Evening session. [Fifth session.]

EVENING SESSION.

The Convention was called to order at 8.30 P. M.

THE PRESIDENT: If it is expected that this Association will do any business, it necessarily follows that people must be on hand; and I shall ask that each of you gentlemen here, of the Association, constitute yourself a committee of one, to see that members are here at the proper time to-morrow morning.

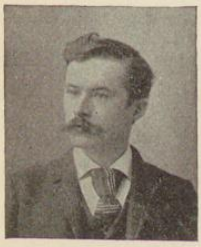
The first paper will be "On the Use and Construction of Switchboards," by Mr. M. C. Sullivan, of New York. In the absence of Mr. Sullivan, his brother, Mr. Sullivan, of Chicago, will represent him and read his paper.

I take pleasure in introducing Mr. Sullivan.

MR. SULLIVAN: I might say what my brother would say, if he were here—that the object of this paper is not so much to lay down any principles or laws, as it is to start suggestions; and he wished me to say to the Convention, that all he desired in this regard was to bring to the attention of the Association managers in an informal way the question of switchboards and their fire-proof construction; so that the few remarks which he and I got together and put into this paper I am sure you will accept in the spirit in which they are written, namely, to bring them to your minds in the nature of suggestions.

THE CONSTRUCTION, SAFETY AND OPERATION OF SWITCHBOARDS.

Beginning with the very first central station that was constructed, the watch-word of the manager has been "improvement." Having realized the main object of his ambition—the supplying of electric light and power to consumers, and maintaining this supply—his next great work was to improve the means of generating that current. The question of utility was, of course, the principal consideration, but artistic effect was not lost sight of; so that at the present time we have scores of both light and power stations that are models of electrical and mechanical construction.



In the early days, most of the devices that made up the stations were "thrown together"; those that received most attention were most important. Consequently, we find the most improvement in steam generating apparatus, as well as in the appliances for connecting the engines to the dynamos. Overhead, as well as underground, lines have undergone a revolution, and inside wiring is so vastly different from what it was once that an old-time wireman would not know the system if he came upon it suddenly and without introduction. Everything has been improved, it would seem, save that most important of all station apparatus, the switchboard.

The switchboard may be likened to the pilot-house, or what is technically termed the conning tower, of a modern war-ship. In the early days of naval construction the pilot-house was of no more importance than the pilot-house of an ordinary steamer now-a-days; but, keeping pace with other improvements, it was soon discovered that this point of the modern iron-clad was the nerve centre of the vessel. From here the immense machinery, the rudder, firing of the guns, signaling—in short, every force which the ship may possess, could be controlled. Appreciating this importance, the designer has surrounded the conning tower with every possible safeguard, and exhausted every ingenuity known to the ship-builder's art.

The switchboard is, or should be, the pilot-house of your station. Here should be located means for determining accurately the working of the entire system, down to the minutest details. Disable your switchboard, and, like wrecking the pilot-house on a man-of-war, you are helpless. The great advantage to be gained from centralization has been lost. It must, therefore, be apparent that every means should be exhausted to perfect and protect this apparatus.

The manager who has seen his station grow from a mole-hill to a mountain, who has been compelled to add on dynamo after dynamo to satisfy the demands of the crowd seeking light and power, now has a problem on his hands to equip a switchboard that will not only handle the service of the present time, but what is in store in the future. He knows from experience that what may be called the "skeleton board," with spring connections, will not suffice for this, and he must look about him for another method. In thus casting about for the proper assistance, the manager is unfortunately thrown upon his own resources. While the

manufacturers of electrical devices have kept improving all the time, and, as station managers know, kept improving the price, sometimes for better, often for worse, they have rather curiously left the switchboard to take care of itself. Consequently, the manager has had to listen to tales of woe from the operator who ever and anon has been tickled with the giddy currents passing through the board, and other inconveniences so well known to those who have had to deal with old-time boards. Drawbacks of this character are more apparent in the arc light station than in any other. A great source of the trouble here are the cables, or flexible conductors, used for making the cross connections from one part of the board to the other. While we may exhaust every means to make the operator safe from contact, the use of these cables cannot very well be eliminated. It is possible, however, to construct a board on which any combination may be made without cables, but it would be so large and cumbersome as to become practically inoperative ; in fact, it would be a very complicated affair. It is, nevertheless, practical to equip a board for arc service, so that every part of the live circuit would be entirely insulated from the front. In large composite stations, embracing arc and incandescent lighting, of both high and low tension, and power generators for street railways, condensation is one of the most vital features, not in the sense of crowding anything, but utilizing every inch of space to instal the apparatus necessary to do the work required. A most effective way to build a board for stations of this character is to have it arranged in the form of a square, so that one side can be devoted to each division of the service. Stations occupying a large open floor with high ceiling present the opportunity for building the ideal switchboard. This could be raised above the floor a sufficient distance so as not to occupy any valuable floor

space. For that matter, it might be suspended from the ceiling. The wires from the dynamos could run directly to this lift, thence through the switchboard, and from the latter to the cupola, arranged as nearly over the board as possible. This would give us a central starting point for our lines, enabling us to at once trace each and every wire in the system. However desirable such an arrangement as the above may be, the conditions are such that we cannot always do as our best judgment dictates, but rather have to make the best of things as we find them.

The prime object to be secured in switchboards for high tension service is safety, not only to attendants, but to the station. The necessity for this received a terrible emphasis when the famous Grosvenor Gallery Ferranti station in London went up in smoke, because of a poorly constructed switchboard feeding an incipient arc. This safety can be secured by having every part of the board over which current is transmitted insulated in such a manner that contact from the point is impossible.

The prime necessity of switchboards in railway power stations is facility for rapid manipulation, whereby any part of it can be reached in the shortest space of time. Here, also, the indicating instruments must be within plain sight, so that the movement of the current, with its rapid variations, can be readily noted.

In low tension incandescent stations and plants, with their multiplicity of circuits, and the necessity for manipulating things quickly, so that whatever interruptions may occur will be reduced to a minimum, there is no limit to the refinements to be obtained. It can be reduced to the simple question of putting switches in circuit, or we can design the board in such a manner that it will be universal throughout, whereby any dynamo or dynamos can be placed on one line, or several lines on one dynamo. The indicating instruments, switching

devices, resistances, lightning arresters, in fact, all accessories, should be arranged to occupy the smallest space possible, and be within easy reach of the operator. It is not necessary or advantageous to have the board arranged in the form of a perpendicular wall, as seems to be now the general rule. It is just as well to design it so that the switches can be arranged in the form of shelves up the front of the board; or, in the case of extremely large stations, the board itself could occupy the whole of the floor space in a room in some part of the station, and the instruments be fixed on tables, leaving an alley-way between each table of sufficient room to get around readily. These tables need not be of any great length, for, should they happen to be, it would take too much time to reach certain points. They should be cut in sections so as to make the distance to be covered as short and direct as possible. Cases where measures of this kind are necessary are not often met with, however.

All switches and apparatus, for whatever service, should be manufactured with a lug or extension of the contact, so that the connection can be made from the back of the board. The resistance boxes, and all the regulating apparatus, which require considerable space, should be placed behind the board and provided with a rod extending through the face of the board. The board should be as symmetrical as possible, so that in rapid manipulations the grasping of a wrong switch cannot occur.

Rapid manipulation being essential in arc light stations, although not in the same degree as the three other types of stations, this feature is one which must be considered. In designing a switchboard for this work, we should keep before us the question of safety to the operator, for, if we can make him feel comfortable, freeing him from the hazard of working on a board that is not

insulated, he is going to possess more confidence. Many attempts have been made to design a board for this purpose that would do away entirely with cables without being cumbersome. Complete success has not crowned these efforts.

A very convenient form of board for this service is to arrange two slabs of marble, slate, or other form of insulating material, leaving a distance of six inches between the two. One slab, say the inner one, may have connections from all the dynamos, each dynamo circuit having its own bar. The outer slab contains holes through which the current from these dynamo circuits may be plugged into any circuit or circuits, making it a sort of checker-board arrangement, the square being defined by the line wires running horizontally, and the dynamo circuits running vertically, or *vice versa*. The plugs by which the circuit is completed should have hexagon insulated handles, so that a good hold can be had. All the lightning arresters, ammeters, etc., should be placed directly on the slate, or whatever may be used for the purpose, and the board should be complete in itself in every way before any wires are attached. Binding posts can be provided for these connections, and the work of disconnecting any circuit or dynamo from the switchboard is but the question of a moment. As cables will be necessary in the different combinations, a trough should be provided along the front, in which the slack can rest, to prevent them falling to the floor.

