CERAMIC ART AT THE VIENNA EXPOSITION.

By WILLIAM P. BLAKE.

I. General Survey.

The potter's art, one of the most ancient and the most universal of all, connects itself on the one hand with geology and chemistry, and on the other with painting and sculpture. It is the outgrowth of one of the primal necessities of man's existence,—the preparation and distribution of food,—and is thus intimately identified with domestic and social life. Its productions, though so fragile, are perhaps the most enduring of man's handiwork. The objects that have outlived history are to be viewed not only as specimens of the condition of the art at the time of their production, but as exponents of the habits, the domestic life, and the æsthetics of races long since passed away. There is no other material which can be so readily impressed with the conception of the artist as "clay in the hands of the potter."

Progress and Capacity of the Art.

Such an art should progress measurably in the same ratio as civilization. That it has so progressed is evident to all who saw its representation in the halls of the great Exhibition at Vienna in 1873. The most general and striking impression produced by a systematic survey of what was shown there, was the *vitality* of the art and the high degree of excellence it has reached, not only in one or two countries, but in many. The rapid progress in the manufacture of porcelain and earthenware in several countries since the commencement of the era of industrial exhibitions, shows the capacity of the art for development in any country. Excellence is by no means confined to any section or to any special

source of materials. Chemistry has so far unlocked the secrets of the manufacture that it is no longer confined in empirical bands or limited in its range or locality. A few decades ago the knowledge of the details of compounding the materials for porcelain-ware, or for the glaze and decoration, was centered in but few persons. It was guarded as a secret; and the death of a master was perhaps the death of his art in the range of his labors; but now principles survive individuals, the art is universal, and seems established on an enduring basis. Chemistry has also given pottery a new life, and has enlarged the range of its uses, and has extended its capacity for decorative and ornamental purposes.

The great capacity of the potter's art for advancement in many important directions is one of its greatest attractions. The increasing use of fictile productions for ornamentation, not only in the interiors of our houses, but in the exteriors, in the form of enamelled tiles, plaques, medallions, terra-cotta ornaments, and bricks of various forms and colors, is highly gratifying, and marks a new era in the modern development of ceramics. But the capacity and known possibilities of the art are far beyond the artistic sense and appreciation of the people.

Necessity for Instruction in Art.

What is now needed is not so much the possession of materials, of knowledge, or even of artistic skill, as the elevation of the public taste, so as to create an appreciative and large demand for the products of higher efforts and greater skill. The manufacturers need encouragement and appreciation. The industry requires an artistic sense among the consumers of its products. If the public will not buy superior goods, the manufacturer cannot make them without loss. It is true that to a certain extent manufacturers should lead public taste; and no doubt their duty in this respect is not always appreciated by them, but it is well understood by some of the great establishments abroad, and they are reaping rich rewards. Wedgwood, in striking out a new path, not only secured immediate support, but established a reputation of far greater value. Palissy's art survives him and is the basis of an extensive industry. But the people generally

yet need to know more of pottery as an art to secure a fair appreciation of novelties and to stimulate progress. A great obstruction to progress is the servile following of others, the constant reproduction of old forms and old designs—imitations rather than novelties.

The high development and perfection of the ceramic art in Europe is due in a great degree to the establishment of porcelain works under government protection and favor, and the rivalries between them. Each establishment became a school of art, producing models for imitation, launching out into unknown fields, experimenting and perfecting without regard to the demands of trade,—being raised above them and independent of them. They became leaders of public taste, and their influence was strengthened by the patronage of royalty and court circles.

The Exhibition in 1851 revealed to Great Britain its manifest inferiority in artistic manufactures; and it did not take long to ascertain that the cause was the neglect of art education amongst the people, while the continental artisans were taught with the greatest care, and familiarized from their youth with the choicest productions of ancient and modern art. It was conceded that the art schools and museums of France exercised a great influence upon the manufactures of the country. England saw that to compete with such a rival great efforts must be made, and that the people must be educated. The government took the matter in hand; it was studied and reported upon by government commissions, money was freely appropriated, museums were founded, and a Department of Science and Art established as a branch of the government.

The favorable influence of these efforts was apparent in Paris in 1867; it was still more evident in the London Exhibition in 1871, and was abundantly shown at Vienna. Great Britain, from a position of mediocrity in 1851, has risen to a commanding position in the potter's art, standing to-day in the front rank, not only as regards excellence of materials and manufacture, but in artistic skill.

All this is full of teaching to the educators of the United States. Ceramic industry, as we shall presently see, is

already established here, but, though in its infancy, gives promise of a great future. Its growth can be greatly and advantageously modified by a little well-directed effort. Art education is not only required by potters, but by all artisans, and by the people generally. It not only produces skilled specialists, but becomes diffused and raises the standard of public taste, increasing the appreciation of the public and the demand for really meritorious works, thus reacting beneficially upon the industries.

There is a great multiplicity of sources of designs for ornaments at the present day; and the facilities now afforded for copying and reproducing the most precious artistic works of the past should cause them to be seen everywhere. Every town should have its art-gallery and its classes for drawing and modelling. The children in our public schools should not lose such influences as may be exerted by the possession of sets of casts of architectural decorations, of sculpture and bas-reliefs, all of which may be procured for little above the cost of the materials and transportation. The general influence of art museums abroad is not to be lightly estimated. They are exerting a gentle and imperceptible, but a most powerful, influence upon the culture of the communities in which they are located. Who can estimate the influence exerted by the South Kensington Museum upon its millions of visitors? And we are not to lose sight of the influence, also, of the great exhibitions which bring together in friendly rivalry the master-efforts of the most skilful artisans of the time, and afford the conservators of museums their richest harvests of novelties and gems of excellence from all lands. These are the most powerful of all agencies in the education of the people, and they afford the most salutary stimulus to the artistic industries, especially when the producers have access to typical examples of the best efforts in their arts by the generations that have passed away.

The effect of museums and systematic art education in France is spoken of by the reporters on porcelain in 1871, as follows: "The tradition of past generations of art-workers still lives in France and is kept alive, not only by countless examples of their skill, happily preserved in many noble museums, but also by a systematized education of artists,

which alone is capable of directing onward in its proper course and maintaining constant, a National School of Art." *

Museums of Ceramic Productions.

What we specially need, then, in the industry to which these pages are devoted, is a well-chosen collection of all the best examples of the potter's art, in all ages, and from every country. New York already has the nucleus or commencement of such a collection † in the Metropolitan Museum of Art, where the unrivalled collection of De Cesnola presents a great wealth of examples in earthenware and terra-cotta, of the Phœnicians, ancient Greeks and Romans. This is supplemented by a Loan Museum, chiefly from the private collection of Mrs. W. C. Prime, in which there are excellent specimens of new and old Sevres, Dresden, Austrian, and English porcelain, of delft ware and Saracenic tiles. A somewhat similar collection exists in the Athenæum, Boston, and contains some excellent examples of old Sevres, Chinese ware, *pâte-sur-pâte*, an imitation of Henri-deux ware, etc., some of which were obtained at the Vienna Exhibition.

These museums are already exerting an influence upon the public in directing attention to the preservation of old and curious pieces of porcelain and the formation of private collections. Although many such collections are made merely for the sake of getting together odd and rare bits of old china to which a fanciful value is attached, without any comprehension of the nature of the art, or its history, the weakness is by no means to be discouraged, for sooner or later the possession of the objects leads the owner to look beyond them to their origin, and to a comparison of the products in all their qualities of material, form, and decoration.

* Magniac and Soden Smith, On Porcelain, Lon. Exhib., 1871, I., p. 258.

† An important portion of this collection consists of over 4,000 earthenware vases, discovered in ancient tombs at Idalium, a Phœnician city which was conquered by the Greek colonists of Cyprus several centuries before Christ. These vases are perfect in form and fresh in color, and are ornamented according to the fancy of the potter, without any special regard to their size or capacity. The colors are generally only two: a dark brown, almost black, and a purple red. This last appears to have been produced by an oxide of copper, and the brown by umber, an earth which occurs abundantly in Cyprus. The decorative patterns are usually concentric circles and chequered designs, sometimes intermingled with the lotus.

Those who are disposed to make a study of this fascinating subject may derive great assistance from a collection of typical examples of modern productions that can readily be made by themselves at no very great cost. For such an undertaking, students in the United States have great facilities, in consequence of the very general representation of the chief manufactures abroad in the large stocks of ware kept on hand in our principal cities. There are, at least, two establishments—that of Mr. Richard Briggs in Boston, and of Messrs. Tyndale and Mitchell in Philadelphia—which may be regarded as museums of the art; for the proprietors, being enthusiasts in their specialty, take great pains to collect and retain examples of all varieties of manufacture and decoration, and even make visits to Europe to secure representative examples and novelties.

Commercial Value of Artistic Skill.

The United States are destined to become the best market in the world for artistic productions. This results from the very general distribution of wealth among the people and the desire to adorn their homes with the same class of objects sought and admired in communities of riper civilization and culture. Money, for a time at least, anticipates appreciation; but the latter, as already shown, is sure to follow. Economists should not lose sight of the expanding fields of industrial effort which are opened in every direction by increased appreciation of, and demand for, artistic productions amongst the people. It leads to a great variety of manufactures and a rapid increase of wealth. Whole communities are sustained abroad in the production of trivial ornaments. When we consider, also, the great increase in value with which the commonest materials may be endowed by a little artistic skill, we do not hesitate to recognize the commercial value of such skill to the country. The clay which is so abundant under our feet is transformed by the potter into an object of beauty. A single slab of earthenware, which may be produced for a few cents, becomes of almost priceless value in the hands of the artist. The enamels of Parvillée and the plaques shown by Deck in the exhibition are examples. The prices which such objects command are aston-

ishing to those accustomed to the merely utilitarian view of things. The British artisan who reported upon the pottery, in mentioning Deck's beautiful plaques, says: "The most attractive were several large round plaques, about two feet across, painted with large female heads and other decorations. I saw one of them was bought by an English manufacturer. The price paid was £200. Here is an example of art workmanship! This dish, which realized such a large amount, could be made and sold by the gentleman who bought it for about two shillings; and the artist, with his labor, has made it worth £200!"

Influence of Japanese Art.

In the early periods of the introduction of oriental porcelain, and its attempted reproduction in Europe, Japanese and Chinese designs in decoration were closely followed. This is true to a great degree now. The great influx of Japanese forms in such quaint and novel variety, since the modern opening of that country to trade, has had a great influence upon the styles of decoration now in vogue. It is the new field for the decorative artists of Europe, and close attention and study have been given to the spirit of Japanese art. We find the results in the porcelains of the Royal Worcester works, in the *cloisonnée* enamels of the English and French sections, in the bronzes, and in the decorative pottery and porcelain of other countries. Meantime, we see the Japanese striving to imitate English and French forms and ornaments in table and toilet services, instead of more strongly developing and impressing their own peculiar and admirable styles upon their wares. This is one cause of the decadence of Japanese art; another, as pointed out beyond, is the demand for quantity and cheapness at the sacrifice of quality in their products.

Lithography and Photography Tributary to Decoration.

Lithography is now made subservient to the decoration of porcelain. A wide and inviting field is thus opened, especially to potters in the United States, it being possible to produce pictures in this way that few persons, even those familiar with the art, can distinguish from hand paintings. Such decorations may replace, and at no greater cost, the crude,

grotesque daubs which have so long seemed inseparable from all low-priced decorated ware.

Photography also is now tributary to the decoration of porcelain. The beautiful examples exhibited by Julius Leith, of Vienna, may here be specially referred to. A series of plates were ornamented by photographs, apparently from life, as perfect as upon paper, and seemingly so well fixed on or under the glaze as not to be liable to injury by use. When we think upon what has been accomplished by the Woodworth process of relief printing from photographs, it seems more than probable that transfers in indelible colors of such pictures may be made upon porcelain at no greater cost than for ordinary crude engravings. All that appears to be necessary is to have a very fine metallic pigment and a surface sufficiently smooth to receive the most delicate films when transferred from the relief plate to a suitable paper, which can be impressed upon the porcelain, and then removed with water and friction, leaving the ink adhering to the ware, exactly as is now practised with copperplate engravings.

Pottery in the United States.

For the manufacture of pottery in the United States there is no lack of the best materials. Not only are extensive deposits of clay already known and worked, but it is probable that when attention is more generally given to the subject, other deposits will be brought to light.

The art in America is of extreme antiquity amongst the aboriginal tribes, especially in Mexico, Central America, and in the western part of the United States. At the Delaware Water Gap specimens of cups, of good form and rudely decorated, have been washed out, with stone implements.* The clay images of Mexico and the remarkable pottery of Peru are well known. It is important to note that in these examples, as in the ancient pottery of Arizona and Mexico, great attention was given to decoration.

In the early attempts at the manufacture of porcelain in

*The vessels found in the ancient mounds of the Mississippi Valley are considered by Professor Cox to be formed of a calcareous cement, and not of burned clay. They are not, therefore, *pottery* in the usual sense of the word.

Great Britain attention was directed to the American colonies as a source of the materials. In the year 1745, William Cookworthy wrote that he had seen samples of kaolin and petunse found on the "back of Virginia," and that the discoverer had gone for a cargo of it. In 1765, Caleb Lloyd, residing in Charleston, South Carolina, sent a box of porcelain earth to the Worcester porcelain works, saying that it had been obtained in the mountains some four hundred miles west, in the country of the Cherokees.* There appears to have been much interest manifested in this discovery, and the clay was pronounced to be superior to that obtained in Cornwall; but, being without the undecomposed portions of rock, it could not be made into porcelain.

Miss Meteyard, in her life of Wedgwood, mentions the custom of merchants and captains to take in samples of clay and other earthy bodies on their return voyages, particularly from the ports of the two Carolinas, Georgia and Florida.† Bently supplied Wedgwood with clay imported from Pensacola, a port with which he had trading relations. Wedgwood also received a sample of the South Carolina clay, and wrote that "it would require some peculiar management to avoid the difficulties attending the use of it."

As early as 1770 it became evident to the British potters that the pottery industry might be started in America to the detriment of their trade, and Wedgwood wrote as follows:—

"The trade to our colonies we are apprehensive of losing in a few years, as they have set on foot some pot works there already, and have at this time an agent amongst us hiring a number of our hands for establishing new pot works in South Carolina. They have every material there, equal, if not superior to our own, for carrying on that manufacture. We cannot help apprehending such consequences from these emigrations as make us very uneasy for our trade and prosperity."

Porcelain works were soon after started near Philadelphia, but with little success in competition with the established manufacture in England, although some very good porcelain

* "Two Centuries of Ceramic Art in Bristol," pp. 8–13.
† Meteyard's Life of Wedgwood, p. 367.

was produced. Porcelain was made near Philadelphia as late as the years 1849 and 1850, but the works were not sustained. The manufacture is now reported at Phœnixville, Pa., and exists at Greenport, N. Y., where table and toilet ware is made.

The industry, especially in the direction of earthenware, and the common cheap pottery, such as Rockingham, yellow-ware and stoneware, has increased rapidly of late years, under the stimulus afforded by the tariff and the premium on gold. According to the last census there were 777 establishments for the manufacture of stone and earthen ware distributed through the several states, the highest numbers being 170 in Ohio, and 198 in Pennsylvania. Only fifteen are reported in Massachusetts. Eighty-two steam-engines, with an aggregate of 1,586 horse-power, were in use, besides eight water-wheels of 122 horse-power. Hands employed, 6,116; capital invested, $5,294,398; amount paid in wages, $2,247,173; materials are valued at $1,702,705; value of the products, $6,045,536. The number of persons reporting their occupation as potters is 5,060.

In the State of Massachusetts alone, the fifteen establishments, with twenty-three horse-power steam and forty horse-power water, employ 160 hands, and produce to the value of $244,493 annually.

The following are the chief points at which the potteries are located:—In New Jersey, at Trenton, Jersey City and Gloucester. In Ohio, at East Liverpool and Cincinnati; New York, in the city and at Flushing and Greenpoint, L. I.; Pennsylvania, Philadelphia and Pittsburg; Illinois, Peoria; Maryland, Baltimore; Massachusetts, Boston; and in Missouri, at St. Louis. In 1872, it was estimated that there were 148 kilns in seven States, capable of producing at the rate of $30,000 annually per kiln, which would amount to $4,440,000 per annum, and would use 75,000 tons of coal, and 75,000 tons of clays and other materials.

The industry has taken root firmly in New Jersey, at Trenton, and bids fair to thrive permanently. That locality offers the advantages of extensive deposits of the finest clays, cheap transportation by water, as well as by rail; and the proximity

to the coal region and to two large cities, combine to foster its growth, and to make the locality the Staffordshire of the United States. The pioneers of the industry at Trenton were Mr. Steiner, a German, and Mr. Young, an Englishman.

In 1861, there were but five small potteries. In 1868, there were seventeen, with an aggregate of fifty-three kilns, with a capacity, if fully worked, of,—

Number of hands,	1,200
Tons of coal consumed annually,	18,000
Tons of prepared clay,	20,000
Average production of each kiln,	$25,000
Capital invested,	$1,250,000

Mr. Hattersley, one of the pioneers in the manufacture of pottery in Trenton, wrote in 1868 :—

"The writer, after travelling over the States of New York, Connecticut, New Jersey, Pennsylvania, Delaware and Ohio, in search of proper materials and the best place for its manufacture, concluded that Trenton, New Jersey, was the place, situated, as it is, between the two great markets, New York and Philadelphia; healthy, and the State abounding with fine clays and convenient for the collection of all other materials, such as coal, kaolin, flint, sand, felspar, bone, etc., by canal or railroad."

