"Effect of Pressure on Voltaic Couples." (Editorial reference to Doctor Gore's investigation on the influence of pressure upon the E. M. F. generated by a single kind of metal and a single kind of liquid; stating that the amount or balance of effect, therefore, obtained with a voltaic couple would usually be very much less than with a single kind of metal. This conclusion is confirmed by the results of Gibaud's experiments (*vide Comptes Rendus*, 1891, Vol. CXIII, p. 465), in which the amounts of E. M. F. obtained by a pressure of 100 atmospheres were very much less than those usually obtained in Doctor Gore's experiments by a difference of pressure of only about two or three atmospheres. As the pressure alone attending the height of the liquid of a voltaic cell affects the E. M. F., it necessarily follows that the energy of such a cell is affected by gravity and varies with the altitude and geographical position of the cell, which is a rather startling conclusion. 300 words.) London *Electrical Review*, April 14.

BATTERIES, STORAGE.

(See Train Lighting; also Municipal Lighting.)

"The Boese-Lütke Accumulator." (Describing small cell using only from 3 to 7 paste plates and discharging, at 1.8 volts, a constant capacity of 62 ampère hours per kilo of positive electrode. 600 words, 1 illustration.) *Elektrotechnische Zeitschrift*, Feb. 17.

"The Efficiency and the Advantages of Accumulator Batteries." (Editorial comment on results obtained within last two years in the central stations of Cassel, Dessau, Hamburg, Hanover and Breslau, the most favorable report showing an average efficiency in ampère hours of 95 per cent and in watt-hours 80 per cent, at Breslau; all stations using the Hagen battery. 800 words.) London *Electricity*, March 24.

"Present Status of the Storage Battery." By J. K. Pumpelly and C. Sorley. (Discussion of a paper read before the Chicago Electric Club March 20, with details of the Keller-Degenhardt electric vehicle.) *Western Electrician*, April 8.

"Nouveau Réducteur De Charge et De Décharge Pour Accumulateurs." By E. Leroy. (Details of a method for automatically charging cells; using resistance. 1,600 words, 4 diagrams.) Paris *L'Électricien*, March 11.

"Accumulator Substations." By Hermann Müller. (Description three substations in Düsseldorf, one of which now contains a battery of 140 cells having an output of 500 ampères, and arranged on three-wire system.) *Elektrotechnische Zeitschrift*, Vol. XIII, No. 28.

"The Waddell-Entz Storage Battery Street Cars." (Description of car to be operated on the Second avenue line, New York. 800 words.) *Electrical World*, April 29.

BIOGRAPHICAL.

(See Obituary.)

Ernst Werner von Siemens (with steel engraved portrait; 1,400 words.) London *Electrician*, March 24.

Dr. Ludwig K. Böhm (800 words, with portrait). *Electrical Review*, April 15.

François van Rysselberghe (800 words). *Electrical Review*, April 8.

Dr. J. Allen Hornsby (with portrait). *Electrical Industries*, April.

John C. Henry (1,000 words and portrait). *Electrical Engineer*, April 5.

J. W. Parker (500 words and portrait). *Electrical Engineer*, April 12.

"William Wallace, and His Contributions to the Electrical Industries." By William J. Hammer. (Reply to letter from Charles Stowell, 1,000 words; and answer by Mr. Stowell, 700 words.) *Electrical Engineer*, April 12 and 26.

Frederick Sargent (with portrait). *Electrical World*, March 18.

R. H. Pierce (with portrait). *Electrical World*, March 18.

"An Indianapolis Railway Group" (portraits of President J. P. Frenzel and staff). *Street Railway Review*, April.

Charles G. Smith (700 words and portrait). *Street Railway Review*, April.

Henry Meville Whitney. (President West End Street Railroad Company, Boston. 1,200 words and portrait.) *Street Railway Review*, April.

W. J. Dealy (175 words and portrait). *Electrical Age*, April 22.

"The Grave of Benjamin Franklin." (Letter from G. Wilfred Pearce calling attention to the neglected condition of graveyard containing remains of Benjamin Franklin and his wife, and suggesting the raising of a fund for improving same, and comment. 800 words and illustration.) *Electrical World*, April 8.

"Chicago." Historical reference to street railway lines, and to dealers in street railway supplies and machinery, with portraits of G. H. Wheeler, F. R. Greene, T. C. Pennington, M. K. Bowen, J. B. Parsons, C. Nagl, C. T. Yerkes, R. C. Crawford, J. M. Roach, J. W. Helm, F. L. Threedy, W. T. Bernard, D. F. Cameron, T. P. Phillips, C. F. Orr, F. W. Kohler, G. A. Kohler, W. S. Burling, G. Cutter, C. J. Stromberg, J. Allen, E. Burrell, H. Bishop, P. H. Carey, E. H. Harrison, W. H. Smith, J. M. Hayes, M. C. Bullock, D. W. Davis, N. W. Robinson, L. M. Tracy, W. W. Nugent, J. W. Clark, C. E. Loss, P. F. Leach, S. K. Gregg, G. E. Palmer, W. Taylor, W. Goodhue, B. E. Sunny, T. P. Bailey, G. K. Wheeler, L. E. Meyers, J. A. Corby, W. R. Mason, W. A. McGuire, W. J. Cooke, J. H. Harris, C. C. Keen, C. E. Jenkins, E. B. Preston, E. P. Rogers, P. H. Hover, G. Meyers, G. L. Reimann, J. A. Mosher, J. A. Sheriffs, H. E. Longwell, B. F. Stewart, J. S. Tebbets, C. S. Cook, G. B. Merrill, D. B. Dean, H. H. Windsor, F. S. Kenfield. *Street Railway Review*, April.

J. W. Godfrey (with portrait). *Electrical Engineer*, April 19.

"Edward Weston and His Electrical Work." (6,000 words, 17 illustrations.) *Western Electrician*, April 29.

"Captain William Brophy." (500 words and portrait.) *Electricity*, April 26.

"Nikola Tesla." (6,000 words and portrait.) New York *Herald*, April 23.

"J. H. Rhotehamel." (800 words and portrait.) *Electrical World*, April 29.

"J. H. Vail, George F. Sandt, U. T. Fackenthall." (Members of the Electrical Engineering and Trading Company. 900 words, 3 portraits.) *Electrical Engineer*, April 26.

"The Life and Inventions of Edison." By A. and W. K. L. Dickson. Third Paper. (A handsomely illustrated serial, the first paper appearing in the November number, with new portrait of Edison. Sixth Paper, illustrating the megaphone used for speaking long distances; Edison and his first phonograph in 1878; Edison's original tin foil phonograph, now at British Patent office museum; one of Edison's early phonographs; listening to messages from Edison (1888) at residence of Col. E. G. Gourard, England; Edison and his chief assistants, 1889; the phonograph exhibition at Crystal Palace, London, in 1888; section of wax cylinder showing impressions made by human voice; modern phonograph with electric motor; phonograph apparatus for dolls. 9,000 words.) *Cassier's Magazine*, April.

CENTRAL STATION, THE.

(See Alternating Current Apparatus, Gas Lighting and Municipal Lighting.)

"The Electric Lighting of Dresden." (Description of the plans offered for the erection of an electric station. 1,500 words.) London *Electrical Review*, March 24.

"The Paddington Central Station." (Description concluded. 1,600 words, 3 illustrations.) London *Electrical Engineer*, March 31.

"City of London — A Forecast." (Editorial comment on the semi-annual report of the City of London Electric Lighting Company. Assuming that the total paid-up and expended capital by December 31 amounts to $3,000,000, and that there are only 100,000 lamps connected up affording a gross earning of 12s. each, or a total gross earning on private lighting of $3,000,000 per annum, there will be slight prospects of fair dividends, owing to the loss on public lighting at 2½d. a unit. 800 words.) London *Electrical Engineer*, April 14.

"Opening of the Ancona Electric Works." (Description of the electric plant at Ancona, Italy. 1,200 words.) London *Electrical Review*, April 14.

"The Use of Ground Connections in Electric Light Installations." By R. V. Picou. (Abstract of paper read at the February meeting of the French International Society of Electricians, suggesting the perfect grounding of the negative conductor, and referring to heating effects and electrolytic action. 1,000 words, 3 diagrams.) *Electrical Review*, April 15.

"The Day Load." (Editorial suggestions for increasing the sale of electric current. 1,000 words.) London *Electrical Review*.

"The Painting of Wood and Iron Structures." By Edward H. Brown. (Abstract of a paper read before the Engineers' Club of Philadelphia. 2,800 words, and editorial 500 words.) *Engineering News*, April 20.

"The Design of a Central Station for Incandescent Electric Lights." By E. P. Roberts. (Suggestions regarding the preliminary investigation forming the basis of a correctly designed station; designing a station for town of 10,000 inhabitants; probable number of customers with output curves for same; and station lamp output diagram; table showing the income per lamp and per horse-power installed, with explanations showing how the calculations are made.) *Electrical World*, March 4 and 25, and April 22.

"The Birmingham Central Station." By Julius Maier and A. P. Haslam. (1,500 words, 3 illustrations.) London *Electricity*, March 31.

"The Alternating Current Plant at Clermont-Ferrand." (1,000 words, 3 illustrations.) *Electricity*, April 12.

"The Springfield, Ill., Electric Light and Steam Distribution Plant." By Leslie W. Collins. (Detailing method of supplying steam from central station. 2,000 words, 6 illustrations and 2 plans.) *Electrical Engineer*, April 5.

"The Newcastle-on-Tyne Electric Supply Company's Central Station." By Julius Maier and A. P. Haslam. (1,800 words, 3 illustrations.) London *Electricity*, April 7.

"Les Installations Électriques De La Ville De Zurich." By A. Palaz. (13 diagrams, and illustrations and 11,000 words.) Paris *L'Électricien*, February 11, 18, 25, March 4.

"The Central Station of the Akron Electric Company." (Description and two illustrations. 1,600 words.) *Electrical World*, April 22.

"Concrete Foundations for the Electric Power House of the Brooklyn Railway Company." (550 words, 2 illustrations.) *Scientific American*, April 22.

"Central Electric Lighting Stations in Massachusetts." (Abstract of the eighth annual report of the Board of Gas and Electric Light Commissioners of the State of Massachusetts, showing 56 central station companies (33 of which paid no dividends), operating 217,000 incandescent lamps; 18,582 arcs; 2,784 motors aggregating 6,930 horse-power; the total receipts for light and power aggregating nearly $3,000,000; and editorial comment.) *Electrical World*, April 15.

CHEMISTRY.

(See Tanning, Electrotyping and Metallurgy.)

"The Applications of Ozone." From a correspondent. (Extended details regarding production and application of ozone and illustrating different types of generators. Part IV; 1,000 words, 13 illustrations; Part V, conclusion, 2,000 words, 8 illustrations.) London *Electrical Review*, Feb. 24, March 3, 17, 24–31.

"Some Applications of Electricity to Chemistry." By James Swinburne. (First of a series of three "Tyndall" lectures before the Royal Institution.) Electrolysis; deposition of metals and chemicals. 2,500 words. London *Electrician*, April 21.

"The Production of Artificial Diamonds." (Review of investigations by Morris, Moissan, Friedel and Berthelot, and concluding: "It is fairly evident from this account of what has most recently been done, that we are not yet in a position to compete with the paste merchant in his efforts to replace the natural brilliants; but it is equally clear that the problem, which has a chemical fascination apart from the mere alchemistical joy of manufacturing the most costly of gems, is being solved by steps which are probably the surer for their very deliberation." 1,600 words.) London *Industries*, April 14.

"The Electrolytic Manufacture of Caustic and Bleach." (Details of plant of the Electrolytic Caustic Soda and Chlorine Trust, at Snodland. 800 words, 5 illustrations.) London *Industries*, April 14.

COMPENSATING DEVICES.

"The Compensator." (Describing the Westinghouse compensator, an instrument used in maintaining a constant potential on alternating circuits. 700 words, 1 illustration.) *Stationary Engineer*, April 15.

DYNAMO ELECTRIC MACHINERY.

(See Alternating Current Apparatus, and Magnetism.)

"Vertical Dynamo for Electro-Metallurgical Purposes." (Illustrating vertical dynamo constructed by the Maschinenfabrik Oerlikon, Oerlikon, for the Aluminium Industrie Actiengesellschaft, Neuhausen, Switzerland; coupled directly to the vertical turbine shaft and having an output of 400 kilowatts. The dynamo shaft carries the armature and the commutator, a total weight of revolving material of about 12 tons. 250 words, 1 illustration.) London *Industries*, March 24.

"A Hand-Made Electro-Motor." By R. Raddatz. (Telling how to build a small motor of $\frac{1}{5}$ or $\frac{1}{6}$ horse-power. 2,200 words, 4 illustrations.) *Electricity*, April 12.

"Theoretical Elements of Electro-Dynamo Machinery — XVI, XVII. By E. Kennelly. (Stress distributions continued. 1,600 words, diagram and table; 1,500 words and diagram.) *Electrical Engineer*, April 5, 12.

"Search Light Projectors." An experimental comparison of the Mangin and Schuckert projectors. By M. Burstyn. (Reprint from "*Mittheilungen aus dem Gebiete des Seewesens*," by the Imperial Austrian Hydrographic office, Vol. XX, Nos. 2 and 3, with tables showing results of the photometrical measurements taken on the beams of light sent out from the projectors; strength of current, 64 ampères, distance between photometer and projectors, 1,100 meters. 2,400 words and table.) *Electrical Engineer*, March 22.

"Impedance." By A. E. Kennelly. (A paper read before the American Institute, April 18. 8,000 words, 10 plates and tables.) *Transactions* American Institute Electrical Engineers, April.

"Electric Light and Power — VII." By Arthur F. Guy. (With diagrams showing winding of field magnets for series, shunt and compound-wound machines. 3,500 words and 3 diagrams, March 24.—Armature winding: Drum; cylinder or long ring; disc or short ring; closed coils and open coils. 1,800 words.) London *Electrical Engineer*, April 7.

"Les Enroulements Des Machines Electriques." By W. C. Rechnicwski. (Serial, including 22 diagrams, showing methods of winding different types of armatures. Commenced January 14.) Paris *L'Électricien*, Jan. 14, Feb. 18.

"Which is the Armature?" Brief comment, and statement: "We take it that in an alternating generator the element whose induction is constant is the field, and the part with the alternating current is the armature, and that the same relation holds good if the machine is run as a motor." (250 words.) London *Industries*, April 21.

EDUCATIONAL.

"An Early Engineering Magazine." By Hyland C. Kirk. (Description of *The Glasgow Mechanics' Magazine*, published in 1824, with 11 illustrations, 3,000 words.) *Engineering Magazine*, April.

"The Past and Future of Engineering." By Gordon B. Kimbrough. (Dilating on the preëminence of the engineer in the development of civilizing forces, and concluding that electricity is the most promising agent for the engineer, who "should not be satisfied until he has carried electricity into every rural household." 2,500 words.) *Engineering Magazine*, April.

"Engineering and Literature." (Abstract of remarks of Mr. Bryce at the annual banquet of the Institution of Civil Engineers. 800 words.) London *Industries*, March 24.

"Electricity as a Factor in National Economy." (Part I, 500 words; Part II, 2,000 words; Part III, 1,200 words.) London *Electricity*, March 31, April 7 and 14.

"The Training of Electrical Engineers." (Editorial comment on the want of breadth in technical schools, with suggestions for practical improvement, and extracts from letters from Compton & Co. and W. B. Esson and others. 6,000 words.) London *Electrical Engineer*, April 7 and 14.

"Large and Small." (Editorial on the value of gaining a thorough practical knowledge in order to realize the exact bearing of parts to whole. 550 words.) London *Electrical Engineer*, April 7.

"A Practical Course." (Description of the electrical branch of mechanical engineering established at Stevens' Institute of Technology. 1,100 words, 2 illustrations.)

"Massachusetts Institute of Technology." (Details of the heating and ventilating systems. 2,800 words, 8 illustrations.) *Heating and Ventilating*, April 15.

"The University of Chicago." By Hjalmar Hjorth Boyesen. (Nine pages, including portraits of John J. Rockefeller, President Harper, Thomas J. Lawrence, R. G. Moulton, George C. Walker, E. G. Robinson, William Gardner Hale and A. A. Stagg, and views of the buildings.) The *Cosmopolitan*, April.

"Laboratory Instruction in Physics." By D. W. Hering. (Indorsing the method of analysis rather than the progressive method, though admitting that to adhere strictly to one method throughout the whole course of physics would be unwise and unprofitable. 3,200 words.) *Science*, April 21.

ELECTRO-PHYSICS.

"A Novel Electroscope." By E. C. Rimington. (Detailing more simple methods of illuminating an electrodeless vacuum tube rotated in a constant electric field between two charged plates, than described in his paper entitled "Experiments in Electric and Magnetic Fields." 150 words, 1 illustration.) London *Electrician*, March 24. See also letter from H. L. Kerdel, London *Electrician*, April 7, and reply from Mr. Rimington, April 14.

"On the Current Strength in Simple Circuits Containing Resistance and Inductance Under Periodic Impressed Electro-Motive Forces of the Rectangular Wave Type." By A. E. Kennelly. (The article published March 18 noted the reduction of current following the introduction of non-ferric inductance; the present article considers the effect of introducing capacity instead of inductance. 500 words, curve, tables and diagrams.) *Electrical World*, April 8.

"The Differential Equation of Electric Flow." By T. H. Blakesley. (Abstract of a paper read before the Physical Society, March 24, to show that the ordinary mathematical expressions for electric flow fail to explain all known facts, and to point out that in order to interpret these facts, certain properties of matter not usually recognized must be admitted. Also the discussion of the paper. 1,000 words.) London *Electrician*, April 7.

"Molecular Physics." (Brief reference to a proper explanation of the phenomenon seen when an electrical discharge is passed through a Geissler tube. 1,000 words.) R. A. F., in *Science*, April 21.

"On the Kathode Rays in Gases at the Pressure of the Atmosphere and in the Highest Vacuum." By Dr. Philipp Lenard. (Communicated to the Royal Prussian Academy of Sciences by Prof. von Helmholtz. Experiments showing that kathode rays, once produced, are propagated through a space filled with air. 1,400 words, 1 diagram.) London *Electrician*, April 7.

"Pumping Electricity." (Comment on a communication comparing the dynamo with a pump. The generator merely sets electricity in motion, the electro-motive force depending on the speed or pressure. Likewise the pump raises the water, the rate of flow being limited by pressure and resistance due to friction. 1,200 words.) *Stationary Engineer*, April 15.

"The Determination of High Potential Differences." By Dr. A. Heydweiller. (Abstract from the *Elektrotechnische Zeitschrift*. Three tables, 2 illustrations. 500 words.) London *Electrician*, April 14.

"Gas Glow Burners vs. Geissler Tube light." (Abstract of paper by Dr. Ch. Heinzerling and Dr. L. Holthof, entitled "Progress of Modern Illuminants, with Special Reference to the Gas Glow Light of Auer," in the *Frankfurter Zeitung*. 900 words.) *Electrical Review*, April 29.

"Apparatus for Performing the Tesla Experiments." (Description of apparatus used by Prof. M. Schoentjes, of the University of Ghent, Belgium. 300 words.) *Electrical Engineer*, April 26.

ETHICS.

"The Present Status of Engineers." By A. J. F. Porter. (A paper read before the American Society of Mechanical Engineers. Suggestions for establishing a better understanding between the different branches of the profession at the coming congress of engineers. 5,000 words.) *Cassier's Magazine*, April.

ELECTRO-THERAPEUTICS.

"Electro-Therapeutic Quackery in England." By George H. Guy. (Comments on the frauds practiced by electric belt makers. 1,000 words.) *Electrical Review*, April 8.

"Electrodes for External Use." By R. G. Brown. (Describing Brown's electrodes. Reprint from Brooklyn *Medical Journal*. 1,500 words, 5 illustrations.) *Electrical Review*, April 8.

"Recherches sur les effets physiologiques des courants á haute fréquence, par le Dr. d' Arsouval." (A review of the lecture on the physiological effects of currents of high frequency, delivered before the Société Française De Physique, March 3. 700 words.) *L' Électricien*, March 25.

"Electricity and Micro-Oganisms." Beslau *Nord und Süd*, April.

"Electricity in Gynecology." By John M. Fisher. (5,000 words.) *Therapeutic Gazette*, April.

"Electricity in the Treatment of Urethral Strictures." By G. Howard McFadden. (1,500 words.) *Times and Register*, April 8.

"Electro-Rectal Surgery." By Homer C. Bennett. (900 words.) *Times and Register*, April 8.

"Electrolysis. Popularly Put for the General Practitioner." By J. Mount Bleyer. (700 words.) *Times and Register*, April 8.

ELECTROTYPING.

"The Galvanoplastic Process — II." (Compilation from "Die Galvanoplastik, Ausführliches Lehrbuch der galvanoplastischen Praxis nach den neuesten theoretischen Grundsätzen und praktischen Erfahrungen," m. 48 Abb. 3d edition. J. Weiss. Physical laws and ideas: The historical development; electricity and galvanism; positive and negative electricity. This section deals with the theoretical rather than the practical side of the question.) *Paper and Press*, March.

GAS.

"The Present and Future Competition between Gas and Electricity." By Joseph Gwynn. (A paper read before the Ohio Gas Light Association, giving comparative data on the growth of gas and electricity, and stating that there were made in 1892, 145,000,000 carbons; 5,093 fan motors by four companies that only made 2,012 in 1891; and an aggregate of 19,216 horse-power in stationary motors by seven companies.) 1,700 words. *Electrical Review*, April 15.

"Incandescent Gas Lighting." (Abstract of experiments undertaken to determine the colors which the various metallic oxides employed in the manufacture of the Welsbach mantel gave to the light. 700 words.) London *Industries*, March 24.

"Modern Gas and Oil Engines." By Albert Spies. (First Paper— illustrating and describing the Otto, Fielding, Day and Griffin engines. Second Paper— describing the Caldwell-Charter, Roots, Palatine, Campbell, Foos, American Priestman and English Priestman, Kane, and Kane launch. 6,000 words, 25 illustrations.) *Cassier's Magazine*, April.

"Economical Gas Power Plant." (Installed in the spinning mills in Abbeyville, France. 1,100 words, 2 illustrations.) London *Industries*, April 21.

GENERAL ELECTRIC COMPANY AND CORPORATIONS.

(See Lamp, Incandescent.)

"First Annual Report of the General Electric Company." (Full text, giving details of 1,277 local lighting companies supplying 2,500,000 incandescent and 110,000 arc lamps; of 435 roads operating 8,386 cars over 4,927 miles of road; of an increase in size of generators to 12,000 incandescent lights; 40,000 horse-power in machines for power purposes were shipped during the year; two electric locomotives of 1,600 horse-power each are under construction. Dividends paid or to be paid,

$1,971,056.50, plus net profits of $1,024,954.59 carried forward as surplus.) *Electrical Engineer*, April 12. Editorial comment, 900 words: "Does not seem to afford an encouraging outlook for the largely increased capitalization." *Electrical Engineer*, April 19. (Also, critical analysis of the balance sheet, 800 words.) *Electrical Engineer*, April 26.

"General Electrics' First Annual Report." (Report in full and editorial adverse criticism on the "absurd" values at which certain stocks are estimated, with statement "that the common stock is worth today less than fifty cents on the dollar.") *Electricity*, April 19.

"The Way of Trusts." (An excellent advertisement for the Westinghouse interests. Leading article reciting extracts from the democratic national platform, from President Cleveland's inaugural, and from the Act approved July 2, 1890; and calls on Attorney-General Olney to do his duty and crush the General Electric Company, because "they are delaying the universal use of electric power"!!! 3,500 words.) New York *World*, April 7.

"Public Rights in Private Contracts." (Clearly stating the interest the public at large have in the contracts of individuals. 800 words.) *American Stationer*, April 20.

"Woodhouse & Rawson." (Editorial comments on suggestion to reorganize the company. 800 words.) London *Electrical Engineer*, April 14.

HEATING, ELECTRIC.

(See Metallurgy.)

HISTORICAL.

(See Biographical.)

"Reminiscences of an Active Life." By Dr. P. H. Van Der Weyde. (Continued. 3,000 words.) The *Manufacturer and Builder*, February and March.

"An Early Dynamo." By Townsend Wolcott. (A paper read before the American Institute of Electrical Engineers, on the presentation by Mrs. Seeley of a dynamo built in 1867 by Prof. Charles A. Seeley. Also editorial by Horace Greeley in New York *Tribune*, March 28, 1867, and note from *Scientific American*, April 20, 1867. 2,500 words.) *Transactions*, American Institute Electrical Engineers, April.

INDUCTION.

(See Telephone.)

INCUBATION.

"Keay's Incubator with Electric Regulation." (Illustrating fifty-egg machine in which thirty-seven chicks were hatched from forty fertile eggs; with diagrams of temperature and barometer readings for the twenty days of incubation. 1,200 words, 5 illustrations.) London *Industries*, March 24.

INSURANCE.

"The Fire Hazards of Electricity." By Captain William Brophy. (A paper read before the Boston Society of Arts, April 13. "The man or firm . . . that installs electric wires in such a way as to increase the fire hazard should be deemed guilty of a misdemeanor, and should fire result should be deemed guilty of arson. The electric lighting company who would connect its service wires and furnish current to a building unsafely wired should be deemed an accessory before the fact and punished accordingly." And discussion. 6,000 words.) See also, portrait and biographical notice of Captain Brophy. *Electricity*, April 26.

"Electric Wiring and Insurance." (Editorial comment on recent statement laying blame of excessive fire loss to electricity, and stating that the proportion of fires caused by defective electrical construction is only 1¼ per cent. 500 words.) *Electrical Review*, April 29.

