PRODUCTION OF PHOSPHORUS AND CHLORIDES OF CARBON BY MEANS OF ELECTRIC FURNACES.

That phosphorus can be extracted from the raw and unmixed phosphate rock is demonstrated by Dr. F. J. Machalske, a chemist of Long Island City, N. Y., who has constructed for the Anglo-American Chemical Company, of same place, two electric furnaces, condensers, etc., for the manufacture of yellow phosphorus from phosphate rock, by means of the intense heat of an electric arc. Our diagram represents in section the details of the electric furnace for the production of phosphorus, and our first engraving shows two such furnaces in operation. Each furnace has a chamber, 36 inches by 12 inches in area and 18 inches high, consisting of carbon crucibles, lined with calcined magnesia and a special mixture, and covered with fire clay and red bricks and a mixture of asbestos flour and borax.

Each furnace has on top an apparatus for feeding the rock into the chamber; an apparatus for holding an electrode 8 feet long and 4 inches in diameter.

The bottom and top electrodes are connected with numerous special electrical appliances, and by means of six cables, each 1,500,000 C. M., with two large transformers, as shown in our engraving, which are made by Wagner's Electric Manufacturing Company, and are similar to those furnished by this company for the calcium-carbide plant at Niagara Falls, N. Y. Each transformer is of 2,000 amperes capacity, and provided with a double-pole double-throw switch, and an apparatus for regulating the electric arc and heat in the furnace at 32 steps, ranging from 30 volts by 4,000 amperes to 120 volts by 1,000 amperes, alternating current.

Current for the plant is furnished from the circuits of the New York and Queens Electric Light and Power Company of Long Island City. When the current is turned on, in five minutes a temperature of about 7,000 deg. is produced, which smelts in fifteen minutes 150 pounds of Tennessee phosphate rock, consisting chiefly of calcium phosphate, which is split up into its component parts, setting free vapors of phosphorus, which are condensed under water, and the residual slag, being in a very hot, sirupy state, is allowed to run off as shown in our engraving.

The extraction of phosphorus is, so to speak, a complete one, as the residue of phosphorus in the slag does not exceed one per cent. The operation is a continuous one, and the arc can be drawn to 15 inches. The condensed vapors of phosphorus collect in condenser mostly in the shape of dark yellow colored cork shavings, which, after being taken out of the condensers and treated with sodium-hypobromide, as same possesses the property of reducing the red phosphorus and removing the impurities, without affecting yellow phosphorus, are shaped, in usual manner, into nearly white, glassy and transparent sticks.

It is claimed that yellow phosphorus may be produced by this method at a rate of seven cents per pound, inclusive of the cost of electric power at three cents per horse power hour, and phosphorus produced at such a rate is a very cheap raw material for the production of phosphoric acid. The production of chlorides of carbon by means of electric furnaces has been the subject of experiments by Dr. F. J. Machalske, and it is stated that by treating in such a furnace a mixture composed of salt, carbon, and sand, and condensing the vapors, there is obtained a colorless liquid of pleasant odor, specific gravity 1.6, and boiling point at 172 deg. F. It may be solidified at 9 deg. F. This liquid is carbon tetrachloride, much heavier than water, uninflammable, and possessing higher grease-dissolving properties than those of naphtha; and as it can be produced at a low cost, it is expected that carbon tetrachloride will find an extensive application in the extraction of oils, greases, etc.