There are now some twenty establishments and sixty kilns, producing crockery, chiefly white "stone-china," to the annual value of $1,500,000 to $2,000,000. When in full operation, they employ from 1,200 to 1,500 hands, and consume from 25,000 to 30,000 tons of coal. One of the largest establishments, the Glasgow pottery of Mr. Moses, covers about four acres of ground, and has six large kilns in operation. The manufacture is confined chiefly to the finer sorts of stone-china, fully equal to any imported; but, we regret to note, it is stamped with British marks, in order to meet the prejudice of the consumers in favor of imported ware. But this we believe is passing away, and the time will soon arrive when the trade-marks of American establishments will command respect and preference. It is altogether possible that the United States, holding the greater part of the available coal

of the world, in contiguity with illimitable supplies of the best and most varied clays and potting materials, and having unusual attractions for skilled and ordinary labor, will soon commence the export to less favored regions. Meantime, the home market is expanding faster than the rate of supply from home sources.

Notwithstanding the gradual extension of the industry in the United States, the importation of pottery amounts to about $6,000,000 annually, and is steadily increasing, as will be seen from the following statement furnished for the report, at my request, by Edward Young, Esq., chief of the bureau of statistics, Washington.

Statement of value of Earthen, Stone and China ware, imported into the United States during the years ended June 30, 1869 to 1873, inclusive.

1869,	$4,372,607
1870,	4,388,771
1871,	4,681,376
1872,	5,270,785
1873,	6,015,945
Aggregate in five years,	$24,729,484

The value of the different kinds of pottery for three years in succession, with the amount of duties paid, has been as follows :—

*Statement of the Quantity, Value and Duty of Earthenware and Porcelain entered into Consumption in the United States.**

DESCRIPTION OF WARE.	Rate of Duty.	1871.		1872.		1873.	
		Value.	Duty.	Value.	Duty.	Value.	Duty.
Brown earthen and common stone-ware,	25	$96,694 71	$24,173 70	$127,346 33	$31,836 59	$115,253 07	$28,813 28
China, porcelain and parian ware, plain white,	45	391,374 00	176,118 30	470,749 50	211,837 28	479,617 15	215,827 72
China, porcelain and parian ware, gilded or ornamented,	50	571,032 12	285,516 07	814,133 52	407,066 76	867,205 77	433,602 89
Other earthen, stone or crockery ware,	40	3,573,254 38	1,429,301 74	3,896,664 45	1,558,665 78	4,289,867 85	1,715,947 15

* From Home Consumption and Impost Statements, etc., by Edward Young, Washington, 1874, p. 143.

We are to consider, however, the difficulties under which we labor; the possession of the coal, the clay, the transportation and an expanding market are not sufficient; we need the labor and the enterprise to bring these dormant sources of wealth together. As in Wedgwood's time, there are those who think this can be done but in Great Britain, and that we should send our clay, our sand, and our coal, over the ocean to be worked into objects for our daily use. The writer of Wedgwood's life, published in 1865, says:—

"No country situated as America then was, and is now, with her civilization thrust centuries back by the curse of blind and intemperate party strife and internecine war, can hope to gain perfection in an art. A country in this condition gains most by the export of raw materials and the import of manufactured goods."

As yet we have barely begun to explore for and to understand the varied sources of potters' materials which are known to exist all over the country.

There is no need of looking about for anything connected with the art, unless it be the artistic inspiration to be gained by contact with older civilization and the artistic culture which is the inheritance of mankind.

American materials are more and more brought into use at the American potteries, to the exclusion of those formerly imported. In Chester County, Pennsylvania, and its vicinity, there are establishments for mining, washing and preparing kaolin or fine china clay, equal to any from Cornwall, in England. There are valuable beds of such clay in South Carolina, Georgia, and in Illinois in Pope County, at which last-named place a superior clay is obtained and is highly valued at the Ohio potteries and others.

There is an abundance of fine quartz and felspar rock throughout the Eastern and Middle States, and mines have been opened in Maine, Connecticut, Pennsylvania, Delaware, and Maryland. Mills to crush and grind these materials, with expensive machinery, have been erected at several points on the Susquehanna, at Trenton, and on the Connecticut, and in various places in the West.

Decoration of Porcelain and Earthenware.

The decorations of plain white china and earthenware, in colors, is a branch of the potter's art which is assuming considerable importance in the United States, chiefly in consequence of the protection afforded by the tariff, the duties being *ad valorem*, and, of course, much less upon plain white ware than upon the same with the costs of decoration added. It is not alone services for the table, plates, tea-sets, etc., which are thus ornamented, but toilet-sets, and especially set basins and other ceramic plumbers' ware and fittings. There are several establishments in New York, Boston, Philadelphia and the West, particularly in Chicago, where quite an extensive business is established in decorating and matching broken sets of china or stoneware. Some attention has also been given at the East to the decoration of tiles.

Mr. Staring, of Chicago, has successfully established the business of decorating porcelain in the West. He not only succeeds well with plain colors and gilding, but with flowers and fruit. Pieces of costly sets, that are accidently broken, are replaced by taking plain white pieces and decorating them to match the rest. Toilet sets, pitchers, mugs and dinner services, are decorated to order. A business of considerable proportions is being established in this way.

Some parties in New Haven and New York propose to decorate ware by machinery, on a large scale, under patents issued to S. J. Hoggson. An organization has been formed under the title of "American Enamel Decorating Company." The process consists in a rapid transfer of designs from rollers to the object to be decorated. It is claimed that the work can be done with great rapidity and accuracy, and at very little cost.

Ramifications of the Potter's Art.

The following list of trades engaged in the potters and connected arts in Great Britain, is suggestive and interesting:—

Brick and Tile makers.
Brown Stone potters.
Chemical potters.
Chimney Top manufacturers.
China and Earthenware manufacturers.
China gilders.
China menders.

China Riveters.
China and Porcelain Door Furniture makers.
China and Porcelain manufacturers.
China drillers.
China Figure manufacturers.
China Ornament makers.
China painters and gilders.
China Toy makers.
Drain Pipe and Tile makers.
Earthenware Figure manufacturers.
Earthenware manufacturers.
Egyptian Black-ware manufacturers.
Encaustic Tile makers.
Fancy Jug manufacturers.
Fire Brick makers.
Jug manufacturers.
Melting Pot and Crucible makers.
Muffle manufacturers.
Parian manufacturers.
Plumbers' Pottery makers.
Porcelain Letter makers.
Porcelain manufacturers.
Potters.
Potters' engravers.
Rockingham Ware manufacturers.
Stone Bottle makers.
Stone Mortar and Pestle manufacturers.
Stone potters.
Stoneware manufacturers.
Terra-Cotta makers.
Tobacco Pipe makers.
Vase manufacturers.

To these may be added the following occupations sustained in Great Britain by an active ceramic industry :—

Brick and Tile Machine makers.
Brick Makers' Implement manufacturers.
Brick Mould makers.
Grinding Mill makers.
Kiln builders.
Machinists in general.
Pug Mill makers.
Potters' Wheel makers.
Ash merchants.
Chert Stone dealers.
China Clay merchants.
Clay merchants.
Flint millers.
Manganese merchants.
Marble Clay merchants.
Pipe Clay manufacturers.
Zaffres refiners.

Classification of Pottery.

The word *pottery* in its widest sense, and as used in this Report, is a very comprehensive term, including all fictile productions of which clay is the chief material. This wide range of products may be grouped under two grand divisions —the *Earthy* and the *Vitreous*. Of the first, ordinary earthenware and faience are examples; and of the second, porcelain or china. The chief characteristics of the earthy division are, as the name indicates, an earthy substance, porosity, infusibility, opacity and comparative softness; of the vitreous, a vitreous substance, fusibility, translucency and comparative hardness.

The earthy group includes faience, terra-cotta, bricks, etc. Faience is also a comprehensive term, taking in all varieties of earthenware stoneware, etc., and comprises two chief classes, the *glazed* and the *unglazed*. The objects may also be grouped as hard faience, and soft faience, stoneware being an example of the former; but the classification according to the glaze, or superficial coating, is to be preferred. Of glazes, which consist of a composition much more fusible than the body of the ware, there are many varieties. All, however, have this in common, that they may become more or less fluid in the furnace, and cover the porous surface of the paste or body, giving a vitreous surface when cold. They are all more or less siliceous, but the substance giving the fusibility may be an alkali, or metallic oxide, usually oxide of lead, or of zinc, or oxide of tin. The alkalies and lead give a transparent glaze, and oxide of tin gives an opaque glaze or enamel, and objects covered with it are described as enamelled. A common and cheap method of glazing hard faience is by throwing salt into the kiln while the objects are hot. The soda combines with the silica in the ware, and a vitreous glaze, known as salt-glaze, results.

For this Report an arbitrary grouping is preferred, chiefly with a view to convenience of description. The objects are grouped according to their uses rather than by their material or manufacture. The faience and porcelains of the principal countries are first considered; next, the mural and floor tiles, as a distinct and largely represented branch of ceramic industry; third, terra-cotta, bricks, etc.; and fourth, the materials used and their distribution. In each of these divisions there was a profuse representation in the Exposition; and a thorough, critical, and explanatory description would have required much more space and time than have been at command. In general, only the salient features are touched upon. The writer has, as far as possible, brought prominently forward the names of the principal exhibitors, recognizing in this the discharge of a duty to them as well as to the public. Every exhibitor at a great exhibition, who makes a display worthy of the occasion, does so at no small outlay of time and money, and he is justly entitled to all of the advantages

which such participation can give; and one of the greatest of these advantages is publicity through the reports.

It has been impossible to notice all that was interesting in this group. Many important displays have not been mentioned, partly for reasons already given, and, in some cases, from the difficulty or impossibility of obtaining any information concerning them. In the absence of exhibitors or their agents, and the presence of the notice,—"Visitors are not allowed to touch the objects,"—little can be learned that is afterwards available in a report. The reporter would here direct the attention of exhibitors in future exhibitions to the importance of preparing a concise printed statement of the chief facts concerning their products, for the information of those whose attention is specially directed to them. Such facts and descriptions can be verified by examination, and modified, if need be, to conform to the opinions of the examiner. With such information at hand, the exhibitor need not always be present, and will, in any case, be spared many questions while benefiting the public as well as himself.

Some idea of the great extent of the exhibition in the ceramic department may be gained from the fact that over one hundred and sixty awards were made. The number of exhibitors was of course much greater, but I have not been able to obtain it. In the British section alone, there were thirty-six.

II. Porcelain and Faience.

GREAT BRITAIN.

The ceramic productions were the most salient features of the exhibition from the United Kingdom. They occupied the most favored place in the grand transept, next to the superb metal work of the Messrs. Elkington. They gave the most gratifying evidence of the substantial growth of the artistic element in Britain. This advance, together with that shown in the metal-work referred to, in the furniture, carpetings, and decorative art generally, may be accepted as the result, in great part, of the efforts, since the Exhibition of 1851, for general art-education in Great Britain.

When, in 1762, the people of the pottery region petitioned Parliament in favor of an Act for a turnpike road, they set forth that in Burslem and the neighborhood there were nearly one hundred and fifty separate potteries for making various kinds of stone and earthen ware, employing and supporting nearly seven thousand people. Many tons of shipping, and seamen in proportion, were employed in winter carrying materials for the Burslem ware, and as much salt was used for glazing as paid an annual duty of £5,000 to the government.

In ten months of 1871 there were 90,412 packages of North Staffordshire ware exported from Liverpool. The total value of the exports of porcelain and earthenware from the kingdom—the greater part of which was produced in the Staffordshire potteries—amounted, in ten months of 1871, to £1,423,110 in value. This is about the same as in 1864 and 1865, the value of the production being in the latter year £1,442,000. The annual consumption of coal in the art, in 1865, was about 450,000 tons, and in 1870, according to official returns, 680,000 tons. To color the clay and print the ware, in 1865, about 67,000 pounds of oxide of cobalt were used, and 1,100 tons of borax and boracic acid in glazing, and 12,000 ounces of gold in gilding. About 4,500 tons of calcined bones from South America were consumed annually. In 1861, 40,697 persons were engaged in the manufacture.

English porcelain is said to differ from either the *pâte dure* or the *pâte tendre* of the French, and, to a certain extent, to combine the qualities of both. A high degree of translucency is obtained by the use of phosphate of lime. It is not as plastic as hard porcelain, but may be cast, moulded, or turned easily in the ordinary ways. It combines well with the frits of the *pâte tendre*, and with glazes adapted to colored decorations.

The exhibitors deserve great credit for their liberal representation of the industry, by sending to such a great distance so many bulky and fragile objects of great value. The more important of the collections will now be briefly noticed.

MINTON'S, *Stoke-upon-Trent, and 28 Walbrook, London.*—This well-known firm made a fine display of china and earthenware, dinner, dessert, tea, and toilet services; china, majolica, and parian vases, statuettes and other ornaments; enamelled tiles for walls, grates, hearths, and flower-boxes. To this enumeration must be added a novelty in British manufacture, *pâte-sur-pâte* decoration, a process which originated at Sevres in 1847, under Ebelman, though known long before in China. A series of plates and some vases gave satisfactory evidence of the complete success which has attended the efforts to introduce the process in England, by the aid of M. Solon, from Sevres, who removed to England during the Franco-German war. The nature of the process is indicated by the name: the design is worked upon the plate in paste or thin porcelain body, the same as the body of the plate itself. But the body of the plate or foundation for the design is previously colored a pale celadon green or a darker color (some were dark-brown or black), and the design, being worked over this, permits the color to be seen through the thin or depressed portions after vitrification, and thus deepens or forms the shades, while the thicker portions of the paste show less of the ground-work color, are higher, and give the lights an appearance of a higher degree of relief to the surface than actually exists. When the design is finished and the piece is fired and glazed, the translucency of the design is heightened, and the whole forms a homogeneous mass.

This series of specimens attracted great attention, and all were sold before the close of the exhibition to various museums, as high as $100 being paid for a single plate. One of these plates may be seen at the Boston Athenæum.

PÂTE CHANGEANTE.

The Messrs. Minton also make the peculiar chameleon ware, or *pâte changeante*, which appears of one color by solar light and another by artificial light. In the daylight it is a grayish or celadon-green, and at night is pink or crimson. This kind of paste was invented by the chemist Regnault, when Director of the Sevres establishment.

Henri-deux Ware.

The Mintons also exhibited specimens of another remarkable form of decorative ware—imitations of the celebrated faience of Henri-deux. These specimens were much admired, and commanded high prices from amateur collectors. They were copies of famous pieces. Among them were two tall salt-dishes or stands, one of which was purchased by a citizen of Boston and presented to the Athenæum, where it can be seen. The difficulty and expense attending the manufacture, make these objects very costly, but the price is doubtless high in proportion to the extreme rarity of the ware, and the limited demand for it. Of the original ware, there are said to be only fifty-five pieces known. There are twenty enumerated in the list of photographs of specimens in the collections at South Kensington, including two in the Louvre. Brongniart in his treatise says that about thirty-seven were known in France.* This ware has always excited great interest among collectors and connoisseurs, based upon its intrinsic beauty and novelty, and its extreme rarity. The pieces have sold for fabulous prices. An aiguière, or ewer, belonging to Mr. Magniac was purchased for £80 at the sale of M. Odiot's collection in 1842, and shortly after was sold for £96, and has since been valued at £2,000. A circular plateau in the South Kensington Museum, purchased originally by M. Espoulart, of Mans, for £3 4*s*., was bought in 1857 for £140. At the sale of the collection of the Comte de Pourtalès, in March, 1865, the "Bibernon" was purchased, by Mr. Malcolm, for the sum of £1,100. This Biberon is one of the best known specimens of the ware. A capital figure is given in Brongniart, pl. xxxvii. It stands a little over ten inches in height, and bears the arms of France with a coronet, and the initials and emblems of Diane de Poitiers. The ciphers and armorial bearings, which appear on so many specimens, indicate, beyond doubt, that this ware was the favorite at the brilliant court of Francis I., and Henry II. Its origin was for a time in doubt, and has been the subject of much specu-

* At that time the most interesting specimens were in the possession of M. Saurageot, M. Odiot, M. Preaux, and M. Count Pourtalès. The Ceramic Museum at Sevres had only two.

lation, but it is now conceded that it was made at Oiron, in the south-west of France.

In composition it is a faience of superior quality, the paste, according to an analysis by M. Salvetat, of the Sevres laboratory, consisting of,

Silica, ...	59.
Alumina, ...	40.24
	99.24

without lime or magnesia, and only a trace of iron. It withstands high firing without change, and is quite white. M. Salvetat was also satisfied that the glaze did not contain tin. Brongniart notes the fact that this white earthenware body was made in France long before the first attempts to manufacture white earthenware in Great Britain, which dates from the end of the seventeenth or the beginning of the eighteenth century. But the distinguishing peculiarity of the Henri-deux ware remains to be described. The ornamentation is inlaid, filling incisions or depressions in the body, though flush with the surface. For this filling, pastes colored with ochre were chiefly used, and the designs in general appear of an ochrey brown or yellowish color on the white groundwork. But black, blue, pink and green colors are known. It is believed that this inlaying was accomplished by means of moulds, the intricate interlacing designs being first carved upon a model from which casts were taken. The paste pressed in the moulds so formed, received the designs in intaglio, and the spaces were afterwards filled with a soft, colored paste, the whole operation being similar to that of making encaustic tiles.*

Royal Porcelain Works, *Worcester*.—These works, now under the management of Messrs. Phillips & Binns, with Mr. R. W. Binns, F. S. A., as the Art Director, made a most attractive display of the specialties of their production, notably of ivory-porcelain in Japanese forms and decoration;

* For details with figures, reference is made to Brongniart's treatise, ii, pp. 176-178.

of porcelain, majolica, enamelled terra-cotta, vitreous stoneware and fine earthenware.