"Electrical Insurance Risks." (Abstract of communication from F. W. Fairfield suggesting a closer inspection of exterior wiring as well as interior wiring, by insurance inspectors. 400 words.) *Electrical World*, April 29.

INSULATION.

(See Wiring.)

INSTRUMENTS.

"Letters from a Laboratory — XLI." By Julian A. Moses. (Suggestions for polishing and lacquering instruments.) *Electrical Review*, April 22.

LAMPS, ARC.

"The Future of Arc Lamps." (Calling attention to the little knowledge regarding the underlying principles and the actual working of arc lamps possessed by the average electrical engineer, and to the need of a well-written treatise on the subject. 400 words.) London *Industries*, April 14.

LAMPS, INCANDESCENT.

"Edison Lost the Case." (Full decision of Judge Moses Hallet in the United States circuit court in the case of the Edison Electric Light Company et al. vs. Columbia Incandescent Lamp Company et al., refusing preliminary injunction. 1,800 words. Also interview with J. H. Rhotehamel. Portraits of Judge Hallet and Henry Goebel. Also item telling how the "local crowd disposed of their General Electric stock." 500 words.) St. Louis *Globe-Democrat*, April 22.

"The Columbia Incandescent Lamp Case." (A complete report of the final hearing on the motion for a preliminary injunction on behalf of the Edison Electric Light Company vs. The Columbia Incandescent Lamp Company, in St. Louis, on April 11, occupying nearly six pages,

and presenting in full or in abstract all the principal arguments, and the principal affidavits, with 17 illustrations of exhibits. A valuable paper.) *Electrical World*, April 22.

"The Story of the Evolution of the Edison Incandescent Lamp.—I." (Affidavit of William J. Hammer in the Columbia lamp case. 3,000 words, 31 illustrations.) *Electrical World*, April 22 and 29.

"Economy in Using Incandescent Lamps." By C. H. Stearn. (Brief statement of experiments conducted on the Continent, and comment on editorial review of Dr. Bohn's paper. 600 words.) London *Electrical Review*, March 24.

"Can a Practical, All-Solid Incandescent Lamp Without Vacuum Be Made." By F. M. F. Cazin. (Maintaining that such a lamp is not only possible, but that one will shortly appear on the market. 4,000 words.) *Electrical Age*, April 8 and 22.

"How to Convert Incandescent Lamps into Geissler Tubes." Communication from E. M. La Boiteaux. (Explaining how he secured varied luminous effects with burned-out lamps. 250 words.) *Scientific American*, April 15.

"Monopoly." (Editorial argument that a "comprehensive and permanent control of electric light and power could never be concentrated in a single organization," hence lamp consumers have little to fear. 900 words.) *Electrical Engineer*, April 5.

"The Incandescent Lamp Situation." (Communications from H. Ward Leonard, C. H. Wilmerding and others, and substance of interview with Mr. F. P. Fish relative to the questions asked by Mr. F. S. Terry. 4,000 words. And editorial, 600 words.) *Electrical World*, April 1.

"An Interesting Point." By A. B. Upham. (Maintains that "a person who takes certain elements and combines them to form a complete and patented whole is equally an infringer upon such patent." 500 words.) *Electrical World*, April 15.

"The Incandescent Lamp Situation." (Letter from Franklin S. Terry relative to the possibility of the General Electric Company securing control of the lighting industry, and stating that "The General Electric Company is undoubtedly entitled to the profits on the patents it owns, but I do not believe that it is equitable or just, nor was it the intention when the patent laws were framed, to permit the use of one patent to obtain a profit for a whole system or line of goods, far more than could be legitimately earned in the sale of the goods covered by the patent, nor do I think that it was ever intended that a patent should be used to create a monopoly in direct opposition to the interests of the public." 1,800 words.) *Electrical World*, April 15.

"Arc Lamps Versus Large Incandescent Lamps for Street Lighting." By Sidney F. Walker. (Maintaining that the lamp of the future for street lighting will be an incandescent lamp giving from 300 to 400 candle-power. A reply to W. H. Massey's statements. 2,000 words.) London *Electrical Review*, April 7.

"Early History of the Manufacture of the Goebel Lamp." By C. F. Dunderdale. (Reminiscences of Henry Goebel and his work, with illustrations of his air pump and filament cutter. 1,800 words.) *Electrical Review*, April 22.

"The New Sunbeam Lamp." (Extended description of the Von der Kammer lamp. 1,300 words, 1 illustration.) *Electricity*, April 19.

"Recent Improvements in Stopper Lamps—the Benjamin and the Green." (Details of newly-patented improvements. 800 words, eight diagrams.) *Electrical Engineer*, April 19.

"Mr. F. S. Terry on the Lamp Question." (Maintaining that while Edison may have been the first to produce "a commercial incandescent lamp, the present advanced condition of electric lighting is largely due to the inventive skill and patient labor of others"; and that "the attempt of the General Electric Company to use these patents as a means to control the entire lighting industry should be opposed as a matter of public policy." 1,300 words.) *Electrical World*, April 22.

"Relation of Candle-Power, Voltage and Watts." By Messrs. C. P. Feldmann and Versteeg. (Extended data from the results of tests, one set of lamps being tested at 37 different voltages ranging from 21 volts to 176 volts.) *Elektrotechnische Zeitschrift*, Feb. 3.

"An Early Account of Goebel's Lamp." (Reprint from the *Electrical Review* of May 15, *1882*, of a description of Goebel's lamp. 900 words.) *Electrical Review*, April 29.

"Decision in the Incandescent Lamp Suit." (Text of Judge Hallett's opinion, with editorial comment. 3,000 words.) *Electrical World*, April 29.

"Effect of Judge Hallett's Decision." (Reported interviews with leading members of the electrical industry. 3,000 words.) *Electrical World*, April 29.

LEGAL DECISIONS.

(See Lamps, Incandescent.)

"Street Railway Law." (Abstract of decisions: Passenger failing to get transfer ticket; injury to workman in street; advertisement and sale by city of street railway franchise; inquiry to person crossing street; rights under charter; damage to franchise by construction of sewer; failure to keep street in repair; negligence of driver. 3,200 words.) *Street Railway Review*, April.

"The Edison Feeder and Main Patent Case." (Comment on decision of Judge Green, handed down March 28, in the case of the Edison Electric Light Company vs. Westinghouse, Church, Kerr & Co., in favor of the plaintiff. 1,000 words. And editorial, 300 words.) *Electrical World*, April 8.

"The Decision in the 'Feeder and Main' Suit." (Extracts from Judge Green's decision, and comment. 2,000 words. Also Dr. Chandler's testimony. 1,000 words, 2 diagrams.) *Electrical Engineer*, April 19.

"The End of Mr. Martin's Suit." (Opinion of Referee in full in the suit of T. Commerford Martin vs. W. J. Johnston, to recover compensation. Mr. Martin's complaint dismissed with costs.) *Electrical World*, April 22.

LEGISLATION.

"A Specimen of Legislative Imbecility." By Allen R. Foote. (Commenting on a bill before a state legislature to limit the price of arc lighting to 25 cents a day. 1,500 words.) *Electrical Age*, April 22.

LIGHTING, DECORATIVE, ETC.

"Indirect Lighting." (Reprint of editorial remarks in *Gas World* on a series of papers by Dr. Franz Menning in *Der Gesundheits-Ingenieur*, based on experiments made in the Hygienic Institute of the University of Halle. Information of value on illumination by diffused reflectors. 1,400 words.) London *Electrician*, March 24.

"The Electric Light in Public Buildings." By Alfred H. Gibbings. (Plea for the revision of insurance rules. 1,400 words.) London *Electrical Review*, March 24.

"Electric Light and Gas." By E. C. De Segundo. (Comparative data showing cost of gas and of electricity under given conditions, conclusion, also showing sanitary advantages. 1,500 words.) London *Electrical Review*, Jan. 27, Feb. 10, 17 and March 31.

"Electric Lighting in Churches." By John McGhie. (Details of the electrical features in the church of St. Francis Xavier, New York. 1,000 words, and 4 illustrations.) *Electrical Engineer*, March 1.

"Electricity in a Modern Club." (Description of the electrical effects in the Colonial Club, New York. 2,200 words, 6 illustrations.) *Electrical World*, April 1.

"The New Hotel Waldorf." (Complete details of the lighting features. 3,000 words, 6 illustrations.) *Electrical World*, April 8.

"Easter Decorations." (Illustrating an electrical display in a florist's window. 300 words, 2 illustrations.) *Electrical World*, April 15

"Ship Lighting." (Abstract of lecture delivered by A. H. Bates, before the Hull and District Institution of Engineers and Naval Architects.) The *Steamship*, March.

"Ship Lighting. The New Cunard T. S. Steamship Campania." (Details of the electrical features, with handsome illustration of steamer. 1,000 words.) London *Industries*, March 24.

LIGHTHOUSE APPARATUS.

"Some Notes on Lighthouse Apparatus." By J. Kenward. (Reviewing the history of the art, urging the employment of more powerful lights, and the use of colored incandescent side lights of unequal intensity on vessels at sea. 2,300 words.) *Science*, April 21.

LIGHTNING.

"Recent Foreign Studies of Thunderstorms." I. Great Britain. By R. De C. Ward. (A well-prepared summary of important studies, including titles of literature on thunderstorms published in 1890-1892. 4,000 words.) *American Meteorological Journal*, April.

"Lightning Arresters in the United States." By Alexander J. Wurts. (Description of the Wurts Arrester. 1,400 words, 3 illustrations.) London *Electrician*, March 31.

"Lightning Protection." (Brief communication from Oliver Lodge, relative to a remark in Mr. Preece's presidential address "as to the behavior of lightning discharges." 400 words.) London *Electrical Review*, April 7.

MACHINERY, TOOLS, ETC.

"The Modern Traveling Crane." By Alexander E. Outerbridge, Jr. (A paper read before the Franklin Institute, detailing the essential features of electric cranes and the work performed at the Baldwin Locomotive Works. 5,000 words, 3 illustrations.) *Cassier's Magazine*, April.

MAGNETISM.

"The Effects of Magnetism on Animal Life." (Commenting on experiments by A. A. Knudson, before an audience at the Brooklyn Institute, indicating that magnetism has no apparent effect on the animal system or disagreeable effect or perceptible sensations when applied to the human body. 900 words.) *Stationery Engineer*, April 15.

"Electro-magnetic Theory." By Oliver Heaviside — XLVI. Par. 191, 192. (3,800 words.) London *Electrician*, March 24.

(Par. 193: The effects produced on electro-magnetic waves by a small amount of conductivity, to be afterward increased. Par. 194: Electric conductivity locally condensed into the conductance of any number of parallel plates. 3,000 words.) London *Electrician*, April 7.

METALLURGY, ELECTRO.

(See Chemistry.)

"Electric Tempering." (Abstract of note in the *Comptes Rendus* for March 13, describing process for casehardening metals. 240 words.) London *Electrician*, March 31.

"Electrolysis and the Purification of Lead." (Details of new process for the purification of lead, resulting in the production of chlorine. 300 words.) London *Electrical Review*.

"Boston and Montana Electrolytic Copper Plant." (Details of plant at Great Falls, Montana, containing 288 depositing vats holding 1,600,000 pounds of pig copper in the shape of anodes, current for which is transmitted 2,100 feet through twenty-one half-inch copper wires. 200 words.) *Electrical World*, April 1.

"L'Electrolyse De L'Aluminium." By Ch. Haubtmann. (Details of the various processes for obtaining aluminum. 1,800 words.) Paris *L'Électricien*, March 25.

"The Silver Plating Industry — II." (Review of knowledge regarding the hardness of electro-deposited metals, with details for testing, and "table of hardness determinations." 3,700 words, 3 diagrams. III. Reflection from Electro-plated Surfaces. 1,600 words, 2 diagrams.) London *Industries*, March 31, April 21.

"The Moissan-Violle Electric Furnace." (Illustrated description showing a carbon crucible within a closed cylindrical carbon vessel, and the whole inclosed in a block of limestone, through which and into the carbon vessel project carbon rods. 200 words, 1 illustration.) London *Electrician*, March 24.

"Electric Rod and Rivet Heaters." (Details of an electric rod-heater and an electric riveter exhibited at a meeting of the Royal Institution, by Alexander Siemens. 1,200 words, 5 illustrations.) London *Electrical Engineer*, April 7.

"Electric Heating and Forging." By G. D. Burton. (Abstract of paper read before the Harvard Lecture Club, including details of Burton apparatus and method of utilizing the current. 1,600 words.) *Electricity*, April 19.

"Les Fours Électriques De Laboratoire." By J. A. Montpellier. (Describing the various forms of electric furnaces used in French laboratories. 3,000 words and 6 illustrations.) Paris *L'Électricien*, April 8.

METERS AND MEASUREMENTS.

"A Large Wattmeter." (Illustrating a Brillic registering joule meter for 800,000 watts. 160 words, 1 illustration.) London *Industries*, March 31.

"The Elihu Thomson Watt-Hour Meter." By G. H. Baillie, W. L. Baylay and C. H. C. Woodhouse. (Details of a series of tests at the London Institute. 1,500 words.) London *Electrical Engineer*, March 24.

"Weston Electrical Measuring Instruments." (Full description of the Weston meters. 3,000 words, 6 illustrations.) *Electrical Review*, April 8.

"Recent Improvements in D'Arsonval Galvanometers." By Nelson H. Genung. (A paper read before the electrical section of the Franklin Institute. 2,700 words, 10 illustrations.) *Electrical Engineer*, April 12, 19 and 26.

"The New Standard Kennelly Ammeter." (Full description. 1,100 words, 2 illustrations.) *Electrical Engineer*, April 19.

"Thermal Galvanometers." By E. Tremlett Carter. (Commenting on description of Holden's hot-strip ammeter, and answering problem proposed by editor. 2,000 words.) London *Electrician*, April 14.

METEOROLOGICAL.

"Notes on the Climate and Meteorology of Death Valley, California." By Mark W. Harrington, Chief of Weather Bureau. (50 pages, including diagrams and tables.) *Bulletin* No. 1, Weather Bureau, United States Department of Agriculture.

"Notes on a New Method for the Discussion of Magnetic Observations." By Frank H. Bigelow. (Relating more particularly to such as use photographic traces for automatic records. 40 pages, including charts and tables.) *Bulletin* No. 2, Weather Bureau, United States Department of Agriculture.

"The Diurnal Variation of Barometric Pressure." By Dr. Frank N. Cole. (32 pages, including 14 tables.) *Bulletin* No. 6, Weather Bureau, United States Department of Agriculture.

"The Hodgkin's Fund." A prize of $2,000 is offered for the most satisfactory essay upon the known properties of atmospheric air considered in their relationships to research in every department of natural science, etc.; and a prize of $1,000 for the best popular treatise upon atmospheric air, etc.; also a gold medal to be awarded annually. *Proceedings*, Smithsonian Institution.

"The Mechanics of the Earth's Atmosphere." A collection of translations by Cleveland Abbe. (Containing memoirs prepared by Hagen, 1874; six by Helmholtz, 1858 to 1890; by Kirchhoff, 1869; five by Oberbeck, 1877 to 1888; by Hertz, 1884; three by Bezoed, 1888 to 1889; by Rayleigh, 1890; by Margules, 1890; by Ferree, 1890.) Published by the Smithsonian Institution, Washington, 1891.

MINING.

"Electric Mine Railway at Bleiberg, in Corinthia." Reprint from from *Proceedings* Institute Civil Engineers. (Details of an installation costing $6,500. 1,000 words.) *American Engineer* and *Railroad Journal*, April.

"Electrical Coal Mining." By James T. Burchell. (A paper read at the International Convention of Mining Engineers at Montreal. Details service performed by electric coal cutters in several mines, and gives data favoring electricity rather than compressed air while commenting on Lloyd's paper in the *Colliery Engineer* of December. 2,500 words.) *Engineering News*, April 6.

"Electricity in Mining Industries." (Editorial comment on the general application of electricity in mining. 900 words.) *Age of Steel*, April 15.

"Influence of Electricity on Colorado's Progress." By Irving Hale. (A summary of the various applications of electricity within the state; of the saving effected in the cost of silver mining where available water-power has displaced steam; of the refining of metals with heavy currents; and referring to the utilization of electricity in raising water from the irrigating ditches in the lowlands; and in operating hoists in stone quarries. 12 pages, including 6 illustrations.) *Colorado Magazine*, May.

"The Jones Rotary Electric Drill." (Detailed description of its construction and operation. 650 words, with 4 illustrations, showing sections and parts before assembling.) *Electrical Engineer*, April 19.

MUNICIPAL LIGHTING.

"Municipal Electric Plant in Berne, Switzerland." (Illustrations showing connection box, dynamo room, overhead construction along the River Aar, battery of accumulators and diagram showing battery connections. 1,600 words.) *Electrical World*, April 15.

"Municipal Ownership of Street Lighting Plants." (Abstract of a report of a common council committee of Youngstown, Ohio, with table showing the cities owning lighting plants, and also estimates prepared by Mayor Pingree, of Detroit. 1,200 words and table.) *Paving and Municipal Engineering*, Indianapolis.

OBITUARY.

"Charles Victor De Sauty." Died at Gibraltar, April 11. (400 words, and the poem "De Sauty" by Dr. Oliver Wendell Holmes.) London *Electrician*, April 14.

"Death of Grosvenor Porter Lowrey." Died, April 20, in New York. (600 words and portrait.) *Electrical Review*, April 29.

Theodore Puskas. Died in Budapest. (1,000 words.) *Electrical World*, April 29.

Edward G. Gilbert (with portrait). *Street Railway Journal*, April.

PATENTS.

"The Morality of the Patent System." By Dr. Frederic A. C. Perrine. (Maintaining that the history of the past 100 years has not proven the necessity for protecting the right to individual property in an idea. 2,400 words.) *Electricity*, March 29.

"Notes on Certain Proposals for Patent Law Reform." By W. Lloyd Wise. (Suggestions regarding the proposed Patent Law reform and of weeding out impracticable patents. 2,000 words.) Reprint from the *Chamber of Commerce Journal*. London *Electrician*, April 7.

"Patent Law Reforms." (Editorial comment on paper by Mr. Lloyd Wise, and deprecating the reduction of fees, for "to increase the number of petty patents would lead to frivolous restrictions and vexatious blackmail." 1,100 words.) London *Electrician*, April 14.

PHOTOGRAPHY.

"Photographic Development by Electrolysis." (Commenting on the value of sodium hyposulphite as a developer when prepared by electrolyzing a nearly saturated solution of acid sodium sulphite. 300 words.) London *Electrician*, March 31.

"Electric Spark Photographs." (Editorial comment on lecture by C. Vernon Boys. 900 words.) London *Electrical Review*, March 24.

PHONOGRAPH.

"The Composition of Vowel Sounds." (Editorial comment on experiments conducted at the Massachusetts Institute of Technology by C. R. Cross, G. V. Wendell and C. J. Blake, showing that a definite quality of sound corresponds to each rate of rotation of the cylinder. 600 words.) London *Electrical Review*, April 14.

PLATINUM.

"The Production of Platinum." (Reference to platinum mines in the Ural mountains, in the Canadian mines and elsewhere, and abstract of report of the mineral industries in the United States at the eleventh census. 700 words.) London *Industries*, April 7.

POWER TRANSMISSION.

"Electricity as a Motive Power." By Albion T. Snell. (A series of papers on the general scheme of electrical transmission of power, commenced March 17. 2, Dynamo and motor; 3, Units and symbols; 4, First approximation to the size of armature for a given output and speed; 5, Fundamental equation connecting the total E. M. F. with the armature constants. 1,600 words. 6, The ratio between radial depth of core and diameter of armature; 7, Determination of the number of conductors on the armature; 8, Design of field magnets. 1,600 words, 9 illustrations.) London *Electrician*, March 31 and April 14.

"The Distribution of Electrical Energy." (Description of the "Volta" and the "Pacinotti" power plants. 1,200 words, 3 illustrations.) *Electricity*, April 5.

"Electric Machine Tools." By S. S. Wheeler. (A trade description of work done by the Crocker-Wheeler Company. 2,300 words, 7 illustrations.) *Electrical Engineer*, April 12.

"An Electric Deck Planer." (In form resembling a lawn mower, the cutter revolving at 3,000 and the geared motor at 2,000 revolutions per minute. Invented by Malcolm Sutherland. 250 words, 1 illustration.) London *Electrician*, March 24.

"Magnetic Clutches." (Brief note referring to the Harrington system used in the repair shop of the Atlantic City Electric Railway Company. 200 words.) *Electrical World*, April 15.

"The Distribution of Power by Alternate-Current Motors." By Albion T. Snell. (A paper read before the Institution of Electrical Engineers, April 13.)

"Operating Water Works by Electric Motor." (Description of the plant at San Antonio, Texas. 700 words, 1 illustration.) *Electrical Engineer*, April 26.

"Long Distance Transmission from the Snoqualmie Falls." (Proposed plan for transmitting power in Washington. 500 words, 1 illustration.) *Electrical Engineer*, April 26.

PROGRESS, ELECTRICAL.

"Electrical Development Abroad." (Extracts from reports of United States consuls to the state department. 2,000 words.) *Western Electrician*, April 8.

"Electrical Progress in Germany." (Reference to train lighting, elevated electric traction, and accumulator traction. 1,500 words.) *Electrical World*, April 15.

RAILWAYS, ELECTRIC.

(See Progress, Electrical.)

(See Bicycle, Electrical.)

"Electric Railways and Electrical Disturbances." (Testimony and discussion of the bill of the Clapham Junction and Paddington Railway, before the House of Commons, including remarks by Prof. Ewing, Mr. Preece, Mr. Saunders, Lord Kelvin, Prof. Ayrton, and others. 4,000 words, 2 illustrations; and editorial comment, 1,200 words.) London *Electrician*, March 24.

"The Possibilities of High-Speed Electric Traction." By Frank B. Lea. (A paper read before the Owens College Engineering Society, March 14, and detailing present practice in high-speed steam and electric traction.) London *Electrical Engineer*, March 17 and 24.

"An Electric Car Test." By Dr. Frederick Bedell. (Details of test made at Rochester, New York, with double-geared motor. 900 words, and platted curves. Editorial comment, 400 words.) *Street Railway Review*, April 1.

"Electric Railways." By John C. Henry. (Detailing recent improvements in electric traction. 3,600 words.) *Street Railway Gazette*, April 8.

"In the Matter of Rail Joints." By "Motor." (Plea for a better fitting of all parts than is now furnished. 2,200 words.) *Street Railway Journal*, April.

"British Street Railway Statistics." (Table showing capital stock, bonded indebtedness, cars, mileage. 250 words and table.) *Street Railway Journal*, April.

"Method of Engaging Employés." (Describing plan followed by the Denver Tramway Company, with lists of questions. 2,400 words.) *Street Railway Journal*, April.

"Car Equipment Tests." By Charles F. Urebelacker. (Describing methods for making simple tests. 5,000 words, 3 diagrams, 2 forms.) *Street Railway Journal*, April.

"Country Roads and Electricity." (Summary of the arguments presented by the Wheelmen's League in their scheme for improving the country roads of New York state at an estimated cost of $10,000,000. 2,600 words.) *Scientific American*, April 15.

"T Rails." (Editorial in favor of their use by street railway lines. 500 words.) *Engineering News*, April 13.

"Electric Railroads and Electrolysis." (Editorial comment on C. H. Morse's paper and suggesting the grounding of the negative side of the generator rather than the positive as the obvious remedy. 1,000 words. And comment on Hermann Lemp's letter. 500 words.) *Electrical Engineer*, April 12 and 26.

"Electric Rapid Transit Projects Abroad." By C. J. Black. (General reference to some work in France; and also in the United States. 1,200 words.) *Street Railway Gazette*, April 15.

"The Advantages of Electrical Traction on Railways." (Comment on the work accomplished in France, and referring to a self-contained locomotive, carrying its own generators, storage cells, etc. 600 words.) London *Industries*, April 7.

"The Heilman System," "La Traction Électrique, Système Heilman. État Actuel De La Question." By E. Meylan. (Description of 42-ton locomotive of 400 horse-power, having a six-pole generator coupled direct to the compound engine shaft, while each of the eight axles support four-pole motors. Generator wound for 400 volts and 1,025 ampères at 300 revolutions. Water tanks and coal bunkers on either side of boiler. 3,300 words, 9 illustrations.) Paris *L'Électricien*, March 25.

"The Heilman Electric Locomotive." (Editorial comment on the self-contained electric power installation on a vehicle resembling an ordinary locomotive. "The project should not be laughed at, as, under the auspices of the French state railway engineers, information of material benefit to all interested in the progress of electric traction." 800 words.) London *Electrical Engineer*, April 7.

"Plantation Roads." (Editorial suggesting use of light electric railway freight lines for moving sugar cane to the mills. 700 words.) *Street Railway Review*, April.

"The Boynton Electrical Bicycle Road." (Details of a proposed road to be operated on Long Island. 2,200 words, 5 illustrations. And editorial. 400 words.) *Electrical World*, April 15.

"A Solution of the Brooklyn Bridge Problem." (Advocating the use of the movable sidewalk. 1,200 words.) *Street Railway Review*, April.

"Cook's Elevated Railway System." (With portrait of L. F. Cook, of Tacoma. 1,700 words, 7 illustrations.) *Street Railway Review*, April.

"Postal Street Cars." (Describing systems in use in St. Louis, Cincinnati and Canton, and proposed line to Carthage. 1,000 words, 2 illustrations.) *Street Railway Review*, April.

"Selling Power from Trolley Circuits." (Suggestions and editorial comment. 1,500 words.) *Street Railway Review*, April.

"A Chapter on Paving." (Detailing cost of granite block, cedar block, asphalt, wood and other forms of pavement. 2,000 words.) *Street Railway Review*, April.