We now come to the most important feature of the whole question. What material shall be used for our switchboards? As it must be fireproof, the use of wood is entirely prohibited. We must, therefore, look for something entirely different. Various efforts have been made to make wood fireproof. This has been accomplished to a limited degree, but the element of doubt

still remains. Slate, as many of you know, is the best thing which nature has yet offered us. For strength, lightness and insulation, it is the only material in sight. Unfortunately, however, slate is an alluvial deposit of a laminated character, and often contains metallic substances which destroy its insulation, causing short circuits and other disagreeable features. When in the rough stone it is hydroscopic to a considerable extent, and when it becomes saturated with moisture, makes surface leakage possible. Great care should consequently be exercised in selecting slate for switchboards, and only that which possesses absolutely no metallic properties be used. This can be determined by the well-known rules of electrical testing.

The drawbacks met with in slate have determined some manufacturers in using marble for this work. This has only one-fifth of the breaking strain of slate, and, where it is used instead of slate, this must be taken into account. Marble presents the same hydroscopic elements of slate, and there is some metal in it; but, owing to its peculiar formation, this metallic substance is not in any great connected quantities as it is between the laminations in slate.

Iron should be used for the framework of all switchboards, and in the case of high tension currents a wire should be run from this iron framework to the ground, which is entirely insulated from the circuit, so as to prevent the board from becoming charged and discharging through a person who happened to be near by.

Complete plans and specifications for your board should be perfected, so that when an order is given to the manufacturer, you will know whether it is his fault or your own if things do not turn out as you desire. This may require more time and attention than you wish to give to this branch, but, if you have experienced

the inconvenience some people have suffered, you will feel very differently.

Improvements have been and are constantly being made. To this spirit of progress may be credited the wonderful development in electricity during the last ten years. Our central stations really mark the different steps in the grand march of our industry. Shall not this continue, and shall not the next decade follow out the unchangeable law of progress by bringing forth improvements destined to make even the glorious past pale into insignificance? Everything points that way, and to him who shall review the electrical events of the next ten years it will, no doubt, be given to speak of our station switchboards as embodying the highest electrical and engineering knowledge; in short, perfection.

THE PRESIDENT: You have heard the paper of Mr. Sullivan; it is now open for discussion. I will call upon Mr. Leslie, of New York, to open the discussion.

MR. LESLIE: I do not believe that I am competent to criticise the paper, because I only heard a very small portion of it, and I happened not to be provided with a copy. Consequently, I beg to be excused.

THE PRESIDENT: The question of switchboards is one that comes home very closely to every man in a central station; and there is probably no point in which central station practice is so weak as in good switchboards. It is a very noticeably weak place in the construction of a station with which I have something to do here in Buffalo; and I am not alone in that, as exceptionally few of the stations that I have been in have modern switchboards. This subject is one about which every active member of this Association should be in earnest. We can learn a great deal from one another, and I regret exceedingly that Mr. Leslie was

not here in time to hear more of the paper, and that we did not have it to print, as we had others, as I have seen some of the work in the Manhattan station in New York, which, I am sure, would have been of great benefit to others if they could have seen it as I have, and I think Mr. Leslie will reconsider the matter after he hears some others discuss this paper. I trust that the members here who are connected with stations, whether active or associate members, will discuss this paper fully. It is not necessary for one to have read the paper entirely. If they will get upon their feet and say what the practice is in their station—say what they are doing—what kind of a switchboard they have, and what difficulties they have had with it, perhaps someone else who has had similar trouble may have found a way out, or designed a plug, or wired up his board, or used certain material—marble, slate or something—from which we can get an idea, so that when our proceedings are printed and sent out to members who are not here, and who have not listened to this paper, they can gather something of interest, even though they are absent from the meeting. I will call upon Mr. Scott to speak to us upon this subject.

MR. SCOTT: We have a wooden switchboard, and, according to the paper which has just been read, that is contrary to law. But it is fireproof, because it is wired in such a manner as to make it so; and I have found that the great danger from fire with switchboards is either from a dirty connection, a loose screw, or from lightning. We have had trouble from all those causes, and in order to obviate the trouble from lightning, we provided each feeder with a double lightning arrester. We have two lightning arresters on each leg of the feeder running to separate grounds, so as to be certain that if one lightning arrester does not act, the other will.

Then, in order that it shall not reach the main plug cut-out to the dynamo, we put a double fuse block cut-out on each feeder, and fuse that only to the limit of that feeder, fusing the dynamo cut-out to the limit of the dynamo, so that if any lightning does pass the lightning arresters and come in, it takes the feeder cut-out instead of the main cut-out, from which it might arc and destroy the armature. I think a plain wall of well shellaced hard-wood is better than slats, because edges and corners are susceptible to attack where a full board is not so liable to it, and I like the full board better on that account.

We have one of the wooden Westinghouse lightning arresters on each feeder, then we have one of the marble lightning arresters on each feeder. We have had some terrific thunder-storms that have come in and have stopped the engine, but the arresters have carried them off, and we have never had an armature injured.

MR. ROBERTSON: The matter of switchboards is something that has given us a great deal of trouble. We started in when we put in our Westinghouse plant with what is known as a Spencer plug switchboard, and as this gentleman has just stated, we also have had some terrible lightning. Our switchboard is of wood. I have seen lightning flashes come in there that would destroy a switch and would not even phase the safety fuse; so that we have come to the conclusion out there that a fuse is not a protection against lightning; neither is a lightning arrester. We have never made any very great efforts to make a modern switchboard of our arc light board. It has been patched on to, from to time to time, as we have added different dynamos and circuits, until now it is a mixed up mess of cables and terminals, and I doubt very much if any operator could learn just how to connect and plug up that switchboard in a week,

if he tried. I expected, when this paper was read, to have some sketches submitted with it that would give me some ideas which I could put in my pocket and carry home and embody in a new board. Beyond that, it seems to me that the paper brought out all the features which we have found by actual experience that our switchboard lacked.

THE PRESIDENT : I think Mr. Leslie will appreciate the position we are now in, and will give us a description of his switchboard in the Manhattan Station.

MR. LESLIE : The new switchboard and switches of novel design have been in operation at our station for a sufficient length of time to prove their utility and convenience. The accompanying illustrations and description will be of interest, we think, to all central station managers and to others.

The circuit wires from the pole line enter the dynamo room through the upper part of two windows, one being used for the arc wires and the other for the alternating incandescent wires. The latter we will trace.

A wooden framework of 2x3 inch stuff, suspended about one foot from the fire-proof ceiling, carries all the wires in the room, thus facilitating an easy inspection. These incandescent wires run directly over the instrument board, which is shaped in a novel form, 16x9 feet, and has an easy exit on each end to the machines. The instruments are arranged on slate panels, with spaces between, allowing a clear view of the dynamo. The station converters are at the top of these panels ; below are placed, in the following order, the pilot lamps, voltmeters and ammeters. Under the panels are slate slabs carrying the rheostats controlling the dynamo exciter, and under these are run the compensators. These are connected in the usual way.

To the converters are attached, besides the usual

pilot lamp and voltmeter, a pair of connections, which, with a sliding contact of simple design, connect to one of the two standard Cardew voltmeters and thus reads, by sliding the contact, the voltages of each circuit in succession. These features render it possible for an attendant to properly care for a greater number of circuits than would be the case with the old styles of instrument boards.

From this board the wires run directly to the switch-board and terminate in the circuit interchanging switch at the top of the board.

Referring to Fig. 2, the circuit wires terminate in the binding posts C+ and C— which are connected to the anchor shaped blades. The lips of the latter fit into two clips, one pair of each on opposite sides of the two-inch marbleized slate slab. Therefore, when one pole of a circuit is being broken at, say, the bottom right-hand corner of the front side of the slab, the other pole is being broken at the upper left-hand corner of the back of the slab, the length of each break of contact being eight inches, and having the added advantage of the interposition of the slate slab, thereby effectually preventing an arc or short circuiting from one pole to the other.

To the binding posts of the clips are attached flexible cables, specially insulated; one pair, B1 and B2, terminates in black handled plugs; the other pair, R1 and R2, terminates in red handled plugs. These cables are brought to the front of the board through the middle timber, as illustrated in Fig. 1.

