the latter also shows clearly whether the material is of the same texture throughout, and whether it may therefore be expected to wear equally.

At the meeting of the British Association held at Bath, in 1864, attention was directed by Mr. Sorby to a refinement of the acid test; this consisted in the application of microscopic photography to the corroded surface. Mr. Sorby exhibited a series of photographs, taken by Mr. Hoole, of Sheffield, from various samples of iron and steel which had had their surfaces polished and then acted upon by dilute acid in the manner we have described. The photographs were taken direct from the microscope, and were largely magnified. In the meteoric iron the crystaline nature of the material was clearly exhibited, and in the gray pig crystals of graphitic carbon were shown shooting through the mottled surface of the metal, while in refined cast-iron long lines of hard parts were to be seen arranged in layers. Slightly-hammered bloom showed a confused mixture of iron and slag; Bowling bar-iron, a compact texture, the slag being driven off; and Swedish iron a still closer grain, more resembling steel. The different steels also presented entirely different appearances, the difference between blister and cast-steel being strongly marked. Altogether, it appears that the acid test is an extremely useful one, particularly when assisted by microscopic examination, while the system of taking magnified photographs, as suggested by Mr. Sorby, affords an excellent means of registering the results obtained.—*Mechanics Magazine.*

Separating Phosphorus from Metals.

It is well known that phosphorus is a substance which prevents the production of pure qualities of iron and other metals, and all attempts to remove the same have hitherto failed. Mr. Carl H. L. Wintzer, of Hanover, has found that chlorine gas and chloride of calcium are adapted to obtain the desired result. Chlorine gas, as a simple element, does not decompose, and chloride of calcium is the only combination thereof which, at the different degrees of temperature which occur in practical metallurgy, neither volatilizes nor decomposes unless another agent be introduced. Other known combinations of chlorine, as chloride of magnesium decompose even at the boiling point of water; chloride of sodium becomes volatile at a comparatively low temperature.

Mr. Wintzer therefore employs chlorine gas and chloride of calcium for the removal of phosphorus, in processes of melting ores and in the treatment of metallurgical products. He makes use of this gas and the salt in blast furnaces, as well as in the process of puddling, refining, and recasting, and in any kind of furnace and in all processes of melting, applying the gas direct or adding the prepared salt (chloride of calcium) in any convenient form; or employing solutions containing muriatic acid, with the simultaneous use of lime or calcareous substances, by which process chloride of calcium is formed at the moment of its application. Through the effect of chlorine gas and chloride of calcium on phosphatic ores and metals, volatile combinations of phosphorus are formed and thereby the phosphorus is removed. The process is as follows:—In smelting an ore of iron or other metal containing phosphorus as an impurity, the operator charges into the smelting furnace with the ore, chloride of calcium in the proportion of from five to twenty-five parts by weight for each part of phosphorus found by analysis to be contained in the ore, and in other respects the smelting operation is conducted in the ordinary manner. The resulting metal will be found much more free from phosphorus than if the ore had been smelted without the addition of chloride of calcium. In place of adding the chloride of calcium direct, lime and muriatic acid may be mixed separately with the ore, or may be otherwise applied in combination. It is more convenient, however, to employ chloride of calcium ready formed. Or, in place of employing chloride of calcium, chlorine gas may be used; the gas may be mixed with air and forced as a blast through the ignited chargo in the furnace, or the gas itself may be blown through the melted metal after it is tapped out of the furnace. The quantity of chlorine thus applied should be from three to fifteen times the weight of the phosphorus contained in the ore or metal. Chloride of calcium or chlorine may be applied in a similiar manner when remelting iron or other metals, when it is desired to separate phosphorus therefrom. Phosphorus can thus be separated from all metals to which a strong red heat can conveniently be applied; more especially, however, is it more applicable to the treatment of iron and copper.—*Mechanics' Magazine.*

Punched Tubes and Gun Barrels.

The manufacture of punched steel tubes and gun-barrels by Messrs. Deakin & Johnson's process, is likely to become a most important industry. The principal gun-barrel makers of Birmingham are now advertising that they are prepared to make fifteen thousand of these gun barrels weekly, and Messers. John Brown & Co., of Sheffield, have nearly completed the erection of very heavy machinery for rolling the tubes, after punching, into barrels and jackets, for 7-inch rifled cannon. It is but a short time since even the most enterprising steel masters believed it to be impossible to punch a 10-inch hole down through an ingot two feet six inches in diameter and four feet high; yet this has already been accomplished, while, as for gun barrels, a single tube, of dimensions sufficient for the manufacture of four regulation barrels, is punched almost at a blow. The material employed is Bessemer steel, and it is indeed a question whether any other steel would permit of this mode of manufacture. With the least imperfection of the ingot, it cracks open or flies to peices under the punch, and thus only perfect material can pass. As to the endurance of barrels made by this process, one test made at Birmingham, some time since, showed that a barrel of the Enfield pattern, punched from Bessemer steel, withstood, without injury, single charges of sixteen drams of powder and twenty-five Enfield bullets. The latter were forced into a continuous bar of solid lead when fired yet the bore of the barrel remained intact.

The best gun barrels are now made of Marshall's iron, which is sold in skelps about 8 inches long, 5½ wide, and ⅝-inch thick, at, we believe £28 per ton. Bored and ground and with the "lump"