

information to practical use. Scientific research is the common name for this new tool. . . .

"No one knows the correct answer to the question as to whether or not we have reached the end of our material progress; but in view of the short time that man has used this new intellectual tool, and, moreover, when one considers the immensity and complexity of nature, it is reasonable to believe that if the same methods continue to be employed, progress also will be continuous.

"Therefore no limit is in sight, provided, and this is an important proviso, that man himself does not call a halt. The forces of ignorance, tradition, and superstition are strong and view with some alarm the progress of science. There are many who say that these new methods have been too successful, especially as applied to the field of production, and point to our great surplus of material things, to the increase in 'technological unemployment,' and all the tragic circumstances of our present depression including the paradox of poverty in the midst of plenty.

"The engineer refuses to believe that the world's troubles can be laid at his door. He places most of the blame upon the waste and extravagances of war and misdirected economic effort, to the stimulation of high pressure sales methods, the over-pledging of future wages and income, and reckless speculation in inflated values.

#### SCIENTIFIC METHODS MUST BE CONTINUED

"While it may be admitted that there is no universal panacea and no *get well quick* cure, it would seem reasonable to expect real improvement if, for example, the same scientific methods which have been so effective in increasing production, could be brought to bear upon the problem of control and of balancing production against ultimate consumer demands. No claim is made that scientific men or engineers have a monopoly of wisdom or of brains; but it would seem that the methods which have proved so successful might be applied to the solution of the more complex social problems to the great advantage of all the people. Therefore instead of yielding to the forces of reaction, it is our duty to make strenuous effort to extend the use of the scientific method. This can be done only by education.

"Every man and woman should have the benefit of an education in the fundamental facts and methods of science. Every professional man should learn enough to understand something of the physical nature of the world, as well as of his own body. Science, in addition to creating all these new arts and new knowledge, may be accredited with something finer and more important. It has en-

couraged in the minds of its followers what may be called the scientific point of view.

"One who possesses this scientific point of view is inclined to be modest and tolerant of others; he searches for the truth; he hunts for facts which, if found, become his guide. He tries to see things as they exist, not as he has wished them to be; naturally he is honest with others but even more important, he is honest with himself in thought and in action. It is vitally important for our future welfare that our lawyers secure an education in science at least equal to their legal training. I single out the legal profession because the lawyer is today our political

## Dr. Michael I. Pupin

### Receives 1932 John Fritz Medal

**F**OLLOWING Edison Medal presentation Wednesday evening, January 27, 1932, the 1932 John Fritz Medal was presented to Dr. Michael Idvorsky Pupin, "scientist, engineer, author, inventor of the tuning of oscillating circuits and the loading of telephone circuits by inductance coils." Doctor Pupin is an honorary member and past-president of the A.I.E.E., and was the recipient of the Edison Medal in 1920.

The John Fritz Medal is an honor awarded by sixteen representatives of the four national engineering societies: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and American Institute of Electrical Engineers. It was established in memory of John Fritz of Bethlehem, Pa., one of America's great pioneers in the iron and steel industries. The medal is of gold and is awarded not oftener than once a year for "notable scientific or industrial achievement, without restriction on account of nationality or sex."

This portion of the Wednesday night session was presided over by William S. Lee, junior past-president of the A.I.E.E. as chairman of the John Fritz Medal board of award. Mr. Lee introduced as the next speaker Bancroft Gherardi, past-president of the A.I.E.E. and vice-president and chief engineer of the American Telephone and Telegraph Company. Mr. Gherardi spoke at some length regarding the life and achievements of Doctor Pupin; his address follows.

#### Mr. Gherardi Outlines Doctor Pupin's Achievements

"Fifty-eight years ago, late in the winter of 1874, a young Serbian landed at Castle Garden. He was without money or property, without friends or influence,

master. . . . If our legal doctors who make and interpret our laws remain ignorant of the new heaven and the new earth, what will happen to the poor bewildered common citizen.

"However, I think we may face the future with courage, as the expansion of educational facilities in recent years has been accompanied by an increase in the study of science in our schools and colleges. This may enable the new generation to meet the new problems with intelligence and success. After all, the forces of reaction and ignorance cannot prevail permanently in a country in which the voters are properly educated."

and without knowledge of the language of this country. Many would say that he had nothing; but this would fail to recognize the things which he had. He had good health, character, ambition, a mind eager to find knowledge and to use it, and high ideals. This evening I have been selected as the spokesman of four great engineering societies whose representatives are gathered here to pay a tribute of esteem and affection to him.

