

National Conference on Standard Electrical Rules, March 1896

MINUTES
Of
First Meeting
Of the
NATIONAL CONFERENCE ON STANDARD ELECTRICAL RULES

Held at the
Hall of the American Society of Mechanical Engineers,
12 West 31st Street,
New York City, March 18 and 19, 1896

JOINT CONFERENCE

Of Electrical, Insurance and Allied Interests, looking toward the Adoption, Promulgation and Enforcement of a National Code of Rules for Electrical Construction and Operation,

Held at the Headquarters of the
American Society of Mechanical Engineers,
12 West 31st Street, New York City,
March 18 – 19, 1896.

Attendants:

Francis B. Crocker, American Society of Electrical Engineers;
Frank R. Ford, American Street Railway Association;
William H. Merrill, National Board of Fire Underwriters;
Francis W. Jones, Postal Telegraph Company;
A. S. Brown, Western Union Telegraph Company;
Alfred Stone, American Institute of Architects;
William Brophy, International Association Fire Engineers;
C. J. H. Woodbury, American Bell Telephone Company;
S. D. Greene and H. C. Wirt, General Electric Company;
Charles F. Scott, Westinghouse Electric and Manufacturing Company;
E. A. Fitzgerald, Underwriters' National Electric Association;
William J. Hammer, National Electric Light Association;
William Brophy, National Electric Light Association;
Harrison J. Smith, National Electric Light Association;
James I. Ayer, National Electric Light Association;
C. H. Wilmerding, National Electric Light Association;
William McDevitt, Board of Fire Underwriters, Philadelphia;
Morris W. Mead, Bureau of Electricity, Pittsburgh;
E. V. French, Factory Mutual Insurance Company, Boston;

A. E. Kennelly;

W. J. Jenks;

E. H. Johnson.

The meeting was called to order at 11.10 A. M. by Mr. William J. Hammer, who said:
Gentlemen, the first thing in order will be to proceed with the election of a Secretary.
There are certain papers to be received and read, roll to be called, etc., and I would be glad to hear nominations for Secretary.

Mr. Ayer: I suggest the name of Mr. C. J. H. Woodbury, of Boston.

There being, no other nominations, Mr. Woodbury was unanimously elected.

The Secretary then called the roll; and as each gentleman responded to his name, he was furnished with a printed copy of the rules to be considered at the meeting.

The Secretary then read the following letters:

The Chairman stated that Mr. Henderson sent a letter, and that Mr. Anthony had also sent a letter stating that he would be in attendance at the meeting; also that Mr. Barton had sent word that he would attend.

The Chairman: The next thing to be considered will be nominations for a permanent chairman of this meeting. The chair is ready to entertain nominations.

Mr. Ayer: I nominate Mr. W. J. Hammer.

The motion was duly seconded; and the Secretary put the question on the nomination, which was carried unanimously.

The Chairman: I would like to call upon Captain Brophy, who has a motion to make.

Mr. Brophy: Mr. Chairman and gentlemen; In making up the list of associations that were to be asked to send delegates to this meeting, I think we overlooked one very important organization, that is, the Associated Factory Mutuals, of Boston. I move that Mr. French, their representative, be asked to represent them here on this occasion. Seconded.

The Chairman: Before proceeding, further, I wish to state that when the matter was first brought up, the committee was not fully conversant with the scope and magnitude of this organization; but we have felt lately that it was highly desirable to have as strong a representation of the insurance companies as possible, and the Factory Mutuals should be recognized in the same manner as other national organizations, as they represent, I understand, something like seven hundred million dollars of insured property and form practically a national organization of great scope.

Those in favor of the Associated Factory Mutual Insurance interest being recognized on the same par with the other organizations which have already been invited according to this list and that Mr. French, who is their chief inspector and represents them here should be recognized as other official delegates, please signify the same saying aye. The motion was duly carried.

Mr. Stone: Are all of these national organizations?

I see some of them are apparently not. I am going to ask if it would be proper for the Pittsburgh and Philadelphia organizations to be represented; some of these organizations do not seem to be exactly national.

The Chairman: I will state that the Pittsburgh organization and the Philadelphia organization are not recognized at all. We have extended a complimentary invitation to gentlemen identified with those interests to attend in their individual capacity, not as representing an organization; but merely to come in an advisory capacity, that they may give us the benefit of their suggestions and criticisms, so that they can cooperate with us in this important work.

I desire to express my heartiest appreciation of my election as permanent chairman of this important gathering, and I certainly trust that we have taken a decisive step towards the securing of the much to be desired result of having one national code which will meet with the full approval of the electrical, insurance and allied interests. The National Electric Light Association has very largely been interested in this work from its inception; and the committee in which I have the honor of being chairman, have taken the initiative in calling together this representation of the organizations interested. Our committee deemed it advisable, in view of that fact, to request that the President of the National Electric Light Association should be present at this meeting and make a few remarks to this body. I therefore take great pleasure in calling upon Mr. C. H. Wilmerding, the President of the National Electric Light Association, to address the meeting.

Mr. Wilmerding: Mr. Chairman and gentleman; it is perhaps fitting that the National Electric Light Association should welcome you here today. As Mr. Hammer has just said, it is

through the efforts of that association's committee that matters have been brought to the present state in regard to the objects of this meeting. The committee of the National Electric Light Association, appointed some years ago, has been working with this end in view a long time; and it is a matter of great pleasure to me, and I think to all the members of this association, that we can say that there is a possibility at the moment of accomplishing the long sought desire. It is, undoubtedly, a very desirable thing that a national code of rules should be adopted. I think that every interest concerned, the central station interest, the manufacturing interest and the insurance interest, acknowledges the importance of this movement. I think that is demonstrated by the unanimous acceptance which we have received to the invitations sent out to join in this meeting and discuss the question. I have no doubt that with the gentlemen we have here today that this object will be accomplished. It may not be a matter that can be done in a day, and I certainly think it will not reach so speedy a conclusion, but I feel sure that eventually we will succeed.

I would like to say in this connection that I believe it would be a desirable thing to constitute this committee into a permanent organization, that the representatives of the interests which have been invited to this meeting make their delegates permanent; and that this committee, or such other delegates as the interests may appoint be known as a board of arbitration upon electrical construction. I think this should be readily accomplished, and I should say, in organizing this meeting, it would be a proper thing to do so in that way; so that, although, of course, it would not be perhaps easy to handle the matter with a full committee, there could be a sub-committee appointed that could meet from time to time, and keep a national code in constant force. We all know that these things are not always permanent. We cannot make a rule today that will last for twenty years; but with a subcommittee and an agreement on the part of the interests represented, that the sub-committee shall have the power to alter the rules as may seem fit from time to time, we will then have something reasonably permanent in its nature, and have rules that the construction and central station interests could look to as being something right. I am speaking as a central station man. We are very often advised to throw out a large stock of material, because it doesn't go anymore; and the permanency of rules would be a great advantage to us, and I should think to the insurance interests as well; to all interests concerned. Gentleman, I hope the results of your deliberations will be in every way successful. (Applause)

The Chairman: Mr. Frank R. Ford represents the American Street Railway Association, in place of Mr. Seely, who has only recently notified the committee of his inability to attend this meeting. Mr. Littell, the President of that Association, sent me word only yesterday that Mr. Ford would represent that Association.

The secretary read the following letter from Mr. Littell:
Brooklyn, N. Y., March 18th, 1896. – Mr. William J. Hammer, Chairman,
Dear Sir: - I have this day appointed Mr. Frank R. Ford to represent the American Street Railway Association in the joint conference of electrical and allied interests to be held March 18th and 19th. Very respectfully yours, (Signed) H. M. Littell, President.

The Chairman: Gentlemen; you have heard the very appropriate remarks that have been made by President Wilmerding. I think that all of us realize that it may be impossible at this meeting, probably is impossible, for us to come to a definite conclusion in regard to this question of a national code "Rome was not built in a day," and this is a question of such magnitude that it may and probably will require the reference of this broad general question to a sub-committee and I think that it is the intention that if such sub-committee should be appointed that they would then report to the various national organizations represented here, from which this body will be formed into a permanent organization. I think before proceeding further it would be well to take

some action on this matter - that someone should make a motion that the organizations which are represented here today shall constitute a permanent organization, so this most important matter may receive their encouragement and assistance in every way that it is possible.

Mr. Merrill: It would be perhaps as well to defer that section until necessity has demonstrated its wisdom. We could then act a little more intelligently.

The Chairman: I think that it is a good suggestion. I merely brought it up so as to get the sense of the meeting, whether it was advisable to take it up at present, or wait until the necessity for such action is demonstrated, as Mr. Merrill suggests. If there is no objection, the matter will be deferred until later. The National Electric Light Association, as has already been stated, has taken a very active interest in this question of rules, from its inception. A statement, I believe, has not been placed on record as to the work which has been done in that direction; and the Association felt at this meeting, called together for this purpose, that it would be as well to have such statement made, and as various parties outside the Association have considered that such would be desirable, Captain William Brophy has been requested to prepare a paper on this subject and submit it at this meeting. I therefore call upon Captain Brophy to read this paper, before we proceed further.

Paper by Captain Brophy: At the convention of the National Electric Light Association held in Kansas City in February, 1890, the first well-directed effort was made towards formulating a uniform set of rules to be observed by those engaged in the business of installing electric light wires and apparatus, which would become universal in their scope, by being adopted by all the insurance boards throughout the country.

A committee of five members of the association was appointed with power to select three representative electrical men to act on a committee for the purpose of devising and adopting national insurance rules, and considering any other matters affecting the joint interests of insurance and electrical companies.

They were also requested and authorized to negotiate with the general insurance organizations throughout the country with a view to securing the appointment by them of representatives of an electric insurance committee; and that the committee of five report the results of its deliberations at the next meeting of this Association.

Pursuant to this plan the Secretary of the committee entered into correspondence with the representatives of the various insurance organizations and with the leading electric light companies of the country; and the result of his persistent and intelligent endeavors in this direction appeared at the meeting of the committee and the representatives of the two interests which convened at the Stockton Hotel, Cape May, August 16th, three days in advance of the first session of the convention of the National Association.

The Committee at its first meeting were met by representatives of fourteen insurance organizations, which represented one hundred or more of the leading insurance companies doing business throughout the United States; also by representatives from the Thomson-Houston, Edison, General and Westinghouse Electric Companies.

A discussion of the proper basis of a code of generic or fundamental rules extended through several sessions, and resulted in an outline representing practically the unanimous views of those present. A special committee presented at the second session a code of by-laws as the basis of a permanent organization, which was, early in the deliberations of the meeting, decided upon as the only practical method of securing and perpetuating an influence sufficiently positive and controlling to be permanent.

The name decided on was the “National Electric Insurance Bureau” and the object as stated by the by-laws to be the “Harmonizing of the electric interests and the fire insurance interests of the United States.”

Provisions were made for the admission of the representatives of the Telephone and Telegraph companies; The National Association of Fire Engineers, and such other insurance representatives as may apply for membership. It was settled that as a method of completing an organization for the following year, the committee chosen by the National Electric Light Association and representatives of the other organizations, having been called together by the original committees, should be members of the Bureau until the next meeting, or until their successors were chosen.

A President, Secretary and Treasurer, together with an Executive committee, were chosen. A sub-committee was chosen to outline a code of rules. This committee was instructed to codify such rules as were then in force by any of the state or local boards throughout the country, and by such light and power companies as may have given careful thought to this matter, and add thereto such matter as was necessary by changed conditions and methods of producing and distributing electrical energy.

The committee of five reported the progress made to the convention and asked for more time to complete the work, which request was granted.

In the meantime the sub-committee appointed by the newly organized “National Electric Insurance Bureau” went diligently to work to perform the task assigned them.

At the next convention of the Association, held in Providence, R. I., a standing committee of five members was appointed by the President “to formulate” and from time to time revise instructions to be known and published as “Instructions of the National Electric Light Association for the Safe and Economical Wiring of Streets and Buildings for the Service of Electrical Light and Power, and for the Proper Inspection and Maintenance of the Same.” Two of the members of this committee were members of the National Electric Insurance Bureau, and they continued their labors in connection with the other members of the “Bureau” in completing the National Rules then well underway.

Just previous to the time set for the convention of this Association held at Montreal, Canada, the Code of Rules was completed and presented to the full committee for approval. A few slight changes were made, and they were then presented to the committee and by it adopted. They were also adopted by the Western Union Fire Underwriters Association and the Fire Underwriters Association of the Northwest, and generally accepted by all such associations throughout the country.

The National Electric Insurance Bureau as organized at Cape May has never been called together by its President since its adjournment, and as a result the electrical interests of the country have been excluded from any participation in the formation of the new or the amendment of old rules for safe wiring.

The Standing Committee on safe wiring appointed by the National Electric Light Association has always been ready to answer any call from the President of the National Electric Insurance Bureau, and to do their best to promote harmony that should exist between the electric and insurance interests. But they have been given no opportunity to do so. As an evidence of that desire this second attempt has been made to continue the good work inaugurated by the National Electric Light Association and it is our hope and desire that the deliberations of this body here assembled will result in an organization National in its scope and the result of whose deliberations will be cheerfully accepted and complied with by all those engaged in the

distribution of electrical energy, those engaged in electrical construction and the Fire Underwriters.

Such is the history of the attempt to “Harmonize Insurance and Electrical Interests” inaugurated by this Association. If the attempt has failed, such failure cannot be due to lack of effort on its part or the part of its representatives.

Mr. Brophy: Two members of that electrical bureau, Mr. McDevitt and Mr. Jenks, are here; and perhaps they may wish to add something to what I have said.

The Chairman: If there is no objection, we would like hear from Mr. McDevitt.

Mr. McDevitt: Mr. Chairman; All I can say in addition to what Mr. Brophy has said is that what he states did occur; and I remember that at the meeting at Cape May there was a large representation of insurance men there. Our proceedings went on very harmoniously, and the formation of the rules at that time was satisfactory to all interested. I believe at that meeting Major Bliven, an insurance man, also President of our Association was made chairman; but Mr. Brophy says they were never called together after that time.

I have always been strongly in accord with the objects for which we are called here today, and while I represent insurance interests, I believe that electric light people have a just right to come and take part in what laws we are framing, which might interfere with them. I do not come here as representing any particular association. I feel that I come here in an independent capacity; and I say again that I believe the object here is a worthy one. I am connected with the National Bureau of Electrical Inspectors Association, and at the first meeting of that Association I suggested that representatives of electric lighting interests be called in; but it seemed to be opposed by some, notwithstanding that the President we elected there as chairman of the meeting that has just been spoken of. That is all I can say; that I can back up what Mr. Brophy has read, as I took part in those proceedings.

The Chairman: We would be glad to hear from Mr. Jenks, who had an intimate relation with that early work.

Mr. Jenks: Mr. Chairman; The work which the National Electro-Insurance Bureau did in 1890 may, I think, will be accepted as one of the foundation stones, at least, of what we shall probably do today. The articles of association, which the National Electro-Insurance Bureau drew up at that time, might, if it be desired to make a permanent organization of this body, fittingly be adopted by us, so wide were they in the breadth of their scope and in the generality of their application to the conditions which we still find existing among the insurance people and the electrical interests. The work which the codifying committee of five members then chosen did during 1890-91, has been accepted as the ground work of what are recognized as the various codes, which may be said to have followed from what was first called the national code; and if we shall do anything which shall be useful, and shall help to bring this national code up to the times, we shall, perhaps, have done all that we can expect to do; that is to say, if we take the national code as it has been brought down to the present, and by the action of such a committee as was then formed, very carefully revise it, we shall still have the same structure, but trimmed and brought up to date, in a way that will commend its more general adoption and better interpretation for the future, so far as we know. Those of you who were familiar with the work which was done at the time will remember that the sentiment which pervaded the committee and the working members of the committee who brought about the adoption of the code, was that the tendency of insurance rules should be toward a simplification of the mass and the material. It would be a tendency toward the condemning of bad practices, rather than toward an educational book for the use of wireman and other constructors; and in so far as I have done anything in the

past, and in so far as I may help to do anything in the future, in this line, my desire shall be to make these rules as short as they may be made; to make them a statement of what must not be done, rather than an educational pamphlet as to how people shall do their work. The electric light people and insurance people, if they combine in a work of this kind, must combine to issue as I think I have said before in this room, a series of insurance commandments, each of which shall begin, as did the Decalogue which Moses received, "Thou shalt not." If we get down to that idea, I believe we shall find that we shall simplify the work, and shall continually still further simplify it as time goes on, because less and less, as time goes on, will the insurance men be compelled to do what our friend Captain Brophy used to do, travel as a missionary from town to town, to teach people how to run their wires; how to wire their interior work, and exterior line construction. I hope this idea of a permanent organization will be approved; and I think it might well proceed upon the lines laid down six years ago by the National Electro Insurance Bureau.

The Chairman: Does any other gentlemen care to speak on this subject before we proceed? I would like to have the Secretary read the statement that is made on the back of the front cover of these rules. These books have only just come from the printers; and I do not know whether the gentlemen are acquainted with what the pamphlet says. After it is read, I will make one or two remarks, and then the meeting will be open for suggestions as to the best method of proceeding in handling the various matters to come up for our consideration.

The Secretary reads the matter referred to on the inside of the cover of the book of rules.

Mr. Mead: Mr. Chairman; a little explanation is probably necessary as to why the copies of the Pittsburgh rules are not here. Beginning with last September we had printed first five hundred and then one thousand copies of the manuals, which contained, in addition to the rules – those adopted by the Underwriters' Electrical Association, a copy of all the acts under which we operate, beginning with the State Legislative acts creating the charter, and then the ordinances creating the Inspection Bureau, which was followed by the ordinances covering the inspection of electric railways and all forms of wiring, including underground work, together with the forms used. The manuals were all gone when I left Pittsburgh, with the exception of those in the hands of the inspectors themselves. I telegraphed for them to one of our inspectors, and expected to have them sent; but he has been taken sick and I am afraid the rules will not arrive before this meeting adjourns. We are about to prepare another manual, which will contain the information I speak of, with all the forms specially prepared for the use of our city. We expect to incorporate in that manual any new rules, which may be adopted here. I believe, however, from the policy of the meeting and the probable course of events that it would be wise to adopt a new code now; but that the matter should be referred to a committee and a gradual development made. Such conditions as practice has brought to our attention we have made note of, and expect to incorporate in our book; so that our next meeting or shortly after I will mail to the delegates in attendance at this meeting a copy of that manual.

The Chairman: There is a copy of the Pittsburgh rules here, which I originally secured from Mr. Mead. It is exactly the same thing as he would have received from Pittsburgh. I will also say that through the courtesy of the editor of the Electrical World we have a copy of the latest German rules, which is a rough translation made of them; and there is quite a large amount of matter here relative to other rules used in this country and abroad.

I will say in connection with the preface that was read that wherever it was possible the subjects were put on parallel columns. In some instances, however, especially in the case of the foreign rules, it was difficult to do so; and if you will note at the head of the last column on the first page it says: "All sections not marked (P. R.) are Board of Trade Regulations. (English)"

(P. R.) are Phoenix Rules.” These two sets of rules were put in the last column in order not to make the book too unwieldy and large. It is easy to tell which rules are referred to, by noticing whether the (P. R.) is stated on them or not. I may call attention in this connection to the fact that Mr. Musgrave Heapy, who is largely responsible for getting up these Phoenix rules, sent me a couple of copies of them; but at the time it was put in the printer’s hands there was only one copy obtainable, and it was difficult for the printer to get it in easily (they usually require two copies) and it took a great deal of extra trouble and time, and made it a little difficult to get all the matter in there on the comparative basis; but it has been done to as great an extent as possible.

You will notice also under the heading of the National Board of Fire Underwriters and Associated Factory Mutual Insurance codes that the different sections are numbered; and in some cases the numbers jumped from 24 to 26, and 41 to 43, etc. That is done, because in preparing the comparative code the different sections have been put in so as to come under the heading of subjects, and the original numbers have been left on, so that, if it is desired in the discussion, reference can be made to the original sections in the separate copies of the American rules which you have received.

I might say that the English Board of Trade rules were issued only a few days ago, and the copy which was used by the printer was taken from the English press; but three different sets were compared as printed in the English papers, so that it may be safely considered that we have as nearly as possible the latest two of the English codes; and as before stated, we have also the latest German code. If it is desirable at this meeting during the discussion to call up particular sections, outside of what is embodied here, we have the matter at hand. If it is considered desirable that this matter should eventually be referred to a sub-committee to prepare a code of rules, all this matter bearing on the subject will be turned over to that committee for consideration.

Gentlemen: Are there any further remarks on this subject; if not, the chair will be glad to hear suggestions and a very full discussion, as to the best method of procedure in handling the matters before us. There are peculiar questions involved, and while our committee have not discussed them thoroughly, we at the same time feel that the matter should be brought before the meeting and a consensus of opinion secured as to the best methods of procedure; whether we should take it up and digest as much as possible, and refer it to a committee, or endeavor at this meeting now to conclude a National Code. I wish to say at this point that the American Institute of Electrical Engineers were to have held a meeting tonight at these headquarters, and they have very courteously postponed their meeting for a week, in order to enable this meeting to hold an evening session if it is desired.

The American Institute of Mechanical Engineers have extended to this committee the use of their rooms today and tomorrow, if we desire them. We therefore have considerable time to discuss matters at this meeting.

Mr. Merrill: In further explanation of the publication of the different codes, I will inquire what the italics given to the National Board Code are intended to signify? On the second page, the word “approved” is italicized throughout the rules. I see that you have also italicized the end of a number of sections and paragraphs. Is that intended to show the changes, which have been made to the National Electric Light Association rules?

The Chairman: No, sir; there has been nothing of that kind done. It is just as it is in the original.

Mr. Merrill: I refer to the type.

The Chairman: The type is the same as in the original; and you will find wherever the italics are used, it is so in the original copy.

Mr. Merrill: Rule 3, section (c) "such as glass or porcelain" in this copy I have are in italics. Rule 3, section (c) "except that 'bus bars' may be made of bare metal" is italicized. I suppose that is done to show the changes made to the National Electric Light Association rules. I want to bring that out.

The Chairman: When this matter was put into the hands of the printer, he asked whether the same style of type should be used all the way through, or whether it was necessary to have half a dozen different kinds of type. He was instructed to use a single style of type as far as possible. There was no part to be put in italics to show any changes. It is either in the original copies or was done through the error of the printer.

Mr. Merrill: I think it is done to show the additions that are made to the National Electric Light Association code.

The Chairman: If that is the case, it is in the original.

Mr. Merrill: The word "approved" is italicized. Comparing the rules on "Conductors," section (c) of the N.B.F.U. code show the words "such as glass or porcelain" in italics. This matter is an addition to the National Electric Light Association code. They are in italics and show an addition. I think it is good thing.

The Chairman: The printer who printed the rules for the National Electric Light Association, is the same party who did the work for the National Board of Fire Underwriters' code; and he prints codes for associations all over the United States. I do not know how it comes there. It was not by suggestion of our committee, and comes from some other source. I assure you that it has been some influence with the printer that has not come from our committee.

Mr. Merrill: That is the idea. I think it is self evident that it is used to show the difference in the two codes.

The Chairman: I don't think there is the slightest objection to it.

Mr. Merrill: I simply wanted to bring out the explanation. The word "approved" is italicized throughout.

Mr. Stone: I am perhaps as much an outsider as anyone here, but before we proceed very far in this matter, it has occurred to me, in looking over the list, for instance, that there are certain manufacturers represented here, and certain others that are not. As I understand it, your idea was that this should be an organization made up of delegates from other organizations, and they should form an organization of their own; the representative any society being, for the time being, a member of that organization. Now, it occurs to me, before we proceed to form such an organization made up of delegates, that we should be careful and circumspect as to the bodies to be represented in this organization; very careful indeed. I inquired about the Philadelphia and Pittsburgh interests and was very properly answered that they are not national organizations in their character. I would suggest, if this is a proper thing, that upon the floor here, or preferably by a committee to be appointed, that we should select the organizations which should be represented in such an organization as this. If we are to have the manufacturers represented here, then I think the manufacturers throughout the country should be carefully looked over, and see whether we have not by mistake omitted some that should be represented. Then there is another question I would raise, but not with a desire to shut out anybody; whether it is desirable to have manufacturing corporations admitted to an organization of this kind, persons who are interested in the manufacture of certain articles for use. I think if we are going to make this a national organization, made up of delegates of national societies, we should be as careful to be inclusive

of those who should be here, and exclusive of those who ought not be here, as possible. I do not pretend to pass in judgment; I am unable to do it. Perhaps the better way would be to appoint a committee. I think the moral force of what we do depends on whom we represent. I hope that either as a body we should take it up and discuss it, or else appoint a committee for the purpose of selecting the societies whom it might be desirable to ask to be represented by delegates in the organization which I hope may be made permanent; and that we shall be very sure that we have every society here that ought to be here, and as I said before that we exclude all societies which ought not. I do not mean to exclude anybody who ought to be invited.

The Chairman: I think it is proper to make a statement that will clear the atmosphere in regard to the question of organizations and complimentary delegates. I think Mr. Stone's suggestion is an excellent one. I would like for his information to state that the Philadelphia and Pittsburgh organizations are not represented here; practically are not recognized, in their standing as national or city organizations, or anything else. We have said as a committee that Mr. McDevitt and Mr. Mead have both been identified with these insurance matters and the preparation of the code of rules, and the technical questions coming before this meeting, for such a length of time, and have done such admirable work in that direction, that we asked them to come here in an advisory capacity, simply as complimentary delegates; not coming here to vote upon the important questions before us – questions coming within the province of these national organizations only – but to come in advisory capacity solely as individuals. In addition to such gentlemen, as these two, we have said, there is Mr. Kennelly, who is an independent consulting engineer. He has done admirable work in connection with the question of temperatures compared with the volume of current, and his tables on the carrying capacity of wires has been recognized as a standard all over the world. Mr. Kennelly is an exceedingly able man, and we have asked him to come and give us the benefit of his suggestions, to strengthen our position. There are a number of gentlemen who have been invited in this way, and there are a lot who should have been. As soon as our committee went outside the national organizations and said we will invite complimentary delegates, it was almost impossible to draw the line. There have been organizations that it was suggested should be invited, but it was objected that they might come in here and have some axe to grind and might use their influence to dominate this meeting. Personally, as chairman, having gone over a great deal of preliminary work, I felt that the movement was on a higher plane than anything of that kind, and I did not believe a gentleman would come here and have such poor taste if he represented a manufacturing interest, and was invited in his individual capacity, to in any way bring matters before this meeting that were offensive, and if he did, I was sure the presiding officer would shut him off, or somebody in the meeting would do so. This has been a difficult thing for us to handle; and I assure you the committee had only one point in view, and that was the main question, of securing this much to be desired result of one national code. At a late day, after full discussion, it was decided to invite a number of capable men, men of high standing in the community, of large experience in the practical questions which come before us, as Mr. Jenks, Mr. Mead and others, who have long familiarity with the codification of rules of this kind and with this movement from its incipiency; and it seems to me that the chair ought to state this emphatically. I have endeavored to do so, in order not to let anyone here, or outside if we could help it, feel that the meeting was packed, or that any discrimination was shown against any particular interest. That is the position our committee has tried to take. We have been placed, perhaps, in a difficult position in regard to this question of complimentary delegates. There may be someone here who will agree with Mr. Stone as to the advisability of the appointment of a committee to take up the question of the

recommendation as to what organizations should be incorporated in this final association; and the chair will be glad to entertain any motion.