The dynamo wires run directly from the machines to the bus bars at the rear of the board. These bars are supported by boxes made of hard rubber, which act both as insulating supports and receptacles for the plugs. Inside of these boxes are the clips on the bus bar to

which the plugs make connection. These latter (the plugs) were designed so that their protecting sleeves extend through holes in the slate board and, when inserted, lock themselves simply by turning the sleeves, which have projecting plugs, in order to prevent their accidentally being pulled out. All permanent joints of bus bars and plugs are soldered.

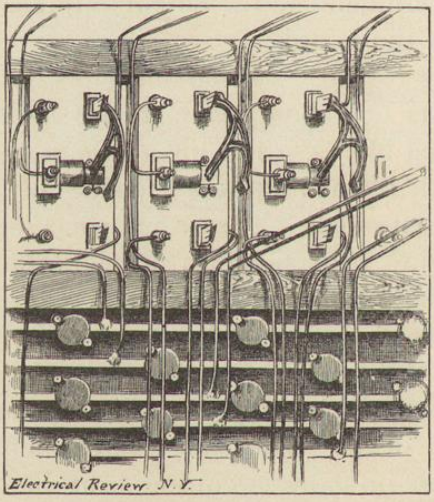


FIG. 1.

The sketch of the front of the board (Fig. 3) represents an attendant plugging in one of these plugs into machine "B" bus bar. Each red and black handled plug is stamped with the number of the circuit interchanging switch to which it is attached. The dynamos in the room are lettered A to V. Their terminal bus bar receptacles are lettered on the marbleized face of the board in white to correspond.

Machines A to J belong to one section of shafting; K to Q to another and R to V to another. The circuit interchanging switches are nnmbered to correspond with the number of circuits they contain, and each panel of the instrument board is numbered to correspond.

The method of operation is as follows:

The circuits are running, let us say on the machines

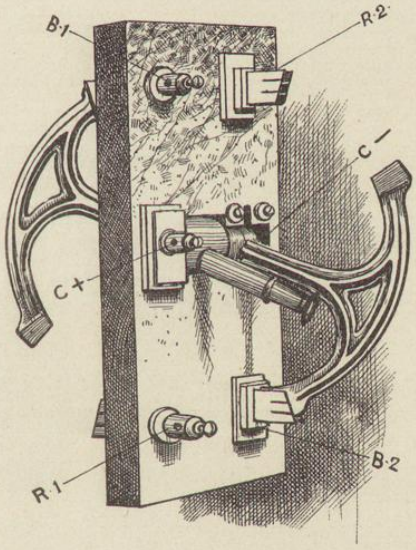


FIG. 2.

on the lower half of the board, and it is proposed to start, in addition, the machines connected to the upper half of the board. A programme is prepared for the proposed arrangement of the circuits on the different machines.

One pair of the plugs of each switch is always idle; when the front blade is up, the black is idle; when it is

down, the red is idle. The idle pair of plugs may be handled as desired, independent of the fact that the circuit is running. Therefore, any or all of the idle pairs of plugs may be plugged onto the bus bars of the

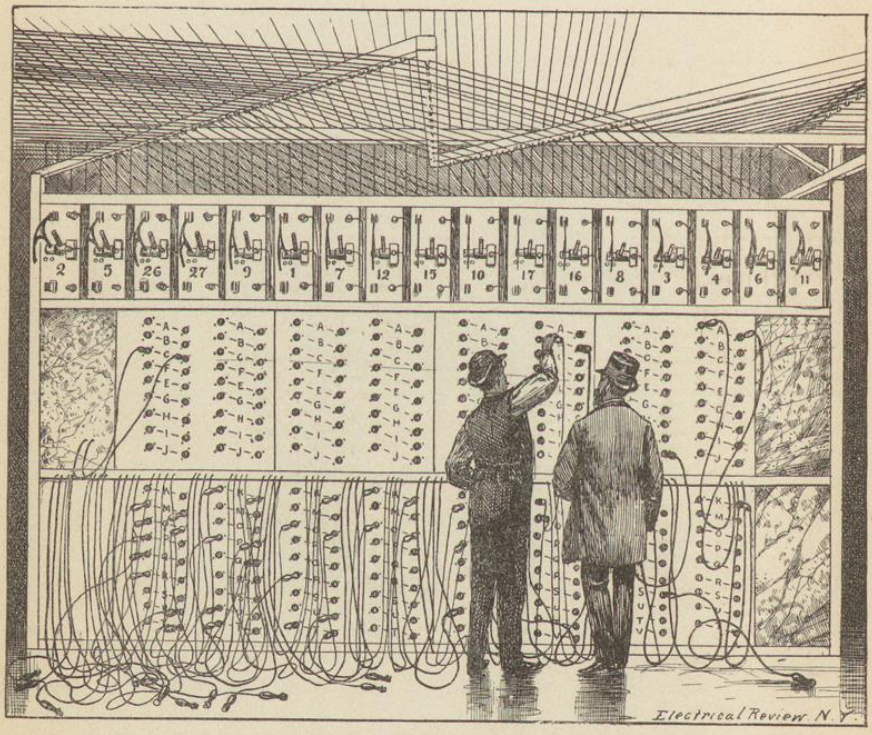


FIG. 3.

machines which are intended to carry the circuits affected by the proposed new arrangement.

After the engine has been started and the machines are at proper voltage, the dynamo engineer, with a stick

having a loop of leather on its end, throws the interchanging switch and the operation is then completed. The voltage of the machines onto which the circuits are to be switched is ascertained by means of a special voltmeter plugged into the machine bus bars. The voltage is then regulated to accommodate the circuit to be switched, an allowance being made for the drop of the machine voltage at the time it assumes the load.

The circuit having been arranged for the usual run, the idle plugs are set for an emergency switch-over, *i. e.*, the idle plugs of the more important circuits are set on the bus bars of the spare machines, or on the bus bars of machines carrying less important circuits, so that, in case of trouble to any machine, the interchanging switch can be thrown in an instant without the necessity on the part of the attendant of stopping to think where and how the circuit affected can be put.

This board is built for nineteen 1,000 volt, sixty ampere dynamos and seventeen circuits. Its total length is sixteen feet. The entire front of the slate is marbleized in imitation of Tennessee marble.

The advantages over all other boards, as claimed by the inventor, are :

1. All electrically connected metals are behind the face of the board and are insulated from the slate by hard rubber.

2. It is non-combustible.

3. It is absolutely impossible to get two alternators in parallel through any mistake of the operator.

4. Any circuit can be placed on any machine, thus securing perfect flexibility.

5. The parts of the board are few.

6. It leads to an easy and systematic running of the wires.

7. It is a handsome ornament to the dynamo room,

rather than a gross disfigurement, as compared with many other types.

THE PRESIDENT: This morning we listened with a great deal of pleasure to Professor Gray, of Chicago. Owing to the limited time that remained to us then, we did not get all the information, I think, that the Association wants regarding the World's Fair. Professor Gray is here again to-night to speak upon the subject, and if there are any gentlemen in the audience who care to ask questions of Professor Gray regarding it, I know he will very cheerfully answer. It seems to me that this is a matter in which each and every one of us should be interested. The apathy which is sometimes apparent with us should not exist in this matter of the World's Fair. We are not going to entertain ourselves at the World's Fair. We need to appreciate that a great many foreigners will come to the country at that time, men whom we want to meet in the manner we would expect to be met if we went abroad under similar circumstances. You who were present at Montreal last summer know something of the treatment we received there. Turn about is fair now. We shall have Canadians, Englishmen, Germans, and visitors from all countries here. We are proud of the industry in which we are engaged, and it becomes this body—the only body of its kind in the world—to take a prominent part in the Congress which has been devised by the Columbian Fair people. What plan that will adopt, I cannot foreshadow now, but I would ask that each one of you consider the matter fully, and we will take it up again to-morrow morning. Some action should be taken by this body before it adjourns, as to what it will do in concert with the other electrical bodies. I will call upon Professor Gray to address you.

WORLD'S FAIR.

PROFESSOR GRAY: I do not know that there is very much more for me to say than that it may not be clear in the minds of some of those present just what the plan is. I suppose that some of you have in your minds a question to ask, and if you will state it, that will probably be the quicker way, and the more satisfactory way, to come to a clear and full understanding of just what we are trying to do, and just what we want *you* to do.

