FIRE CLAY MANUFACTURES.

In smelting iron, and several other metals, it would be impossible to conduct the operations unless we were in possession of some substance which will withstand a very high degree of heat without becoming fused. In fire clay we have such a substance, and upon it, when formed into bricks, several of the arts are completely dependent. Although fire bricks are common and well known, we have hitherto found it very difficult to find accurate information respecting their manufacture. At last, however, we have something reliable on the subject, published in the London *Engineer*, in the form of a paper lately read before the Society of Engineers, by H. W. Stephenson. Condensed extracts of this essay will be of interest to many of our readers, as fire clay is found in various parts of our country, while the manufacture of bricks and other articles usually made of this substance is carried on in very few places, and the method of making them is understood by a very limited number of persons.

DEPOSITS AND PROPERTIES.

Among the various deposits which have succeeded the formation of the primitive rocks upon the surface of the globe, there are certain earthy strata of very considerable extent, composed chiefly of silica and alumina, partly in combination, and partly in mere mechanical mixture with other less essential ingredients. These strata are characterized by the very minute state of division of their particles, and their want of firm connection or solidity. It is to their peculiar structure that the most valuable property of clay must be ascribed—that is, its plasticity, or the property of forming dough with water, sufficiently soft to take the most delicate impression from a mold, and so deficient in elasticity that even the slightest indentation is lasting and persistent. Although the clays may be reviewed in general as the remains of certain rocks which have been decomposed by various agents, chiefly atmospheric, which have, in a word, been weathered; yet there are few cases in which the production of clay has occurred in the immediate locality of the rock whence it is derived, and in such a simple manner as to enable its origin to be traced in all particulars, and established indubitably by chemical facts. The most prominent physical properties of clay are its plasticity and behavior when exposed to heat. Exposed to the most intense heat that can be artificially produced, clay refuses to become liquid, and acquires at most a slight degree of flexibility. Its particles then cohere so strongly together that the burnt mass is hard and sonorous. The ingredients which most affect the quality of the clay are sand, iron, lime and magnesia. The plasticity of clay diminishes with the amount of any one of these substances which it contains. The quality is affected in the most marked manner by sand, somewhat less by lime, and very little by oxyd of iron. When clay contains iron and lime the action of heat upon it is very different: the silica, alumina, lime, and iron then form together a mixture similar to that employed in the manufacture of bottle glass, which melts in the fire with more or less ease, according as it contains much or little of the two latter ingredients. Magnesia exerts less influence upon the character of the clay; the more quartz and silica enter into the composition of the clay, the more difficult is it to fuse. Fire clay is commonly found in the coal measures, at a great depth from the surface, but it not unfrequently happens that it lies on the top. Its thickness varies according to circumstances, in some places 3 feet, and in others reduced to 18 inches. As a rule it is very strong and hard, and cannot be worked to advantage without the aid of gunpowder.

TREATMENT OF THE CLAY.

The clay on being raised to the surface is laid out in long parallel heaps, say 20 feet high, being 20 feet wide at the bottom, and tapering to 5 feet at the top. A series of ridges is thus formed, purposely, however, in order to collect as much rain as possible, which, combined with the direct action of the atmosphere, soon reduces that which was at one time hard and retentive, to a soft, comparatively plastic state. Difference of opinion exists among manufacturers as to the policy of adopting this system, inasmuch as to carry it out fully a very large capital is necessary, and which for the time being lies dormant. The sole advantages accruing in keeping so large a stock is, that it is more easily pulverized and reduced to power, thereby causing a considerable saving in engine power, labor and expense. To carry out this method to its fullest extent no clay ought to be used until it has been exposed to the action of the elements for at least two years. It might not be always convenient to lay out so much capital in dead stock. After the clay is brought to the worksthe first process is that of grinding—the most approved plan is that of two large stones, 10 feet in diameter, and 20 inches wide, hooped all round with iron, and revolving slowly on a cast iron pan, or bed-plate, which in some works is also made to revolve very slowly the contrary way to the stones. The rough clay from the pit being conveniently placed for the workman, is cast under the edge stones, when it is ground to a coarse powder, which falls through an open grating in the center of the bed-plate, whence it is lifted in the sifting cylinder by an endless chain of buckets. The clay, as it passes down the cylinder, is separated into two parcels, the coarse, or that which is too large to admit of its being passed through the meshes of the cylinder, is returned by a long wooden spout to the mill, where it a second time is ground, whilst the fine particles are received into an endless belt composed of glazed sack cloth, and conveyed into the mixing pan, or pug mill. Up till within the last few years the process of pugging was performed entirely by the feet. The pug mill consists of an upright cylindrical vessel about ten feet high and two feet in diameter; a vertical shaft with horizontal arms works in the axis of this cylinder; the clay is put in at the top, mixed with water, and in due time passes to an aperture at the bottom from which it is taken out. Some manufacturers prefer allowing the pugged clay to lie and *sweat* for a few days in a dark place, thereby giving greater case and facility in working, the clay being rendered of a more plastic nature by the delay. Others remove it immediately from the pug mill to be molded into bricks, retorts, &c.

MOLDS.