Mr. Stone: I think the bringing of these gentlemen in is just the thing. I was only speaking now of what I hope will become a permanent organization; and I should hope that whenever we had a full meeting of the delegates of the permanent organization we should have the advantage of the presence of such gentlemen with us always, and that the committee which had the matter in charge would invite them to be present. I only meant that my remarks should apply to the suggestion which came from the chair, that in the permanent organization we should determine pretty closely upon what lines we would make the organization, and then be inclusive – to be sure that we included all that came under the category; not by any means to shut out ourselves from the advantages which I feel we have in the presence of the gentlemen whom have named, and perhaps you have not named, who have been invited to meet with us. It might be better, I do not know, but it would make it more inclusive, to simply include national organizations. There is one organization I know nothing about at present –the Western Electric Company. It is not represented here, and the Westinghouse Electric and Manufacturing Company is. I do not make these remarks with any desire to criticize; but I think if we are going to invite manufacturing corporations to send their delegates here, and to be part of the permanent organization, then I think we ought to be sure to invite them all on the same plane. I do not know whether the Western Electric Company is on the same plane with the others or not. However, in the formation of the permanent organization these questions should be carefully considered; we should carefully consider what societies should make up the permanent organization; not by any means to ask that the people here should not be here; on the contrary, I should invite these gentlemen, and know we shall derive great benefit from their presence.

Mr. Greene: I think everyone will agree with Mr. Stone that the success of any permanent organization will depend very largely upon the organizations which go to make it up, and on the discretion which, as Mr. Stone properly says, is shown in excluding as well as including the organizations to be represented. While I represent a manufacturing company, I appreciate fully the force and the meaning of what he says. I would move, therefore, that a committee of five, if that number is agreeable to the delegates present, be appointed by the chair to consider the best method of forming a permanent organization, with instructions to report after lunch.

The Chairman: It is moved and seconded that a committee of five be appointed to take this question of a permanent organization, and recommend a list of organizations which should be invited to co-operate in this permanent organization to be effected.

Mr. Greene: I did not intend to make my motion as specific as that - they are simply to report with recommendations as to the forming of a permanent organization. That committee might not in its first report be able to say what organizations it would want to include; let it merely make a recommendation as to the methods to be adopted to secure a union of interests.

The motion was put and carried.

Mr. Mead: It struck me that, in speaking of Mr. McDevitt, of Philadelphia, Captain Brophy, of Boston, and myself of another city, it is a good thing to have city representatives and forces of that kind, which can congeal the political powers and bring about an enforcement of the rules you may adopt. There are different means of enforcing these rules. The Board of Underwriters has a strong power in one place, and in other places you want the legislature, the ordinance and law effect, as we have in Pittsburgh. I would not put the rules on a basis of “Please, will you.” Let us say, “We want to help you, and you must do as we say; but if you do

wrong we will be after you.” The force of city ordinances will help in all these directions. If we find it necessary, we can bring the force of the legal powers to help us enforce the rules. They should not be set up as a picture to be looked at; and those connected with the legal departments of the city can assist us in compelling the enforcement of the rules you may adopt. Such rules will have a more beneficial effect by the backing up of legal expression, and delegates from different cities will be helpful in that line, at least. It is not particularly important whether the complimentary delegates have a vote in this convention or not; but we desire to assist you in carrying out what you adopt; if necessary, by force of local laws.

The Chairman: That is highly desirable. Captain Brophy made some remarks to me this morning relative to action in New England in regard to this matter. We should be glad to hear Captain Brophy on the subject.

Mr. Brophy: In the state of Massachusetts today each city is obliged to appoint an inspector of electric wires. We are now perfecting that act, and amendments are now pending. From experience in Boston, and previous experience with insurance companies, I want to say most emphatically that I never found any difficulty with the men legitimately in the business they are ready to do what is right. They are ready to do this in Boston today; but we have certain men who are not legitimately in the business, and many of them do not know how to perform the work; but will undertake to do what they know how to do and for less than the cost of the work if done properly. They never notify the insurance board or the inspector of wire, of their intention to do such work, and steadily try to conceal the fact that they have done it; and from the objectionable work of these people we expect trouble in the future. We propose to reach them in some way or another, and the amendments now pending to the law will reach them. That can be done, as Mr. Mead says, through municipal bodies; through municipal force; the fire department in New York and other departments in other cities.

In Boston we are putting wires underground. We have a class of men who go to certain men and say, “Your telephone wire is down.” He answers, “Yes; the wire department won’t allow us to put it across the streets and we had to discontinue it until we find some other method.” Then he says to the person, “Why, I have the right to string wires across the streets of the city of Boston from the fire department. I can put your wires back.” He puts them back and gets paid. The wire department inspector comes along and takes it down. That is a specimen of the people we have to deal with in Boston. Bye and bye we will have those fellows behind the bars.

The Chairman: I will appoint as the committee to recommend a method of permanent organization Messrs. Stone, Greene, Merrill, Brophy and Crocker.

Mr. Greene: I move that we adjourn until two o’ clock.

The motion was carried.

Wednesday-----Afternoon Session

Chairman Hammer called the meeting to order at 2:10 o'clock.

Mr. Woodbury: Mr. Chairman and gentleman; I am a non-resident member of the Engineers' Club of this city. I endeavored to procure for you cards of invitation to the club during the noon hour, but was unable to do so, owing to the absence of every member of the house committee. However, if any of you choose to accept the privileges of the club, I should be happy to introduce you there, and after this meeting adjourns you can go over there and enter your name, even if we do not get the desired signature. The Engineers' Club is at No. 10 West 29th Street, diagonally opposite the Gilsey House, and directly opposite the Lawyers' Club. You will find it a very pleasant place to stay, and I trust to see many of you there.

The Chairman: If the committee is ready to present their report we call –

Mr. Merrill: I merely wish to move a vote of thanks to Mr. Woodbury for his kind invitation. Carried.

The Chairman: We will now have the report of the committee on permanent organization.

Mr. Stone: The committee appointed to recommend a plan for the permanent organization of electrical, insurance and allied interests have taken liberty to add to that which is upon the program the words "including municipal authorities having supervision of the same." I should say that this matter of municipal authorities was included in the hope that before long there will be inspectors of municipal electrical bureaus or something of that kind, which will be interested in the work we are doing, and if there should be, we hope that they will form an organization, and desire to be represented in this body.

The Chairman: Action will be deferred until the report is handed in the proper way.

Mr. Stone then presented the report as follows:

The committee appointed to recommend a plan for a National Organization of Electrical, Insurance and allied interests including municipal authorities having supervision of electrical work, beg leave to unanimously report: -

That in view of the good results already obtained, and the pertinent suggestions brought out by the discussion, your committee recommend that it is desirable to hold future meetings for conference, and that the organizations here represented be, and they are hereby requested to continue their representation by the annual appointment of a delegate and that in addition thereto the following organizations be invited to annually appoint delegates to attend future conferences, namely,

American Society of Civil Engineers.

American Society of Mechanical Engineers.

American Institute of Mining Engineers.

American Society of Naval Architects and Marine Engineers.

National Master Builders Association.

The representatives of those engaged in the manufacture of electrical apparatus shall be termed associate delegates, and shall have all privileges, except the right to vote upon rules.

National Conference on Standard Electrical Rules, March 1896

The conference shall have the right to invite to its meetings persons skilled in the subjects under consideration but their privileges shall be limited to the presentation of papers and to the discussion of subjects.

New York, N. Y.
March 19, 1896.

Alfred Stone.
Francis B. Crocker.
William Brophy.
William H. Merrill, Jr.
S. Dana Greene.
C. J. H. Woodbury.

Mr. Greene: On the question of signing, the committee are unanimous; and if there is to be any discussion, it seems to me it would be well to discuss the report now, and get it out of the way.

Mr. Ayer: I move that the report be accepted. Carried.

The Chairman: I think it will be desirable at the present time if any gentlemen present desire to call attention to any point in the rule as they are read, for them to do so. There are various questions, even if they are referred to a committee, which it would be well for us to thrash out to some extent. To open this discussion I should like to call upon Mr. Kennelly, in reference to the table of capacities of wires. On page 15, according to the Brown & Sharpe, the Birmingham and Edison standard gauges, the capacity of a 0000 wire is given by the National Electric Light Association code and the Associated Factory Mutuals Insurance code at 175 amperes. The National Board of Fire Underwriters code places it at 218 amperes. The Associated Factory Mutuals Insurance companies had before them the question of increasing the tables, but they have considered it unadvisable, at any rate at present, to go beyond the original limit recommended in Mr. Kennelly's report. This is a very important matter, and one to which Mr. Kennelly has given a great deal of attention. I think it would be well to secure an expression of Mr. Kennelly's opinion as to the advisability of changing the original ratings.

Mr. Kennelly: I did not expect to be called upon so early to make any remarks, but I hope I can give assistance in reaching a decision upon this matter. You will remember that the rules which were issued in 1888 by the Committee of the London Institution of Electrical Engineers for the reduction of fire risks in electric lighting, practically specified that the limiting current strength that a wire should carry in house wiring installations was such as would raise its temperature 10 degrees C. or 18 degrees F. This was not the language of the rule, but was substantially its purport. The table of safe carrying capacities of wire appearing in the code of the National Electric Light Association and also in the code of the Associated Factory Mutuals Insurance, practically embodies this specification, according to my own measurements of the electrical heating of wires in wooded moulding.

It must be admitted that this specification of 18 degrees F. temperature elevation after continuous full load, and these tables of wires and currents thereon based, allow a very wide margin of safety in the heating of wires. When the rules were adopted many practical installation men objected to this rule as being unnecessarily stringent and as calling for a greater expenditure in copper than was sometimes necessary for the regulation of voltage.

A wire may be admitted to be safe at a safe temperature, so far as fire risks are concerned, when the hand can be steadily closed upon it. The limiting temperature at which the hand can be borne upon a wire in this manner is about 50 degrees C., or 122 degrees F. Taking this as the

safety limit, and the summer temperature as 30 degrees C. or 86 degrees F., the safe temperature elevation that can be allowed for a wire is 20 degrees C. or 36 degrees F.

The table of wires in the National Electric Light Association and Associated Factory Mutuals Insurance codes allows a margin of roughly 50 percent in current. Thus, No. O. B. & S. wire, which is marked in the tables as having a carrying capacity of 100 amperes sufficient to raise its temperature 10 degrees C., would carry one hundred and forty-five amperes steadily before it reached a temperature elevation of 25 degrees C.

I presume on account of the large margin of safety left by the original rule of the committee of the London Institution, the National Board of Fire Underwriters amended its own rules and changed the table of carrying capacity to that shown in column II, under the National Board of Fire Underwriters code. This table adds 25 percent to the first nine currents in concealed work, and represents an elevation of temperature amounting roughly to about 14 degrees C. or 25 degrees F. at steady full load.

The recently issued rules of the British Board of Trade call for a maximum temperature elevation of 30 degrees F., or about 17 degrees C., and are equivalent to a still further increase in the permissible current strengths, and a corresponding reduction in the margin of safety.

Mr. Stone: I would like to ask if there is any difference in the matter of disintegration or injury to the insulation of the wires by any increase in the heat above 16 degrees C. or 25 degrees F.?

Mr. Kennelly: I am not aware that there is any danger at a temperature below that at which you can hold your bare hand upon a wire.

Mr. Greene: It seems to me that this question resolves itself into a question of what is a safe current carrying capacity of wires. Certainly, from the information given by Mr. Kennelly the carrying capacities as shown in column 1, are very conservatively rated and there is a large factor of safety, considerably larger than is the case with the capacities given in table 2. Of course, if people are willing to pay for the additional cost of copper, it is always desirable to have a large factor of safety, but as a rule, they do not wish to spend any more money than necessary on copper.

The tables, both in column 1 and 2, show the maximum capacity in amperes, but do not give the corresponding maximum temperature rise of the wires, and after all, that is the practical point which should be known. Generally, it is common practice today to guarantee electrical apparatus for certain maximum temperature rise above surrounding air under full load conditions of service, the usual guarantee being forty degrees C. or seventy-two degrees F. It will be seen that there is a great difference between this rise and that mentioned by Mr. Kennelly as having been used in compiling table No. 1. It would seem that thirty degrees C. (which is fifty-four degrees F.) rise could not be excessive for maximum temperatures in conductors, and if the table of carrying capacities were made out for both open and concealed work, and it was specifically stated that the tables were made out on the basis of a maximum temperature rise of thirty degrees C., I think it would be much more satisfactory to everyone. I think it is quite proper that there should be a distinction between open and concealed work, because it is a well known fact that the conductor can carry a larger amount of current when "open" than when concealed in a moulding, with the same temperature rise in each case. It certainly must be confusing to a layman to see two such tables as those given in column 1 and 2, with such large discrepancies in the current carrying capacities in wires of the same size and with no explanations given.

Mr. Scott: In connection with the subject we have been discussing, fuses are mentioned. In fact, the table of carrying capacity of wires is given under the heading of "Safety Fuses." It

states on page 14 that "safety fuses must be so proportioned to the conductors that they are intended to protect that they will melt before the maximum safe carrying capacity of the wire is exceeded." Going on a little further the implication seems to be that the fuse is to melt before the safe carrying capacity of the wire is exceeded, and this table gives the safe carrying capacity of the wires. Therefore, if that is correct, a 0000 wire should be protected by a fuse that will melt with a current of 175 amperes and the normal current which could be carried on such a circuit would be much less than that; possibly not over half as much, if a sufficient margin is allowed between the normal carrying capacity and the number of amperes which will melt the fuse. The current which the wire will carry normally must, of course, be in perfect safety to the insulation on the wire, and the wire itself. The difficulty comes from abnormal conditions. These conditions are to be protected by the fuse. The safety device in this case seems to be of equal importance to the exact rating of the wire, and the wire can readily be permitted to carry a greater current if the safety device can be relied upon.

Mr. Kennelly: I think the suggestion of Mr. Greene is an excellent one. The common sense plan to be to make a rule something like the British Association rule, that the wire should not be heated more than so many degrees C. or F. above its normal temperature by a full load current. The British Board of Trade rule is 30 degrees F. The rule in the National Electric Light Association and Associated Factory Mutual Insurance codes is 18 degrees F., while in the National Board of Fire Underwriters code it is 25 degrees F. The rule which would take it up to the temperature at which you could bear your hand on the wire would be 36 degrees F. If you decide upon some temperature beyond which the wire should not be heated then it is easy to determine the current strengths to fit it. It seems to me that it is rather obscure to simply state a list of currents and not give any reasons why the currents are adopted.

The Chairman: I would like Mr. Kennelly to make the recommendation of 30 degrees, if he would consider that was, in his judgment, the proper temperature.

Mr. Kennelly: I do not know that I am qualified to make a statement that 30 degrees is the proper temperature. The first question is whether you are going to allow a wire to carry a current where there is no margin, and depend upon the fuse. Are you going to have a current that will just permit you to bear your hand upon the wire in summer, with a temperature elevation of 36 degrees F.? If you do, you have very little margin for accidental overload, when the fuse does not protect the wire. If you are going to allow some margin, the Board of Trade rule is a good one - 30 degrees F.

The Chairman: You think it would be a conservative margin, from 30 to 36 degrees?

Mr. Kennelly: It would leave a margin of say, 20 percent in current for overload.

The Chairman: The question we should consider is whether 20 percent is safe, or whether we should recommend 40 percent.

Mr. Kennelly: 20 percent is about the margin the English Board of Trade gives for attaining the limiting temperature at which you can keep grasp of a wire in summer time.

Mr. Greene: I do not want to attempt to shut off discussion on this matter, for it is very useful; but it seems to me at the points brought up in connection with the wiring tables and the point by Mr. Scott as to the possible proper interpretation of the wording of the wiring rules with respect to safety fuses as related to the capacity of wires, brings to mind the fact that we shall require many more days than two to arrive at any satisfactory solution of these questions, if indeed we could ever all agree here in joint discussion. It seems to me that if we intend to take up these rules systematically and intelligently, to decide whether or not they are correct as they stand, or whether they can be simplified, or whether the developments of the years since they were first

promulgated require some additional rules, the only satisfactory way in which that can be done is by a sub-committee. I bring the matter up now, because I feel satisfied that we shall have to resort to that plan for a final determination of these matters. While I think it is an excellent idea to bring out these points for discussion here at this time, it seems to me that if we are satisfied that we are going to have a sub-committee eventually, we might as well appoint it now, so that the committee can get their ideas together and listen to the discussion, with the object of applying it to their work when they start. With that in view I move that a sub-committee be appointed by the chair, for the purpose of reporting to this meeting, upon the whole question of rules covering the use and application of electricity, and that the following organizations be represented on that committee:

American Institute of Electrical Engineers.

American Street Railway Association.

National Electric Light Association.

American Institute of Architects.

Underwriters National Electric Association.

It will be noticed that these are all national concerns. None of them are connected with the commercial production of apparatus or of electricity itself, and it seems to me that they are all vitally in the preparation and revision of the rules.

The Chairman: I will make a suggestion for Mr. Greene to consider. If the National Board of Fire Underwriters and the Underwriters National Electric Association are included, could not one delegate represent both organizations? The latter is the association of inspectors and employees of the National Boards and one delegate could represent both organizations. Then if the Associated Factory Mutuals are invited, which represents seven hundred million dollars of insured property, we could get a representation of all the interests.

Mr. Greene: I think it is a good suggestion, and accept it; and amend accordingly.

Mr. Merrill: It does not seem to me that the committee suggested in the report handed in is too unwieldy. It is not too large; and very likely some of the delegates appointed on the sub-committee will not be present during all the discussion; and it seems to me the committee may wisely be enlarged to include ten members.

Mr. Greene: In my experience with committee work, if you go beyond six or seven members the committee becomes unwieldy and it is difficult to get a full meeting present. It seems to me if there is any work to be accomplished the smaller the committee, the better, within certain limits.

Mr. Merrill: My only point in that this committee is going to be a very important one, and we should be careful not to offend any organization.

The Chairman: My understanding is, that if the committee is appointed, when it reports it shall report back to this organization of twelve associations; and in the interim I presume any one who is interested will receive a copy of the paper and send any criticisms they like to the committee.

Mr. Greene: My resolution is not that it shall have full power but is to report to the associations here represented.

Mr. Merrill: Speaking solely for the insurance interests I believe that it would be to include the Underwriters National Electric Association separately. I consider it would further your ends.

Mr. Greene: I am perfectly willing to do that – make it seven altogether. I make that amendment.

The Chairman: The motion of Mr. Greene has not been seconded and it is hardly open for discussion.

Mr. Ayer seconded the amendment.

The Chairman: Any further suggestions or criticisms on any of these names?

Mr. Jenks: Do I understand that this committee, when chosen, is to be a representative committee of this organization, not yet formed?

The Chairman: As I understand it, they are to have no power in themselves; they are to recommend a final code to these 12 or 13 organizations that are to form the permanent organization.

Mr. Jenks: Then would it be really in order to choose the committee, before the organization itself takes shape? It does not seem to me proper that it should.

Mr. Greene: My idea was not that it should necessarily represent a future organization, but the present meeting. We are meeting here now as delegates from certain organizations, and it seems to me it is certainly in order for the committee to appoint a sub-committee, which may or may not be later instructed to report to a permanent organization.

The Chairman: That would be merely pertaining to this particular meeting.

Mr. Greene: If this meeting desires to form an organization which will be permanent, resulting from this meeting, that committee will naturally report to this organization, or the committee could be modified by the permanent organization; when formed, if not satisfactory. My idea in suggesting the committee is that the sooner the men are appointed, so that they know who are to form the committee, the sooner the discussion will begin to take some form. What is the objection to having the permanent organization made now by these interests?

Mr. Ayer: I would like to say a word in explanation of the condition, which presents itself. We have here now all the interests relating to this matter, except a few organizations which are added in the proposed permanent organization. This is fairly a representative organization of the interests that are affected by the work that is to be done. These other institutions invited to participate in this thing may or may not care to send a representative. They probably will; but in no particular case is their interest so prominent and conspicuous as are the interests here represented; and I think, while it might be more formal to have a meeting of a representative from everyone of the organizations constituting this body, prior to any work going ahead the delay incident to this, which means the calling of another meeting to get under way, would not be justifiable in view of all the facts.

We have gotten in shape the rules as printed – five different sets. They may be sent out over the country by the committee suggested here, which is certainly a representative committee of the interests which are affected most vitally, and who are most interested in the adoption of permanent rules. This sub-committee can send these various rules to the different associations of fire underwriters in the several states – the municipal electricians, electrical boards and other similarly interested parties, a list of whom would readily be suggested when they get to work, asking for their criticisms and comments and suggestions on these rules. That will bring in a mass of stuff, which it will be for them to edit, and will bring the matter into such shape as to enable anyone to get the best set of rules. This sub-committee can get the results of all the sources of information tabulated and arranged so that the matter can be acted upon quickly and intelligently by the larger body. It seems to me that we should establish this national code as soon as possible. I do not think exception would be taken to the proceedings if they were carried out in that way. The work to be done by this committee would hardly be called in question in a general way by those sending delegates to this organization, who will finally ratify this national

code, and it seems to me we can go along with perfect safety, and very wisely, and select this sub-committee, which is to be the working committee, and get this thing into some concrete shape for the action of the representatives of the organizations concerned.

The Chairman: I will put the question on the appointment of this committee of seven, selected from the associates named, including the Associated Factory Mutuals Insurance board. The motion was put and carried.

The Chairman: The chair will announce as that committee, Prof. Francis B. Crocker, American Institute of Electrical Engineers; Mr. Frank R. Ford, American Street Railway Association; Mr. William H. Merrill, National Board of Fire Underwriters; Mr. Alfred Stone, American Institute of Architects; Mr. E. A. Fitzgerald, Underwriters' National Electric Association; Mr. William Brophy, National Electric Light Association; Mr. E. V. French, Associated Factory Mutual Insurance Company.

The Chairman: What is the pleasure of the meeting; shall we discuss these rules now, or take up the question of the advisability of forming a permanent organization?

Mr. Greene: Do I understand that the report of the committee has been adopted?

The Chairman: Do you mean the committee to which these matters should be referred?

Mr. Greene: I mean the report presented by Mr. Stone.

The Chairman: That report was accepted.

Mr. Brophy: I think it would be a great benefit to the committee if any member of the Association has any criticism to the rules as they stand, or any suggestions to make, he should offer them. I think if they can be thrashed out, they should be.

Mr. Merrill: I move that they be taken up seriatim, clause by clause. Adopted.

The Chairman: Do you desire that the Secretary read these rules; or that we merely take them up for consideration?

Mr. Ayer: I suggest that he read them by sections.

The Secretary then proceeded to read the rules.

Section 3 (f) "Conductors must have ample carrying capacity to prevent heating."

Mr. Kennelly: I think that should be to prevent undue heating.

Mr. Stone: I suggest that some degree of heat might be mentioned there.

Mr. Crocker: The third column is identical; and the first column is the same effect.

The Chairman: I think if anyone should make a suggestion such as Mr. Kennelly did, perhaps a vote should be taken that be recommended to the committee for adoption in the final code.

Mr. Ayer: I suggest that the Committee is all present, and a suggestion of that kind they will take notice of.

The Chairman: The only question is whether the gentlemen present approve of the recommendation.

Mr. Jones: I suggest that if anything important strikes the mind on any gentlemen present it would be better for them to express it, so that all can discuss it.

Mr. Jenks: Referring to division (e) of the same section, why should bus bars be of the bare metal?

Mr. Jones If you have a copper conductor of sufficient capacity to carry a current into a lug, and you connect that lug by solder, if it not of the same capacity, there is a weak spot right there.

The Chairman: The question Mr. Jenks brought up is as to the advisability of discriminating in favor of bus bars.

Mr. Brophy: It seems to me that high potential bus bars should not be left uncovered.

The Chairman: We are considering section (e), under "Conductors."

Mr. Ayer: I don't think any of them should be uncovered.

Mr. Jones: I think it is a difficult thing, because my company has what we consider a pretty fine installation. We have a brick vault, and these low voltage bus bars are exposed in there, perfectly fireproof, and inaccessible to unauthorized persons. We think they are well protected in there.

Mr. Wirt: The same thing is true of railway switchboards. They are made of slate, and the bus bars are fastened at the back, and frequent connections are taken, and it would be inconvenient to insulate them.

Mr. Jenks: could they not be insulated with tape, so as to, in some measure, protect them there?

Mr. Ford: As regards to street railway bus bars, they are very often in large sizes, made laminated and bolted together. That is, of course, for ventilation, and if you have them taped, it would be impossible to adhere to that construction. In some cases the bus bars are, say, an inch or half inch one way, by four or five inches long; and two or three bars of that kind are bolted together, with a narrow space between. Now, in case of taping them over, you would not have that necessary ventilation.

Mr. Jenks: It seems to me that no matter how large the bus bars are, and no matter how low the potential, they had better be protected against accidental short circuits by some sort of covering.

Mr. Smith: We have never considered it in our practice worth while to insulate the bus bars; one reason being that the great number of connections on it would make it very inconvenient. I do not know of one instance that we have ever had trouble or a cross between one bar and another; and in some of the modern boards we are using laminated copper bars, leaving a very small space for a circulation of air. We do not consider it as necessary to insulate them.

Mr. Ayer: The point raised on that is one that applies locally to the owners of the plant. It is a matter of interest to them wholly or singly; for in all low potential currents there is little opportunity for serious danger. The location of switchboards gives ample protection to the building against fire. There is, however, a chance of injury to the machinery in the station. If owners are willing to take that chance, they should be privileged to do it. In the case of high potential currents there is danger to life.

There are arguments on both sides of this question. Within the last two weeks there was a switchboard destroyed where they had it connected to 200,000 incandescent lamps. Fortunately, there was no loss of life, but it was a very serious accident, and one might have been attended with serious results. It is worth recommending that the bus bars should be insulated in the case of high potential currents, under some conditions; although I know in practice there are a good many arguments why they should be exposed.

Mr. Brophy: The wire department of the city of Boston is by law made responsible for all electric conductors and appliances; and it has directed its energies towards preventing accidents to persons and loss of human life, as well as the loss of property by fire. If it permits the use of bare bus bars on high potential circuits and loss of life should result therefrom, the head of the department would be held responsible, and could not escape public condemnation. That may be a local matter with us, but we cannot permit the use of any device that endangers human life.

Mr. Merrill: Eighty percent of the plants throughout the country have uncovered bus bars, and it would be a hard matter to make them change.

Mr. Jenks: Mr. Chairman; I would like to inquire of Mr. Jones whether his suggestion as to the capacity of wires is met by No. 7 under "Conductors," in the first column?

Mr. Jones: I presume generally speaking that would cover the point; but as a matter of fact, my observation tells me that almost all the connections throughout the country are not made with reference to the number of soldered places in the joint which becomes part of the conductor, and it is frequently the case that it is not as good a conductor. The subject, I believe, has been up before the London Institute of Electrical Engineers; and some of the most intelligent of the members recommend that a mechanical joint be made as nearly as possible, and solder be used as a filling in, and not be relied upon as the main construction.

