first time, a method for the rational design of alternating current transformers. Our knowledge of this important piece of apparatus has, up to this time, consisted in part of a precise and complete knowledge of its behavior and in part of a keen sense of propriety in design on the part of the more progressive practical electricians; but a rational method for correlating the various items in the design with a view to the production of a transformer which shall at once meet prescribed conditions in the best possible way we have not had. The method has rather been to assume (on paper) a large number of alternative designs, to calculate the action of each in detail, and to adopt that design which best meets all the requirements.

It is only fair to the practical electricians to say that Mr. Carter's results will not invalidate much, if any, of their more recent work for the reason that the old method of designing is fully adequate if enough labor is devoted to it, and this condition has been abundantly satisfied. Teachers of electrical engineering, on the other hand, may hail Mr. Carter's paper with satisfaction as affording further occasion for the application of elegant mathematics—not used in practice!

UNDERGROUND ELECTRIC CURRENTS IN NEW YORK CITY.

THERE is a serious and growing trouble with gas and water pipes, due to hurtful electrolytic action of underground electric currents, mainly from trolley lines. Mr. A. A. Kundson has recently reported to the American Institute of Electrical Engineers the results of an electrical survey of New York City and of the Brooklyn Bridge. He finds the conditions at the anchorages to be such as have been known to do serious hurt to water pipes, although, as he points out, the action upon the massive iron anchors to which the suspending cables are attached may be very slight, because of their being surrounded by concrete in which there is a certain amount of free lime and a definite lack of those chemical salts which conduce to destructive electrolytic action. The matter is, however, sufficiently serious to be taken into deliberate consideration, as it is unlikely that the anchors can withstand the present action for a long series of years.

HIGH-VOLTAGE POWER TRANSMISSION.

MR. CHAS. F. SCOTT has recently presented to the American Institute of Electrical Engineers the results of some unique tests of high voltage transmission lines. These tests have been made partly in the laboratory by Mr. Scott and partly upon the operating plant at Telluride, Colorado, by Mr. Mershon. One of the most interesting of the results is that the loss of power due to discharge between the two wires (outgoing and returning wires) begins to be excessive when the e. m. f. reaches about 50,000 to 60,000 volts. This kind of loss was one of the uncertainties which confronted the engineers who installed the now classical plant which transmitted power (at 30,000 volts) from Schaffhausen to the Electrical Exhibition at Frankfort in 1891, and these tests of Mr. Scott are the first to show just when this loss becomes considerable under practical conditions. The highest e. m. f. at present used in power transmission is 40,000 volts at the Provo plant of the Telluride Power Transmission Company in Utah, which transmits power to a distance of thirty-five miles.

W. S. F.

NOTES ON INORGANIC CHEMISTRY.

THE current number of *Nature* contains a full abstract of a paper read by Professor W. C. Roberts-Austen at the Institution of Civil Engineers on the extraction of nickel from its ores by the Mond process. This process is an entirely new departure in

metallurgical practice and also in the principles thus far applied. It depends upon the fact that nickel forms a volatile compound, $Ni(CO)_4$, by direct union with carbon monoxid, and that this compound is decomposed with deposition of metallic nickel at 180°. The compound was discovered by Dr. Ludwig Mond in course of an attempt to eliminate carbon monoxid from gases containing hydrogen. The only other metal forming similar volatile compounds with carbon monoxid is iron; hence it seemed possible to utilize the reaction for the practical separation and purification of nickel. An experimental plant was erected at Smethwick, near Birmingham, in 1892, using as a source of nickel 'Bessemerised' matte. The matte, after dead roasting, contained 35% nickel, 42% copper and 2% iron. Two-fifths of the copper was extracted by sulfuric acid and marketed as sulfate. This residue, containing 51% nickel, was then reduced by water gas, care being taken not to reduce the iron. The material was then submitted to the action of carbon monoxid in a tower at a temperature not exceeding 100°, the volatile compound being passed to the reducer, where the nickel was deposited. The carbon monoxid was circulated between the tower and the reducer for a period varying from seven to fifteen days, in which time 60% of the nickel had been removed as nickel carbonyl. The residue was then returned to the first stage of the process. The nickel was deposited in the reducer, either on thin sheets of iron or on granules of ordinary commercial nickel. The product contained 99.8% nickel. This plant is now in full working operation and over 80 tons of nickel has been extracted from different kinds of matte. The conclusion is reached that this process is well able to compete with any other process in use for the production of metallic nickel. Professor Roberts-Austen pointed out that its application to the nickel ores of Sudbury, Ontario, would probably contribute largely to the resources of the Dominion.

