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NOTES ON FAIENCE AND ITS MANUFACTURE.

No. III.

In our last issue we gave a brief history of faience ware. The present article treats on enameling and baking.

Faience must be baked twice: the body must first receive the necessary hardness, then, after the enamel has been applied to it, it must be baked again to vitrify the coating. These two operations may be carried on either together or separately in the same oven. An oven suitable for accomplishing either purpose alone is represented in Fig. 1. Fig. 5 shows an oven for carrying on both operations together. It is divided into two compartments, the upper one of which, being the hottest, is used for the first operation, while the enameling is done in the lower compartment. There are two fires, A and B, situated on opposite sides of the oven. Fig. 4 illustrates the position of the articles in the oven. They are placed on plates of unenameled faience or "biscuit," supported by pillars of the same material. The success of the operation depends greatly upon an exact regulation of heat. In this respect experience is the only guide. To observe the progress of the operation, cups formed of the same material, enameled and bare, are placed into a special compartment, easy of access, and heated to the same degree as the main portion of the oven. From their condition the progress of the operation may be observed. An oven large enough for about a gross of ordinary pottery consumes about seven cubic yards of wood during one operation, which lasts about 36 hours.

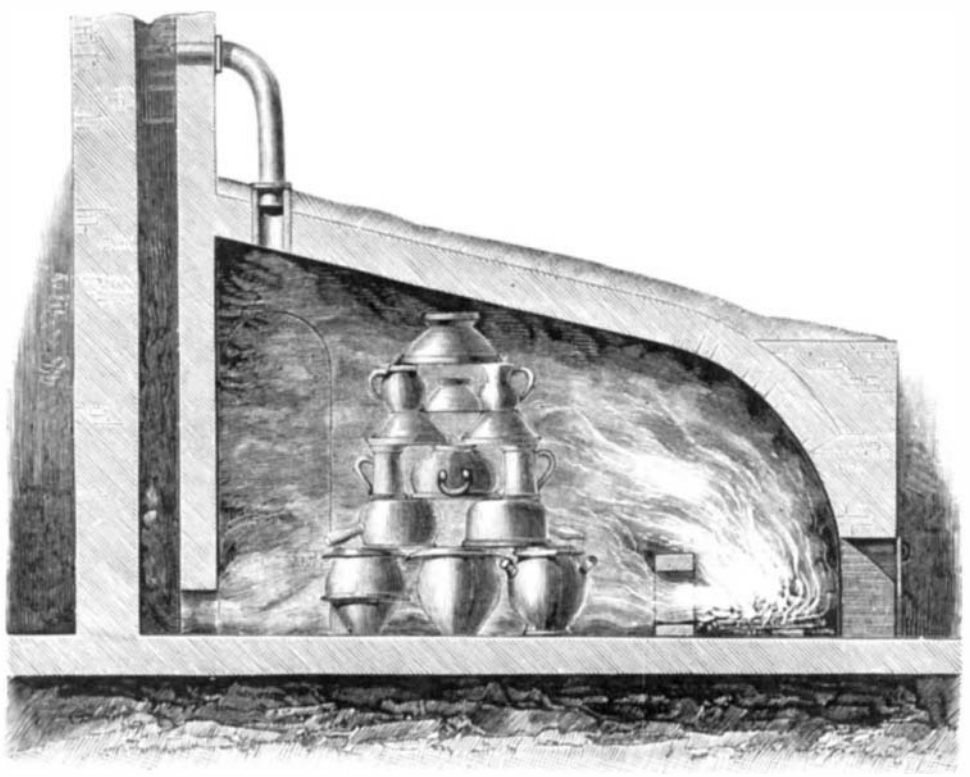

Fig. 1.—POTTER'S OVEN.

The enamel consists of: Minium (oxide of lead), 52 parts; oxide of manganese, 7; brick powder, 41; total, 100.

The substances are fused together and reduced to powder; the enamel is then ready for application. This enamel is intended for brown pottery. For white faience a mixture is used consisting of oxide of tin, oxide of lead, silex, sea salt, and carbonate of soda.

