of the dynamo. What it really was was the fiftieth anniversary of the pioneer investigations on dynamo machines. It is difficult for me to conceive how this celebration could have been imagined to be a celebration of the fiftieth anniversary of the dynamo itself as a machine. There is evidently a profound misconception somewhere, for which I have myself absolutely disclaimed any responsibility.

A dynamo is a machine for converting mechanical energy into electrical energy. Its prototype was, of course, the Faraday disc experiment, followed by such machines as the Pixii, Saxton, Allen (modified later by Lontin), Niaudet and others. The Faraday experiments were made in 1831; Pixii made his machine about 1832; the Clark machine was made in 1834; the Stohrer machine was made after the Pixii, in 1844. However, they were called magneto-electric machines, but there is no essential distinction between such machines and a dynamo electric machine.

After the Abbé Nollet, the alliance machines were made for producing electric arc light. Knight made, in 1854, the first dynamo of the inductor type, so far as can be ascertained. The Siemens shuttle armature, made by Werner Siemens in 1856, was used in a number of types of commutating dynamos. The Holmes machine, an alternating machine like the Alliance, came in 1857. The Paccinotti, the basis of the Gramme construction of 1870, came out in 1860, and the shuttle armature of Siemens appeared in the Wilde-Ladd, Wheatstone and Varley machines of about 1866–1867.

If the question is supposed to concern the time when the first dynamo in America was made, which, after all, does not seem to be a very important matter, it can be said that Davis's "Manual of Magnetism," the edition of 1842, shows magneto-electric machines of the Saxton and Pixii type as on sale in America. Wilde-Ladd machines using a Siemens shuttle were to be found in collections of electrical apparatus, and modifications of such machines were used by Moses G. Farmer in furnishing the current for exploding charges of powder in blasting and the like by melting a fuse wire by current.

This is a mere skeleton of the case, but shows that there is no such possibility of claiming the earliest dynamo made in America as defined by some particular type. It is unfortunate that the discussion ever arose from a misunderstanding which I have pointed out as to the nature of the fiftieth anniversary held at the Franklin Institute last April.

The *Journal* of the Franklin Institute for July, 1928, Volume XX, No. 1, may be referred to as showing the real nature of the anniversary celebration which was actually held, and which had nothing to do, as stated before, with the earliest dynamo in America. I hope that this statement will clear up the matter.

ELIHU THOMSON

EARLY GRAMME MACHINES

THE number of Gramme machines exhibited at the Centennial Exposition in Philadelphia in 1876 is increasing almost as rapidly as the men in Buckram.

There was a slight error in the notice in SCIENCE for April 13 which indicated that the celebration held in the Franklin Institute was in honor of the invention of the dynamo. In point of fact, it was the fiftieth anniversary of the first scientific test of the dynamo ever made in this country. Some of the scientists who attended this fiftieth anniversary took an active part in the testing of dynamos fifty years before. This is particularly true of Dr. Elihu Thomson and Dr. E. J. Huston.

On June 5, 1928, I received a letter from Professor A. P. Carman, of the University of Illinois, from which I quote the following:

> I went to Purdue as Professor of Physics and Electrical Engineering in 1889, and was much interested in finding that Gramme machine as part of the equipment. My students worked with it for three years while I was at Purdue. My interest in the machine was increased by the fact that we had at Princeton the exact mate of this machine. The Princeton machine was purchased by Professor C. F. Brackett at the Philadelphia Centennial Exposition, and I had heard from Professor Brackett that it was one of the two duplicates which were at the Exposition. I do not think that Professor Brackett knew where the second machine went. I had worked as a student with the Princeton Gramme machine.
>
> I had never heard of the machine which you say was purchased by Professor Barker of the University of Pennsylvania, but there was a similar machine at Cornell University which Professor Anthony had made after the model of the historical Gramme machines which are now at Purdue and at Princeton.

Professor Carman has surely thrown a monkey-wrench into the machinery. In addition to this, he has cited another Gramme machine of which I have had no knowledge.