Mr. Brophy: The best practice is to make the joints electrically perfect without the aid of solder; the solder is applied to prevent corrosion.

Section 4.

Mr. Brophy: There are many switchboards made of slate and marble, that extend to the floors and ceilings; and I can see no harm in allowing them to do so. Solid wood boards should not be so constructed.

Mr. Merrill: In answer to Captain Brophy, I would say that the rule does not require the switchboard to be raised from the floor. In a footnote special attention is called to the fact that such construction is advisable. We have had fires in closets near the switchboards.

Mr. Brophy: No one could make a closet of the switchboard.

Mr. Merrill: It is not put in as a rule, but as a suggestion under the rule. The space behind switchboards is often used as closets. Accumulations of oily waste and rubbish in these places have caused fires.

Mr. Scott: Switchboards are often made with iron framework on which the marble slabs are mounted. In a general way it corresponds to the dynamo frame. It supports the conductors. The dynamo frame is specified to be insulated. I have my doubts about that being necessary or advisable in all cases. I believe in certain large stations it is found advisable to ground the dynamos, and they have been securely grounded. I think it is a question worthy of consideration, whether the framework of the switchboard should not in most cases, if not always, be insulated. It is bad general practice to honeycomb a switchboard with an iron frame work connected with the ground, and have open terminals on the back. Air insulation between the bus bars is sufficient so long as it is not broken down. There is a great difference in the probability of a short circuit occurring between bars one inch apart and those a foot apart. If switchboard conductors are to be left bare, a provision might well be introduced providing minimum distances for different potentials.

The Chairman: It is an important question to take up – the proximity of conductors at various potentials – in long distance transmission, high tension, and alternating and direct current work. It would not be at all out of the province of this committee to recommending some safe distance, which would be a guide in the construction and erection of electrical conductors in switchboards, and otherwise, proportionately to the potential employed. I think it is an important recommendation of Mr. Scott's in relation to the insulation of the switchboards. It seems to me that in many cases it is highly advisable.

Mr. Brophy: I think Mr. Scott is right. We have had some pretty bad accidents from switchboards, and they cannot be too well insulated; and there seems to be certain limits of space

between high potential and low potential bars. This might be a good time to decide this. I do not know myself about the desirability of grounding the dynamo under all circumstances. It might cause serious difficulty on commercial lights. I would like to hear what Mr. Scott thinks.

The Chairman: Do you think it is a good thing, Mr. Scott? The insulation of the dynamos is better than it used to be.

Mr. Scott: That is a question on which I really have not a decided opinion. I think it is a question on which a great deal can be said on each side; and in some cases the reasons on one side will prevail, and in other cases the reasons on the other side. If the coils of a dynamo were always insulated as well as we would wish, the question of the insulation of the frame would not arise. With the insulation we have it is not unusual to add to the insulation, and insulate the frame. In some cases, such as a static charge of the belt, the danger to the machine has been avoided by the grounding of the frame of the machine. I have brought up the question, not because I have a decided opinion on one side or the other: but I do not think the rules should prescribe definitely one or the other method, to apply to all cases.

Mr. Crocker: The grounding of dynamo frames to get rid of static electricity can be done through a sufficiently high resistance to make it free from any danger to life or breaking down of the insulation. For example, a vacuum tube will serve as a high resistance through which high-tension static electricity will discharge itself to the earth, but it will not serve as a circuit through which any dangerous current can pass. A wet string, for example, is also a sufficient ground for static electricity, but it is not a dangerous ground. In that way, we get the advantage of the effects. There is no danger of a rush of current in case another ground occurs on the circuit, at the same time you free yourself from the objectionable static electricity. A glass tube, filled with water, also serves as a convenient ground.

Mr. Scott: Whether the tube would serve as a convenient ground would depend on the potential of the dynamo. If a dynamo frame is insulated and becomes connected with the circuit, and is touched by an attendant standing on the floor he is in danger of a shock. This is not a question that can be settled by one or two points on either side, but is a general one; and I am not certain but that it is one that lies with the safety of the station, and the method of operating the machinery, rather than one in which the fire risks are concerned.

Mr. Brophy: I think the danger of fire would be outside of the station in case of failure of the insulation when the frame of the dynamo is connected to ground through a low resistance. A failure of the insulation of the circuit of the interior of stores, workshops or dwellings might be the cause of personal injury or loss by fire. When a well-insulated floor does not surround the dynamo it is an advantage to the attendants to have the frame grounded, as it protects them from serious shocks.

Mr. Crocker: In regards to Mr. Scott's two points; the first one could be covered by stating the resistance of the intentional ground as so many thousand megohms per hundred volts. For example, a dynamo shall be purposely grounded by a resistance of, say, one megohm per 100 volts, in which case the current that could pass through it would be a harmless quantity.

In regard to the attendant being ground and touching a machine charged up to certain potential, I should say that he should be protected by a floor around any dynamo that is of sufficiently high tension to be dangerous, which should be insulated, and where he can stand with impunity; and it should not be possible for him to stand on anything connected to the ground and at the same time touch the frame of the machine. In fact, a high potential dynamo should have a wooden platform around it upon glass or porcelain insulators.

The Chairman: I call upon the Secretary to read the report of the committee on permanent organization, as it is now prepared and signed by the committee. (The report when handed in originally was prepared in rough form and unsigned.)

The Secretary read the report.

Mr. Ayer: Would it be a proper thing to amend it? The original report was adopted.

The Chairman: I do not see any objection now to taking formal action.

Mr. Stone: I move that the societies not now represented should be invited to join the permanent organization; that they be informed of the action we have taken and requested to communicate with the Secretary of this meeting and signify their desire in the matter, as to whether they will join. Carried.

Mr. Ayer: I move that the report now presented and signed by the committee, be adopted. Carried.

Mr. Jenks: I simply want to suggest that it seems to me a very considerable amount of time will be spent if we continue in just the way we have been doing – reading all the rules in duplicate. I would suggest that if the Secretary would read over the second column – the code which is more explicit and full, perhaps, than the first column – sufficiently slow, so that we can compare, as he goes along, what may be read with the columns on either side, and interrupt him, as may be necessary, that perhaps one reading may be sufficient.

The Chairman: If there is no objection to that, we will follow that course.

Mr. Crocker: Before going on to that, I would like to ask what action is to be taken in regard to the organization of this permanent body, now that it has decided upon. This committee, which has been appointed, has for its duty, the preparation of a standard set of rules; but there are other matters to be determined; for example, the preparation of by-laws for this new and permanent organization; and it has occurred to me that it might be well, before many of the members should leave the room, to arrange for a permanent organization, or rather the details of a permanent organization. I move, therefore, that a committee of three be appointed to prepare a scheme for the permanent organization of this body, including the necessary by-laws.

The Chairman: It is moved that a committee of three be appointed by the chair to take up at once the preparation of the necessary rules or by-laws to govern this permanent organization, and report at the evening session.

Mr. Crocker: This matter is not of the greatest importance, because a body of this kind is very simple in its organization. It is really a committee, and, therefore, acts simply in that capacity. The duties are definite and the organization has only one duty to perform; and so, I should imagine, these rules will be largely mere formality, and there is no great hurry about it; but it occurred to me that there are some points to be determined before the officers should be elected, and, now that the permanent body has been determined upon, at least some action should be taken to put it in shape. I think the report of the committee might be left until tomorrow to give them more time to report.

The motion on the appointment of the committee was put and carried.

The Chairman: The chair will appoint that committee in a few moments. Is there any other question to present to this meeting?

Mr. Jones: I would like to know if a name has been adopted for this new association?

The Chairman: I think it is proper that the committee should select a name, unless you have some name in mind. Does any name occur to you, Mr. Jones, that you might suggest to the committee? I will appoint as that committee Messrs. Crocker, Brophy, and Merrill.

Mr. Jones: I am at sea as to my own status. I have been invited here by a committee of the National Electric Light Association, in an advisory capacity. It seems to me that we have gone clear of our mother association and formed ourselves into a new and independent organization; with power to act and to frame laws, and it seems to me it is a question whether the National Electric Light Association will accept what we are doing.

The Chairman: The new committee really is to form the permanent organization. After that joint conference as we exist at present is at an end.

Mr. Jones: I think Professor Crocker, in his position as chairman of the committee is able to do the subject full justice. I do not think this meeting is in the interest of any particular manufacturing concern. We are not to take one side with the inspectors, nor are we to take the other side with the manufacturers, and to try to work in the poorest kind of installations; but we are here to take the most enlightened stand we can on the subject. If people do not take risks, and do not build shops, and put in electric wires, there will be no money to pay insurance premiums. If you are going to put up high standards, where the cost of insulation and wiring will be very great, it will stagnate the whole business, as the board of trade did in London, when they made their rule so conservative. I think we want to have gentlemen like Professor Crocker on the committee, who can be independent. He is not allied to any of those interests, except incidentally, (slight laughter) and I do not think that it will swerve him at all. He represents a body (The American Institute of Electrical Engineers) and he would not dare allow any other influence to control him.

Mr. Brophy: I think I have done my share of the committee work already.

The Chairman: I think the best way to accomplish results is to get busy men to do the work. I picked those gentlemen out as representing diverse interests, and independent of any bias. Unless there is some objection I should like to have that committee of three gentlemen, as appointed, report tomorrow.

Mr. Brophy: I came here from a little rural town in the east; and I want to see this town, perhaps. As you all know, all work and no play, makes Jack a dull boy.

The Chairman: I understand Captain Brophy saw the town last night, and I object to his doing so tonight.

Mr. Brophy: Now let some other fellow, who sees the town every day, act as my substitute on this committee.

The Chairman: Is there any objection to the suggestion of Mr. Jenks, that the second column only of the rules be read, and the reading be done slowly, to enable comparison with the rules on either side? I should like to say, as far as the last column is concerned – the English Board of Trade and the Phoenix Rules – that it was difficult to place them on the same basis as the others; and it might be advisable to read them independently or separately.

The Secretary then proceeded with the reading of the rules.

Section 5, (b).

Mr. Brophy: I think the first part of this rule is well enough; the last part might be improved.

Mr. Merrill: I would ask Captain Brophy to state his objection to an inch of slate back of a resistance box; why it is not as good as separation, with air?

Mr. Brophy: Because I know of nothing so good as air. I have found in practice that an air space of three to five inches behind the resistance box is equally as good as the same

thickness of slate. It is not always possible to support resistance boxes on suitable supports twelve inches from the wall or switchboard, under all circumstances.

Section 6, (c).

Mr. Ford: I would like to suggest in railway installations the use of a separate ground for one side of the current and a separate ground for lightning arresters.

Mr. Kennelly: I would suggest that the words “conductivity not less” be changed to “resistance not greater.”

Mr. Ayer: It would be wise to make it explicit, that no ground wires shall be run from lightning arresters.

Mr. Ford: I think that grounding of railway generators should be explicitly provided for; that is, a description of the proper grounding of this machine.

Mr. Merrill: Does that not come under “Electric Railways” rather than lightning arresters, as well as the former point made in respect to the separate ground?

Mr. Jones: Is there anything further on that that tells you what lightning arresters are, or what a ground is?

Section 7

Mr. Wirt: As to this rule about testing, there should be some rule for testing resistance between the primary and the secondary of transformers. This subject should be investigated.

The Chairman: That would come under alternating currents.

Mr. Brophy: I think this rule should be made more definite. In many places it is customary to test arc light circuits through low resistance grounds in the station; that is a dangerous practice, and one which the wire department of Boston has felt called upon to stop. Now a voltmeter and multiplier is used for this purpose. That prevents the possibility of fire due to an excess of current on the circuits thus formed. The method of testing alternating current circuits is somewhat different, but with the same end in view. I think this rule will have to be amended. The matter of testing the insulation between the primary and the secondary coils of transformers, and between these coils and the earth, has become a serious one.

There has been one fatal accident in Boston and one in Winchester, Mass. due to imperfect insulation in the transformers. The failure of this insulation of transformers is not infrequent, and it is fortunate that so few accidents have occurred. If some method could be devised of readily testing the insulation, it would be of great importance; it would be still better if some effective means could be devised for preventing accidents to persons handling lamps or sockets.

Section 9 read.

Mr. Ford: I believe this finishes the general class of central stations. Before leaving that section, I would like to inquire as to how far these rules relate to the complete construction of the station. I have a small pamphlet relating to the requirements for standard electric lighting and power stations and schedule of charges for these stations. In this there are a number of provisions made for the building itself, as to its walls, height, area, smoke stack, wire tower, heating and lighting, etc., also on electrical arrangements which correspond with the rules we are now discussing; and in addition there are rules for care and attendance and for fire protection. Now, I would like to have the sense of the meeting expressed in regard to the question of incorporating

some of these rules we are discussing, in so far that they have not been considered in the present rules under the heads of "oil and waste" and "care and attendance."

Mr. Merrill: I would suggest that matters relating to construction of building may not be considered as properly coming under the head of rules for safe electric wiring. We want to make this code as simple as possible, and if we laid down requirements of building construction, matters relating to things outside of electricity, we will get a complicated book.

The Chairman: I agree with **Mr. Merrill:** I call Mr. Ford's attention to pages 21 and 22 where rules will be found in reference to power stations and car work; and on page 23, in reference to car houses; so that under the head of "Electric Railways," there is additional matter relating to central stations.

Mr. Merrill: Only electrical arrangements are covered by these rules.

The Chairman: We should be careful and not dictate to architects things that have no bearing on the electrical features.

Mr. Ford: There are sections covering the wire tower through which the wire shall be brought into the building, and lighting of the building, which, of course, is covered in these rules, and in sections on care and attendance, waste, oil, etc., which, to some extent, are mentioned in the present rules.

The Chairman: Everything of that kind should be referred to the committee for their careful consideration, undoubtedly.

The Secretary read the opening paragraph under "Class B."

Mr. Crocker: As to class B, over three hundred volts, would the three wire system with 200 volt lamps on each side be a high tension system; or would it be advisable or necessary to consider it so? The limit of 300 volts was probably set when we had the three-wire system, operating at a maximum of 250 volts, which is used in railway service. If we had a three-wire system, having 200 volts on a side, would it be included in the high-tension system? We may have a system that will come close to the dividing line, and the question is, not what this rule says, but what shall the rule be which is to be adopted? Would a three-wire system, having 200 volts on a side, and 400 volts maximum potential, be included in class B, or should the limit of 300 volts be raised?

Mr. Brophy: The wire department of the city of Boston was created by an Act of the Massachusetts Legislature, and it is the only department or organization whose supervision of electric wires and appliances is sanctioned by law or can enforce its requirements. It has found that classification of high and low potential circuits would cause serious trouble for the owners of telegraph, telephone, and other circuits, and so it was found necessary to make three classes; and I think it would be desirable for this committee to consider that matter before getting down to work.

The Chairman: What were those classes?

Mr. Brophy: High potential, medium and low.

The Chairman: What were the electromotive forces?

Mr. Brophy: We got down to the Western Union.

Mr. Jenks: What were the electromotive forces?

Mr. Brophy: It simply would not go above such a limit as low, such a limit as medium, and such a limit as high.

Mr. Jenks: What are the limits and volts?

Mr. Brophy: We had no difficulty with the electric light wires, but we're bringing the telegraph and telephone wires under the same requirements and restrictions as incandescent light

wires, so that it was necessary in our case to make another class. High potential are those having a difference of over 300 volts, and not less than 1 ampere of current; medium are those having a difference of less than 300 volts, and an unlimited amount of current; low are those having a difference of less than 300 volts and 0.5 of an ampere of current.

Mr. Jones: We use 300, 350, and 400 volts every day, all over the country, and have for years. You can take hold of one of our wires outside with one hand and ground with the other, and it won't do you any harm. We have all voltages cut down through high resistances. I was going to mention in regard to this matter that over 300 volts as a high potential system cannot be made to apply to telegraph wires. We want to be on the safe side, and we are willing to abide by any reasonable rules – and even do much better than you dictate – but we do not want to be compelled to do anything foolish in the matter, as we are sometimes asked to do in municipalities. They ask us to do these things, because they have an idea that we are running over 300 volts of large quantity currents.

Mr. Merrill: There is a separate class at the end of the code, which treats the telephone and telegraph wires, and signal wires. It is not necessary to make any changes here that I can see.

Mr. Ayer: I understand that the New England Board of Trade rules provided for all classes of potential, and made separate conditions for the different pressures, and the discussion of the question where you should class the 440 volt, three wire system, was very full when they were making up the regulations at the public hearing of the Board of Trade. Captain Brophy has reports of that meeting. It would be useful matter for the committee to have, together with the conclusion which the Board of Trade reached, after the discussion of this matter. It will throw a great deal of light on the subject.

The Chairman: I know that in the English rules they have arranged that thoroughly. In addition to the discussion here, if the committee will take into consideration the discussion in England, it will assist them considerably.

Mr. Merrill: For the benefit of the committee, I desire to bring out an expression as to whether or not any gentleman here considers that with the present devices on the market it would be safe to raise the limit of voltage on the low potential system to over three hundred volts.

Mr. Kennelly: The trouble is in regard to the point raised by Professor Crocker; if you bring the double pressure three wire system to raise your pressure to 450 volts, there is no dividing line between that and railway work, since such system may have between their station bus bars a pressure of 500 volts.

Mr. Ayer: I do not think the appliance on the market will justify a change there. I think it is the result of the discussion in England that the appliances will not justify it.

Section 11.

Mr. Brophy: I suggest that the paragraph relating to service blocks be stricken out. They are used for rubber hooks exclusively; are they not?

Mr. Ayer: No, sir.

Mr. Brophy: Rubber hooks we have excluded.
Section 16; clause (c)

Mr. Brophy: Is it advisable to have service switches placed where underground wires enter cellars and basements of business houses?

Mr. Merrill: No sir, the place for a service switch is the nearest convenient place.

Mr. Brophy: We have not complied with the provision of this rule in Boston, except where the switch can be placed near the door or some other accessible place. When placed in

cellars and basements, where they can not be readily reached by the firemen we have ordered them out.

Mr. Merrill: It does not require that they be placed in a damp basement.

Mr. Brophy: The switch is placed in the circuit as a matter of convenience in case of fire, when it is desired to cut off the current, but in a majority of cases they cannot be reached when placed in the cellar or basement, or some other out of the way place.

Mr. Merrill: You do not object to a service switch but object to placing that switch where it would be a hazard?

Mr. Brophy: Yes, where it would be a hazard to life or property, when they are placed in a two thousand-volt alternating circuit.

Mr. Jenks: I wish to raise the question whether or not the contractor would not interpret this section, 16, "The switches and fuses must be placed," to be mandatory, and whether he would not consider himself bound by that rule, irrespective of whether the basement was damp, or an out of the way place, where the circuit-opening devices cannot be got at in case of fire. Would it not be safer to make the rule more flexible?

Mr. Merrill: I think practice has generally carried that out that way – without placing the switch where it would be useless or hazardous to the property. "Possible" means, of course, possible with safety and convenience; that is the sense of the thing.

Mr. Brophy: Our own inspectors have interpreted the rule literally, and we have had occasion to take out some switches on that account. I think it would be better to make it clearer.

Section 17.

Do I understand that this applies to overhead work entirely?

Mr. Merrill: Inside wiring at the entrance to every building, etc.?

Mr. Brophy: Yes, sir.

Mr. Merrill: No sir, it applies to all entrances.

Mr. Brophy: Then it will be necessary, in many cases where the underground wire enters the basement to carry the wires up to the door?

Mr. Merrill: It does not refer to the entrance of the building; but to the service entrance and to the electrical entrance.

Mr. Brophy: I do not think, then, that the switch will be of much service, unless for overhead service, for the purpose for which it is intended. If the building is on fire on the first floor, they cannot get at the switch.

Mr. Merrill: In some cases they might not.

Mr. Brophy: And the switch tends to reduce insulation – every switch does, and I doubt very much if it is going to be practical for underground conductors to put a switch in these circuits in that way.

Mr. Merrill: I think we should be departing from the law established by practice, if we suggest doing away with the service switch. They are quite generally used, and have performed very good functions a number of times. I agree with Mr. Brophy that there are places where service switches are undesirable – that is where it is undesirable to install a switch; but a switch, as such, I think he will agree is generally recognized as a good thing in the service conductor to any building.

Mr. Brophy: I think I am responsible for this rule, so that I am going to bear all the blame myself; but I find in practice it does not always work well.

Mr. Stone: In regard to this matter of properly installing wires in insulated conduits, is it not possible that by using thin wires in proper tubes that we can rid ourselves of the insulated conduits?

Mr. Merrill: Does not that more properly come up under the head of conduits, those relating to protecting the wire from abrasion?

Section 20.

Mr. Brophy: With discussing the merits or demerits of American tubing, or anything else, I do not like to see any brand, any article, recommended in rules of this kind. I do not care whether it is the American Circular Loom Tubing or anything else.

Mr. Ayer: In reference to this rule for wires going through the partitions, floors and other places, I would state that in breweries the insulating tubes, glass and porcelain, are bad things; the workmen there will break them, no matter how placed. They are a rough class of fellows that work in breweries, and we had a great deal of trouble from this cause. It was found necessary to use iron pipes exclusively in those places for protection; and the glass and porcelain tubes were always broken.

The Chairman: I believe in St. Louis there are a great many breweries.

Mr. Merrill: I think that is provided for in the clause read a short while ago, where provision was made for the protection of wires exposed to abrasion. The construction was definitely outlined in regard to running wires in pipes and boxes providing for protection when exposed to extreme abrasion.

Mr. Ayer: In many places, in going through brick floors, it is difficult to get protection.

Mr. Merrill: It is not intended to use glass tubes where iron pipe is run up through the floors.

Mr. Ayer: The interpretation put on these rules by the inspectors there demanded the things.

Mr. Merrill: If you will refer to sub-division (f) of section 18, on page 10, you will see that it is taken care of in that section.

Mr. Ayer: This refers to special wiring, and they insisted on following it literally. We had a good deal of trouble from that cause. Where there are references and cross-references, they are not fully interpreted by local inspectors.

Section 23.

Mr. Stone: Is it possible that we can safely wire the building with thin wire, with proper fuse, and depend entirely upon the insulated wire, and not be obliged to depend upon the insulation of the tube?

Mr. Merrill: It seems to me that this committee ought to have the benefit of a full discussion of this point, so that we can act intelligently.

Mr. Brophy: I, as a member of this committee, desire a fair and full discussion of this question.

If we use iron tubes for interior conduit we must permit the use of twin wires or a pair of single wires for the transmission of alternating currents in some cases as it is an electrical necessity. If we permit this for the transmission of alternating currents we must also permit the same for the transmission of direct currents, or leave ourselves open to the charge of unjust discrimination.

Mr. Ayer: The rule contemplates the use of twin wires in the conduits, but they are insulated conduits. The thing to be discussed is whether to require insulated conduits.

The Chairman: Where two wires are placed in the same tubes?

Mr. Ayer: In any event, and if so, under what conditions. It seems to me we should not insist upon insulated conduits in buildings. I think that is the sentiment of nearly every one, in practical work, that the insulation of the wire is all that should be relied upon – that the insulation of the conduit should not be considered. I believe that iron tubes properly constructed so that they may be free from all burs and other abrading substances likely to interfere with the insulated wires when being drawn in and out, are things which should be considered as conduits, and should be approved.

Mr. Stone: This question is very far-reaching and affects very much the insulation of wires in buildings. Many and many a person would use electricity and wire their buildings, if it were not for the almost prohibitive cost of so doing, if you use concealed wires. In large office buildings it is much more applicable than it is in dwellings, as far as expense goes, we are tied up now to two or three patented articles, and are compelled to spend a large sum of money for insulating tubes, when, it seems to me, if necessary, we should add a percentage of cost to the insulated wires, so that they are absolutely safe, and we should put on plenty of fuses, so that there is no danger, and in that way we would increase the wiring of buildings very largely, instead of restraining it as we are now doing. Such material as brass protected conduit is a delusion. The first carpenter that comes along to nail the floor, and has a nail long enough, is liable to run it through one of these tubes and make a connection with the wire. I hope that the electricians here are going to be able to frame such rules, and put the laymen who know little about these things, in a position that we can fall back upon local electricians, and say that is good work. If not, I want to know, so that I can tell my clients that it is out of the question for the present; that we must rely upon insulating tubes and not insulated wires.

The Chairman: My attention has been called to the fact that Mr. A. L. Halloway, Past President of the American Society of Mechanical Engineers, has honored us with his presence. We shall be glad to have Mr. Halloway come forward and occupy a seat on the platform.

Mr. Stone: I suggest that he be considered as a delegate to this meeting, as his society is among those to which invitations are to be sent.

Mr. Halloway: I happened in here, Mr. Chairman, because I am staying in the house, and was simply curious to see what was going on. I should like to be allowed to remain as a spectator.

Mr. Brophy: The question of whether we shall have insulated or uninsulated interior conduits is a very important one. The insulation of all samples that have been tested by me is too low to be depended on – very much lower than any insulated wire used at the present time. It would not be safe to put bare wire in these tubes. I think it is wrong to insist on the use of a so-called insulated conduit and at the same time permit nothing but the best grade of insulated wire to be placed therein. All such conduits are simply wire-ways, in which they are placed for convenience in drawing them in and out, and for mechanical protection. All that is necessary is that the interior shall be smooth and in no way injure the insulation of the wire.

Mr. Jenks: If any citation of facts were necessary to show the correctness of the position which Captain Brophy takes in this matter, I need only refer to the wiring which was done 10, 12, and 14 years ago to the stems of fixtures. These stems were wired in the earliest days of electric lighting, with low grades of insulation (grades we would not use now for fixture wiring) and yet, in thousands of cases throughout the country they are as good today, so far as practice

shows, as daily operation shows, as they were when they were put in. It seems to me that is a tribute to the value of iron pipe, which we should respect in considering the requirements that are going to be made as to the wiring of buildings.

Mr. French: I do not think I can add very much on this subject. Conduit work is not work we come across to any extent. It has seemed to me, however, that perhaps the interior lining of the tube was of very little use, that the main difficulty was in regard to getting a smooth inside to the iron pipe; that if we could get smooth inlets and outlets, we could accomplish all that was necessary and perhaps be reducing the expense and help the cause along. I have not had much experience in that sort of work, and could not add very much to this discussion.

Mr. Smith: I quite agree with all that has been said in relation to this subject. I think a good iron pipe is sufficient, as has been demonstrated by Mr. Jenks' statements. I will cite a case in point, and go back to a building that was wired about twelve years ago, the Dakota; and that wiring was all done in zinc tube, I recollect, and with Underwriters' wire. There is no trouble and there has not been since the building was opened. I was informed only within the last month that there were not more than half a dozen outlets that the electricians knew of, that it had been necessary to run over; that all the wiring which was done twelve years ago is intact today.

Mr. Jenks: I think it would be interesting for Mr. Smith to give us his estimate as to what extent the early conductors which were wired with Underwriters' and similar wire, ten or twelve years ago, and connected with his station, have had to be rewired in consequence of the giving out of such conductors in the iron pipes or fixtures.