Continuing his researches on metallic lithium and calcium, Moissan finds that these metals are soluble in anhydrous ammonia, forming compounds more stable than those with the other alkalies. The substances are represented by the formulæ Li,NH_3 and $Ca,(NH_3)_4$, the ammonia being apparently analogous to water of crystallization. Both of these compounds take fire on coming in contact with the air at ordinary temperature.

The interesting investigations of H. N. Stokes on the compounds of phosphorus and nitrogen are continued in the November issue of the *American Chemical Journal*. It is found that on saponification, the series of chlorids $(PNCl_2)n$ gives rise to a corresponding series of acids $(PNO_2H_2)n$. The compounds where n is 3, 4, 5 and 6 have been formed, but when n is 7 the chlorid yields an acid of the formula $(PNO_2H_2)_7 + H_2O$. The constitution of these compounds is represented by a ring formula where the phosphorus and nitrogen alternate. This ring may thus contain 6, 8, 10 and 12 atoms, but when 14 atoms are present the limit is passed and the typical constitution is departed from. Applying the tension theory of von Baeyer regarding carbon atom rings, in which he finds that the most stable ring is that which contains five carbon atoms (the pentamethylene ring), Stokes finds that the phosphorus-nitrogen ring containing eight atoms would be most stable, and this is exactly borne out by the facts, $P_4N_4O_8H_8$ being the most stable of these acids. This analogy existing between the carbon rings and those of other elements is an interesting broadening of chemical theory.

The question as to the origin of petroleum continues to attract experimenters.

In his inaugural dissertation at Freiberg, Th. Lehmann finds that the distillation of fish remains under pressure gives rise to an oil which in its constituents shows a very close resemblance to petroleum, and hence the conclusion is drawn that petroleum deposits have arisen from the remains of sea animals. There is, however, in this work little advance on that of Engler. The well recognized fact that petroleum could have been formed in this way by no means proves that all petroleum has this origin, or that some or much has not been formed according to the theory of Mendeleef from the action of water upon metallic carbids in the deeper layers of the earth's crust.

J. L. H.

CURRENT NOTES ON ANTHROPOLOGY.

RUSSIAN ETHNOGRAPHY.

AN unusually interesting article is that on the ethnography of the Slavic stock, by Professor W. Z. Ripley, in the *Popular Science Monthly* for October last. He finds a remarkably uniform type of head form among the Russians due, he believes, to the uniformity of their environment. Two contrasted psychical types, however, coexist throughout the Slavic nations—the one tall, blonde, long-skulled; the other of medium stature, swarthy, broad-skulled. Which represents the primitive Slavic type? Desperate contests, in which much ink has been shed, have been fought over this point by the learned of Europe. Professor Ripley does not shout in a clarion voice with either combatant, but 'rather inclines to believe' that more can be said in favor of the latter. 'The Slaves penetrated Russia from the southwest,' driving before them a primitive people ethnically allied to the Finns, hence of north Asiatic origin.

ARGENTINE ETHNOGRAPHY.

UNDER the title *Etnografia Argentina*, Sr. Felix F. Outes has published a supplement to his work on the Querandi Indians, mentioned in these notes (October 7, 1898). He repeats and defends his opinion that they belonged to the Guaycuru stock of the Chaco. His arguments do not seem to me convincing. The Querandi proper names appear to belong to an Aucanian dialect, and when they were driven from the coast they fled to the Ranqueles, who are a known branch of the Aucanian family.

In an article in the *Bollettino della Società Geografica Italiana*, 1897, Sr. Guido Boggiani copies and describes the singular rock inscriptions at the 'Gorgo das Pedras,' not far from Corumba, State of Matto Grosso. They are alleged to be extremely ancient, the modern Indians denying knowledge of their origin or meaning. They present familiar types of aboriginal petrographs, human foot-prints, bird foot-prints and the signs for man, etc.

THE ETHNOLOGICAL SURVEY OF CANADA.

THE second report of the Committee on the Ethnological Survey of Canada, presented to the British Association last August, has been issued. It contains a brief official report of progress and an Appendix including 'Haida Stories and Beliefs,' by Professor C. Hill-Tout, and 'Customs and Habits of Earliest Settlers of Canada,' by Mr. B. Sulte. The Association now makes an appropriation for this work and it is progressing more rapidly.

Both the papers in the Appendix are valuable original contributions, though one cannot but regret to see that Professor Hill-Tout is engaged in discovering the affinities between the Salish dialects of British Columbia and the Polynesian languages. That is a step twenty years backward in linguistic science. Mr. Sulte's picture of the early settlers and their mode of life is vivid and striking.

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