The principal branches of manufacture at the present time are fine porcelain and stoneware, for services of all kinds; also fine earthenware, parian for useful and ornamental objects, terra-cotta, and the novelty "ivory porcelain." The decorations include all the usual styles for useful wares, paintings of flowers, birds, landscapes, figures, etc., etc. The ornamental works consist of enamels on royal blue ground, Raphaelesque embossments, majolica, painting of all kinds on vases, etc., majolica and the ivory porcelain. This last is a new article having the color and lustre of ivory, and it is especially well adapted to the imitation of the remarkable objects in ivory for which Japanese artists are unrivalled. These objects, so successfully imitated by the works, consist generally of vases formed of sections of the tusk of the elephant, of jugs, bottles, flasks, etc., and of tablets, all embossed or carved in relief, or deeply incised and variously decorated in colored laquers, and with bronze and gold. In these reproductions of Japanese forms and decorations, the Worcester artists have been remarkably successful. They are not servile imitations, but the true spirit of Japanese decorative art appears to have been acquired and to be well understood. In this ware there are at least three points of merit: first, composition of the body, its successful imitation of the softness of ivory harmonizing completely the material with its carved appearance; second, the perfection of the forms; and third, the mastery of the spirit and the color of the decoration. Plaques made in this way would be agreeable additions in the decoration of cabinets and furniture, or wherever ivory tablets would be appropriate. The material gives a new and pleasing basis for graphic decoration in any style.

The manufacture of fine porcelain was commenced at Worcester in the year 1751, and the first royal patent was given in 1789. The undertaking originated chiefly through the exertions of Dr. J. Wall, a physician with chemical skill and artistic tastes. As early as the year 1763, the productions of the establishment were highly esteemed. Dr. Wall, at an early date, applied the process of transferring printed de-

signs to a glazed surface to the decoration of his porcelain. The earliest known date of this printed ware is 1757, upon a jug now in the collection of the Museum of Practical Geology, London. The design is in black, *over* the glaze; and the pieces so decorated were exposed to the heat of the enamel kiln only. The invention of under-glaze printing soon followed, the designs being transferred to the unglazed biscuit. Robert Hancock, who had studied under Ravenet at the enamel works at Battersea in 1750, was the engraver of the early designs for transfer.

The earliest Worcester porcelain, according to Mr. Binns,* was made of a frit body, and he thinks that the following formula is similar to that used by Dr. Wall: sand, 120 parts; gypsum, 7; soda, 7; alum, 7; salt, 14; and nitre, 40. After fritting, it was crushed, and 75 parts were mixed with 15 of whiting and 10 of pipe-clay. The glaze used contained 38 per cent. of red-lead, 27 of sand, 11 of ground flints, 15 of potash, and 9 of carbonate of soda. For common ware an inferior paste was made, containing steatite. This gave a body less dense than the other, and of a yellowish color.

Attention was early given to the imitation of Chinese and Japanese wares, induced by the high estimation in which oriental porcelain, or china, was then held. And with that depraved pandering to public prejudice, which seems to be one of the great vices of the ceramic art, false marks were sometimes affixed, especially to these early imitations.

A crescent is one of the earliest ordinary marks, as, also, a script *W*, and afterwards the name or initials of the firm, either stamped in or printed. A Chinese fretted square, marked in blue, was frequently employed. Oriental characters were also marked in blue on some of the pieces, and a specimen in the Geological Museum has the Dresden mark of two crossed swords in blue under the glaze.

Specimens were shown of the beautiful tea-set presented to Lord Dudley on his marriage. The decoration consists of turquoise blue enamel, put on in drops near together, so that

* "A Century of Potting in the City of Worcester, being the History of the Royal Porcelain Works from 1751 to 1851," by R. W. Binns, F. S. A., 1865, p. 40. Also, in De La Beche, "British Pottery and Porcelain."

the surface appears to be *thickly* set with turquoise. Each cup and saucer is carefully mounted in a stuffed morocco case. The small set of six pieces was valued at about $6,000.

Wedgwood, Josiah & Sons, *Etruria, Staffordshire.*—This well-known establishment, identified with the growth of artistic pottery in Britain, was worthily represented by some of its best productions of the jasper or Wedgwood ware: white bas-reliefs on colored grounds, unglazed imitations of the famous Henri-deux ware; art-pottery paintings by M. Lessore; paintings on raw enamel, by M. Bean; majolica vases; dessert and fancy articles. Also by enamelled, printed, and cream-colored earthen ware; chemical and telegraphic, and sanatory and plumber's ware. Wedgwood's basalts are dark porcelanous biscuits of great hardness, and capable of receiving a high polish. They resist acids, and bear a high degree of heat without injury. The white porcelain biscuit has similar properties. The jaspar bodies are peculiarly adapted to cameo portraits and all bas-relief decorations, as the ground may be of any desired shade of color, while the raised figures are white. The basis of many of the medallions and plaques is the white body overlaid by a coating of the dark. I have tested the hardness of these tablets, and find them scarcely inferior to quartz, or about $6\frac{1}{2}$ on the mineralogical scale, being superior to felspar. They are still made at the works from the original moulds by Flaxman. According to the chemist Salvetat, Wedgwood ware consists of—

Silica,	66.49
Alumina,	26.00
Oxide of iron,	6.12
Lime,	1.04
Magnesia,	0.15
Alkalies,	0.20

The "jaspar ware" may be regarded as a vitrified stoneware of fine quality. The vitrifying substances added to the clay body are flint, ground glass, felspar, sulphates and carbonates of lime and of barytes. White jaspar contains from 15 to 30 per cent. of plastic blue clay, 0 to 15 per cent. of

kaolin, 0 to 15 of Cornish stone, or 40 to 50 per cent. of these clay materials, to which is added 25 to 45 per cent of sulphate of barytes, 0 to 10 per cent. of flint, and 0 to 2 per cent. of gypsum. Twenty per cent. of calcined bone is sometimes added. Half of one per cent. of cobalt gives this body a blue color; one per cent. of chrome, a dark green; nickel, a light green; copper, bluish green. Basalts and the Egyptian ware are made by introducing some forty per cent. of burnt ochre, and sometimes ten per cent of mill iron cinder.* In addition to the bas-relief unglazed, and jasper ware, the establishment now turns out annually large quantities of the ordinary stone-china glazed ware, plain and decorated. Full dinner-services, ornamented with fern leaves, flowers, or autumn leaves, can be had at the works for between £10 and £11. The printing of armorial bearings, crests, or monograms upon the ware from engraved copper-plates, is an important branch of the decorative work. Plates so ornamented to order, and with a single band of color at the edge, can be had at 7*s.* 6*d.* the dozen.

No porcelain is now made. Its production was carried on for a short time about the year 1808 by the nephew of Mr. Wedgwood. A small amount of majolica is manufactured, and some ornamental objects, among them examples of the "*email ombrant*," which consists of depressed designs, chiefly of human figures and animals, into which transparent colored enamel is allowed to flow.

The following list of pieces, composing complete dinner and dessert services, and a scale of prices for services and for pieces separately, at Etruria, will be found useful for reference and comparison:—

* Beckwith's Pottery, etc., p. 24.

Earthenware Table Scale. (Gilding of Covered Pieces extra.)

RATE.	GILDING. s. d.	s. d.	C.Color, marked Nursery. s. d.	Br.Lines marked Nursery. s. d.	s. d.	s. d.	s. d.	s. d.
Plates, 9 in. and 10 in., doz.,	Price of Gilding Enameled Patterns.	Price of Gilding Printed Patterns.	2 6	2 9	2 3	2 6	2 9	3 0
" 8 in., "			2 0	2 4	1 9	2 0	2 4	2 6
Muffins 7 in., "			1 9	2 0	1 6	1 9	2 0	2 3
" 6 in., "			1 6	1 9	1 3	1 6	1 9	2 0
Flat Dishes, 22 in., each,			4 6	5 0	4 6	5 3	6 0	6 6
" " 20 in., "			3 0	3 6	3 0	3 6	4 0	4 3
" " 18 in., "			2 0	2 6	2 0	2 6	2 9	3 2
" " 16 in., "			1 3	1 6	1 3	1 6	2 0	2 2
" " 14 in., "			0 11	1 2	0 11	1 2	1 4	1 6
" " 12 in., "			0 8	0 10	0 8	0 10	0 11	1 0
" " 10 in., "			0 4½	0 6	0 4½	0 6	0 7	0 8
" " 9 in., "			0 3½	0 4	0 3½	0 4	0 5	0 6
Round Dishes 1 size higher.								
Fish Drainers same as the dishes they fit.								
Gravy Dish, 22 in., . each,			–	–	6 0	6 6	7 0	9 3
" " 20 in., . "			–	–	4 6	5 0	5 6	6 3
" " 18 in., . "			–	–	3 6	4 0	4 6	5 0
" " 16 in., . "	–	–	–	–	3 0	3 6	3 9	4 3
Soup Tureen and Cover, 11 in., ... "	2 4	2 6	3 6	4 0	4 0	4 0	4 6	5 0
Soup Tureen Stand, . "	0 8	1 0	1 0	1 3	1 3	1 6	1 6	1 8
" " Ladle, . "	0 6	0 6	1 0	1 3	1 0	1 0	1 2	1 2
Sauce Tureen and Cover, "	1 0	1 2	0 8½	0 10	0 8½	0 10	1 0	1 2
" " Stand, . "	0 4	0 6	0 3½	0 4	0 3½	0 4	0 5	0 5½
" " Ladle, . "	0 3	0 4	0 3½	0 4	0 3	0 4	0 4	0 4½
Coverdish, 12 in. 3 div.			–	–	3 6	4 0	4 6	5 0
" 12 in. . . "	–	–	–	–	2 10	2 4	2 9	3 3
" 11 in. . . "			1 6	2 0	1 6	1 9	2 0	2 3
" 10 in. . . "	1 6	1 9	1 3	1 9	1 3	1 6	1 9	2 0
" 9 in. . . "	–	–	1 0	1 4	1 2	1 4	1 7	1 9
" 8 in. . . "	–	–	0 10	1 0	1 0	1 2	1 5	1 6
" Drainers, half-price of Coverdish, each.								
Salad, 11 in., . . . "	1 3	1 6	–	–	1 6	1 9	2 0	2 3
" 10 in., . . . "			–	–	1 3	1 6	1 9	2 0
Oval Bakers, 12 in., "	–	–	0 8	0 10	0 11	1 0	1 3	1 4
" " 11 in., . "	–	–	0 7	0 9	0 9	0 10	1 0	1 2
" " 10 in., . "	–	–	0 6	0 8	0 7	0 8	0 9	0 11
" " 9 in., . "	–	–	0 4	0 6	0 6	0 7	0 8	0 9
" " 8 in., . "	–	–	0 3½	0 5	0 4½	0 5	0 6	0 7
" " 7 in., . "	–	–	0 3	0 4	0 4	0 4½	0 5	0 6
Round or Deep Bakers one size higher, each.								
Cheese Stand, 11 in., . each,	–	–	–	–	1 9	2 0	2 3	2 4
" " 10 in., . "	–	–	–	–	1 3	1 6	1 9	2 0
Boats and Pickles, . "	0 4	6d. / 4d.	0 3½	0 4½	0 3½	0 4	0 4½	0 5
Boats and Stands, . . "	0 4	0 6	0 7	0 9	0 7	0 8	0 9	0 10
Hot Water Plate, 10 in., "	–	–	1 4	1 6	1 4	1 6	1 7	1 8
" " " 8 in., "	–	–	1 0	1 2	1 0	1 1	1 3	1 6
Beef Steak Dish, 14 in., "	3 0	3 6	5 6	7 0	5 6	6 0	7 0	8 0
" " " 12 in., "	6	3 0	4 6	5 0	4 6	5 0	5 6	6 0
Hash Dish, 14 in., . . "	3 0	3 6	–	–	4 0	4 6	5 0	5 6
Root Dish, 12 in., . . "	3 0	3 6	5 0	5 6	5 3	5 6	6 0	6 6
" " 11 in., . . "	2 6	3 0	4 3	4 6	4 3	4 6	5 0	6 0
	£ s. d.	£ s. d.			£ s. d.	£ s. d.	£ s. d.	£ s. d.
Dinner Service for 18 persons, . .	0 15 7	0 18 8			2 13 8	3 2 2	3 11 7	3 19 3
Dinner Service for 12 persons, . .	0 13 7	0 16 4			2 1 1	2 7 8	2 14 11	3 0 11

EARTHENWARE DINNER SERVICE

FOR EIGHTEEN PERSONS.

54 Plates, 10 in.
18 Soups, 10 in.
36 Plates, 8 in.
1 Dish, 20 in.
1 " 18 in.
2 " 16 in.
2 " 14 in.
4 " 12 in.
4 " 10 in.
4 " 9 in.
1 Soup Tureen and Stand.
4 Sauce " "
4 Vegetable Dishes.
1 Salad Bowl.
1 Fish Drainer.
1 Pie Dish, 11 in.
2 " 9 in.
1 Cheese Stand.

FOR TWELVE PERSONS.

36 Plates, 10 in.
12 Soups, 10 in.
24 Plates, 8 in.
1 Dish, 18 in.
2 " 16 in.
2 " 14 in.
2 " 12 in.
4 " 10 in.
1 Soup Tureen and Stand.
2 Sauce Tureen and Stand.
2 Sauce Boats and Stands.
4 Vegetable Dishes.
1 Salad Bowl.
1 Fish Drainer.
1 Pie Dish, 11 in.
2 " 9 in.
1 Cheese Stand.

EARTHENWARE DESSERT SERVICE

FOR EIGHTEEN PERSONS.

18 Dessert Plates.
4 Low Comports.
4 Tall "

FOR TWELVE PERSONS.

12 Dessert Plates.
4 Low Comports.
2 Tall "

EARTHENWARE TOILET SERVICE

DOUBLE SET.

2 Ewers and Basins, 6's.
2 Chambers, 6's.
2 Soap Boxes.
2 Brush Trays.

SINGLE SET.

1 Ewer and Basin, 6's.
2 Chambers, 6's.
1 Soap Box.
1 Brush Tray.

JOHN MORTLOCK, *Oxford Street, London*, exhibited china, breakfast, dinner, dessert, and tea services, of Minton's manufacture, with stone-china dinner-services of Minton and of Wedgwood's ware, decorated by the artists Solon, Mussill, Coleman, and others.

DANIELL, A. B., & SON, *46 Wigmore Street, London*, exhibited pottery and porcelain, dinner, dessert, breakfast, and tea services, besides toilet ware, majolica vases, and ornamental objects of various makers. This firm offered deco-

rated iron-stone china dinner services at from 60 to 80 florins the set ($30 to $40); a fern pattern set for six persons for 85 florins ($42).

Doulton, H., & Company, *28 High Street, Lambeth, London*, exhibited an interesting and important series of "blue metallic clay goods" for pavings, copings, ridge-tiles, channellings, and curbings, and for use in buildings where extra strength is required. Also, a collection of artistic stone-ware mugs, jars, flagons, etc. These last were especially interesting as examples of what may be accomplished with the cheapest and commonest materials in artistic hands. The objects were very pleasing, and the prices moderate. Each article is hand-made, and, while it is soft, designs are drawn upon the surface with a sharp-pointed style, leaving a deeply-incised line, into which the faintly-colored salt glazing flows and fills it flush with the surface. The designs consist chiefly of birds, animals, and flowers. Twenty or thirty artists are employed, and the articles produced are in great demand. For this manufacture, the clays of Devonshire and Dorchester, with the sand of Woolwich and of Charlton, are chiefly used. The clays are simply dried and broken up, and mixed with the sand in proportions determined by the quality of the ware desired. The paste, after kneading and beating to secure complete mixture and solidity, is passed between cast-iron rollers. The objects are burned with coal in open kilns of the Staffordshire pattern, and are glazed with salt.

A good collection of this pottery can be seen at the rooms of the Household Art Company, Boston.

FRANCE.

The French section afforded an excellent *aperçu* of the condition of the ceramic art in that country. There were many exhibitors, each producing some special forms or characters of ware. Although there was an abundance of decorated porcelain, there was a stronger and more striking representation of artistic enamelled faience, majolica, highly-colored wall tiles, and imitations of the ware of Bernard

Palissy. The lovers of artistic decoration lingered over the display made by Deck, admiring not only the high chimney-piece, but the large plates and ornamental objects decorated by paintings from the hands of masters in the art. Their names, well known to connoisseurs, displayed on a large mural tablet in enduring enamels, are as follows: Messieurs Anker, Bennier, Collin; Mademoiselle Escallier; Messieurs Gluck, Hirsch, Jullien, Legrain, Rannier, and Rieber.

Parvillée, Leon, *Paris, 1 Rue Neuve-Fontaine-St. Georges, at the angle of the Rue de Douai*, exhibited a variety of decorative objects, vases, plates and platters in enamelled terra-cotta, in Persian patterns remarkable alike for brilliancy of colors and the sharp-dividing lines of the designs, the enamels being in high relief. The basis of these wonderfully-fine enamels is the red terra-cotta or earthenware. The designs have been obtained directly from Persian work and manuscripts. The specimens attracted much attention from connoisseurs, and most of them were sold early in the season to the agents of the art museums of Europe. One of the finest examples—a vase of peculiar form, with tall narrow neck and sculptured handles—was secured by a citizen of Boston for the Art Museum in that city.

Interior Decoration in Enamel.

M. Parvillée has executed many important works for interior decoration in the oriental style, and exhibited a portfolio of manuscript designs in colors of the apartments which have been decorated by him with his enamelled plaques and tiles.

The enamels of M. Parvillée are opaque and have considerable relief. The colors are extremely pure and clear, and are laid on with care,—the same precaution of drawing a dark dividing or marginal line between each color, as in the specimen described from Choisy-le-Roi, being taken. In Parvillée's specimens, however, the enamels appear to have been put directly upon the white earthenware paste without glaze, which, apparently, was added afterwards for the interior and edge of the vessel.