Mr. Smith: To a very small extent. There were quite a number that were wired in the early days with paraffin insulation, that caused a great deal of trouble. That was dropped and we then had the Underwriters' wire, and with the better insulation there has been very little trouble from the wiring of fixtures. It has been a mystery to me why there was not more. I have seen a good many cases where the wires ran between the shell and the iron pipe, very close, hardly room to get it in, and yet they have stood for years.

Mr. Merrill: I would like, if possible, to bring out a little larger expression on this point, and simply for the sake of argument – and not because I believe specially in what I am going to say – I will state that because a certain poor form of construction happens to be put in a building and stays there for a considerable length of time, in one or two, or even twenty, particular instances, it does not follow that we can permit that construction universally. I know of a case where two alternating current primary wires are run up the side of a door-case, and held in place by metal staples, the two wires of opposite polarity being under the same staple, and have been there eight years, but it is not good construction. (Laughter)

The Chairman: I believe you come from Chicago, Mr. Merrill?

Mr. Merrill: As a matter of fact it is in New Jersey. (Laughter) The statement has been made that an iron pipe is a suitable conduit if the burs are removed, and if the pipe is smooth. Now, how are we going to be sure that the burs are removed? How are we going to be sure that the pipe is smooth? Some sort of a lining on the pipe, I think, helps us a little towards that assurance. Our statistics show that we have more cases of burn-outs, perhaps not involving any very great loss, by grounding of currents on iron pipes, metal cornices and structural iron work – grounded metal work of all descriptions – than we do from any other one cause. We have had a number of cases of the current grounding to the exterior of a gas pipe and burning through the pipe and igniting the gas, causing fires which in some cases involved considerable loss. Now if we use plain iron pipe for conduits, are we going to accept burnouts of that nature inside of our conduits? I know that this matter is one that has received the attention of all practical men

throughout the United States. As I said in the beginning, I am not prepared to say that the construction is either good or poor; but for the benefit of this committee, who will be called upon to suggest a clause covering this point, I would like, if time permits, to ask a few remarks from pretty nearly everyone present.

The Chairman: I think we should have as free a discussion of this important matter as possible, as Mr. Merrill wishes to get the consensus of opinion on this point. If there is any further discussion, we should be glad to hear from everybody present.

Mr. French: If the lining is simply to help smooth up the inner surface, what is the need of making requirements for insulation? Another thing, can anybody tell us how much more it costs to line a pipe with something which helps to insure smoothness than plain iron pipe. Is the cost any appreciable amount?

The Chairman: Would the question be taken care of at all by original inspection of all tubing to be installed, in order that the inspector may have control of the tubing prior to its installation? After it is installed it is out of his province to pass judgment upon it. Could that possibly take care of it – having the inspector give his approval of all pipe before it is installed in any building; would that be practicable?

Mr. Merrill: Let us make rules that will throw as few duties on the inspectors as possible.

The Chairman: It is a very serious thing in connection with the insulation on wires where joints are made; a roughness in the pipe is a serious matter.

Mr. Kennelly: The reason for a lining in the interior of iron pipe must be either mechanical or electrical; if it is simply mechanical it is inexpensive. If the reason is electrical, is it not rather anomalous that in a city like this you can have a hundred miles of pipe in the street in which the insulated wires lie in a bare grounded tube, whereas the moment you go into a house you must not have it?

Mr. Merrill: We all know very well what is taking place in that underground pipe, and we do not want those occurrences in insured property. We know that a burnout on an Edison underground system is not so rare an occurrence as to escape our attention.

The Chairman: Mr. Kennelly referred to the conduits in which are installed the electrical conductors other than the Edison tubes.

Mr. Jenks: The drawing-in system.

Mr. Brophy: Up to the present time there has been no demand for a plain iron pipe with a perfectly smooth interior surface in which to place insulated wires. It is not a difficult thing to produce and if we insist on having it, it will be forthcoming. I think there is no trouble in making a pipe, the interior of which will be perfectly smooth, and a few mechanical contrivances will smooth the ends, when necessary to cut them.

Mr. Ford: I will suggest that an easy way might be made by protecting the wire itself mechanically, putting a coat of lead on it, or some mechanical coat, to protect it from the burs of the pipe.

Mr. Brophy: That means added expense again.

Mr. Ford: I just make the suggestion.

Mr. Wirt: It seems to me that the experience we have had with railway motors has a bearing on this subject, and that is the winding of armatures, which are provided with wires that have poor insulation, compared with wires used in buildings, which have to stand 500 volts; and we have comparatively few burned out armatures on railway work of modern design. It seems to

me that the service there is more severe than any service in a house. The current is apt to be twice as great as the wire is able to carry continuously and yet we have had little trouble.

Mr. Jenks: I would like to ask some of the gentlemen who have made this matter of conduits a study within the last two or three years, as I have not had an opportunity to do, whether a plain iron pipe does not conduce to safety, by the blowing of the fuses in case of any possible difficulty inside, as compared with any system of conduits, which has an interior or insulated lining? Suppose an arc to occur there, something we may imagine ought to be prevented, or something that cannot be prevented, after the system is in place, will not the arc produced inside the tube be so low in resistance as to very quickly and surely blow the fuse, and thus cut off the difficulty, in the case of plain iron pipe coated with insulating materials?

Mr. Fitzgerald: I do not like to say very much; because in my own association, the New York State, I am opposed to conduits altogether, personally. I think that a good first-class extra-insulated wire in an iron pipe would answer every purpose. I do not think this brass armored tube is a good thing to put in a house. We have had a good many fires, but we have the same insulation exactly in the iron tube that is in the brass tube – but the latter has not been long enough on the market for us to know exactly what the results will be. I have not a very favorable opinion of it myself, I think we ought to be able to get up a wire properly insulated and protected that could be put into an iron pipe or steel pipe with greater safety than we can do in the case of the conduit on the market at the present day.

Mr. Crocker: I do not pretend to have any very extensive acquaintance with the latest results in iron conduit, which is really the question; but it seems to me that it is possible to have plain iron tubing, and as Captain Brophy says, it will be made smooth for us if it has to be. That is the fact with all kinds of arts. The wire, properly insulated, in a smooth tube should apparently be safe and I think in the majority of cases it would be; but I think that nothing but long experience will ever decide such a question. I do not think that any opinion will be final, even if it is the opinion of a great many; and I should hope by the time the committee formulated these rules it would have a little more experience to go on. Furthermore, I think it would be necessary to make a special investigation on this point in order to get positive information, by investigating special cases because to my mind it is a matter of experience, and only experience can decide it. I do think, however, that the chances are that the plain iron tube, with properly insulated wires, will be successful.

Mr. Brophy: I do not like to do all the talking. We have in New York conduits in the streets in which are laid insulated wires. They are covered with lead; the lead is not an insulator; the lead simply protects the insulation from the action of sewer gas; prolongs the life of the insulation. We have in Boston the same thing, only we use there a cement-lined pipe. Cement is not a high insulator; it has very few insulating properties at all. Between the terminals of some of our dynamos we have as high as 7,000 volts. We require there an insulation of twenty megohms per mile per hundred volts, for the wires underground. As yet we have had but one burnout, and that was evidently due to carelessness, not the wire in the conduit. Now, as we can safely carry current of that difference of potential in an iron tube, laid in the ground, where you have nothing between this and zero, I think we can safely depend on the insulation on wires made today, in an iron tube inside of buildings.

Mr. Woodbury: A short time ago I saw in Alabama an interior conduit installation made of zinc pipes which were originally made for speaking tubes. At bends a number of short pieces of tubing, about two inches in length, were strung together; and that installation has stood in a building for a good many years.

In regard to underground conduits, not only is the lead armor of the underground cables in contact with the earth through the conduit, which is generally a good conductor, and if not so naturally, as in the case with the creosoted wood, must certainly be made so by the dampness absorbed by the wood; but in order to diminish the effect of electrolysis, according to the best practice this lead armor is secured at various places by wires soldered to the armor and also run out to a proper grounding place, in order to prevent this covering from becoming a conductor and connecting points of the earth at different potentials, which are due to both ground returns, and also the leakage from generator currents used for lighting and power.

Mr. Ayer: I think that practice has demonstrated that all our underground work with high potentials leaves this point to be considered – whether the danger incident to burs remaining in the tubes, which can abrade the insulation of the wire while it is being drawn in, is the only thing that makes an issue in this question. It is the possibility of abrading the insulation that you draw into the tubes and that may occur in the unlined conduits by burs. There is no question that insulated wires as made can be placed in iron conduits and will be permanent.

We have many instances of wires laid in iron underground conduits, without lead covering, drawn in in the usual way. Some have been taken up in Chicago, which have been down six years, in iron pipes, drawn in in the usual way, with no lead covering, and show a high insulation test. Some were frozen in the tube so that they could not take them out when they wanted to. They wanted to see the insulation, after five or six years, but the wires were frozen in the tube, showing the condition of the tube. There is no question that we have insulation which will stand up in iron pipe, which is simply a containing tube for the insulated wire, but the real point is whether or not we can trust iron pipe as it will be furnished to us, to be free from abrading surfaces, which would seriously lower the insulation and make it a menace to the building in which it is installed, as a fire risk. It does not seem reasonable that that will be true.

Mr. Brophy: It is only a few years ago since it was impossible to cover insulated conductors with lead in a satisfactory manner. That was the means of keeping back the installation of high potential underground wires. Today there is no difficulty in producing a perfect lead covering. A demand was created, and it was met by the manufacturers. Again, comes the question of how much energy in watts shall be conveyed over a pair of wires placed in an interior conduit, plain or insulated? I have seen two iron pipes that were placed side by side, and in which were run each leg of an alternating circuit, become red hot, due to the inductive effects produced. The potential at the dynamo was increased from one thousand to fourteen hundred volts, without producing a satisfactory light, the larger part of the energy being used to develop this heat. Fortunately, the pipes were buried in the ground; had they not been, a fire might have resulted.

On motion, the meeting adjourned until Thursday morning.

Thursday----- Morning Session.

Chairman Hammer called the meeting to order at 10.15 o'clock.

The Chairman called upon the Secretary to read the minutes of the meeting held on Wednesday.

Secretary Woodbury read the minutes, as requested.

Mr. Ayer: Do I understand the minutes are corrected, and that Captain Brophy will represent the National Electric Light Association?

The Chairman: Yes sir, and if there is no further objection the minutes will stand approved, as corrected.

The Chairman: There are several communications here, which the Secretary will proceed to read.

Letters were read from the Automatic Fire Sprinkler Company, Worcester Electric Light Company and James H. Carey, Springfield, Mass.

Mr. Ayer: I offer a motion that all these letters be referred to the committee of seven, and any similar letters that may be received. I refer to the committee appointed yesterday to prepare the final code.

Mr. Woodbury: Mr. Chairman and gentlemen; There was something which occurred late in the day yesterday, in the course of the report, which I have been thinking over, and it appears to me that it is such an important matter that it may be worthy of new consideration by this meeting; and for the purpose of giving it the renewed consideration, if the meeting desires, I move that the report on organization be reconsidered. As there is a difference in parliamentary practice in some parts of the country, I think that my motion ought to perhaps insure a community of understanding, if not of action; and I will state that the motion to reconsider, if carried, as I understand it will bring the matter before the meeting again. The motion in itself is not a reversal of any previous action; it simply brings the matter up for further consideration. In support of my motion I beg to make a few suggestions to you in this line. The National Electric Light Association – and I can speak of it with perfect freedom, because I am not a member of that organization, and not eligible for membership in it, and not in any way connected with it – the National Electric Light Association has for a number of years had under careful consideration rules for the installation of electrical apparatus. These have been from time to time amended to keep pace with the march of events and in the progress of invention of apparatus and improved manufacture of material. We are brought here together as a convention by invitation and under the patronage of that organization to consider these rules. Those who are here are here as the guests of the National Electric Light Association, and we are also here by reason of official action which has been taken by our superiors in various corporations and interests with which we are affiliated. That authorization has come from votes of Directors, orders of Presidents or General Managers, and in all instances the invitation has been considered in a way and received with the consideration that has been entirely in accord with the source from which it comes.

Now, the rules in most general force are naturally those of the Underwriters, because the patrons of wiring and electric light companies in all their phases naturally reach out first to know what the Underwriters desire in the matter, because the Underwriters' rules refer fundamentally, and in greater degree, to methods of installation and reaching out to methods of operation, whereas we should naturally expect any rules emanating from the National Electric Light Association should very largely deal with questions of construction and legitimately be broader in their scope. I had supposed that this meeting would naturally consider the various points. If the Underwriters' rules are open to criticism, such criticism can be offered; and the question then

arises as to what extent these criticisms can be or will be received by these Underwriters' Associations. If anything can be added to strengthen them, making the final rules of the broadest in their scope, so much the better.

We have come here, and what have we done? Instead of acting to any finality as a convention, or making arrangements for such action, we have provided for another organization. We meet here as guests of the National Electric Light Association, and we virtually legislate the National Electric Light Association, out of the crowd, except as a representative. A number of organizations have been invited to join us. Now it appears to me that, if the sense of the meeting agrees with me, it would be a very nice thing, holding to the present line that was laid out in that communication from the National Electric Light Association, if there are persons representing any body or bodies, as there appear to be, that have not been fully or properly represented in the names on that card, why, then, it would be in order for this meeting to extend an invitation for them to join the body already called together by the aid of the National Electric Light Association, so that the final deliberations of this body, whatever they may be, may come out with the strength of the National Electric Light Association as an organization at the head of it.

Now the position, which has been proposed, is that certain societies will be invited to send delegates. In an informal way I have been able to see representatives of one of the societies named, and to hear from a second one since yesterday, and I have been informed in each instance that they have never done anything of that kind; as it was explained to me in one instance, that when an organization through its President, or by reason of parliamentary action, takes any course, that course completes, if you please, a circuit. If a committee is appointed, that committee goes out to do its work and finally reports to the chair. When an individual was appointed by their society to go into another body as a representative, he went out from the control of that body, and there was nothing to require him to complete his work in a report; but be that as it may, on the question of opinion, there is no doubt as to the question of practice.

In the proposed method of reaching out, especially to non-electrical organizations, we may find that people are not interested. Those of us who are here are certainly interested enough to be in attendance, which is always one point gained in any meeting; and for these reasons I trust there will be a full and free expression of opinion, because it is never too late to mend, and if anything can be mended, the sooner the better; with the idea, however of retaining the line of this proposed organization right along in consonance with the call which brought us together; my idea being that it would be better to add to the present line of action rather than to rub out and begin over again, and to ask a number of societies and associations to send delegates to a meeting which they themselves will form and at which would be submitted rules for their consideration.

The Chairman: This is an important matter, and I think it would be well to hear an expression from as many of you as possible, as to whether it is advisable to reconsider this action of yesterday or not.

Mr. Ayer: The suggestion of Mr. Woodbury seems to me to be an attempt to get at exactly what we are doing, but possibly by some other route. He suggests that we preserve our organization here and add to it. That is exactly what this plan contemplates. We have got together the people whom it was thought are most vitally interested in the establishment of standard rules. After we got together we find there are additions which should be made. Just such proceedings are incident to the organization of any kind of an association. You take any society organized to represent an interest, or take the case of organizing a club; you make up a list of the people you think you would like for charter members. Afterwards you discover you have left out

a number who ought to have been included; but I do not think it is the practice or has been the practice to wipe out what you have done, so as to start over again. I see no reason why we cannot proceed to form a permanent organization on the lines laid down. Mr. Woodbury takes the point that the National Electric Light Association has taken the initiative and done a lot of work. It is true that some society had to take the initiative; and the National Electric Light Association is organized solely for the purpose of advancing the interests of electrical work. The Association was formed twelve years ago, and some eight years ago they formulated rules, which were found to be necessary. These things have grown. We found, however, that we could not establish a standard as the National Electric Light Association, which would be observed by everybody. But we find that the National Board of Fire Underwriters considers it wise to establish rules; local boards of fire underwriters consider it wise to establish rules; and so on. All these things are perfectly well known to us. The conflict of these rules is the reason of the desire for a national code.

So far as any complimentary consideration of the National Electric Light Association in this matter is concerned, it is very nice for Mr. Woodbury to suggest it; but it would defeat the object of the meeting. By reason of its prominence in this work, that Association has come forward and asked that this matter be taken up by the interested parties. We are to consider this work of making rules and determine a code; and by all agreeing to it, establish a standard. If any one society or organization, or one group of interests should be given the control of this matter, or given a leading part in it, it would defeat the object for which we are brought together. I think the plan as outlined is perfectly systematic and in line with the proceedings which should be observed. I cannot see wherein we are not carrying out the work on the best lines. It is unfortunate that these added societies were omitted in the beginning because it is undoubtedly a fact that nearly every one, if not all, of them is vitally interested in the rules. I recognize that certain men engaged in certain lines of engineering work, members of the American Society of Civil Engineers or the American Society of Mechanical Engineers, do not think much of a thing of this kind and do not care about it; but there are members who are interested, and when you have this matter presented to a meeting of any one of these societies, you will find a lot of interested members. Take the civil engineers engaged in mining work, wherein electricity plays an important part, as it does in all the engineering practice of this country, and you will find members vigorous in defense of a membership in an organization like this. Perhaps a man engaged in a specialty, where electricity does not enter as an element, he may feel no interest in electrical matters, have no interest in them, and does not care about them; and from such men Mr. Woodbury might get an expression of that character.

In delegating authority to an individual to represent an association, it is quite true that the society has no direct control over the man when he goes out, and it may be, and has been in many cases, considered unwise for the society to send out a delegate. The matter has come up in the National Electric Light Association, and other societies of which I have been a member, and they have declined to send delegates to many meetings of a broad character, to which they have been invited by interests, where it was thought it would be interesting to the organization to have such a delegate; but it seems to me that this request upon the organizations whose names we have mentioned is one that will meet with approval. We have as an evidence of it the fact that they have sent to this meeting a representative, and have delegated authority to some one to represent them here. I think the question is fully answered in that particular; and when it comes to the society committing itself to any action of the delegate, he must go back, to them, necessarily, and get an endorsement of his action by the association, and his action will then

meet with the approval of the association as a body. The representatives forming this body will go back to their several associations for a ratification of the action of this organization; and I do not think that in a single instance they will decline to ratify it. But the matter is in their own hands. If the society feels that it cannot endorse the action of the meeting of delegates, they are at liberty to condemn it. I cannot see any reason for disrupting this organization or undoing the work, or delaying the work, by deferring anything in the nature of a permanent organization for some further period. It is a difficult thing to get men together, and we should make the most of our present opportunity. Furthermore, I do not think it wise that the National Electric Light Association or any other association should have any more than a single representative in proposed organization.

Mr. Woodbury: If I had understood the matter as stated by the last speaker, I should merely say that the work of yesterday is just in line with what I believe to be the best for the interests of all concerned. But if the meeting is to shape in the line of permanent organization, and add to it the names that were on that report, not otherwise included, and invite other interests and other societies to send delegates to attend some future meeting of this permanent organization, then we would have something that was right along in the line of my desires. My desire was not to disrupt, but to build up; not to weaken, but to strengthen; not to delay, but to hasten. What I desire is to effect this organization as rapidly as possible. Here are a number of men who have been interested enough in the subject to be here in attendance, who have received official invitations, and the quicker we get down to business of the meeting the better; giving concentrated attention to the rules, seriatim, if you please, or through a committee, if you please, but all looking to the possibility of an improvement of the rules, if there are such probabilities, of adding to them or correcting them, or in any way altering them for the best interests, but what is far greater, of the millions who are patrons of electrical interests. It is for that reason of building up, of going ahead, of strengthening, that caused me to believe that the gentlemen here present might choose to modify the action of yesterday in some respects.

Mr. Greene: It seems to me that Mr. Woodbury misses the point in mixing up a possible future organization with the present meeting. I do not think that any action recommended by the special committee appointed yesterday, nor any action taken by this body adopting the committee's recommendation, would affect in the slightest degree our work. The committee of the National Electric Light Association invited such delegates to be present here as it thought best to all concerned, for certain specific purposes. This meeting has appointed a sub-committee to consider the further details of that specific purpose. I do not understand that if this proposed permanent organization, something in the future, is effected, that it will affect in the slightest degree this present meeting, nor will it affect the obligation of that sub-committee to report to this organization; and this present organization must necessarily continue in force, entirely regardless of the proposed permanent national body, whether it is formed or not, until the report of this committee. It is true the sub-committee yesterday, in recommending the permanent organization, did think it wise to suggest that certain of the delegates who are here present as complimentary delegates, should be made associate delegates in the permanent organization; but I do not see how that could affect the right of those delegates here now to vote on any question which may come up before this body. Therefore, it seems to me that we can go ahead with our work as it is laid out here. This body can certainly take no action with reference to a permanent organization until that has been submitted to all the various societies represented by delegates. They are the parties to say whether they will join the permanent organization, not the delegates. We cannot commit our organization to say whether we will come in as associate or active

members, in the proposed organization. Let us go ahead. If the delegates agree with the recommendation of the committee to include the associations and organizations whom they thought it wise to recommend as forming the nucleus of a permanent national body, let these invitations be sent to them; but let us go ahead now with our own work on the lines that were laid out, and accomplish the purposes for which the meeting was called together.

Mr. Johnson: Sometimes you will clear up a subject better by asking a question, particularly if you happen not to be familiar with what has preceded. I would like to make this inquiry. At the present time I want certain questions answered in regard to the application of existing rules. I have been hoping to be able to come to this meeting and get those questions answered. I assume from the remarks made that this convention is going to deal with any question that may be a live one at the moment. We know that that question is not the only one that will have to be answered. We know that tomorrow another will arise, which has not yet risen. The object of the permanent organization is to create a body to answer these questions which will arise in the future. If I am correct, the right course is being taken. The question today can be answered here. The one I cannot see now, but which I know will arise tomorrow, can be answered by that body; which is the thing that has been lacking, and which is the thing we will need.

Mr. Woodbury: If there is such a unity as has been stated, I will bring it to a live issue in this way. I move as an amendment to the report the following:

ORDERED: - That this convention invites the following organizations to send delegates to future meetings of this convention: American Society of Civil Engineers; American Society of Mechanical Engineers; American Institute of Mining Engineers; American Society of Naval Architects and Marine Engineers; National Master Builders' Association.

This I offer as an amendment to the report. Now, if there is that unity, this will accomplish the purpose. (Note: Three of the societies mentioned above were represented at the meeting. It seems strange to mention them here. C.)

Mr. Stone: We are all after the same object. I think the course which was pursued yesterday was logical – and was suggested by the chair, I think, more than in any other way. The remarks the chair made suggested the matter to me. We were invited to come here and discuss these rules. We came here as representing different societies, but we had no organization, and it was suggested that there be an organization, and some one made use of the statement on the floor that the societies here represented be an organization. Of course, it is impossible that these societies form an organization but delegates of these societies can make an organization. You will remember also that it gave rise to a question as to the character of the societies or concerns, which should be represented in an organization of this kind for this purpose, and so the matter was referred to a committee, to consider it fully. The committee drew the distinct line, which seemed entirely proper to them, and apparently has met with the endorsement of the meeting, that those dealing commercially with electrical matters should be associated with us, and others, representing a clientage outside of the commercial interests, should be the delegate body, which should form this new organization; keeping all those now in, and adding the others. Now, there was not meant to be any break in the continuity of the work; I cannot see the break. I suppose Mr. Woodbury did not mean to say that all those societies be invited to send in delegates, because he read the names of some societies which had been invited originally to send in delegates. It seems to me that by taking the action which is contemplated now, we take a backward step on the action which was taken yesterday, in regard to the division as to delegates

and associate delegates, a division which seems to me very wise. I was glad to find that this distinction was not only accepted by, but also defended in our committee strongly by a member of the committee who represents one of these organizations that are dealing commercially in electrical appliances. He was as strong an advocate as any one, I think the strongest perhaps, of leaving all these organizations out as delegates and making them associate delegates. I cannot see any break in the continuity, or how we are going to hasten things by the proposed action.

If we let things go on as started we really provide for a continuation of what was done by the National Electric Light Association. I think all feel, and all will be glad to express, their great obligations to that Association for the great amount of work it has done in bringing this organization about.

Mr. Ayer: As I understand it, the report of the committee recommended additional societies to form a part of this organization, as Mr. Woodbury desires. The report of the committee contemplated an invitation to these other societies to send delegates to become members of this organization. If I am wrong, I would like to be corrected.

The Chairman: I think the position that Mr. Woodbury took was that he desired to see no injustice done to the National Electric Light Association, which had taken such an active interest in this matter. I think the gentlemen who are identified with that Association and with this work will appreciate Mr. Woodbury's disinterested motive. I think if the committee had put in their report that in addition to the names recommended, they would suggest that the following associations be invited to send delegates and the elimination of certain names from the report. Mr. Woodbury would have said nothing.

It seems to me that the committee's report is pretty well taken care of, and as far as the National Electric Light Association is concerned, I want to support Mr. Ayer's statement in full. I feel confident in stating that the National Electric Light Association is perfectly willing to subordinate any ambitions or desires it has in this matter to the good of the cause. We want to see the results accomplished and are willing to have the National Electric Light Association disappear entirely as sponsor of this movement. That Association is aware that in New York City today there are five different bureaus passing upon electrical work, and that is done all over the country, to a greater or less extent. We all realize that we must have one single standard code of rules. The National Electric Light Association feels that a movement of this kind, in which it has taken the initiative, is going to secure that much-to-be desired result. Mr. Woodbury has made a motion, which has not been seconded, and is therefore not before the house. I suggest that the report of yesterday be read once more, and then if Mr. Woodbury has a motion to take any further action, and it is seconded, we will act; if not, I suggest that the report stands exactly as it was read and adopted yesterday, and that we proceed with the rest of the business.

Mr. Woodbury: There were no omissions whatever in the list of names which I read. It merely consisted in reading those which were added to the names, as suggested by the committee.

Mr. Greene: Do I understand that your idea is that we should not drop any names of the delegates here present, but that the permanent organization should include all of those and the additional names as well?

Mr. Woodbury: Certainly; that is the entire matter – to preserve the organization, but not to wipe out this and make another organization.

Mr. Greene: The point of difference between us is that you do not think there should be any distinction between delegates to the permanent organization; they should all have equal voice, and should include all the delegates here present with the addition of the others?

Mr. Woodbury: I mean that the permanent organization should be made just on the plans laid out by the National Electric Light Association. That Association invited a number of interests to send delegates. These invitations were accepted and the delegates have come, and now we find there is a recommendation to ignore the position of the National Electric Light Association in the matter; to wipe out this organization, and to set up another one in advance of our accomplishing the objects contemplated in our original call.

Mr. Greene: Not to wipe it out.

Mr. Woodbury: Why does this report not wipe out this convention?

Mr. Greene: The intention in calling this meeting was not to make it a permanent thing, but to do certain work. It would die a natural death, when that work was completed. It is not a question of wiping out, but of continuing that work.

Mr. Woodbury: Whether its death is occasioned naturally, or from strangulation by its rules – which has caused the death of many an organization – there is no doubt that its existence would be stopped.

Mr. Greene: The point is, I think, that the National Electric Light Association intended it should be wiped out upon the completion of its work.

Mr. French: Is the only point of difference between the report of the committee and his ideas that the delegates from manufacturing concerns should be excluded?