Now, the idea of this organization is that all the world may participate, as your president has suggested. When we go into that Congress, then we go in as individuals; we go in in our corporative capacity. We can help to organize this Congress, because we can work better in that way through these various organizations; but when we go into the Congress, we go in just as a man from England would, or from France, or from Germany, as members of that particular Congress, and not as members of the American Institute, or the National Electric Light Association, or some other Association. For the time being we merge ourselves into this general Congress, and for the reasons that I have stated. It is a *world's* Congress, and not a local one. It is manifestly, then, for the interest of everyone who is interested in electrical science, and who is interested in electrical progress, in all of its departments, to co-operate in this way. We will attend meetings where all the different sections will meet—the electric light, electric railroad, telegraphic and telephonic sections, and the section on the theory of units and standards—to hear

papers that will be prepared in advance by speakers selected from the very best men in the world, on some original topic relating to this science. We want to meet, then, in general session, all of us, in one grand Congress, to hear these papers. When you come into your sections you do not want to be confined there to just the members of *this* Association, for instance, to consider electric lighting; but you want to hear from eminent men from all parts of the world. You want to get all the information you can; that is the great value of this Congress. It will be the same thing that you have here, but in a much larger sense. I do not need to dwell upon the importance of this feature of it; I simply want to interest you and get it clearly set before you as to just what it means and how it is to be accomplished. And I want to define my position. I have been appointed by these authorities to organize this Electrical Congress through the aid of my committee and advisory council and the co-operation of such associations as yours, the American Institute, and the various electrical clubs; but when we meet, we meet under the auspices of this general organization—the World's Congress Auxiliary of the Columbian Exposition, and they furnish and do certain things for us.

JUDGE ARMSTRONG: It has been the habit of our Association to hold semi-annual meetings, and it is our intention, I suppose, to meet during August in Chicago. Now, I had supposed, in listening to Professor Gray this morning, that the meeting held in Chicago would be the meeting in this building at the time he indicates. From his explanation to-night it would seem, however, that we are invited to go there as individual members of this Association, and not as an Association to hold our Convention there.

PROFESSOR GRAY: Yes.

JUDGE ARMSTRONG: Now, I would like to know (because what we will do will depend largely upon that) what arrangements can we make, meeting there with our Convention? We are required to hold annual conventions, and may hold conventions semi-annually. The advantageous convention for us in 1893 will be the summer convention, and we, of course, will want to hold that in Chicago. We would prefer above all things to hold it, as nearly as we can, in connection with this Congress; yet we cannot lose our identity, and we must preserve our own Convention. Can that be arranged?

PROFESSOR GRAY: Well, I have no authority to extend the privileges offered by the Fair authorities to any association as such; of course, there is no objection to your holding the Convention at that time; that is, unless it may not be deemed good policy; but I have no authority from this Auxiliary department, which furnishes us the facilities that I have spoken of, to extend to any association whatever, as such, the use of the halls; and I have asked that question pointedly, and they say that all the congresses held in that building are to be held under the general auspices of this organization.

JUDGE ARMSTRONG; That is all right. We have no objection to meeting under the general auspices of that association; but should we have to meet under the particular auspices of that association?

PROFESSOR GRAY: I do not know just what you mean by particular auspices.

JUDGE ARMSTRONG: I mean this, that we ourselves would be a group. I understand that there will be some fifteen or twenty small rooms that would be set aside—

PROFESSOR GRAY: Yes.

JUDGE ARMSTRONG: Now, could we hold the sessions of our Convention, subject to their regulations or directions as to time, and all that, so that others could come

as others are invited here to come, and yet preserve our identity ; or must we go, as you suggested, as individuals ? It may happen that we are members of this Association ; but as individuals, to go there and meet under the auspices of this body, being directed and controlled entirely by them, and meeting as individuals interested in electric light—is that the way we have to go ?

PROFESSOR GRAY : You would meet in a section which was devoted to electric light, or whatever was allowable in that section, and you would organize in your own way, appoint your own officers and have your own papers.

JUDGE ARMSTRONG : Well, everybody interested in electric light would do that.

PROFESSOR GRAY : Everybody interested in electric light would do that. In other words, they would not allow you to go there and shut out any one who properly belonged there, because he was not a member of this Association. But any one, from a foreign country, or from this country, who was not a member of this Association, if he properly belonged there, would be entitled to a seat in that section. That is my understanding of it.

JUDGE ARMSTRONG : If you will pardon me for speaking again—you said we ought to take some action on this. The only action we can possibly take is recommending to members of this Convention to take as active an individual part as they can in this Congress. We cannot, associated, take any part in it, and we must go there as individuals. I did not understand that. I am very glad of Professor Gray's explanation, because I think that a majority of the members of this Association would have been sadly disappointed when they went out to Chicago by finding that possibly there would be a large number there who were not members of this Association, the majority taking charge of the whole thing.

Our Convention we can hold in our hotel rooms, and dispose of that; but on the Exposition grounds, we would have no particular direction there. So it seems to me that the only thing we could properly do would be to recommend to the members of this Association that they attend, as far as possible, the sessions of the Congress there devoted to electrical matters.

PROFESSOR GRAY: I work on the lines as laid down by this World's Congress Auxiliary. Perhaps, to answer some of your questions, I might read from a general statement that I have here, published by the Auxiliary itself, giving all the different departments, and the subdivisions, etc., of the various congresses; and as the first page, which is very short, contains the general idea, I will read it:

"The World's Congress Auxiliary is constituted as follows:

"First.—A central organization authorized by the directors of the World's Columbian Exposition, and recognized by the Government of the United States as the proper agency to conduct a series of World's Congresses in connection with the Exposition.

"Second.—A local managing committee for each congress. This committee constitutes the means of communication and action between the Auxiliary and persons and organizations desiring to participate in a given congress. Each committee must necessarily consist of a comparatively small number of persons, who are resident in or near the place where the congress is to be held.

"Third.—But a World's Congress obviously requires the co-operation of the world. Each committee, therefore, has adjoined to it, and constituting its non-resident but active branch, an Advisory Council, composed of persons eminent in the work involved, and selected from many parts of the world. The members of such councils will co-operate with the proper committees by individual correspondence.

"Fourth.—General, honorary, and corresponding members are also appointed, and they are invited to give their advice and co-operation in relation to the whole series of proposed congresses.

"Fifth.—Committees of co-operation appointed by particular organizations are recognized by the Auxiliary as representatives of their respective societies or institutions."

Now that bears upon the questions you were asking.

"Sixth.—The chairmen of the general committees constitute the President's Advisory Council."

That is the general outline of the organization along the lines upon which we are to proceed. I want to say, as an illustration, here is the department of engineering. You know in engineering we have civil, mechanical, mining, metallurgical, electrical, marine, and naval engineering. Now, all those different engineering societies can come into this Congress, as an Engineering Congress. But they come there as a General Congress. Of course they come from all over the world. They merge themselves in that World's Congress for the time being; but in the preparation and organization they act in their various organized capacities. I want to say, while I am on this topic, that some of you may have seen that there was a double assignment. Electrical Engineering was assigned to the Department of Engineering, but, as holding an Electrical Congress without it would be like the play of Hamlet with Hamlet left out, when we came together it was agreed that Electrical Engineering should be dropped from the programme of general engineering and merged into the Electrical Congress. And although they had sent out their letters and programmes, it has been agreed since to merge that branch into our Congress. And here is another announcement which has just been given out.

"The World's Congress Auxiliary makes the following special announcement:

"While electrical engineering has been included in a scheme for the Electrical Congress of 1893, it was also originally assigned to the Department of Engineering, for consideration in the Congress of Engineers. It was thought, however, by representatives of the Electrical Congress that this double

assignment would tend to detract from the completeness and success of that Congress. A conference on this point was held between Professor Elisha Gray, Chairman of the General Committee of the Electrical Congress; Mr. O. Chamute, President of the General Committee of Engineers, and President Chas. C. Bonney, of the World's Congress Auxiliary, and it was mutually agreed that the double assignment above mentioned should be cancelled, and the entire subject of electricity remitted to the Electrical Congress. The importance and magnitude of the other great interests to be considered in the Engineering Congress made their representatives feel that they could well afford to be generous to their brethren of the Electrical Congress in the matter of electrical engineering. Their courtesy in this regard will certainly be highly esteemed."

MR. MEAD: Do I understand, Mr. President, that the desire is to have the different electrical associations appoint a committee or representative delegates as subsidiary to the local organization there, and through those delegates to work up a general attendance of the associations at home later?

