Calcium.

M. Moissan, of the University of Paris, who has been successful in the extraction of the rare metals in the electrolytic furnace, has recently undertaken a series of experiments with the metal calcium, which, although abundantly distributed in nature in the state of carbonate, sulphate, etc., has not up to the present time been prepared in any considerable quantity in the pure state. It will be remembered that at the commencement of the century Sir Humphry Davy was the first to establish the existence in lime of a metallic body, and by decomposing it by an electric current in the presence of mercury he obtained an amalgam of the metal calcium. Later on, in 1855, Matthiessen electrolyzed a mixture of chloride of calcium and chloride of strontium, and thus obtained small globules of calcium having a yellow color. A few years later Jobin prepared the metal by a purely chemical process, causing the metal sodium to react upon iodide of calcium in fusion contained in an iron crucible; however, the quantity of metal obtained was small, 300 grammes of iodide giving but 6 to 8 grammes of calcium globules. After other experiments, scarcely more advantageous, M. Moissan has been the first to obtain a relatively considerable weight of the metal. He employs two methods; in the first, which is purely chemical, he utilizes the property which calcium possesses of dissolving in liquid sodium at a dull red heat. In an iron crucible of one liter capacity are placed 600 grammes of anhydrous iodide of calcium, together with 240 grammes of sodium. The whole is heated to dull redness, at which temperature the sodium unites with the iodine of the iodide of calcium, and the calcium set free dissolves in liquid sodium, which is in excess. Upon cooling it crystallizes in the middle of the mass of sodium, and by proper separation one may obtain brilliant hexagonal crystals of pure calcium. The amount of the latter is equal to 50 per cent of the theoretical weight contained in the iodide, and 40 grammes have been obtained at a single operation.

The second process employed by M. Moissan consists in the electrolysis of iodide of calcium in fusion at a dull red heat. A cylinder of pure nickel is used for the negative electrode, and for the positive a rod of graphite. The calcium thus prepared has been examined as to its physical and chemical properties. Among its physical properties may be mentioned the following: it may be melted in vacuo at a temperature of 760° C. and then appears as a brilliant liquid. After cooling, the metal is rather soft and may be cut with a knife. It may be broken by striking it, and the fracture presents a crystalline structure. Its surface, when it has not been attacked by gases, is of a clear white color, approaching that of silver. Its density is 1·85.

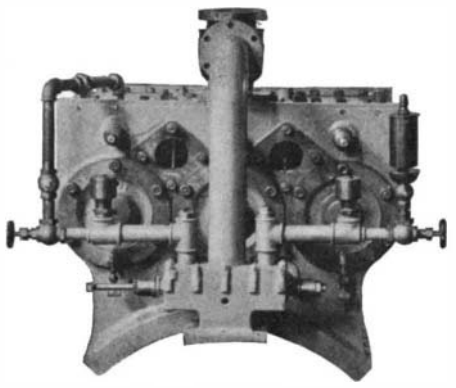
As to its chemical properties, calcium when brought to redness unites with hydrogen, forming a crystalline hydride; it combines with chlorine at 400° C., and with bromine and iodine at a dull red heat. In oxygen the metal, when raised to 300° C., gives a brilliant combustion. It decomposes water at the ordinary temperature, and also decomposes sulphurous acid gas with incandescence. When heated in carbonic acid gas, it becomes covered with a deposit of carbon. Calcium combines with sulphur at 400° C., and burns with incandescence in the vapor of phosphorus. It unites with carbon in the state of lamp black below redness, and produces calcium carbide. Calcium when cold does not unite with nitrogen, but when heated in that gas it absorbs it slowly, and the metal, at first brilliant, assumes a yellow color. This explains why the alloys of calcium, which up to this time were regarded as the pure metal, were all more or less yellow, this color being due to the nitride. The latter compound is obtained in transparent crystals of a yellow-brown color, melting at 1200° C.

SOME Greek divers have recently discovered a treasure-ship which was sunk near Chios, where, in 1770, the Turkish fleet was totally destroyed and the Russian flagship was sunk. The latter was found thirty fathoms deep, and over $60,000 in gold and silver has been obtained from the hold of the flagship.