The oxides of lead and tin are intimately mixed and calcined; a yellow powder is thus obtained, called "calcine," and forming the base of white enamel. It is mixed with the other ingredients in the following proportions: Calcine, 47; sand, 47; sodium carbonate, 3; sea salt, 3; total, 100.

This mixture, melting at a temperature of 70° Wedgwood's pyrometer, is fused, and when cool it is finely pulverized. For application to the biscuit, it is triturated with water, which holds a considerable portion of the powder in suspension. The articles to be enameled are simply dipped into this liquid, a sufficient quantity of the powder adhering to the surface. When the external surface is to be enameled brown the vessel is first dipped into the brown enamel; after drying, it is filled with white enamel, emptied, and allowed to dry again.

When dry all traces of enamel must be removed from the bottom of the vessel, as otherwise, in baking, the bottom would adhere to the support. The enamel is removed from the bottom by means of brushes; this operation is very injurious to health, as it fills the air with fine particles of lead compounds, which are inhaled and swallowed by the operatives. This manipulation is called varnishing and brushing, and is illustrated in Fig. 2.

Fine faience goods must be placed in the oven very carefully. They are generally inclosed in muffles, made from biscuit, and these are placed on top of each other in the ovens; the latter holding about 20 to 30 of them, according to size.

Fig. 6 represents one of the chambers, containing several plates and a bowl in position.

By the application of heat the enamel is fused and partially penetrates into the biscuit, to which it imparts its color and a beautiful luster. The coating is hard, and does not crack or scale off when it is of good quality and properly prepared.

When articles are to be decorated by painting, the paint is applied to the enamel when the latter has become cold. The goods are then again moderately heated, by which the colors are firmly attached to the enamel. The pigments used are essentially the same as those used in porcelain painting.

"Fine" faience, properly so-called, is a product of modern times, and must be distinguished from the "common" faience just described. It consists of an inner white, opaque body covered by a crystalline lead glazing. The first "fine" faience was made in England, toward the end of the last century, by Wedgwood. It was he who discovered that silex is bleached by calcination, and that calcined silex bleaches clay. Pottery made from this material is very white and hard, ringing when, struck with a hard body, with a clear metallic sound. Its beauty and durability soon brought it into great demand, and for practical purposes it is to-day universally used in preference to its rivals. It was also called half-porcelain, opaque porcelain, and china, although originally the latter term was used to designate regular porcelain, china, or fine faience. It cannot be cut by steel, and differs from porcelain proper only by its opaqueness, the latter being translucent and more completely vitrified. China industry is of the utmost importance in Europe, especially England.

As stated above, the material consists of levigated clay and calcined silex, to which sometimes a little chalk is added. The glazing is of variable composition, but consists generally of oxide of lead, or minium, silex, feldspar, and soda. It is prepared and applied like ordinary enamel.

In England three varieties of china are distinguished: 1. Pipe-clay ware, containing a little chalk. 2. Stone ware. 3. Feldspar ware.

English pipe-clay, according to Schuhmann, is composed as follows: Clay, 86 parts; silex, 13; chalk, 1; total, 100.

The glazing for pipe-clay ware consists of: Sand, 31 parts; minium, 30; litharge, 27; calcined feldspar, 7; borax, 3; crystal glass, 2; total, 100.

Stoneware, according to Oppermann and Battenaire, consists of: Clay, 87 parts; silex, 13; total, 100; and is glazed with the following mixture: Silex, 42 parts; minium, 26; borax, 21; sodium carbonate, 11; total 100.

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Fig. 2.—APPLYING ENAMEL.

