Edouard Branly

The Successful Rival of Mme. Curie at the Paris Académie des Sciences

By P. F. Mottelay

EDOUARD BRANLY, who was recently elected to fill the Gernis vacancy at the French Académie des Sciences by a majority of only two votes over Mme. Curie, was born at Amiens on the 23rd of October, 1844. He made his first studies at the College of St. Quentin, and, after following a course at the Collège Henri Quatre, in Paris, was admitted at the Ecole Normale Supérieure in the last-named city. The completion of his studies had brought him a Fellowship at the French University and the degree of Doctor of Physical Science, as well as that of Doctor of Medicine. He then became Professor at the College of Bourges and subsequently was appointed Director of Physical Instruction at the Sorbonne, which post he retained up to the year 1876, when he commenced a series of lectures in Natural Philosophy at the free school for advanced students.

Professor Branly has been indefatigable in his electric researches and has made many very valuable discoveries, as will be seen by reference to the *Comptes Rendus* of the French Academy of Sciences, as well as to the different scientific publications of the time.

The results of his most important early investigations are recorded in a volume published in Paris during 1902, "Télégraphie et Téléphonie sans fil récepteur....," which naturally attracted world-wide attention, for in it he brought forth the all-necessary receiver that has proved such a factor in the development of wireless telegraphy. His discovery of electro-static phenomena in batteries, positive discharge by gases, violet rays and incandescent bodies, were no less brilliant. For his exposition of radio-conductors, the

EDOUARD BRANLY: A PIONEER IN WIRELESS TELEGRAPHY

Paris Academy of Sciences awarded him the Houleigue prize, and the International Jury of Superior Precept Instruction gave him a *grand prix*. For his remarkable work done from 1898 to 1900 in wireless investigations the French Minister of Public Instruction made him a Chevalier of the Legion of Honor, and Pope Leo XIII. invested him with the Order of Commander of St. Gregory the Great.

During the past twenty years Prof. Branly has brought forth many improvements to his previous discoveries. He has introduced among other apparatus, new radio-conductors with tempered and polished steel contacts for wireless telegraphy, new independent distributing contrivances for producing tele-mechanical effects without wires, and, some four years ago, he constructed safety apparatus independent of all syntonization to prevent the action of accidental sparks in these same tele-mechanical effects. He has also done much toward solving the problem of maintaining secrecy of communication between transmitting and receiving stations.

Of late the Professor has awakened still greater astonishment by his reported progress in tele-mechanics proper. He has shown that, without possible interference by electric atmospheric disturbances, he can start and regulate machinery, discharge artillery, operate mines, start the lamps in lighthouses, etc., by wireless, at as great a distance as 150 miles, and that a system of reflected waves will enable him to observe the resulting operations. Some of the explanatory details of this have already been disclosed in these columns.

Electrolytic Iron—Can It be Made an Industrial Product?*

By Charles F. Burgess

DURING the past five years investigations have been carried on in the chemical engineering laboratories of the University of Wisconsin, dealing with electrolytic refining of iron and its use in the production of alloys. About three tons of iron have been refined and over 1,000 alloys produced and tested. While this experimental work has been on the "test tube" or laboratory scale, it is believed that some of the results indicate the feasibility of enlargement to commercial state, and a short discussion is submitted here bearing on the question, "Can electrolytic iron be made an industrial product?"

Many old textbooks on electro-chemistry give descriptions of methods of depositing iron electrolytically, implying, therefore, that electrolytic iron is not a new product. The only use suggested, however, is for facing engraved plates used for printing. By following any of these earlier processes it is seen that only very thin layers of iron can be deposited, the coating tending to become dark, rough and powdery. It is to overcome this limitation that the work at the University of Wisconsin was undertaken, and that this has been successful, in a measure, is indicated by an iron cathode nearly 2 inches in thickness.

THE FIELD FOR ELECTROLYTIC IRON.

The manner in which electrolytic refining has revolutionized the copper industry is now an old story, and electrolysis has likewise become an industrial agent in the metallurgy of silver, gold and lead. Now, that it has been found that iron can be refined electrolytically almost as easily as copper, it is pertinent to

inquire whether there is a field of usefulness for such iron. This depends upon whether electrolytic iron has superior qualities due to purity or physical condition, and whether it can be procured at low cost.

From the standpoint of purity it must compete with some notable metallurgical developments which have resulted in product such as being made by the American Rolling Mill Company in a basic open hearth process. For this material a purity of 99.94 per cent is claimed, and justifiably so, as some of our analyses show. The electric furnace is another factor which is contributing largely to the control of the composition and purity of iron alloys, and the striking possibilities which are offered in this developing field cannot be overlooked in advocating the development of an electrolytic iron process.

The chief source of commercially pure iron has been and, perhaps, now is, the high grade Swedish and Norway iron, used largely as a base material for high grade crucible steel. The analyses of this material usually indicate a high purity, though frequently and erroneously calculated by difference, after determining carbon, sulphur, silicon, phosphorus and manganese. It is not uncommon to find oxides and slag to the extent of 2 per cent in this material, and this impurity undoubtedly may have an influence on the resulting alloys made from it.

ELECTROLYTIC IRON 99.97 PER CENT PURE.

We have found that electrolytic iron can be produced with a purity as high as 99.97 per cent, and, perhaps, even better, using extraordinary precautions. This record has been made by using the best commercial grades of pure iron as anodes. A few hundredths of 1 per cent of purity must be sacrificed in using anodes of mild steel or other less pure materials. Electrolytic refining offers a means of reducing or screening out most of the impurities commonly found

in iron and of producing a material not only of high purity, but of great uniformity. Even though it may be shown eventually that electrolytic iron may not have a higher purity than that attainable by other methods, the uniformity of its composition should make it a valuable material as a means of eliminating many of the variables with which the crucible steel maker has to contend.

Using an electrolyte containing 40 grammes of iron per liter in the form of ferrous sulphate, together with 40 grammes of ammonium chloride, it has been found possible to conduct a continuous refining operation for many months at a current density of 6 to 10 amperes per square foot of cathode surface, and at a potential difference of about 1 volt. The current efficiency is very close to 100 per cent, as it is in copper refining.

A CALCULATION OF COST.

This leads to the calculation that 1 kilowatt hour will refine 2 pounds of iron; or a cost for power of ½ cent per pound is attainable. The costs for labor, solution maintenance and fixed charges are estimated to be not greater than the power costs, making a cost of refining of about \$20 per ton. Assuming the anode material to be a mild steel costing \$35 per ton, the cost of electrolytic iron would be in the neighborhood of \$55. These approximate calculations indicate that this material might well compete in price with high grade Swedish iron.

Among the properties of electrolytic iron which may give it some added usefulness is its contents of hydrogen and the brittleness which results from this occluded gas. This hydrogen may be of some service in reducing oxides in a melt. The brittleness of the electrolytic iron before the hydrogen is driven off makes it easy to break it up into pieces suitable for introduction into the steel crucibles.

* A paper read before the Chicago section of the American Electrochemical Society.