Mr. Woodbury: No; that does not come up as a live issue now at all.

Mr. French: That is the only difference, as far as I can understand it, between your motion and the report of the committee; you simply want to add to the delegates here. The committee wishes to add and also subtract.

Mr. Jenks: Perhaps it may illustrate the idea which several of the members are endeavoring to make mutually clear, by recalling the procedure of six years ago, at the time the first codification of national rules was made. In that case, as in this, the National Electric Light Association took the initiative. They appointed a committee which issued invitations to other representative men in the electrical interests. We all met at Cape May two days in advance of the meeting of the National Electric Light Association, not because we were to be a tail to that convention, or a head, but because it was convenient. It was arranged, however, that we should go there at that time. The first thing we did was to draw up a code of by-laws, which stated that the gentlemen there assembled formed themselves into a new body, which did not before exist. We said we will call ourselves the National Electro-Insurance Bureau; our object being to adopt a platform of rules upon which we will all agree. The National Electric Light Association is one factor in this new organization; the insurance people are another, and a large factor, and they have several representatives. In that case it was deemed wise to make all the representatives of the insurance, electric light and power interests co-equal upon the floor. In this case it is deemed wise to have a voting body composed only of national associations of electric lighting, or insurance and other interests, and to make the manufacturing interests associate members, having the same rights and privileges, but not having a vote in the proceedings of the convention. I do not see that our action here differs essentially from the action which we tried to take at Cape May; and the only trouble with that body as then formed was that its president did not call it together again to perpetuate it. It actually performed the work of getting together the material which was afterward adopted by the National Electric Light Association, also by the Western Board of Fire Underwriters, the Underwriters' National Electric Association, and others, as the basis of what we call the national code. That is what we are endeavoring to amend, as I understand it. We appointed a committee last night to draw up a code of by-laws for this

organization, to be composed of the associations represented at this meeting, and some others; and to provide for associate members. I happen to be among the associate members, if the arrangement goes through. We do not organize as including any association not represented here, but we say it is desirable to invite people who are not here and to invite other societies to send delegates to our next meeting. I do not think there is anything inconsistent with Mr. Woodbury's ideas, and perhaps there is a little misunderstanding as to what we are trying to do. If the vote of yesterday means that in organizing we should bring in as members elected and forming part of the nucleus, people who are not here, I do not agree with the idea. These people should be invited to attend next time; and not appear as members of the initial body. We can ask the committee appointed last night for their report and vote upon it, and adopt a code of by-laws; and then perhaps, those of us who represent national organizations or those of us who would be associates, representing manufacturing organizations, can go home, and say, "We became members of this new body subject to your ratification. Do you believe in it? If you do, choose us or someone else to attend the next meeting as your representative because the body which we formed must consist of delegates, not in their personal capacity, but simply as representatives." If a delegate here today dies or moves away, some other delegate will fill his place at the next meeting. I think by the time the report of the committee formed last night is in, we would all agree upon what we are trying to do.

The Chairman: I call upon the Secretary to read the report presented yesterday, and then we will proceed with the regular business.

Mr. Brophy: I think we are wasting valuable time. We understand what we are here for, and we are going to do what we can to perfect this organization. It is understood that nobody is trying to wipe out this organization. The National Electric Light Association does not feel snubbed, and we are greatly obliged to the gentlemen who came here to help us. Now let us go on and finish our business.

Mr. Merrill: I move the report of yesterday be read. Carried.

The report was read.

Mr. Merrill: I understand Mr. Woodbury made a motion regarding that report.

The Chairman: The motion was not seconded.

Mr. Merrill: I will second the motion.

Mr. Woodbury: The first motion was to reconsider this report, and in that way to bring it anew before the meeting. I did not know it had not been seconded, or I should have yielded at once when the chair stopped me.

Mr. Merrill: I will second Mr. Woodbury's first motion. I think we are wasting quite a little time here, and it might perhaps be as well to proceed as quickly as possible to the further discussion and consideration of the rules. Now, in case this report stands, I suppose the matter of the by-laws would be next in order of business, and would come up for discussion. I happen to know that the committee is not yet quite ready to report; and I think that committee could report probably more intelligently after the discussion of the rules is finished than they could before; and in order that we may proceed to the discussion of these rules, I would ask that the delegates give due consideration to Mr. Woodbury's motion, and temporarily set aside that report, so that we can take up the whole general subject after the discussion of the rules is finished. It seems to me that the most important thing is first to bring out a very full expression of opinion on the rules as they now stand, and on the way in which they have been enforced or not enforced in different parts of the country.

Mr. Jones: I would like to ask what is the status of my company here in this arrangement?

The Chairman: I should imagine, Mr. Jones, that your company would be in a similar position to the General Electric and Westinghouse Company and other organizations, and an associate member. That would be my interpretation of the report.

Mr. Jones: We do not manufacture anything.

The Chairman: It is a commercial enterprise, whereas the commercial feature is eliminated from all the others.

Mr. Crocker: That question was disposed of yesterday. Mr. Woodbury raises another point. Let us dispose of that. The question as to the advisability of having corporations as associate members was disposed of yesterday, as I understand it. Now, Mr. Woodbury, after making a statement, moves to reconsider the action on the report, which motion has been seconded. I think it would be well to take a vote on that question of reconsideration.

The Chairman put the question on the motion to reconsider, which was lost.

The Chairman: There was another motion that Mr. Woodbury made, and which was not seconded as originally made.

Mr. Fitzgerald: I second that motion.

Mr. Woodbury: The motion was substantially that by way of amendment to that report, that the Secretary should send invitations to such organizations that were included in the committee's report, and not represented here, to send delegates to future meetings of this Association. But I shall not press that motion as already my duties as Secretary under the last vote will require me to send letters to all of the parties mentioned in the report, whether they are represented here by delegates or not. I regret that I did not make myself clearer; but the point is simply this – to preserve the integrity of the present organization. I believe that when this report goes out, and under the action of it for future meetings, it will be found to lack the head which it now has by reason of its connection and reference to the National Electric Light Association as a permanent organization already made, and time alone can determine whether I am right or wrong. I was asked one question; and I will say there is absolutely nothing personal in the matter one way or the other. I am not in any way connected with any manufacturing Electric Corporation; so that does not come within the limit that we assume; the personal question never entered my mind. I was very much surprised to have the question broached; it is not a live issue at all.

Mr. Ayer: I think I see what Mr. Woodbury is getting at and he is right. The report says that this organization be perfected with all these different societies as the original members. Now we have included in the organization all these new societies that have not been invited here or proposed, and that are not represented here. If they do not come in later on at the next meeting, any one staying out, it forces a new method of organization. I think that is the point Mr. Woodbury is trying to make plain.

Mr. Woodbury: Certainly.

Mr. Ayer: The report as it reads covers the names of the associations represented here, and added organizations to be asked to join this organization. That is the condition he tries to put it in. His method makes it clear and better and less ambiguous later on. We are here to act. We say we will do this thing; and if we say that some parties that are not here have agreed to this thing, and it is unanimous, - it certainly is not so.

Mr. French: I did not mean to indicate that I thought Mr. Woodbury had any personal interest in the matter; I simply wanted to bring out a condition that did not seem clear, between what he desired and the committee desired.

Mr. Ayer moved to reconsider the report.

The motion was put and carried.

Mr. Merrill: I move that the report of the committee be referred back to the committee for amendment and further report; and that Mr. Woodbury be added to the committee.

The motion was put and carried.

The Chairman: Mr. Merrill called attention to the fact that there is a committee, of which he is a member, relative to the by-laws; and they were called from their committee meeting, in order to be present when this subject was discussed; and as that is a very important committee and they should act at once, perhaps it would be well for the committee to retire and finish their report.

Mr. Merrill: Mr. Chairman, that committee cannot very well report until the report of this committee has been again submitted, because the basis of the resolution will be changed slightly.

The Chairman: We will now proceed to the consideration of the rules, page 14. I will say to the gentlemen in the rear of the room, who have just come in, that there was an expression on the part of the delegates present, that these pamphlets should not go out of the room.

Mr. McDevitt: I think we have arrived now at the most vital point in the whole realm of electric lighting, the subject of safety fuses.

The Chairman: Mr. McDevitt will allow me to suggest that the section be first read.

The Secretary read section 24.

Mr. Jenks: Is it understood that the first of the rules prohibits the use of cutouts in the canopies or shells of fixtures, absolutely and without exception?

The Chairman: It says, "They must not be placed in the canopies or shells of fixtures." That is explicit.

Mr. Jenks: What do I understand by the language of the rule, that they must be supplied with a device of some kind for enclosing the fusible strip, made of non-combustible and moisture-proof material. Does that mean that there must be no cut-out arranged without a cover over the fuse, either in the form of a plug or mica or porcelain, or some other cover; that is, the cut-out must not be left so that the fuse is exposed to the air?

Mr. Merrill: Obviously, the covering of a cutout is necessary.

Mr. Brophy: We do not approve cut-out blocks provided with heavy covers, as they are a source of danger to persons standing near them; a dead short circuit will blow them all to pieces. We prefer a cover just strong enough to hold the melted metal within the box. A twenty-ampere fuse on a five hundred-volt circuit in certain styles of covered fuse-box is a pretty dangerous thing.

Mr. Merrill: The trouble there is with the device, and not with the rule.

Mr. McDevitt: This subject and the following one, both of them, are very important and I do not think that the course we are just going through, of altering and amending, will give them the consideration which they deserve, that is the whole subject of the safety device, including the fuse, the base block, with its terminals, distance between breaks, and the device, all together. Now, the advantage which this organization possesses of having scientific men present should lead to a full and clear discussion; and I think the whole feature of safety devices is a proper

subject for consideration to remedy the defects and dangers which exist. First there is, I may say, the "hundred and one" different alloys that are made for the purpose and are on the market; again, to take the best of them, under certain conditions they will carry from 75 to 175 percent beyond what they are rated for. I think the whole thing is wrong. There are a number of scientific men who have made tests on fusible devices, and I think there are men in this room who have done it, and exposed some hazardous defects in what we call our safety devices. I think it is a fit subject for a proper committee in this organization to take up. I would like to hear an expression from some of the members.

The Chairman: Do you mean to report at this meeting?

Mr. McDevitt: No sir, it would take more time than that.

The Chairman: Do you think it of sufficient importance to appoint a special committee for this particular subject?

Mr. McDevitt: I would like to hear an expression of opinion.

Mr. Brophy: I have not been able to buy fuses that show a capacity anything near what they are marked. They vary, as Mr. McDevitt says, from one hundred to one hundred and fifty percent above what they are rated. I find that the distance between the terminals of fuses determines very largely their melting point. I find, too, that the copper tipped fuse will not melt nearly as quickly as those that are not tipped. The fuse today is little better than a delusion and a snare, and they are comparatively worthless; and in most cases the present styles of cutouts are imperfect. Many of them we have had to reject in Boston owing to the fact that the terminals are too close together. It is a subject that should, possibly, be taken up by a special committee. I am in favor of Mr. McDevitt's idea, and hope he will make it as a motion.

Mr. Woodbury: This question of the cutouts is certainly one that is worthy of a great deal of consideration. I have been told in connection with a certain number of cells of storage batteries that 140 amperes of current has been conducted for over six months through a fuse marked 50 amperes. Then there are different methods of marking fuses in different parts of the electrical world. I understand that the electric light or power people call a five ampere fuse one that would safely conduct five amperes of current, and will yield and blow at some current above that; with the protective apparatus of battery circuits a five ampere fuse is one that would break down in a short time with five amperes. I trust that the matter will be taken up, possibly in connection with some of the committees on rules, and that they will formulate, not merely some of the vital characteristics and specifications in regard to the fuses, but also what shall be the name; shall it be as it is now, like the difference between the current of a river and the wind; Northern current flows to the North, and Northern winds blow from the North – in a contrary direction. We have the same inconsistent terminology in regard to fuses in different parts of the electrical world.

Mr. McDevitt: I would advise the appointment of a proper committee to take that subject up.

The Chairman: A committee of how many, and how appointed?

Mr. McDevitt: Three or five.

The Chairman: Three?

Mr. McDevitt: Yes, sir.

The Chairman: Do you suggest that the names be subject to nomination by the meeting?

Mr. Ayer: I wish to say a few words before that question is put. I do not see what is the use of appointing a committee on special work of that character and take up the subject as is intended. The special work, which is being daily done by testing bureaus, is about all you can

expect any results from. We all know what we have in the market today, and we all say they are not worth a – picayune. We know that a committee is not going to get us something else. No committee is going to spend the time to develop some new fuse or cutout which will be better; they cannot do it. It must come from the practical men who have been striving for years to get it. We have all the distinction for cutouts that is desired. I do not think the matter calls for a special committee; and I think it is unwise to appoint committees, unless they are certain to be able to accomplish something; and there is not evidence, I think, before any of us, which indicates that it is likely that fruitful results will be derived from any special committee on this question of fusible cut-outs.

Mr. McDevitt: I agree with the gentleman; I think the subject should be referred to some proper association.

Mr. Greene: I amend the motion to the effect that the American Institute of Electrical Engineers be requested to give the matter special attention.

Mr. Crocker: As a representative of that body, I would say that the American Society of Electrical Engineers have never done work of that kind before, and would not do it in this case.

The Chairman: They have already declined to do that, in reference to the establishment of a uniform standard of light.

Mr. Crocker: In reference to this commercial question of the establishment of lights, they decided it was unwise to attempt anything in that direction. I think what Mr. Ayer says is true, that it will be worked out, either in laboratories or by the companies interested, and we shall have a solution of this question, or a decision upon it, at least; and I am quite sure that it will be simply pigeon-holing the matter if it was referred to the American Institute of Electrical Engineers.

The Chairman: I would like Mr. McDevitt to state what the amendment to the original motion is, so that we will have it clear in our minds.

Mr. McDevitt: My idea was to have the subject referred to one of the associations connected with this organization. I think there are three or four that should be able to take this matter up. If not, the selection of some prominent men from some of the associations. That is my idea.

Mr. Ayer: We cannot command the services of prominent men in these associations, and that is the thing to be done. In the absence of that, people who are engaged on the subject will work it out, and we will reap the benefit of it when the time comes.

Mr. Jenks: I believe the organization Mr. Merrill is connected with are actively engaged in working on this matter and have facilities for doing practical laboratory work. If anybody is to take it up, it seems to me it must be somebody in that line of business.

The Chairman: I suggest that Mr. McDevitt incorporate in his amendment a suggestion to whom he considers would be the proper parties to take this under consideration.

Mr. Merrill: I would ask Mr. McDevitt to refer the matter to the committee of seven, to which the rules have been referred, for their special consideration and attention and let them work it out.

The Chairman: I think that is the proper way; that the committee shall give it very careful consideration. I ask Mr. McDevitt if he will take that as a substitute for his motion?

Mr. McDevitt: Yes, sir.

Mr. Brophy: The fire departments in Boston are testing fuses in their laboratory, and they will do all they can to solve the question.

Mr. Merrill: Mr. McDevitt himself has done very valuable work in this field. We want statistics from a number of laboratories, so that we can compare results.

The Chairman: The amendment is that the matter be referred to the committee of seven, already appointed, with the request that they give their particular attention to this most important matter. Carried.

Mr. Ford: In connection with safety cut-outs, I bring up the question of automatic circuit breakers for use on switchboards and distribution boards in isolated plants. I use a good many in New York City, and they have proven very satisfactory in certain cases and under certain conditions. I believe the rules do not touch on it at all at present.

Mr. McDevitt: On that subject I would like to say that I think the committee, in considering the question of the unreliability of fuses, should take into consideration the feature of circuit breakers as a substitute, in some cases. In our city they are also being used extensively on switchboards. I hope the committee will consider that in connection with the subject of safety fuses.

Mr. Brophy: Not long since one of our power circuits in Boston was accidentally opened during business hours, and the motors came to a stop with full loads on; when the circuit was closed and the current turned on, nearly every armature was burned out. That company fully realized the value of automatic circuit breakers.

The Chairman: Under the head of electric railways there is reference to automatic circuit breakers. I think it would be well to secure a free expression of opinion on this subject. Automatic circuit breakers are coming to the front, and we should have a general expression of views on the subject.

Mr. Merrill: As far as the rules are concerned, it seems to me they provide for the installation and use of automatic circuit breakers. Of course, they do not do it under the head of "safety fuses." In electric railway stations they provide for them specifically, and in all low potential circuits they provide for "automatic cut-outs." Therefore, as far as the criticism of the rules is concerned, it seems to me that it is unfounded although as a general matter of great importance, I should like to hear the subject fully discussed.

Mr. Greene: I agree with what has been said about the unreliability of fuses in general; but I think, perhaps, the fuse has been attacked unjustly, because of faults which can be corrected. There has never been any proper grading, I think, of fuses based upon the time required for the blowing of the fuse. Of course, that is the important point --the time required to reach the melting point. I know that the electric bureau of the National Board of Fire Underwriters is carrying on experiments; and I have no doubt that they will result in some common sense rules being adopted which will involve the time element, and that, after all, is the thing that should be fixed and definite; and something we can go by. Of course, circuit breakers have their field, especially in the case of large currents, high potential, railway work, power transmission work, and things of that kind; but I think it would be a serious mistake to conclude that the safety device should be done away with, because they are giving trouble at the present. The troubles can be remedied by proper restrictions.

Mr. McDevitt: What does the gentleman mean by the time element; the time in which it is in use, or the time at which it should go.

Mr. Greene: The time at which it should go.

Mr. McDevitt: That is very important.

Mr. Greene: Yes, sir. Then there is the question of contact resistance. It is common practice with the underground systems in large cities, low potential systems, to inspect the fuses

periodically, taking them out and cleaning the contacts; otherwise there is a gradual resistance at the contacts, which is more marked in the streets than in buildings.

Mr. Jones: Perhaps it would be practicable to arrange fuse plugs so that you could not put a 20 ampere fuse where a 10 ampere fuse should go; and I think that while you are saddling a great many of the troubles off on the scapegoat of the unreliability of fuses in general, that much is due to the carelessness or want of knowledge of persons handling them. I know two or three cases where I have looked in fuse boxes, expecting to find fuses of proper amperage; and found ten or fifteen times more. If it is practicable to have fuse blocks manufactured, so that ten-ampere fuse blocks will take that fuse and no other, we will be a long way toward a remedy.

Mr. McDevitt: Speaking of the time element of fusible alloys, I have had experience with fusible alloys in connection with automatic sprinklers, where the proper alloy was applied to the sprinkler, and in two or three years' time the alloy has failed to be dissolved by the proper temperature, which is no doubt due to the effect of time and some mechanical change in the alloys. That has also occurred with fuses in connection with electric lighting. That is a hard subject to get down to – that part of it. Also in certain tests I made I found that fuses, for fifteen or twenty minutes, would carry seventy-five percent above that which they were calculated for.

Mr. Mead: I take it, from Mr. McDevitt's statement, that he does not intend to do away with the fuse idea entirely, on account of its general unreliability?

Mr. McDevitt: No, sir.

Mr. Mead: It strikes me that the point is to work the best element; that is, both a fuse and cutout. Let us have a fuse that can be approximately relied upon and an automatic cut-out that will as nearly as possible, which combination has the virtue of protecting the circuit twice, where you otherwise would be protected but once. In Pittsburgh, in the low potential lines in our city service, both automatic cutouts and fuses are in service. The drop will act automatically, and if the fuse should not act according to its specified amperage, the automatic drop will cut out the current. If they can be put in they will give you better protection; and I suggest that it is a proper thing for a committee to take into consideration under the general head of fuses and fuse protection.

Mr. Ford: With regard to field electric magnetic circuit breakers, outside of their use in electric railway plants for generators, for the protection of feeders, and for the protection of car equipment, instead of fuse cut-outs, I believe that they have a further field in the isolated plant, especially in relation to power transmission; factory plant service. There they should be used for the protection of motors. Every circuit should have an automatic circuit breaker, instead of the fuse cutout, and in many cases for the protection of feeder circuits, both for lighting and power, where large currents are used. I know of a circuit breaker, in fact two designs of circuit breakers, which will act within one-hundredth part of a second. Of course, no fuse will blow in anything like that limit of time; or, inversely, they take a good deal longer time to blow.

Mr. Greene: The question as to length of time required for safety fuses or automatic circuit breakers to act involves the safety of the connected wires. Now, if the wires do not heat up to an excessive temperature, no particular harm can be done, as far as I can see, to the circuit, even if the wires do not heat up much. According to some recent tests made by our company, the results show that the fuse may take several minutes to blow, at the same time the wires will rise only a few degrees in temperature.

A test was made on a standard link cutout; a 70-ampere fuse was used. 70 amperes was put on for forty-five seconds, then raised to 75 amperes, ran one minute, then raised to 85 amperes, ran two minutes; then raised to 90 amperes and ran one minute and ten seconds, when

the fuse blew. The room was 20 degrees C. Temperature of this wire at the end of test, taken near the terminal, 28 degrees C., showing a rise of temperature of only 8 degrees C.

A second test was made using the same fuses (70 amperes) starting with a current of 100 amperes. This current was continued for 28.9 seconds, when the fuse blew, and at the end of the test the wire had risen 29 degrees C.

While it is undoubtedly true that the fuse does not act as promptly as a circuit breaker, it is also true that, if the margin is not too great, and as Mr. Jones suggested, the wrong fuse is not employed, five minutes' time required for the fuse to heat up to the melting point does not necessarily involve a dangerous circuit.

Mr. McDevitt: That is one of the results of the sluggish action of the fuses, destruction of the insulation on the wire. I was called into a newspaper office seven or eight years ago, where smoke had been issuing from the wires, and the current had been turned off. I had the current turned on again, when smoke again appeared; but it was fifteen minutes before the fuse went out. It was the proper size fuse for the amount of current. After two or three occurrences of that kind, the insulation is all destroyed.

Mr. Jones: I would like to suggest that it might be important for the committee to consider the detrimental effect of resonance. When a wire is under tremendous electrical strain, these surgings go through everything, and seem to puzzle our ordinary electricians, myself among them. A sudden connection or disconnection of a power circuit from a machine sets up resonant effects which in systems employing high voltages are extremely hazardous; the resonance rising in pressure to an enormous extent and capable of breaking down an insulation that would be many times more than secure for the main working pressure.

Mr. Kennelly: I do not think there is any danger from resonance, except as regards lightning. We frequently find electric surgings in house wire and in gas pipes, under the influence of lightning; and we know that the surgings and sparkings occasionally produce dangerous results; but in the great majority of cases they take place without accident. No danger is to be apprehended in ordinary service from resonance taking place in commercial circuits produced by the electro-motive force of the generator.

As regard the fuses, it is, of course, fashionable to abuse fuses, and they often deserve it; but, on the other hand, we might fairly bear in mind many thousands of fuses that have done good work, and perhaps saved the circuits attached to them.

Mr. Jones: I was under the impression from something Professor Forbes said in relation to the wires at Niagara Falls, that they had to cut in some resistance, to let it down easily; that they would not dare to take it off on a jump as it would be destructive to the highest insulation.

Mr. Kennelly: I think Mr. Scott can inform you on that point.

Mr. Scott: Fuses are used on the Niagara Falls circuits, which are arranged to blow off very quickly. The actual time from the beginning of disruption of the fuses until the circuit is broken is very short as it is arranged to clear itself by explosion. So far, no difficulties at all have occurred. There have been but few occasions on which fuses have blown in commercial work, although many experimental tests were made.

In considering the subject of fuses, we are very apt to have in mind some specific size or condition, and to base our commendation or criticism on that particular case. The different questions which have come up in the last hour have covered a very large range of service, from the protection of fifty watts to the protection of several thousand horse power; and ranging from one ampere at fifty volts, to many hundreds of amperes to many thousands of volts. Fuses may be placed in a central station for the protection of heavy circuits, where they can be readily

inspected and quickly replaced, or they may be for the protection of wiring in houses, where probably not more than one-half percent of the fuses will blow in a year or ten years. The blowing of a fuse depends, of course, upon its temperature; and it will blow when its temperature becomes hot enough to melt the material. That rise of temperature will depend upon the rate at which heat is given to the fuse, and the rate at which it can get rid of heat. The heating of the fuse will depend upon its resistance. Its contacts, which often afford a variable element and the rate of getting rid of heat will depend upon the size of the fuse and its contacts and the temperature. The time of melting and the current strength will also depend on the temperature of the surrounding air. A fuse in a boiler room, where the surrounding temperature is high, will melt with a small current.

The rating of fuses has been the subject of criticism. Here is a piece of lead wire of a certain size, and by experiments we may determine that it will carry ten amperes for five minutes, and then melt at the ordinary temperature of the air. If it carried fifteen amperes it may blow in less time; if twenty amperes, in still less time; if it carried fifty amperes it may blow out in a few seconds. It may carry five or eight amperes continuously. How shall that fuse be rated? The rating for the ordinary wire-man should be such, I think, that if the fuse is marked for five amperes it is the fuse he is to place in a current which will carry five amperes. If the fuse could be made to invariably melt at six or eight amperes it would be very good, but that is a closer margin than can be used with reliability for the carrying of five amperes. If six amperes will melt a fuse, five amperes will raise the temperature nearly to the melting point, making it too hot under normal working if the melting point were high, or making the air temperature a large factor if the melting point were low. The time of melting depends upon the mass of the fuse; a lead fuse is sluggish, while a copper fuse heats and melts quickly. In protecting an individual lamp, or two lamps, where the current is a few amperes, it is not necessary, I think, to have a fuse which would blow on two, or three, or four amperes. The wire, which is required to carry such a lamp, will not overheat when carrying ten or fifteen amperes. The accident, which is liable to occur on a circuit of this kind, is one which will cause the flow of a very heavy current. In ordinary lighting service, if a lamp socket or lamp cord becomes defective and a short circuit is formed, the current will increase many times beyond the normal current, which would readily blow a fuse of much larger capacity than would be required for carrying the current normally.

With regard to the rating of fuses, then, should a fuse be marked for the current which it will just carry indefinitely or for a current on which it will blow quickly, or should it be marked for a current which it will carry indefinitely and safely, allowing some margin, a margin of 25, 50 or 100 per cent between the normal current and the current of the circuits? The desirability of selecting one rating, or another will depend on the location of the fuse, whether it be for the protection of low voltage lighting work of small capacity, or whether it be for large capacity, several hundred amperes, or even for heavier work in central stations. In connection with high tension work at one or two thousand volts, the question is not so much the carrying capacity of the fuse as the increase of current above the normal is generally considerable when the action of the fuse is required; but the vital problem is to get a fuse which will open the circuit without causing arcing and further destruction of apparatus.

Another point in connection with fuses and circuit breakers – if a lighting or power circuit from a central station be protected by a circuit breaker in the station, and out on the line the different branches be protected by fuses, then a heavy current on one of the branches may not blow the fuse on that branch instantly, but will cause the circuit breaker in the station to open, thus opening all the circuits connected with that feeder.

The subject of fuses is an extremely complicated and difficult one. I believe, however, as has been pointed out, that the fuse has done a great deal of effective work and should not be generally condemned, but should be improved; and that a large part of the failure of fuses arises from the defective cut-outs on which they are placed and on the careless manner in which they are often installed.