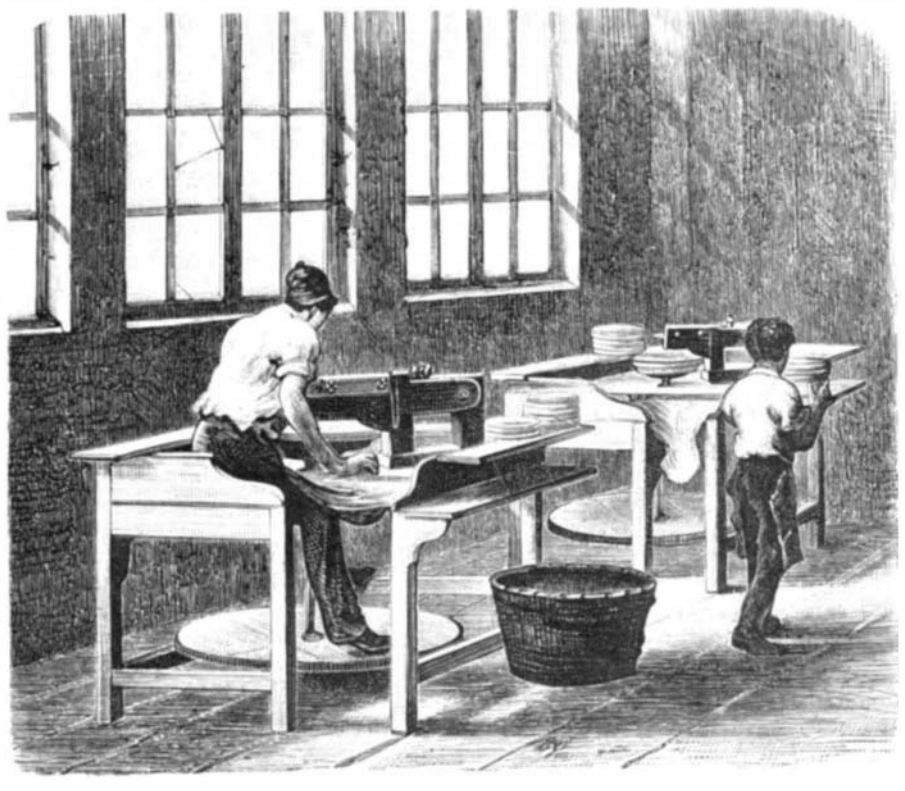

Fig. 3.—PLATE MACHINES.

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Feldspar ware, according to St. Amand, consists of: Clay, 62 parts; kaolin, 15; silex, 19; feldspar (decayed), 4; and covered with the following glazing: Oxide of lead, 52 parts; kaolin, 25; silex, 13; crystal glass, 10; total, 100.

The machines used for shaping fine faience are identical with those used for ordinary faience. For some articles which are manufactured in very large quantities, as plates, special machines have been devised.

Fig. 3 represents a plate machine. The shaft of the wheel carries at the top a circular block of wood, forming the counterpart of the inside of a plate. A sufficient quantity of clay, rolled so as to form a sheet of the required thickness, is placed upon this block and pressed down closely. To a standard is attached the shaping tool or "caliber," movable in vertical direction. Its profile at the lower edge corresponds exactly to the external form of the plate. By causing the wheel to revolve slowly, the plate is brought into the desired shape.

For forming articles not of circular shape or otherwise difficult to form, moulds of plaster of Paris are used. These, when dry, rapidly absorb the water from the clay and cause it to harden rapidly.

To bake the biscuit, the temperature must be brought up to about 100° Wedgwood's pyrometer; for enameling, 10° to 30° are sufficient.

Although not strictly belonging to the faiences, we may nevertheless mention in connection with it the so-called "gray pottery" (grès-cérames). It consists of dense, heavy material, which rings with a metallic sound. It is opaque, of a finely grained texture, and sometimes nude, sometimes glazed with a mixture of salt, oxide of lead, and silica.