If the large pieces of interior decoration are carried out

with the accuracy of detail characterizing the ornamental objects, they must be extremely costly. They are very different from the bolder and rougher work on terra-cotta, designed chiefly for exteriors. One of the chief works, by the celebrated Luca della Robbia,—reputed to be the discoverer of stanniferous enamels in Europe,—was the decoration, in enamelled terra-cotta, of a room—a writing-cabinet—for Piero di Cosimo Medici, about the year 1464. It was lined throughout, walls, ceiling, and pavement, and the parts were so perfectly fitted together that it appeared to be all in one piece. It has been suggested that the remarkable medallions illustrating the seasons, now in the South Kensington Museum, originally formed a part of the decoration of this cabinet, which, unfortunately, no longer exists, and is known only through tradition and the writings of Vasari.*

Choisy-le-Roi, H. Boulenger: *Dépôt in Paris, Rue de Paradis Poissonnière 4.*—Objects of utility and ornament, in faience, "granite," and "half-porcelain." A great variety of objects are made at this establishment, and were on exhibition, such as articles for the toilet, for perfumers, pharmacists, plumbers, and decorators; dessert sets, candlesticks, flower-pots, tiles for jardinieres, clock-stands, match-boxes, vases, etc., etc. They also imitate the faience of Rouen, Italy, Nevers, the enamelled plaques of Persia, and the porcelain of China and old Sevres.

A round plaque, in Persian style, is remarkable for the relief of the enamel and the distinctness and brilliancy of the colors. It is ten and a half inches in diameter, and has a projecting annular support below, giving greater strength to the piece without adding much to the weight. The basis or ground-work is ordinary earthenware, of white body, glazed in white, like stone-china. The upper surface is highly decorated, with opaque colored enamels laid upon the white enamel covering the whole. There

* Luca della Robbia was born in the year 1400, and is distinguished for his meritorious artistic productions in marble, terra-cotta, and bronze. The frieze of the singing boys, in the Museum of the Uffizii at Florence, and the bronze gates of the sacristy of the Duomo in Florence, are examples of his labors in these materials. He is supposed to have introduced the use of stanniferous enamels in Italy in the year 1438, with a view to the execution of indestructible paintings.

are eight different colors. The design appears to be carnation pinks, treated conventionally, quartering within an arabesque border of brilliant yellow dividing the area of the flowers from an outer margin of a beautiful deep blue color. The ground-work of the central portion is white, being the general glazed surface upon which the enamels are laid. The great element of beauty in such a plaque is the relief, with a curved surface, of the design. It may be said to *catch* and reflect the light. The design is visible and brilliant, when viewed obliquely, in any position. There is no one *best* light in which to view it. Instead of the blinding glare of a plain mirror-like surface, the design stands out clearly and brilliantly, looking as if the flowers were laid upon the plate. This remarkable relief, in some portions to the extent of one-eighth of an inch, appears to be due, in the first place, to the composition of the enamel and management of the heat, which permits incipient fusion without flowing. It is evidently not very fluid in the fire, and does not seem to have any special affinity for the ground-work glaze, for it does not spread upon it. The differently colored enamels would, however, unite, where they are placed side by side, were it not for a narrow dark line of a brown, earthy character, which is traced around every part of the design, isolating each patch of colored enamel, and apparently preventing the flow by sinking into and *drying up*, so to speak, the soft vitreous surface of the glaze. It also serves the purpose of "setting off" each part of the design, and adds to the general effect. It is a dead, earthy surface, without lustre or relief. Girard, in reporting upon the beautiful enamels of Collinot in the Paris Exhibition of 1867, says that the absolute neatness of outline is obtained by tracing around each flower a cupreous composition, which, being modified by the fire, gives a metallic cavity, retaining the enamel in its place. This suggests *cloissonée;* but the border in the Choisy-le-Roi specimen, and in Deck's enamels, has no metallic appearance and does not form any cavity. It simply presents a surface repellant to the flow of the enamel, as a line of wax or oil repels water.

THIERRY-POULIN, *manufacturers of porcelain and faience: dépôt, 48 Rue Caumartin, Paris.*—This establishment, among other objects, exhibited dinner-services in white faience, decorated in brilliant colors with flowers and leaves of the natural size, such as passion-flowers, branches of currants, lilies, convolvulus, and hazel-nuts,—all remarkable for fidelity to nature in the drawing and coloring. The price of such sets complete is 400 francs.

SERGENT: *dépôt Avenue d'Orleans 106, Paris.*—Manufacturer of artistic faience and paintings upon faience, imitations of the Pallisey ware, relief plaques and majolica.

BARBIZET.—Majolica and imitations of Bernard de Palissy's works.

GEOFFROY.—Yellow and blue enamels, etc.

SLABS FOR FURNITURE.

HOURY, JULES, *Paris.* A specialty by this exhibitor is slabs of porcelain, with figures in relief covered with a transparent blue glaze. They are designed chiefly for setting in furniture, the tops and sides of caskets, and for tables. The glaze is thin on the high lights and collects in the depressions, thus enhancing the effect of low relief. The process is like that for producing *émail ombrant*, but the design is the reverse, being raised instead of depressed. The British artisan (Locke) in describing this work says: "The slabs are modelled in stems and leaves in low relief and then covered with a beautiful blue glaze; the color is wiped off the high parts of the modelling and looks as if the light had fallen across it and the blue falls into the shadows. It must not be compared with the majolica made in England, which is similar in treatment, for the tone of the blue was bright and pure and the design suited the purpose. It gives us an idea of what good things can be done without much labor. * * * I should like to see the English use their decorated porcelain in objects of use more than they do, for this exhibitor shows what can be done with it."

The jury made Honorable Mention.

Lustred Ware.

Brianchon I. Ainé, *Paris*. This exhibitor confined his display to a variety of specimens of ornamental objects, covered with a very brilliant pearly or nacreous glaze, semi-metallic in appearance, and to the eye of a chemist, evidently due to the partial reduction of oxides in the glaze to a metallic state. There is a great variety of tints, from pearly white to a rose pink; and some of the objects, such as shells, where the iridescent surface is peculiarly fitting, are very pleasing to the eye.

This is a modification of an ancient art, which was long kept a secret. Its revival in France is due to M. Brianchon, who has succeeded admirably, making his pieces with more certainty and brilliancy than the old masters of the secret could attain. The early invention is attributed to the celebrated maestro, Georgio Andreoli, whose lustred wares are so highly prized by collectors. The purple or silver-lustred ware of Staffordshire is similar. The process was introduced there in Wedgwood's time, but has never made great progress. M. Brianchon's process consists in making enamels of nitrate of bismuth, iron, uranium, nickel or cobalt, and adding a reducing agent, such as resin or essential oils. Objects of this nature have also been made at the Royal Porcelain Works, Worcester, and by the Beleek Company in Ireland.

This exhibitor received a Merit Medal.

Sevres Manufactory.

There was no formal exhibition of Sevres products, but the celebrated porcelains of this noted establishment were not unrepresented. Amongst other pieces and collections the dessert service of Sevres *pâte tendre* should be noticed. It dates from the year 1765, and is a beautiful turquoise blue in color. It was exhibited by Prince Nicolas Repine, of Kiev, Russia.

The scientific as well as the artistic development of the ceramic art, owes much to the laborious investigations and experiments pursued, for a long series of years at this establishment, under the direction of such savans as Brongniart,

Regnault, Ebelman and Salvetat. Chemical science was needed and was freely used to throw light upon the great empirical art. Results of great practical value to ceramic industry followed. The composition of foreign porcelains, of clays and mixtures, was ascertained. The principles of the art of combining were established, and the secrets of glasses and enamels, and colors, were unlocked and discovered to the world. We can scarcely measure the influence upon the potter's art of such an establishment. And in judging of the quality of productions of private manufactories as compared with its productions, we should remember the superior advantages enjoyed by the union of science with the accumulated experience handed down through generations, and preserved by royal patronage.

Sevres as a School of Art.

At the London Exhibition of 1851, the jury unanimously assigned the first place to the products of the Sevres manufactory, and awarded the Council Medal.* They, however, very justly point out the fact that the light in which these products should be regarded is wholly different from that in which the productions of commercial industry should be viewed. The Sevres productions are rather those of a richly-endowed school of design, and in the French exhibitions they have not been placed in competition with the results of private enterprise. The influence of Sevres as a school of design has extended over the whole of Europe, and many of the most beautiful objects in porcelain produced elsewhere are imitations, or slight modifications, of the old productions of the Sevres school.

As early as 1698, the porcelain products at Saint Cloud were thought to be equal in quality to those of China. The manufacture was continued, in 1708, by the Brothers Dubois, under the protection of the Prince de Condé. But they did not succeed at Saint Cloud or at Chantilly. They removed to Vincennes, but failed again. In 1745, a company was formed, under the royal patronage, with special privileges for thirty years; but, in 1753, this was revoked, and the king became interested to the extent of a third, and the establish-

* Reports of the Jury, p. 542.

ment was removed to Sevres. The first success is said to date from 1768.

Hard and Soft Porcelain.

From 1753 to 1768, only the *pâte tendre*, or soft porcelain, was made; but, from that time, both the soft and the hard were made. About 1804, the production of the soft porcelain ceased, M. Brongniart, the director of the works, deciding to give his attention wholly to the hard,—the *pâte dure*. But the use of the soft paste was resumed in 1847 by M. Ebelman, he taking some of the old paste, which had rested undisturbed in covered tanks for forty-five years. The peculiarities of these two varieties of porcelain are described by M. Arnoux in his report on the pottery and porcelain at the Paris Exhibition of 1867, as follows:—

"France furnishes the largest amount of hard porcelain, and it is there, also, that it is best manufactured. France is highly favored for its production from the quarries of kaolin which abound in the centre and south. This material suffices, without any addition, to constitute the body; it is white, easy to work, and takes, in firing, a fine transparency. The glaze, which is fired at the same time as the paste, is also entirely composed from felspathic rocks, and vitrifies on the surface by the sole intensity of the heat required in the firing. Such a product presents, after cooling, great consistency, and the hardness of this glaze will defy the best tempered steel instruments. But defects arise from the very excess of these qualities. This hardness leaves little resource for decoration; the fine colors for grounds are banished, and the painting, unincorporated into the glaze, lies upon the surface and looks hard and unfinished. This is so thoroughly acknowledged that the Paris decorators now often prefer to paint upon French cream-color ware instead of porcelain.

"The manufacture of soft porcelain has always been limited, for it is the most difficult of all pottery. Its inventors, persuaded that Chinese porcelain was a kind of glass, persisted in composing a paste of the same ingredients. Sand, lime, and some alkaline materials were therefore vitrified in the proportion considered desirable to give a white half-translucent substance. But, as after being ground it had not the least plasticity, and could not be worked, they added as small a quantity as possible of the calcareous earth found in the plaster-quarries in the neighborhood of Paris, so as not to injure the whiteness or transparency. We cannot describe here

all the difficulties that the manipulation of such a mixture presented. It could neither be thrown nor pressed into moulds in the ordinary way; and the shapes were got by casting it in thick plaster moulds, and carefully turning and pushing it by hand afterwards. Moreover, as in the process of firing this porcelain, so properly called *pâte tendre*, the pieces were very apt to sink and lose their shape, the way of propping them was of the utmost importance; but when the biscuit stage was safely attained, the rest was comparatively easy. From its composition, this biscuit had the greatest affinity for combination with the vitreous mixture forming the glaze, and the result was that this glaze, not being hardened by the biscuit on which it had been melted, retained all its softness and so thoroughly incorporated the colors of the painting that, after firing, they looked sunk into it. An equal advantage was, that the alkaline nature of the biscuit and the low temperature required enabled those soft and beautiful ground-colors to be used which are not to be met with on any other pottery: the green, made from copper of an unequalled transparency; the turquoise, so attractive to the eye that a single piece placed in a room seemed to take all the light to itself; the bleu-de-roi, so well named from its richness; and that warm, delicate color, the rose du Barry. We purposely mentioned the low heat required to incorporate the colors with the glaze, because the experienced potter knows their richness decreases with the rise of temperature, and this is the reason why, for grounds in hard porcelain, hardly more than two colors can be depended on,—the blue from cobalt, and the opaque, heavy-looking green, from chrome."

A large number of vases in hard porcelain, of Sevres manufacture, were exhibited in 1867, and M. Arnoux said of them that the forms recently adopted were less beautiful than in 1851 and 1855, when Messrs. Dieterle and Klagmann gave their assistance to the establishment. Among the best were a large vase from Dieterle, the figures painted by M. Roussel, with the decorations by M. Avise, and all those executed by M. Barryat.

Sevres pâte-sur-pâte.

And of that variety of hard porcelain known as *pâte-sur-pâte* (paste upon paste) to which great attention has been given at Sevres, Mr. Arnoux observes:

"The name of *pâte-sur-pâte* explains sufficiently the process, which consists in staining the body of the hard porce-

lain in celadon, or other color, by the addition of a colored mixture, of which oxide of chrome is generally the chief ingredient; and then, when the piece is still in the clay state, to paint or rather model upon it with a brush, using white porcelain body as the pigment, and taking advantage of the transparency it will acquire when fired to produce an effect similar to that obtained in the Limoges enamels, by working the semi-transparent enamel on a black ground. Consequently the artist will increase the thickness of the white clay for the high lights, and decrease it where the color of the ground is to be seen through. Much experience is required to calculate the effect, the white clay before firing being equally opaque in the thin as in the thick parts. Of course any mistake is irremediable, as it can only be seen after the piece is fired. It was from studying the Chinese celadon that Mr. Ebelman started this kind of porcelain. The colors used on account of the high degree of temperature are extremely limited." To chrome, as a foundation color, must be added cobalt, nickel and uranium, which are also used to stain the clays when some other tint is wanted in addition to the white.

During the late Franco-German war, the Messrs. Minton, of England, secured the service of M. Solon, the artist by whom a great success in the *pâte-sur-pâte* process had been achieved; and we now find the results in the beautiful specimens displayed by the firm at Vienna. *Vide* p. 235.

Reference has been made to the impossibility of moulding or working the soft paste porcelain by throwing, in the ordinary way, owing to its want of plasticity.

Casting Porcelain Body.

Since the year 1850, the method of casting, rather than of moulding objects, has been in use. The paste being made thin, so as to flow like water, is poured into the plaster moulds, which absorb a part of the water and cause a thin film of the paste, or body, to adhere to the sides. The excess is decanted. This gave lightness and perfection of form to the objects, such as cups and small vases, but the process did not succeed with large objects, inasmuch as in the decantation the paste, adhering to the upper part,

became deformed by its weight, drawing it away from the sides of the mould. To overcome this difficulty the large moulds were encased in an air-tight jacket of sheet iron, within which the air was exhausted previous to the decantation, thereby causing the deposited film to adhere firmly to the sides of the porous plaster. This improvement was cited in 1867, by M. Dommartin, as one of the advances made in the art of manufacturing hard porcelain.* A large vase made in this manner was exhibited at Paris in 1867.

Extent of the Industry in France.

The following data regarding the pottery and porcelain industry of France are drawn from the report by Messrs. Salvetat and Dommartin in 1867. Clay, for pottery purposes, is found in almost every part of France. The best china clays are found at St. Yrieix, near Limoges; but the kaolins of the Pyrenees, the Cher and the Allier are largely used. The manufacture of porcelain is carried on in three districts. 1. Limousin, which comprises Haute Vienne and the Creuse. At Limoges, in this district, there were more than thirty white china works. 2. Berry, including the works of Cher, Allier, Nievre and Indre. These works produce chiefly white china and articles of common use. 3. Paris and its environs and Champagne. The productions of Paris are varied. The fancy articles known as *Articles de Paris*, such as flowers, cups, baskets, etc., are made by several small makers. Others produce biscuit-ware, or articles for mounting in ormolu, bronze or carved wood, such as lamps and tazzas. Many persons receive white porcelain from the trade, and decorate it according to the demand of the day. Although not confined to Paris, it may be regarded as essentially Parisian.

Earthenware is made in Paris, at Beauvais, and in some parts of Normandy. Fine faience is made chiefly at Creil, Montereau, Sarreguemines, Choisy le Roi, Gien and Bordeaux. Artistic faience has its centre in Paris and its environs. In 1867, Messrs. Salvetat and Dommartin pointed out that in the manufacture of faience, steam power tended to

* Rapports du Jury Internationale, iii. 171.

replace hand labor; and the introduction of English methods had transformed the manufacture. Also that, as regards porcelain, the softening caused by the high temperature required for the baking, deforms pieces made in any other way than by hand; and that up to that time no mechanical assistance had been found available; but there was good reason to hope that in the shaping and preparation of the material, mechanical art might eventually lend its aid.

Workmen were paid by the piece. No less than 1,362 men and 458 women were employed in decoration of china alone, in Paris, in 1867. The greater number of the potteries have agencies, or depots, at Paris, or send their ware there for sale. Paris is the great centre of the trade, and Limoges is next in importance. From this last named place, ware is sent to all parts of the empire, by the aid of travellers and agents. The annual value of the product of fine faience was estimated, in 1867, at 10,000,000 francs, and of porcelain at 20,000,000 francs.

French Stone-China.

At the Paris Exposition, in 1867, the various brands of stone-china ware were carefully examined by M. Aimé Girard, with reference to their hardness, porosity, and price. To ascertain the hardness of the glaze upon a plate, for example, he used a small platform of wood, sustained upon three points resting upon the plate, one of them being tipped with a diamond. This platform was then drawn back and forth over the surface, and the weight required to be added to the platform to produce a scratch was the measure of the hardness. He found that a pressure of more than one kilogramme was required to make as much of an impression upon hard porcelain as one hundred and twenty grammes would give on lead-glazed stone ware. His results are given in the following table.*

* From Rapports du Jury International, III., p. 136.