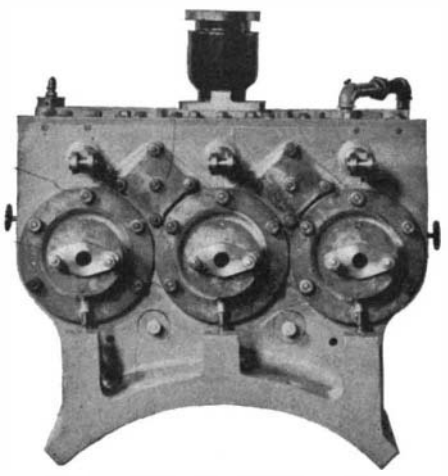
A HUGE OVERLAND TRACTION ENGINE.

One of the largest traction engines ever built was recently completed by the O. S. Kelly Company, of Springfield, Ohio, and shipped to Cuba, where it has been used with considerable success on one of the largest sugar plantations.

The engine is essentially a triple-cylinder geared locomotive with enormous drive wheels, especially adapted to the roads over which they are to travel. The three cylinders with their valve-chests form a single large casting placed on the forward end of the boiler. Steam passes directly from the boiler to the central steam-chest and thence to the outside chests. The engine has a three-throw crank-shaft with cranks 120 degrees apart, fitted with three pairs of eccentrics. As the point of cut-off is carried late enough always to insure admission of steam to two pistons, heavy loads are easily started. The boilers are of the locomotive type with grate surfaces varying from 9 to 12 square feet. The boiler pressure is 180 pounds per square inch. The engine gives a continuous tractive force of 12,000 pounds at the wheel rim, moving at a rate of 330 feet per minute; the horse power developed is therefore 120.



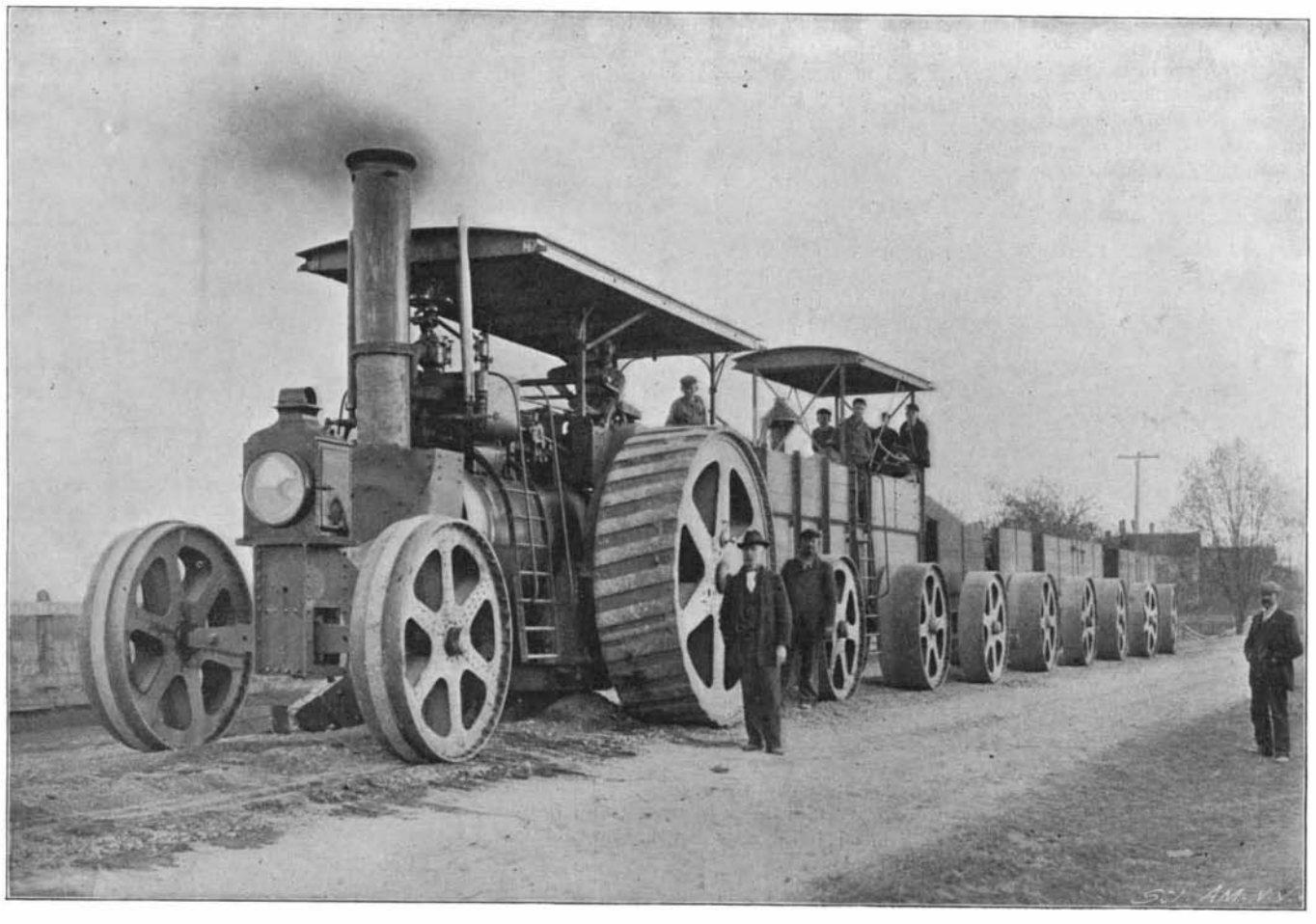
FRONT VIEW OF CYLINDERS.