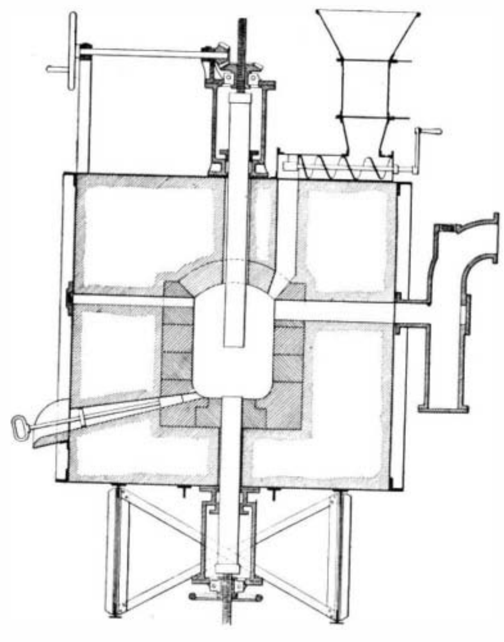
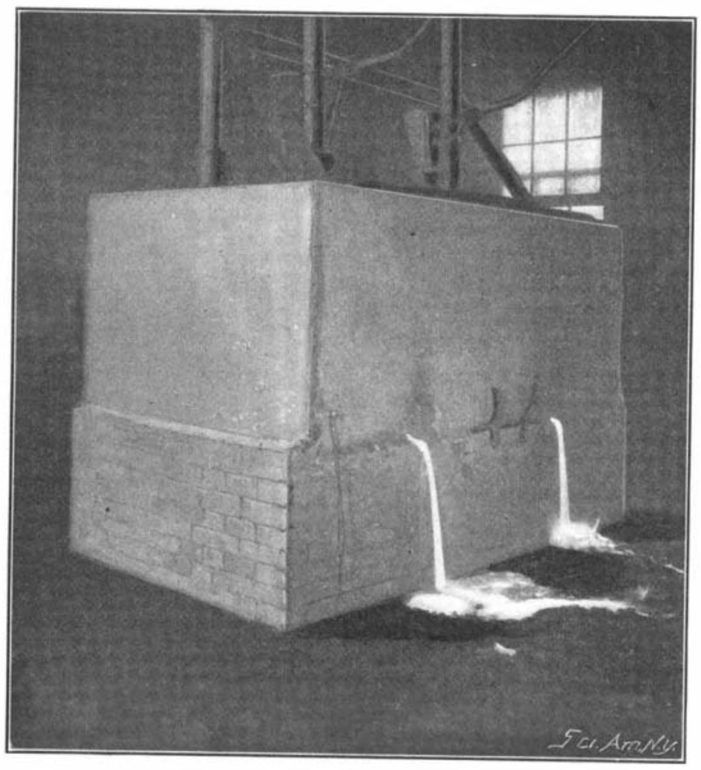


DIAGRAM OF ELECTRIC FURNACE.

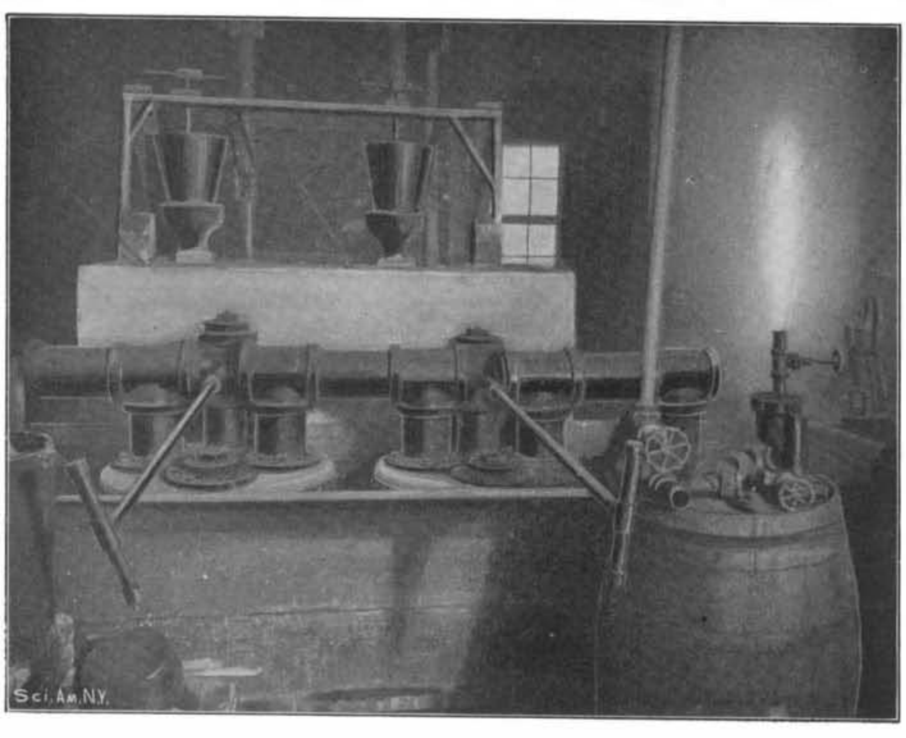
Recent Experiments on the Passive State of Metals.