Comparison of the principal kinds of fine quality Faience, as shown at the Exhibition in Paris, in 1867, as regards their quality and price.

DESCRIPTION OF FAIENCE.	Hardness	Grain.	Price.	Price.
1. SUPERIOR QUALITY.			Francs.	Francs.
Sarreguemines China, France, . . .	0k.625	8.25	2.0	3.10
Minton & Company's white glaze, . .	0k.530	12.35	2.95	3.25
Rörstrand, Sweden, ...	0k.440	9.43	–	3.00
Gustafberg, Sweden, ...	0k.480	11.24	2.20	–
2. SECOND QUALITY.				
Choisy-le-Roi, "Granite China" (France),	0k.420	11.23	1.95	3.15
Stoneware of Villerry and Boch (Prussia),	0k.415	13.14	2.20	3.80
Stone-China of Pinder Bourne (England),	0k.485	10.00	2.75	2.95
3. ORDINARY WARE.				
Opaque of Sarreguimines, France, . .	0k 620	13.25	1.50	–
Opaque porcelain of Gien, France, . .	0k.375	14.50	1.55	2.60
Cream colored ware, Minton & Co., Eng.,	0k.400	8.20	1.58	–
Opaque porcelain of Creil, France, . .	0k.505	10.14	1.55	–
Opaque porcelain of Montereau, France,	0k.450	15.40	1.55	2.50
Half-porcelain of Choisy-le-Roi, France,	0k.390	11.31	1.55	2.25
Cream colored ware, Copeland & Co., Eng.,	0k.340	8.64	2.60	3.15
Cream colored ware, Wedgwood, Eng., .	0k.320	8.57	2.10	2.95

The column representing the hardness shows the weight required to produce a scratch with the point of a diamond. The "grain" or degree of porosity is expressed by the weight of water which was absorbed by one hundred grammes of the ware. The prices were furnished by the manufacturers or their agents; and in the first column are for a dozen white plates, eight inches in diameter (twenty-one centimetres); in the second column for the same number and size of decorated plates. The three divisions or qualities are based upon the degree of whiteness; the third all having more or less of a yellowish tinge.

PRUSSIA.

Royal Prussian Porcelain Factory, Berlin.

This famous establishment, which has been notably represented at all of the great exhibitions,* sustained its reputation at Vienna, by its display of vases and ornamental porcelains of various kinds, plastic work in biscuit, services, and in decorative figures, etc. Plain white porcelain is also made.

The works were established in 1763, and are sustained chiefly for the promotion of the industry, technically and artistically. In the year 1871, the production amounted to 500,000 pieces, worth 160,000 thalers, from raw materials costing 11,050 thalers. The greater part of the product is for home consumption. Three hundred and three workmen are employed and two steam-engines of 40 horse-power.

The Royal Saxon Porcelain Works, producing what is known as Dresden porcelain, are established at Meissen, a few miles above Dresden. The establishment was founded by Augustus II., the Elector of Saxony. Tschirnhaus and Böttcher, two alchemists in his service, commenced to make experiments about 1706; and the credit of making the hard porcelain for the first time in Europe is accorded to Böttcher. He made a red or jaspar-like ware, which could be cut and polished by the lapidary, and a glazed, brownish red ware.

* Gold Medal at Paris, 1855; at Paris, 1867, *Hors du Concours*.

He discovered the method of making white porcelain in 1709, and he was appointed Director of the Meissen works in 1710. Five years later, white porcelain of excellent quality was commonly made, and in 1720, under the direction of Horoldt, excellent paintings with gilding were produced. Groups and figures were modelled in 1731, and, in the succeeding twenty-five years, the productions attained their greatest perfection. The varied productions of the establishment at the present time were conspicuously displayed upon the crimson-covered canopied stand in the main transept, adjoining the rotunda. They consisted chiefly of the finer sorts of vases and decorated ware, and fully sustained the high reputation of the works. The productions, however, include ordinary dinner-services and ware for domestic use, much of it decorated in cobalt blue, and artificial ultra-marine; colored enamels, and other materials for the production of porcelain. About 600 workmen are employed, and the value of the product annually is about 400,000 thalers (in 1871, 370,000 thalers). The market is chiefly abroad. For the blue decorated dinner-services there is a great demand, so that the works are two years in arrears of the orders.

C. Tielsch & Co., *Altwasser, Schlesien, manufacturers of porcelain, stone-china, and fire-brick.*—The consumption of raw materials by this establishment amounted to 324,483 thalers in value, and the production to 20,000,000 pieces, worth 750,000 thalers, the greater portion of which was for home consumption. Forty-five officers and foreman, and about 1,700 workmen, in two establishments; seven steam-engines, with an aggregate of 158 horse-power. Founded in 1845. Progress Medal awarded.

Carl Krister, *Waldenburg, Schlesien*, exhibited table-services, clocks, vases, etc. There are two establishments, founded in 1831, manufacturing not only porcelain articles, but bricks, fire-bricks, and tiles. They make a specialty of table and coffee services. The consumption of raw materials, in 1871, amounted to 220,000 centners, and the production to 639,000 thalers worth, mostly for home consumption.

Thirty-two officers and overseers, 1,475 workmen; 6 steam-engines, with 126 horse-power. Merit Medal awarded.

C. HECKMANN & RAPPSILBER, *Königszelt, Schlesien*, exhibited toilet-services, table-services, mosaics, etc. Established in 1864. Make a specialty of table, coffee, and toilet services. Value of the productions in 1872, 270,000 thalers; sold in Germany. Four hundred workmen, 2 steam-engines, 32 horse-power. Diploma of Honor awarded.

WAECHTERSBACHER STEINGUTFABRIK, *Schlierbach, Hessen-Nassau.*—Coffee and tea services. Established in 1834. Two hundred and twenty-eight workmen, 1 steam-engine, 5 water-wheels.

VILLEROY & BOCH, *Mettlach, Wallerfangen, Septfontaines* and *Dresden*. This establishment, well known from its productions and as the largest in existence, probably, for the production of fine faience, made an attractive display of its products in the rotunda. This display comprised dinner and dessert, coffee and tea services, toilet ware, vases and ornamental objects in faience and in terra-cotta, of superior quality and decoration. The terra-cotta plates, platters and tablets, were ornamented by incised designs, filled in with the same material as the base or groundwork, but of a darker color, as encaustic tiles are made. This, and the manufacture of tiles by pressure from pulverized materials, constitute specialties of the establishment.

The productions amount in value to 1,000,000 of thalers annually. In 1871, the total value was 1,170,000 thalers. Nearly the whole of Germany is supplied with faience from this establishment, and at such low prices that foreign manufactures cannot profitably compete for the trade.

The works were started at Wallerfangen in 1789; at Mettlach in 1810; at Septfontaine in 1767; and the tile works in 1868. There are 1,848 workmen, 36 officers, 7 steam-engines, 217 horse-power. Medals were awarded at London in 1851, and at Paris in 1855 and 1867. The jury awarded the Merit Medal.

The firm also have four establishments at Dresden for the manufacture of stoneware, especially stove tiles, stoves and paving blocks. They made about 320,000 thalers' worth of ware in 1871. Six hundred and ten workmen, 19 officers, 3 steam-engines, 145 horse-power.

MACHELEIDT, TRIEBNER & CO., *Volkstedt bei Rudolstadt Schwarzburg-Rudolstadt.* Exhibited porcelain figures, groups and medallions. The establishment, which was founded in 1760, makes a specialty of medallions for wall decoration. In 1871, the works used 6,100 centners of raw materials, worth 3,300 thalers. Half of the product is exported. Four hundred and twenty-eight workmen, one water-wheel. Diploma awarded.

ACTIEN GESELLSCHAFT FÜR TELEGRAPHEN-BEDARF, *Berlin.* Manufacture and exhibited telegraph materials of porcelain, gas retorts, etc. Merit Medal.

THALLMAIER, FR. X., *München.* Establishment founded in 1849. Exhibited services, dishes, vases, etc., beautifully decorated. Special mention should be made of a service with chrome-green groundwork, ornamented with arabesques and flowers, and of the artistic cabinet of porcelain paintings; original copies after modern masters. Merit Medal.

DRESSEL, KISTER & CO., *Scheibe, Schwarzburg-Rudolstadt.* Groups, statuettes, busts and porcelain figures. The market for these productions is about half at home and half abroad. Nearly 610 workmen are employed. Six water-wheels, 24 horse-power. Merit Medal.

Also at Passau, Bavaria, established in 1853, for the manufacture of porcelain figures, fancy articles, and stone-china ware. This establishment makes a specialty of crucifixes, basins for consecrated water, etc. Consumed, in 1871, between 50,000 and 60,000 florins' worth of porcelain earth. Two hundred and sixty workmen, five water-wheels.

THEWALDT, J. HÖHR, *Nassau.* Stoneware and porcelain for chemical laboratories and culinary purposes. Established

in 1792. Consumed, in 1871, 2,100 thalers' worth of raw materials. Market in Germany. Twenty-three workmen, 1 steam-engine of 12 horse-power. Diploma awarded.

WINGENDER BROTHERS, *Höhr, Hessen-Nassau.* Exhibited clay pipes, cigar-holders, etc., of which they make some 5,000,000 pieces of all kinds annually, valued at 18,000 thalers. A market for one-half of their production is found in Germany, the balance is exported. They employ 68 workmen. Works established in 1798.

SCHLESISCHE THONWAARENFABRIK, *Tschauschwitz Neisse, Schlesien.* Stoves, majolica building ornaments, refractory ware, etc. A specialty is made of majolica building ornaments. The chief market for the products is found in Germany. There are 204 workmen, 1 steam-engine of 24 horse-power. Value of products in 1871, 90,000 thalers, out of clay worth 8,500 thalers.

H. J. NYGEN & CO., *Duisburg, Rhenish Provinces.* An interesting series of refractory blocks, shaped carefully for the various parts of high furnaces, cast-steel furnaces, reverberatory furnaces, etc., was exhibited by this firm, as also gas-retorts, crucibles, etc. The productions, in 1871, amounted in weight to 360,000 centners, and in value to 200,000 thalers. Two hundred and sixty-six workmen employed, The greater portion of the product is used in Germany. Progress Medal.

MAGDEBURGER BAU-UND CREDIT BANK, *Magdeburg.* Exhibited clay goods, glazed and painted stove tiles, stoves, glazed terra-cotta ware, building and paving bricks, firestones, etc. In 1871, they produced 85,000 thalers' worth of goods, using 30,000 centners of clay, 216 workmen, 4 steam-engines of 19 horse-power, 14 ordinary burning ovens, 1 Mendheim's gas ring-oven with 18 chambers, and 1 Hoffmann's ring-oven with 16 chambers.

RUSSIA.

Imperial Porcelain Manufactory. This imperial establishment, founded in the year 1744, and located near St. Petersburg, exhibited products comparable with the finest of Sevres, Meissen or Berlin, consisting of vases, services, platters, jardinières, bouquet-holders, biscuit-figures, etc. They were all remarkable for perfection in form, color and exquisite painting, but a few of the most striking objects will be mentioned. In biscuit, nothing could be finer than the large bouquet of flowers and leaves, showing a quality of paste unsurpassed for whiteness and working capabilities. Every petal was perfect, and almost as thin as in nature. Lace pattern dishes bore equal testimony to the perfect control of the form of the paste in firing. A tea-set, antique Chinese pattern, decorated with flowers, attracted much attention. Among the large objects, the most notable were the porcelain table-top, three feet in diameter, snow-white in the centre, with a wreath of flowers forming the border, perfect in drawing, color and every detail; and a magnificent vase six feet high, painted with twelve cupids, dancing, holding a string of ivy. This vase was valued at $2,500.

This establishment was founded in 1744. It employs 230 workmen, and has a steam-engine of 12 horse-power. It has 4 furnaces and 6 muffles. The annual production is valued at 100,000 roubles.

Repine, Prince Nicholas, *Kiev*, exhibited a beautiful dessert-service of old Sevres, of the year 1765–1766: color, turquoise blue. See "Sevres."

Stépanoff, Michel, *Varsilièro, Bogorodsk District*, exhibited refractory tablets and bricks, alembics, gas-retorts, etc. The establishment was founded in 1871; it employs 100 workmen, 14 horse-power steam-engine, and the production is valued at 200,000 roubles. Diploma.

There was also in the Russian section a fine series of earthenware, domestic utensils, and liquid measures, remarkable for excellence of form and cheapness; but no information concerning them could be obtained.

AUSTRIA.

Imperial Porcelain Works, *Vienna*.—The manufacture of porcelain was established in Vienna, in 1717, by Blanquièr. In 1746, the works were purchased by the Empress Maria Theresa for 45,000 florins, and Blanquièr was made director. In 1750, forty men were employed; in 1761, one hundred and forty; in 1770, two hundred; and in the year 1780, three hundred and twenty. In the period from 1760 to 1790, under the sculptor Niedermayer, the production of figures and groups was most developed. More attention was then given to decoration of the ware by painting, under the direction of the chemist Leithner, who produced the beautiful blue color known by his name, the reddish brown, and the superb gilding.

The first artists of the day were engaged to furnish sketches; and amongst the artists we find the names of Watteau, Sancret, Boucher, and Angelica Kauffmann. In 1827, Director Niedermayer died, and the establishment gradually declined in importance until 1864, when the Reichsrath refused further sums for its maintenance and stopped operations. The models were destroyed, and the buildings were turned into an imperial cigar factory.

Private porcelain works, *zum Eisgrübl*, had been established in 1702, and this firm came into possession of most of the stock on hand in the imperial works, and has since continued the manufacture on a smaller scale.

Fischer, Moritz von, *Herend, near Weszprim, Hungary*.—This famous establishment has its chief depot in Vienna, and made a very extensive display of all its reproductions of celebrated manufactures of porcelain, chiefly of old Sevres, Meissen, old Chinese, and old Japanese. Here could be seen counterparts of the raised flower-work of Saxony, of the open perforated basket-work ware, of old Vienna porcelain, and of the Italian Capa di Monti. These imitations are much sought for, and are the basis of an extensive business. Most, if not all, are distinctly marked with the maker's name and place of manufacture, so that no deception or mistakes can result. Some ordinary Chinese and Japanese ware is

tolerably well imitated; but there is a notable failure in the attempts at the finer and distinctive peculiarities of the best pieces from those countries.

Two large portraits on porcelain, by this exhibitor, merit special mention: one of Humboldt, with a porcelain frame about three feet by two feet, and another of Paul Esterhazy, sixteen inches by twelve. Another example of a portrait, with a frame of porcelain, and all in one piece, is to be found in the Japanese section.

A perforated tea-set, in Chinese style, attracted the attention of the Prince of Wales, and was purchased by him. A large vase, with Chinese decoration, is also worthy of mention. The jury decreed a Progress Medal.

Fischer, Ignaz, *Buda-Pesth, Hungary*, exhibited specimens of painting on porcelain, to which the jury decreed a Diploma of Honorable Mention.

Alois Klammerth, *Znaim.*—A collection of quaint and cheap pottery, in red, black, and yellow enamels, and mostly of articles for common domestic use, kitchen utensils, etc. The forms were simple, but elegant, and the quality was excellent. They are, withal, sold at a very low price. Some of the ware is decorated by turning or scraping off the dark-colored glaze before firing, so as to expose the light-colored body below; and an excellent effect is produced. Progress Medal.

Franz Schleiss, *Gemunden am Traunsee*, exhibited quaintly colored faience and majolica blue, white, yellow, and green; also, kitchen ware and drinking-mugs, all of odd patterns and coloring. Merit Medal.

Haas & Čžžek, *Schlaggenwald and Chodau, near Carlsbad, in Bohemia.*—This firm made a fine display of choice porcelain in the rotunda. It comprised dinner and dessert services, tea-sets and ornamental vases, etc. Some of the tea-sets were exquisite in form and decoration. Price, 124 florins. A superb dinner-service, for twenty-four persons, was ticketed 1,560 florins. The exhibition made by this firm

at Paris, in 1867, received the silver medal, and at this exhibition receives the Progress Medal.

DEUK, ALBIN W., *Vienna*, exhibited some beautifully decorated porcelain and imitations of French, Meissen, and Chinese ware. The firm exports to Russia and the Orient alone, over 10,000 cwts. annually. Merit Medal.

ERNDT, BERNARD, *Vienna, ix, Pramergasse, 25.*—Among the many attractive displays of stove tiles from Austria, Hungary and Bohemia, the exhibition made by M. Erndt stood preëminent. A description of the various patterns and colors would fill a small volume; but no adequate idea of the tiles can be conveyed without plates. Most of them are in high relief, and are colored rich dark brown or green, or are plain white. They are about eight inches square and three to six inches thick. They constitute a specialty in ceramic manufactures, differing greatly from paving or mural tiles or household pottery. The use of such tiles is enormous in Austria and Germany, nearly all the apartments being warmed by the "porcelain" stoves. The great merit of this exhibit was recognized by a Progress Medal.

GEBRUDER SCHÜTZ. Stiermark and in Bohemia; Earthenware. A very interesting exhibition of quaintly formed pitchers and jugs, with long narrow necks and flattened sides, as shown in the annexed outline, standing about sixteen inches high, and colored bright blue, vermilion and green. Upon the same stand there were plates and a coffee service of earthenware, with a rich chocolate brown glaze, very attractive not only in color but in form, and very cheap, the whole coffee set being marked at only four florins, about two dollars. The jury accorded a Merit Medal.

HARDTMUTH, L. & C., *Budweis.* This firm made an extensive display of peculiar styles of porcelain and faience, designed especially for export to the Orient, with which it would appear there is an extensive trade in this class of ware, the chief excellence of which seems to be its con-

formity in shape and decoration to old-fashioned, obsolete styles. Merit Medal.

SWEDEN.