REAR VIEW OF CYLINDERS.

The drive-wheels are eight feet in diameter and are built up from center castings to which side sheets are riveted. The steel plate tires are provided with cleats four inches wide and two inches thick, extending completely across the face at such an angle and distance apart as to insure the complete bedding of one cleat on each wheel before the preceding cleat has left the ground. The front wheels are five feet in diameter, and are similarly constructed. Steering is effected by the usual hand-wheel, worm, and shaft, fitted with chains secured to the front axle.

By the use of steam traction-engines pulling wagons adapted to the kind of freight which they are to contain, not only may large loads be readily transported, but an economy is effected even in countries where beasts of burden are cheap and easily obtained. With a grade not exceeding five per cent, a load of thirty tons exclusive of engines and wagons can be hauled thirty miles per day. Over dry, natural soil, even 112 tons have been hauled. The engines are adapted to haul freight from plantations and from mines so remote from railways that the transportation of low-grade ores becomes unprofitable.



THE TRACTION ENGINE AND ITS LOAD UNDER WAY.

Hardening Articles of Plaster of Paris.

A German patent has been granted for the treatment of articles of plaster of Paris with an aqueous solution of ammonium borate, for the purpose of hardening them and rendering them insoluble in water. A simple and efficient process for accomplishing this object would be highly desirable, as it would serve to greatly prolong the life of plaster casts, which being quite soft and not entirely insoluble, sooner or later become superficially defaced, and washing specially wears down the outlines of the object.

The process above referred to is said to give results decidedly superior to anything that has heretofore been proposed. The hardening liquid may either be mingled with the plaster in the act of moulding or may be applied on the surface of the finished casts with a brush.

The solution is prepared by dissolving boracic acid in warm water and adding thereto sufficient ammonia to form the borate which remains in the solution.

The manner of using the solution is thus described: The saturation of the gypsum or painting of the plaster of Paris is carried out in the cold. The objects are subsequently rinsed off and dried. The surface becomes very hard after two days and insoluble in water, while the induration in the interior advances more slowly. By means of the fluid described, gypsum floors can be hardened and rendered more durable and impervious to the influence of the weather. Saturating with ammonium borate is said to be epecially useful on exterior walls of buildings, barracks, etc.; on the latter, because experiments have proved an antiseptic action of the liquid.—Journal of Franklin Institute.

A Southern Exposition.

A Southern Exposition will be held in the Grand Central Palace, New York city, October 31 to November 25, 1899. Its aim will be to display the commercial resources of the Southern States and to show the use which has been made of them. It is believed that the exposition will be of vast benefit in attracting capital to the Southern States, where there are great opportunities for investment. The present is a particularly auspicious time for the display of Southern products in the North, owing to the new era of good feeling, and a warm reception is assured to the Southern visitors. The mineral wealth of the South will be suitably illustrated, and also its industries. Col. John J. Garnett is the Director of the Exposition, and the advisory committee includes prominent men.