The passive state of metals is the subject of an interesting paper read by Prof. Hittorf before the German Electro-Chemical Society at its recent meeting in Zurich. It is known that some of the metals, especially iron, assume in some cases an inactive state in which they acquire singular properties, and remain unattacked by many reagents which are usually capable of combining with them. The author wishes to show that this passive state is not due to a thin layer of oxide upon the surface, as has been commonly supposed heretofore. He carries on a series of parallel experiments with iron and chromium, owing to the close analogy of the two metals. A striking example of the passive state is found when one of the metals forms the anode in a certain electrolyte, when the electromotive force set up at first quickly diminishes and as the metal assumes the passive state is reduced almost to zero, coming back to its former value when the circuit is opened. In a series of experiments, Prof. Hittorf forms a chromium-platinum couple, the chromium being surrounded by a solution of sodium chloride or nitrate, and the platinum by a depolarizer of dissolved chromic acid. Under these conditions, the electromotive force diminishes more quickly as the current is stronger—that is, when the resistance of the circuit is less. In the case of iron, like results are obtained, but not with the halogen salts (except the cyanides); by putting in circuit a galvanometer of small resistance, the deviation becomes smaller, and is finally almost zero, but upon opening the circuit the electromotive force increases, and at the end of half an hour it returns to its former value. The iron retains all the while its metallic luster, and its weight is invariable. If left on short circuit for a long time, even for days, the iron still remains bright and unattacked; in this case the return to the normal is slower. This action is found, in the case of iron, with nitrates, chromates, acetates, etc., but not with sulphates. It will be noted that the metal returns spontaneously to the active state, and this fact cannot be reconciled to the formation of a layer of oxide, for the latter being insoluble and not volatile, the passive state should continue. The experimenter shows, besides, that iron oxidized by heat is not really in the passive state, as it gives, under the above conditions, about the same electromotive force at first as the polished metal. It is found that analogous metals, nickel and cobalt, also assume the passive state, but the action is less marked. Prof Hittorf intends shortly to publish a series of interesting results obtained with silver, lead, etc. If silver is taken as an anode in a sulphate of soda solution, upon closing the circuit there is at first produced a cloud due to the formation of sulphate of silver; this formation diminishes, and then ceases altogether. If the silver is now removed to another place free from the cloud, it is remarkable that it ceases to form any more sulphate, but after a time becomes black, and by combining with oxygen forms peroxide; after the silver is covered with the peroxide, the oxygen forms bubbles upon the surface. Lead has an analogous action in a solution of sulphuric acid.

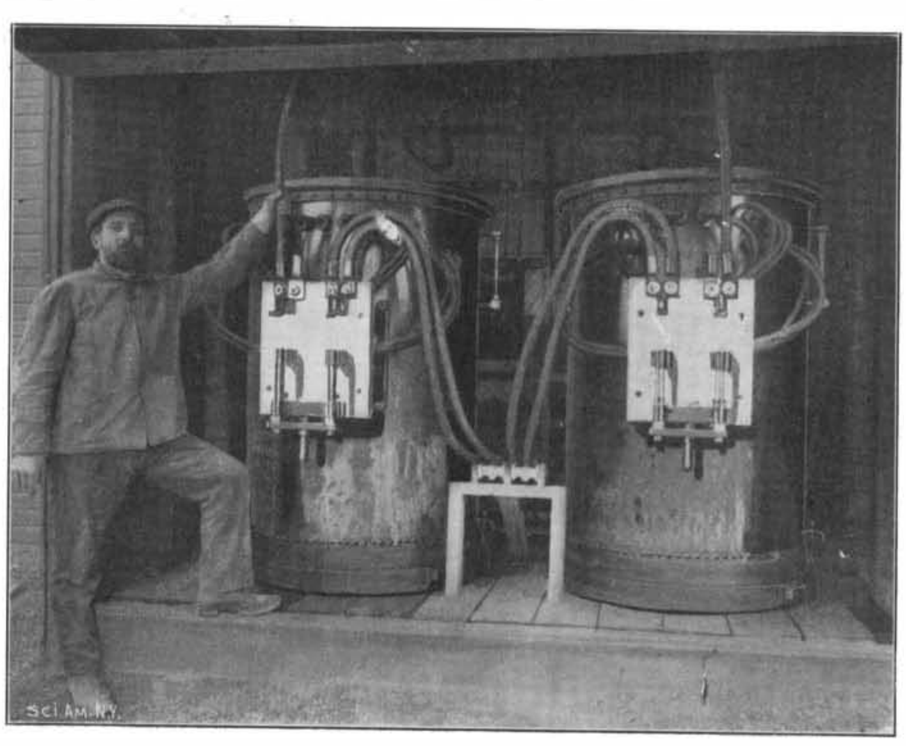


FURNACES BEING DISCHARGED AFTER EXTRACTION OF PHOSPHORUS.

The Philippine Commission has amended the Harbor bill by appropriating an additional $1,000,000 immediately, subject to the approval of the Governor General. This amount is to be used for the extension of the breakwater and the dredging of the inner harbor to a depth of 30 feet, which will admit of the deepest ships coming right up to the bulkheads. The appropriation also provides for the deepening of the Pasig River to a depth of 18 feet. The bill of the Commission also authorizes the Chief Engineer to accept additional contracts amounting to about $2,000,000 in anticipation of appropriations by the American Congress for various improvements.



TWO ELECTRIC FURNACES IN OPERATION.



THE TRANSFORMERS AND SWITCHES.