There were two principal exhibitors of porcelain and earthenware in the Swedish section, both showing the possession of excellent materials and skill in the manufacture. Feldspar, one of the principal materials used in porcelain, is obtained abundantly in Sweden, and is exported in quantities to England.

Rörstrand Porcelain Works, *Stockholm*. The display from this establishment was very interesting, consisting of porcelain vases, urns, dinner-services, plates, cups and saucers, etc. The tea-cups especially were well-formed and decorated. The handles were delicately formed and well attached. Some dark blue enamels with gilding, and a set in black enamel with raised designs in white of flowers and grasses, repaid close examination. White iron-stone china, parian, biscuit and majolica, are made at the same establishment.

These works were founded in the year 1726, and they now employ over 500 persons and a steam-engine of 70 horse-power. The production in the year 1872 was valued at 830,000 rix dollars. The greater portion of the product is sold in the country; but some is exported to Norway, Denmark, Finland and Russia, and small quantities to France and England. There is in connection with the establishment a hospital for the sick and infirm, a school for the children, a Sabbath school and a library.

Gustafberg Works, *Stockholm*. (W. Odelberg.) This establishment also made a fine display of porcelain, faience, parian and majolica ware. The dinner-services were excellent in form, color and decoration. Sets of cups and saucers, of good pattern and well fired, glazed in single colors all over, except the interiors, and the central parts of the saucers were noted as worthy of mention. The colors,

such as red, purple, blue and lavender, were very even and bright, and produced a fine effect.

Some very good specimens of majolica were shown by this and by the Rörstrand establishment, characterized, however, by the apparent abundance of oxide of copper, for a vivid green was the predominating color of the glaze.

The Gustafberg works were established in the year 1826, and now employ about 400 persons and 4 steam-engines, with a total of 91 horse-power. Raw materials to the following amounts were used in the year 1871 :—

40,500 cubic feet of clay, from England ;
20,000 cubic feet of "fire-stone," from France ;
800,000 lbs. of feldspar, from the neighborhood ;
34,000 lbs. of bones, from Sweden ;
24,000 lbs. oxide of lead ;
22,000 lbs. of borax, from France and England ;
160,000 cubic feet of stove coal ;
700 cubic feet of wood.

The value of the products reaches the sum of 702,000 rix dollars.

PORTUGAL.

Several exhibitions in the Portuguese section give evidence of the growth of ceramic industry in that country. The manufacture of porcelain is carried on at Vista Alegre, Aveiro, and at Sacavem, Lisbon. It has long been established at the former place, and the products are held in high estimation. Modern improvements have been introduced, and a variety of artistic and ornamental objects, such as vases, statuettes, etc., are manufactured. Pinto and Tilho exhibited toilet and tea-sets, apparently modelled after British patterns, but without special merit.

There was considerable ordinary pottery and majolica, rather crude in form and coloring, but not uninteresting ; green and brown coloring predominated. Some red, unglazed jugs, from the manufactory of G. Mafra, deserve

mention for the peculiarity of their form. They are evidently a modified form of alcarazza, intended to hold and cool drinking water, by suspending them in a cool and airy place. The top is closed over, the only opening being the spout, through which the vessel is filled by immersion. A curved handle at the top is convenient for carrying, and one at the side for tipping it.

In the year 1870, the importations of glass and ceramic products were valued at 150,522,000 reis, and the exportations at 36,911,000 reis. Of faience, in the same year, 132,688 kilogrammes, valued at 24,077,000 reis, were imported from England.

DENMARK.

Royal Porcelain Manufactory, *Copenhagen*, exhibited in the Rotunda and in the Danish court decorated porcelain of all kinds, especially works in biscuit, consisting of medallions, busts and bas-reliefs, after Thorwaldsen, Bissen, and others. Thorwaldsen's "Night and Morning," and the medallion portraits, deserve special mention for their excellence in form and composition of the paste, and their pure whiteness. The works also make a specialty of imitations of the old Saxon and Danish ware.

The list of premiums received at former great exhibitions is a long one, and at this exhibition the works fully sustain their reputation.

The fine terra-cotta ware of this section, consists of choice vases, urns, tazzas, etc., in imitation of the old Etruscan and Greek forms. These are black in color with figures in red, and the reverse. Others are decorated with sprigs of ferns and flowers on the plain black surface. They are exquisite in execution and color, and were much admired. All this ware is remarkably perfect in form, and is burned without distortion. The prices are moderate.

ITALY.

Majolica.

Although specimens of majolica ware, as usually designated, were to be found from all the principal countries, it is chiefly to the Italian and Spanish sections that we should look for the typical specimens.

The name majolica is believed to be derived from Majorca, the Spanish island from which it is supposed the first specimens were taken or exported to Italy. The island, according to Fabio Ferrari, was called Maiolica by ancient Tuscan writers, and Dante writes, "Tra l'isola di Cipri e Maiolica." Pottery was made there by the Moors from an early period in the Middle Ages, and it became famous. There is a statement, considered mythical by some, that, at the conquest of the Balearic islands by the Pisan fleets, in 1115, part of the spoil consisted of the famous Majorca ware, and that it was used for the decoration of the towers and façades of the Pisan churches. The term majolica, or maiolica, appears originally to have been restricted to the lustred wares,—those in which there was a nacreous chromatic effect, due to the partial reduction to the metallic state of the oxides forming part of the composition of the glaze. This lustre, though easily produced when the cause is known, was doubtless one of the great secrets of the art for a time, though doubtless produced, in the first instance, unintentionally by the imperfect combustion of the fuel in the kilns giving a smoky atmosphere containing free carbon, or carbonic oxide gas. A coarser ware, of potter's earth, covered with a white slip, upon which the designs were painted, and glazed with lead, was known as *mezza-maiolica*. The true majolica was probably tin-glazed, though it does not appear by any means certain that this constituted the distinction. Towards the middle of the sixteenth century, the terms seem to have been applied to all varieties of the glazed earthenware of Italy. Mr. Fortnum, with M. Jacquemart, M. Darcel, Mr. J. C. Robinson, and others, think that the word majolica, or maiolica, should be again restricted to the lustred wares, although in Italy, and elsewhere, it is commonly used to designate all varieties

of earthenware, excepting "terraglia," in distinction from porcelain.*

It has also been maintained, that although Majorcan wares were known in Italy, the art may have been derived from Persian potters reaching the eastern ports of that country. This view is supported by the fact, that the style of decoration of the early Italian wares is more Persian than Moresque.† Again, it is suggested that after the conquest of Majorca and of the province of Valencia, at the end of the thirteenth century, Moorish potters emigrated to Italy and introduced their practice of the art with the tin glaze ‡ and metallic lustre.

In England and in the United States it is the habit to designate as "*majolica*" any pottery covered with a colored glaze. The term should be restricted to ware coated with opaque enamels. The ornamental ware, especially when modelled after natural objects, and coated with transparent glazes of various colors, is more correctly described as *Palissy ware.*

Capo-di-Monti Ware.

Ginori, *The Marquis of: porcelain manufactory, Doccia, near Florence.*—This establishment, founded in the year 1735, now produces many varieties of artistic and domestic porcelain and decorative objects, in majolica and faience. It is celebrated especially for its reproductions of the famous Capo-di-Monti ware, the pieces being made from the old moulds, and so well colored as scarcely to be distinguished from the old examples preserved in collections. The peculiarity of this ware, as is generally known to connoisseurs, consists in the decoration of the surface by groups of male and female figures in relief, covering the surface on cups and saucers, vases, plaques, boxes, jugs, etc. Most of the figures are in a nude or semi-nude condition, and are tinted with flesh color, and are surrounded by flowers or wreaths, of which pink or rose color is the prevailing color. Many of

* Fortnum's Maiolica Hispano Moresco, Persian, Damascus, and Rhodian Wares, etc., page xxxvii. of Introduction.

† Jacquemart, cited by Fortnum, ibid., p. xxxix.

‡ With regard to the origin of the tin glaze, usually attributed to Luca della Robbia, see *infra*, Part "Ceramic Clays and Materials."

the specimens are no doubt as good, or better, than the old. They attracted much attention and command a high price. As examples of skill in sculpture or modelling, they are certainly not remarkable. They do not bear comparison with the exquisite relief figures of Wedgwood's establishment. They lack sharpness and distinctness of outline, and have a half-fired look, partially blended as they are with the background, evidently forming a part of the body of the ware, all being moulded in one piece and of the same material. Considerable attention has also been given at this establishment to the imitation of the celebrated productions of Urbino, Castel Durante, and of Gubbio.

The productions have been conspicuous at most of the great exhibitions, and have received many medals, notably at Paris in 1855, London in 1862, Paris in 1867. The proprietor was also honored in 1867 by appointment to membership of the Legion of Honor of France.

Torquato Castellani, *Rome*. This exhibitor appears to devote his energies to the reproduction of choice examples of old Italian majolica and decorated pottery, chiefly bottles and urns. One of these, with massive twisted handles, is represented in outline. It was about 12 inches by 15 inches high, and was purchased by the St. Petersburg Museum for £7 15s.

Monaco. In the small building outside the Industry Palace, set apart for the products of this State, there were many specimens of decorated faience, in the old Dresden style. They were chiefly vases and baskets covered with colored flowers in relief.

Incised or Sgraffiato Ware. This name is applied to a species of decoration practised in Italy by the potters of the Renaissance period, or towards the beginning of the fifteenth century. It is also known as Perugia ware, having originated in the province of Perugia. The design is scratched out of a thin layer of light colored clay over a darker body beneath. The object is then glazed, and colors

are sometimes added. The art has been revived by the Messrs. Minton & Maw.

It suggests, also, the style of decoration so effective on the stoneware of the Doulton's, Lambeth, British section.

INDIA.

The list of the ceramic contributions from India fills several pages of the Descriptive Catalogue, but consists chiefly of earthenware and glazed tiles.

Dr. Leitner, Lahore, sends a tea-cup of Lhassa porcelain, and specimens of the Lahore porcelain, the last attempt at the manufacture, which will soon die out unless encouraged. Peerano, of Tatta Sind, forwarded ninety-five variously colored specimens of domestic pottery, including floor-tiles and specimens of the materials and implements used in the manufacture and glazing of pottery. Similar collections were sent by other persons from various parts of India.

For a notice of the tiles, etc., see Tiles.

JAPAN.

Japan entered fully into the spirit of the great Exhibition, and made the most systematic and comprehensive display of the varied industries of the country yet seen by Europeans. The ceramic products were a salient feature, and illustrated the manufacture of porcelain faience and terra-cotta from many of the provinces. When we reflect that this country, with China, is the birthplace of the art of porcelain, and consider the numerous separate establishments for its production, its general use among the people and the extent of the manufacture, not only for native use but to please the taste and meet the requirements of foreigners, we shrink from attempting a critical review of the industry, or even a description of the representative examples accumulated at Vienna.

The fertility of the people in design and modifications of the potter's art surprises every one, and none more than those who have in vain striven to exhaust the novelties of

the manufacture in materials, form and ornamentation. There is an unceasing variety, and, apparently, no end of surprises in store for amateurs and collectors. But it is not in porcelain alone that the Japanese potters attain excellence and variety. They produce faience and ware resembling the finer sorts of terra-cotta, plain and enamelled. The exquisitely decorated faience of Satsuma was a surprise to connoisseurs at Paris, in 1867. It was admired in London, at the Exhibition in 1871, and appeared in still greater variety of forms and decoration at Vienna. The potters seem also to be copying European "masters," for they are making this ware into forms to suit foreigners. Certain it is that, as the demand for any one of these varieties of ware increases and large orders have to be filled, the care and detailed labor diminishes, and we lose that painstaking and exquisite finish which is freely bestowed on a few select objects. Thus it is that older specimens of ware are generally the most desirable. The same is true of the metal work and the ivory carvings. Quality must be sacrificed to quantity.

The Japanese Commission, however, who had the responsibility of securing a proper representation, made judicious selections and placed some of the choicest, as well as the more ordinary objects, before the jury.

The list includes vases, white and blue, in red color, and in the deservedly admired celadon green; perforated work, enamelling in relief, egg-shell ware, monochromatic and polychromatic decoration, decoration with flowers and figures, and with laquer and gold. There were not only vases, but plates, bowls, sackie-bottles, sackie-cups and tea-pots in great variety; tiles, large decorated slabs, a fire-place and mantel, and dinner, breakfast and tea services, after European patterns.

The Japanese porcelain, it is well known, is the *hard*, or *pâte dur* variety. It is, in general, highly vitreous, compact and hard, but is tough and resists heat well.

Amongst the many porcelain-making establishments in Japan, those of Sai-kio, Inari, Kutani, Owari* and Awadji,

* Owari is in the Second District, Tokaido, and Awadji in the Seventh District, Nankaido.

are held in the highest esteem. Most of the potteries are small. The production is not centered in extensive works, and this accounts for the diversity of patterns, the differences of paste, of glazing, and of colors.

A pair of large vases, of modern make, attracted attention. They are about five feet high and twenty inches in diameter ($1^{m}\cdot623$ and $0^{m}\cdot495$). These are decorated around the tops with groups of peonies, others with dragons modelled in low relief between birds and flowers, on the flat in blue, under the glaze. A flower-vase also commands mention. Size $0^{m}\cdot484$ in diameter at the top. Blue enamel, ornamented with figures of peacocks and peonies. One of the large plates represents the four seasons by four groups of flowers. The outside is ornamented with butterflies and arabesques. Diameter, $0^{m}\cdot984$.

Miaco Faience.

A cheap buff-colored earthenware, resembling the Satsuma, is made at Miaco. It was exhibited at Vienna, and is now abundant in the shops. The forms are various and quaint, particularly where the taste of the Japanese is left free to assert itself. Foreign samples of tea-cups, saucers, and plates have been supplied to them, and much of the ware we receive is made after these patterns. The decoration is pleasing, consisting generally of flowers, grasses, etc., mingled with gilding; but it is generally rude, and not carefully executed, in comparison with the best Satsuma. The gilding, instead of being in compact, distinct points, is in smooth, diffused patches. Some of the ware is formed in imitation of sections of bamboo, with great fidelity in the details. Insects, drawn and colored with accuracy, are sometimes substituted for flowers in the decoration. A very interesting collection of this ware has been imported by Mr. Vantine, in New York.

CHINA.

The representation from this country, as from Japan, is very large, and includes almost every variety of hard porcelain, in the purely Chinese styles, and much that has been

made in imitation of European forms, particularly dinner and tea sets, coffee-cups, etc. The vases are very numerous, and many of them of great size and elaborate decoration. Crackled ware and specimens of *pâte-sur-pâte* are not wanting, and the whole is made the more interesting by a collection of old porcelain, bronzes and cloissonée enamels, sent by Archdeacon Gray.

Amongst the vases we find several of the beautiful red color, so much prized in China, particularly if old, as indeed is the case with all old specimens, whether of china, bronze or enamel. Very old specimens command enormous prices, and are frequently counterfeited. Among other objects to be noted are garden-seats, in celadon, with raised ornaments in white,—*pâte-sur-pâte*,—admirably executed.

One great seat of the porcelain manufacture in China is on the Poyana Lake, the outlet for the goods being via the Yan-tse-Kiang.

Most of the ware exported to Europe and America, chiefly the highly decorated dinner and tea services, is from Hong-Kong.

According to Julien, the manufacture of porcelain in China was commenced in the country of Sinping, Honan, under the Han dynasty, and, therefore, some time between B. C. 185 and A. D. 87. In the year 60, porcelain was in common use. Marco Polo saw the process of manufacture in the thirteenth century.*

Specimens of Chinese porcelain had reached Europe before the Portuguese doubled the Cape of Good Hope in 1497, after which it became more abundant, through the importations by the Portuguese and the Dutch, who traded in it largely.

Cloissonée Enamels.

The Chinese section, as indeed the English, French, and Japanese sections of the Exhibition, was very rich in displays of this peculiar ware, which may be regarded as a connecting link between porcelain and bronze. It is an ancient art in China and Japan, but is now receiving increased attention there, owing to the foreign demand, and pieces of great size

* Catalogue Museum Practical Geology, 1871.

and beauty are produced. In this art the design is first marked out upon the metallic or porcelain surface by thin strips of brass, bent and folded, so as to mark all the details of an intricate pattern. These are fastened to the surface on edge by soldering, and the cavities or *cloissons* thus formed are filled in with fusible enamels of different colors. The piece is then baked, the enamels fuse into the cells, and, after cooling, the whole surface is ground off smooth, bringing the enamels and the thin brass partings to a flush finish. Dark blues and greens, with a sprinkling of red and white, are the usual colors.

Imitations are now made extensively in France and in England. Some of these productions are remarkable for their beauty and perfection of finish. Special mention should be made of specimens shown by Barbedienne and by Elkington.

There is one variety of cloissonée enamel on porcelain which is rare, only a few specimens having been seen in the United States. Porcelain body is substituted for metal, and the brass partitions seem to be inserted directly in the porcelain body. A cup in the writer's collection is so enamelled over the whole exterior, while the interior is ordinary white, translucent porcelain.

Some of the choicest specimens of Chinese cloissonée were obtained at the sacking of the summer palace of the emperor, and, together with wonderfully wrought specimens of jade and other decorative objects, were distributed from thence over Europe.