Ordinarily it receives a sort of vitreous covering all over the surface, consisting of silicate of sodium and alumina, during the first baking, and a repetition of this latter operation is thus rendered unnecessary. The purpose is accomplished by simply mixing sea salt with the fuel used for baking. The salt evaporates, and the vapor, coming in contact with the heated articles, decomposes; the sodium oxide and the various other oxides generally contained in sea salt unite with the

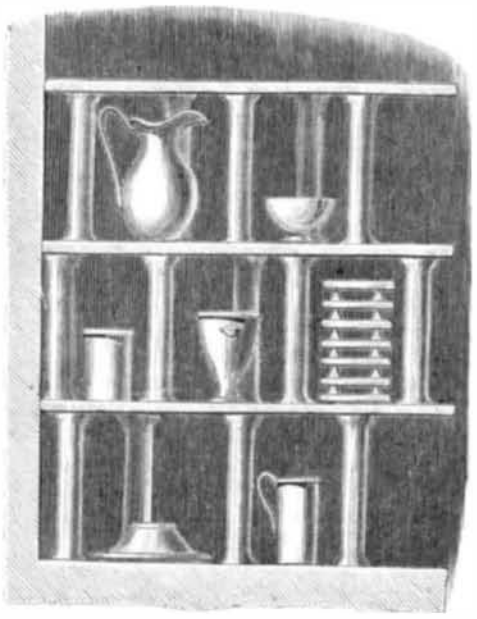

Fig. 4.—POSITION OF ARTICLES IN OVEN.

silica of the vessels and form a glass, which penetrates into the pores of the clay and renders it impermeable and glossy. This simple process is the invention of Wedgwood. 100° to 120° of heat (Wedgwood) are required to finish it. Fig. 7 represents an oven used for baking gray pottery. The articles to be baked are placed on Wedgwood shelves.

Gray pottery is very hard and brittle. It cracks frequently on sudden changes of temperature and when directly exposed to the fire. This quality of ware may be white or colored. The following is the composition of the material used in its manufacture:

White.—Kaolin, 25 parts; clay, containing a little kaolin, 25; feldspar, 50; total, 100.

Colored.—Kaolin, 14 parts; clay, 14; silex, 15; pegmatite (decayed), 27; sulphate lime, 21; sulphate of baryta, 9; total, 100.

Black.—Kaolin, 2 parts; clay, 48; calcined ocher, 43; manganese (black), 7; total, 100.

Gray pottery was manufactured extensively thousands of years ago by the Chinese and Japanese. A Japanese vase is exhibited at the Louvre, 2½ feet high and 2 feet wide, which was manufactured at Meissen by Boettcher, previous to the invention of porcelain.

BLASTING BY COMPRESSED AIR.

The risk attending the use of gunpowder or other explosives in coal mines has led to the trial of compressed air for breaking down coal, experimentally that is, and the experiment seems decidedly promising. A small portable machine was used, by which two men were able to compress air so as to give a pressure of 14,200 lb. to the square inch. The compressed air was conveyed through wrought iron pipes to a cast iron cartridge, 12 inches long, placed in a hole drilled in the coal; into this cartridge the air was forced until it burst, breaking down the coal. A pressure of 9,550 lb. to the square inch was found sufficient to break down hard coal.