Mr. Greene: I should like to present for the consideration of the committee on revising rules the possibility of connecting the capacity of fuses or circuit breakers with the maximum rise in temperature; in other words, that it should be clearly stated that a fuse must blow or circuit breaker must act, after a temperature rise in the wires of more than so many degrees. It seems to me that if a rule of that kind could be adopted, it would be a great point gained.

Mr. Crocker: I think it is all a question of rating. I think that a dynamo or motor has rather more heating capacity than a wire, and is more sluggish in its rise of temperature, other things being equal, and with the same rating.

Mr. Wirt: How would it affect the commutator?

Mr. Crocker: Of course, that is another question of rating. The machine is intended to operate reasonably well with a certain percentage of overloads, say 25 or 50 per cent. Now, it seems to me that everything should be rated on the same basis, and as Mr. Scott has said, the question is largely one of rating. It would be possible to design a motor which would stand several hundred percent rise in current, without overheating or other sparking, but it is not necessary to have such a margin.

Mr. Wirt: Take the commercial machines.

Mr. Crocker: It seems to me that wiring is usually put in with a larger factor of safety (and as Mr. Kennelly pointed out yesterday the factor of safety is very large) than the motor or dynamo, but that is merely a question of practice. There is this difference, of course, that you can get at the dynamo or motor, you can see what it is doing, much better than you can in the case of the wire, which is inside a conduit or moulding. I think that point should not be forgotten; and it is apparent, therefore, that the smaller factor of safety is allowable for the former.

My idea about fuses has always been that if you specify definitely the condition under which they should be used, as to length, position, exposure to the atmosphere, size of containing enclosure, size and material of contact points to which it is attached, and other reasonable conditions that should always be defined in the case of any piece of apparatus that is intended to work correctly, then you would get reasonably reliable results in the case of fuses. But when we have a spool of wire of a certain diameter, and call that a five ampere fuse, without specifying any of those conditions, and without stating whether it is to blow at five amperes, or to carry five amperes normally, or to blow at ten amperes, why, then, the fuse is as unsatisfactory a device as one could well imagine.

But I fail to see either from a theoretical or practical standpoint, why there is any inherent difficulty. The laws of physics involved are very simple and definite; and I should say that we could get absolutely reliable results within reasonable limits, if the ordinary conditions of physical, and for that matter, practical work, were applied to this case. It seems to me that they should be applied to this case with particular care, rather than to be ignored, which has been the practice heretofore and is apparently to remain the practice, because I see no great tendency towards standardizing fuses. Mr. Jones spoke of supplying a fuse base to make it impossible to put the wrong fuse in, which is a good idea. I fail to see any element of uncertainty except, possibly, the one as to the effect of long continued currents.

That is a point on which we have little data, being like the fatigue of metals under mechanical stress, and is one of those peculiar molecular properties which the best physicist is unable to make definite statements in regard to. I do not think that element is a very serious one, and even that, uncertain as it is, could be eliminated by changing the fuse at certain periods, which would not involve great expense if it were necessary to do it. It simply means that it may be one of the conditions of coming electrical work to insist upon regular and periodic renewal of the fuses, which might be incorporated in the rules, if necessary.

Mr. Wirt: In reference to this question of the length of time a fuse has been in service affecting its melting point, I think experience with automatic sprinklers helps us out, as Mr. McDevitt said. I believe Mr. Woodbury could give us some interesting data on that point.

Mr. Woodbury: Any reference to this point of sprinkler solders is a matter of ancient history to me. Suffice it to say that if any solder is exposed to influences which corrode any of its constituents, its substance has been changed, and therefore its melting point has been altered. It is well known in establishments which are devoted to some of the industrial chemical processes, where the vapor is so actively destructive of solder, that it is necessary to re-solder the lanterns used around the place every year or two, as a great many lanterns are used, because in that class of works the operations go on night and day.

The question of fuses is not merely one of alloy, but also of protecting it within certain limits, by enclosing it, and relying on the disruptive action of the expanding vapor, or of the metal enclosed, which must be of considerable volume, and also the increased volume of the air, which is heated to a very high temperature by the arc. To illustrate the great heat of the arc, a short time ago I placed in service a five ampere fuse, one that would blow at five amperes, and surrounded this fuse with a roll of asbestos paper, perhaps two inches in diameter, and attached it to the street railway current at 525 volts; and the temperature of the paper was so great, that the vapor of the lead formed a flux with the silica of the asbestos paper, and the inside of the asbestos paper was lined with a crude form of glass; and which you have no doubt all noticed in looking over asbestos lined fuse boxes, in some form or other. The question of the length of fuses has been taken up. I know of instances where fuses as long as fourteen inches were made for purposes where results would have been obtained by fuses three-quarters of an inch in length.

If the fuse is enclosed by something that will cause the arc to be shot out or blown out by its own volume of vapor and air expanded by the heat, a fuse about three-quarters, possibly not more than five-eighths of an inch, will give efficient service in protecting certain lines of apparatus. The variability of fuses made of copper and of German silver has given rise to considerable difficulty; the variability having risen from the difference in the conductivity of the metal, caused by the oxidation of the outer surface. I am inclined to think that a properly protected lead and tin alloy fuse is as permanent in its nature as any of the protectors operating by a fusion of metals. However, where there are a number of open fuses near together, as is necessary in protecting a large number of parallel circuits, the operation of one fuse may cause a difficulty, because this metallic vapor is enough of a conductor to act as a switch to shunt the current from one wire over a very large number of wires. The subject is a very broad one, and one which demands both laboratory investigations and the results of practical experience to determine the nature of the devices, which must reach into different lines, whether they are to protect the plant from itself or against foreign currents.

Mr. Jenks: I desire to make just one remark called to mind by what Mr. Woodbury said about copper and German silver fuses. Of course, the usefulness of fuses, as ordinarily applied, and as described in the rules which we have before us, is due to the fact that we propose to run

them at a maximum load, within a small percentage of the current necessary to melt it. If you take a copper fuse, and undertake to run it within ten percent of the currents required to melt it, you keep it red-hot. The same is approximately true of German silver. This point should, of course, be considered, and very carefully, in the selection of the material. There is also another point, which somebody ought to know – the relation of the melting point of the material selected for fuses to the average temperature of the surrounding air. This is another factor of interest and importance. For example, if you select a fuse which melts at a temperature of four hundred degrees F., and the average temperature of the air is sixty degrees, the maximum being eighty, the variation in the available capacity of the fuse, caused by changes of temperature of surrounding air, will be slight; the percentage of change in the temperature of the surrounding air being only twenty degrees out of, say, three hundred and forty degrees, which will be required as a temperature sufficient to melt the fuse.

Resulting from the solution of the question of how large a rise in temperature is necessary to melt the fuse, will follow the watts necessary to be expended, and (including the factor of time) the violence of the explosion that will be produced; and is not a matter for very careful consideration, and for standardizing, whether the fuse which shall be considered the proper one for the ordinary uses of electric lighting or power, shall be made of pure lead, nearly pure lead, or of some such alloy as will reduce the melting point to a much lower standard on account of the relatively small amount of energy which would then be required, and the consequent reduction of the explosive action. As I understand it, fuses have been barred out of fixtures because of the possibility of the explosive action of the fuse melting the canopy of the fixture, and assisting thereby in maintaining the arc. Is this a proper statement of the reason?

Mr. Merrill: That is true, to a certain extent; and also because the device introduced here in the canopy of fixtures could not be thoroughly well insulated in its connections, and because it gave us four additional screw connections or a circuit at an undesirable point. A further reason is that there seems to be no real necessity, except in isolated cases, for the introduction of fuses under fixture canopies.

Mr. Jenks: Of course, the fuses that have heretofore been put under fixture canopies must be in future located back from the fixture.

Mr. McDevitt: One of the causes for electrical fires years ago, resulted from the leakage of gas at the insulating joints, and the blowing of the fuse ignited the gas and destroyed the rubber compound, which was at that time used around them. At the present day, we have gotten over that by the use of mica insulation. Another objection is that the blowing of fuses disfigures the ceiling.

Mr. Jones: Mr. Chairman, I assume from your remarks yesterday that the present discussion has no particular reference to telegraph companies, except so far as they employ machinery for lighting or power; nevertheless, it may be interesting to the gentlemen present to have a little idea of our telegraph practice. Of course, we are immensely more interested in our protection from fire and lightning than you possibly can be as we have a great deal at stake, more than any insurance we carry, far above it. We carry no insurance at our principal offices that would compensate us for the complete loss of our plant by fire, as you can see.

At all of our principal stations we employ fuses of one-half ampere capacity to protect our delicate apparatus from sneaking currents. We have found it impossible to secure lead wire fine enough for such fuses, and have consequently selected German silver of a suitable gauge. I may say that we have studied the subject of lightning protection very thoroughly, availing ourselves of the experience of Mr. Preece, in London, and we confine ourselves to the blade

arrester for our telegraph wires, ramifying in every direction over the country, and insert between these blades a sheet of perforated mica, of sufficient thickness to protect us against a voltage, of say, one thousand volts; but that will not break down all our signaling currents, which are no greater than four hundred volts at any one station. We have found that where our wires become crossed with high potential electric light circuits that short fuse blocks are not sufficient protection, as the incoming current from the crossed electric light wire will continue to work across a short space after the fuse has blown. We, therefore, place first a six inch fuse of five ampere capacity next to the blade lightning arrester alluded to, thoroughly grounded with a large copper wire, and inside of that again a shorter fuse, about two inches, of one-half ampere capacity. The object of this is to cut off the high potential incoming current at the long fuse the moment that it jumps through the arrester to seek a ground. The object of the short fuse is to head off sneaking currents of lower voltage and of small quantity, so that nothing greater than one-half ampere can possibly traverse our inside circuits, in which the delicate apparatus is placed. The thickness of mica that we use is between six and ten mils. The object of this is, as before mentioned, to protect our apparatus against lightning that has a voltage not much in excess of our signaling currents.

Lightning is a very unmanageable element. We have it from the very faintest echo upon our wires to the most appalling displays of electric phenomena. This more particularly occurs in the South and the Southwest, where at times the lightning is in almost continuous blinding sheets and the thunder one continuous roar. Where this lightning happens to strike we do not believe that anything short of an iron cage could afford protection to human life or machinery. We have on our California circuits a No. 9 B. & S, copper wire that has several times been struck by lightning and melted, and the poles in many cases, where they were not properly earth wired, have been shattered by the lightning.

Mr. Kennelly: I would suggest that the importance of this subject lie in obtaining safety in the circuit to which the fuse is applied. What we all seem to want is a device to protect the wire from becoming too hot. I do not think it is worthwhile trying to get a committee, or any set of men, to test and discover a fuse which will do it; but if you will specify a rule which you can hold up in the inspection, where the law enforces that rule, you may be sure that the conditions can be met with; and that you will cause the manufacturers to produce the article. If you will only be specific as to what you require the fuse can be made without excessive expense. Rule 25 (b) says: - "Safety fuses must all be stamped or otherwise marked with the maximum number of amperes they will carry indefinitely without melting." If you will state that this is to be done in the fuse block practice, and, moreover, if you will specify that an excess of current of say 50 per cent above the normal, shall melt the fuse in a specified time, you will have all the requirements to enable you to see whether a fuse meets the conditions of practice. If you will make reasonable specifications I believe you will find all the good manufacturing companies glad to meet them.

Mr. Mead: Allow me to suggest a word to the committee about fuses – why not add "Preferably flat fuses." In Pittsburgh the inspectors have trouble inspecting fuses, unless they do it very closely, and a flat fuse can be made more readily than a round one, which for the average house purpose might be more easily substituted with wire, by any one so inclined; especially in a city like Pittsburgh, where the fuses are liable to get discolored on account of so much smoky atmosphere.

The Chairman: Of course, that might be particularly necessary in Pittsburgh.

Mr. Brophy: I am very glad to hear this discussion, because it is a benefit to the committee. If I understand the drift of the thing, it would be desirable to accomplish what Mr.

Jones stated; and I hope the representatives of the Westinghouse and General Electric Companies will consider the matter, and see if they can produce something which will prevent putting in any but the proper fuse block. I think Mr. Kennelly struck the keynote of the whole thing. We must compare the melting point of the fuse with the safe carrying capacity of the wire, and we must determine first what the safe carrying capacity of the wire is; then the excess of current that will blow the fuse, and then comes the rating of the fuse. I think there is no rating, judging from the results I have obtained from different makes of fuses. The old practice was to put in a fuse for so many lights; and I think possibly that practice exists in some sections of the country now. That was very wrong, indeed; it implied nothing.

Mr. Jones: I was in Chicago the other day, looking at a dynamo plant. I saw a fuse marked "50". I said to the attendant, "What does that mean?" He answered, "Fifty lights." I looked at the fuse and it said fifty amperes.

Mr. Brophy: That is a thing the committee must look to; a specific and uniform rating, and then, I have no doubt, the complaint against fuses will be less.

The Chairman: It is about time to adjourn for lunch.

Mr. Merrill: I move that the meeting adjourn until two o'clock. Carried.

Thursday-----Afternoon Session.

The Chairman called the meeting to order at 2:20 o'clock. He said: I notice in the back of the room the Secretary of the American Society of Mechanical Engineers, Mr. F. R. Hutton. We will be pleased to have him step forward and take a seat upon the platform.

Mr. Hutton: The Secretary, unfortunately, is grinding his own nose on his own grindstone; but I appreciate the invitation extended. Permit me, while I am here, to say that it gives the American Society of Mechanical Engineers much pleasure to have this body assembled in their quarters.

Mr. Stone: Your committee held a session, and after a comparison of views, have unanimously corrected the report upon permanent organization, which we trust will meet as unanimously with the acceptance of those who are here.

The Secretary read the report.

Mr. Fitzgerald: I move the adoption of the report as read.

The Chairman: The report is now open for consideration. I would like to ask whether it would be desirable to read the entire list of the organizations which will constitute the permanent committee. We have changed the reading a little, and if the Secretary will read the complete list as it now stands of the members of the permanent organization, it will be desirable to have that read.

The Secretary read the list, as requested.

The Chairman: There appears to be no further discussion on the report.

Mr. Fitzgerald's motion was put and carried.

The Chairman: Before proceeding with the reading of the rules, I would like to ask information of the gentlemen present as to the desirability of presenting before the meeting here anything which has been submitted by a manufacturing organization. Several gentlemen present have handed me packages, and there is one just come in from downtown with a request to have its contents brought before this meeting. It does not seem to be the province of the meeting today to take these things into consideration; but I would like a motion made, referring these things to the committee, or if it is advisable for us to consider them, or unadvisable for us to consider them, let it be so expressed.

Mr. Merrill: I move that these matters be referred to the committee. Carried.

The Chairman: I think it would be desirable, in view of the lengthy discussion this morning, and the work we have to go over this afternoon, that the discussion should be limited to the specific points at issue and expressions made which will guide the special committee. They do not want a rambling discussion on these various points, without coming to some conclusion; that is what we want to arrive at. The committee wishes to be instructed, to get the benefit of the criticisms, and the criticisms should be as specific as possible and the discussion as short as possible.

The Secretary then resumed the reading of the rules, beginning with No. 25.

Section 26.

Mr. Jones: If you will allow me to interrupt, I wish to ask a question. If this one table differs from the other two, don't you think it would be preferable to follow Mr. Kennelly's table in the first column?

Mr. Kennelly: I may, perhaps, be allowed to set that matter straight. I am not the father of any particular table, but rather the observer that has prepared a series of tables to show the amount of temperature rise for any given current in any wire. The table in the first and third

columns practically represents and embodies the specifications made by an English committee eight years ago, virtually requiring ten degrees C., or eighteen degrees F., rise at full load, which rule was found to be very safe, but had such a large margin that the table was changed to that which appears in the second column, representing a rise of 25 degrees F., instead of eighteen degrees F., the British Board of Trade has recently adopted thirty degrees F.

Mr. Merrill: In view of Mr. Kennelly's statements, I ask if there is any objection to the table in the second column?

Mr. Kennelly: No, but the simpler way would be I think, to adopt a specific temperature rise, and to adopt then, as embodying that, a certain table. This table does not on its face carry any expression as to how it is arrived at, and if the rule held that a wire should not be allowed under full load to rise in temperature so much F. or so much C., and the table showed how it should be done, it would be a more specific way of carrying it out.

Mr. Jones: Mr. Kennelly's suggestion seems to be the common sense one; but it must be made practical. It must be pointed out in what way that can be carried out definitely and surely. On the other hand, this table means nothing. It does not show what the percentage of conductivity of the copper wire is to be, or even whether it is to be copper wire; it merely says Brown & Sharpe gauge, and is to carry so many amperes. That might be an iron wire and, again, it might be fifty percent copper. If the competition is hot the manufacturers might protect themselves and put in a little alloy. So in view of that, if Mr. Kennelly could point out some good practical way by which his rule could be applied that is a good one, rise of temperature compared, with the carrying capacity of the wire.

The Chairman: Mr. Kennelly has probably had more experience in this matter than any gentlemen present; and Mr. Kennelly might be requested to give this his attention and give an additional recommendation to this meeting a little later.

Mr. Jones: I think I might say what his modesty forebode, that the British table was made up on Mr. Kennelly's investigations.

Mr. Jenks: Before any specific utterance is looked for from Mr. Kennelly, it appears to me that the question of whether we shall have a little more, or a little less, margin in this matter of inside wiring, is a matter of policy, very largely, and of necessity so, with those companies which attach their generating or distributing systems, to inside wiring and who thereby take a certain amount of risk in connection with the action of the inside wiring.

About three years ago I had occasion to consult with several representatives of central stations, and independent engineers, also, in reference to the matter of whether it was desirable to increase the current carrying capacity of the wires in this table, and I have before me a portion of an article from one of them, that I want to ask permission to read, because it seems to me there are one or two points brought out, that may be of importance in practical work, and which we should consider, or Mr. Kennelly should consider, before fixing upon a standard. This letter was written by the electrical man, or the practical man, of the Edison Electric Illuminating Company of Boston, and has broad reference to the conditions which exist in central station work:

"From the Illuminating Company's point of view, we believe permission on the part of the Underwriters for a decrease of size in the conductors for the exterior wiring of buildings would be very undesirable for the following reasons: We find it to be almost universally the case that after the wiring is installed for a certain number of lamps of a certain candle power, the candle power is increased, thus demanding double the amount of current. In addition to this, it is generally the case that the number of lamps is also increased, so that the copper, instead of being too heavy, as it was for the original installation, is entirely inadequate to carry the amount of

current necessary to supply the final installation. No doubt the size of the wires in the tables is a little large for the amount of current which it is figured to carry, but as our experience tells us that in almost every instance the amount of this current is increased, we do not think it advisable to decrease the size of the wire. Even in cases where the wires can be readily pulled out when an increase becomes necessary, it seems doubtful whether it would be policy to cut down the amount of wire on account of the cost of labor in taking it out and putting it back again when it became necessary. Of course, this latter is a question of judgment in each particular case. In case the contractors installing the wires do not get them in large enough, the Illuminating Company is held responsible for poor service and in many cases has to go to considerable expense in order to keep its service up to the standard, so that, look at it in any way, it is our interest to have the wires as large as possible.”

Another letter from a very well known and competent insurance inspector brought up the other point of the change in the standard of the voltage of the lamps, and the consequent change in the current. He says: “Another reason for requiring large wire lies in the fact that the plant installed for Mr. A. was originally a 110 volt 0.5 ampere outfit, and ten lamps were placed, we will say, on a No. 16 B. & S. conductor. The plant for some reason is changed to a 50 volt 1 ampere system; it is true that the converter may be changed to correspond, but it seldom is unless at the order of some authority, and unless there is some such interference, 10 amperes will traverse the wire which was originally run for but 5 amperes. (5 amperes is our rule for an ultimate cut-out.)”

“Now experience has given us here plenty of instances in central station work similar to the above. There is a close competition in the center of the city between the alternating and the direct current systems. The patronage is constantly shifting; today it is Edison, tomorrow Westinghouse or Slattery, and we are kept busy watching for results which a sufficiently large wire and a minimum current flow would amply protect against. We are compelling reinforcement of conductors constantly.”

These things certainly should deserve some attention in the fixing of the margin of safety in this matter.

Mr. French: Mr. Merrill asked what the matter is with the present table. I am not prepared to criticize it as a whole, but in making our rules we did not feel justified in adopting it for the present.

As an example of the results of some tests we have made, a No. 00 wire with an ordinary waterproof braid over it, was made to carry a current of 240 amperes. In about ten minutes the insulation had softened somewhat. You could press it between your fingers and it would show the impress of the skin lines. You could also rotate the insulation around the wire. If you cut a little piece out of the insulation the inside appeared gummy, showing that the waterproofing material had become more or less softened by heat. Now that current of 240 amperes was only 20 amperes more than Mr. Merrill’s table for open work.

I should like to get the opinion of this meeting as to what factor of safety should be used.

The question of where the danger point is to be fixed is one of material only, i.e., at just what point do the ordinary insulating materials begin to perish? That has been taken at about 150 degrees F., perhaps it can be taken higher. This point we cannot decide by discussing, but by testing and the collecting of data, but we can decide perhaps the point, which is one of judgment, i.e., what should be the factor of safety?

Mr. Kennelly: It may be taken for granted that the boiling point of water is the utmost limit of temperature which a wire should attain under any conditions. I should not, however, like

to advocate that so high a temperature should ever be permitted in practice. I have always understood it to be considered a good rule that the limiting temperature a wire should take is one at which you can just bear your hand on the wire, and if you take that temperature, which is about fifty degrees C., and take the maximum normal temperature, of, say, thirty degrees C., the difference between the two gives an elevation of temperature of twenty degrees C., that, I think, no wire should exceed in conservative practice. The next question is what margin we are to have. No man is competent to decide it; we have individual experience everywhere. Some might be in favor of allowing fifty percent so that fifty- percent excess on full load current must bring the wire up twenty degrees in temperature. I would not like to take the sole responsibility of a recommendation. If you will state what margin you want, I can say approximately the corresponding limiting current required for all sizes of wire under ordinary conditions.

Mr. Merrill: In any experiments of the safe carrying capacity of wires undertaken under any conditions, the personal element must enter very considerably, and there is a chance for large errors in readings, which in all tables that I have ever seen, with the exception of this one in the second column, becomes very apparent when curves are plotted from the ampere capacities given and the circular mils corresponding. One man can safely and conveniently hold his hand on a wire that would be very objectionable to the sensitive nerves of another man. If you use thermometers or any other similar arrangement, there is a chance for an error of reading as well.

We were called upon very suddenly to make some changes in the table of the carrying capacity of the wire, owing to the fact that we experienced a great deal of difficulty in getting the sort of conductors we wanted on account of the peculiar limits heretofore put upon the carrying capacity of small wires. We found that if we increased the carrying capacity of No. 14 from ten to twelve, and No. 16 from five to six, that we brought about an economical means of secure construction that we were after. That is in wiring from the cabinet or distribution center to the last lamp, with only one cutout, and limiting the current depending on the cut-out to six amperes. That allowed us to use No. 14 wire and No. 16 cord. We did away with the fuse where the cord taps on to the wire. Proceeding upon that assumption, we plotted curves by Mr. Kennelly's table and straightened them out, and then added certain percentages to these tables, for our new tables on open and concealed work.

Having secured these values, theoretically correct, we checked them by experiments to see if under any circumstances they were too large. We were firmly convinced that there was no danger in allowing these currents. The table is a safe one, though it is possible that it is not one that an illuminating company, or a man who wires a building, or the owner of a building might wish to follow if he desired an economically operating system. The carrying capacity of the wire, except in small wires far beyond this table, will generally be proportioned; that is, they will not allow as much current on their larger size wires as this table allows, for commercial reasons; and the only reason we have any wish to place these values on the small wire is to secure construction which in other respects we are unable to secure. The principal criticism on that table and the only experiments that have been carried out that tend to show that these values are erroneous in any particular are in the larger sizes of wire given. I do not think that anybody will contend that a No. 14 wire will not carry twelve amperes or a No. 16 wire, six amperes.

I would, therefore, submit to Mr. Kennelly's consideration these points and say to him that the organization which I represent (and I have no doubt the committee which has been appointed by this body) would be glad to make any changes which he thinks would make the carrying capacity of the larger size wires nearer in accord with the percentage of safety given for

those of the smaller sizes. The trouble may be that the curve is a little too straight at the top, where the larger values are given.

Mr. Jones: This is an involved question, between the commercial practice and the objects of this committee, to secure safety to life and property. While you are fixing a minimum for the wire, for the carrying capacity of the wire, it should not be so stated, and should not be given out, as I would suggest to the chair, that a large number of people in the country, who are looking to this meeting for information, would think you are giving out these numbers and gauges as the proper wire. It may be they will save a few cents in using a No. 14 wire instead of a No. 12; but their annual cost of coal and power will, of course, eat that up many times over.

We have architects here who are interested in these matters, and we know that they have great responsibilities, as I have learned from some slight experience myself. There is a first-class building to be erected. The architects in the past have been familiar with the plumbing, water pipes, gas pipes, etc., and you cannot teach them any new tricks in regard to those things in buildings; but the advent of electricity has been a recent feature, and some of them are not quite up to date in regard to the requirements of a modern office building in this respect.

A large office building, for instance, requires telephone wires, district messenger call wires, two or three telegraph companies want to put wires in, and then the proprietor of the building may want to let an apartment to someone who desires to make some exhibition of a motor, where a little power is necessary. They find they have only two No. 10 wires fitted for so many lamps, and they put a little motor on, and away it goes. Another thing, wires are put in a building by some electrical construction company, which goes in to see how little wire they can put in, and how much money they can take out. If the architect understands this subject properly, such risks cannot be so easily incurred; and you can help architects in this matter, if you will give a proper expression of the subject in the rules. A building should be prepared for the egress and ingress of wires, the same as it is provided with doors, to let people in and out, and these wires should be adapted to the purpose. In this age, when electricity is coming so largely into play for domestic use, modern buildings should be constructed with special reference to the employment of wires of all kinds.

Mr. Jenks: The main difficulty, so far as the insurance men are concerned, is that where motors are put on, as Mr. Jones has stated, or where the electrician of the building runs wires forming some new outlet, or extends an old branch line, the insurance inspector is not notified, and has no opportunity of knowing what is being done, after the first installation is complete. Again, if the owner of the building sees fit to drop the Edison service and attach to an alternating service, or if he takes out 16 C. P. lamps and puts in 32 C. P. lamps, by which he will send twice as much current through his wires as before, nothing is known about that by the insurance men, unless there is a better system of inspection introduced. The difficulty may in time be overcome by some system of municipal laws which will give a commissioner of wires absolute control, and oblige him to travel constantly from point to point, looking for such things. The insurance men are interested in having a large margin of safety, so that the fall of potential in buildings and consequent heating of wires shall be small; and especially that they shall have opportunity of knowing when anybody has made changes.

Mr. Kennelly: This condition can be met by carrying out the suggestion made yesterday, of having definite fuses for definite carrying capacity of wire; then the fuse block will apply to a certain size wire, so that you cannot get a wrong size fuse block to fit it, and the moment an inspector sees a block has been changed, he will know there is danger of overheating the wire.

Mr. Mead: In looking at the table, I notice the carrying capacity of No. 16 and 18 wire is stated. We have taken a very broad stand and barred them out entirely. There has been no wire under No. 14 used in Pittsburgh.

