, I find some remarks of Prof. J. J. Thomson, which appeared originally in the *London Electrician* and which have a bearing upon some experiments described by me in your issue of July 1.

I did not, as Prof. J. J. Thomson seems to believe, misunderstand his position in regard to the cause of the phenomena considered, but I thought that in his experiments, as well as in my own, electrostatic effects were of great importance. It did not appear, from the meagre description of his experiments, that all possible precautions had been taken to exclude these effects. I did not doubt that luminosity could be excited in a closed tube when electrostatic action is completely excluded. In fact, at the outset, I myself looked for a purely electrodynamic effect and believed that I had obtained it. But many experiments performed at that time proved to me that the electrostatic effects were generally of far greater importance, and admitted of a more satisfactory explanation of most of the phenomena observed.

In using the term *electrostatic* I had reference rather to the nature of the action than to a stationary condition, which is the usual acceptance of the term. To express myself more clearly, I will suppose that near a closed exhausted tube be placed a small sphere charged to a very high potential. The sphere would act inductively upon the tube, and by distributing electricity over the same, would undoubtedly produce luminosity (if the potential be sufficiently high), until a permanent condition would be reached. Assuming the tube to be perfectly well insulated, there would be only one instantaneous flash during the act of distribution. This would be due to the electrostatic action simply.

But now, suppose the charged sphere to be moved at short intervals with great speed along the exhausted tube. The tube would now be permanently excited, as the moving sphere would cause a constant redistribution of electricity and collisions of the molecules of the rarefied gas. We would still have to deal with an electrostatic effect, and in addition an electrodynamic effect would be observed. But if it were found that, for instance, the effect produced depended more on the specific inductive capacity than on the magnetic permeability of the medium—which would certainly be the case for speeds incomparably lower than that of light—then I believe I would be justified in saying that the effect produced was more of an electrostatic nature. I do not mean to say, however, that any similar condition prevails in the case of the discharge of a Leyden jar through the primary, but I think that such an action would be desirable.

It is in the spirit of the above example that I used the terms "more of an electrostatic nature," and have investigated the influence of bodies of high specific inductive capacity, and observed, for instance, the importance of the quality of glass of which the tube is made. I also endeavored to ascertain the influence of a medium of high permeability by using oxygen. It appeared from rough estimation that an oxygen tube when excited under similar conditions—that is, as far as could be determined—gives more light; but this, of course, may be due to many causes.

Without doubting in the least that, with the care and precautions taken by Prof. J. J. Thomson, the luminosity excited was due solely to electrodynamic action, I would say that in many experiments I have observed curious instances of the ineffectiveness of the screening, and I have also found that the electrification through the air is often of very great importance, and may, in some cases, determine the excitation of the tube.

In his original communication to the *Electrician*, Prof. J. J. Thomson refers to the fact that the luminosity in a tubenear a wire through which a Leyden jar was discharged was noted by Hittorf. I think that the feeble luminous effect referred to has been noted by many experimenters, but in my experiments the effects were much more powerful than those usually noted.

## WHO SHALL DO THE WIRING?

BY

Lea Harris

THE editorial on "Putting in Wires and Fixtures," in the August 5th issue of THE ELECTRICAL ENGINEER, convinces me that, like myself, others are believers in the oft-repeated statement that "electric light companies should leave the putting in of wires and fixtures to some one else" (in many cases to those more competent than the employees of the local company).

I am glad to see a growing interest in this subject, and would like to see a general expression of opinion through these columns from the various cities. There is no doubt in my mind that the New England town spoken of is "torn wide open" on the subject, as it is one that is causing various companies no end of trouble. Dallas was shaken from "stem to stern" when the new order of things went into effect. Previous to that time the local companies, in order to gain the supremacy, made the wiring a secondary consideration and the results can well be imagined. They could not afford to go to the expense of doing fancy work, as they were not charging for it, and consequently it was "fearfully and wonderfully done." The paramount idea in everybody's brain was to get the lights in and as soon as possible. This worked very nicely until the plant was installed, and all the lights put in that could be, and then the question arose as to what was to be done with the large gangs of wiremen. A number were discharged, but a very respectable number were retained, in the event that some one might want lights—which they did—but the employment of 10 or 12 well-paid men for the purpose of wiring two or three places a week soon played havoc with the receipts. The company passed through a series of vicissitudes, as all companies will that are run upon such an uneconomical basis, and finally passed into the hands of the parent company. A new order of things was inaugurated. It was given out that in future consumers would be expected to pay for everything, the company simply furnishing the current, and the consumer to get whom he pleased to put in his wires and fixtures. It was a difficult matter to overcome the existing idea that "it didn't cost anything to have lights put in," but they finally learned that it did, and after nearly two years' experience it is plainly to be seen that the step was a wise one for all.

The wiring was given over entirely to local contractors, who made it to their interest to introduce as many lights as possible, resulting in general good to all. Of course, abuses crept in, as a few people found out that they could have it done more cheaply by employing a discharged employee, or one who would do it after work hours; so much so that a concerted action on the part of the contractors and the local company resulted in the municipal authorities taking up the subject. A city electrician was appointed, ordinances and rules were drawn up and adopted, and matters began to brighten. All new work was done *strictly* in accordance with the rules, and even more so in special cases. All old, bad work was condemned and made new at the expense of the consumer, outside lines rebuilt, and in place of continued dissatisfaction on the part of the consumers, caused principally by lights going out, broken wires, burned-out fuses, etc. etc., "peace reigns o'er all."

The city electrician is absolute authority as to the merits