"State Regulation of Electric Railroads." (Editorial comment on the discussion in Massachusetts of the state regulation of railroads. 500 words.) *Electrical Engineer*, April 19.

"Are They Railways or Tramways?" (Brief editorial reference to decision by the exchequer court at Ottawa, apparently allowing electric roads to import rails free of duty. 200 words.) *Electrical Engineer*, April 19.

"Important Electric Railway Legislation in Connecticut." (Press dispatch to *Evening Post*, giving abstract of general electric railroad bill reported unanimously at Hartford. 500 words.) *Electrical Engineer*, April 19.

"Notes on the Cost of Operating Cable Railways." (Abstract of paper by D. Bontecou read before the American Society of Civil Engineers, April 19. "The cost of operation for a fast and frequent service is less with the cable than with any other form of traction; and the cost of first-class construction is so large that a suitable amount of business is needed to make a cable road profitable." 1,300 words.) *Engineering News*, April 20.

"Moyens De Réduire Les Depenses D'Exploitation Des Tramways Électriques." By Em. Dieudonné. (1,500 words.) Paris *L'Électricien*, April 8.

"Electric Locomotive for the Northern Railroad of France." (Description of self-contained experimental locomotive on the Northern Railroad of France, having six wheels with motors placed on the ends of two axles, eighty storage cells, etc. Abstract of article from *Le Genie Civile*. 700 words, 1 illustration.) *Engineering and Mining Journal*, April 22.

"Safety Fuses Versus Magnetic Cut-Outs in Electric Railway Work." By W. E. Harrington. (Relating experience with fuses, and indorsing his own magnetic cut-out. 1,100 words.) *Electrical World*, April 29.

"Low Resistance for Railway Ground Return." By Hermann Lemp. (Suggesting the welding of the rails as the most available method; and incidentally describing a welding car to be operated in Boston. 600 words.) *Electrical Engineer*, April 26.

"Electric Railway." Georges Petit. Paris *Revue Scientifique*, March 25.

"Remarkable Sale of a Street Railway Franchise." (Details of the franchise offered for sale by the municipality of Indianapolis. 3,000 words.) *Paving and Municipal Engineering*, May.

"A City Engineer's Views of Modern Street Paving." By Niles Meriwether. (Abstract from the annual report of the city engineer of Memphis, Tennessee, illustrating the method of laying annealed brick on streets on which street car lines are located. 1,200 words, 1 illustration.) *Paving and Municipal Engineering*, May.

"The Gravity System of Rapid Transit." By Major Benjamin S. Henning. (Details of cost and indorsing its introduction on the New York-Brooklyn lines. 4,000 words, 3 illustrations.) *Engineering Magazine*, May.

"Cost of Street Railway Building." By William T. Harris. (Suggestions on which to base the cost of new lines, and to estimate the value of existing property. 5,300 words.) *Engineering Magazine*, May.

RAILWAY PLANTS, ELECTRIC.

"The Electric Railway in Bangkok." (Details of the Short system installed by W. J. Davidson. Reprint from Bangkok, Siam, *Times*, of February 25. 1,400 words.) *Street Railway Gazette*, April 22.

"The First Electric Railway in New Orleans." By A. Langstaff Johnston. (Introductory; the route; the track; the line; the power house; car house; work shop and offices; contractors. Details of the plant of the New Orleans and Carrollton roads. 3,000 words, 8 illustrations.) *Electrical Engineer*, April 19 and 26.

"New Terminal Stations for the New York and Brooklyn Bridge." (2,000 words. 2 diagrams.) *Engineering News*, April 20.

"The Globe Street Railway, Fall River, Massachusetts." (1,600 words, 3 illustrations.) *Street Railway Journal*, April.

Colorado Springs, Colorado; Salt Lake City, Utah; Ogden City, Utah; Butte, Montana; Helena, Montana; Great Falls, Montana, and Spokane, Washington. (An editorial description of the street railway interests in these various cities, including many details regarding cost of maintenance and operation; of methods of accounting; of repairs; etc. 18 pages, including 27 half-tone illustrations and 2 forms.) *Street Railway Journal*, April.

"Fly-wheel Accident at Lowell, Massachusetts." (Details of the destruction of a 20-foot fly-wheel of a Cooper-Corliss engine in the power house of the Lowell & Suburban Street Railway, Lowell, Mass. 3,000 words. 4 illustrations.) *Power*, April.

"The Mekarski Compressed Air Tramway at Berne, Switzerland." (3,300 words.) *Engineering News*, April 20.

"Conduit System of Electric Railway." (Letter from Chief Engineer T. R. Hinsdale, giving a concise description of the Love conduit system in service on the Rock Creek line. 500 words.) (Fuller descriptions in issues of March 19, April 16 and Dec. 29, 1892.) *Engineering News*, April 20.

RUBBER.

"Rubber Tree Culture in Mexico." By the Mexican minister at Washington. (An abstract of the bulletin of the Mexican Agricultural Society, prepared by Señor Don Matias Romero, Minister of Finance in President Diaz's Cabinet. Dealing in probabilities rather than actualities. 5,000 words.) *India Rubber World*, April 15.

STANDARDS AND UNITS.

"The American Proposals with Regard to Electrical Units." (Letter from M. Guillaume and translation of his remarks before the Société Internationale des Électriciens. 1,200 words.) London *Electrician*, March 24.

"The Metrical Reform — Its Conditions and Needs." By Joseph V. Collins. 4,500 words and 1 table.) *Electrical Review*, April 15.

"The Weston Standard Cell." (Details of Professor Weston's new cell that does not vary under wide range of temperature, and having an E. M. F. of 1.019 volts. 1,000 words and 2 illustrations.) *Electrical Engineer*, April 12.

"The Standardizing of Electrical Instruments." By W. M. Hill. (Part I : Introduction ; Clark's cell as a standard ; standardizing a voltmeter by Clark cells. 1,800 words, 5 diagrams. Part II : A convenient ammeter standard. 2,000 words, 10 diagrams.) *Electrical World*, April 15 and 22.

"A Secondary Standard for Arc-Light Photometry." By M. Blondel. (Verbatim translation of remarks at the meeting of the Société Internationale des Électriciens on March 1, proposing to use an arc lamp and a system of perforated screens for providing a unit of light. 2,000 words, 2 illustrations. Editorial comment. 300 words.) London *Electrician*, April 7. See also issue April 28, 1892, and March 10 and March 31, 1893, of London *Electrician*.

"A New Form of Portable Photometer." By Sir David Salomons. (A paper read before the Institution of Electrical Engineers, March 23. 3,600 words.) London *Electrical Review*, April 14.

"How to Ascertain Candle-Power." (Brief reply to a query from Julius Pinney, advising how to use Bunsen's photometric apparatus. 200 words.) *Electrical Review*, April 29.

"Where is the Litre?" By T. C. Mendenhall. (A reply to Stephen H. Emmens' Article in *Science* for March 17, criticising the inaccuracy of the present definition of the litre and the so-called simplicity of the metric system. Professor Mendenhall explains the action of the international committee who resolved that "the term *litre* should be used to express the volume of a kilogramme of pure water at maximum density. The one-thousandth part of this, that is to say, the volume of a gramme of pure water at maximum density is called the *millimetre*, and the abbreviation *ml.* is used to stand for it." Also stating that "The International Bureau is engaged in an elaborate investigation of the relations of mass, volume, and density in pure water, and when the results are available, they will doubtless satisfy the most exacting demands." 1,100 words.) Also reply by Mr. Emmens. 1,000 words. *Science*, April 21 and 28.

STEAM ENGINEERING.

"Heat Movement in Steam Engine Cylinders." (Indorsing Professor Kirsch's statements of the desirability of jacketing the cylinder ends and the piston. 1,400 words.) London *Electrical Review*, March 24.

"Belting for Machinery." By Henry A. Mavor. (A paper read before the Institution of Engineers and Shipbuilders in Scotland. 3,500 words, 1 diagram, 1 table.) London *Electrical Engineer*, March 31, April 7.

"Steam Engine Indicator — II." (Explaining the practical use of the indicator. 2,000 words and Figs. Nos. 14 to 21.) *Power*, April.

"The Power Catechism: For Practical Engineers." (A series of questions and answers, this section covering questions 92 to 129, on the subject of boilers. 2,800 words.) *Power*, April.

"Condensers." By Benjamin Thurtell. (A paper read before the Robert Fulton Association of Stationary Engineers, describing the Chicago water jacket syphon condenser. 1,300 words.) *Stationary Engineer*, April 1.

"Boiler Feed Pumps." (Suggestions for estimating the proper size of feed pumps required in boiler plants. 2,000 words.) *Stationary Engineer*, April 1.

"The Cost of Steam Power Produced with Engines of Different Types Under Practical Conditions; with Supplement Relating to Water Power." By Charles E. Emery, Ph. D. (A paper read before the American Institute, March 21, and containing elaborate tables showing cost of steam power under varying conditions. 13,000 words.) *Transactions* of the American Institute Electrical Engineers, March. (Discussion of paper, March 21, by Professor Forbes, Frank Sprague, Professor Barr and others. 7,000 words.) *Transactions*, April.

"Evaporative or Air Condensers for Steam Engines." (Editorial comment on Mr. Longridge's description of condenser in *Industries*. 1,000 words.) London *Electrician*, April 7.

"Observations on the Working of an Evaporative Condenser." By Michael Longridge. (Details of construction of a condenser on a roof in Dundee, and of experiments therewith; with tables, diagrams and illustrations. 2,400 words.) London *Industries*, March 31.

"The Transmission of Heat through Tube Plates." By A. J. Durston, engineer-in-chief of the navy. (A paper read before the Institution of Naval Architects, March 23, detailing experiments made at Devonport with a view of ascertaining the temperature of tube plates and tubes under certain conditions of working, and their bearing on the leakage of tubes. 3,500 words, 13 diagrams.) March 31, April 7. (And discussion, 1,000 words, April 7.) London *Industries*.

"The Coating of Cylinder Walls." By A. Bandsept. (Suggestions for lining the interior walls of a steam cylinder with a non-conducting coating. 1,100 words. From the *Bulletin Technologique* de la Société des anciens Élèves des Arts et Métiers.) London *Electrician*, April 14.

"Progress in Steam Engineering." By Robert H. Thurston, LL.D. (I.—Evolution of typical forms. 2,500 words.) *Engineering Magazine*, May.

"Condensing for Electric Light Stations." By Reginald Wood. (Comment on tables given by Mr. Crompton and Professor Kennedy, and showing that with a suitable condensing plant a saving of 17 per cent in coal and in water is effected at full load. 500 words.) London *Electrician*, April 14.

"Steam Engine Trials." By the late P. W. Willans. (Abstract of a paper read before the Institution of Civil Engineers on April 11, dealing with an extensive series of condensing trials made with a 40 I. H. P. Willans' central-valve engine. 1,200 words.) London *Electrician*, April 14.

"Heating Boiler Feed Water by Live Steam." By Albert Spies. (Commenting on Kirkaldy's experiment and Weir's system.) *Cassier's Magazine*, April.

SUBWAYS.

"The Paris Mains." By M. Dieudonné. (Detailed description of the underground circuit in the Champs-Elysées section.) Paris *L'Électricien*, March 18. Abstract (1,300 words, 7 illustrations), in London *Electrical Engineer*, April 7.

"Experience with Electrical Subways in New York City." (An exceedingly comprehensive and valuable article based on the articles by William Maver in the *Electrical Engineer*, January 4, 11, 18 and 25, and the paper read at the St. Louis meeting of the National Electric Light Association by William H. Browne. 3,500 words.) *Engineering News*, April 6.

"Putting Electric Wires Underground." (Editorial summary of the underground question, with suggestion that "a city might build a complete system of electrical subways, and then grant to the bidder offering the highest per centage of gross receipts the sole right to use these subways and furnish electrical service at fixed rates for a term of years." 2,000 words.) *Engineering News*, April 6.

"Cost of Laying Water Pipe." By C. D. Barstow. (An exhaustive and itemized detailed report of the laying of eleven miles of pipe in a southern city that contains many points of value to the subway engineer when preparing estimates. Gives accurate record of the time, its proper distribution to the different divisions and the cost of the work. 6,000 words, including 9 tables.) *Engineering News*, March 30.

"Joint-Boxes on Underground Networks." (Description of the Bowden coupler system. 3,000 words, 5 illustrations.) London *Electrical Review*, April 7.

TANNING.

"Notes on the Influence of Electricity in Tanning Operations." By Conrad K. Falkenstein. (A paper read before the Institution of Elec-

trical Engineers. The functions of the electric current being: 1. To increase the rate at which liquor diffuses itself through the hide, by endomose effects. 2. To increase the chemical activity of the reaction by molecular vibration. 3,800 words, 6 tables.) London *Electrical Engineer*, April 7.

"Notes on Electro-Tanning." By Dr. S. Rideal. (Commenting on Mr. Falkenstein's paper on the influence of the electric current on tanning operations, and referring to extended article on page 404, vol. x, of *Industries*. 400 words.) London *Industries*, April 14.

TARIFF.

"L'Électricité et L'Industrie Nationale en France." By Ch. Haubtmann. (Maintaining that the protective tariff is injurious to the French manufacturing industry, as it lulls to inactivity the spirit of progress, thus enabling foreign firms to gain the monopoly of working patents in France to the detriment of French inventions. A number of cases are mentioned to show how the French houses are tributaries or distributing agents for large German companies. 2,400 words.) Paris *L'Électricien*, April 8.

TELEGRAPH.

"The United States Governmental Departmental Telegraph Service." By George C. Maynard. (Details of the telegraphic service in the executive departments at Washington. 2,400 words, 1 illustration.) *Electrical Review*, April 1.

"The Telegraphers' Tournament." (Description of tournament held in New York on March 25, with names of participants, list of prizes, etc.; F. J. Kihm winning with a record of 248 words in five minutes. 800 words.) *Electrical Review*, April 1.

"Strange Effects of an Earth Current." By J. Fetzer, Sergeant Signal Corps, U. S. A., and Operator at Fort Apache, Arizona. (Correspondence.) *Scientific American*, April 15.

"An Invention Without Commercial Value." By C. D. Haskins. (Description of an ingenious "duplexed string" device. 600 words and diagram.) *Western Electrician*, April 8.

"Earth Currents in India." By E. O. Walker. (A paper read before the Institution of Electrical Engineers, March 23. 2,000 words.) London *Electrical Review*, April 7.

"The Electric Telegraphs of the World." London *Board of Trade Journal*, March 15.

"Professor Gray's New Telautograph." By William Maver, Jr. (Describing the Gray, the Bain, Caselli's and Robertson's writing machines with reproductions of messages. 14 illustrations, portrait of Elisha Gray. 5,000 words.) *Engineering Magazine*, May.

TELEPHONE.

"The Telephone in Vienna." (Extract from report on the Vienna Telephonic System made by Prof. J. Hopkinson. 1,300 words.) London *Electrical Review*, March 31.

"American Bell Telephone Company." (Full report of the annual meeting. 3,000 words.) *Electrical Review*, April 8.

"The 'Long Distance' Transfer Signaling System." (Details of the Pickernell-Dunbar System, necessitating the use of the instruction circuit between the operators only once when ordering a connection. 750 words and 1 diagram.) *Electrical Engineer*, April 5.

"A Novel Telephone Line Construction." (Description of the Kragl method of diagonal line construction across tops of high buildings. Reprint from the *Electrotechnischer Anzeiger*. 600 words.) *Electrical Review*, April 15.

"Telephone Legislation." (Editorial: "Discussion of the bill now pending in the New York legislature." 700 words.) *Western Electrician*, April 8.

"Long Distance Telephony." (Correspondence from Charles A. Brown and Thomas D. Lockwood regarding the early use of magneto telephones over the long distance lines.) *Electrical World*, April 8.

"Doctor Hopkinson's Report on the Vienna Telephones." (Editorial criticism. 350 words.) London *Electricity*, April 7.

"Influence du fil Compensateur du Système à trois fils sur les conducteurs téléphoneniques." (Review of Grawinkle's article in the *Elektrotechnische Zeitschrift* of February 3. 1,500 words, 4 diagrams.) Paris *L'Électricien*, March 11.

"An Important Bell Telephone Patent." (Full text of Alexander Graham Bell's receiver patent, granted January 30, 1877. 2,400 words, 6 diagrams.) *Electrical Review*, April 22.

"Park Benjamin on the Telephone Patents." (Opinion regarding status of the Blake Transmitter patent and statements in regard thereto in the thirteenth annual report of the American Bell Telephone Company. 900 words.) *Electrical World*, April 8.

"State Telephone to Ireland." (Reference to telephone communication established by the English Government between the post offices of Glasgow and Belfast. Length of circuit, 145 miles; overhead conductor, hard drawn, 800 pounds to the mile; 22 miles of submarine cable insulated with gutta percha and lined with brass ribbon, four conductors each 180 pounds to the mile. Half a mile of circuit is carried in ducts in streets of Glasgow. 600 words.) London *Electrical Engineer*, April 14.

"Telephony—Indian Experience." By A. Sandford. Communication stating why changes in the switching system from the Law to the Mann occurred in Calcutta in 1885. 1,100 words.) London *Electrical Engineer*, April 14.

"Telephonic Communication between Belfast and Glasgow." (Details of construction and of the opening of the line. 1,200 words, 1 illustration.) London *Electrical Review*, April 14.

TESTING.

"The Schiseophone." (Abstract of Captain de Place's description in the *Comptes Rendus*. A microphonic apparatus for testing metal for flaws. 300 words.) London *Electrical Engineer*, March 24.

TRAIN LIGHTING.

"The System of Electric Car Lighting on the Jura-Simplon Railway." (Complete details of plant, with cost and expense of operation and maintenance. 2,000 words, 5 diagrams.) *American Engineer and Railroad Journal*, April.

Berlin-Hamburg Line. (See "Electrical Progress in Germany." 350 words.) *Electrical World*, April 15.

Electric Lighting of trains in France. "Éclairage Electrique Des Trains en France." By E. Dieudonne. (Complete details, including description of accumulators, the wiring system, and the apparatus. 1,600 words, 5 diagrams.) Paris *L'Électricien*, March 25.

WAR.

"Automobile Torpedoes." By Franklin T. Drake. (Three lectures delivered to the officers in attendance at the Naval War College, Newport, Rhode Island, October 26, 27 and 28, 1892, describing the Howell torpedo, the present and future efficiency of automobiles in general, and the probable type of future torpedo cruiser and destroyer. 52 pages, 22 diagrams and illustrations.) *Proceedings* of the United States Naval Institute, No. 1, 1893.

WELDING.

"The Combs-wood Welding System." (La Soudure Par L'Arc Voltaique a Combs-wood.) (2,500 words, 5 illustrations and a table.) Paris *L'Électricien*, March 4.

WIRING.

"The Insulation of Private-House Circuits." By E. Tremlett Carter. (Calling attention to the diversity of opinion regarding the standard of insulation not only in house circuits, but in street mains and of dynamos, and that a very wide range in actual insulation resistance is productive of only a trifling variation in the cost of materials. 750 words and diagram.) London *Electrician*, April 7.

"Concentric Wiring." By Sidney F. Walker. (Commenting on article by Mr. Maver (Feb. 17). While it is very doubtful if concentric wiring will cure the ills referred to, the number will be reduced by thought and care in designing. 1,100 words. Editorial comment: "We cannot understand his mode of reasoning regarding the earthing of an alternate-current circuit." 160 words.) London *Electrician*, April 7.

"Parallel Distribution." By Francis Jehl. (Details and diagrams (11) illustrating the direct system, the feeder system, the loop system and the double loop system of circuits.) 4,500 words. London *Electrician*, April 7 and 14.

WIRE AND CABLES.

"Paper Insulated Wire and Its Manufacture." (Description of the insulation and the factory of the Norwich Insulated Wire Company. 900 words, 8 illustrations.) *Electrical Engineer*, April 29.

WORLD'S FAIR.

"World's Columbian Exposition." V.—Sewerage and Sewage Disposal. (Complete details of the Shone ejector system of sewerage in use at Jackson Park, and of the collection and cremation of the garbage and waste refuse in the Eagle cremating furnaces. 2,200 words, 2 illustrations.) VI.—Intramural Railway Power Station. (Complete details, including plans. 3,000 words, 2 illustrations and 1 large inset, and editorial comment.) VII.—Boiler Plant, with details of fuel oil plant reprinted from *Power*, and which have since been materially changed. VIII.—Engineering Headquarters; International Engineering Congress, etc. *Engineering News*, March 23, April 6, 13 and 20.

"Electric Buoys for the World's Fair." (Describing the "Fair way lane" of thirteen buoys, placed half-mile apart from Van Buren street to Jackson Park. 1,000 words, 1 illustration.) *Electrical Review*, April 15.

"Lighting the Biggest Building in the World." By T. C. Martin. (Details of plan for lighting the Manufactures building; a meritorious article. 3,000 words, tables and 9 illustrations.) *Electrical Engineer*, March 29.

"Frederick Sargent; a Brief Review of His Work." (800 words.) *Electrical World*, April 1.

"The Pier Movable Sidewalk." (Complete description. 1,400 words, 5 illustrations.) *Street Railway Review*, April.

"The National Significance of the Fair," "Will It Be Worth While to Go to Chicago?" and "Will It Be Dangerous to Go." (Three editorials. 1,700 words, 5 illustrations.) *Review of Reviews*, May.

"The Columbian Exposition and American Civilization." By Henry Van Brunt, architect of the Electricity building. (Detailing the educational influence the Exposition will exert, not alone as an object lesson in architecture, but in many other of the fine arts, and in the inspiration of higher ambitions and new ideals. 8,000 words.) *Atlantic Monthly*, May.

"The Columbian Exposition." By J. J. Peatfield. (A general review of the work accomplished at Chicago, and brief reference to former expositions. 10 pages, 16 illustrations.) The *Californian*, May.

"A Dream City." By Candace Wheeler. (A general description of the artistic features of grounds and buildings. 16 pages, 15 illustrations.) *Harper's Monthly*, May.

"Expenditures at Chicago." (Editorial comment on the Auditor's report for March, showing an expenditure of nearly $15,000,000 for buildings, as indicative of the deep-spread interest in the art of architecture. 600 words.) *Architecture and Building*, April 22.

"The Columbian Exhibition at Chicago." A review of the work accomplished, with details of construction of main buildings. 4,000 words, 1 illustration.) London *Industries*, April 14.

"India Rubber at the World's Fair." (Editorial comment on the method of assigning space, suggesting that it would have been better for the rubber interests to have secured a section by themselves for a combined display and thus avoided the delay incident to the general allotment of space. 900 words.) *India Rubber World*, April 15.

"Lighting the White City." (Description of the Westinghouse incandescent plant. 1,500 words, 3 illustrations.) *Electrical Engineer*, April 26.

LIST OF PUBLICATIONS INDEXED.

NEW YORK CITY.

American Analyst, 19 Park pl.
American Art Printer, 22 College pl.
American Engineer, 47 Cedar st.
American Institute Electrical Engineers, Transactions of the, 12 W. 31st st.
American Stationer, 128 Duane st.
Architecture and Building, 23 Warren st.
Architect and Builders' Edition, Sc. Am.
Art Interchange, 9 Desbrosses st.
Bradstreet's, 279 Broadway.
Cassier's Magazine, Potter bldg.
Cosmopolitan, The, Broadway and 25th st.
Electricity, 6 Park pl.
Electrical Age, World bldg.
Electrical Engineer, 203 Broadway.
Electrical Review, 13 Park row.
Electrical World, 41 Park row.
Engineering Magazine, World bldg.
Engineering News, Tribune bldg.
Engineering and Mining Journal, Park pl.
Heating and Ventillation, 146 World bldg.
India Rubber World, World bldg.
Literary Digest, 18 Astor pl.
Manufacturer and Builder, 83 Nassau st.
North American Review, 3 E. 14th st.
Outing, 239 Fifth ave.
Power, World bldg.
Quarterly Illustrator, 92 Fifth ave.
Review of Reviews, The, 13 Astor pl.
Safety Valve, The, 55 Liberty st.
Scientific American, 361 Broadway.
Scientific Am. Supplement, 361 Broadway.
Science, 874 Broadway.
Scribner's Magazine, 743 Broadway.
Street Railway Journal, World bldg.
U. S. Paper Maker, Vanderbilt bldg.
Vogue, 61 Union pl.

BOSTON, MASS.

Am. Meteorological Journal, 7 Tremont.
Arena, The, Pierce bldg.
Engraver and Printer, The, 84 Summer st.
New England Magazine, 231 Columbus av.
Weekly Review, The, 5 Somerset st.
Youth's Companion, The, 201 Columbus av.

CHICAGO, ILL.

Belford's Monthly, Dearborn st.
Black Diamond, Temple Court.
Brewer and Maltster, Lake and Clark sts.
Current Topics, 1025 Masonic Temple.
Dial, The, 24 Adams st.
Electrical Industries, Monadnock bldg.
Electric Spark, 611 Bort bldg.
Goodform, 177 Monroe st.
Illustrated World's Fair, McVicker's bldg.
Industrial World, Randolph & Fifth ave.
Inland Printer, 212 Monroe st.
Interior Decorator, 313 Dearborn st.
Lumber Trade Journal, 92 La Salle st.
Music, 240 Wabash ave.
Open Court, The, 175 La Salle st.
Pop. Electric Monthly, Monadnock bldg.
Railway Master Mechanic, The, Rookery.
Stationary Engineer, 226 La Salle st.
Street Railway Gazette, Monadnock bldg.
Street Railway Review, Dearborn st.
Western Society of Engineers, Transactions.
World's Col. Exposition, Illustrated.

DENVER, COL.

Colorado Magazine, 17th and Arapahoe sts.