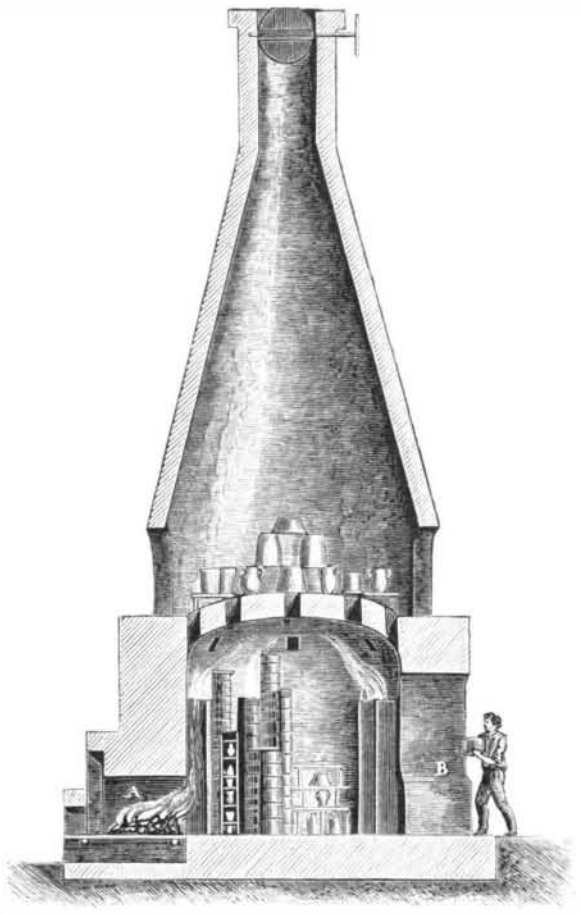

Fig. 5.—OVEN FOR BAKING AND ENAMELING.

In a paper lately read before a meeting of coal miners, at Manchester, England, one of the inventors of this system, Mr. W. E. Garforth, of Dukinfield, expressed the conviction that before long a pressure of ten, fifteen, or twenty thousand pounds per square inch would be so utilized that they would be able to put into the miner's hands a power that would enable him to get out coal, without risk, either from blown out shots, explosions, or the production of deleterious gases.

Comparing the two systems of breaking down coal—by gunpowder and by compressed air at 8,000 lb. pressure per square inch and upward—Mr. Garforth thought that the latter would be nearly, if not quite, as expeditious as the former, while it possessed many signal advantages, especially in the matter of safety.

Remedies for Biliousness.

Dr. Rutherford says: "As yet we have found 4 grains of iridin a certain remedy for biliousness. It may be made into a pill with confection of roses, and taken at bedtime. It produces no disagreeable sensations, and on awaking in the morning the yellow tongue is clean, and the headache and *malaise* are gone. As iridin, though a powerful hepatic, is not a powerful intestinal stimulant, it is well to give in the morning an ordinary mild saline aperient, such as Püllna water. Iridin, though an agreeable remedy at the time, has a somewhat depressing effect, and it probably should not be taken much oftener than once a week."

Dr. Rutherford also states that "euonymin is a hepatic stimulant in man as it is in the dog. Two grains of it made into a pill with confection of roses, and taken at night, seem to be as efficient a remedy for biliousness as iridin. If the dose be not too great it leaves no depression. A dose of a saline aperient should be taken in the morning. I have been much struck with the success of euonymin in functional derangement in several persons who had tried nearly all the commonly used cholagogues with varying and often limited success. I have no doubt that in consequence of our experiments euonymin will come to be a universally employed hepatic stimulant."

The Spectrum of Brorsen's Comet.

Professor C. A. Young, of Princeton, writes to the New York *Times* saying that Brorsen's comet has not an exceptional spectrum, as indicated by Huggins' observations of 1868, but falls into line with all the other comets. Professor Young's observations were made upon the evenings of April 1 and 2, and a comparison between the spectrum of the comet and that of the flame of a Bunsen burner showed a coincidence exact within the limits of observation.

RECENT AMERICAN PATENTS.

An improvement in oil stills has been patented by Mr. Clark Alvord, of Kendall Creek, Pa. It consists in a series of metal rods arranged permanently in the bottom of a still, and projecting downward toward the fire and upward into the oil. The object is to thoroughly distribute the heat through the oil.

An improved soldering machine, patented by Messrs. Joseph W. Miller and Bernard Coll, of Baltimore, Md., is designed for rapidly soldering the tops and bottoms of cans, pails, etc. It has novel features, which cannot well be described without an engraving.

An improved water elevator, patented by Mr. A. W. Coates, of Alliance, Ohio, is provided with a weighted plunger, which, by its descent, forces water up through a stand pipe.

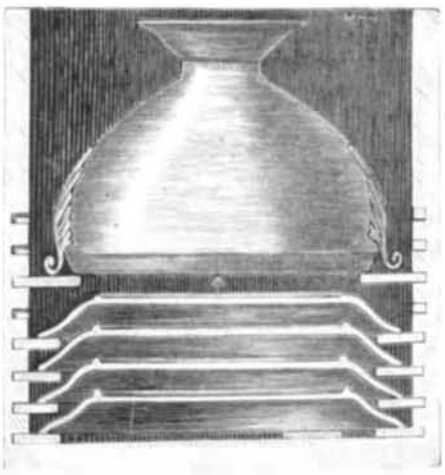

Fig. 6 INTERIOR MUFFLE.