"Limitations of time compel silence upon Doctor Pupin's early struggle for an education, and his studies at Columbia University, at Cambridge (England) and at the University of Berlin; except only this: that no one can read the account which he gives of this period of his life in his wonderful autobiography without being convinced that in the earlier influence of his mother, and in the period in which he was getting his education, was laid the foundation upon which rest his many achievements during a long and varied career. From the time of his connection with the staff of Columbia University, the story of his life is a continuous record of contribution to our knowledge and our methods of thought. Of these only a few high spots can be mentioned this evening.

#### INVENTION OF LOADED TELEPHONE LINE WELL TIMED

"Perhaps because I am a telephone engineer, I am starting by referring to his invention of the loaded telephone line. For several years prior to Doctor Pupin's work which led to his inventions and patents on this subject, it was known that the addition of continuously distributed inductance to a telephone circuit would add to the transmission efficiency of the circuit; that is to say, it would diminish



the losses of the telephone current during its passage through the wires. It had been suggested that similar results should follow from the placing of inductance coils at intervals in the circuit. This had even been tried experimentally without favorable results. By means of a beautiful mathematical investigation Doctor Pupin established the fact that it was not sufficient to place inductance at intervals in the circuit, but that the inductance must be designed with reference to the circuit conditions and must be uniformly spaced at intervals having a relationship to the shortest waves which it was desired to transmit. He confirmed the results of his mathematical investigations through a brilliant series of laboratory experiments and in addition he designed and demonstrated the advantages of the toroidal type of loading coil—a design which fundamentally has persisted even to the present time, although it dates from over thirty years ago.

“Doctor Pupin’s patents were acquired by the Bell Telephone System and from that day to this his inventions have played a fundamental part in long distance telephony. The time at which Doctor Pupin made these inventions was most opportune: They came just when telephone engineers were confronted with serious problems in the extension of long distance telephone service over greater and greater distances, and also when, due to the unfavorable effects of non-loaded telephone cables, very serious problems were arising in the planning of long distance lines. These problems were particularly difficult where the numbers of circuits required were so great that overhead open wire constructions presented formidable difficulties, and where the lines had to be brought into large cities.

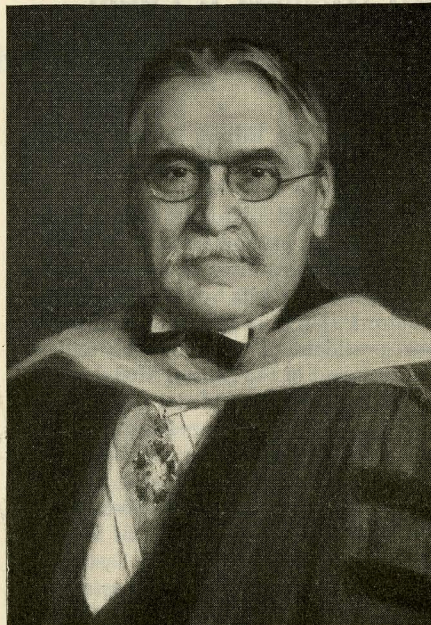
“As part of the mathematical investigation of the loading problem, Doctor Pupin developed a mathematical theory of certain forms of artificial lines or electrical networks. Such artificial lines today have numerous important applications in the communication art.

#### ORIGINATED TUNED CIRCUIT

“Doctor Pupin was the original discoverer of the electrically tuned circuit, that is, of the possibility of so proportioning the electrical characteristics of a circuit that it would respond energetically to any predetermined a-c. frequency. The electrically tuned circuit is used today in every important branch of the electrical art, in telephony, in telegraphy, in power transmission, and last but not least, in radio systems. It was first used by him and then by others in the analyzing of alternating currents, that is to say, in their separation into the different frequencies of which they were composed. In a way Doctor Pupin was unfortunate in the time in which he made this inven-

tion. At the time that he made the invention the radio art was practically non-existent and for many years thereafter it was used only for incidental and specialized purposes. Today, however, practically every home contains an electrically tuned circuit in the radio receiving set; but Doctor Pupin’s discovery was so far ahead of the development of radio and therefore of the general use of tuned circuits that few realize that, if this contribution of his were to be removed from the radio systems of the present day, they would no longer function.