INDIANAPOLIS, IND.

Paving and Municipal Engineering.

PHILADELPHIA, PA.

Paper and Press, 1004 Chestnut st.
United Service, 1510 Chestnut st.

SAN FRANCISCO, CAL.

Overland Monthly, Mutual Life bldg.
Technical Society, Transactions of.
The Californian, 411 Market st.

WASHINGTON, D. C.

Kate Field's Washington, 39 Corcoran bldg.
Smithsonian Institution, Publications of.
U. S. Naval Institute, Transactions of the.
U. S. Weather Bureau, Publications of the.

LONDON, ENGLAND.

Electrician, The, 3 Salisbury ct., E. C.
Electricity, 29 Ludgate hill, E. C.
Electrical Engineer, 139 Salisbury, E. C.
Electrical Review, The, 22 Paternoster row.
Industries, 358 Strand, W. C.
Machinery, 50 Strand, W. C.
Railway World, The, 39 Victoria st.

PARIS, FRANCE.

L'Électricien, 58 Rue Sainte-André-Des-Arts.

TITLES OF RECENT PUBLICATIONS.

GERMAN.

"Vörschläge zu gesetzlichen Bestimmungen über elektrische Maasseinheiten." By Dr. E. Dorn. (Berlin: Julius Springer.) 90 pp., 4to.

"Hulfsbuch für die Ausfuhrung Elektrischer Messungen." By Dr. Ad. Heydweiler.

"Die Berechnung Elektrischer Leitungsnetze." By J. Herzog and C. P. Feldmann. (Berlin: J. Springer.) 350 pp., 8vo.

"Anordnung und Bemessung Elektrischer Leitung." By C. Hochenegg. (Berlin: J. Springer.) 180 pp., 8vo.

"Die Elektrischen Leitungen." By J. Zacharias. (Vienna: A. Hartleben.) 245 pages.

"Die Accumulatoren zur Aufspeicherung des Elektrischen Stromes, deren Anfertigung, Verwendung und Betrieb." By J. Zacharias. (Jena: H. Costenoble, 1892.)

"Die Elektrischen Leitungen und ihre Anlage Für Alle Zwecke der Praxis." Second edition: J. Zacharias. A. Hartleben, Vienna.

FRENCH.

"Bulletin de l'Association des Ingénieurs Electriciens." (Paris: Gauthier Villars et Fils.)

"Carte Générale des Lignes Télégraphiques Internationales." By MM. Paul Jaccottey and Maxime Mabyre and M. Emile Levasseur. (Paris: Institut Géographique Ch. Delagrave, Rue Soufflot.)

"Manuel de L'Ouvrier Monteur Electricien." Par J. Laffargue. Paris: Bernard Tignol, 53 Quai des Grands-Augustins.

"Leçons sur l'Électricité." By Eric Gerard. (Paris: Gauthier-Villars et Fils.) Two vols.; third edition; 630 pages.

"Formulaire de l'Électricien." By E. Hospitalier. (Paris: G. Masson.) Eleventh annual issue.

ENGLISH.

"Polyphased Alternating Currents." By E. Hospitalier. (London: Alabaster, Gatehouse & Co.) 85 pp., 8vo, illustrated.

"Mining and General Telegraphic Code." By Bedford McNeill. London: Whitehead, Morris & Co.

"Memoir of James Prescott Joule." By Oscar Reynolds, LL.D., F.R.S., etc., with portrait. 199 pp., with index. The Manchester Literary and Philosophical Society, 36 George street, Manchester, England.

"Electric Ship-Lighting." By J. W. Urquhart. (London: Crosby Lockwood & Son.)

"Telegraphic Connections," embracing recent methods in Quadruplex Telegraphy. By C. Thom and Willis H. Jones. (London: E. and F. N. Spon, 1892.)

"Electric Light: Its Production and Use." By J. W. Urquhart. (London: Crosby Lockwood & Son. Fifth edition.)

"Journal of the Institution of Electrical Engineers." Nos. 102 and 103. London: E. and F. N. Spon, 125 Strand.

"Year Book of Learned and Scientific Societies." Tenth annual issue. London: Griffin & Co.

"Electric Lighting and Power Distribution. By Perren Maycock. London: Whittaker & Co.

"Griffin's Electrical Price-book." Edited by H. J. Dowsing. London: Griffin & Co.

"Manual of Practical Medical Electricity." By Dawson Turner, B.A., M.D. (London : Baillière, Tindall & Cox.)

"Medical Electricity." By W. E. Steavenson, M.D., and H. Lewis Jones, M.A., M.D. (London : H. K. Lewis.)

"Dynamos, Alternators and Transformers." By Gisbert Kapp. Illustrated. (London : Biggs & Co.)

"Proceedings of the Royal Society." Vol. LII, No. 319. (London : Harrison & Sons.)

"Journal of the Iron and Steel Institute, 1892." (London : E. and F. N. Spon.) 600 pages.

"The Imperial Institute Year Book." (London : Offices of the Imperial Institute, South Kensington.)

"Electrical Experiments." By G. E. Bonney. (London : Whittaker & Co.)

"How to Manage the Dynamo." By S. R. Bottone. (London : Whittaker & Co.)

AMERICAN.

"Pumping Machinery : A Practical Handbook of the Construction and Management of Steam and Power Pumping Machines. By William M. Barr. Philadelphia : The J. B. Lippincott Company. Pages 450, with 260 illustrations.

"Elements of Physics." By H. S. Carhart, M.A., and H. N. Chute, M.S. (Boston, U. S. A.: Allyn & Bacon.) 380 pages.

"Fundamental Theorems of Analysis." By Alex. Macfarlane, D.Sc. (Boston : J. S. Cushing & Co.)

"The Imaginary of Algebra." By Alex. Macfarlane, D.Sc. (Massachusetts : The Salem Press.)

"The Measurement of Electric Currents." By James Swinburne. "Meters for Electrical Energy." By C. H. Wordingham. Science Series No 109. (New York : The D. Van Nostrand Company.) 240 pages, illustrated.

"The Transmitted Word." By W. J. Keenan & James Riley. Boston, 1893. (Dorchester Press Co.) 113 pages; 5 by 7 inches.

"General Specifications of Wiring for Electric Light in Buildings." By Robert A. Cummings. (Published by the author. Columbus, Ohio, 1893.) 10 pages ; 6½ by 9 inches ; paper cover.

NEW PUBLICATIONS RECEIVED.

COMMON SENSE IN MAKING AND USING STEAM. Facts for the consideration of proprietors of steam plants. By William Harrison Bailey, M.E. Mason Regulator Company, 10 Central street, Boston ; 60 pages ; 5 by 8 ; price 25 cents.

A simply written but practical work of convenient size for ready reference, and worthy of perusal by every steam user.

KEY TO STEAM ENGINEERING. (Third edition, enlarged.) Henry S. Williams, 65 Federal street, Boston; 174 pages; 4 by 6½; price 50 cents.

A simple treatise on the principles governing steam engineering, with a series of questions and answers, covering sixty-six pages, on the subject of air, water, fuel, steam, boilers, engines, belts, shafting, speed, etc. It is just the book that the dynamo tender in the smaller stations should possess, as well as every engineer and steam user.

HANDBOOK OF THE AMERICAN REPUBLICS: Bureau of the American Republics, Bulletin No. 50. Washington, January, 1893. 604 pages; 6 by 8½.

Affording the latest reliable data regarding our commercial relations with the nations of North, Central and South America, compiled in such form as to be easily referred to, and having its value reinforced by a table of contents, list of illustrations, of which there are thirty-nine, and a complete index. In addition, there is a complete traveler's guide, with rates by steamship and by rail, a cable rate sheet, postal rates, etc.

ALTERNATING CURRENTS OF ELECTRICITY: Their Generation, Measurement, Distribution and Application. By Gisbert Kapp, C. E.; with an introduction by William Stanley, Jr. New York: The W. J. Johnston Company, Limited, 41 Park row; 166 pages; 5 by 7.

Mr. Stanley mentions the importance, from an educational standpoint, of Chapters I and II, for "they contain a summary of the elemental knowledge necessary for a correct understanding of the principles operating alternating currents in simple circuits possessing resistance and self-induction." Chapters IV and V are devoted to calculations and suggestions of value to the manufacturer, and the remaining chapters are devoted to central station work, the transformer, and alternating current motors. The work is a reprint from the professional papers of the Corps of Royal Engineers of London.

ELECTRICITY AND ITS USES. By J. Munro. Third Edition. Chicago: Fleming H. Revell Company, 148 Madison street; 208 pages; 96 illustrations, 5 by 7½; price $1.40.

An unpretentious, but clearly written and well-illustrated work intended only for the student and the general reader interested in electrical appliances. The complete index, table of contents and list of illustrations add to its value.

ELECTRICAL TABLES AND MEMORANDA. By Silvanus P. Thompson, D.Sc., B.A., F.R.S., and Eustace Thomas. Spon & Chamberlain, 12 Cortlandt street, New York; 128 pages, illustrated; price 50 cents.

A vest-pocket book of tables not much larger than one's thumb, yet containing just the information so often desired and that often can only be reached by returning to the library, while room for this little work can always be found in the pocketbook that is always the accompaniment of the electrical engineer. Circuit testing, magnetic properties of iron, pull of electro-magnets, management of arc lamps, details for setting up accumulators, etc., are some of the chapter headings.

PATENTABLE INVENTION: By Edward E. Renwick, Civil and Mechanical Engineer and Expert in Patent Causes. Rochester, New York: The Lawyer's Coöperative Publishing Company; 155 pages; 6 by 8; price $2.00.

A concise presentation of the views of inventors on what constitutes invention, arranged in paragraphs under the chapter titles of Patentable Invention; Inventions Patentable by Law, with subheads: A Useful Art, Machines, A Manufacture, Compositions of Matter, and Patentable Designs; Invention Patentable in a Reissue Patent. Then there is a table of titles of typical cases adjudicated by the courts, and which have been selected as best illustrating the subjects treated.

TELEPHONE LINES AND THEIR PROPERTIES. By William J. Hopkins, Professor in Physics in the Drexel Institute of Art, Science and Industry. New York: Longmans, Green & Co. 1893. 258 pages; 100 illustrations; price $1.50.

A practical book illustrating and describing the design and construction of ærial and subway circuits; the long-distance circuits and the stringing of wires in thickly settled districts; the various forms of conduits; the different makes and properties of cables; the improved switchboards and methods of connecting up. Then there are chapters on the propagation of energy, induction, impedance, etc. The information is of value to engineers dealing with the transmission of heavier currents as well as to the telephone and telegraph interests.

COMMENT AND CLIPPINGS.

MR. HERBERT LAWS WEBB, who is now in England again, has made quite a technical literary reputation in America. Besides many articles in electrical and popular journals, he has just gained the $100 prize for the best article in the WORLD'S FAIR ELECTRICAL ENGINEERING on "How can the Department of Electricity in the Exposition best serve Electrical Interests." Not by direct returns, thinks Mr. Webb, nor in enabling men to place orders at once, but by cultivating the interest and attention of the general public, and he says this so succinctly and artistically that he is paid at the rate of some £5 a page.—*London Electrical Engineer, April 14.*

THE very interesting semi-social and literary receptions given by the St. Louis Electric Club each Saturday evening are receiving well-merited commendation as a practical solution of the question how to unite the electrical and allied industries in an organization that will serve the best interests of all parties, enable all to work harmoniously together and obviate the needless friction that is expensive and unnecessary, and, as a rule, due merely to a lack of knowledge of the exact facts in the case. The delicious noonday lunches that are served at the club also exert a strong influence in bringing the members into closer relations, and it is often remarked that between 12 M. and 2 P. M. of each day one can generally meet the representatives of every electrical or allied interest in St. Louis at the clubrooms.

THE great aim of an exposition such as is to be given in Chicago, is to educate the people, both at home and abroad, in the nature of the arts and industries, and their products, rather than the making of direct sales. The best display, then, for everybody in the rubber trade would have been that which made the best impression upon the public mind of the great field for the use of rubber in every department of life without regard to the individual manufacturers. After this striking object lesson, the people would have been more ready to listen to the salesmen, agents or merchants who had rubber goods to sell. An international fair is a general advertisement, acquainting people with the existence of

certain wares and conveniences, and serving to open the way to those who mean later to sell goods. The average visitor is little concerned at the time of viewing the display with the name of the company making the product. For all these reasons it is to be regretted that the idea of a combined display, which found space in these pages a year ago, did not commend itself to the trade.—*India Rubber World, April 15.*

MR. C. M. WILKINS, of the well-known firm of Partrick & Carter, in answer to the question: "What specific arrangement of electrical exhibits at the World's Fair would probably induce the architect to recommend the utilization of electrical features to a far greater extent than heretofore?" stated that, in his opinion, every educated and progressive architect is well informed concerning the necessity and the utility of electrical appliances in the modern building, and experiences very little difficulty in preparing specifications indicating what electrical work will be required to accomplish certain results:

Therefore, to undertake to show him simply that electric lights, bells, alarms and the numerous other useful electrical devices now made should be included in his plans might be considered as an affront to his intelligence.

In Mr. Webb's essay will be found the following: Others who are prejudiced against all electrical appliances because they have had unfortunate experiences with cheaply made and badly arranged electric bell installations. A few moments' reflection on those words suggests at least one answer to your question, namely: The arrangement of exhibits designed to interest the architect should be such as would make plain to him the construction as well as the operation of the apparatus exhibited, to the end that he may be thoroughly informed as to the most perfect and complete devices, and he will then be enabled to specify apparatus and systems which he knows by actual observation and examination are the reverse of cheaply made and badly arranged. By this means, the prejudice to which Mr. Webb refers will soon be removed, because the architect can assure his clients that perfectly constructed electrical appliances are made and perfected systems of installation have been devised. In a few words, let the exhibits be so arranged that the architect can familiarize himself with the mechanical construction and electrical operation of the apparatus and the methods of installing the same, and we can trust to his intelligence and good judgment to select and demand the best.

PROGRESS IN STEAM ENGINEERING.—The steam engine stands today as a nobler monument, a higher tribute to the genius of man than any other product of his many and mighty powers that the world has yet seen. It is the source and the foundation

of all his material wealth, and largely of his intellectual and moral wealth. It is the prime mover in every application of his inventive and constructive genius to the solution of the problems of modern civilization. It drives the machinery of mine, mill and workshop ; it transports him and his possessions across the continents and over the seas ; it gives life to the whole system of transmission of all the energies, including those of the electric light and the electric railway. It makes all that he has and is a possibility, and stands, the mist-giant, a genius of more than Aladdin-like power, the maker and the guardian of modern life. Light, heat and electricity, all the powers of nature are but its servants and do its work and run its errands, at arm's length or miles away, in the extension of its powers to near and distant fields of labor alike.

In performing the work of modern civilization, man has compelled the service of over 50,000,000 horse-power of steam-giants, equivalent to more than 75,000,000 horses of average power, for the rated horse-power of the steam engine is to that extent in excess of the power of the animal. This is the equivalent of the steady working power of the whole population of the globe, and probably largely in excess of that amount.—*Prof. Robert H. Thurston, in the Engineering Magazine for May.*

DYNAMO COMMUTATORS.—Improvement seems to take place more slowly in the case of the commutator than in any other part of the direct-current machine. No one seems to have thoroughly investigated the question of the best metal or alloy to be used. Copper and its alloys have alone been tried, with the exception of iron, which has been or is employed in Germany. Copper and its alloys are also used for brushes. Carbon has come into use in America, but does not seem to have found favor in this country, perhaps because there is some difficulty in obtaining the right quality. It would surely be worth the while of some of the large makers to experiment with some of the hundreds of alloys in use in the arts to see whether any other kinds would be better than copper, gun-metal, and phosphor-bronze. Various makers have found great difficulty in collecting large currents. Copper seems to "seize" more easily if it reaches a temperature much above 100° Fahr. Some makers ventilate their commutators. If it were not for the absurd prejudice that exists against fans, when not forming part of the dynamo, a jet of air on the commutator

would keep it in order and save wear and tear.—*London Industries, March 24.*

ALUMINIUM SOLDERS.—Mr. J. Novel has been investigating the most suitable alloys for soldering aluminium, with the following results: Solders which are white in color—(1) Pure tin, melting point, 250° C.; (2) Pure tin (1,000 parts) and lead (50 parts), melting point, 280°–300° C.; (3) Pure tin (1,000 parts) and pure zinc (50 parts), melting point, 280°–320° C. He recommends the last solder as being suitable for jewelry and fancy articles. The following two alloys give a slight yellow color to the juncture, but have higher melting points, and therefore give a better union. (4) Tin (1,000 parts) and copper (10-15 parts), melting point, 350°–450°; (5) Tin (1,000 parts) and nickel (10–15 parts), melting point, 350°–450°. A yellow alloy suitable for soldering aluminium bronze consists of tin (900 parts), copper (100 parts), and ⅔ parts of bismuth. By varying the amount of copper differences in the color of the solder can be obtained, and by altering the percentage of bismuth the melting point can be raised or lowered. This alloy is also valuable for soldering aluminium to copper, zinc, brass, iron, or nickel.—*London Industries, March 17.*

COMBINATION FIXTURES.—The combination of gas and electric lights in one chandelier has made possible a variety of decorative uses for brasswork affording wide scope for artistic application. Many beautiful devices have been adopted in public buildings of recent construction, while in a notable cathedral, but lately consecrated, the elaborately designed altar rails, chandeliers and brackets of decorative brasswork represented an expenditure of over $6,000. A well-known designer in brass achieved a rarely beautiful effect upon a private interior lately submitted to him for decorative finish. With no visible source of light the illumination was accomplished with wonderful skill. At intervals about the walls were set four medallions, each eight feet in length, reaching from floor to ceiling, representing an opal surmounted with diamonds. The opal in this case was a sheet of transparent Mexican onyx beautifully veined; the diamond setting was composed of cut-glass bulbs four inches in diameter. Each bulb contained an electric light and the onyx was clearly and similarly lighted, the whole inclosed in a framework of delicately chased brass, ormolu-gold in effect. Upon the white

enameled walls the brasswork shone in bold relief, lightly yet perfectly defined, in a series of curves and scrolls tapering off in shimmering lines. Upon the ceiling another medallion appeared formed of cut glass, faintly illuminated with opalescent incandescent burners set in a brass framework of elegantly chased flowers interlacing and branching out in delicate scrollwork over the entire surface, bound with innumerable cords and tassels, also of brass, pendant from the ceiling.—*Exchange.*

THE Chicago Electric Club has elected the following named officers for the ensuing year: President, J. P. Barrett; vice-presidents — F. W. Parker, E. Baggot, F. W. Cushing, George Cutter; secretary, F. L. Perry; treasurer, J. W. Johnson. Managers — F. W. Horne, chairman; L. A. Ferguson, S. A. Douglas, M. A. Knapp, J. W. Buckley, E. C. Ferguson, C. T. Page, A. S. Terry, Ben. Williams, L. S. Hills. Membership committee — C. C. Haskins, T. G. Grier, D. G. McDougall. House committee — F. B. Badt, chairman; F. E. Degenhardt, H. P. Lucas.

THE BERLIN TELEPHONE EXCHANGE.—At the commencement of this year the number of telephone subscribers in Berlin has reached twenty thousand. The following figures show the rapid development of the telephone in Berlin since the first exchange was opened on April 1, 1882, with 50 subscribers. At the end of the same year the number had already risen to 458; 1883, 1,069; 1884, 1,625; 1885, 2,412; 1886, 4,324; 1887, 5,507; 1888, 6,955; 1889, 9,199; 1890, 11,854; 1891, 14,490; 1892, 17,013; 1893, 20,000. This is a slight contrast with the 5,000 subscribers in London.

An occasional contributor has sent us more than one communication on the Physics of Thought-reading, and claims that such inquiries should not be shirked. He suggests, as Professor Houston has done, that ether vibrations may explain thought transference. As soon as this or any other class of phenomena really comes within the domain of physical science we will try to find space for its discussion. One criterion of its inclusion should be a capability of measurement. Hertz's researches were nothing if not quantitative. When the wave-length of thought-transference can be even guessed at by the observation of stationary thought-nodes, or if, like gravitation, the action is found to be a definite function of the distance, the subject shall claim our attention. If thought be a form of radiant energy, it should obey the laws of optics. Reflection of thought is to be found in the phenomena of plagiarism, but how are we to measure the angles of incidence? Interference phenomena are abundant in the House of Commons, and if distortion or perversion of thought be a form of refraction, accompanied sometimes by chromatic effects, it is indeed too prevalent; though the refractive index, or, as it has been called, the coefficient of

mendacity, may be difficult to determine. An elegant form of such refraction is known as hyperbole, but what is the focal length of a gross exaggeration, or the negative focus of a disparaging remark? Thought-reading may have its scientific aspects, but it does not at present come within those branches of physical science which are discussed in our columns.— *London Electrician, March 24.*

IN the Orange Free State there are 1,284 miles of telegraph lines, 1,473 miles of wire and 31 offices, in which 283,757 messages were handled during the past year. This does not include the lines belonging to the Cape Government railway system.

THE Caledonian Railway Company, of Scotland, has in service 10,063 miles of telegraph and signal wires, and 39,700 cells of battery. In 1892, 1,106,278 telegrams were forwarded over these lines.

THE largest single span of telegraph wire in the world is across the river Kistnah, between Bezorah and Sectanazoun, India. It is over 6,000 feet long, and is stretched from the top of one mountain to that of another.

A MONSTER ACCUMULATOR.—The Tudor Accumulator Company tabulate the following particulars with regard to their largest type of cell:

Useful capacity for ordinary work (five hours)	27,200 ampère-hours
Maximum charging current	4,800 ampères
Maximum discharging current	7,680 "
Length of cell	235 centimetres
Width	152 "
Height	120 "
Weight of electrodes	4,170 kilogrammes
Total weight without acid	6,078 "
Acidulated water	1,940 "
Total weight (nine tons)	9,018 "
Price (£395)	9,936f.
Packing	323f.

This enormous cell contains 50 kilowatt-hours, and can give out nearly 10 kilowatts—a progress from Planté's little cell!

ELECTRICAL PATENTS.

The intention is to include noteworthy patents only in this list. It is not a complete list of all electrical patents. The following were issued between February 28 and April 11, inclusive.

492,483.—*Busy Signal for Telephone Circuits.* E. J. Hall and F. A. Pickernell.

One feature of the invention is the use of a test system in which the busy signal is words or phrases repeated by a phonograph.

493,245.—*Ear Attachment for Telephones.* George McC. Brown.

The ear tube is attached to an ordinary receiver by means of a hollow rubber bulb, one end of which is secured to the ear tube while the other end is contracted around the receiver. At the end, the ear tube diverges into two branches, each provided with an ear tip so that both ears may be used for receiving the message.

493,253.—*Signaling Telegraph.* William E. De Crow.

The time when a signal is received and registered at the central office is automatically recorded on the register strip, the device at the same time acting as an indicator to make known any fault in the line, by reason of which the register fails to operate, although the box may be pulled and the circuit-breaker wheel act in its normal manner.

492,789.—*Speaking Telephone.* Thomas A. Edison.

To the diaphragm is attached an electrode whose end rests in a vessel containing a conducting liquid. Opposite this electrode, but not in contact with it, is a second electrode which is stationary. The electrodes are connected with opposite sides of an electric circuit, the same being completed through the liquid. As the diaphragm vibrates, due to the voice, the amount of the liquid interposed between the two electrodes varies to alter the resistance of the circuit.

493,704.—*Listening and Ringing Key for Telephone Switch Boards.* William M. Goodridge.

Each plug of the operator's plug connectors is connected with a spring, the spring normally resting against contact points electrically connected together, whereby the two plugs are normally in electrical connection. A key is provided for each spring by means of which it may be pressed away from its contact point to make connection with a back contact connected with the calling generator, so that each plug may be independently connected with the calling generator. A third spring is electrically connected with the two contact points against which the plug springs normally rest and makes contact with a terminal connected with the operator's telephone set, a key being provided for breaking this connection.

492,811.—*Wire Connector.* W. S. Kissinger.

The connector comprises a cylindrical sleeve having conical ends provided with holes at the apex through which the wires to be coupled pass. Between the wire and the sloping side of the end of the sleeve is interposed a wedge provided with teeth to engage with the wire. Any tension upon the wire causes a firmer gripping of the wire.

492,482.—*Signaling Apparatus and Circuit.* E. J. Hall and F. A. Pickernell.

Means are provided for ringing polarized bells by means of alternating current magneto-electric generators without materially affecting speech-receiving instruments included in the same circuit. Means are also provided whereby a generator common to a number of switch-board connecting cords, some carrying voice currents, others forming conductors for the passage of call currents, may be employed without involving telephonic interference or induction between any two such cords due to voice currents.

492,883.—*Telephone Transmitter.* C. T. Bloomer.

Between a pair of conducting plates is interposed finely divided carbon, the plates being also connected by one or more spiral strips or ribbons embedded in the carbon. One of the plates is carried upon or secured to the diaphragm, the other being stationary, so that as the diaphragm vibrates the pressure upon the mass of carbon will be varied, which, with the change in position of the spirals of the ribbon, alters the resistance between the plates. By the use of the spiral ribbons the maximum resistance between the two plates can never exceed a definite amount.

492,471.—*System of Combined Telephony and Telegraphy.* F. A. Pickernell.

Telephonic and telegraphic signals are simultaneously transmitted over the same circuit, each of the limbs of a metallic circuit telephone circuit serving as one side of the telegraphic circuits, which have ground returns. Thus, with the two metallic conductors, one telephone and two telegraph circuits are obtained. In order to adapt the system to long distances in which the transmission of telegraphic signals becomes otherwise unreliable, the circuit is divided into sections, and between the sections are interposed automatic telegraphic repeaters.