On June 7, I received an illuminating letter from Dr. Elihu Thomson. He says:

> The celebration held at the Franklin Institute was really limited to the fiftieth anniversary of the first comprehensive tests made on dynamos, in which as many machines as could be gathered together at the time were put through not only photometric and mechanical tests, but the electrical tests. This had not been done before, so far as I am aware, and the results were of considerable value. The very Gramme machine which you purchased for the Purdue University, and which was the one at

the Centennial Exhibition of 1876 was borrowed from the Purdue University for the Franklin Institute tests, and figures prominently and very honorably in that series of tests

Dr. Charles E. Munroe, son-in-law of Professor Barker, of the University of Pennsylvania, suggested to me that I might find some reliable information respecting the Gramme machine at the University of Pennsylvania by addressing Professor Arthur W. Goodspeed, professor of physics at that institution. I have a very interesting letter from Professor Goodspeed on this point. I quote as follows:

> I think that you are correct in your impression that Barker bought the Gramme machine that was exhibited at the Centennial. We have one here now which I was told in 1884 when I first come to the University, by Professor Barker, that it was the first machine ever imported into this country, and I have exhibited it as such for 44 years. I referred to the matter at the recent 50th anniversary of the Thomson and Houston Tests that were made at the Franklin Institute, and Elihu Thomson had the same recollection as I have.
>
> It might be well to address a note to Professor Magie of Princeton who has been there for many years, probably before Brackett's death and he may be able to shed some light on the question.

Following the suggestion of Professor Goodspeed, I wrote Professor Magie, at Princeton, for his view of the case. He says:

> We have a Gramme machine in the museum of the Palmer Physical Laboratory which Prof. Brackett used to tell me was one of the two exhibited at the Centennial Exposition in Philadelphia. It was bought by him at the close of the Exposition.
>
> An account of the machine signed by me is attached to it. It contains statements which I am sure I did not invent and which I could have heard only from Professor Brackett. These statements, however, have not remained in my memory except the last one relating to the purchase of the machine. The inscription is as follows:
>
> "This machine represents the first type of a commercially successful direct current generator. It was developed by Gramme in 1873. It was imported into the United States in 1875 or early in 1876 with a second machine of the same design. The two machines were exhibited at the Centennial Exhibition in Philadelphia during 1876, one being operated as a generator and the other as a motor. This was the first public demonstration in this country of the transmission and utilization of electric power. The machine was purchased by Dr. C. F. Brackett for the University soon after the close of the Exhibition."

As they say in "The Mikado," "Here's a pretty kettle of fish." Apparently, there must have been three Gramme machines at the Centennial Exposition. I spent over two months in Philadelphia and visited the exposition practically every day it was open during my stay. I was so infatuated with the electrical exhibit that I feel quite certain I went to look at it every day I was at the exposition. My memory is very clear in regard to the number of machines. There were only two. A large and a small one. When I bought the small one for Purdue I was told by some one, I can not give the authority now, that Dr. Barker had bought the large one for the University of Pennsylvania. It has been fifty-two years now, and during all this time I have held firmly to this belief. It is barely possible that another machine was in storage and that probably was sold to Professor Brackett.

> Seven cities claim great Homer dead
> Through which the living Homer begged his bread.

Presumably, the only one of the Gramme machines which has a clear title to immortality is the one purchased for Purdue University.

In a more recent letter received from Dr. Elihu Thomson, a solution of the riddle is made. Dr. Thomson says, under date of July 11:

> I think there was another Gramme dynamo in the possession of Dr. Barker, of the University of Pennsylvania. I think Dr. Barker imported this Gramme dynamo ahead of the Centennial Exhibition. I have a recollection of having seen him use it before that Exhibition on the stage of the Academy of Music in Philadelphia, while he was delivering a public lecture.

After all, perhaps Dr. Barker did import his Gramme machine prior to the Centennial Exposition. It would be interesting to search the financial records of the university for 1875 and early 1876 to see if any notice of such purchase could be found. If so, peace would be restored.