“Immediately upon the discovery of the X-ray, Doctor Pupin made two important contributions. He was the first to discover the phenomenon of secondary X-ray radiation; that is, that when X-rays



**Dr. M. I. Pupin**

John Fritz Medalist for 1932 with the citation of “scientist, engineer, author, inventor of the tuning of oscillating circuits and the loading of telephone circuits by inductance coils”

strike on any matter, that matter becomes itself a source of X-ray radiation. This fact was not only important in itself, but it contributed to many other scientific advances in X-ray work. Doctor Pupin did much experimental work in X-ray photography and he was, I believe, the first in this country to make an X-ray picture with the aid of a fluorescent screen. The advantage of this method over those previously used was that it enormously shortened the time necessary for the photographic exposure and made it possible to take X-ray pictures in many medical and surgical cases where, without a short exposure it would not be practicable to get an effective X-ray picture.

“Doctor Pupin was the first to suggest the use of an electrical rectifier in con-

nection with the receiving of radio signals. While his original invention made use of an electrolytic type of rectifier cell, his invention was broad enough to cover the use of any type of rectifier element. Here again Doctor Pupin was unfortunate in that his invention was so far ahead of the development of the radio art that it was many years after his work was done before there was any extensive opportunity to use this contribution practically.

#### AN EDUCATOR AS WELL AS A SCIENTIST

“Doctor Pupin has had an important part in the building up of the scientific and engineering departments of one of our greatest educational institutions—Columbia University. He has not only contributed much in this way, but the graduates of Columbia who studied under him in many cases have made distinguished records in the fields of science and engineering. Of the many, I shall only mention two—Dr. Robert A. Millikan and Dr. Gano Dunn, a past-president of the A.I.E.E. These and many others testify with the greatest enthusiasm to what they owe to Doctor Pupin’s teaching and to his inspiration.

“During the war, Doctor Pupin had an important part in starting the National Research Council. The purpose of this body as defined by President Wilson in his executive order with reference to it was: stimulating research in mathematical, physical, and biological sciences, and in the application of these sciences to engineering, agriculture, medicine, and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare. Throughout the period of our participation in the war, Doctor Pupin devoted his abilities and his boundless energy to the vital problem of submarine detection.

#### “FROM IMMIGRANT TO INVENTOR”

“No statement of Doctor Pupin’s achievements, however brief, could omit the mention of his autobiography, ‘From Immigrant to Inventor.’ It is in itself a contribution to literature, to science, and to education, and a wonderful study in the process of Americanization. From this book many native-born Americans can learn something of the spirit and aims of our country.

“Doctor Pupin’s honorary degrees, his membership in societies and his presidencies of them, his American and foreign decorations, medals and awards, are too numerous to mention; but they testify to the judgment of others as to his personality and his work. In 1921 the A.I.E.E. awarded to him the Edison Medal, the highest honor which the Institute could confer. Now three other great engineering societies, civil, mechanical, and



mining, have joined with the electrical engineers in awarding to him their great joint honor.

"Doctor Pupin, I salute you: an inventor who has made important contributions to the application of electromagnetism to the uses of man; a scientist who has added important facts to our knowledge of science and contributed to scientific idealism; an educator who not only has an enviable record as to those who have studied under him, but who has advanced the cause of education; a citizen who has contributed much to this country; an American who is proud of the country of his adoption, and of whom his country is proud."

Following Mr. Gherardi's address, Mr. Lee presented the medal and certificate to Doctor Pupin with fitting remarks, to which Doctor Pupin responded as follows:

### Doctor Pupin Responds

"As I sat here," began Doctor Pupin "listening to the kind eulogy, the generous eulogy of my good friend, Bancroft Gherardi, I could not help recalling to memory some of the faces of the peasants in my native village who were my school-mates over 65 years ago. I saw them as if in a vision, sitting right here in the front row, looking around, dazed, wondering. One of them asked me, 'Michael, how in the world did you manage it? How many saints and angels, tell us, guided you on your way from the humble pasture lands of our little village to this glorious palace of American engineers?'"