495,090.—*Granulated Material for Transmitting-Telephones.* W. W. Jacques.

The granulated material is said to have a low resistance and a high microphonic power, that is, ability of the particles to separate a considerable distance without breaking the circuit. The method of producing the granulated material consists in coating grains of carbon with powdered alumina and subjecting the coated grains to an intense white heat in an inert atmosphere. The granulated material thus produced, when used in transmitting telephones of the Hunning's type as the variable resistance, is found to have higher microphonic power and lower resistance than grains of substantially pure carbon, or other grains of carbon compounds heretofore used for the same purpose.

493,314.—*Lightning Arrester.* Elihu Thomson.

The lightning arrester comprises, besides the discharge plates and arc rupturing devices commonly employed, a resistance in the ground connection which possesses little or no inductive character, so that the least possible opposition is offered to the passage of lightning discharges, while its non-conductive property is a maximum, so that the line current tending to follow the discharge to ground meets with such a resistance that the arc is broken.

492,549.—*Lightning Arrester.* A. Wurts.

The circuit to be protected is equipped with a large number of lightning arresters distributed along the line, and to prevent the passage of generator currents across the arc paths produced by the discharge, a short circuit is provided about the machine which is adapted to be closed by the passage of an abnormal current. A circuit breaker is provided in the short circuit which immediately breaks the circuit upon its being closed, thus cutting the machine out of circuit entirely.

493,380.—*Combined Cut-Out and Lightning Arrester.* E. F. Hammarström.

An open ring is composed of two different kinds of metal welded together, and is supported upon a bearing connected with the line wire. The ends of the ring rest upon a spring connected with the other pole of the source of current, the circuit being normally from the ends of the ring to the spring. When an abnormal current traverses the circuit, the ring is caused to expand, its diameter increasing until its ends cease to overlap the spring, when the latter flies up, due to its resiliency, and breaks the circuit.

494,186.—*Lightning Arrester.* Alexander Wurts.

The principle upon which the arrester works is that of continuously, during a storm, providing a passage to ground for the escape of lightning charges as soon as formed, the passage being through a condenser. Several condensers are provided, each having one side connected to ground and the other to contact plates arranged in a circle. Upon a shaft adapted to rotate are mounted a pair of arms, relatively insulated, which make contact with the plates as the shaft is rotated. One of the arms is connected with the line to be protected while the other is connected to ground. When the arm connected with the circuit makes contact with any plate a path is opened to ground through one of the condensers, and if any charge be upon the line it will pass to the condenser. As the arms revolve, the second arm, which is connected to ground, makes contact with the same plate and, both sides of the condenser being now grounded, the condenser will discharge itself and is in condition to receive another charge upon the return of the proper arm. The circuit is thus continuously connected to ground through a condenser so long as the arms are rotated.

492,815.—*Electric Arc Lamp.* C. K. McFadden.

The upper carbon is fed by mechanical means, while to the lower carbon is attached the core of a solenoid in series with the carbons. To the lower end of the solenoid core is secured the piston of a dash pot.

483,745.—*Dynamo-Electric Machine.* Foree Bain.

The core of the armature is built from a number of dish-shaped plates which are successively slipped upon the shaft and straightened out so as to lie in one plane, whereby the plate is caused to grip the shaft.

495,463.—*Electric Arc Lamp Carbon.* George M. Lane.

The arc lamp carbon is composed of two carbon pencils united by a web of the same material, one of the pencils being somewhat longer than the other, whereby the arc is first formed between the longer pencils of a pair and shifts by means of the web to the second pencils, the arc thus shifting from one pencil to the other during the burning of the lamp by means of the connecting web.

493,360.—*Electric Arc Lamp.* Rudolph M. Hunter.

The lamp is designed for use upon the ends of slender mast arms, brackets, and the like, where it is desirable to have the weight of the lamp a minimum. The carbons and carbon holders are suspended from the mast arm while the feeding mechanism is entirely removed from the carbons and is placed in a box supported upon the base of the post, the feeding mechanism being connected with the carbons by means of a cord.

494,531.—*Electric Lamp Vibrator-Regulator.* Daniel M. Moore.

The lamp is adapted to regulate the brilliancy of incandescent lamps supplied with alternating or continuous currents. In circuit with the filament and within the exhausted part of the globe is provided a circuit breaker, comprising a contact anvil, and a spring carrying a piece of magnetic material. In the neck of the globe is placed an electro-magnet, which is adapted to be moved by means of a handle toward or away from the piece of magnetic material upon the spring which thus acts as its armature. The magnet acts upon the armature to cause a series of rapid breaks, the rapidity depending upon the proximity of the electro-magnet to its armature and the intensity of the light depending upon the rapidity of the breaks.

493,359.—*Electric Arc Lamp.* Rudolph M. Hunter.

The invention is designed to produce a large crater upon the positive carbon and to distribute it uniformly over the end of the carbon. The lamp is of that type in which the carbons are placed at right angles to one another and the light obtained from the crater formed on the end of the positive carbon. When but a single negative carbon is used the crater does not form uniformly over the end of the positive carbon, but forms on the side toward the negative carbon. To overcome this objection, several negative carbons are used with their ends, disposed at different points around the circumference of the positive carbon, and in order to form the crater more uniformly over the surface the positive carbon or the frame carrying the negative carbons is rotated around the axis of the positive carbon, thus subjecting every part of the circumference of the positive carbon to the influence of the arc.

494,150.—*Process of Manufacturing Filaments for Incandescent Lamps.* Alexandre de Lodyguine.

This method consists in carbonizing a filament of organic material, and afterward passing a current of electricity through the filament placed in a vacuum, whereby the occluded gases contained in the filament are dispelled and the filament is coked; this operation reduces the resistance of the filament to approximately that of the hot resistance of the original carbonized filament. Lastly the resistance of the filament is rendered uniform by the deposition of carbon.

495,240.—*Incandescent Lamp.* George H. Benjamin.

The lamp consists of a glass bulb, provided with a neck into which a close-fitting glass plug is inserted. The plug is provided with a channel, in which is placed a metallic wire, which thus surrounds the plug, the ends of the wire protruding from the end of the lamp. After the plug has been placed in position a current of electricity is sent through the metallic wire, and the material of the glass bulb pressed against the same, whereby a union is made between the glass of the plug and the bulb and the metallic wire, thus effecting a seal.

494,149.—*Process of Manufacturing Filaments for Incandescent Lamps.* Alexandre de Lodyguine.

The material for the filaments is formed from bamboo, paper, thread or other organic substance, and after having been bent into the proper shape and secured to a former is placed in a receptacle and subjected to the action of a chemical agent, as fluoride of boron which dehydrates and decomposes the organic material, leaving only carbon. The filament is then subjected to a high temperature, with the exclusion of oxygen, after which the occluded gases are expelled and the material coked by being subjected to a high temperature caused by the passage of a current of electricity. The final step in the process consists in depositing carbon upon the filament, thus giving to it the proper resistance.

494,827.—*Voltaic Cell.* Edward Weston.

The density of the cell, and consequently the electro-motive force, is practically independent of temperature changes, a standard cell being thus provided whose electro-motive force is at all times a constant quantity. It has been found that the electro-motive force of all cadmium salts is practically independent of temperature changes, apparently due to the fact that such salts are equally soluble in hot or cold water, the density of the solution remaining the same, so that there is no disturbance of electro-motive force due to changes in density. The chemical affinities in the cell are substantially the same, independently of the temperature of the cell, within reasonable limits. Any salt of cadmium may be used which forms a practically insoluble compound with mercury when the salt is in the state of a saturated solution in water, or in a solution of the salt of cadmium employed. In the preferred form of cell, a saturated solution of cadmium salt in water is used as an electrolyte, and as electrodes an amalgam of cadmium and mercury opposed to an electrode of pure mercury and proto-sulphate of mercury.

494,587.—*Electric Coal Mining Machinery.* E. C. Morgan.

A cam mounted upon the end of the motor shaft engages with a roller upon the reciprocating frame which carries the tool, to give to the same a backward stroke against the tension of a coiled spring, which acts, when the cam continues its motion to release the roller, to thrust the tool forward. The motor thus serves to impart to the tool its backward stroke while the spring gives to it the working stroke.

493,375.—*Method of Balancing Armatures.* Gano S. Dunn.

A number of longitudinal holes are provided in the core of the armature, the winding being so arranged that when completed the ends of the holes will be exposed. Masses of lead are then inserted into the holes and so adjusted that the armature is balanced, after which they are fastened in position by driving a punch in the end of the plug to spread its sides against the walls of the hole.

492,888.—*Dynamo Electric Machine and Motor.* Rudolph M. Hunter.

The machine is of the multipolar type and is provided with a Grammering armature wound with several distinct windings. The windings are connected in series so that the current generated in the first winding passes successively through the others receiving added impetus in each winding. The effect produced is similar to that obtained by connecting several distinct machines in series.

493,858.—*Transmission of Power.* T. A. Edison.

A pulley having a rim of magnetic material is provided with a peripheral groove extending around its face. Within this groove are wound a number of turns of wire included in an electric circuit. The passage of a current creates a north pole of that part of the metal upon one side of the peripheral groove, and a south pole of that upon the other side, so that an iron or steel rope or a leather or steel belt carrying magnetic material will be attracted to the face of the pulley, and its driving power greatly increased.

493,679.—*Dynamo Electric Machine and Motor.* Harold P. Brown.

The armature instead of being wound with wire is wound with flat bands or ribbons of copper, the different convolutions being separated by a tape of asbestos paper, or its equivalent, coated or impregnated with burnt shellac. It has been discovered that by thus impregnating the asbestos paper with gumlike insulating material an insulation is produced which is at once fireproof, waterproof and not liable to permit perforation or jumping of the current through it when under high tension or when the apparatus is subjected to electric shocks. Shellac gum is well adapted for this purpose when first dissolved in alcohol and afterward boiled or burned until the alcohol has evaporated. It is then applied to the asbestos while still hot and the completed coil subjected to a high degree of heat.

495,125.—*Electro-Magnet.* S. H. Stupakoff.

The invention is designed to overcome the difficulty often occasioned by the retention of the keeper of the electro-magnet by the residual mag-

netism after the exciting current has been removed. The invention consists in interposing between the keeper and the poles of the electro-magnet a thin sheet of magnetic material of such cross section that it furnishes a path for only a small number of the lines of force when the magnet is fully excited, but which has sufficient cross section to practically absorb all of the lines due to residual magnetism, whereby the keeper is shunted out of the magnetic circuit by the magnetic sheet, when the exciting current is removed and the keeper caused to fall away from the poles in consequence.

492,480.— *Transformer and Means for Developing Rotary Magnetic Fields.* Charles S. Bradley.

The primary of the transformer comprises three coils connected in tri-phase relation and surrounding a magnetic core. One of the coils is connected directly between the mains of the alternating current supply, and has a phase corresponding to that of the generator. A second coil is connected between the same mains after passing through a pair of retardation coils which produce in the current a lag, preferably of sixty degrees. A third coil is connected likewise between the same mains, but passes through a pair of condensers which act to advance the phase by sixty degrees. Thus a tri-phase current is produced which induces a rotary magnetic field in the core. If a tri-phase secondary current is desired, three coils connected with the secondary conductors surround the core, and the rotary field induces in them a tri-phase current. If currents of a higher number of phases are desired, more coils are placed upon the core.

494,705.—*Electric Locomotive Regulation.* Rudolph M. Hunter.

Rheostats for varying the strength of the current, and commutated field magnets for varying the strength of the magnetic field are dispensed with, the regulation being accomplished by varying the counter electro-motive force of the motors inversely with the current required, and proportionally as the speed increases above the normal. Two motors are preferably used, whose counter electro-motive forces may be added or otherwise disposed to produce the required results. Thus, when the car is starting from rest, and a large current is required, the counter electro-motive force is reduced to that of one motor, thereby permitting the necessary large flow of current. As the speed increases, the counter electro-motive force increases and reduces the current passing through the motors. Thus, within certain speeds the regulation is automatic, but when the speed reaches that allowable in the streets, the counter electro-motive forces of the motors are added, thus opposing the current to such extent that the required current to maintain the normal speed on the level passes through the motor. The motors should have their coils calculated so as to give the proper counter electro-motive forces for given speeds, and so as to work for proper regulation when coupled in parallel or series. In practice it has been found that series motors are best adapted to this method of regulation, or motors so grouped that the armatures are in series with the field coils, whether the armatures be coupled in series or parallel with respect to one another.

492,403.—*Means for Operating Throttle Valves of Steam Engines.* Frank E. Kinsman.

The invention is particularly designed for locomotives and an electro-magnet is included in an electric circuit which is adapted to be closed automatically from a neighboring section of track, from a switch, a drawbridge, or the like. The magnet acts upon its armature to close the throttle valve of the engine to stop its motion.

493,089.—*Truck for Electric Locomotives.* J. C. Henry.

The motor is supported upon a frame that is rigidly connected to one of the axles of the truck, but is connected to the other axle through a spring. The king-pin through which connection between the truck and the car body is obtained is carried upon the field magnet of the motor so that the weight of the car is transmitted to the truck axles through the field magnets of the motor.

492,627.—*Apparatus for Electrically Propelled Cars.* C. J. Kintner.

In order to enable the motorneer to sound a warning signal when both hands are engaged, a foot lever is provided which carries a spring adapted to be brought into position to be struck by a series of radial fingers carried upon the car axle to send momentary currents through a gong signal bell. Push keys are provided in the car by means of which the mortorneer may be signalled to stop.

492,773.—*Electric Railway Block System.* Francis O. Blackwell.

A number of electro-magnets are arranged in a circle with their axes lying along the circumference and are secured by means of a spider to the frame of the truck when the brake is applied to a car. Secured to the axle of the truck is a series of hollow cylinders lying in a circle with their axes along the circumference. The electro-magnets rotate within the hollow cylinders, and when it is desired to apply the brake, current is sent through the electro-magnets, which induce magnetism in the surrounding cylinders in a direction to oppose the motion of the electro-magnets, and the latter are gradually brought to rest.

493,914.—*Converter System for Railways.* Alard Du Bois-Reymond.

The system comprises sectional working conductors arranged along the track, with which trolleys or brushes upon the car are adapted to make contact. Where uni-phase currents are used, two such sectional conductors are employed ; where tri-phase currents are used, three conductors are provided. The primaries of the converters are connected in series with the generator, the converters being located one at each section. The secondary of each converter is normally short-circuited by a cross connection, thus reducing the counter electro-motive force to almost nothing. In one of the conductors connecting the secondary coil with the sections of the working conductors, is placed a solenoid, through which no current passes until the car passes upon the section, at which time the circuit is closed from one section through the motor on the car to the other section, and the solenoid is energized to attract its core, which by its motion opens the

short-circuiting cross connection of the converter and all of the current passes through the motor on the car. When the car passes from the section the solenoid core drops to close the short circuit.

493,328.—*Multiple Thermal Cut-Out.* L. P. Bonebrake.

A number of levers extend radially and are so pivoted that their inner ends lie in a circle, the outer ends being connected by means of fuse wire with a bar forming a part of the circuit. Against the inner end of the first lever, bears the end of a spring-pressed lever connected in the circuit and adapted to complete the circuit through the fuse wire. When the fuse is blown, the spring-pressed lever acts to turn the radially placed lever upon its pivot, thus separating the ends of the ruptured fuse wire, the end of the spring-pressed lever then passing to and making contact with the second radial lever of the series, thus automatically closing the circuit through a second fuse wire.

493,369.—*Electric Switch.* Alfred Stromberg.

The invention embodies an electric protective device in which the district to be protected, as a safe, window, or the like, is covered by a flexible curtain interwoven with conductors forming an electric circuit in which is included a resistance. The conductors at the protected district are connected by means of a wire with the central office with a ground return. At the central office a pair of electro-magnets are included in the circuit, one being sufficiently excited by the normal current to attract its armature to open a bell circuit, so that should the circuit through the protected district be broken from any cause, the armature will fall to close the bell circuit and sound an alarm. The second electro-magnet is not sufficiently excited by the passage of the normal current to attract its armature, but should the conductors at the protected district be crossed or grounded the resistance will be cut from the circuit and the current sufficiently increased to cause the electro-magnet to attract its armature to close a second bell circuit, thus sounding an alarm. In this manner, if the conductors at the protected district be cut, crossed, short-circuited, grounded or otherwise tampered with, an alarm will be sounded at the central station.

493,672.—*Automatic Electric Cut-Out.* Francis B. Badt.

The cut-out is designed for isolated plants in which a gas engine is used to charge a storage battery so as to supply current at all times of the day without continuously running the engine. It is desirable to open the dynamo circuit before cutting off the engine supply, as otherwise the battery would run the dynamo as a motor. Both the opening of the dynamo circuit and the cutting off of the engine supply are accomplished automatically, so that the attendant has but to start the engine and connect the dynamo in circuit with the battery. Since the back electro-motive force of the battery gradually increases as the charging progresses, a regulator is provided for the dynamo which maintains the current constant by increasing the electro-motive force of the machine. In shunt with the battery is provided an electro-magnet in a circuit of such resistance that it is not sufficiently excited to attract its armature until the battery is completely

charged, at which time the electro-motive force of the dynamo is a maximum. When this maximum electro-motive force of the dynamo is reached, sufficient current traverses the electro-magnet included in the shunt circuit to cause it to attract its armature to close an auxiliary circuit through a second electro-magnet, the attraction of whose armature releases a weight which in its descent first opens the dynamo circuit and then cuts off the supply of the engine.

495,107.—*Electrode for Secondary Batteries.* George D. Coleman.

The electrode is formed by blowing or showering the finely-divided lead or other molten metal through a closed chamber, or housing, and receiving it when near the point of congelation in a suitable mold, the particles merely welding together at their points of contact to form a coherent mass of great porosity.

492,713.—*Welding Metals Electrically.* C. L. Coffin.

The metals to be welded are placed with the edges to be joined abutting, then by means of a carbon pencil an arc is formed which heats the plates sufficiently to cause the weld. The arc, instead of being formed over the joint, is formed at a short distance to one side so that the heat at the joint may not be so intense that the carbon composition of the iron is altered.

493,918.—*Electrically Operated Railway Switch.* Powell Evans.

Upon the trolley pole is carried a pair of contacts which make contact with a pair of brushes supported from the same object as that from which the trolley wire is suspended. The brushes are connected with a pair of electro-magnets stationed near the switch, one of the magnets being pivoted and connected with the movable portion of the track switch so that its motion may operate the switch. The contacts upon the trolley pole are connected with a reversing switch so that the relative polarities of the electro-magnets may be altered to effect a movement of the one which actuates the switch.

494,657.—*Electric Meter.* Milton E. Thompson.

The meter is particularly designed for measuring alternating currents, and comprises an armature consisting of a hollow closed conductor of copper, or other conducting non-magnetic material, and series and shunt coils which act upon the armature to produce its rotation, the series coils being included in series with the working circuit whose energy consumption is to be measured, while the shunt coils are placed in shunt across the working circuit. The common axis of the shunt coils is at right angles to the common axis of the series coils. The damping effect is produced by the reaction of the eddy currents produced in a metallic disk rotating between the poles of a magnet.

495,071.—*Compressed Air Apparatus.* Elihu Thomson.

The invention is designed for increasing the efficiency of compressed air apparatus. Air in expanding from the normal temperature becomes exceedingly cool, and its effectiveness as a motive agency is greatly reduced

thereby, but if the compressed air be heated before it passes to the motive device, in which it performs work by its expansion, it may be worked with greater efficiency. The invention consists in placing an electrical heater in heat conductive relation with the supply pipe through which the compressed air passes. The heater comprises a cylinder, forming a portion of the supply pipe, having its interior walls covered with asbestos, against which the electrical conductors rest, the circuit through the conductors being opened and closed simultaneously with the closing and opening of the air-supply valve. In this manner all of the air passing to the motive device undergoes the heat action of the conductors.

494,964.—*Galvanometer.* E. F. Northup.

In this galvanometer all external adjusting magnets are dispensed with, and in place thereof, means are provided for adjusting the strength of the moving magnetic field of the system. This is effected by short-circuiting, more or less, the magnetic lines of force emanating from the poles of the magnets in the moving system, leaving the system entirely independent of all external magnetic fields other than that of the earth.

494,239.—*Electrical Excitation of Vacuum-Tubes.* Harry T. Barnett.

Heretofore two or more vacuum-tubes have not been successively worked in multiple, since, as the excitation is in the nature of a discharge, the tube of least resistance will be the only one that is excited. To overcome this difficulty the inventor places between the ends of the tubes and the mains, condensers, the capacities of which are proportional to the least cross sections of the tubes, or to the desired luminosities of the several tubes.

492,457.—*Electric Railway Block System.* Francis O. Blackwell.

The trolley conductor is divided into a number of sections all of which are normally in electrical connection with the supply conductor. Circuit connections are provided for cutting the sections temporarily out of circuit and are so arranged that when a train is on a given section, the controller corresponding to the preceding section is shifted so as to cut the section out and leave without motive power any train that may come upon it. When the train advances one section farther, the section just left becomes the cut-out section, and the one formerly cut out is now connected in circuit again and may be occupied by a second train. In this manner the distance between the trains must always be greater than one section.

492,547.—*Thermostatic Fuse Device.* A. Wurts.

Certain metals, as zinc, cadmium, mercury, antimony and bismuth, have to a marked degree the property of extinguishing an arc when formed between them, the peculiarity being attributed to the generation of non-conducting vapor or metal by the first arcing, which in turn prevents the continuance of the arc. A number of bodies of such material are placed in close proximity but insulated from one another and are placed in shunt with a fuse wire which bears against and makes contact with all. Upon the passage of an abnormal current, the fuse wire is ruptured and an arc

formed between the bodies adjacent to the break, which arc is immediately extinguished owing to the property above mentioned.

494,225.—*Electrical Meter.* Gustaf Rennerfelt.

Two drums are provided, one in the shape of a cone and the other in the shape of a reversed cone. One of the drums is continuously driven by means of a clockwork, and its motion is transmitted to the reversed cone by means of a friction wheel which bears upon the surfaces of both cones. To the reversed cone is connected the recording mechanism. The friction wheel is mounted upon a longitudinally movable shaft connected with the core of a solenoid through which latter the current to be measured passes. As the current varies in strength the core is moved to change the position of the friction wheel and correspondingly vary the ratio of reduction between the two cones. Thus, if the current increase, the friction wheel will be moved in a direction to increase the rotation of the reversed cone, and vice versa.

The *Quarterly Illustrator* stands alone in its usefulness to the practical advertiser intent on preparing artistic circulars and announcements, and desiring to be well up on all that pertains to illustrative art. For therein the cream of periodical illustration is shown in the varied processes most suitable to the subject in hand, with a richness in text and illustration that educates at a glance. It is the best "dollar's worth" that has appeared for a long time, and Mr. Harry C. Jones, the publisher, 92 Fifth avenue, New York, deserves recognition for the excellent judgment displayed.

It affords us much pleasure to announce that Mr. C. McL. Paine assumes the business management of the *Architects' Electrical Bulletin* with the beginning of this month. The growth of the journal and the warm interest manifested in it have encouraged us to secure the services of this gentleman, who is well known in the electrical field from his successful connection with the *Western Electrician*, and lately with *Electricity*. His long journalistic experience and his popularity are elements that the *Bulletin* is glad to enlist, believing they will greatly help in the work of making the use of electricity at once safe and universal.—*Editor E. W. Little in the April Architects' Electrical Bulletin.*

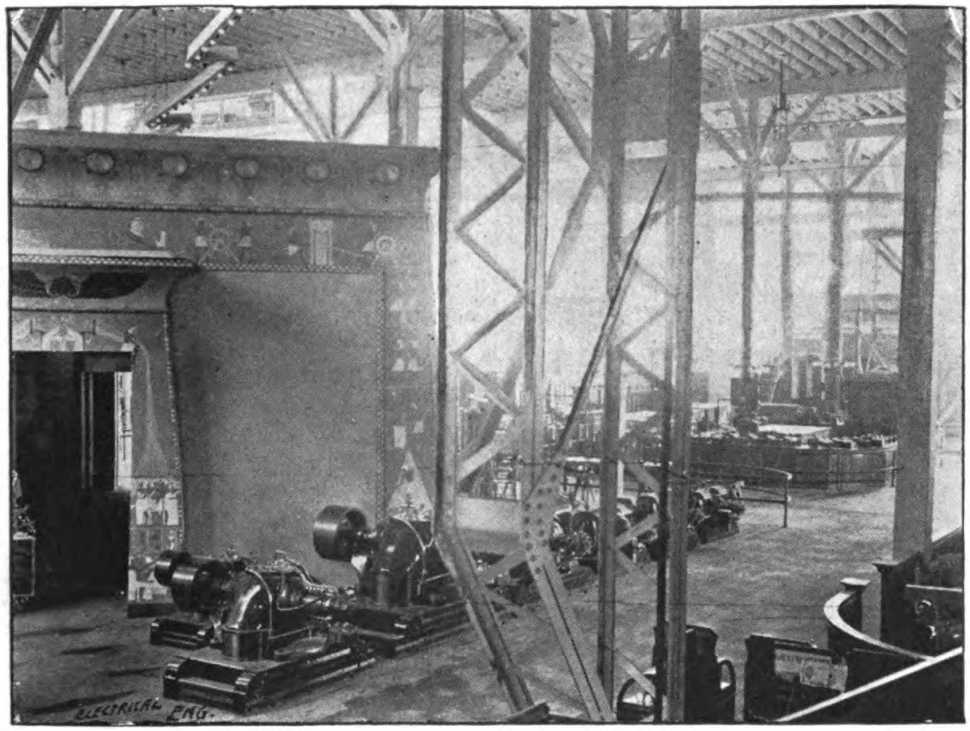
EXCELLENT PASTE FOR GLAZED SURFACES.—For attaching to glazed surfaces nothing is better than bichromated paste, which is used for attaching paper to glass in the manufacture of electric instruments, and which is a most useful paste for many purposes in damp climates. It is made as follows: Flour, 2 teaspoonsful; water, 4 ounces; bichromate of potash, 5 grains. The flour must be rubbed to a smooth paste with the water, then placed in a saucepan over the fire, and kept stirred until it boils. Add the bichromate slowly, stirring all the time, then stand to cool. The paste must be kept in the dark and used as soon as possible. Soak the paper in it and attach to the glazed surface, then place in direct sunlight for a day; this sets up a chemical change in the bichromate, and renders the paste insoluble.—*Journal of the Photographic Society of Japan.*

Electrical Engineering

ONE WAY TO SEE THE EXPOSITION.