PROFESSOR GRAY: Yes, sir; that you co-operate in that way; not only by creating a general interest in the Congress, but by making suggestions to this committee. You know somebody must have it immediately in charge; somebody must do the work; somebody must be responsible. Now, we want to get our committee, which consists of this local committee that we have mentioned, and the advisory council, and your organizations, as co-operating with us. We want to get a concensus of opinion. We want, by correspondence, and otherwise, to know what are your ideas, and what are the ideas of the majority of the electricians here and all over the world, as to just what the programme should be, for instance, and just how the Congress should be conducted. And the whole thing should be worked up, the programme should be mapped out, the assignment of the duties to the various individuals who are to take part should be

made, and when we come together we should not have to lose time by reason of not knowing what we are there for. So there is a vast amount of work and thought to be put into the subject before the Congress assembles.

MR. MEAD: I speak with two points in view, as interested in two organizations: First, as an associate in this organization; second, interested as president of an electric club. Is it intended that the electric clubs shall co-operate, to any extent, in the same manner?

PROFESSOR GRAY: Most certainly; most certainly it is.

MR. MEAD: For instance, the New York Club is, perhaps, the starting club of the electrical club feature, they subsequently having organized the Boston, Chicago, Pittsburg clubs, and, I believe, the Buffalo club. There are now several citizens organizing clubs in Philadelphia and Cleveland; so it seems to be an era of organization in electrical fields in various cities, and I know that in Pittsburg we contemplate the active co-operation of prominent and surrounding towns. So that you have in those clubs a local active working force. Not all of them, perhaps very few, are identified with this Association; but if it is intended to reach clubs in the manner suggested for an electrical association, I desire to know that also.

PROFESSOR GRAY: Yes, it would be well for every club and every association that is at all interested, to appoint a committee. Then, later on, perhaps, we will get all those committees, or an executive committee from those committees, together; because there will be a great deal to think about when it comes near to the time of the Congress. We will have to have it all mapped out and understand what is to be done as nearly as possible before the Congress meets.

JUDGE ARMSTRONG: I would move that there be a

committee of three appointed, to whom this matter be referred, unless we have a committee on the subject. I am under the impression that we *have* a committee on that subject.

THE PRESIDENT: We have a commitee on the World's Fair, Mr. Armstrong, but I think it is quite proper that a committee of three or five be appointed to take up the matter and report to-morrow morning to the Convention.

(Motion to appoint a committee was seconded and carried.)

THE PRESIDENT: I will name as that committee, Judge Armstrong, F. W. Cushing and W. L. Candee.

THE PRESIDENT: There is one common end which every electric light man—and we are not exclusive in that—is trying to attain, and that is, a mastery of the financial element. The financial side of electric lighting has never been discussed; it has never been brought up. We have heard a good deal about the loss of money which all of us have sustained, and I have prevailed upon my esteemed friend, the Hon. Erastus Wiman, who not only has had experience as extended as any man in America in general finance, but also as owner of a central station.

I take great pleasure, gentlemen, in presenting Mr. Erastus Wiman, of Staten Island.

MR. WIMAN: Mr. President, Ladies and Gentlemen—It is a great gratification to have had the invitation from your president to appear before you on this occasion. I particularly delight in it, simply to make recognition of the very delightful manner in which your president represented you last year in Montreal—in my native country. I think the hearts of the Canadian people were entirely captured, not only by the president, but by the gentlemen who remained with him,

I do not know how long ; I hope it was a good two weeks. It seems to me that they never wanted to get away from Montreal, and when he wrote to me that he would like me to come to Buffalo and speak to you a few minutes on this question, I could not resist the temptation, simply out of gratitude for the way the Yankees captured the Canadians last year at Montreal. (Laughter and applause.)

ELECTRIC LIGHTING FROM A FINANCIAL STANDPOINT.

It would seem as if in the evolution of progress on this continent, that electricity was the flower and fruit. The stupendous change which in the condition of the human race has been possible by development on this side of the sea, needed just such a revelation as is possible only in electrical science. A drama of such proportions, on a stage of such intelligence, illustrating such principles as self-government, such events as a material progress beyond all that the world had ever seen, needed above all things a new force, a new hit from the mysteries of the unknown, a new law of nature as forceful as gravity, as helpful as heat, as widely diffused as air. Electricity thus takes its stand just at its right place in the marvelous procession of events in the human progress towards a higher and nobler life, which has been rendered possible by the discovery of America.

The advent on this continent of the Anglo-Saxon race, the high principles and purposes that animated the Pilgrim fathers, the sturdy development of all that was best in the mental, physical and spiritual nature of man, laid the foundations for the material progress to which all the world has contributed. Hither have come the strongest, the youngest, the most intelligent and the best adapted of human kind, to be assimilated into the great

body politic, taking part and lot in the government and development of the country. But great and well prepared as were these people for the momentous task before them, they would have had no progress to compare with what has been achieved, had not the country itself been the most magnificent the sun ever shone upon. In area so vast, in minerals so abounding, in agricultural possibilities so abundant, it is no wonder that Emerson described North America as "another name for opportunity." How magnificently the American people have availed themselves of this opportunity of all opportunities in the world's history, it is needless here to recount. How vast is the internal commerce that throbs and pulsates over this fair land we may not now stop to estimate, and how important a part this great city of Buffalo is destined to play in it, electrically, we can only dimly guess.

But in contemplating the progress made in the last century, and seeking to discover the influences and forces that have most contributed to the growth of wealth—to the comfort, safety and happiness of the human race, as illustrated on this continent—it may be safely claimed that electricity, even in its early stages, has played a not unimportant part. It would seem as if in a country of such vast areas as is the United States, nothing in the whole category of events would be so highly beneficial as a means of instantaneous communication, and yet this vast boon of instantaneous communication was only possible by electricity. With wide stretches of territory extending from ocean to ocean, from the most northern latitude to the most southern, the power of communication without delay, without the loss of a moment, was of stupendous importance. It may safely be said that, of all forces that rendered possible rapidity of growth, rapidity of accumulation of wealth, and devel-

opment, this power of instant intelligence, transmitted all over these vast areas, has been the most forceful, the most effective. Next to possessing so vast a country, as Emerson again says, "the last, best gift of God to mankind" came with it, in due and proper time, this most marvelous force of electricity, whereby its remotest portions were instantaneously placed in communication with each other, and through which enterprise was stimulated, all movement quickened, the news spread abroad the land, and the whole series of commonwealths bound together in a common progress.

Incidental to the unequaled usefulness of telegraphy in the marvelous progress of the country, has been its contribution, in a special degree, to the railroad service, which to so great an extent has contributed to material growth, the increase of wealth, and to the comfort and happiness of humanity. The use of the railway telegraph has practically doubled the tracks of every single track railroad on this continent, rendering the movement of trains so precisely, so rapidly and so safely, that without this facility of instantaneous communication, the railroads would not have achieved half, which by its aid has been accomplished. So that, incidentally, electricity is to be credited with no small portion of the enormous results attributable to that vast system of communication which in the last half century has done so much in making this vast continent blossom as a rose.

But just as telegraphy had reached its perfect degree of usefulness in general purposes, as in the railroad service, shown by the perfect growth in electrical science, it was supplemented by a still more wonderful faculty of communication in the telephone. My friends, in all the series of wonders which the electrical world has revealed, this telephone is to me the most wonderful. To a layman like myself, who simply wanders along the outer

edges of this magical land of discovery, this transmission by the aid of electricity of the human voice in audible and natural tones to great distances, is of all things the most marvelous. Not only is it the most marvelous, but it is the most effective, and in the highest degree the most useful. No one thing could have more perfectly fitted in to make this country grow and prosper, to knit together its neighborhoods, its people and its places like that which has been done by the telephone.

Mankind has not yet adequately appreciated the debt of gratitude which it owes to Alexander Bell, to my friend Thomas Alva Edison, and the gallery of other worthies, who not only invented this device, but by an exercise of the highest business sagacity have elevated it into a condition of usefulness in a few short years well nigh universal. That an ample reward has followed quickly the display of this business sagacity, and in return for the constant employment of the telephone to a degree more exacting and more beneficial than almost any other known device, is a circumstance that all should be profoundly grateful for, who know the difficulties, delays and disappointments which usually follow in the train of invention, promotion and introduction for the eventual benefit of the dear public.