Mr. Merrill: Do you use No. 14 cord?

Mr. Mead: Yes, sir. I do not refer to chandelier work, but to branch circuits.

Mr. Merrill: How do you get that into a socket; can you get the No. 14 cord into a commercial?

Mr. Mead: I do not know that you can. We do not allow anything under No. 16 wire for that purpose at all, and if there is room, endeavor to force a larger size.

Mr. Merrill: You do allow a smaller capacity in flexible cord?

Mr. Mead: Yes, this apparently seems to allow it, on account of its being stranded.

Mr. Merrill: The carrying capacity of No. 16 and No. 18 wire is given, but they are not allowed for use, except as specified in certain sections as cords or fixture wire.

Mr. Mead: You will find in summer time that they are apt to plug in the motors, and overload your wire, on branch circuits. You get a greater current there for motor purposes, and consequently greater current capacity is needed, necessarily; and we allow no wire under No. 14.

The Chairman: Has any gentleman any recommendation that shall act as guidance to the committee in this matter, further than the conversation that we are indulging in? It seems to me that it will be entirely in the province of this committee to ask Mr. Kennelly to consider this matter of rating, and specially report to the committee as to his view on this matter. I think Mr. Kennelly's view should be very valuable to the committee.

Mr. Merrill: I will state that as a member of that committee that I shall assume, unless this committee does receive specific recommendations on these points, that this meeting agrees to make no recommendations.

The Chairman: I think we should be specific, especially in important matters like this. That is what we are here for, and the committee desires to get a consensus of opinion of this body; and we should instruct them as well as we can.

Mr. Jones: Almost everybody recognizes Mr. Kennelly's ability to conduct such experiments with precision; and if we are going to leave it to several gentlemen, we will have those personal equations come in which have been spoken of, and you will find the results will not correlate at all. If you can find any way by which you can get Mr. Kennelly to do this service, it will be of very great benefit.

Mr. Kennelly: I shall be at the service of the committee if I can be of any use to them.

Mr. Wirt: I think we ought to make some definite suggestion about the overload which should be permitted; and I suggest that a wire shall not heat with a fifty percent overload more than fifty degrees F. I think that is about what the specifications call for in the case of dynamos, and that would be ample allowance.

Mr. Jones: Is that irrespective of the temperature of the atmosphere?

Mr. Wirt: Yes sir, that is the temperature rise.

Section 26 – Switches.

Mr. Ford: This same question of heating, which comes up in paragraph (d), might be changed to "undue heating" and possibly some limit be given.

The Chairman: That is an excellent suggestion, and the committee will kindly make note of that.

Mr. Scott: Switches may be either in house wiring or on switchboards in central stations. What constitutes undue heating depends upon the surroundings. A bare conductor, out of the way from contact with other things, might heat up to a very high temperature, without any bad result. On ordinary wires, the heating limit is determined by the insulation on the wire. When we had paraffin insulation, it was desirable to run the wires cool; with the present grade of wires they may be run warmer. We would like to have insulation not affected by heat, so that they might be run warmer than is now proposed.

On switchboards, where the parts are mounted on noncombustible marble bases, and are under constant inspection, the temperature limits do not apply which due to concealed work with wires which are surrounded by materials easily melted and deteriorated, or to switches in houses where bad contact are not liable to be discovered. In short, the same temperature limits which are made to apply to concealed work and general wiring, ought not to apply to the switch contacts, bus bars, etc., on switchboards in central stations. If twenty-five to thirty degrees F. is a suitable rise for general wiring, I regard forty to fifty degrees F. as a fair figure for central station switchboards and wiring.

Mr. Jones: How would it do to have the manufacturers submit their switches to a properly constituted committee of this new organization, have them tested, and then have them marked accordingly; ten ampere switch; twenty ampere switch; twenty-five, fifty or one hundred, etc.

We had on our New York switchboard, which was put up by careful men, a hot switch connection; not because it did not have capacity, or was not designed properly, but because the switch had not been set up properly, and heat was given out instead of electrical energy passing through. I merely state these details for the benefit of the committee, so that they can take up everything in regard to switches. A switch may be rated at a manu-factory as a fifty-ampere switch, and when it is put up in the shop you will find you can hardly hold your hand on the knife blades. I put my hand on a lug where there was a soldered junction, and found it unbearably hot. The lug had been reamed out too much and a lot of solder was interposed in the circuit, and the carrying capacity of the solder did not equal that of the wire.

Mr. Mead: Would it not be right to place a limit to the safe carrying capacity of a snap switch; they use those in places where a knife switch would be safer in every way. There ought to be a limit suggested where the department could draw the line.

Mr. Merrill: What would the gentleman consider a snap switch?

Mr. Mead: I mean a regular handle switch, anything but a knife switch, such as is on the wall over there.

The Chairman: You mean where the actual break is produced mechanically and independently of the movement of the hand; turning the handle to a certain point, and an automatic mechanism causes the break, in contradistinction to a switch moved by a lever only?

Mr. Mead: Substantially that.

Mr. Wirt: I believe it is the universal experience that the greatest trouble we have is from the heating of the switch contacts and contacts in fuse boxes. That was the cause of the adoption of porcelain cutouts. I have seen wooden cutouts with the wood charred. I think instead of having a rule like (d) that "switches must have carrying capacity sufficient to prevent heating," that something should be stated as to the temperature of the switches; that is, say, fifty degrees F., which is a very moderate temperature rise, and one that most of the switches will stand. I think switches should be able to carry fifty percent more than the rated capacity and break the current.

Mr. Kennelly: I think the plan is a good one. The best way is to say the switches shall not under normal conditions heat more than so many degrees F. I think fifty degrees is rather high. I think for full load carrying capacity twenty-five degrees excess is ample.

The Chairman: The gentlemen present will probably remember the experiments Mr. Edward Weston made and reported at the Washington meeting of the National Electric Light Association. He showed the immense amount of power lost on the switchboards; and it is a subject well worthy of the committee's full consideration. Some suggestion, such as Mr. Wirt brought up, the committee would like to have in the way of a definite recommendation.

Mr. Jones: I would also like to suggest for the consideration of the committee the subject of the mounting of switches upon slate. I have found serious iron veins running through slate switchboards; and although on large circuits they do not amount to much, still there will be a current crossed in there and that should be taken care of.

Mr. Merrill: In the list of materials it is stated that slate is a non-combustible, non-absorptive insulating material, if it is free from metal veins. Consequently, if such veins occur the material could not be approved under that clause.

The rules in other parts provide against the use of snap switches on series arc circuits, and we have had a good deal of trouble in connection with the meaning of the words "snap switch."

In reference to testing switches, the points made, of course, apply to the rules throughout, to wires, switches, cut-outs, etc., and we find that in the enforcement and interpretation of these rules, we are compelled to carry out a very expensive system of continuous testing. A recommendation of that kind, applying to switches alone, while switches may be as important as other devices, is no more forceful in regard to this special section than it is to the rules as a whole; and I do not think you want to alter your rules by specifications for testing any more than is absolutely necessary in order that the manufacturer may know the exact requirements that he had got to build a switch to meet.

Mr. Jones: An architect or contractor goes to a manufacturer and says he wants a fifty-ampere switch. He installs that, and the Board of Underwriters sends an inspector who looks at the switch, and asks, "Is that a proper switch according to the rules?" The contractor answers, "We got it from A. B., and it is rated as a fifty ampere switch." The inspector says, "Well, I would like to see whether it will do what our rules require or not." How is he going to get current enough to warm it up to see what it is going to do?

Mr. French: Mr. Jones brought up the exact point. If we leave the rule as it stands, we leave it to somebody's opinion as to whether the switch has safe carrying capacity; and I think it is one of our duties to make these rules more definite. Although I think Mr. Kennelly's requirements are correct, many switches will not sustain it; and some such rule is necessary.

Mr. Wirt: We were sending out switches that were supposed to be all right for ten amperes; but I heard there was some trouble with the switch, and I tested it and found it would not carry more than two amperes, without holding an arc. I think if we make the rule that a switch shall not heat more than twenty-five degrees F., and shall carry fifty percent in excess of its rated capacity, it will lead all manufacturers to conform to the requirement. I make this as a motion for the consideration of the committee.

Mr. Merrill: I ask for an additional interpretation as to the voltage, these rules are for low potential, that is, under 300 volts. Does the gentleman consider that these switches should be tested at 300 volts, at 480 volts, or at how many volts?

Mr. Wirt: No, sir; I believe the switches should be tested for the circuits on which they are designed to run. Manufacturers make socket switches that are not to be used on circuits

greater than 125 volts potential; others for voltages under 250; others 500, and others 3,000. If the general requirement is made that a switch shall carry fifty- percent excess in current, it will cover all excess, and leave out the question of voltage. Of course, they will have to be made for the proper voltage.

Mr. Brophy: I find in practice in Boston we are obliged to test switches, and we test them according to the conditions under which they will be used. We reject a great many. We allow a temperature rise of about twenty-five degrees F.

Mr. Ford: A good commercial specification for a switch is to have a maximum carrying capacity of one thousand amperes per square inch of area of the blade, and say, fifty amperes per square inch of contact surface of blades and clips. Some manufacturers get as high as seventy-five or even one hundred amperes per square inch of contact of blades and clips.

Mr. Merrill: I should like to hear a further expression on the matter of voltage. A switch may be marked as to its safe carrying capacity in current, and the contractor therefore considers it suitable for use on low potential circuits, puts it on a 220 volt circuit, and it is burned out. The switches coming under this low percentage wiring should test at least 220 volts, unless they are definitely marked.

The Chairman: The motion, as made by Mr. Wirt, is that the committee be recommended to change section 26, rule (d), so that all switches may be designed to carry fifty percent excess, with a rise of twenty-five degrees in temperature.

Mr. Scott: Do I understand the motion to be a rise not exceeding twenty-five degrees F., with a fifty percent overload?

Mr. Wirt: The overload is simply for the breaking of the arc. An increase of current limits the capacity of a switch to break the current. For instance, a socket switch will break 1-1/2 amperes of 125 volts, and if you raise the current to a 2 amperes it will hold an arc. Therefore, it is necessary to have some limit placed as to the amount of current a lamp socket switch will have to break.

Mr. Ford: A question of expediency has come into my mind. All of these discussions are in the nature of a recommendation to this committee, I believe. Now, is there any use of having a special motion put for each particular point?

The Chairman: I think not. I think as long as the recommendations are taken down, if there is no objection to them, they will be presented to the committee.

Mr. Brophy: Our stenographer is taking notes of everything that is said.

The Chairman: Our committee will receive the notes of the stenographer, and that will give the expression of opinion; and all we want to do is to get that expression as concisely as possible.

Mr. Scott: It strikes me that fifty percent is a very close margin, between the rated capacity of the switch and its maximum capacity. If a 16 C. P. lamp be run on a small switch, and a 32 C. P. lamp be put in the socket, such a limit would be exceeded. An ordinary small switch ought to be able to carry at least double its normal current. The electromotive force at which switches should be tested for insulation, the test being made between the two live terminals of the switch which are to be connected with the circuit, and the ground, in my opinion should be placed at several hundred volts, 500 or even 1,000 volts, for switches which are to operate on 50 or 100 volt circuits. A good mechanical construction ought not to break down with a test of 500, 800 or 1,000 volts; and a switch which will break down at two or three hundred volts is liable to break down mechanically, and is not good construction.

Switches should be able to break a current greater than that for which they are rated, but it is difficult to name an excess which will apply to all cases. The character of the circuit to be broken has very much to do with the action of the switch. Direct currents are more difficult to break than alternating currents, currents of high voltage are more apt to arc than those of low voltage, and current through a circuit having coils of wire, such as motor field, is more difficult to break than a lamp circuit. The switch should be able to break a current at least double the normal current. Switches for 50 or 100 volt lighting circuits should be able to break a current of that character at 300 or 400 volts. Double pole switches should be made with the poles sufficiently separated so that a slight arcing at one of the breaks will not carry across to the other side of the circuit, forming a short circuit. This is of special importance in switches for 500 volt direct current circuits. The variety in current electromotive force and character of circuit renders it difficult or impossible to give a definite specification applicable to all cases.

Mr. Jones: I was in Chicago a few weeks ago, and a fuse blew out on one of these double pole cutouts. My assistant started to replace the fuse, and it was a pretty delicate job, although the fuse block could be readily got at; but the first thing we knew the fuse tumbled over and touched the other side, and there was a great report. I find great objection where two poles come together so closely.

Section 31 – Flexible cords.

Mr. French: I would like to ask what the general opinion is as to the taping of the ends of flexible cords, as stated in the third column, under (d).

Mr. McDevitt: I have had some experience with that in our city. The object was to keep the ends of the flexible cord from fraying. In many cases this was done to excess. The result was that we had a lead contact in the socket of the lamp. In a couple of instances, where a short circuit occurred, the flame wound down the flexible cord and formed an arc in the socket of the lamp. I do not believe in it.

Mr. Jones: Does this bring up the subject of using solder on the joints of wires at all?

The Chairman: Merely putting it on the end of the flexible cord wire.

Mr. Jones: I think that subject itself deserves some attention.

The Chairman: I think we will bring it up later.

Mr. Fitzgerald was called upon to speak on the subject.

Mr. Fitzgerald: I do not think I can add anything to what Mr. McDevitt has said. My experience is exactly as he stated. It seems to me it is a matter that requires a good deal of attention.

Mr. Merrill: We had a large number of burn-outs of socket shells, due to the stranded parts of the cord coming in contact with grounded metal work. The shell should be made of insulated material, or else lined.

Mr. Brophy: We had two deaths in our vicinity chargeable mainly to the fact that the ends of the strands came in contact with the socket; the two thousand volt current leaked, and the persons were killed.

Mr. Jenks: Does your experience point to the remedying of that by putting an insulating film on the inside of the shell, as Mr. Merrill suggested, or by this plan of soldering the ends, so as to keep them together?

Mr. Brophy: I think the better way would be to insulate the socket.

Mr. Jenks: Is that provided for by the rules? If not, perhaps the committee will note the recommendation that socket shells be insulated on the inside.

Mr. Smith: I think from my experience, the better way is to solder them. I have found a number of short circuits have occurred from the fine wire getting crossed inside the shell, without coming in contact with the shell, and making a short circuit inside the socket.

Mr. McDevitt: We have had such occurrences; but notwithstanding the attempt to connect all the ends of the flexible conductor, they will still fray out, and there have been sections of the flexible cord that have extended out, and, as the gentleman remarked, have caused short circuits. I have never believed in the lead contact inside of copper contact. It is my experience that solder covers a great many faults in electric wiring.

Mr. Fitzgerald: I think the principal trouble is from poor construction; that is, inexperienced men installing these sockets. I think carelessness is the principal cause of trouble. We do not have very much trouble where experienced men handle these things.

Mr. French: There is one thing in the third column to which I would like to call attention; i. e., the advisability of using fused rosettes. In some cases it has seemed to us better to require a fused rosette and to allow quite a liberal number of lamps on a circuit. This encourages the “closet” system of wiring, i. e., the grouping of all-main cutouts and switches in one place where they can be safely enclosed in a box if desired.

I have heard some severe criticisms of rosettes, the idea being that the fuses often blow, making it necessary in manufacturing plants to get up over moving machinery to replace them. This is said to be seriously objected to by manufacturers. On the other hand, the feeling is that the fuses do not blow very often and that greater safety is secured by limiting the possible current on the rather inferior insulation on the ordinary sockets and cords. The cord and socket are, perhaps, at present the weakest part of the system outside of the cutouts and would be the weakest if we could get the cutouts in boxes where they could do no harm. I would like to hear the experience of the meeting on this point.

Section 33 – Converters.

Mr. Mead: Where would underground work come in. The section says, “Converters must not be placed inside of any building.” The cellar is a good place for a converter where it is properly constructed.

The Chairman: The next clause provides for that.

Section 34.

Mr. Kennelly: I would like to suggest that the secondary coil of a converter should be grounded at its center.

Mr. Jones: Does there seem to be any necessity for specifying how much resistance shall exist between the primary and secondary coils of converters, or of any particular method of construction, to ensure their safety?

The Chairman: I do not think there is anything in the rules covering that.

Mr. Jones: It occurs to me that if they were properly made and inspected that some unfortunate things that are only too fresh in our minds would have been averted.

Mr. Ayer: Relative to suggestion of Mr. Kennelly as to the grounding of the secondary coil of the converter at its center, it seems to me that is putting a severe strain on the insulation. I assume a low resistance ground is meant, something that, in the event of a ground occurring on the line and a breaking down of the insulation of the transformer, the current would pass through, so as to destroy the converter and cut out the primary current from the secondary. You put an insulation strain on your transformers that is rather serious; and, taking a good many

transformers in the circuit, you get a condition that may make considerable trouble. But there is no doubt about the advisability of getting some sort of transformer protection, especially on the primary lines, where two thousand volts and upwards are transformed directly to the house service low potential.

In a discussion of this question some time last spring Professor Puffer recommended the same thing. I suggested carrying out a practice, which I adopted years ago in a good many cases, of using a magnetic cutout. This magnetic cut-out was made with two solenoids, each of which have one connection to one of the secondary lines, one on one side, and one on the other, the other terminal being connected to ground; the second terminal of the solenoid making through the solenoids a short circuit of your secondary mains, and ground your secondary at both sides. These solenoids are of very high resistance, so that the leakage of a 50 volt current amounts to 8 watts, and for 110 volts, to about 11 watts. This gives absolute protection. Any rise of pressure on the secondary mains above 500 volts would operate then circuit breaker. It is very positive. It rather straddles the question of grounding secondaries, or grounding house mains, by grounding them through a fixed high resistance ground connection. It gives an absolute, positive acting device, not necessarily one that burns up transformers; in fact it leaves the transformer to take care of itself, but cuts out the primary from the secondary main. There are many cases where the transformer could be destroyed, and leave the primary current on the secondary mains. Such protection is not absolute or certain. I speak from practical experience. I have known cases where fatalities attended the breaking down of the transformer, where the transformer was completely burned up.

This is a matter to which I have given a great deal of thought, and it has never been discussed, to any extent; but I found in the early days of the use of transformers the necessity of some such protection where there are many of them connected with the line. Thunderstorms would readily break them down, and create punctures, which would give a connection from one side of the transformer to one side of the secondary circuit; the lights would burn and things continue on apparently all right. Transformers do break down, and will break down, with the high potential being used; and I believe the right thing to recommend and in time to demand, is a proper protection for isolated transformers, to give you protection between the secondary and primary; but the question of grounding secondary mains at low resistances is a very serious one, and should receive a very full discussion before action is taken.

Mr. Kennelly: I think the matter is so important, that it is worthwhile to give it a few moments. I should be sorry to advocate anything which would unduly harass manufacturers; and if this recommendation of the grounding of the secondary of the transformer means unnecessary expense to the manufacturers on account of troublesome lightning, and danger of puncturing insulation from lightning, then I should hesitate to make it; but I believe that I make this suggested recommendation in the interests of manufacturers just as much as in the interests of the parties who receive lighting from electric systems.

If we exclude lightning, there can be no objection to grounding the secondary, because it is obvious that the system should be capable of standing the working pressure, if we had all the lines underground so that no lightning could affect the system. Then no one can fairly object to grounding the center of the secondary on the score of danger of puncture, because if the transformers are going to be so weakly insulated that grounding the secondary is going to injure them, those transformers had better be replaced. It may not be necessary, however, to actually ground the secondary. A simple protective device that will ground the secondary if a cross develops would be preferable, and if Mr. Ayer's device were simple and practical, its adoption

would seem worthy of consideration. A cross between the primary and secondary coils of a transformer is, we know, of very rare occurrence; yet we all know that no one would be justified in permitting a person standing, say on a cellar floor, to handle the socket of a lamp if the operation involved making contact with one of the secondary conductors, unless the transformer had just been tested free from leakage or cross. If, however, the secondary coil of the transformer were grounded permanently, or protected in an equivalent degree, there would be no such danger from accidental contact.

The Chairman: When we finish this matter under the National Board of Fire Underwriters' code, I should like to have the English Board of Trade and Phoenix rules read over, as far as they relate to these points. You will find several pages ahead some important matters on this point in the British practice, and covering the point Mr. Kennelly has brought up. All of these matters are dwelt upon, and I think they would be well worthy of consideration at this time, because it is an exceedingly important matter; and if there is no objection the Secretary will kindly read through under these headings and then read on the last column the English Board of Trade and Phoenix rules. You will find the points are dwelt on quite strongly, and should be considered in this connection.

The Secretary read the rules as requested.

Mr. Ayer: In considering this question of the protection of the transformers, the practical conditions to be met with have got to be well understood. You take it in the case of distribution with the overhead system, where there are any material number of transformers in a network covering a large area, there is no such thing as getting an insulated circuit. You have got a grounded circuit, always.

There has been a great deal of discussion, especially among the Edison companies and Underwriters, as to the wisdom of grounding the third wire of the Edison system. That has been a very fruitful topic of discussion. I think it is useless to try to enumerate the details or discuss the pros and cons of this here.

In a resume of these English rules you see that they contemplate at all times an automatic device in the secondary circuit, or in the primary wire, if not in the secondary, which will automatically cut off the primary current from the transformer or the secondary from the house. That is the English practice. They also insist, under Board of Trade rules, that transformers shall be made, so that it shall be impossible for any communication between the primary and secondary coils, placing brass shields between the windings, so that in the event of contact with the brass shield, which is grounded, the transformer is destroyed. That does not give the protection, and they recognize that protecting the coils of the transformer does not protect the secondary wires from possible connection with the high tension; and they call for some intervening device which shall open the secondary circuit in the event of the primary circuit forming a connection therewith. It is a simple thing to make. I have one in my residence today and have had for five years, which has been in service all the time. The thing is operated with a leakage of 500 volts from the primary line to the secondary. It introduces a high resistance ground on the secondary, and a leakage on the secondary of about eight watts. I believe the solution of the problem of the protection of the secondary coil is the introduction of this intermediate automatic device; and when the committee gets down to business, if they want to make a test of such a device as I have referred to, I shall be glad to furnish one. I only state this for the benefit of those who may not be informed, on the subject. It was made especially for me, for station use, when I had charge of a large station; and a few of them were given to some personal friends, who introduced them in particular cases. They have never been put on the

market or advertised. No manufacturer, to my knowledge, has ever made them in this country, but the device is not patented. The device was worked out after a great deal of thought, and it covers the ground very well. Devices have been made in England operated by clockwork, fuses, etc., but not similar to this, to my knowledge.

The Chairman: I note that Mr. Wilmerding has honored us with his presence; and we will be glad to have him take a chair on the platform.

Mr. Wilmerding: Thank you; I am very comfortable where I am.

The Chairman: The committee on permanent organization prepared the report yesterday, and signed it. It was requested to suggest a name for the permanent organization; but this, through some inadvertence, was neglected, and I would like it to be decided today what the name should be of that permanent organization, we have already approved of. The chair will be glad to entertain a suggestion as to the proper name for the permanent organization.

Mr. Merrill: In Professor Crocker's absence, I would make a verbal report of the committee on by-laws, as far as the name is concerned. I think the committee got as far as to agree on a recommendation for the name, and they refer to the organization as the "National Conference on Electrical Rules."

The Chairman: I would like to hear an expression of opinion as to the advisability of adopting that for the name of the permanent organization.

Mr. Kennelly: I think the name could be amended. I think "electrical rules" is not explicit. "Electrical rules for Safe Wiring" would be better. Instead of "Conference" I should say "National Association."

Mr. Merrill: We wanted to make it brief and to the point. We wanted to give it some sort of distinctive name, and if the name suggested is adopted, it would be referred to as the "National Conference."

Mr. Jones: I would suggest that we call it "The American National Board of Electrical Installation and Wiring."

Mr. Merrill: That would get it mixed up with the National Board of Fire Underwriters.

The Chairman: "National Association of Electrical, Insurance, and Allied Interest"; it ought to state what the Association is.

Mr. French: The name the Committee has proposed is pretty good. The idea of a "conference" is what the thing is based upon; and it suggests to everybody that these delegates come here and confer, and nobody is compelled to carry out their ruling and that is a conference, pure and simple. The shortness of the thing is a good point; it will get to be known as the "National Conference."

Mr. Merrill: This matter was gone over in the committee quite thoroughly, and for the reason stated by Mr. French, we gave up the idea of the word "association," or "board," or "committee" or "organization" or anything of that kind, and adopted that phrase, the "National Conference" as distinctive and at the same time peculiarly applicable to this gathering.

Mr. Stone: It seems to me that the name suggested is felicitous, in that it expresses just what we are. I would like to see the words suggested by Mr. Kennelly, "Safe Wiring," appear in the name, so as to bring that in with the "National Conference."

Mr. Merrill: The committee thought that brevity was necessary and "Electrical Rules" means, of course, rules for safe wiring, economical operation, protection of life, etc. But the one thing that we all agreed upon at once were the words "National Conference," which we all seemed to agree upon as soon as they were suggested, and as to the remainder we were not very particular.

The Chairman: Perhaps it would be well to bring in the word "Standard."

Mr. Ayer: I move that "National Conference on Standard Electrical Rules" be adopted as the title for the permanent organization.

The Chairman put the question on the motion, which was carried.

The Chairman: If there is nothing else to come before the meeting we will proceed with the consideration of the rules.

Section 42 – Car Houses.

Mr. Ford: I believe this is the first time that the American Street Railway Association has been consulted with respect to these rules; and though I was notified only yesterday morning that I was to take up this matter for the Association, there are a number of points which have occurred to me with reference to advisable changes of these rules. In general they touch the subject entirely too briefly. The electric railway interests of this country are, in point of fact, larger than lighting interests.

Railway switchboards as at present constructed, make provision for the lighting circuits of the station from a small quick break jackknife switch. There is no circuit breaker placed between that switch and the main generator bus bars. As a result any short circuit on the lamp circuit, if it is large enough, throws the generator circuit breaker out, or if it is not large enough to throw the circuit breaker, may cause destructive effects from fire. I believe that a correct method of grounding generators and lightning arresters should be specifically stated. In most instances the generators are grounded directly to the track. I know of some cases where the wires are simply run to one point on the track, and the whole system is grounded at that point. In case of any repairs to the track, or taking up of that individual rail, of course the system has no return to the generator, or else a return through high resistance.

I would like to be informed just how far these rules should relate to outside construction. If they have any bearing on this subject, it seems to me that good construction should be very definitely specified.

Then, again, considering the point of car wiring, at present the wiring for lights is placed between the ceiling veneering and roof boards. The best construction requires ten lights in the car, and the wiring for these lights has to be provided for with several different commutations. As a result, there are probably ten or twelve wires all bunched together in a narrow space, between the veneering and the roof boards, and between some of these wires there is a difference of potential of five hundred volts. In case of any leak through the roof a short circuit occurs, the wires having simply fire and weatherproof insulation. There has been suggested, lately, and I believe there has been installed in several cases, complete wiring for cars with interior conduit, which seems to me to be a very excellent thing, and possibly it would be advisable to make some provision for it in these rules. The amount of capital invested in this country in street cars wired for electric lights, and their equipment, will amount to sixty million dollars; and it seems to me the subject should be treated in the rules more fully than in three lines as at present.