BY FRED DE LAND.

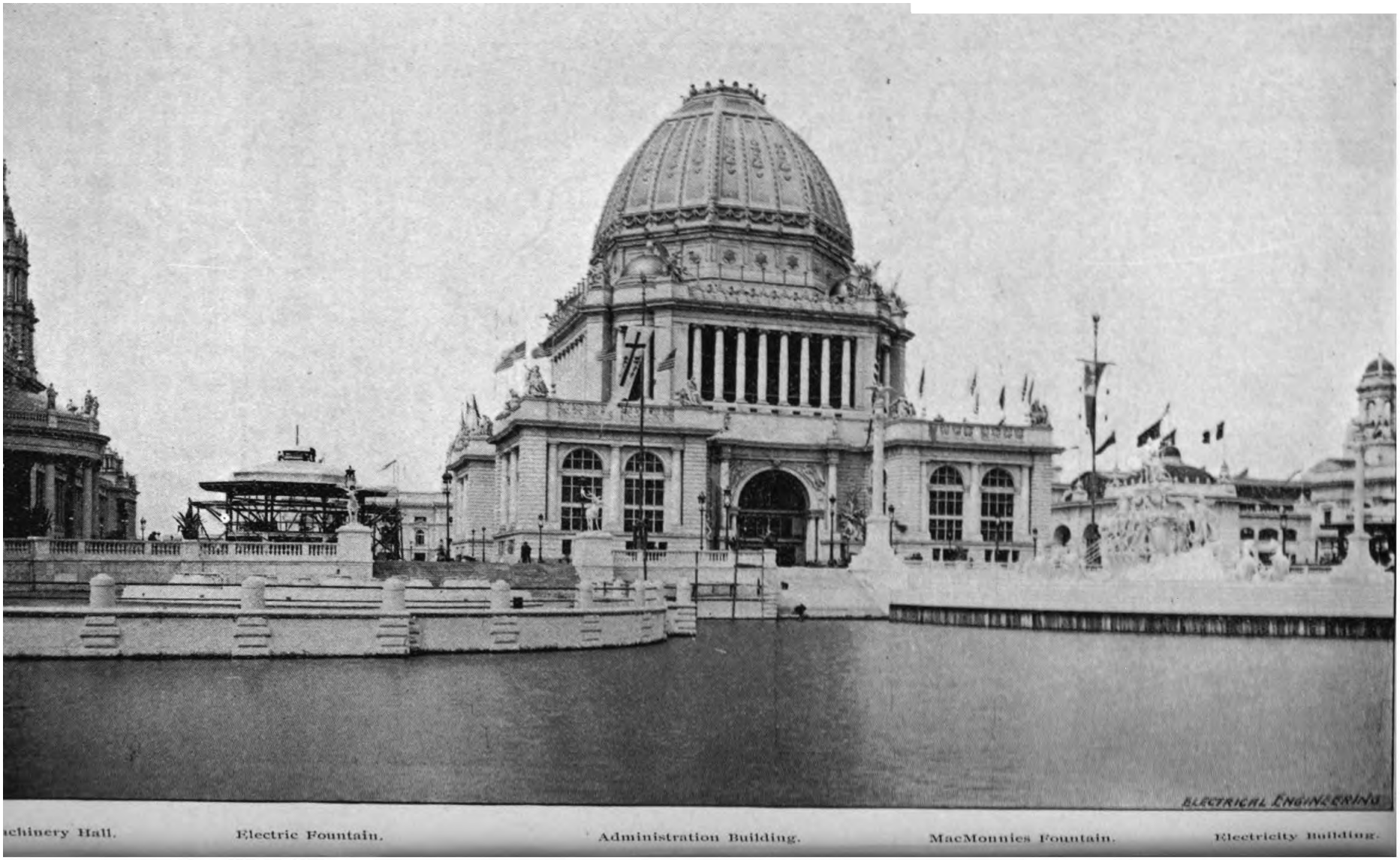
To properly answer the question: "How can I best see the Exposition?" is not an easy task, for no set plan would be rigidly followed for obvious reasons. Neither can everything be studied



ENTRANCE TO EGYPTIAN TEMPLE.

for lack of time. But systematic observation may result in a far more comprehensive understanding than can ever be gained in indiscriminate sightseeing, and with far less fatigue to brain and body. Curbing the desire to give vent to one's enthusiasm,

 Vol. 1, No. 6, June, 1893.



achinery Hall. Electric Fountain. Administration Building. MacMonnies Fountain. Electricity Building.

and resting as often as possible, if only for a moment, will greatly minimize the fatigue that is ever the accompaniment of sight-seeing.

The first day might well be spent in strolling about the grounds, studying the completed work of the architect and the landscape artist that represents the outcome of combined energy, genius and untiring industry, in grandeur and in beauty far exceeding our highest expectations ; in noting how world-wide is the scope, and how the general plan has grown in magnitude during the brief period of the two years in which the Exposition has practically been built ; an exposition within which is housed under 350 acres of covering the output of skilled handicraft from all quarters of the civilized world ; an exposition that may stand forth as the embodiment of the aims and desires of the people of this great republic, planned and wrought and finished not by the hands or at the dictates of kings and princes, but by the people and for the people, solely in the interests of educational advancement.

Having inspected the grounds and the exterior of the buildings, it might be well to have the evening meal at one of the many restaurants on the grounds, and, if physical endurance will permit, remain to witness the illumination of grounds and buildings, more especially of the court of honor.

Among the best points from which to observe the prelude to this scene, that will ever be memorable for its beauty, is the end of the long pier that projects out from the Casino, the curving beach promenade with its sloping sea wall, or the top of the Manufactures building.

To the poetically inclined, either will be favorite retreats on clear evenings when the sun is going to rest, painting crimson and gold the clouds in the west, and deepening the blue of eastern sky ; when the lapping waters acquire a deeper hue as the shadows lengthen, till only a darkened surface remains, smooth, silent, restful, reflecting the glory of the fading light as the deep gold and crimson clouds change to amber and pinkish opalescence that slowly drifts on through the door of night — while over all falls that subduing influence that forms the prelude to Nature's benediction.

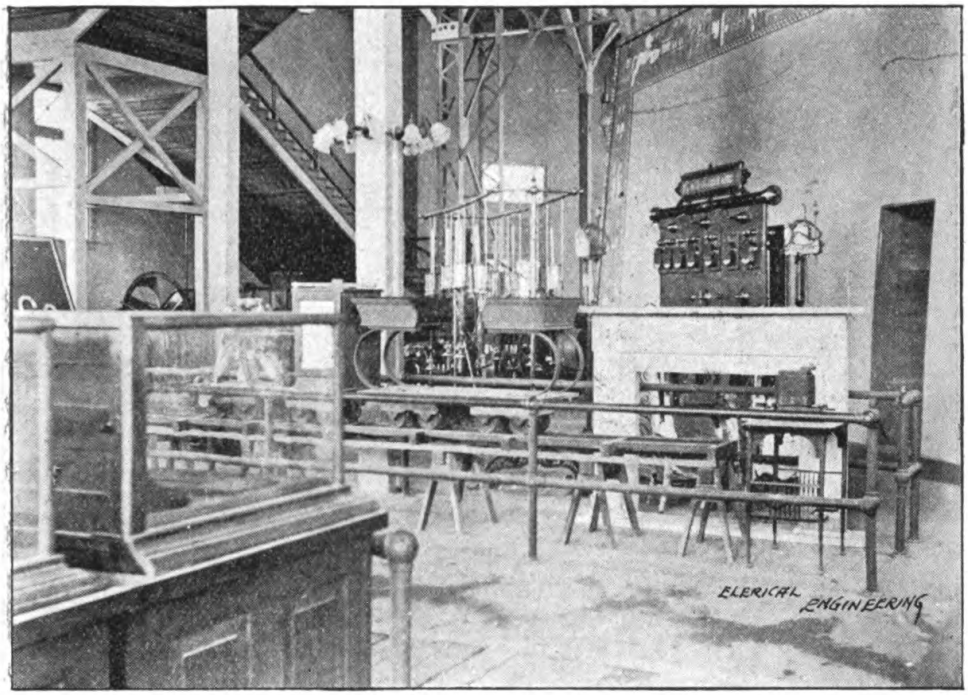
Then from every quarter a wealth of golden light will burst forth like the triumphal notes from the cathedral organ at the

close of service divine, inspiring, uplifting in its effects; and night will be converted into day.

That is the poetical point of view. Yet the engineer or the contractor looking for the practical side of the question will find himself absorbing more or less of that magic charm termed enthusiasm, and will commence to dilate to himself, if not to others, on the transformation scenes of wondrous beauty. Scenes that are produced with electricity as the star, with the aid of 6,000 arc lamps, 100,000 incandescent lamps, four great search lights and the equipment of the two electric fountains.

Before the darkness gathers one after another of the rows of arc lights are placed in circuit, outlining the divisions of the grounds, making brilliant the main entrances to the buildings, and marking the roadways and the bridges as clearly as though the sunlight were streaming downward, or as if a thousand stars were suddenly suspended near the earth's surface, and causing the big dome on the Horticultural building to resemble a hemisphere of fire. Strains of music float upward in the distance, the evening concerts have begun, and the first scene is ended.

Resting dark against the western sky is that dream of domes crowning the Administration building that we never grow weary of, so harmonious and artistic are its proportions. From out the darkness a torch appears on the gallery above the colonnade, and a moment later thirty-two flambeaux, sixteen feet in height, fed with natural gas brought from the wells an hundred miles distant, bend their yellow flames to the will of the wind and cast weird-like shadows on the dome. Then, like a flash, a string of four hundred golden beads has been strung around the base of the dome, while lower down along the cornice line below the roof level a second ribbon of light from 800 lamps appears, while from the higher string eight fiery ribs of light project upward to the summit of the dome where they join in uplifting a golden coronet, of such typical beauty that from the extremity of the pier it appears like a tracing of a golden crown suspended in midair. Eighty lamps are used on the corona, and 320 lamps in the eight ribs, every glass bulb being hidden from sight, while on the back of the columns are invisible lights that illuminate the colonnade. Thus, the mellow radiance, springing from its unseen source, brings out the artistic features in panel and pillar, column and dome, while through the window and doorway streams the light



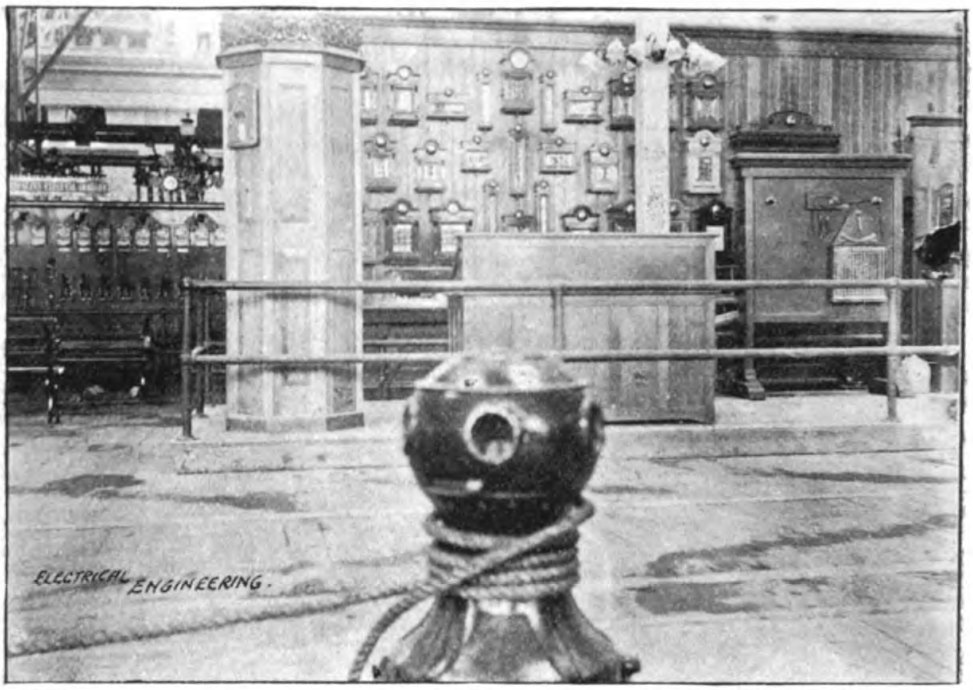
FARMER'S HISTORICAL APPARATUS IN WESTERN ELECTRIC COMPANY'S EXHIBIT.

from the 3,000 lamps that flood the interior of the building with their penetrating rays.

A second later all the buildings on the court of honor are framed in light that streams downward from the thousands of bulbs placed along the cornice lines sixty feet above the roadways, and from peristyle and buildings the reflections shine in the lapping waters like molten gold. But as though this were not sufficient light to chase away every darkening shadow, the grand basin and the lagoons seem afire, as mirrored within their depths are the reflections from more than a thousand lamps placed close to the water's edge. And through this golden liquid the richly draped gondolas move swiftly hither and thither, as the dusky Venetian bends his oar to the music of guitar and tambourine; and the electric launches shoot by in their swift flight, leaving a wealth of shimmering golden bubbles in their trail.

Thus closes the second scene.

Down from the lofty height of the Manufactures building creeps a broad beam of white light that passes over the heads of the massed humanity till it is focused on the great fountain, causing



HOUSE GOODS SECTION, WESTERN ELECTRIC EXHIBIT.

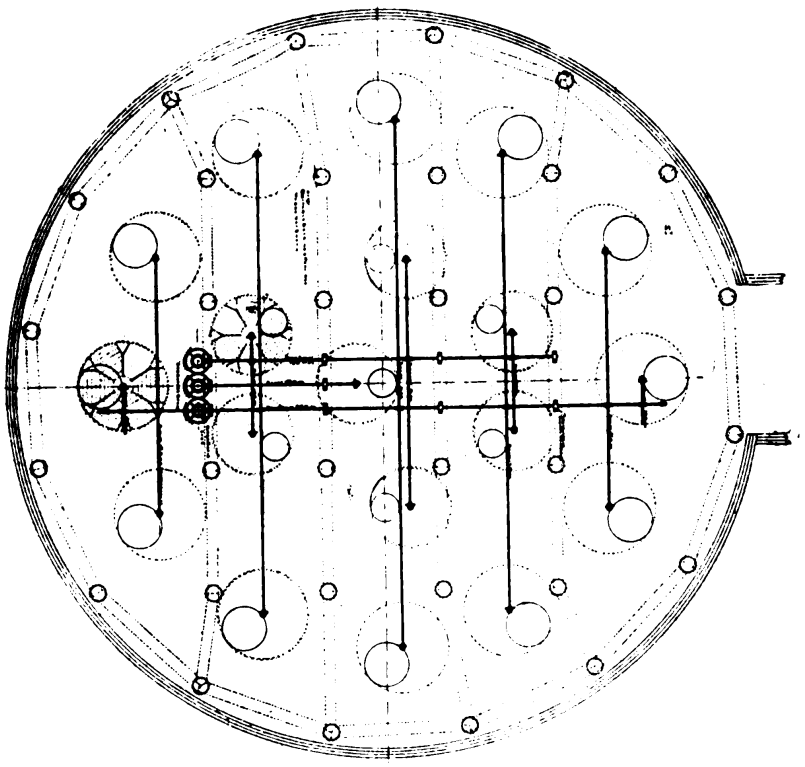
it to stand forth in all purity and whiteness like a spectral ship with a crew of spirit maidens. A glass is moved, and a roseate hue brings all to life, and over the edge of the basin cascades of laughing colored waters chase each other into the lagoon, while, moving around the horizon that colored beam lingers a moment on the fairy-like form of Diana, then changing to white illumines the benign countenance of Liberty, passes on and far out over the lake toward the unseen eastern shore, then suddenly is flashed upward till it reaches the zenith, where the rays from three other electric search lights are slowly converged until a silvery pyramid of light is formed that is easily seen from many an inland point. And again the white light changes to red, to sea-green, and varied colors.

And the third scene closes.

Then comes the fourth and last scene, the one that to many proves the most attractive, "the lighting of the electric fountains."

On each side of the MacMonnies fountain or cascade, an electric fountain has been constructed that, briefly, consists of a sunken

iron chamber or caisson, resting on a cemented pile foundation, within which are nineteen arc lamps, a switch board completely equipped, color screens, signal bells, etc. The bell circuits extend to a room in the northeast tower of Machinery hall, where the chief operator of the fountain is stationed, and who signals from

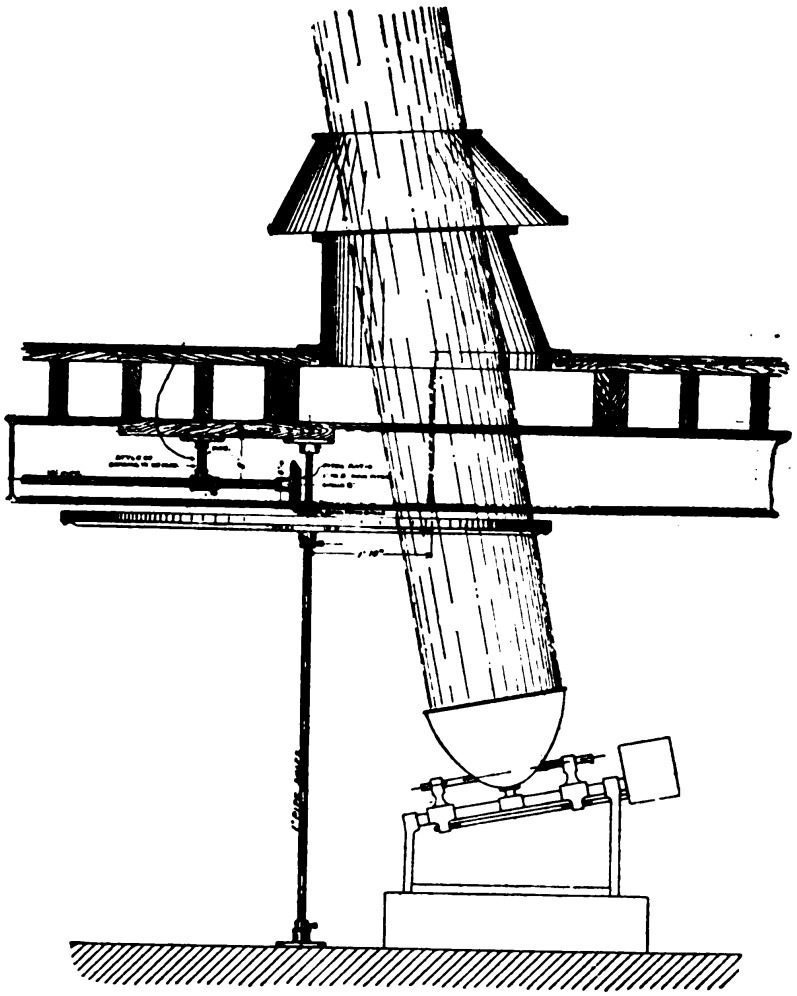


PLAN OF COLOR SCREENS IN FOUNTAIN.

thence to his subordinate within the caisson the requisite instructions for securing the desired effect, a code of signals having already been established.

Extending upward from the operating chamber and several inches above the water line is a set of nineteen circular domes, each covered with heavy plate glass, while beneath each dome, and nearly on a line with the ceiling of the chamber, a revolving color screen is affixed, having six sections made of colored glass slides, ruby, yellow, blue, green, sea-green, and clear glass, removable at will, and so arranged as to permit any combination of colors. As these screens are connected by bevel gearing they may all be simultaneously operated on a horizontal plane by a single attendant, and a rapid play of colors secured. The

projectors with silvered reflectors over twenty inches in diameter, rest on platforms beneath each dome, and the beam cast by each is claimed to be equivalent to over 200,000 nominal candle-power. There are 1,500 water jets that rise within the hoods partially



VERTICAL VIEW OF PROJECTOR RAYS.

covering the dome, or concealed with the bronze ornaments, and are controlled by valves placed within the operating chamber.

During the regular hours of the Exposition these fountains project water upward in the unique form of giant geysers, wheat sheaves and parabolas, attracting universal attention and praise. But when the current is turned on, and the projectors cast their powerful beams through the colored slides, then the tumbling water is turned into banks of streaming fire, the wheat is of

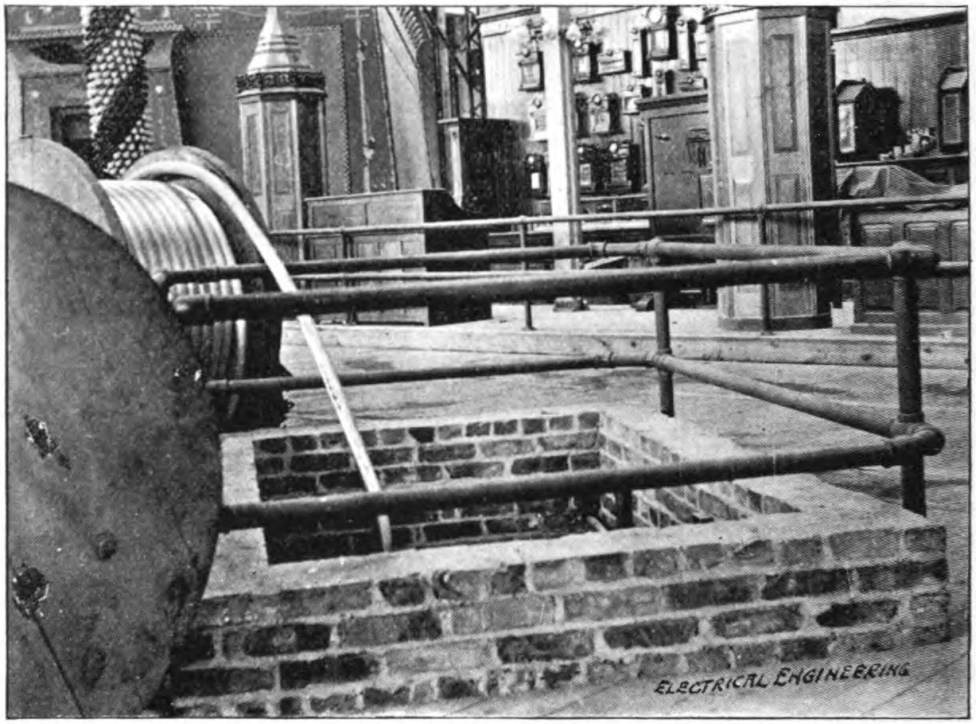
THE WESTERN ELECTRIC EXHIBIT.

golden ripeness, the geysers explosively hurl masses of bursting flames skyward, and the rubies and emeralds and diamonds chase each other over the sides of the basin. These changes follow in rapid succession, and then there is a period of rest followed by changing views; vivid scenes that will remain in Memory's chamber for many a day.

Thus endeth the evening's display.

The second day will naturally be devoted to inspecting the Electricity building and its exhibits, a section of the exhibition of universal interest to a majority of the visitors.

Fronting the main entrance is the open Greek pavilion erected by the American Bell Telephone Company, twenty-five feet in height, and with a dome rising forty-five feet above the audience chamber in which "long distance concerts" will be given on special occasions, when visitors will be favored with the sound of music, both vocal and instrumental, transmitted from New York, Boston and other cities. Like the main structures, this building is staff, covered in imitation of white marble, has two reception rooms, a private office and a storeroom, is appropriately furnished



SECTION OF SUBWAY, WESTERN ELECTRIC EXIBIT.

and supplied with an abundance of both daylight and electric light, the illumination from the latter being obtained from the bulbs depending from the panels in the decorated ceiling.