But another field of opportunity for the usefulness of electricity for the benefit of mankind has been found in its uses for the creation of light. Just think what it means, those words "creation of light," and how supreme the effort of man thus in imitation of the most divine of all acts, implied in the words, "Let there be light." In that command the most stupendous results followed in the creation, in what is revealed, not only all that is upon the earth, but all the wondrous revelations of the heavens above. It is a singular fact that so many ages had passed since the world began, and that only

by the slightest degrees was the darkness which falls like a pall upon the earth mitigated. Many can even now remember, especially in country places, the tallow dip, the short sixes, the oil and spirit lamp, and the uncertain though mellow rays of the finished wax candle. It is quite within the memory of many men here that petroleum, with its wonderful power of illumination, was discovered, and all the world has since been blessed, not only by its illuminating power, but by the business skill and sagacity which, through the Standard Oil Company, has diffused this article so universally, so safely, and so cheaply ; illustrating the high benefits of a well managed monopoly, as against the universal condemnation of that economic feature of the hour.

With the discovery and development of gas, of course a vast change took place. But in the sixty years of its development, before it reached its meagre perfection, there was the slowest kind of progress, so that it is only up to within the last half century that artificial illumination became at all general even among great aggregations, like cities and towns.

It remained, however, for electricity, and within our own lifetime, to beget a degree of success in this wonderful work of the creation of light that nothing else had ever yet achieved. Once started on its mission, the progress made in adapting this subtle current to artificial illumination has been most remarkable. It may be doubted if in the history of any science, the same rapidity of movement has been made as in the adaptation of this form of energy to the highly useful and beneficial purposes of the creation of light. Great as have been the results to the country in instantaneous means of communication by the telegraph in general use, in the railway service and by the telephone, it may

be questioned whether any of these uses exceed the benefits and enlargement of capacity, which the highest form of artificial illumination made possible. For instance, remote places adjacent to cities, to which a gas main was an impossibility, have been reached by an electric wire. Neighborhoods have been joined together, localities connected, and property increased in value by rendering communication at night secure and safe as in the day. In the application of the arc light to public works of great importance, like aqueducts, tunnels, and especially to manufacturing, numerous branches of business are susceptible of being carried forward twenty-four hours in the day, which without it would be impossible. Thus is doubled the capacity of many establishments and the earning power of many an investment. In all public places, as in theatres, halls, and in almost all business establishments, where business after the setting of the sun is essential, electricity is already beginning most effectually to supplement daylight, and play a part almost as effective as the sun itself. As one in a journey across the country in a railroad car dashes through the cities and sees the long stretches of electric lights in cities like Rochester, Buffalo and Detroit, and going further west even to the Pacific, touches the newest towns, he sees how universal the use of the arc and incandescent light on the streets has become. It shows to what an extent, over what broad areas, this beautiful system of illumination has pervaded. But not only in the streets is electricity found, but it is beginning to be seen in almost every store, every hotel, every place of resort, so that by its rapidity of growth it has made an advance hardly equalled by any other article of consumption. Indeed, so far has it come to be now a universal street light that a prominent president of one of the largest

gas companies in the country declined to avail himself of an automatic street gas lighter at a mere nominal sum, simply because he said it was useless to compete longer against street illumination by electricity.

It will thus be seen that so far as fulfilling the purposes of its manufacture, electric lighting is a definite and ascertained success. So far as experimentalization is concerned nothing now remains to convince the public of its safety, of its effectiveness, of its healthfulness, and of its general adaptability to all circumstances. Hence, as an article of merchandise, the light furnished by electricity is just as much in demand to-day as wheat or corn, as beef or bread. So that this assemblage of electric light men may congratulate themselves, that notwithstanding many difficulties and obstacles, they have, by the excellence of material, by its reliability and effectiveness, created an article of merchandise of real value, for which there is a strong demand.

It is true, that in the creation of this article of merchandise, up to this period, there have been many mistakes. There has been a great waste of money, and if the past had to be lived over again, there are not a few who would shape their policy in an entirely different way to achieve the result now reached. But the very success of the business, in the creation of the demand, has been its own misfortune. I mean success in the rapidity of new inventions, in the labor-saving devices, in the marvelous progress which electrical science has made in the past few years. All this has been in a certain degree costly ; but no one will now regret the cost if the article produced is only safe, certain, effective and profitable. The value of the franchises acquired, the good will of the business secured, the pre-emption of the electrical field for further growth and use in every

variety of its application, must always be borne in mind as not the least valuable of the assets acquired.

The question of profit remains to be decided in very many localities. I have been favored during the last month or so with an enormous number of letters, in response to a request for information as to the condition of the electric lighting business all over the country. A great deal has been sent me of a confidential nature, and I can only give the general impression which the whole correspondence has made upon my mind. My conclusions are, first, that there is an enormous demand, only as yet partially developed and partially met, for electric lighting; second, that the public have been led to believe that it can be created for a very little money; third, that in competition with gas, an insufficient price has been asked for a light infinitely more brilliant, infinitely greater in candle power, far more healthy, and, as a rule, far more safe; fourth, that at the start of many electrical plants, the most meagre and insufficient foundations were laid for a business requiring the utmost precision and the most perfect material. If a mill for the manufacture of cottons or woolens were to be erected, the greatest possible skill would be required, the best material needed, and the most perfect engineering ability obtained. But in numerous electric plants this kind of expense was thought unnecessary. The result has been that numerous establishments have been created that needed almost everything in the shape of good construction that could make it a mechanical success.

It is these conditions, coupled with the rapidity with which inventions have followed one upon another, the constant reduction in the price of electrical machinery, the rapid growth of electrical appliances, and the radical changes and methods, which in six months would appear to be old in the history of a business which was

so new and making such tremendous strides, as make it exceedingly difficult to maintain the expenditure on capital account within the original limit of corporations.

But these changes are not confined to electricity, but extend quite as much into the domains of mechanical sciences generally. Probably no commercial enterprise has so stimulated the inventors of steam apparatus as has electricity. Indeed, it has brought out a new order of things entirely in this respect.

The high speed engine, working under high pressure and with great expansion, yet with a precision and uniformity of motion which reduces variations in speed to one-quarter—yea, one-tenth per cent., is a creation sprung from the demand of electrical machinery. So is the sensitive and quick acting governor, by the aid of which, only, this almost perfect performance of the engine is made practicable. So are also the perforated belts, which clasp the spinning pulleys without slip and without cushion. The clutches, which with unfailing hold grasp the rapidly revolving shafts, or release them without a jar or grinding, are, so to speak, creations of electricity.

So also the wrought rimmed pulleys traveling with immunity at a rate at which their old-fashioned cast iron predecessors would invariably collapse, perchance dealing death and destruction.

Who would, twelve years ago, have thought it practicable to place ponderous steam boilers with their glowing furnaces on the sixth floor of a building; six solid stories full of steam generators, small and compact in the space they occupy, gigantic in the power they send forth. It has been electrical progress which lifted these boilers to their exalted location in the very heart of our large cities, where every square foot of space is valued in dollars, and room for a steam plant represents a large

fortune. To assist in creating light was the original object of these boilers ; later they have also been called upon to deliver heat and to supply power for the many industries which best thrive close to the thronged thoroughfares of trade and commerce. It was the wants of electricity which reconstructed the steam boiler, so that now a 500 horse power boiler need occupy no more space than 100 horse power used to cover.

And how many barrels upon barrels of lubricating oil have not been saved by the improvements which electric light works made necessary in bearings and journal boxes? In short, there is no article used in transmission of power, no part of the modern steam plant, which has not been more or less modified to meet the need of greater speed, greater uniformity and absolute reliability, unconditionally demanded by the introduction of electric light.

But may nobody here imagine that all these improvements came without a struggle and without losses, caused by failure of plant. Such losses are expensive lessons, so expensive that in themselves they form almost a complete explanation of present conditions. Nowhere else could be found a more striking illustration of the old proverb, that "Necessity is the mother of invention." Thus inventions—and perhaps not all unqualified successes—have been made at so rapid a rate, that a piece of machinery becomes antiquated before its very newness has worn off.

"Knowledge is power," but when dealing with electricity we yet meddle with a giant whom we do not thoroughly know, whose strength, temper and capabilities we can hardly more than guess at. Increased knowledge will make the giant our docile servant, and teach us how hereafter to wrest a profit.

Looking back upon the past, it is easy enough to

account for the difficulties, obstacles and want of profit in many establishments, but if there is one thing more than another that has made the progress towards profit a difficult one, it is the mistaken apprehension of the public that electricity can be got for nothing. There is something so mysterious and occult; something so magical about electricity, that the impression has got abroad that it is only necessary to press the button, and with the least exercise of skill, labor or expenditure, the miracle is produced. The attempt to compete with poor gas, at a low price, with infinitely less illuminative power was, of course, a necessity. But the public estimation of electricity has never yet reached the standard which it should have done. The slow introduction of the current into private houses is, perhaps, the best illustration of this condition. Even to-day, in some cities, it is thought the arc light can be had for fifteen cents a night and the incandescent light for a mere song. Fifteen dollars a year is slightly over a quarter of a cent an hour, yet for this, for ten to twelve hours, a beautiful bulb of incandescence is expected at every street corner and in every remote suburb for almost less than it would cost to burn a wax candle.