Mr. W. E. Washburn, of Sackets Harbor, N. Y., has patented an improved hampering pad for horses, which consists of two plates, one carrying points, which stand opposite perforations in the other, when they are in their normal condition pressed apart by a spring. When the horse presses against a fence or other object with his breast he is pricked by the points.

Mr. C. S. Piersons, of Sandy Hill, N. Y., has patented an improvement in harness, which renders it stronger, lighter, and more durable, and less expensive than ordinary harness. Its construction cannot be described without an engraving.

A compact and convenient receptacle for holding flour for household use, has been patented by Mr. Joseph Johnson, of Marshalltown, Iowa. The invention consists in a cylindrical receptable having a grid for supporting the body of the flour, and a rotary sieve for sifting it and delivering it to a chest, upon which the receptacle rests.

Mr. G. D. Eighmie, of Poughkeepsie, N. Y., has patented an improvement in men's drawers, which consists in cutting the

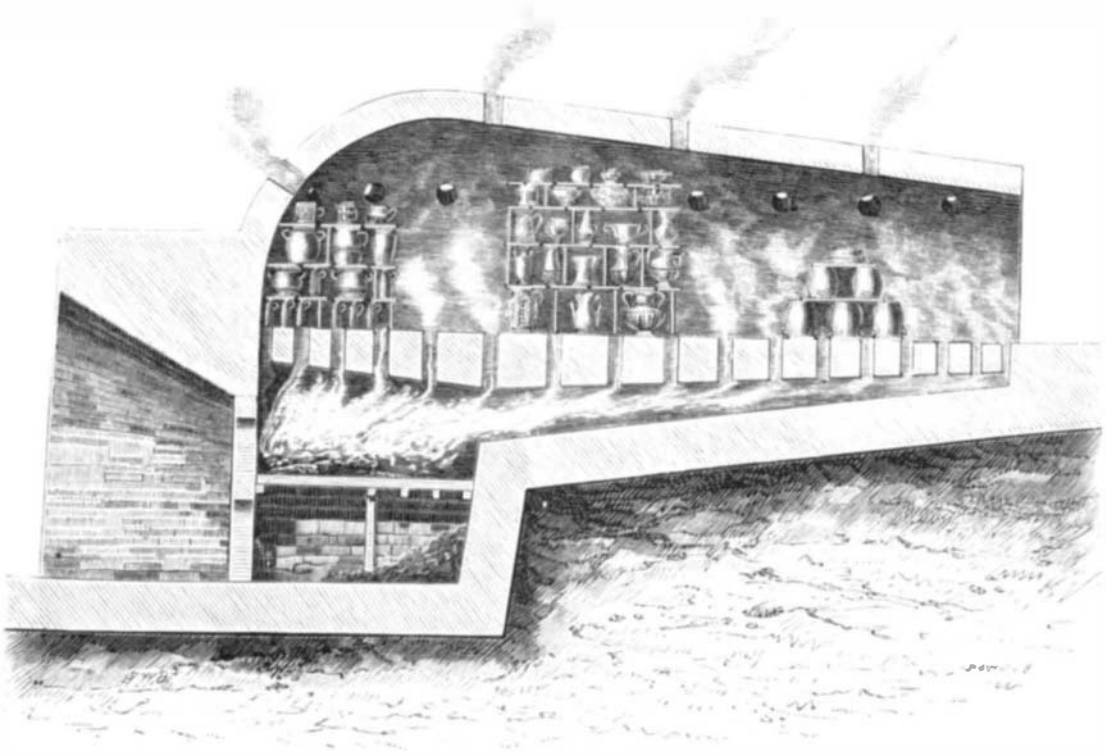

Fig. 7.—OVEN FOR GRAY WARE.