"To them I answer, 'Some day I will send you a translation of the beautiful speech of Bancroft Gherardi, which will answer the question better than I can.'

... At every point of my uphill road, I met generous encouragement. Among these, I must mention the generous encouragement of my Alma Mater, Columbia College. Without its scholarships, fellowships and facilities for scientific research work, I should have been unable to contribute even the little I have contributed in the scientific field. In fact, I wouldn't be here this evening.

"Their generous spirit is the same as the generous spirit of the John Fritz Medal board which conferred upon me this very distinguished honor. I accept it; I accept it gladly. I am proud of it and I promise that I shall always consider it as a token of the generous spirit which I met at every step in this blessed land.

"Now, my friends, permit me to change my line of thought. I have been requested to address you and deliver to you, if possible, a message from the field in which I toil as an humble worker. That field is the field of power, of heat and electrical power."

[The remainder of Doctor Pupin's address may be found on p. 156-7 of this issue.]

## Fourteen Institute Committees

### Hold Meetings During Winter Convention

**D**URING the 1932 winter convention in New York, N. Y., January 25-29, meetings were held by several of the Institute's general and technical committees. Proceedings of these meetings are summarized in the following paragraphs, except the standards committee meeting which is reported under the "Standards" department of this issue.

#### STUDENT BRANCHES

Previously, this committee had been authorized to get out a booklet telling what the electrical engineer is, what he does, what type of man makes the best engineer, what qualities he should have, and what education he should be given. This was prepared with the object of giving high school students some definite information concerning electrical engineering in order to discourage those who should not go into it, and to encourage those who should. Following the distribution of two copies of this booklet to each of a selected list of 1,500 of the leading high schools in the country, requests for 12,000 copies were received, 2,000 more than the original edition.

Because of the widespread and enthusiastic approval which this booklet met, the committee at its meeting voted unanimously to ask the board of directors to authorize the printing of an additional 20,000. (The board of directors later authorized the printing of 10,000 additional copies at present.)

The second of the two most important problems discussed at this meeting was that of arranging attractive programs for the student Branches, on the subject of safety. A bibliography to be prepared by the committee and a paper by Prof. C. F. Scott on this subject, are expected to be sent to all Branches. It was proposed that one type of meeting might consist of a paper by a student on "What Safety Means in Industry," accompanied by a demonstration of the prone pressure method of resuscitation from electric shock. It was voted that the committee arrange definite plans for conducting safety instruction through the student Branches.

#### TECHNICAL PROGRAM

Plans for the summer convention program were discussed by the technical program committee, and it was decided to include a session on protective devices in place of a session on application to iron and steel production, due to a conflict in date with the national convention of the Association of Iron and Steel Electrical

Engineers. Also it was decided to add sessions on power generation, and on electrochemistry and electrometallurgy. The sessions which it is now planned to hold during the summer convention are: transmission and distribution, communication, automatic stations, electrical machinery, research, education, protective devices, power generation, electrochemistry and electrometallurgy, and selected subjects.

In connection with the number of pages available for printing, a discussion took place on the value of printing the technical committee reports submitted yearly by the various technical committees. It was decided that the question as to whether or not committee reports should be published, would be left to the discretion of the technical committee chairmen.

It was believed that section 89 of the by laws requiring that manuscripts of papers to be presented be received not less than ninety days before the date of presentation should be enforced, and therefore it was voted that "the manuscripts tentatively scheduled for the summer convention must be received at Institute headquarters, in complete form, by March 20, 1932, and where papers are not received those available on the docket will be substituted."

#### AUTOMATIC STATIONS

The automatic stations committee decided to request allotment to this committee of one session at the coming summer convention. Among the papers available are two on operating data and experiences with automatics, and two describing new devices.

It was decided to give further consideration to revisions of standard designations. A discussion was held concerning the various automatic schemes used with communicating circuits such as supervisory control and remote indication. A subcommittee was appointed to correlate these schemes with the various forms of communicating circuits available. In considering reclosing cycles on a-e. automatic reclosing circuit breakers, it was decided to investigate the present tendency to use only one or two reclosures instead of the usual three, and the use of practically instantaneous operation on the first reclosure.

#### EDUCATION

At the meeting of the committee on education, an attempt was made to determine the proper sphere of activity and responsibility of this committee. Without