A further contribution of early electric arc lights may not be out of the way here. In 1870 I taught physics and chemistry in the Indianapolis high school. I had prevailed upon the trustees to purchase what was thought in those days a large invoice of apparatus and supplies for a series of illustrated lectures on physics and chemistry. Among other apparatus was an electric battery of twenty-four Bunsen cells. With this outfit was also a lamp with carbon electrodes. With this apparatus I produced an electric light which caused a somewhat vivid publicity. In my scrap-book I have preserved an interesting published interview with a reporter who came to see this marvelous light at the high school. I hardly need say that I did not see his report until it was published. It was as follows:

Further information may be obtained by anyone who will take the trouble to visit the high school where Professor Wiley performs experiments for the benefit of his pupils. The galvanic battery was manufactured by Bunsen and contains twenty-four large cells. The experiments with these instruments were highly satisfactory, the light being only two or three per cent. less than that of the sun. The gas flame paled to a vapor and the air was filled with flickering waves like those we see in summer when the atmosphere is at white heat. The light itself is a white flame as trying to the eye as the sun. The hue given to surrounding objects is sickly in comparison with the light of day.

The reporter, after all, has given a vivid description of this characteristic phenomenon.

In the *American Journal of Science and Arts*, July, 1879, I published a paper relating to the exhibitions of electric light at Purdue University. I had constructed a special lamp to be used for this purpose. In order to increase the conductivity of the carbons I plated them with copper. I made various other adjudications in regard to the lamp in order to make it more effective and to utilize the carbons more economically. On the publication of this paper I received a letter from Dr. Charles J. Brush informing me that he had taken out a patent on copper-coated electrodes and warning me that if I wished to use them at all I should have to pay a royalty to his company. This was the first intimation that I had that the process which I also invented was covered by letters patent. I wrote to Dr. Brush that I had no expectation nor desire to offer my invention for commercial purposes, and that I should certainly not do so anyway in view of the fact that he had already patented the process. My invention was largely, however, the improvement which I introduced into the copper-coated electrode. This was my first introduction to Dr. Brush, whose wonderfully successful career in electric lighting and in other allied branches of science has reflected such credit upon himself and has facilitated such valuable improvements in all branches of the technical science connected with electric illumination.

H. W. WILEY

WASHINGTON, D. C.

THE PROPOSED NATIONAL PARK IN THE MAMMOTH CAVE REGION AND THE KENTUCKY GEOLOGICAL SURVEY

THE creation of a national park in the Mammoth Cave region has been pending for several years. Regarding the progress of the movement the director of the Kentucky Geological Survey, W. R. Jillson, writes:

> . . . Over a million dollars have now been raised and subscribed for the purchase of this park, and I am assured by Governor Sampson who is chairman of the organization raising the funds, that there will be no difficulty in securing the entire amount. In other words, Kentucky will do its part and the Mammoth Cave region will become a national park in due course.

It is perhaps premature to congratulate Kentucky on this achievement. But it seems worthwhile to point out the change in sentiment which this large amount of public subscription reflects. Five years ago I made my first visit to the cave area. At that time the subject of a national park was greeted on all sides with annoyance and resentment—even with counter propaganda on governmental invasion of private rights. I soon learned that it was necessary to avoid the subject to save argument. This spring the attitude was patently different. The native residents seem to be ready for the change; many of the employees connected with the cave properties are not averse to the plan; some even have contributed to the public funds.

How much the efforts of the Kentucky Geological Survey and its publications have had to do with this change in sentiment is difficult to evaluate. It seems to me that it may be more than coincidence that during the past five years there have been published the volume on the geology of Edmonson County, in which Mammoth Cave is located, a booklet on Kentucky State Parks, besides the survey and publication by cooperation with the U. S. Geological Survey of several topographic quadrangles in that vicinity. I noted in one hotel the state geologic map displayed in the main lobby. The state seems to be conscious of its geologic survey! In anticipation of the growing interest in the cave area an illustrated guide by A. K. Lobeck is shortly to be published.

In its molding of public sentiment by the dissemination of information the Kentucky survey appears to have made an achievement.

A. C. SWINNERTON

ANTIOCH COLLEGE

QUOTATIONS

CHEMISTRY IN INDUSTRY

SIXTEEN years ago the Society of Chemical Industry last met in America. Those who recall that meeting remember the spirited controversy between Sir William Perkin and Duisberg over synthetic rubber. No one then dreamed what was impending and what enormous demands the nations would soon make upon applied chemistry. As President Francis H. Carr said in the annual address, the great advance which has occurred is due in part to the fact that whole nations have made united effort to achieve a com-