III. Floor, Wall, and Ornamental Tiles.

The Exhibition contained a rich assemblage of decorative tiles of several countries, notably from Great Britain, where the art has attained its greatest perfection. Little, in fact, remains to be desired in respect of excellence of materials, perfection of form, and beauty of design. The highest skill of the potter and the best efforts of decorative artists are called into requisition in this manufacture, and the resources of the chemist's art, applied to enamels, are taxed to their

utmost in the production of the most brilliant colors. Graphic and chromatic decorations in ceramics find in this field their legitimate basis of application and their greatest possible expansion in the future. The great object of the tile is decoration; and the flat surface in the wall or on the floor is more appropriately the basis of ornament than a plate or dish on which, when in use, the decoration is obscured. The antiquity of the art of decorating with tiles is well known, and the perfection which it attained in several countries is shown by the specimens which have been handed down to us unchanged,—not even dimmed by age. The tiles of India, Persia, Arabia, and Spain, the mosaics of the Romans, and the walls of the Alhambra, are familiar examples. Glazed decorated tiles were used in Egypt, and among the Assyrians and Babylonians. They were introduced in Spain by the Saracens and Moors. In China they were employed in remote periods for both exterior and interior decoration. The Exhibition contained specimens of antique tiles from India and from the mosques of Samarcand, of the fourteenth and fifteenth centuries; and thus a retrospective glance of the art and its application in this place is fully justified.

The Indian tiles were brought by Dr. Leitner from Lahore, where they were taken from old monuments; but the colors are as vivid as they ever were. The art, which was connected with the Mogul architecture, is now almost dead, as it is no longer sustained.

Manufacture of Tiles in Great Britain.

The manufacture in Great Britain dates from mediæval times, and is supposed to have originated in the Roman mosaics,—the transition from tesseræ to the tiles, with impressed designs, being gradual,—the difference in the first place being in the size of the pieces only. Evidences of the gradual modification of the size have been found, and in Spain, small tiles, intermediate between British tiles and tesseræ, are now in use. Recent excavations at Chichester have brought to light mosaic pavements and Roman tiles.

It is highly probable that the convenience and greater rapidity of laying larger tiles led to their adoption, and the

requirements of the details of design led to the quicker and cheaper method of stamping the figures upon the clay. For a long period after the use of the red or Samian ware, introduced by the Romans, ceased, tiles appear to have been the only branch of the decorative fictile art in Britain. They were applied chiefly in ecclesiastical decoration, about the altars and choirs, and for memorial purposes. The excellence of this mediæval tile-work is regarded as having stimulated and led the way to improvement in decoration of household pottery. Some of the earliest specimens of the art, preserved in the British Musem, are from ruined churches in Norfolk. The neighborhood of Great Malvern appears to have been one of the chief centres of production in the thirteenth and fourteenth centuries, and few churches in Great Britain can show a greater variety of ancient tiling than the Priory Church of Great Malvern, the interior of which abounded with encaustic tiles in the floors and forming panels in the walls.

The manufacture in Britain has been assigned to two periods. The most ancient tiles are believed to have been fabricated between the years 1290 and 1380, and those of the second period during the prevalence of the perpendicular style in building. Numerous kilns have been unearthed at Malvern Hills, and it is believed that Tewkesbury Abbey and Worcester and Gloucester Cathedrals were supplied with tiles from these kilns. The manufacture is supposed to have been continued in Worcester County down to about the year 1640, and to have been repressed, if not stopped, at that time through the influence of Puritanism. In that year visitors were appointed to visit the ecclesiastical structures of the kingdom and destroy all ornaments of a "superstitious nature."* The designs upon the tiles at that time were largely formed of sacred symbols and inscriptions, of memorial letters and monograms, and of heraldic devices, chiefly in connection with tombs. These mediæval tiles have been classed according to their decorations, as follows*:—

1. "Sacred symbols; inscriptions, consisting either of verses of the Scripture or pious phrases.

* Antiquarian and Architectural Year Book, 1844, p. 128.

2. "Armorial bearings of the sovereign or individuals connected with the monastery by benefactions or otherwise; personal devices or mottoes.

3. "Ornaments conformable to the style of architecture or character of decoration prevalent at the period, but devoid of any special import."

Some of the emblematic figures, of which examples characteristic of these old ecclesiastical tiles are here given, consist of lions, dragons, and adders, and have been supposed to have reference to the text, "Thou shalt go upon the lion and the adder: the young lion and the dragon shalt thou tread under thy feet."

The tiles of the earlier manufacture generally measure five inches square, and the later, six inches. Some have been found nine inches square and two and a quarter inches thick. A specimen in the writer's collection, probably from the Malvern kilns, is a little over five inches square and three-quarters of an inch thick.

The material is ordinary coarse red clay, such as is used for making brick, and the design appears to be formed by a lighter colored clay filling incisions or impressions in the surface, and subsequently glazed. The design is supposed to have been impressed by a stamp while the clay was still moist, and the depression so formed was filled by the lighter clay in the condition of thin paste, for the cavities are frequently seen to be but partially filled.

Prosser's Method.

But tiles are no longer made in Great Britain in this manner. Prosser's method, patented some thirty or forty years ago, and perfected by Mr. Minton, marks a new era in tile manufacture, and has contributed greatly to the advance of this branch of artistic decoration. It consists chiefly in the use of powdered clay, instead of the wet, plastic mass. The paste being duly compounded of the proper clays and silex, and strained through cloth, is dried and then ground to powder. This powder, when slightly damp, is pressed in steel moulds by a powerful screw. The size and form of the moulds determine the size and

shape of the tile. Tiles so formed are more perfect in shape, are denser, stronger and more uniform in wear, than those made from clay in its plastic state. There is less shrinkage in firing, and little or no distortion. Most of the cheap tiles upon the Continent are made by the old methods, and are by no means so exact in their forms, and sharp in their edges and angles, as those made from the damp powder under pressure, in accurately formed moulds.

The exactness and uniformity of size obtained by the new method greatly stimulated the industry, and it has been steadily increasing in importance to the present time. Many firms are now engaged in the manufacture in Great Britain, particularly at Stoke-on-Trent, and Burslem in Staffordshire. The establishment of Messrs. Minton, Hollins & Co., now carried on by Mr. Hollins, is one of the oldest, and is occupied exclusively in the production of all varieties of tiles.

The rapidly increasing demand for tiles of all descriptions of late years is remarkable, not only in England but throughout Europe. They are used in almost all modern buildings of any pretension. They make the most serviceable and ornamental floors for public buildings. In the South Kensington Museum alone there are some 40,000 square feet of pavement laid. They are used in railway stations, on shipboard, and for decorating walls and pavements of churches. For this latter purpose, great numbers are required in the work of restoration of old cathedrals. At Worcester, the cathedral which has lately been restored, chiefly through the munificence of the Earls Dudley and Ward, who gave equal to $350,000 in gold for the purpose, has a tiled chancel of most elaborate design, a part of which is over four hundred years old. The dilapidated portions have been renewed with tiles made in exact imitation of the ancient tiles, and at a cost of not less than $10,000, under the direction of Sir Gilbert Scott, the architect.

One firm alone (Minton, Hollins & Co.) cite the following among the principal places for which they have furnished the tile pavements :—

"The Royal Palaces of Windsor, Osborne and Marlborough House; the Palace and State Yachts of the Sultan of Turkey; the Royal Residence of Prince Dhuleep Sing; the New Houses of Parliament, Westminster; the New Foreign Offices; the New Government Buildings in India; the South Kensington Museum; the New Albert Hall; the Senior and Junior Carlton Clubs; the Cathedrals of Ely, Lincoln, Litchfield, Gloucester, Wells, Glasgow, Armagh and Sydney (New South Wales); the New Capitol at Washington (U. S. of America); and many of the principal Ducal Mansions, Government Buildings, Churches and Public Institutions in Great Britain," etc., etc.

Varieties of Tiles.

The varieties of tiles as now made may be classed according to their manufacture, irrespective of form or use, as follows:—

1. Plain tiles, unglazed, glazed or enamelled, in colors.
2. Encaustic tiles, unglazed or glazed.
3. Majolica tiles.
4. Enamelled, decorated or painted tiles.

The plain tiles are usually made from natural clay mixtures, selected with reference to their colors when burned; or coloring substances may be added. The color pervades the whole tile like a brick, not being, as in the case of an enamel, merely superficial. The addition of a transparent glaze makes the color more brilliant, and gives a smoother surface. The general colors of both the plain tiles are black and white, red, chocolate, salmon, drab and buff. But almost any desired color can be given to plain tiles, by enamelling them upon the surface with opaque enamels. For this process the plain white, buff or red tiles are taken. Bright reds, crimson, purples, blues, greens and browns may thus be obtained. These enamelled tiles, like the glazed, have a smooth glassy surface, and are more appropriately used upon walls than in pavements, where the attrition would soon destroy the gloss of the enamel and produce scratches. The smooth surface is also rather slippery and dangerous to walk upon. For these reasons

the plain unglazed tiles are to be preferred for pavements.

Besides the use of the glazed and enamelled tiles in mural decoration for dados, panels, etc., they are especially applicable, and are largely used abroad, for lining the walls of dairies (the dairy farmers finding them superior for cleanliness and keeping the milk pure), for larders, kitchens, around sinks and cooking-ranges, in bath-rooms, water-closets, and in stables. For such places the six-inch plain white glazed tile is in general use. Another very important application of wall-tile is in hospitals, for completely lining the walls of wards for fever patients. The new St. Thomas hospitals (erected in London opposite the Houses of Parliament) have the fever wards lined with six-inch white glazed tiles, which, it is believed, will prevent the absorption of the germs of disease which it is well-known penetrate porous plaster walls, and are even absorbed by bricks, so that after a time whole wards of hospitals and entire buildings become unfit for occupation. The same is true of rooms in dwellings, hotels, and dormitories in colleges. An impervious tile-wall, which can be thoroughly cleaned by wiping with a sponge, is a great sanitary improvement, and deserves the attention of physicians and architects. A thoroughly vitrified body like porcelain, would be better for the purpose than a porous earthenware base with a glazed surface, though the latter would, no doubt, be far better than even the hardest painted plaster wall.

Another important use of the plain white glazed, or enamelled tiles, is as reflectors in lining dark passages, staircases and entrances, especially in basements, or wherever there is liability to dampness or a smoky atmosphere. They are largely used about the stations of the underground railway in London, particularly around the window-openings, or wherever light is admitted through thick walls. Most of the lavatories and retiring-rooms of the railway stations in England, and on the Continent, are lined with white glazed tiles.

Encaustic tiles may also be either with or without a glaze. In this class the design upon the tile is not merely

stamped or painted on the surface, but is impressed to considerable depth. The tiles are *inlaid*. The process in Britain is as old as the mediæval tiles of Malvern, already noted. In the ancient tiles the design was impressed in the moist clay. In the modern it is equally impressed, but at the time of forming the tile out of the dust, leaving a sharply formed design, which is subsequently filled by a powder of another color. The whole being pressed together forms a homogeneous mass. The impressed design is also filled, in some cases by a liquid slip, as in the ancient tiles, and when dry the excess is scraped off before firing.

The design being impressed to a depth of one-eighth or one-quarter of an inch, and filled solidly with body of a different color from the groundwork of the tile, is not obliterated by wear until the whole substance of the tile has been cut away to the full depth of the design. The brilliancy of the design and of the colors of the tile may, as with plain tiles, be heightened by a simple glaze; but the surface is made slippery, and is not so well adapted to pavements as the simple unglazed surface. Some of the colored bodies, such as blue, green and white, are sufficiently vitrified in burning to give a vitreous semi-glazed appearance. But glazed inlaid tiles are suitable for hearths where not exposed to much wear, and are now largely used abroad for this purpose. Their thickness and strength renders them secure from breakage.

Encaustic or inlaid tiles are usually one inch thick, twice the thickness required for plain wall-tiles. They are especially suitable for pavements in halls, corridors and vestibules, or wherever they would be exposed to attrition and wear by the fire-irons, etc.

Encaustic and Enamelled Tiles in Decoration.

Another important application of the encaustic, and also of the enamelled tiles, is found in decorating the walls of buildings, especially those of brick, either grouped in large panels, or set singly about the window-frames and cornices.

The glazed encaustic tiles are generally used in mural decoration and in fire-places, for lining the jambs and back, where movable or basket grates are used. They not only

have the merit of beauty, but of cleanliness, as all smoke, soot or dust can be easily wiped off the glazed faces.

Majolica tiles are ornamented with the design in relief, produced generally by the insertion of an open-work metallic plate when moulded, giving them an embossed surface, which is variously colored by enamels, and is highly glazed. This kind of tile is extremely rich and brilliant in appearance, and is suited to mural decoration, such as the walls and dados of dining, smoking-rooms, libraries, offices, stairways, entrance halls, for inlaying cabinet work, and for mantels and fire-places. For this latter purpose, there were some fine examples in the exhibition of dog-grates and fire-place fixtures. They are particularly applicable to church-wall decoration, grate-cheeks and for flower-boxes. So also the enamelled ornamental tile may be used for the same purposes, but more especially for the walls of dairies, bathing and retiring rooms, and for baths. The ornamentation is added either by hand, or is transferred from lithographic prints, but is all upon the plain surface, not extending into the substance of the tile, as in the encaustic varieties, or raised above the general level, as in the embossed varieties. The elaborately painted tiles and slabs belong to this class, as also those which are enamelled in various opaque colored enamels.

The use of tiles for flower-boxes for windows has become general, and has raised a demand for such as are peculiarly adapted to the purpose. They are usually eight inches square, half an inch thick, and are inserted side by side in a simple wooden or zinc frame-work, grooved so as to receive and hold the edges of the tiles. The majolica and painted tiles are generally preferred.

An important application of tiles is for inscriptions of all kinds, street names, signs, numbers, especially where dust accumulates, and frequent brushing or dusting is necessary. They are largely used in the underground railway in London, for the names of the stations. Messrs. Minton, Hollins & Co. manufacture every kind and all sizes of these tiles for forming inscriptions, dates and texts, and direct attention especially to their letter-tiles, manufactured expressly for street names, and assert that such tiles have been fixed in several towns for

more than twenty years without being impaired in distinctness. They are affixed either by bedding in Portland cement against the wall, with the edges covered so as to exclude water, or by metal frames secured to the wall by screws, or by cutting out a recess as broad as the tiles, and as long as the name requires. The tiles are then secured in this recess by cement, and the joints are pointed.

Memorial and Mortuary Tablets.

For memorial and mortuary purposes, encaustic tiles, bearing inscriptions, monograms or heraldic devices, seem to be peculiarly appropriate. They have the advantage of being comparatively indestructible by the weather, and of holding their colors unchanged by time, so that inscriptions on them remain legible long after those cut in stone have disappeared. The material is far more enduring than porphyry and granite or marble, especially where exposed to the weather; and even if lost sight of and buried for ages in the earth, tiles, if properly made, will retain their inscriptions in perfection, and may become of great value in antiquarian researches. Being formed in moulds, duplicate copies can be made at little increased cost, and they could be freely used, not only in tombstones, but as memorial tablets in the walls of churches. Inscriptions may be made in small but distinct letters, so that a tile of ordinary size may contain all that is usually placed upon a tombstone. The compactness of such inscriptions renders it possible, if desired, to group a number in a small space, and they could be inserted side by side in the walls of vaults, or upon tombstones specially adapted to the purpose.

The memorial tablets now made and exhibited by Messrs. Minton, Hollins & Co., are twelve inches square, and are designed chiefly for insertion in the walls of churches or chapels. They bear heraldic devices or simple inscriptions, and are variously ornamented and colored. Designs are furnished by them at the works, and any inscription to order. I see no reason why such tiles should not be inserted in ordinary tombstones, in place of the chiselled inscriptions, a recess being cut into the stone to receive the tile, securely bedded in cement.

Early examples of the use of tiles for mortuary purposes are numerous and interesting. Red tiles of this nature, inlaid with black clay, have been found in Devonshire, Somersetshire and Surrey, England.* It is known that inlaid tiles were used to mark the site of graves in Worcestershire far into the seventeenth century. In Malvern Priory church, which contains some of the finest examples of heraldic tablets, Richard Corbet, a knight templar, who died in the thirteenth century, has a plain table monument, the sides and ends of which are covered with tiles, $5\frac{1}{2}$ inches square and $1\frac{1}{2}$ inches thick, decorated with the arms of the Corbet family.†

In the same ancient church, there were examples of monograms, the letters impressed in the clay and then filled in with white earth, and of pious inscriptions in black-letter in connection with them. Inscriptions formed with small tiles, each bearing a separate letter, have been found there, and the grave of Vicar Edmund Rea, 1640, was marked by a border of such tiles, chronicling his death.

In the pottery districts of Staffordshire, earthenware slabs or gravestones were not uncommon. Several examples, with drawings, of specimens in the Mayer collection are cited in Meteyard's Life of Wedgwood. One is a tablet one foot high, nine inches broad, and two inches thick; another, two feet three inches high, one foot seven inches broad, and three-fourths of an inch thick. One is formed of seggar clay, and the other of dark red clay, and both are inscribed, one with raised white letters, and the other with the letters sunk, and covered with a glaze. All of the inscriptions are remarkably clear.

Building-Tablets.

Another example of the use of tiles is found in the building-tablets set into the front walls of houses to show the date of construction, and the name of the builder or owner. The custom was an old one, and was very generally followed in the pottery region. Some of these were made of light brown clay, with the ornaments in relief in yellow clay. Others are glazed white, with the date and armorial bearings painted in

* Life of Josiah Wedgwood, Meteyard, I., 55.

† Antiquarian and Architectural Year Book, 1844, p. 147.

blue. It is in this direction that tile-making connects itself with the industry of terra-cotta, especially in the department of mural decoration by slabs ornamented in relief, either plain or enamelled.

Large numbers of tiles are now used for decorating furniture, being set in the woodwork of cabinets, tables, wardrobes and bedsteads. There were several fine examples at Vienna, particularly in the British section. For such purposes specially decorated tiles are desirable. Plain white or buff tiles may be decorated with figures or flowers, by painting upon the glaze. There are artists who devote their efforts to this work, and the variety of subjects is great. Cottier & Co., the celebrated decorators of interiors, publish a list of classical and allegorical figures, among them such as Pomona, Flora, the Seasons, Industry, etc., and a series of heads of poets, painters, composers of music, discoverers and philosophers.

