ciety. A fee of \$25.00 will be charged for admission to the course and the accompanying laboratory instruction. The complete course of 36 lectures will be given between October 26 and November 8, 1910, inclusive.

Conduction of Electricity through Gases*

BY DR. H. C. RENTSCHLER

Cathode rays consists of streams of negatively charged particles moving in a straight line, but capable of being acted upon and deflected by both magnetic and electric fields, and when so deflected for collection they give on collection a negative charge to an electrometer. If a stream of these negatively charged particles, each bearing a charge e and having a mass m be acted upon by a magnetic field H and an electric field E at right angles to each other, we may get with the magnetic field alone a force

Where V is the velocity of the particle

$$F = e v H$$

Where r is the radius of curvature of the path which can be measured by the deviation of the stream of particles from a straight line

$$F = \frac{m v^2}{r}$$

Equating and solving

$$\frac{e}{m} = \frac{v}{r H}$$

If the electric field E be now put on and the value made such that it exactly counterbalances the deflecting force due to the magnetic field H we have

$$F^1 = E e = F = e v H$$

Solving
$$v = \frac{E}{H}$$

Substituting in the second member of the equation for e/m we get

$$\frac{e}{m} = \frac{E}{H^2 r}$$

The results found for the ratios e/m were about 1/770 of the value for the hydrogen atom in electrolytes, and the value found for the velocity about 1/10 of the velocity of light. The values for e and m were found separately by making use of Stokes' law of falling particles in a viscous fluid. The sudden partial expansion of dust-free air saturated with water vapor causes condensation or, ions as nuclei and the radius of the drops can be calculated from the rate of fall by means of Stokes' law. The total amount of water condensed may be determined by calculation from the amount of expansion and the total quantity of electricity by sweeping the drops into a plate connected to an electrometer. The number of drops can be calculated from the radius and the total condensed water, and the charge on each found by dividing the total charge by this number. The charge e so found was the same as that of the hydrogen atom. Moreover, the value of e/m and e and m were found to be the same for any gas or electrode material. If the cathode is made of a perforated sheet, then back of the cathode and in line with the holes we find the canal rays, which seem to consist of positively charged particles having a mass and a charge the same as the hydrogen atom. An interesting result found for the B-rays of radium, which seem to be similar to the cathode rays except that they have a much higher velocity, is that the value of m/e is much larger than the value found at low velocities. For instance, when the velocity is 2.85×10^{10} cm. per sec., the value of m/e is 3.09 times its value as found from cathode ray experiments. From this the conclusion is drawn that at least a large part of the mass is electromagnetic in character. If we now think of the electric field of force surrounding the electron moving with the particle, we can conceive

*Abstract of a lecture before the University of Missouri Branch on May 9, 1910.

that the electrostatic lines possess the property of inertia, and when the particle is suddenly stopped, as when the cathode rays or negative electrons strike the anticathode or the glass of the containing vessel, a pulse or vibration is sent along the electrostatic line and this pulse is the X-ray. If these pulses were periodically repeated we would have the vibration corresponding to light waves.

Applications for Election

Applications have been received by the Secretary from the following candidates for election to the Institute as Associates; these applications will be considered by the Board of Directors at a future meeting. Any member or Associate objecting to the election of any of these candidates should so inform the Secretary before July 20, 1910.

- 9567 Luck, F. J. W. Rio de Janeiro, Brazil
- 9568 Hatfield, K. G. S., Manchester, Eng.
- 9569 Motter, W. N., Milwaukee, Wis.
- 9570 Pierce, F. L., Milwaukee, Wis.
- 9571 Manzer, F. E., San Francisco, Cal.
- 9572 Allan, S. F., Oklahoma City, Okla.
- 9573 Barry, E. J., Potlatch, Idaho.
- 9574 Barley, A. T., Detroit, Mich.
- 9575 Chatterton, R. R., Ames, Iowa
- 9576 Piekens, G. W., St. Louis, Mo.
- 9577 Sano, S., Tokio, Japan.
- 9578 Hughes, E., Columbia, S. A.
- 9579 Klippelt, J. R., Uniontown, Pa.
- 9580 Prado, H. C., Columbia, S. A.
- 9581 Bodine, H. K., Stratford, N. J.
- 9582 Cousins, R. W., Gary, Indiana.
- 9583 Creagh, H., Manchester, Eng.
- 9584 Lauhren, N. L., Stockholm, Sweden
- 9585 Ojeda, A. M., Columbus, Ohio.
- 9586 Woodruff, L. S., West Allis, Wis.
- 9587 Barwise, A. H. O., Meerut, India
- 9588 Clizbe, R. E., Pullman, Ill.
- 9589 Leigh, A., San Jose, Cal.
- 9590 Starkey, W. C., Mansfield, Ohio.
- 9591 Mukerji, B. R., Allahabad, India.
- 9592 Hart, P. E., Montreal, Canada.
- 9593 Newnham, E., Springfield, Ohio.
- 9594 Voorhees, W. N., Brooklyn, N. Y.
- 9595 Kelsall, G. A., East Lansing, Mich.
- 9596 Moran, H. P., Denver, Colo.

- 9597 Partridge, G. W., London, Eng.
- 9598 Staeffen, H. G. E., Bridgeville, Pa.
- 9599 Howard, O. A., Chelsea, Mass.
- 9600 Irving, C., Los Angeles, Cal.
- 9601 Eckhart, N. A., Potter Valley, Cal.
- 9602 Radford, J. W. B., Madras, India.
- 9603 Taylor, A. Le R., Salt Lake City.
- Total 37.

Section Meetings

BALTIMORE

The Baltimore Section held its regular monthly meeting on May 13, 1910. Mr. A. S. Loizeaux presented a paper entitled "Protection of Service in Large Electric Systems." The paper described the various precautions taken to safeguard continuity in a large public service electric system. After the meeting an informal supper and smoker was held, at which the discussion of the paper was continued.

CLEVELAND

The March meeting of the Cleveland Section was held on March 21, 1910. The program consisted of four papers, as follows: "Financial Aspects of Hydroelectric Development," by E. P. Roberts; "Cost of Hydroelectric Development," by R. C. Beardsley; "Gas Engine Costs and Efficiencies," by Mr. Merriman; "Turbine Economics," by Mr. Dreyfus. Fifty-seven members and visitors were present.

On April 25 a committee was appointed to nominate officers for the ensuing year. Dr. P. W. Cobb then addressed the members on "Physiology of Illumination." At the conclusion of the address there was a supplemental talk by Dr. McLeod and Dr. Hyde. The total attendance numbered 65 members and guests.

The final meeting of the Section for the year was in the form of a banquet given on the evening of May 16 at Webb's Restaurant. The guest of honor was Mr. Charles F. Scott, of