Brick molds are made in a variety of ways, some of brass cast in four pieces and rivetted together, others of sheet iron cased with wood in the two longest sides. Iron molds are sanded but not rivetted. Brass, or, as they are technically called, copper molds, are an improvement on the iron, as they are better than the iron. They require neither sanding nor wetting, and do not rust. They, however, are expensive, and do not last long, as the edges become worn down so fast that the bricks made from the same mold at the beginning and end of the year are of different thicknesses, and cannot be used together. This is a great defect, and a metal mold which will not rust nor wearis still a great desideratum. It is essential that the sides of the mold should be sufficiently stiff not to spring when the clay is dashed into it, and it is equally requisite that it should not be made too heavy, or the molder would not be able to work it with ease and facility. The cost of molding bricks by hand is small in proportion to the total cost. The workman is supplied with a stock of clay (from the pug mill) by his side, a table or bench before him, and two boys or helpers. The mold (brass) is larger in proportion to the finished brick, owing to the contraction of the clay in drying and burning; this, of course, varies under different circumstances, the tougher and finer the clay the greater the contraction, and *vice versa;* in general, one inch to the foot is the calculation for contraction, and the molds must be made accordingly. The usual form of a brick is a parallelopipedon, about 9 inches long, 4½ inches broad, and 2½ inches thick, the exact size varying with the contraction of the clay. The mold itself only makes the four narrow sides of the brick, the one broad surface being produced by the table which supports the mold, the other by a straight piece of wood, with which the workman removes away the excess of clay, by drawing it straight along the upper edge of the mold. To prevent the clay adhering to the mold, it is from time to time damped with water, whichcauses the molded brick to separate from the mold withoutbending or loss of time. The molded bricks are taken away and empty molds brought back to the molder by boys. The bricks are placed in long rows edgeways on the dry flats, a space equal to the thickness of the board, say ¼ of an inch being left between each brick, in order to give vent to the steam generated in drying. The drying sheds or flats consist of long floors, say 90 feet by 30 feet, with flues running the whole extent of the building. It is desirable not to have the length of these flues more than 20 feet, in order to ensure a good draught without any additional coals being used. In most manufactories these drying flats are so constructed that there is ample room for accommodation for two days' work; in this case the molders are never stopped, and are not required to remove their tables or benches from place to place. From thirty-six to forty-eight hours is calculated quite sufficient for drying bricks; so that while the molder and his boys are depositing bricks on one part of the flat a gang of men and boys are engaged in clearing away the bricks from another part. The number of bricks which a workman can mold in a day of ten hours is always very considerable, but depends very much upon the ability and strength of the moulder. With clay in good order a skilled workman can make 2,000 to 2,500 marketable bricks in a day; thus, taking 2,000 bricks as a fair average day's work. Three kinds of machines are used to a limited extent in fire-brick making. One class operate in a manner similar to hand moulding; another have rotary molds, while a third class roll out the clay in a continuous strip which is cut off into the lengths of common bricks. American brick machines are suitable for molding fire clay.

KILNS.

After the molded bricks have been allowed to remain in the sheds until they are uniformly dry, and have become sufficiently hard for burning, they are built up in kilns. The drying operation requires care and attention, so as to allow each brick to be dried equally in all parts. Bricks are burned in a variety of ways. In Staffordshire, cupolas or circular kilns are used. They are arched over the top like domes. The fire holes are openings left in the wall, and these are protected from the wind by a low wall built outside, with a space for the firemen inside. In the Newcastle district, the rectangular kiln is the most common. It is formed of four walls, inclosing a rectangular space, with a narrow doorway at one end, in which end there are also arched openings for firing. The usual method of placing bricks in the kiln is to cross them, leaving spaces for the passage of the heat. When the kilns are first lighted, the heat is raised very gradually, so as to drive off the moisture gently. When steam cease to arise, it is a sign that the water has all been driven off. The fires are now increased, and the heat raised to a high degree. As the heat becomes intensified through the kiln, the fire holes are covered with iron doors to check the draft. When the firing is completed, the fire openings are plastered up with clay, and the fires are permitted to die out gradually. The quality of the bricks will be injured if the kiln is opened before they become perfectly cool. Under ordinary circumstances, a kiln containing 12,000 bricks requires about five days to complete the burning process, and about 15 tuns of coal are necessary for this purpose. It is difficult to tell what degree of heat is required in burning such brick; this is left to the practical skill of the person who has charge of the kiln. There are various kinds of fire clay, and it requires experiment to determine the quality of each. It should be infusible in the fire, and not subject to crack and fly in pieces. The great refractory element in it is silica—pure sand. An excellent clay consists of silica 71.28; alumina, 17.75; oxyd of iron, 2.43; lime and magnesia, 2.30; water and organic matter, 6.94.

WHAT IS TREASON?—Judge Betts of the United States Circuit Court delivered, April 24th, an important charge to the Grand Jury on the law of treason and piracy. He defines treason to include acts of building, manning, or in any way fitting out or victualing vessels to aid the enemy; sending provisions, arms, or other supplies to them; and raising funds or obtaining credit for them. Any person cognizant of such acts who does not promptly inform the authorities is guilty of misprision of treason, the punishment for which is seven years imprisonment and a fine of $1,000.

THE Tenth Company of the Massachusetts Eighth regiment, under Captain Briggs, made a bold *coup* on Friday night. They started for Baltimore in a steamtug, cut out the receiving ship *Alleghany*, lying in the harbor, and anchored her safely under the sheltering guns of Fort McHenry.