The public estimation of the cost of electric lighting has been allowed to prevail to an extent destructive of profit. There has been a hallucination prevalent that there was something miraculous about the production of electricity. The cost of coal, labor and machinery has not entered into the calculation of either the ordinary city official or the private customer. The expectation that something would be produced for nothing, which inheres in the human mind as to the possibility of invention, has attached itself to electricity more than to any other element in the supply of human wants. The consequence is, that in making new contracts, even

to-day there is the strongest disposition to get the prices down, not to what the article can be produced and paid for, but for the least possible amount, irrespective of profit, and equally irrespective of efficiency. There is a true and false economy, and that is the falsest kind of economy that expects a public service at less than the cost of its output and a fair profit.

Having in the process of time developed a large demand for light, evidences of which are seen on every hand; having at the same time gone through a most unusual experience in not only creating that demand, but in the production of the article for its supply, a review is in order as to the present position of electrical securities and the prospect of profit. It may as well be admitted that there has been a serious and costly struggle, and that, taken as a whole, the results in the shape of a total profit on the total investment in electric lighting is not to be seen in the shape of dividends. There are, however, happily, exceptions to this general statement, and in the returns sent to me from all parts of the country, there are a considerable number of companies whose career has shown that in electric lighting there resides the potentialities of a profit equal to that of any legitimate enterprise. The successful companies illustrate what it is possible to do, and though they may not be numerous in comparison with others whose record for profit is small or who report a loss, yet that money can be made continuously and rapidly out of electric lighting is clearly demonstrated. In order to cite an example of steady growth in revenue, and also to show the corresponding ratio of expense, I append the figures for seven years, from one of the most successful companies in the East, whose management has been characterized by the highest ability, and whose location and name it would hardly be

proper to disclose. The figures are authentic, and show a record of which any man might be proud.

EARNINGS OF AN ELECTRIC LIGHT COMPANY.

For 1885—Receipts		$30,768.70
	Expenses	24,901.54
	Net earnings	$5,867.16
For 1886—Receipts		$47,613.76
	Expenses	34,700.83
	Net earnings	$12,912.93
For 1887—Receipts		$57,750.71
	Expenses	34,691.85
	Net earnings	$23,058.86
For 1888—Receipts		$75,734.14
	Expenses	46,235.83
	Net earnings	$29,498.31
For 1889—Receipts		$135,254.08
	Expenses	94,178.69
	Net earnings	$41,075.39
For 1890—Receipts		$199,195.72
	Expenses	150,195.48
	Net earnings	$49,000.24
For 1891—Receipts		$247,679.88
	Expenses	187,092.77
	Net earnings	$60,587.11

The company commenced to pay dividends January 1, 1887, at the rate of 8 per cent., payable in quarterly dividends of 2 per cent., and have continued the same up to date.

Before closing the books December 31st, 1891, we charged off from the earnings of 1891, for depreciation,

$10,000 from the steam plant, and $30,000 from the electric plant. On January 1st, 1892, capital stock $800,000, surplus $90,000.

The above figures speak for themselves, and in the progress shown in receipts and profits there is contained a hopeful sign for many another company whose career up to this time has yielded an inadequate return. Indeed, to present a totally different picture, here is an extract from the letter of an esteemed Western friend that shows the ruins of a senseless competitive struggle and the folly of low prices :

"I am the president and manager of five electrical light companies in this city, but *three* of which have actually survived financial pressure and bankruptcy. One of these three with a capital of $150,000 fell behind nearly $100,000 in seven years, and last year the stockholders voluntarily came up with an assessment of $60,000 to save it from bankruptcy. Another, working under the strictest economy, is but barely able to meet operating expenses. Still the other, a foundling of the gas company, is, under exceptionally favorable conditions, and paying no salary to its executive officer, making a little money ; after eighteen months operation, it last month declared a dividend of three per cent."

With such an experience it is no wonder that the gentleman writes as follows :

"I am aware that books can be kept so as to show an earning, but this is in many cases at the expense of a constantly depreciating capital investment.

"As a matter of course, the profitableness of any undertaking depends upon the prices obtained. In my judgment electric light projectors are themselves to blame for loss of profit through false representations as to the economy of operation. If the truth had been told, and contracts refused except upon a paying basis,

the electrical business throughout the country would now be upon a much better footing.

"The promoters of electrical enterprises, and the sellers of electrical apparatus and appliances, are rapidly killing 'the goose that lays the golden egg' by falsely representing the great economy of operation, and consequently the great profits of such undertakings, thus falsely educating the public into the belief that anything like a reasonable price is extortionate.

"The true policy of the friends of the electrical industry should be directed to show that electrical undertakings upon the basis of the present prices *are not profitable*, and if they expect perfect service they must pay better prices, prices that have prevailed because the companies themselves have not heretofore appreciated and understood the cost of operation, and the great loss due to accidents and rapid depreciation."

These two extremes of success and failure tell the whole story of electric lighting in the past seven years. The companies that have succeeded have done so under favorable circumstances, with a freedom from ruinous competition, exacting good prices, and above all other requisites, with good management. If there is any department in human activity where brains and tact are required to a degree greater than any other, it is in the administration of an electrical lighting plant. This is evident, not only because there was great lack of experience and knowledge of a business that was in the production of an article that was in a certain sense mysterious and unknown, but because there has been an amount of misapprehension as to its cost on the one hand and its value on the other, hardly ever experienced regarding any article of merchandise.

Some attempt has already been made to account for a misunderstanding as to the cost of electric lighting,

but it is proper to allude to the folly which has prevailed in selling it for less than cost. The insane competition with each other in localities where one company was needed and more than one was ruinous is well nigh passed; but there remains the competition with gas companies and the effort made to constantly lower the standard of electricity to that of gas. It is true that in the early history of the effort to use electricity as an illuminant, it was necessary to get down to the standard of the fumes of coal, and in order to show the superiority of one over the other, to yield for a time in the matter of profit. But so rapid has been the growth in the use of electricity, so immeasurably superior is the current to the fume, in health, in brilliancy, in beauty and attractiveness, that the time seems near when electricity can claim the rightful place, and demand the price just so much higher as it is an illuminant just so much better. It took sixty years to introduce gas and make it a reliable servant of man. Its early history shows losses quite in proportion to those in electricity, while its later progress shows that long ago it reached its limit of illumination, its possibility of moderate profit, its constancy of danger, and its maximum of unhealthfulness. It has remained for electricity to show in every new edifice, in every modern place of public resort, in almost every commercial centre, in banks and hotels, as well as in thousands of miles of street lighting, how immeasurably superior is the electric globe of light to the meagre and inefficient gas burner. With this achieved, and a general verdict in the public mind as to the superiority of one over the other, is it not time to break away from a similarity of price, as we have broken away from a similarity of production? An advance in price commensurate with the superiority in the article produced would add largely

to the earning power of electric lighting companies, and it is time it was contemplated and acted upon.

One misfortune has been in electric lighting that a large investment has been available for only a small portion of the time. All day long, when other works by rental or by active employment were earning money, electric light plants have been compelled to stand idle. Even gas companies spend the whole day making gas, accumulating it in their reservoirs for distribution during the night. Electric light plants, however, are compelled to manufacture and distribute at one and the same time. A change, however, impends in which these costly plants and lines of copper can be used every hour in the twenty-four. The development of the facility for the transmission of electricity for power has, however, within the last two years made rapid progress. The introduction into small manufactories of the current to be used constantly or intermittently has, in many localities, become very general. Already in the correspondence sent to me there are quite a few indications illustrating how advantageously the electric light plants can be used during the day for the purpose of power. In cities where manufacturing is going forward, there are hundreds of establishments in which the power required can be furnished from a central station. In the working of sewing machines, both in large establishments and in private houses; in the running of small lathes, hoisting machinery, elevators and even large trip-hammers; in the circulation of air in sick chambers; in even rocking the cradle, the usefulness of electricity is becoming apparent, so that a new era opens for the usefulness of the plant, poles, wire and franchises during the day.