Taking up Rule 41, in regard to running lighting and power circuits from railway wires, which is expressly prohibited here, I believe this is somewhat unjust to the railway companies. Of course, they may not care about going into the lighting or power business, but very often they have buildings of their own which they wish to light from their own circuits. I have in mind at present a railroad in which I am interested, in New Jersey, just across from Harlem. We have a ferry house there, just completed, alongside the power station. It is about six miles from any lighting company, and is too small a building in which to install an isolated lighting plant. In

order to run lights into that building, we will have to get a rotary transformer, or motor dynamo, at an expense of double the cost for the wiring which we intend to put in the building, and also at a considerable loss from the efficiency of the device. In other cases, street railways have parks at the end of their lines, which are generally in the suburbs and not accessible for service wires. In those places they want to light up their dancing pavilions, restaurants, or similar buildings; and very often they have some kind of amusement, like a toboggan slide, to run with a motor. Of course, these risks are hardly to be classed as a preferred risk; but it seems to me that wiring from a generator on a five hundred volt circuit should be allowed in some of these instances, and there should be certain exceptions made.

In regard to the wiring of car houses, that seems to have been taken up quite fully. I will simply say as to the question of bonding rails, it would not be considered in this case the best engineering practice to run a supplementary wire. It would be better to use No. O B. & S. bonds to each joint.

There are a number of points that I might mention, but which will come within the province of the committee. I believe, however, as I said in the first place, that this subject should be treated at more length than it is here.

Mr. Merrill: I would ask if there is any other reason than the simple one of convenience why Rule 41 is objected to? Is there any technical ground against the rule? Of course, if we allow the question of convenience to come in, it will oftentimes do away with the possibility of enforcing any rule; and in that event, whatever penalty there is for the non-observance of the rule, must be enforced. Is there any good technical reason in support of the safety or reliability of an installation of light or motors from currents of trolley wires?

Mr. Ford: I believe on that point there is no doubt, if the installation is put in properly. I think every circuit that is run from a street railway generator, should have an approved automatic circuit breaker in its circuit. This is especially necessary for arc light circuits. It is convenient to run arc lights in strings of eight or nine from railway circuits. I think these arc light circuits should always be protected by a magnetic circuit breaker in addition to the regular fuse cutout. I think if the wiring precautions that are specified for high potential conductors are strictly observed in the case of five hundred volt circuits, that you will have no trouble.

Mr. Merrill: Do you want a lightning arrester?

Mr. Ford: For each circuit? Yes, it would be advisable, I think.

Mr. Merrill: I understand the representative of the American Street Railway Association to state in the event of an automatic circuit breaker and lightning arrester being installed in connection with such an installation, he would then consider the current safe for general use. Is that true?

Mr. Ford: I think so, sir: there are some other restrictions that might be made. I do not think it would be advisable to have wiring of this kind where it would be readily accessible; it should be out of reach; beyond any danger of contact. That is for reasons of safety. It would not make any difference in regard to fires.

Mr. Merrill: How are you going to protect the line running from the motor to earth connection?

Mr. Ford: The motors present a somewhat different feature.

Mr. Merrill: From the lamps, then?

Mr. Ford: I might possibly have made myself a little clearer. I believe all circuits of this kind should be run, if not separately from the switchboard, separately from the main feeder. I do

not think you should ground them directly from any individual circuit. I do not know whether I have made myself clear to you or not.

Mr. Merrill: Nevertheless, you have a wire running from the motor or last lamp to the ground, and wherever that ground may be, it is not protected. Suppose that the current finds any good ground on a gas pipe in a building, your fuse will not blow.

Mr. Ford: Of course, you would have to protect your feeder wire; or if you run it (the circuit) from your generator, you would have to protect it from the grounds.

Mr. Merrill: I have seen installations of this kind proposed by trolley companies. They tap in on the trolley line, and then put in a lightning arrester which they state should be "reliable," and then a circuit breaker, which should also be "reliable," and then put in a fuse with a six inch break, and then they put in a main individual service switch, and then they run the wire through the building, so that it will be practically in a house by itself, and then they propose to install the motor so that it should have the "very best" insulation, so that it shall be permanently and effectively insulated from the ground, and then they run the return wire out of the house, still in a separate part of the building by itself, to the track and ground it there, and incidentally put up a sign reading "Danger" over the motor.

Now, theoretically, that is all very good, indeed, but, practically, what is the lightning arrester which is always reliable? What is the circuit breaker that is always reliable? Install in places where they can receive no competent attention; and where the only assurance of their being in anything like working order is the attention or lack of attention given them by the owner of the property in which the motor is installed. There is a great deal of difference between a lightning arrester and circuit breaker on a station switchboard, and one installed either inside or outside some small mill. I have a case in point, in the West, where an installation of that kind was made, not in accordance with these rules, but simply in accordance with what the workman considered safe practice; and he ran a bare wire from the trolley wire into the house, to the motor, not insulated, hung it on trolley hangers, and informed the occupant that to use a covered wire was impracticable, because the trolley wire was bare and consequently the motor would not work unless he used this bare wire. (Laughter) You see how hard it is to bring about in practice even the most simple requirements; and when we try to enforce such requirements as have been stated by a number of authorities as absolutely necessary to the safe operation of a motor or lamps operated by a grounded trolley system, we feel that we had better give it up altogether and try to do away with the system as much as possible, because even with all the safeguards which engineers can devise it is still inherently defective.

Mr. Ford: I believe that this Rule 41 should be a little more comprehensive; that is, it should allow a railway company to light its own buildings, or buildings it operates.

Mr. Merrill: A railway company's buildings are worth as much as any others.

Mr. Ford: It might be left to the discretion of the Underwriters; they might permit this to be done where other service cannot be obtained. In regard to running lights and motors from the circuit, every street railway company that has a repair shop operates its tolls with a motor run from the five hundred volt circuit. They are full of carpenters' materials and other inflammable substances, and about every one of these shops has one or more motors in use. The same applies to the lighting of the car houses and repair shops. They are lighted according to these rules with the current from the five hundred volt circuit. I think the rule might be extended a little further in order to allow a railway company to light up certain of its buildings, when the necessity arises, under proper restrictions.

The Chairman: Mr. Merrill; is it not a fact that quite a number of railway companies are today supplying their directors' houses with lights and power for motors; running wires into private houses?

Mr. Merrill: There is not a clause in this entire code of rules, which is not being violated in a great many parts of the country every day.

Mr. Ayer: I would like to mention the necessity for adding some rules with reference to car heaters. There are ample opportunities for trouble with them unless they are properly installed and I make it as a suggestion for a note, that all the wiring of cars ought to be made of flexible wire.

Mr. Ford: I overlooked the question of using magnetic circuit breakers, instead of fuse cutouts, for streetcars. A frequent source of damage by fire to streetcars is due to the fuse cutout. There are several very good car circuit breakers on the market and I think the committee ought to take some cognizance of them.

Mr. McDevitt: The reason why it is allowed in car powerhouses is because the hazard is not increased beyond that for which the building is already used. That is the reason why the distinction is made.

Section 46 (a).

Mr. Kennelly: I think the system of figures at first sight does not strike one as embodying any natural law, or as being the outcome of any particular condition; and I would like to be informed how the table has been arrived at. I have no doubt it has been the outcome of experience in some way, and I would like to suggest whether it might not be simplified.

The Chairman: Can Mr. Merrill inform us on what that table is based?

Mr. Merrill: That table was, I think, first suggested by Professor Morton, of Stevens' Institute, and adopted by the New York Board of Fire Underwriters and after a great deal of discussion it was put in this code. The other side advocated simply that the wiring in any building should have an insulation resistance of one hundred thousand ohms. They advocated that separate branches ought to be tested out separately and defined the separate branches of the wire by their capacity. Obviously, a single tap would test a great deal higher than the whole insulation, and consequently could be by that graded double. I do not think there is an especially fine principle involved in the values that have been given, corresponding to the different ampere limits; but it seems to me it is working fairly well in practice.

Mr. Kennelly: My point is that it might be made much simpler if some rule were adopted similar to that which is used in all the countries of Europe. I have here a table, for example, of insulations that are allowed in four different countries: England, America, Germany and Austria, for insulations of circuits not exceeding five hundred volts pressure. They all follow what appears to be a simple, rational rule, except the American table. These figures are nearly the same, but not quite; why should they go to all the trouble to make the thing complex.

Mr. Merrill: You say this table does compare, approximately, with the formula used in Europe?

Mr. Kennelly: Yes, the base is good; it wants smoothing out.

Section 43 – Wires.

Mr. Stone: It seems to me that it would be very wise to strike out this list of wires, because a manufacturer may submit wires which may be properly protected in every respect, and meet with every approved test; but having obtained this approval, there is nothing to insure their

maintaining the test. It does not seem to me that it is a good place, in a set of rules of this kind, to put in the names of manufacturers of wires in this country. There are other ways in which the character of wires can be ascertained. We are supposed to cover the points which make good wiring in the conditions set forth in the rules; and we make a sort of guarantee for the manufacturers of the wires by doing this.

Mr. Ayer: I agree with Mr. Stone in what he has said.

The Chairman: Is it not also a fact that in the case of a number of the wires which are mentioned here, there is quite a variety of the different kinds of the same name of wire. I know of certain cases where there has been considerable competition and a certain class of wire was considerably modified so as to meet the prices. I think gentlemen present know of various instances in which that has been done; and it seems to me it is a question we ought to consider very carefully, whether we should publish a list of that kind. If we do, we should do it in regard to switches, lightning arresters, automatic cut-outs, etc.

Mr. Stone: Mr. Chairman, if you think it wise, I make a motion that the whole clause be stricken out.

Mr. Merrill: As far as the actual inspection work in the field is concerned, it is absolutely necessary to interpret these rules as fully and definitely as possible. If we publish a standard, stating that the insulating covering of wire must be 3-64th of an inch; that it must show an insulating resistance of one megohm per mile after two weeks submersion in water at 70 degrees F., and three days submersion in lime water, with a current of five hundred and fifty volts, and a fellow out in Racine gets hold of that, and looks at it, he cannot tell whether it is that kind of wire or some other kind that he has in stock. He has no means of testing it. We are constantly testing these wires, from samples brought from different markets in the North, South, East and West, and when we find any wire below the standard, we publish the fact throughout the United States. We publish the name of the manufacturer of the wire, so that we can hold somebody responsible for it. We do not want to advertise wires in our rules. I think as the Conference will not be engaged actually in inspection work, it might be well for them to omit all references to manufacturing interests.

Mr. Stone: Is there any real objection, if we should put in just a note to this, stating that the National Board of Fire Underwriters will give information in regard to testing wires?

Mr. Scott: I raise the question as to who is to be the arbitrator over these rules? These go before different inspectors. These are competent men, in large cities, in many cases. They are also to be judged by men in small places; and for this reason the rules should be made as full and explicit as possible.

With regard to the relation of the manufacturer to these rules, the general impression seems to have been that the manufacturer should have nothing to say in an authoritative way, as his business is to run in as poor a grade of material as possible. These rules will help the manufacturer, by indicating what is required, and what meets the demand. The manufacturer of first-class goods will not be in competition with goods that are of cheap and very inferior grade. A high specification here will help the manufacturer very much; but it must not go so far as to direct that the materials shall be so costly that the progress of electrical work will be injured. If, however, there are some means by which a manufacturer can know whether a certain switch, fuse block, lightning arrester, or wire will meet these requirements, and a purchaser will know whether a certain grade offered by a manufacturer meets the requirements, the general introduction of better grade work will be facilitated.

Mr. Ayer: I do not think it is necessary, however, to mention the manufacturer's name in connection with it to give us a standard of comparison. The product may be so described as to give others a chance to meet it; and if there is one man that can fill the specification, he reaps the advantage. I think it is a proper thing to strike out the names of individuals or manufacturers in the rules, and call for the question.

The Chairman: The motion is to strike out all reference to the articles.

Mr. Stone: Everything except the note.

The motion was put and carried.

The Secretary then read the section entitled "Materials," which completed the reading of the rules.

The Chairman: I would suggest that the Secretary read on page 24 the report of the special committee of the National Electric Light Association on the rating of arc lamps, to decide whether it is desirable in our code to insert matter of that kind. It was a special committee appointed to report on this subject at the Washington Convention, in 1894, because of the great difficulty experienced as to establishing something which would be recognized as a standard; and this, I have heard from Mr. Porter, the Secretary of the National Electric Light Association, has in many instances been recognized as a basis. The question is whether it would be desirable to incorporate this in any such set of rules.

Mr. Ayer: Such notes of progress as this are not germane to the rules, but they are of interest and of use, and it seems to me such things as that should be left to the judgment of the committee as to whether they should be incorporated as supplementary matter to the rules, as also the glossary of terms, etc.

The Chairman: If there is no objection, these two sections will be referred to the committee, to consider the advisability of their incorporation.

Mr. Crocker: In behalf of the committee on preparation of by-laws, I should like to ask for instruction from the convention. There is a difference of opinion in regard to whether, in view of the resolution that has been passed, by-laws are called for, because it provides for a certain organization which is to be effected with the consent of the organizations which have sent delegates to this meeting. Now, at these subsequent meetings they can formulate their own by-laws. We have preserved the continuity of this organization by appointing a committee that is immediately to go to work and we are carrying out the object of this meeting; and that committee, of course, would not require such by-laws. It has been suggested by certain members of the committee, and by certain members of this meeting, with whom we have consulted, that we might submit it to the meeting whether by-laws are required or not; if it is the sense of the meeting that a code of by-laws should be drawn up and adopted. I therefore move that it is the sense of the meeting that a set of by-laws shall be drawn up and adopted.

The motion was seconded.

Mr. Jenks: I believe in a set of by-laws, because it is one of those things that stamp stability on this movement. We represent wide and important interests. The results of the deliberations of this body will be looked for not only in this country, but abroad, wherever electricity is used, and it seems to me we want some officers, or certainly some official positions which shall be permanent. We want somebody whose business it shall be to call another meeting when the committee is ready. We want an entity, and we get that by the adoption of some sort of constitution.

Mr. Merrill: I do not think we have any right, under the resolution which has been adopted, to go to work and adopt a set of by-laws until that resolution has been approved by the

people who sent us here. There is no doubt that it will be approved; but I do not think that it is quite becoming in us to submit to the bodies we represent the question of the advisability of forming this thing, and then, before they have had time to consider it, to go ahead and form it. I certainly speak for myself as regards the National Board of Fire Underwriters, and would feel that I was exceeding my authority very much to vote on the adoption of articles, bringing about a permanent organization, until they had delegated me or some other officer to do so; and it probably would be important in a case of this kind to carefully consider the advisability of all sections of that constitution and by-laws as it effects their interest.

We have been called together to consider what is best to be done as to bringing about a uniform set of rules; and after that we are to report and receive further instructions We have drawn up a resolution which it is quite right and proper we should present to our several boards and get their action thereon. We have provided for an active working committee to go ahead with this subject of the rules. It seems to me that we cannot do anything with our by-laws until that committee reports and, consequently, what is the use of having them? There are two main points; first, we have no right to adopt such by-laws, and secondly, we would have no use for them if we did adopt them. When the committee on rules reports the delegates who come to hear the report will also come instructed by their several organizations regarding the proposition made in this resolution; and then it will be time to perfect our permanent organization in all its working branches. We have no necessity for such a thing until this committee reports.

Mr. Jenks: I do not agree with Mr. Merrill that we have no necessity for by-laws until part of the work is completed. It seems to me that in coming together here and forming ourselves into a permanent body, subject, so far as the membership in that body of each individual interested is concerned, to the ratification of the society named in the report. I think we are going ahead very rapidly. We can adopt such a set of by-laws, and form such a permanent organization, with the understanding that if the National Electric Light Association or any other organization does not like the permanent organization which we form, it need not become a member of it; in other words, it can say to its representative, "After reading over your by-laws, we have concluded that we do not want to become a member of your Association, unless the by-laws can be so modified as to bring them within our ideas as to the proper manner of doing this."

As Mr. Merrill said, I do not believe there is the slightest doubt that our work will be ratified by the different bodies represented, which will be shown by their saying, "Go back and attend to business at the next meeting. "But if they do find fault, it can result in nothing further, perhaps than an amendment to the by-laws, which can be made at the next meeting, so that the by-laws can then be made agreeable to everybody.

Mr. Wilmerding: It appears to me that Mr. Merrill's stand is not exactly well taken for the reason that, in submitting this question to the representative here, if you cannot submit something definite – something to show what is proposed – they will hardly be in a position to say whether they want to join or not, unless you can say: "This is what we are going to do." In the other case they may say: "You may make rules that will not be satisfactory; let us see what the conference is going to do and what the rules are; and then we shall decide whether to join or not." I think we should go flat-footed to them with what we propose to do.

Mr. Stone: Perhaps the resolutions prepared are sufficiently general in their character to cover the scope of the work intended to be done.

The Chairman: I think the position Mr. Wilmerding takes is the right one. The question has come up before in connection with an organization of this kind. It seems to me we should

have something to start out with. It can be modified when the next meeting takes place. We certainly should have something that the delegates can go to their different organizations with.

Mr. Merrill: Mr. Chairman, I would ask through you, to have the report of the committee, which you will remember created some little discussion, read by the Secretary. It seems to me that it is sufficiently comprehensive to cover the whole point, so far as our reporting to our individual organizations is concerned.

The secretary read the report.

Mr. Merrill: There is a comprehensive scheme for this organization, which is all we need to present to our several organizations. The point that Mr. Wilmerding makes is all well enough; but he did not go ahead and say that he thought it would be well to elect our officers, or elect our working force. Now, we cannot accomplish a bit more with our by-laws and proceed to business. My point is that we have no right to perfect such an organization and that the resolution is sufficient for the general scheme under consideration.

Mr. Brophy: One important matter is forgotten in this whole thing – who will call the meeting together. There is not a provision made for an officer in the resolution. We do not want to be left helpless, without any one having authority to call us together. I can see no harm to be done in outlining how we are to provide for our officers and to perfect an organization. We may elect the officers now, if necessary. I am perfectly willing that should be done; but in any event we should specify that we have certain offices and that we have a certain organization.

Mr. Merrill: We certainly have. Here is a meeting that has got to be continued as soon as the committee of seven is ready to report. That committee of seven, it is supposed, is going to work. If the committee of seven performs its duties, we have a chairman and secretary already elected by this meeting, and we do not need anything more until we have received the sanction of our several associations on this work. My idea is that the committee of seven will be ready to report before very long to this Association, and at the same time the delegates present would be ready to report on the stand taken by their organizations in regard to the scheme of a permanent organization, and we can then adopt our constitution and by-laws and elect our officers for the term provided. I wish to ask the consideration of the meeting on this point, as it appeals strongly to me. I know the board I represent would not countenance any action on my part which drew them into a permanent organization, without the authorization of my superior officers. They sent me here to confer on the technical part of the subject; and I am pleased that I can make a good report to them on the manner in which their rules have been received. They have a considerable pride in the fact that they have been adopted in the Western territory, Southern territory, New England, Boston and pretty nearly all the municipalities and Underwriters' organizations in the United States, with the single exception of New York City; and they will feel complimented to know that it is not the sense of these more enlightened engineers than they have among their own inspectors, that any very great or severe changes should be made in the code. They will help you, and stand their part of the expense, and no doubt go into this thing with hearty good will; but I think the resolution is all that is sufficient to carry the point.

Mr. Crocker: I think Mr. Merrill makes a strong case of it, and on technical grounds it would seem somewhat doubtful if we did have the right to draw up a definite set of by-laws and elect officers, for future meetings which are yet to be determined upon or authorized. Nevertheless, there is one consideration that comes up forcibly, one that he touched upon, but did not really cover; and that is the question of ways and means. Self-preservation is the first law of nature, and it seems to me that that question should be covered. If that line were covered, if, for instance, these various organizations were requested by this meeting, which we would have a

right to do, to contribute a certain amount, not in the form of actual dues, which they obligate themselves to pay annually, but on this particular occasion a certain amount, that would be well within our province and well within proper limits. That might cover the one point I had in mind most strongly when I was considering the question of the by-laws. That is to say, we want some financial basis for this work and for the continuation of the conference and its objects. It occurs to me, therefore, that you might substitute for the by-laws a resolution requesting that various bodies represented to contribute a certain sum for general expenses, to be expended by the present officers of this meeting.

Mr. Merrill: If it is merely a question of money, I have not the slightest doubt but what expense attendant upon this meeting will be cheerfully borne by the organizations sending representatives here. Speaking for my own board, I am quite sure of it.

Mr. Brophy: I will ask the chairman of the committee to read the by-laws, so called, as far as they have been prepared.

Mr. Crocker read the by-laws as requested. He also said: That is as far as the matter has gone, except as to the question of dues, and the idea of the committee was that the annual dues should be twenty-five dollars for each active and associate member. That is the only question on which the committee was not unanimous.

The Chairman: Mr. Wilmerding is on the point of going to Chicago, and is afraid he will miss his train. He desired to say a few words to the meeting.

Mr. Wilmerding: I simply want to say, gentlemen, now that you are on the subject of expense, dues from the various organizations represented, etc., that we want it understood that the National Electric Light Association has undertaken to meet any expenses that have been incurred up to the end of this meeting; so that with regard to any expenses which have been incurred up to this time, there is no provision to be made for them, they will be paid.

Mr. Merrill: Before Mr. Wilmerding leaves the room, I desire to offer a resolution. I move you, sir, that it be

RESOLVED: - That the thanks of this Conference, upon standard electrical rules, be extended to the National Electric Light Association for its preliminary services in arranging for this work.

The resolution was unanimously carried.

Mr. Stone: I move that when the meeting adjourns, it adjourns to meet at the call of the chair, when he is requested to do so by the committee of seven, appointed to prepare the code of rules. I do this for the purpose of continuing the meeting.

The Chairman: Several persons have spoken to the chairman in regard to this point. It was suggested in this connection that it might be desirable to set some specific date ahead in order that the committee might know it was not left at random, but that we should set some date now, and the committee adapt its work to the time fixed upon.

Mr. Merrill: I move that it is the sense of this meeting that the work should be finished and the chair call another meeting in four months' time.

Mr. Stone: My motion was when this meeting adjourns, it adjourns to meet at the call of the chair. There is another point. The fourth of July will be about four months from now. We don't want to fix the date at a time when everybody will be off on a trip, and won't want to come to a convention. I should think about the twenty-fifth of June will be about the proper time. The colleges have their commencements along about the twentieth of June, and after that comes the exodus of people. I think somewhere between the twentieth and thirtieth of June will be about

the time, say Wednesday and Thursday, June 24th and 25th. Embody that date in the motion, subject to the call of the chair in the interim.

The Chairman: There is another point, and that is the question of where we shall hold the meeting. I have spoken to Chairman Crocker on that point. I would like to say, gentlemen, that last evening I saw Mr. Halloway, past president of the American Society of Mechanical Engineers, and he made the statement that that society had extended to the American Society of Naval Architects and Marine Engineers the courtesy of using these headquarters for their meetings and for the receipt of their mail, so that this house could be used for their official headquarters, and that there would be no objection to extending a similar courtesy to this body. We must have some recognized headquarters, somewhere, and it seems to me proper that New York should be the place and what place better than the headquarters of the American Society of Mechanical Engineers; and if that courtesy was extended to this organization, I should be strongly in favor of accepting it. I see the Secretary of the American Society of Mechanical Engineers is present in the room, and I would like him to assure us on that point. Will there be any difficulty in that respect, Mr. Hutton?

Mr. Hutton: Not only no difficulty, Mr. Chairman, but we would like you to amend the statement and say that the American Society of Mechanical Engineers not only has no objection, but will be very glad to make such an arrangement. The expense is trifling – simply to transfer mail, and we have all the facilities for handling that, and will be glad to serve the Conference to the best of our ability. As to the meeting in June, it would be entirely convenient for that to be held here, and we will make that arrangement, if otherwise agreeable to your committee.

Mr. Crocker: I move that the headquarters of the American Society of Mechanical Engineers be adopted as the headquarters of this conference, and that we accept their invitation, with thanks.

The Chairman: I should say to you to couple with that an expression of our appreciation of the courtesy already extended to us in the past two days.

Mr. Crocker's motion was put and carried.

Mr. Ayer: I offer the following resolution:

RESOLVED: - That the thanks of this Conference on Standard Electric Rules be extended to the American Society of Mechanical Engineers for its courtesy in hospitably giving the use of its hall and rooms.

Carried.

Mr. Stone: To what extent is this committee of seven expected to confine themselves to the rules of the National Board of Fire Underwriters? To avoid the possibility of the feeling too much restricted to them, unless specific amendments have been suggested. I would offer this resolution:

RESOLVED: - That the committee of seven on the codification of the rules are empowered to make such changes in the National Board of Fire Underwriters rules as they may deem expedient, covering all the debate that has taken place at this meeting.

The Chairman: The committee has full instructions as to the preparation of the preliminary code, which they are to report back to the organization. I presume the committee will take into cognizance not only the five codes of rules printed here, but others on the subject. There is one other point. This matter is still set up, in the hands of the printer, and it has been suggested that four or five hundred copies, which can be gotten at an expense of a few dollars, should be ordered, that they may be sent to the manufacturing interests and their criticisms and

suggestions be secured as an additional guidance to the committee. If that were deemed desirable, a motion to that effect would be in order.

Mr. Brophy: By vote of our committee of the National Electric Light Association these are to be printed. Then it will only be for someone to send them out to the proper parties where they will do the most good.

Mr. Crocker: I move that the committee of seven be authorized to request subscriptions from the organizations represented at this meeting and those invited to subsequent meetings, in case it is found that money is required for the work of that committee. It is to be left to the discretion of the committee, not to exceed twenty-five dollars.

Carried.

Mr. Merrill: I offer a further resolution:

RESOLVED: - That the thanks of the meeting be extended to Mr. Hammer, personally, for the great amount of earnest work he has done in connection with this matter.

Mr. Stone: I would offer another, and that is, that Mr. Hammer be added to the committee of seven for the codification of the rules.

Mr. Brophy: I will be glad to have Mr. Hammer on that committee. I will be very glad to have substituted for myself; the National Electric Light Association does not desire to have anything that would look like too much representation on this committee. That we discussed fully when in committee. We do not desire now to be in a position to control that committee.

Mr. Stone: Mr. Hammer would not come to us as a member of the National Electric Light Association – he would represent us on the committee as chairman of this Conference.

The Chairman: That might come up in the minds of people who did not know all the circumstances, and I should be personally willing to stay out.

Mr. Stone: You will act ex officio.

The Secretary put to motion on that vote of thanks to Mr. Hammer for his work in arranging for the Conference.

Carried.

Mr. Brophy: Permit me to state in the presence of those here that Mr. Hammer has worked the labor oar. He has worked hard, spent money of his own, and given his valuable time to this matter; and I do not know where we could find a man who would have devoted the time and energy that he has in bringing this gathering together.

The Chairman: I appreciate these kind expressions very much indeed.

The Secretary put the motion on the question of adding Mr. Hammer to the committee of seven, as an ex officio member.

Carried.

On motion, the meeting adjourned.

Attest:

/s/ C. J. H. Woodbury, Secretary