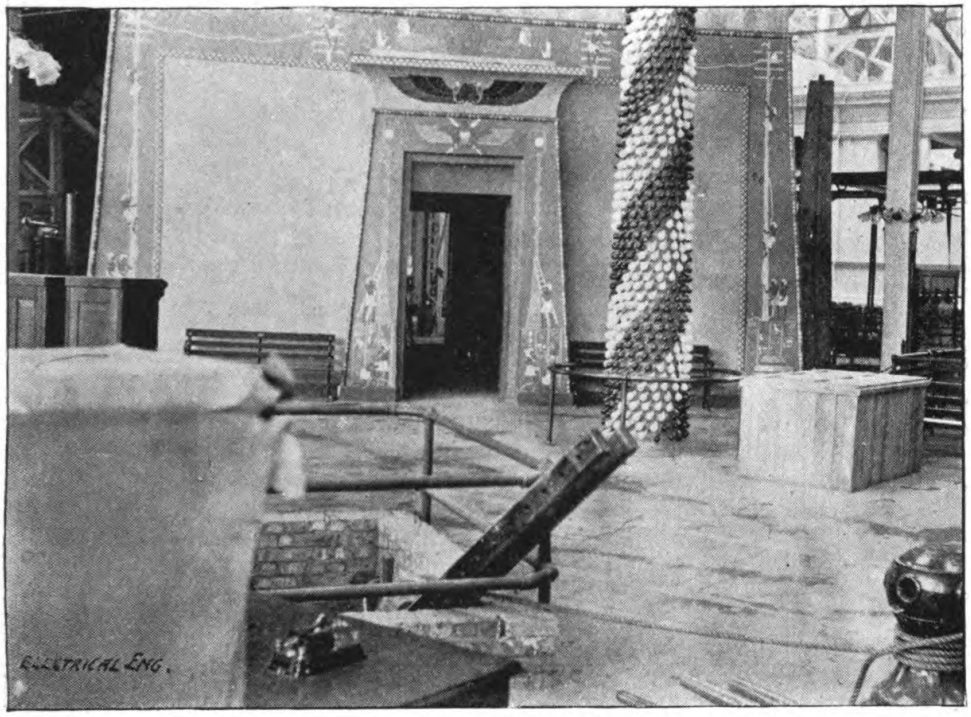
This exhibit is intended to illustrate the evolution of the telephone, its steady growth, the present methods of operating central exchanges, and the possibilities in telephonic transmission of sound. To the right of the reception room are three long double show cases containing the preliminary apparatus used in solving the problem of the transmission of the human voice, including Bell's original telephone of 1875, the four telephones exhibited at the Centennial, and the hand telephone made for experimental use in 1877 ; then follow the early forms of receivers and transmitters, side by side with those now in use both for commercial and for scientific uses, including the Phelps, Blake and Edison instruments, and the present marine and long distance apparatus. On some of the walls are photographic prints of the telephone exchanges in the principal cities, while covering the right wall are interesting statistics graphically displayed, showing the growth of telephone exchanges from 138 in 1880, to 1,351 in 1893 ; of

telephone subscribers from 47,880 in 1881 to 223,140 in 1893 ; of employés from 1,481 in 1881 to 9,970 in 1893 ; while the total number of miles of wire now in service is reported to be 440,793, of which 91,463 miles are underground. And here the thought suggests itself that another ten years may see not only twenty per cent of telephone circuits underground, but eighty per cent, a feature desired as earnestly by the telephone officials as by the municipal authorities. On the west side of the room is the telephone exchange of the grounds, that is, the World's Fair telephone exchange, which is placed here as an operating exhibit of a most instructive character, and one that, by educating the public to a more intelligent comprehension of the system, may go far toward removing much of the unprofitable friction existing between the public and the telephone exchanges, and due principally to the lack of knowledge on the part of the subscriber of the method of operation. The visitor may also be able to understand how a rapidly growing telephone exchange may become more valuable each day to the subscriber through the addition of numerous new circuits and yet prove a non-dividend paying investment, while a study of the more important among the hundreds of patents controlled by this parent company will enable the capitalist to better appreciate the value of the stock of some of the new telephone companies that propose to revolutionize local rates. At the end of the space assigned to the exchange a wide manhole has been built up and covered with an iron grating that permits clear observation of the method employed in bringing cable trunk lines into an exchange, the manhole being illuminated with incandescent lamps. Ducts terminate on the interior surface of the brick wall, and from out these ducts the lead-covered trunk line cables that connect with the Chicago exchange, and the long distance circuits extending to eastern cities, enter the manhole and pass upward to the distributing frames where the sections are unwound and in pairs connected to their respective points on the frame which is already joined in circuit to the switchboard. The latter is the latest improved form of multiple switchboard manufactured by the Western Electric Company, with receiver sections for sixteen operators ; and a constant throng of visitors may be found leaning on the heavy railing that separates the exchange from the balance of the room, watching the female operators as they deftly replace the drops

and plug in the required connections in answer to the various calls.

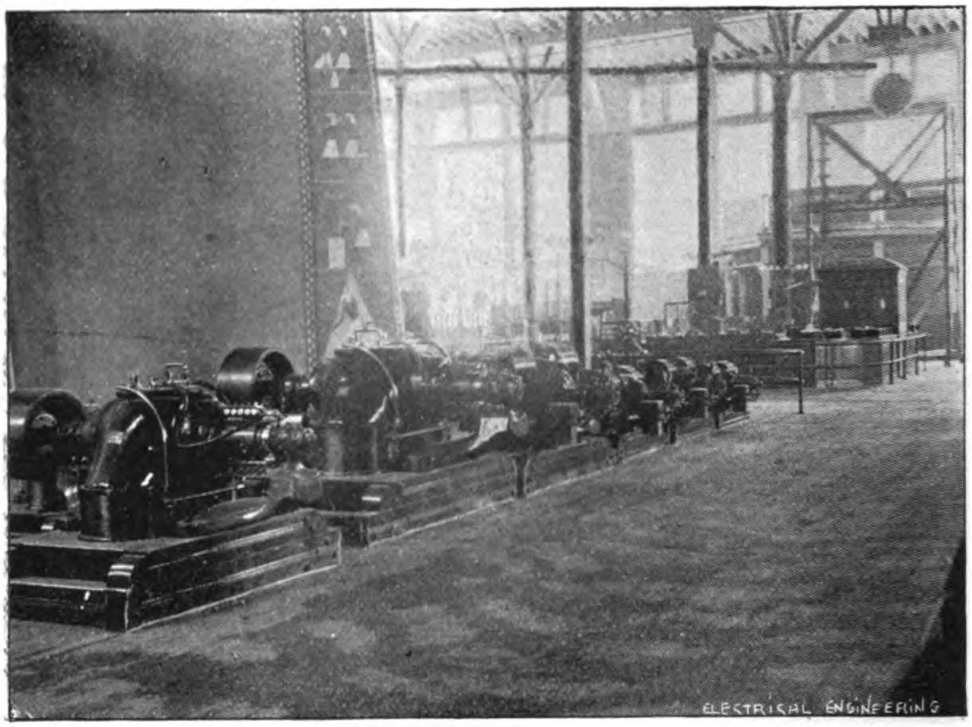
To the right of the Bell telephone exhibit and facing the eastern side of the main entrance, an Egyptian temple has been erected, that is said to be a reproduction of one of those famous shrines that in bygone days was surrounded by throngs of worshipers in a land that is now sand-swept and silent. But unlike its ancient prototype by the Nile, this temple is surrounded by myriads of visitors glad to inspect the visible illustrations of the science and the industry that has revolutionized old methods of lighting and power, of oral and of written communion as exemplified in this exhibit of the Western Electric Company. The Egyptian student will find on the friezes and panels of the exterior sloping walls, a faithful portrayal of the state of the art from the standpoint of a *fin de siecle* artist, for the angular figures are no longer plowing with the conventional straight stick, but, following "the dethronement of the Sun God by the Daughter of Electricity," are engaged in pursuits that clearly illustrate the wide contrast between ancient and present methods of industry. As the amazed Sun God takes his position to the rear of the throne, a procession of artificers carrying the typical parts of electrical apparatus approach their new ruler. On the north wall, ancient Egyptian linemen are portrayed in the act of stringing pole line circuits; the east wall illustrates the response of police and fire departments to summons for assistance; and on the southerly or front wall are indicated the methods employed in placing cables in subways and ducts; and here the engineer who has had charge of underground work, will need only one glance at the sunburned figure placing the tent over the manhole, or at the group operating the capstan, to readily infer that the master hand that delineated these scenes gathered his inspiration from actual observation of the working methods of subway gangs in Chicago. And how the lineman will appreciate the portrayal of that Egyptian pole-climber with his spur just sinking into the pole! The story is told in modern hieroglyphics formed of parts of machinery, tools and instruments arranged in successive order, with here and there a letter or a word added to form the connecting link. The simple character of the distinct coloring is entirely in harmony and in keeping with ancient Egyptian methods.

This temple has an inner and an outer chamber illuminated



VIEW SHOWING TEMPLE, COLUMN AND SUBWAY.

with the soft glow radiating from 1,200 concealed incandescent lamps, the object being to indicate the high artistic effects that may be secured by improved methods of interior illumination. The engineer may assume that ninety per cent of the direct illuminating capacity of these lamps is practically thrown away in securing the peculiarly attractive effect that will appeal to decorative artists, but that is only in keeping with the entire exhibit wherein utility is subordinated to the artistic. The typical Egyptian reed columns are built up of sections of heavy green glass, lens-shaped on the interior, conveying the idea of surrounding water, and each column is capped with the conventional lotus, the varied coloring of which is enriched by the soft beams penetrating from the hidden lamps ; while above the entrance is the luminous winged deity. The ceiling of the inner chamber is of heavy colored glass, above which are numerous stationary incandescent lamps, save a small section in the center that is frosted glass, over which platoons of colored lamps apparently march and countermarch, the effect being to fill the room with vibrating flashes of light from an overcharged sky. The interior cornice or



DYNAMO SECTION, WESTERN ELECTRIC EXHIBIT.

frieze is picked out in winged globes of somber red, behind each of which a lamp has been placed.

Recessed within the walls are plush-lined cases in purple and red tones relieved by old gold, containing some of the smaller devices manufactured by the Western Electric Company, including testing sets, switches, magnetos, telegraph sets, cutouts, etc., and as the cases are permanently affixed, with the light streaming downward from lamps placed within the walls above each case, provision has been made in another section of the exhibit for the examination and dissection of any of the instruments or apparatus here shown, a number of each article being arranged in drawers to correspond with their relative position in the cases, and tables and chairs supplied for convenience in investigating. This is only one of the methods by means of which this public-spirited company propose to let the visitor gain all the knowledge possible regarding the construction and operation of electrical apparatus, and to facilitate a more thorough comprehension of the component parts of the electrical industry as a whole. For included in the entire exhibit is some of the mechanism employed in every

application of electricity from electro-therapeutics to electric traction. Moreover, of this large and diversified display none need be manufactured outside of its own factories, save the incandescent lamp, and there are no joint exhibitors save it be the decorators and the scenic artists.

Adjoining the exit to the inner chamber stands the glistening column of winding incandescent lamps, four feet in diameter and twenty-five feet in height, from the top of which bulb-covered arms extend out to the four corners of the exhibit, the arms being forked to represent flashes of lightning. Corresponding to the movement of an unusually large commutating device, a flame of light passes up this high pillar and darts out along the arms like a lightning flash, and on reaching the extremity apparently leaps across the narrow space, striking a revolving globe, causing it to alternately reflect a mass of blue and white and red flame, when the flash appears at the base of the pillar and the scene is again repeated. To obtain these beautiful effects nearly 3,000 lamps of 16 candle-power are in circuit, the current used being supplied from the 220-volt Western Electric constant potential generators in Machinery hall, and reduced to 110 volts with the aid of motor-generators.

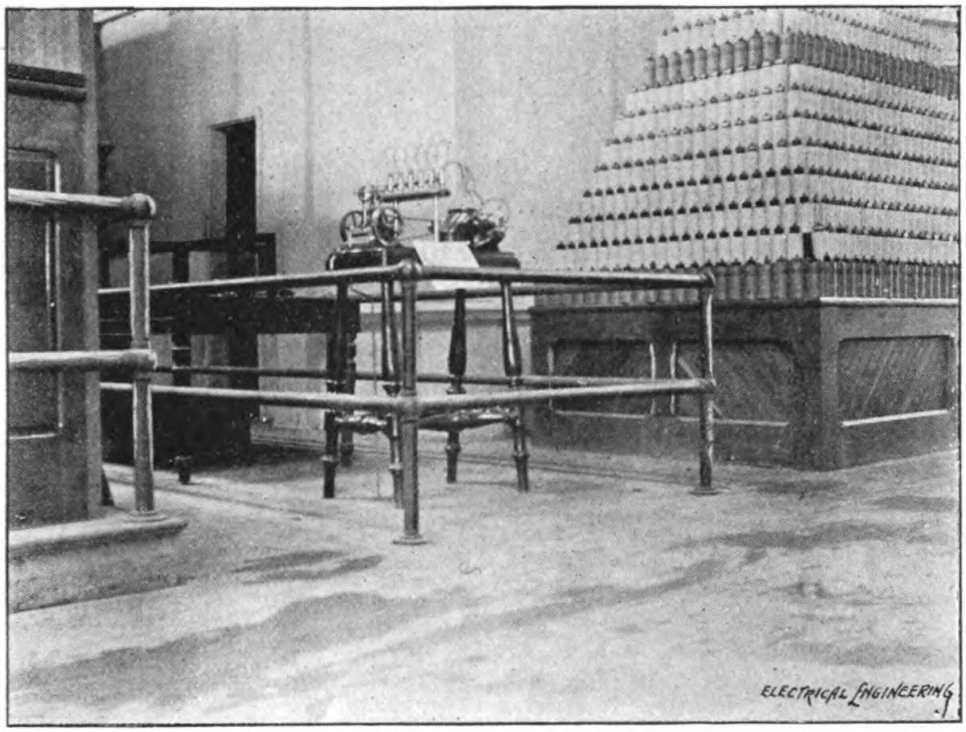
Included among other illuminating devices that, while proving attractive to thousands, to the practical man will be suggestive of future possibilities in the line of decorative lighting, is the large, double-walled glass case suspended over the central aisle of the exhibit, in which fourteen arc lamps are swayed to and fro by the action of a motor-driven device, affording a peculiarly sparkling appearance to the designs and the lettering worked out in broken fragments of colored glass, the latter reading: Western Electric Company, Chicago, New York, London, Antwerp, Berlin, Paris. The hysterical bulb mounted on a flexible joint and making the most unexpected movements, as well as the writing finger that traces out the letters W. E. Co. by apparently placing lamps in circuit will certainly delight the youngsters, while causing many an older head to wonder how it is accomplished. Both devices are automatically operated with the aid of a traveling carriage, adjustable switches and flexible joints.

The telephone central exchange office has been developed by the Western Electric Company, and as here displayed is substantially the same as is now in use throughout the world. This

section of the exhibit includes everything required from the simple diaphragm of a transmitter to the modern multiple switchboard, that has practically revolutionized the work of the central exchange, and which stands side by side with the primitive board that remained in service as late as 1884. There are long distance equipments, the short distance or private telephones for use only from room to room or to connect up the various departments of a factory; there is every detail included in a pole line circuit, and also an actual subway with brick lined manholes, a 100-conductor cable on a reel that is mounted on a stand placed at the edge of the manhole, with the cable skid, and the end of the cable passing into the subway, the threading rod, and the cable capstan ready for service. And in addition to being so suitably labeled that he who passes by may read, in many cases working drawings have been attached to instruments and apparatus, a feature worthy of praise from all interested.

These same remarks apply also to the display in the telegraph section where every modern device from a gravity battery to a Western Union "quad." set is shown either as a working exhibit or in its proper case; keys, sounders, relays, students' sets so simple in construction that every youngster will long to take one home, quadruple sets and operating tables, are only a few of the articles to be seen.

The house goods department is one that will appeal to the æsthetic desire of every matron, for there are house calls, annunciators and burglar alarms in oak and walnut, cherry and ash, some for the kitchen and others with frames richly carved from solid oak fit to stand in the hallway of the White House; model doors and windows, the slightest disturbance of which sets off the burglar alarm; and a little device that attached to the keyhole announces to the waiting wife the return of her lord and master. The hotel proprietor here finds the latest improvement in the combined hotel annunciator, guest-call and fire-alarm, and can make his selections from case of sycamore, bird's-eye maple, or other appropriate woods, all of which are made in the cabinet shops of the Western Electric Company. There is an arch formed of tin speaking tube and elbows turned out in the factory, and the specially devised machine employed would have been placed on exhibition had there been some way to dispose of the finished product. Another article made at the factory on a special machine

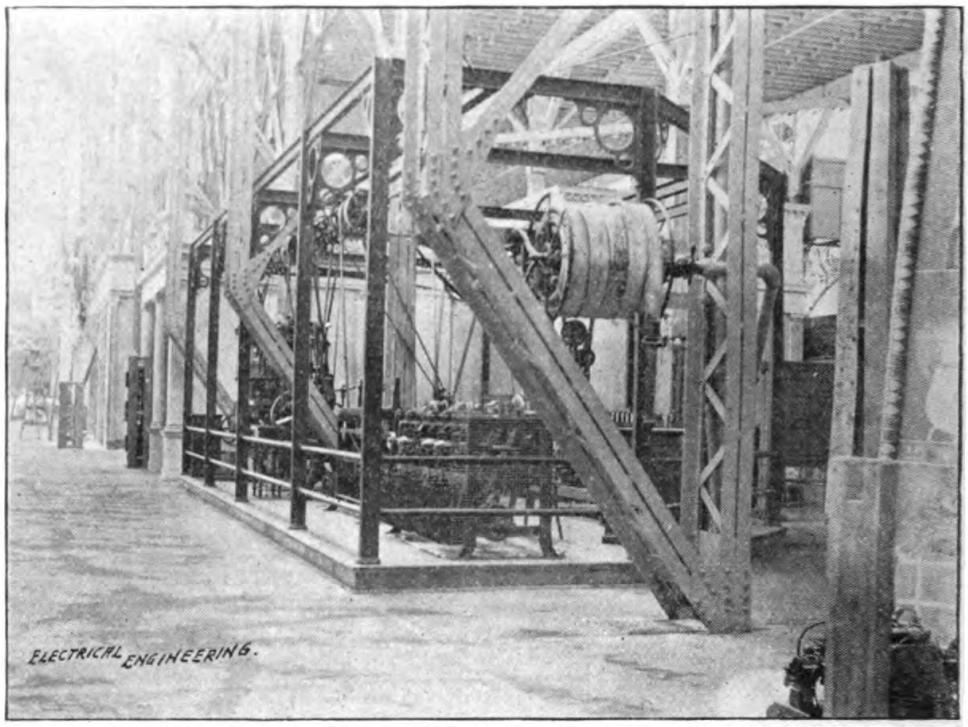


PYRAMID OF BATTERY CELLS.

is the hollow solder filled with resin and requiring no flux, coils of which may be seen in the house goods section. Then there are banks of batteries and bells and push buttons, electric gas lighting material, and every other requisite for perfectly equipping a modern house.

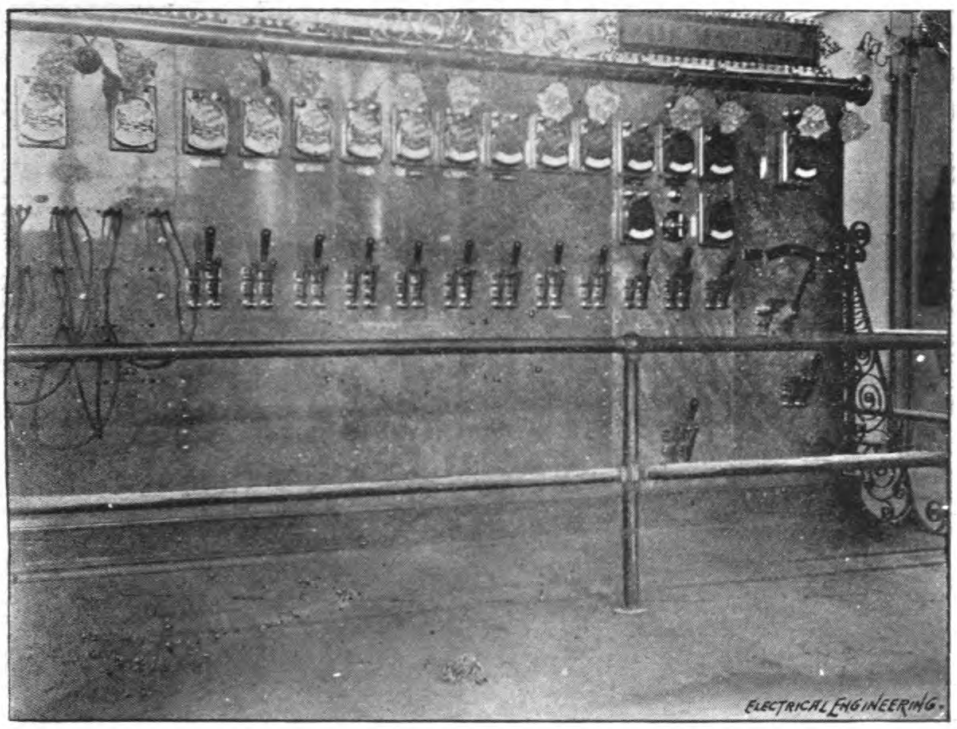
Near this exhibit is a case containing brass castings just as they are taken from the sand in the Western Electric foundry, not ground down or polished in the least, but having every fin attached. It is an exhibit that will attract the practical man who finds pleasure in examining perfect work in whatever stage of completion it may be presented.

The section devoted to wires and cables is filled with big reels and little spools, with great wheel-like coils and miniature loops, containing telephone cables and single conductors, magnet wires as big as pencils and as thin and as fine as hair, arc light wires and trolley wires, bus bars and feeders; while wires of silver and iron, brass and steel, german silver and platinum are all together; each coil or reel plainly labeled.



MANUFACTURING SECTION, WESTERN ELECTRIC EXHIBIT.

Around the operating exhibit of the Western Electric Company a throng of visitors may always be found watching the automatic machines deftly turn out their finished work, and plying the fair attendants with questions on the why and wherefore of it all. Here the practical machinist will find a multiple drill press with drill rods having flexible joints that permit of thirty-two or more holes being bored, and if desired, countersunk at one motion of the lever ; and these holes may be bored and separated by any degree of space not exceeding the length of the table. There is an automatic hexagon nut machine that with one motion punches, stamps, drills, taps and faces six completely finished hexagon nuts from an automatically fed strip of brass. An automatic screw machine having a two-storied turret that receives two rods fed simultaneously and turns out "the piece" finished in every detail when dropping it from the holder. The improvements in these machines were developed in the factories of the Western Electric Company, and naturally, as do all labor-saving machines, enable the product to be obtained more rapidly and at a lessened cost. In the same line of improvement is the



WESTERN ELECTRIC SWITCHBOARD.

spooling machine, winding silk and cotton and paper on spools or bobbins; and the winders and the braiders that operated at a decreased speed clearly illustrate the improved method of insulating conductors, including the No. 35 soft drawn copper magnet wire that is double wound with green silk thread, and No. 18 annunciator or "bell wire," and the paper covered telephone wire. The method of winding magneto-armature generators is also shown, and many a thoughtful visitor has obtained a clearer understanding of the simplicity of the laws governing the science of electricity from watching the operator tell when a sufficient length of wire may have been wound on the armature, not by counting the number of turns or the number of yards fed from the spool, but by measuring the resistance. Again, the statement that sixteen ounces of the wire used (No. 35) would extend in length a distance of two miles, and that it requires less than three ounces of the No. 40 wire to extend a mile, interests everyone who questions the bright operator.

All of these machines are belted to pulleys arranged on line-shafting suspended from an ornamental machine rack of angle

iron that is braced to the floor by a gas-pipe railing, and cross-braced with I beams and scroll brackets. A 10 horse-power Western Electric motor, running at 650 revolutions, drives the line shafting, and affords an excellent example of electric power transmission, the compact, symmetrical little motor doing its work noiselessly and requiring no attention further than to fill the automatic feeding oilers once or twice a month, and to turn off or turn on the current when stopping or starting from or for the day's work.

A section of interest to the municipal authorities is the complete system of police and fire-alarm signal apparatus, including the ornamental corner-box surrounding the capped lamp post and arranged for overhead or subway circuits, the call-boxes and the repeaters.

The lighting station manager will find an entire equipment for his plant, from the big power generator to the 60-light arc dynamo and from the ammeter to the marble switchboard. There is a handsome rack of eight arc lamps, each of a different type, including the single and the double carbon, and the lamp for constant potential circuits.

At the northwest corner of the section and facing the main aisle stands the miniature model theater erected to illustrate modern methods of securing desired spectacular effects with the aid of electrical apparatus, as well as in obtaining perfect illumination in auditorium and foyer. From the darkened auditorium in which there is ample standing room for an audience of fifty or more at one time, a set scene appears on the stage illustrating a village nestling in a mountain pass, with snow-capped peaks rising to the right and rear, while a babbling mountain brook rushes down the distant valley. At intervals of about fifteen minutes an automatic device is placed in circuit that operates the various changes of light effects which constitute the display, and the gray dawn comes creeping upward, followed by the rising sun and the bright white light of day. Gradually the sun passes to the left and sinks behind the mountain peak, the whole valley being illuminated with the glory of its dying rays ; the deep blue of the night follows, and then the uprising of the moon with its golden light, and the twinkling of the bright stars are seen. All of these effects are produced automatically with the aid of a simple apparatus developed in the factory of the Western Electric

Company, and will prove of special interest to all theatrical managers, spectacular and scenic artists, as well as the theater-going public, as illustrating the latest improvements in this line, and though the audience while gathered in the darkened auditorium sees no trace of the mechanism, only the results appearing as shown in the delicate shading of the light, yet all the mechanism is exposed to view on the north side of the building, and, in brief, consists of a resistance group for each circuit and the necessary mechanism for automatically carrying the contact point very gradually over the rheostats so that the change in light effect occurs almost imperceptibly.

The arrangement of this entire display was designed and installed by Mr. Patterson, assisted by Mr. Tucker, and reflects great credit on the designers and the Western Electric Company.

The Weston Electrical Instrument Company's exhibit is at the side of the main stairway leading to the east gallery, and just to the right of Chief Barrett's office, and whether considered from the standpoint of an attractive exhibit handsomely encased, or from that of a technical display that will be sought after by interested parties, it is certainly a decided success. For the open pavilion, with its graceful curving lines, its tinting of creamy white, its carved cornice framing in letters of gold on a scarlet background the words: "Weston Electrical Instrument Company, Newark, New Jersey," and its salmon-colored hangings, are all in harmony.

Forming a portion of the base of three sides of the pavilion are paneled counters supporting sloping cases of heavy polished oak through the glass covers of which may be seen resting on a background of velvet the indicating and measuring instruments in the manufacture of which this company has become so justly noted.