In this respect, with this in view, the whole electrical community are watching with intense interest the possibility of the development in this city of Buffalo

electrical transmission arising out of the successful effort which is now being made to harness the power hitherto latent in the Niagara River. The boldness of the proposal; the extent and character of the enterprise which is now nearing completion in this effort; the pluck and push in the work, challenges alike the attention of the engineering and the commercial world. The relation of this enormous power of nature to the transmission of electricity is the most important consideration which now occupies the thoughts of those most interested. The success which has attended the three-phase current from Lauffen to Frankfort in the transmission of power 112 miles, without material loss, comes just at the right moment to make it seem possible that the enormous potentialities in the forces of Niagara can be made to reach a degree of usefulness never dreamt of in the past and hardly realized in the wonderful present. It seems fortunate, therefore, that the convention which is here assembled should, as it were, be in the presence of the most stupendous event possible in the history of the science of electricity. In the development of the next few years will be found ample food for thought and effort, out of which may grow a relief for electric lighting plants of the greatest possible consequence. If in the City of Buffalo and from the Niagara River there can be transmitted power in such enormous proportions as are now contemplated, sub-divided and reduced, so that into every factory and almost into every house the force and energy can be controlled and operated, there is latent in every central station the possibilities that may come to every town in the country and to all the electric light plants now lying idle during the day, an imitation in modified form of the power that of all forces in the world, Niagara is the best example.

The remarkable success which has attended the introduction of electricity into traction should in a large degree be attributed to electric lighting experience. It is clear that much of the perfection in machinery, both electrical and steam, which enables electric roads to start off on a career of abundant success, would have been impossible had not the field been already explored by the light organizations. Hence it is natural there should follow in many localities a union between the two interests, that of electric railways and electric lighting, and in this prospect there is a hope for the future of promise and profit. In the reconstruction of central stations, therefore, the wants of street lines of travel as well as of street lines of light are to be contemplated, making existing properties often more valuable, and bringing into constant use all the facilities, permanent fixtures, fixed charges, expense of administration, and other expenditures now directly chargeable only to electric lighting. The construction of electric railways into new localities hitherto inaccessible, and the profit possible by by the enhancement in value of real estate, is a tempting field for the electric light proprietor. The advantage of affording along these new lines a supply of power into every house, equally with a supply of light, begets an attractiveness for these new neighborhoods thus created second only to the advantage which is imparted by the rapidity, the cleanliness, the frequency and economy of the electric railway systems now so universally approved.

The momentous revolution in values as the result of highly improved means of street communication by the aid of electricity, is one of the economic features of the hour. In no department of business activity within the past three years has there greater profit been made, has there greater good been done. The growth of wealth in numerous cities has been very great from this means.

Boston is one of the best examples, under the splendid administration of Henry M. Whitney. Whole communities have been knit together, the outlying and inaccessible parts brought within easy hail, and solidity, strength, and rapidity of movement made possible, with all that follows in its train. It is not alone money that is thus made, not alone an enhancement of values, nor is it by mercenary considerations all these benefits should be judged. It is in quickened social life, in intellectual activity, in all that makes this people great and forceful in civilization, that results come from such uses of electricity. It is the creation of homes in the outlying suburbs, the facility of getting away from the workshop and tenement house, and the creation of new hopes and new aspirations for women and children, hitherto huddled and crowded into close and unhealthy city quarters, that have followed the electric railway expansion, so successful in the past few years. You remember the German ballad, where the traveler crossing the stream near his native town, after a long absence, says :

> "Take, O Boatman, thrice thy fee ;
> Take, I give it willingly,
> For, invisibly to thee,
> Spirits twain have crossed with me."

In estimating the profit and loss of electricity, and especially in recalling all the experimentalization in the electric lighting field, the success achieved in other senses than the material gain must be estimated at its full value.

The success which has in so brief a period attended the application of electricity to traction, and the enormous numbers now moved throughout the country by electrical roads, make it reasonably sure that before very long steam roads in crowded localities will be worked by electric energy. Already the great Illinois Central,

having so large a portion of its tracks in the city of Chicago, have in contemplation this marked change. The Wisconsin Central are also favorably considering it. Possibly it is a little too soon to anticipate this change, but that it is coming there can be no question.

In New York City, in Boston, in Brooklyn, and in such suburbs as Staten Island, there is no reason why electricity should not be substituted for steam. Steam locomotives, built to carry their coal about, and to employ an engineer and fireman for each 500 horse power generated, cannot compete with the great compound, condensing, stationary engine, whose forceful power can be extended by a delicate wire distances of twenty-five miles and under.

It is only a question of time when numerous roads having a limited or circumscribed area, will consider the propriety of changing from steam to electricity, and, with that in view, electric lighting plants now being constructed should contemplate a sufficient enlargement to be able to sell power to nearby steam roads. It would indeed be a revolution of enormous proportions, if, from these central stations, a force sufficient could be furnished for operating suburban roads, whether steam or electrical.

In this connection it is impossible to contemplate the extension of the lighting and railway systems dependent on electricity, without alluding to the consolidation now in progress between the two great organizations that, more than all others, have promoted these most important interests. After a somewhat careful study of the question of competition, of consolidation and the establishment of a strong and well managed single concern, as compared with weak and numerous rival undertakings, my deliberate conviction is that all the dangers of monopoly, all the possibly increased

charges for supplies and other fancied ills, are as nothing as compared with the waste of unbridled competition. In the consolidation of the Edison and Thomson-Houston companies a new and important era opens for all interests concerned in electricity, and with such experience, such skill, such business sagacity, and such inventive faculty as has been developed within these companies, now that they are united in one, nothing but good can result, not only to the companies themselves, but to the electrical community at large. Certainly under the sagacious guidance of Captain Charles A. Coffin, who has shown such excellent capacity in Boston, and made a most marked financial success in a field where success seemed most difficult, the career of the combined companies is sure to be productive of profit to all concerned. Great as is Edison, equally great in his line as is Elihu Thomson, neither of them could achieve the desired success unless the man of the hour was forthcoming. Surely in Captain Coffin is found the needed instrumentality to give strength, solidity, and earning value, not only to his own securities, but to others all along the line of electrical development.

A survey of the electrical business world is full of the deepest interest. This new and mysterious force has achieved more for the advancement of the country than almost any other, in the provision of the means of instantaneous communication, in its usefulness to railways, in its lighting remote localities, and in its adaptation for traction and street railways. More money has been made out of its introduction than in almost any other department of human activity.

In the telegraph business a larger capitalization exists, in proportion to the cost of the material, with a capacity to earn a dividend upon the amount, than in

any other department; while in the telephone, and more recently in the electrical railways, the amount realized is in excess of that from any other investment. It is true that in electric lighting a universal success has not been achieved, but beyond all question a great and useful purpose is being served in the creation of light, for which a profitable and steady demand exists, and which can be supplied through the experience and the improvements attained, as the result of the operations thus far.

The future is full of promise for these undertakings, especially in the value of the franchises, the ability to furnish power; in their combination with the gas industries of the country, which must be only a question of time, and in their ability to promote and to assist in the application of electricity to street railway enterprises. The whole subject of electricity, as applied to business, is full of the deepest interest, and no one who feels grateful for having been born in this age, and enjoying all the advantages of the most advanced civilization, can fail to recognize in this wonderful force the advantageous contributions toward the good of mankind, and hold in high estimation the men who, in so short a period, have so rapidly promoted its introduction and high degree of usefulness.

(There being no discussion offered upon the subject of Mr. Wiman's paper, the President called upon Mr. Allen R. Foote to read a paper upon municipal lighting.)

JUDGE ARMSTRONG: Before introducing Mr. Foote, I feel that it would be a very proper thing for us to say to Mr. Wiman, who has devoted a great deal of research, a great deal of time, and a great deal of consideration to this most admirable paper—I think it would be a proper thing for us to say here formally that we thank him for it. It seems to me that he has taken the right view, the view that we ought to

take, of many of the enterprises in which we are engaged—an obligation owing to the people ; a recognition of the benefits produced, and the demand for a return of consideration from those whom we so serve. It is a very admirably written paper, a paper that I have highly enjoyed ; and I would desire to move a vote of thanks to him for it.

(Motion was seconded and carried.)

MR. WIMAN : I am very much gratified at this action on your part ; and these words of commendation from so good a judge as Judge Armstrong is, have been very gratifying to me.

(In view of the lateness of the hour, Mr. Foote's paper was deferred until Thursday morning, and, upon motion, the Convention adjourned until 10 A. M.)