There are astatic ammeters for central stations and isolated plants and portable instruments; voltmeters, potential indicators, milli-voltmeters with readings ranging from 0 to $\frac{1}{100}$ volt, and milammeters having readings from $\frac{1}{10}$ mil-ampère to 10 mil-ampères on a 1,500-mil-ampère scale; then, there are mil-ammeters designed for physicians' use, portable and affording quick, accurate and reliable measurements; there are station ammeter shunts, inspector's sets with lamp adaptors attached for convenience in rapidly testing for faults, the new type of resistance boxes, volt-ammeters, etc. In the center of the open section

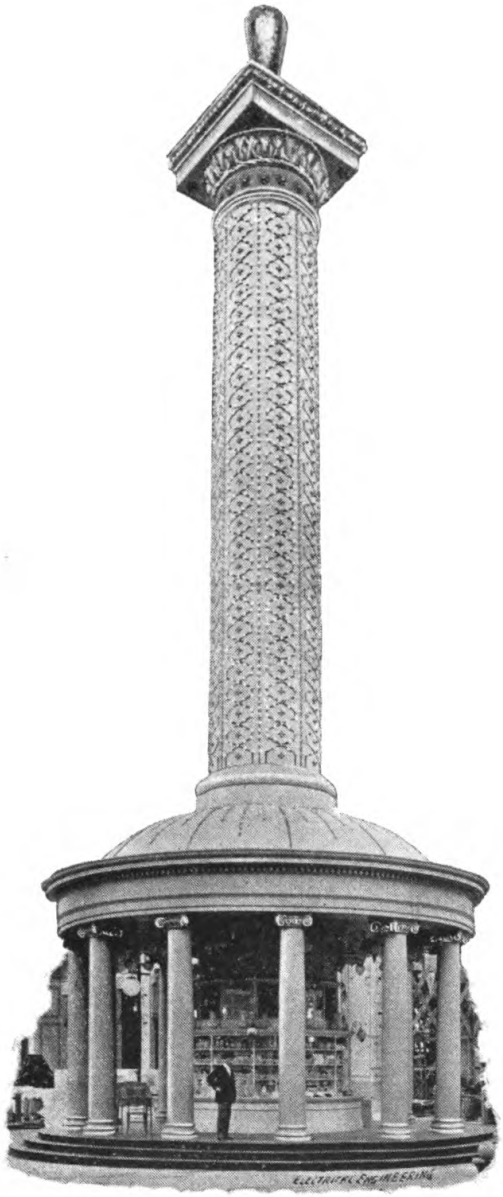
sloping cases are also arranged, above which are framed panels attached to which are the several parts of each instrument that combine to form the four main types of instruments: the ammeter and the voltmeter for direct currents, the voltmeter for alternating current circuits and the central station special instruments, a display that is an object lesson in the care, the accuracy and the finish required in this line of work. Above these frames is supported a large tangent galvanometer that in days gone by rendered excellent service, but is now preserved for its historical value, being practically superseded by the improved instruments and simpler methods here shown.

At one side of this case a register, with pen, ink and pencil, is placed, with an invitation for all visitors to register who may desire to have a catalogue mailed to their address, a point that no user of electrical apparatus should neglect.

The entire exhibit was planned by and erected under the personal supervision of Mr. R. O. Heinrich, who will remain in charge during the summer, and is a credit to the important company he represents.

On the wall of the section forming the front of the reception-room and office there has been placed by Mr. T. J. Murphy, a marbleized slate switch board handsomely finished in imitation of polished antique oak, and which has been utilized by the Weston Company to show an ideal central station arrangement of instruments for four circuits. The top row of instruments are central station ammeters, one connected in for each circuit with a fifth ammeter in the center to indicate the total output of all machines in circuit; beneath each ammeter is a voltmeter, with a potential indicator in the center of the row; then come the ajax switches of from 300 ampères to 1,000 ampères current capacity, and having the standard double connections that permit instant change from a two-wire to a three-wire circuit; along the bottom of the board four Carpenter enamel rheostats are placed in circuit, and in the center of a shelf of imitation onyx extending along the base of the board a ground detector stands face upward.

As all the circuits are in service, an excellent opportunity is afforded for showing the dead-beat quality of the instruments, and the advantages secured in using the illuminated dial, the former, resulting from the extreme lightness and perfect balance of the moving parts, enabling them to respond to the most rapid and



THE PHŒNIX EXHIBIT AND EDISON TOWER.

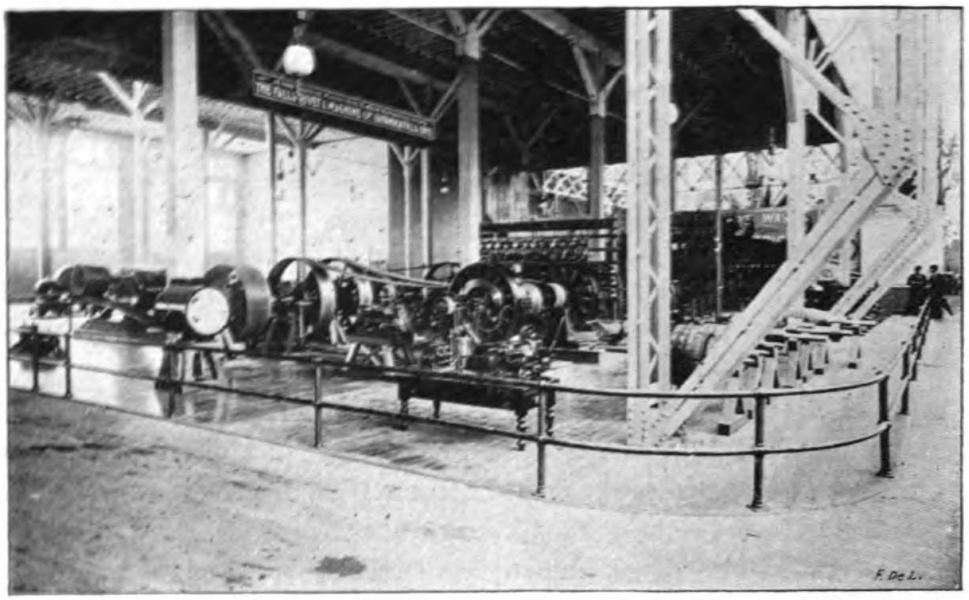
violent fluctuations in the strength of the current on the circuit, without causing undue wear, shock or injury to the pivots, bearings or other parts of the instrument; and the latter feature rendering the figures, lines and pointer distinctly visible at a considerable distance from the instrument, this effect being secured by having the reading scale made of opal glass with an incandescent lamp and a pair of mirrors properly disposed to effectively illuminate the scale uniformly from behind.

Believing that among the representatives from central stations or isolated plants who may call at this exhibit, there will be a few who may desire to see not only the working parts of the instruments but have various methods of connecting in circuit, as well as the special features, clearly explained to them, the Weston Company has fitted up a portion of the reception room for conveniently explaining and testing their various instruments, circuit terminals supplying the different currents being arranged on the wall or on the table. In this way it is expected that the observing visitor who is really interested in both the commercial as well as the scientific aspect may readily note some of the worthy features. For instance, the central station ammeter depends for its operation upon a fall of potential between two points of the circuit carrying the main current, and requires a difference of only about .03 volt to give the full scale deflection, at which time it is taking .07 of an ampère, no matter what the total capacity of the instrument may be. Giving perfect service with so slight a flow of current, and requiring only a No. 16 or a No. 12 wire to connect the instrument in circuit with the main conductor or the shunt, the excessive outlay for conductors of large sectional area and the necessary fittings requisite in attaching all other makes of ammeters to switchboards is entirely obviated. And these remarks hold good on a 10,000-ampère instrument as well as of instruments of lower range. The cost of labor, fittings and conductors required with some instruments are said to exceed the cost of the Weston instrument, a point worth looking into by the central station manager. Then there is a decided economy in the power required to operate them, which is less than .03 of one per cent of the total energy delivered to the circuit. And should the capacity of the station be enlarged, even though far beyond the range of the station indicating instruments already in place, it is only necessary to recalibrate the ammeter, since by its construction

it can be adjusted to any range. Were other than Weston instruments used a loss of the value of the old instruments and the cost of the new instruments would necessarily follow an addition to the plant. Again, these instruments are direct reading, beginning at zero; thus there is no loss of time or possibility of error arising from unnecessary calculations.

A practical everyday exhibit, showing electric lighting and power machinery substantially as it is in operation in many of the largest stations in the country, with no pretence of what may be—or what can be—done, but rather what *is* being done six days in the week, is found in the oblong section, to the left of the Bell Telephone building, above which is suspended the deep creamy hangings bearing a corporate title known wherever central station apparatus is used—the "Fort Wayne Electric Company."

Belted to Falls Rivet line-shafting erected in the center of this section are seven machines representing the latest improvements in the line of motors, alternators, generators and dynamos, running at speeds ranging from 700 to 1,650 revolutions per minute. The shafting is driven by one of the new type of Wood, 500-volt direct-current motors of 120 horse-power, occupying the southwest corner of the section, that receives its current from the Fort Wayne exhibit in Machinery hall, while in the opposite corner stands one of Wood's new type of alternators of 1,500 lights nominal capacity, the simplicity of which attracts universal attention. In decided contrast to this large machine is shown a small motor-driven alternator built as a model by Mr. Wood in 1879, awarded a gold medal in 1880, and which embodies many of the modern ideas and distinguishing features found in the latest and best types of machines. Regarding this historical exhibit, Mr. Barnes writes: "The armature is ironclad; the fields are multipolar, and cast in one piece; the speed is exceedingly slow for such a small machine (1,700 revolutions per minute). The efficiency is very high, the internal resistance from binding post to binding post being but one ohm. It is also fitted with an interlocking commutator, which is found on the most recent pattern of dynamos, and which enables it to be cross-connected, making surprising combinations. It can be made into a self-exciting alternator, a triphase alternator, and a direct-current machine. Three independent circuits, either alternating or direct, can be derived from this machine without stopping it or making any extensive changes. This machine is seen in actual

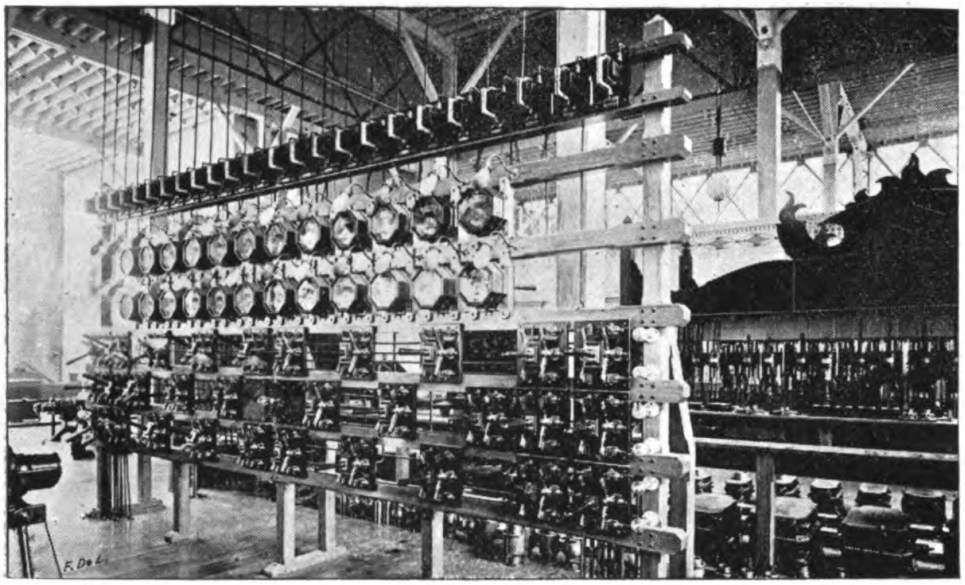


THE FORT WAYNE EXHIBIT.

operation, running an old style Fuller-Wood arc lamp, and driven by Mr. Wood's first ironclad motor, which is in itself quite an advance in dynamo designing."

Also belted to the line-shafting is an 80 horse-power Wood motor, a 1,300-light Slattery alternator, two Wood arc-light dynamos and a Wood generator or direct current incandescent lighting machine.

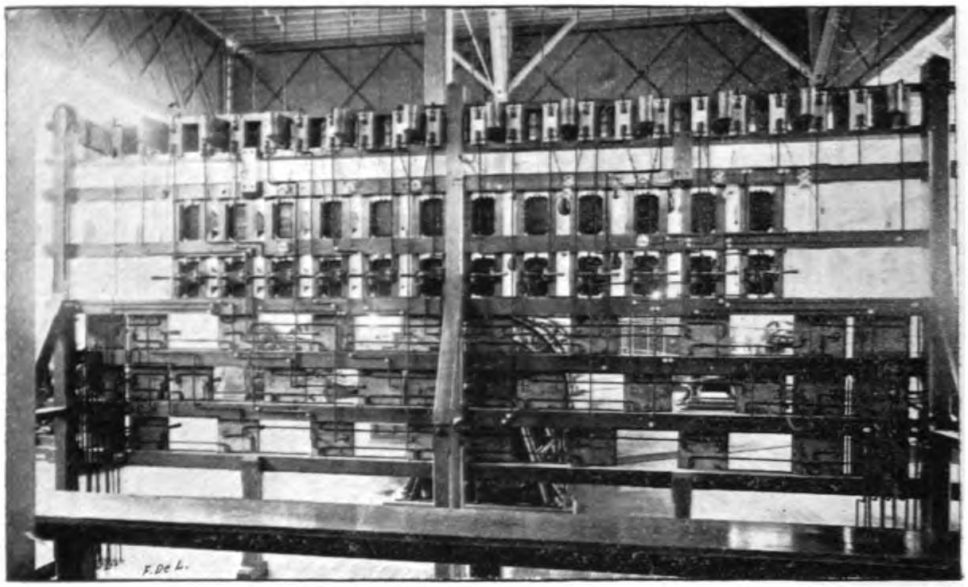
In the lamp rack are thirty-two different forms of arc lamps, including the improved type for 50-volt alternating current circuits, the new lamp for service on 220-volt and for 500-volt constant potential circuits, and Wood's standard arc lamp for constant current circuits. Also included in the exhibit of the Fort Wayne Company are all the arc lamps used in illuminating the gallery above this section and one-half the adjoining gallery, and as the lamps are placed alternately on the separate circuits to avoid the slightest possibility of darkness in the event of trouble in the supply of current from one or even two machines, the wiring is worthy of inspection, as is all the wiring in the section. On a cemented brick fireproof platform, two sets of transformers supplying four different pressures are placed and separately insulated, thus affording minute inspection; and on the shelf-like railing inclosing these transformers, parts of instruments, carbon holders, brushes, segments of commutators and other small



FRONT VIEW OF SWITCHBOARD.

apparatus has been placed for handy inspection by interested visitors, while the various sizes of armatures are ranged along the east side of the main railing.

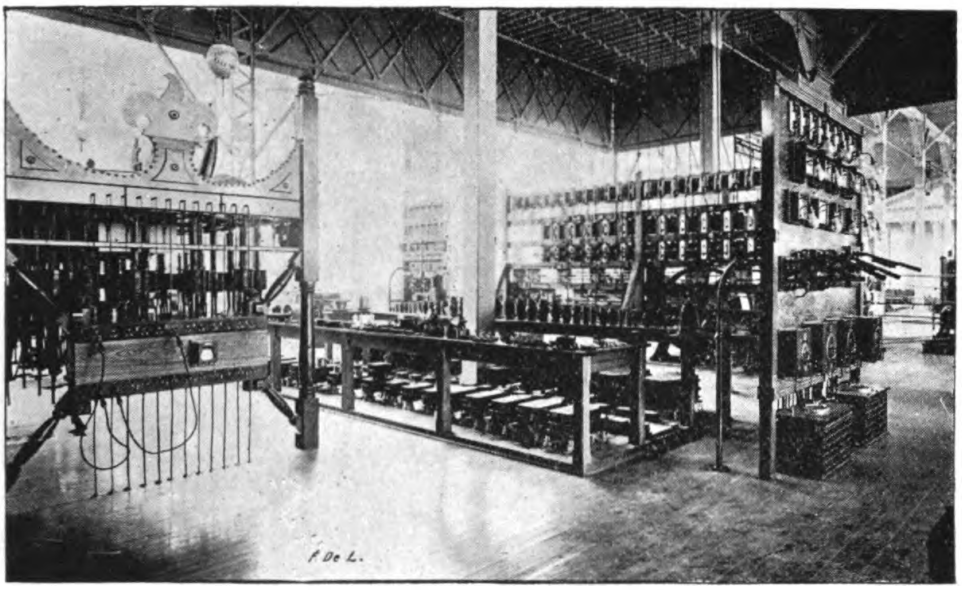
There is a handsome, open frame, ash switchboard from which the various circuits are operated, and on which are the latest improvements in controlling devices, from the sensitive voltmeters and ammeters to the big 500-volt switch, for properly distributing the output of the machines connected thereto. There are three switch boards in all, each for its special service, and on each the wiring is arranged to permit of any combination of circuits, and on the larger pilot lamps are arranged by the side of each section to show when the circuits are alive. Then there is a meter exhibit, and connected thereto are circuits extending to small lamps protruding through a canvas painting bearing at each side the seal of the states of Indiana and of Illinois, and in the center the words : " Fort Wayne Electric Company," the lamps illuminating the letters, making an attractive advertisement that clearly indicates the simplicity and economy of operation of these self-registering meters, and as each word is a load for the meter, the cutting in and out of each or any letter clearly indicates the sensitive responding of the meter to the increase or decrease of the load.



REAR VIEW OF SWITCHBOARD.

Adjoining the section is a handsome staff-covered structure containing storeroom and office, the latter furnished in keeping with so prosperous a company, and here may be found the genial representative who designed and installed the exhibit, Mr. E. A. Barnes.

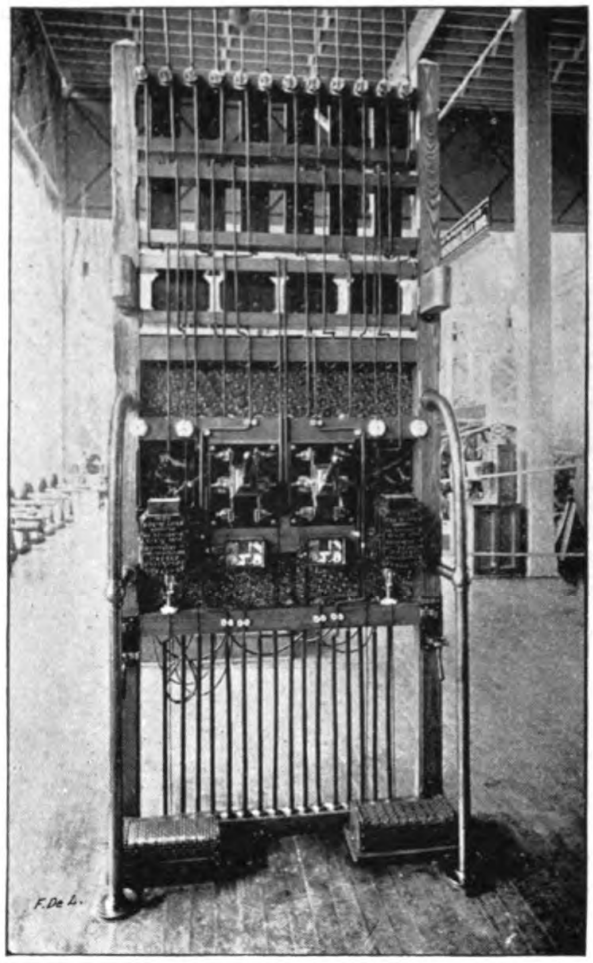
Extending along the center of this space a section of Falls Rivet line-shafting, 35 feet in length, is supported on heavy cast-iron floor stands fitted with a sufficient number of sliding bolts to make them adjustable both vertically and laterally. This shafting is made from forged iron, turned, ground and lead-capped for bearings. The latter are babbited with genuine babbit, hammered solid to the shell, bored out and scraped by hand so as to fit the shaft accurately, and being of the ball and socket ring oiling pattern, are automatically and economically lubricated at all times, a small device at each end of the bearing preventing any oil from working out along the shaft. Supported on this shafting is one cut-off coupling 30 inches in diameter with a 4-inch face, and seven friction clutch pulleys, two each 64 inches in diameter, with 13-inch face, one 60 by 12 inch, one 60 by 10 inch, one 53 by 10 inch, one 40 by 10 inch and one 40 by 8 inch. These pulleys are fitted with steel rims pressed and riveted, making them nearly forty per cent lighter than a corresponding size of cast-iron pulley. This line of shafting is driven at 365 revolutions per minute by



LAMP RACK AND TRANSFORMER STAND.

one of the new type of 500-volt Wood motors of 120 horse-power, and although there is an entire absence of solid brick or stone foundations, the only support being inferior wooden underpinning, yet there is no friction, and perfect service is secured day in and day out since the machinery was started in operation. Above the shafting a sign is suspended bearing the words: "All power transmission machinery driving this exhibit was manufactured by the Falls Rivet and Machine Company, Cuyahoga Falls, Ohio," and the name of that company has become so familiar to central station men since they installed the extensive and remarkably efficient transmission machinery "in the largest arc lighting station in the world," that they require no further introduction.

Directly in the center of the Electricity building, occupying the circle that divides the avenues leading to every entrance, stands the ivory-colored pavilion of the Phœnix Glass Company. Ever rich in its classic, quiet elegance, in the evening hours when a blaze of golden glory streams from every point, this exhibit flashes and scintillates as though adorned with the gems of the Orient. Far above its dome rears the tall, graceful column designed to typify the work of Edison, that is surmounted by a bulb ten feet in height, made of cut glass diamond-shaped prisms, close to the inner surface of which small incandescent lamps are so wired that an excellent radiating effect is secured.



COMBINATION SWITCHBOARD.

On the sides of this column some 5,000 colored incandescent bulbs of 6 candle-power are connected in circuit on a dark molding, the interlacing designs standing out prominently on the cream or old ivory color of the column, and, as a whole, forming an attraction worthy of the designer, Mr. Luther Stieringer.

The dome of the Phœnix pavilion is supported on graceful columns rising from the floor that is reached by ascending three low steps, steps that form a blessed resting place for thousands of weary sight-seers, and suspended from this ceiling by golden chains, or placed on the mirrored shelving bracketed to the Edison column that rises through the center of the pavilion, are samples of all that is latest in rich and daintily designed glass for electric and gas illumination ; not a great mass of cheap glass-ware of obsolete pattern, inartistically arranged, but selections to

PHŒNIX GLASS EXHIBIT.

indicate the latest advances in etchings and tintings, in cuttings and colorings, from the lowest-priced globe to the $200 cut-glass, pineapple design for a richly carved newel-post, and the $250 hand-painted pendant. There are delicate tints in sapphire and topaz, in cream and ruby, orange and citron, silver etchings in rococo, arabesque and empire designs, and etchings with delicate tinted edges; Venetian threads in tints; star-cut balls of the world-famed Phœnix cutting, *thirty-six* inches in diameter, said to be the largest cuttings in the world, and Phœnix diamond-cut pineapples *twenty* inches in diameter. No wonder the fair matrons linger over so attractive an exhibit and ply Mr. Fox with questions relative to the harmonizing of certain etchings or tintings with carpets and hangings of special design, for in all well appointed homes the gude-wife insists that electric and gas fixtures, shades and globes must all play their part in the general scheme of interior decoration. Thus, it is not at all surprising that Mr. Fox should book orders each week for special cuttings and etchings to be made from quaint designs that predominate in boudoir or library, in reception hall or dining-room. For the wealthy, the architects of the millionaires and the decorative specialists have found out where they can secure decorative glass so perfect that it has been likened to crystallized drops of water. The experienced traveler does not need to be told that the Phœnix

Company have gold medals galore, for he finds their handiwork in the great inns like the Auditorium, and in the business palaces, as the mighty office buildings have been termed, where only the best is tolerated. And, in this connection, it is worthy of remark that this exhibit is another visible illustration of the material benefits following the rapid utilization of electricity. For, when gas was the principal illuminant, the artist was hampered by the upward, outward flow of flame that limited the forms and shapes of globes and shades. But with the incoming of electricity, and the rapid spread of the incandescent bulb, the artists of the Phœnix Company cast aside all thought of mere utility, and crystallized their most airy fancies into gems of skilled handicraft.

In the southwestern corner of the gallery of the Electricity building the India Rubber Comb Company and the Goodyear Hard Rubber Company have a neat, compact exhibit of high grade rubber goods. From the company's title one might expect to see a display of combs and of other rubber goods best known under the title of druggists' sundries, but all of that line are shown in the Manufactures building. Herein are samples of material and completed articles of interest to the electrical fraternity, as, for instance, hard rubber sheets from two inches in thickness to one-eighth of an inch, polished so highly as to reflect the motions of passing visitors, hard rubber tubes increasing in diameter to two inches, and polished cylinders or magnet covers six inches in diameter ; rubber rod, insulating hooks, telephone transmitters, rubber battery cells with single and multiple compartments, battery plate dividers, and, in fact, nearly every standard article attractively arranged in the handsome showcase. As some of the samples are of special form, it is natural to assume that this company have a factory equipped to take care of any orders for the manufacture of specialties in hard rubber. Over in the east gallery the India Rubber Comb Company are interested in an exhibit of attraction to users of insulated wire, and which was described in the April number of this magazine, being one of the first exhibits completed. This display is that of the Chicago Electric Wire Company, of Wilmington, a view of which is shown herewith, and the neatly arranged coils of wire, from the smallest to the largest diameters, clearly demonstrate the handsome finish, the toughness and the high insulating qualities of this well-known insulation.