Sizes and Shapes of Tiles.

The sizes and shapes of tiles vary in different countries and with different manufacturers. At the establishment of Minton, Hollins & Co., and with other British manufacturers, 6×6 inches square is the size in most common use. Four of these make one square foot of surface. But 5×5 inches and 3×3 inches are also made, and borders to correspond. The following table shows the range of sizes for plain, unglazed tiles :—

Squares. —				Bands. —			
6	×	6	inches.	$6\frac{1}{4}$	×	$3\frac{1}{8}$	inches.
5	×	5	"	$6\frac{1}{4}$	×	$1\frac{1}{2}$	"
$4\frac{1}{2}$	×	$4\frac{1}{2}$	"	6	×	4	"
$4\frac{1}{4}$	×	$4\frac{1}{4}$	"	6	×	3	"
4	×	4	"	6	×	2	"
$3\frac{1}{8}$	×	$3\frac{1}{8}$	"	6	×	$1\frac{1}{2}$	"
3	×	3	"	6	×	$1\frac{1}{4}$	"
$2\frac{3}{4}$	×	$2\frac{3}{4}$	"	6	×	1	"
$2\frac{1}{2}$	×	$2\frac{1}{2}$	"	$4\frac{1}{2}$	×	$2\frac{1}{4}$	"
$2\frac{1}{4}$	×	$2\frac{1}{4}$	"	$4\frac{1}{2}$	×	$1\frac{1}{2}$	"
2	×	2	"	$4\frac{1}{2}$	×	$1\frac{1}{16}$	"
$1\frac{3}{4}$	×	$1\frac{3}{4}$	"				
$1\frac{1}{2}$	×	$1\frac{1}{2}$	"				
$1\frac{1}{4}$	×	$1\frac{1}{4}$	"				

Of each of these sizes there are diagonal halves and quarters, also octagons, hexagons, pentagons, lozenges, and other regular geometrical shapes. The very small tiles or "tesseræ" range from $\frac{1}{16} \times \frac{1}{16}$ inch to 1×1 inch, and are used in mosaic work. There are larger sizes of the enamelled, ornamental, and the majolica tiles. The largest of the former are 12×12 inches; 9×9 inches and 8×8 inches are also made, besides 8×4 inches, 7×7 inches, 6×6 inches, 6×3 inches, 6×2 inches, and 6×1 inch.

The tiles in France, and on the Continent generally, are made in fractions of the metre, and are larger than the six-inch tile. The Dutch tiles measure $5\frac{1}{4} \times 5\frac{1}{4}$ inches, and are less than half an inch thick. The old Saracenic and Persian tiles are generally larger, being nearly one foot square.*

Minton, Hollins & Co., *Patent Tile Works, Stoke-upon-Trent.*—The plain and encaustic tiles of this celebrated establishment have been rendered familiar to our citizens by their liberal use in the Capitol at Washington and in many of our public and private buildings. But these fail to give an adequate idea of the variety and richness of the designs which are now produced and largely used abroad for decoration.

The firm made a very complete and interesting exhibition of all their varieties of tiles, whether for paving, mural decoration, or other purposes. One of the broad wall spaces between the columns, in the main transept of the Vienna building, nearly opposite the beautiful display of Minton's majolica and porcelain, was set apart for their use, and was completely filled with tablets, painted slabs, and specimens of pavements. The series of tablets hung upon the wall gave a square yard of surface to each different pattern. The greatest novelties were the Persian and Moorish patterns, of great beauty of design and coloring; copies from a series of ancient tiles recently obtained in the East. There was also tiles in imitation of embossed leather. Altogether, it was the most brilliant and complete display of tiles in the Exhibition, and merited the great interest with which it was regarded by all classes of visitors.

* Some interesting and peculiar varieties of form are noted beyond in the description of the exhibition in the Spanish and the Portuguese sections.

The complete descriptive list, to be obtained from the firm, will be more satisfactory than any general notice, though nothing except chromatic illustrations can give an adequate idea of the beauty of the designs and perfection of coloring, nor of the slabs, with groups of ferns and flowers from nature, painted under the glaze, by the artists permanently engaged in the art studio of the firm. The list comprises more than one hundred varieties of tiles. We give below a page from the catalogue, which will give an idea of its contents :—

Descriptive List of Tiles.

No. 1. Embossed Majolica Tiles, ½-inch thick, of Persian design, for the purpose of lining walls, for sides and back of fireplaces, and for mural decoration generally.

2. Embossed Majolica Tiles, ½-inch thick, design and adaptability same as No. 1.

3. Embossed Majolica Tiles, ½-inch thick, of Renaissance design, interspersed with plain glazed tiles, suitable for walls and dados generally, including chancel walls.

4. Embossed Majolica Tiles, ½-inch thick, design and adaptability same as No. 1.

5. Embossed Majolica Tiles, ½-inch thick, design and adaptability same as No. 1.

6. Embossed Majolica Tiles, ½-inch thick, design and adaptability same as No. 1.

7. Enamelled and Painted Tiles, ½-inch thick, Fables, etc., for the purpose of lining the sides of fireplaces, inlaying with cabinet furniture, and for mural decoration generally.

8. Embossed Majolica Tiles, ½-inch thick, of Renaissance design; adaptability same as No. 1.

9. Embossed Majolica Tiles, ½-inch thick, of Persian design (unglazed ground, the ornament enamelled and gilt), for the purpose of lining walls, and for sides and back of fireplaces; suitable also for chancel walls, etc.

10. Embossed Majolica Tiles, ½-inch thick; adaptability same as No. 1.

11. Embossed Majolica Tiles, ½-inch thick, of Grecian design, for the purpose of lining the sides of fireplaces, and other mural decoration.

12. Enamelled and Gilt Tiles, ½-inch thick, of Gothic design, suitable for lining walls and dados.

13. Enamelled and Gilt Tiles, ½-inch thick, of Grecian design, suitable for lining walls and dados.

14. Enamelled and Gilt Tiles, ½-inch thick, of Gothic design, suitable for the sides of fireplaces, inlaying with furniture, and for other mural decoration.

The manufacture of encaustic tiling was commenced in 1840 by Mr. Herbert Minton, and is now carried on by Mr. Hollins in a new establishment, built upon the old site at Stoke-upon-Trent. The business has increased enormously. Aside from the ordinary demand for paving tiles, there is a constantly increasing consumption of plain white tiles for stables, sculleries, closets, walls, etc. The plain white, glazed tiles are sold at the works as low as $2\frac{1}{2}d.$, equal to about five cents each; and, considering how superior they are to any other material, perhaps not even excepting marble, for facing walls, which it is important to cleanse often, the large consumption is not surprising. But the demand has also increased enormously for the encaustic and ornamental tiles, owing not only to the greater number exported to the United States, Australia and other countries, but to the more general appreciation and increased use of them in England.

The great expansion of the industry required increased facilities for the manufacture, and led Mr. Hollins, now the chief owner and the manager, to erect new buildings specially arranged for the rapid and economical manipulation of the large quantities of material. By the courtesy of Mr. Hollins, I was allowed to inspect the whole establishment, and to see every detail of the manufacture. It may be considered a model. The clays are landed at a commodious wharf on one side, and the finished goods are delivered on the other side. The movement of the materials is in *one* direction forward from the clay heaps through the mixing and moulding rooms, to the furnaces, and from the furnaces to the packing rooms, without carrying back and forth. The materials are selected and combined with great care, so as to insure the greatest possible strength and perfection in the product. For the red tiles and the buff tiles, clays are obtained in the vicinity, and are remarkably well adapted to the purpose. The white body is formed of a mixture of the Cornish clays and calcined flint. As much care is taken in the preparation as is bestowed upon the manufacture of the body for stone-china. The basis of the colored enamelled tiles is equally white and strong. Skilled artists of reputation are constantly engaged in the decoration of slabs and large tiles for special purposes. The risk of breakage or distortion of the large slabs in the succes-

sive firings to which they must be submitted, is so great, that they are now usually made in three or more parts, or tiles, and are fitted together after the last firing.

Great labor is expended upon the finer qualities of encaustic tiles. They are made chiefly by hand, of moist clay, and are finished by scraping. Such tiles cost from 1*s.* to 2*s.* 6*d.* each, and are too costly for general use.

Eleven or twelve large kilns are required for the burning. An engine of sixty horse-power suffices to do the grinding and mixing of the materials. An average of 700 persons is employed.

Other exhibitions of the encaustic and enamelled tiles were made in the British section by Robert Minton Taylor, and by the Mintons, the latter being chiefly enamelled tiles and slabs for grates, hearths and flower-boxes. Messrs. Maw & Son did not exhibit, but manufacture tiles in great variety from designs by distinguished artists.*

Simpson, W. B., & Sons, *London*, exhibited a chimney-piece of art tiles and walnut wood, with tiled sides, arranged for an open grate.

Dutch Tiles.

Gebruder Ravesteijn, *Westraven*, near *Utrecht*, made a very complete display of the cheap tiles of Holland, arranging them upon the sides of a tall pyramidal column. They are characterized by crude and quaint designs, usually in blue or purple upon white enamelled ground. There were also yellow, black and marbled tiles in great variety, but no data as regards production and cost could be obtained.

These tiles are designed chiefly for wall decoration, being thin, about one-quarter of an inch thick, and with a smooth, glazed surface. They measure five and one-quarter inches square, and are not very strong. Their use about old-fashioned fireplaces is well known, and there is more or less

* Most of the larger tile works of Great Britian are represented by agents in the United States. Messrs. Miller & Coates, of New York, have long represented Messrs. Minton, Hollins & Co., and the public are indebted to them for great efforts to extend the use of tiling for decorative purposes. The establishment of R. Minton Taylor is represented by Mr. Thomas Aspinwall, 39 Murray Street, N. Y.; and Maw & Son, by Anderson, Merchant & Co,

demand for them at the present time for the same purpose. An agency was established for these tiles in Boston a few years since, and they can now be obtained there at a moderate price.

Vast quantities of the Dutch tiles were imported in England about the middle of the last century for fireplaces, but after the discovery of the method of transferring designs by printing from paper to earthenware, about the year 1752, the manufacture of imitations commenced, and the demand was in part supplied by home-made printed tiles.

Ancient Tiles—Samarcand.

For the exhibition in the Russian section, of a suite of the curious enamelled tiles of the fourteenth and fifteenth centuries, from the mosques of Samarcand, we are indebted to the Museum of the Society for the Encouragement of Arts, at St. Petersburg. The specimens consisted of capitals, parts of columns and cornices, and of brickwork and tiles. The tiles or plates vary in size from 8 × 10 inches to 12 inches square, and 12 × 16 inches, and even larger. They are heavily and boldly incised, so as to form the designs to a depth of an inch or more, and were evidently moulded, probably in cement or plaster moulds; but some parts of the designs, especially Arabic letters, are undercut, apparently by hand-trimming after the clay had partly dried. The designs and inscriptions are all remarkably sharp, and appear as if carved out. The sections of columns are 15 to 18 inches long, and 3 inches in diameter, half round, with raised spiral ornamentation. The principal colors of the enamelling are dark blue, white, light green and a bluish green. Light buff-colored bricks were combined with short pieces of glazed torquoise blue tile set between them, producing an excellent effect.

French Tiles and Plaques.

In the French Section, the beautiful mantel by Th. Deck, Paris, and the mural tile decoration, by Callinot, were the chief attractions to be noticed under the head of Tiles.

Deck's mantel, or rather chimney-piece, of enamelled earthenware, is formed of tiles about nine inches square.

Each tile bears a part of the general design. A *jardinière*, lined with a movable zinc or copper tray, takes the place of a mantel-shelf, and is designed to be filled with cut or growing flowers. The whole stands about twelve feet high, and is valued at 10,000 francs.

E. COLLINOT, *Paris*, made the most complete and varied display of enamelled faience imitations of Persian and Oriental. The prominent objects were the broad mural panels of the pavilion, or canopy, within which the smaller objects, such as vases, plaques and dishes, were arranged. Even the columns supporting the canopy were formed of the same material as the vases, and all were highly decorated in Persian designs, laid on in brilliant but thick enamel, so that each color stood out separately and in relief, without running into or blending with the next. This was the characteristic style of the enamel decoration, and resembled the remarkable work by Parrillez, upon dishes and vases. The tiles, or plates, for panels in the walls of apartments, were about one metre long and half a metre wide, several being grouped together to form one panel some ten feet long and three feet wide. One of these panels, decorated in boldly-drawn figures of rocks, leaves and flowers, in Chinese style, attracted much attention, and was sold to the Grand Duke Vladimir of Russia. Another panel was decorated with branches of the Japanese flowering peach, of full size and excellent in color, and with showy aquatic plants, all upon a groundwork or background of canary yellow enamel. Work of this kind, for walls of apartments, is furnished at 450 francs per square metre; the great cost being in the artistic decoration, for the basis is cheap clay ware, which seems hardly worthy of such expensive and beautiful additions. The raised, embossed form of the enamel, obtained doubtless by successive additions, is peculiarly favorable to the distinctness of the flowers, giving them a decided relief above the surface, while their outlines are sharply set off from the groundwork. The productions of this artist have received gold and silver medals at the successive great Exhibitions, and he has been honored by an imperial decoration in recogni-

tion of his services to art, in reviving Persian ceramic designs.

Reference should here be made to the notice in a previous portion of the Report of the display made by Deck, and to the section upon Enamelled Terra-cotta, etc.

Tiles from India.

Several collections of ancient tiles were forwarded from India, most of them being taken from tombs at Tatta, and from a ruined fortress near the same place on the Buggar, a western branch of the Indus, built in the year A. D. 1421. The following account of the method of making tiles is taken from notes sent on by the Local Committee in India.

Tiles are prepared in moulds, and when dried are rubbed over with a piece of wet cloth, and beaten with an earthen maul for the purpose of smoothing the surface. They are then kept for two or three days, or more, till they become sufficiently firm; and, after having been cut to the proper size, are piled in layers in the sun to dry.

The tiles, having been sun-dried, may then be sent to the kiln, after which the required pattern is traced upon them in the following manner: "A perforated paper pattern is placed upon the surface and powdered charcoal is sprinkled over it. On removing the paper the pattern remains on the earthenware, and is then brushed over with a solution called 'Sahree.' When this is dry, glaze of the required color is prepared and poured over it; the article is then allowed to dry again, after which it is placed in the glazing kiln and fired." The "Sahree" appears to be a colored clay differing from the body of the tile.

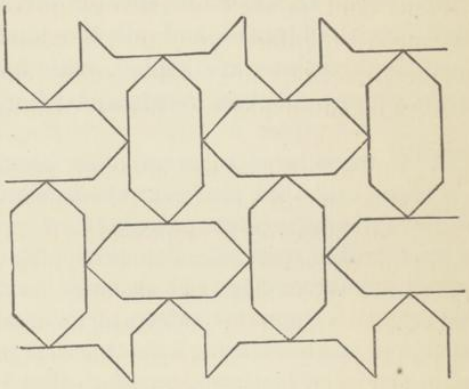
The use of colored tiles in Indian architecture is referred to the third period, beginning with the *Sur* dynasty in 1540, when colored decoration was first introduced with boldness.

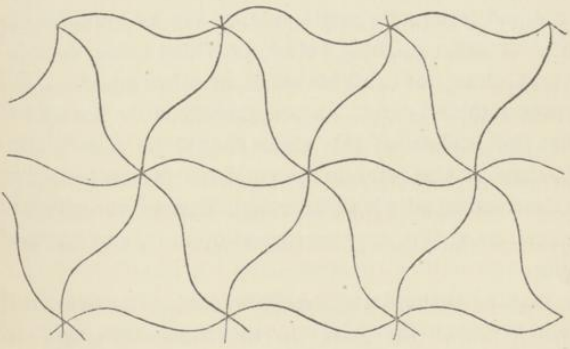
"The system of encaustic tiling had been introduced about the end of the thirteenth century in Persia, where the ruined mosque of Tabreez is said still to glow with a most elaborate pattern and hue. The first fine specimen of this art in Upper India seems to be the Killa Kona mosque,

in the Poorana Killa, which was the citadel of Sher Shak's city, just outside the Delhi Gate of the modern town."* Fergusson says that colored tiles were then freely employed.

Spanish Tiles.

Soleria, A. Y., *Tarragona*. In the Spanish section there were some interesting forms of tiles and mosaic work, glazed and encaustic, but chiefly glazed or enamelled, on a basis of brick clay. The largest square tiles measure $7\frac{3}{4}$ inches on a side, and are five-eighths of an inch thick. The tiles, of which two of the forms and combinations are here shown in outline, are much smaller, the hexagons being about $2\frac{1}{2}$ inches long and $1\frac{1}{2}$ inches wide. The colors are black and green, and the star between is white.





The peculiar curved triangular tile, about two inches broad and enamelled in different colors, produces a pleasing though somewhat bewildering effect.

Laying and Setting Tiles.

One great drawback to the general use of tiles in the United States, especially in private residences in the coun-

* H. G. Reene, in a "Note on the Stone Industries of Agra."

try, has been the supposed difficulty of setting them properly. In the large cities the agents usually keep experienced men in their employ, who can lay down the tiles if desired. A few simple directions will, however, enable any skilful mason to fix them properly.

The foundation must be firm and secure in all cases, so that there shall not be any settling or absence of equal support under all parts of the pavement. Cement mortar, without sand, is used in setting the tiles, so that a perfect bearing is obtained and all the joints are filled. The following directions are copied, with only slight modifications, from those published by Messrs. Minton, Hollins & Co :—

1. If there is no cellar or other opening underneath the space intended for the tile pavement, the foundation may be brought up to within three inches of the proposed surface of the pavement with brick, gravel, broken stone, clean stone clippings, or other solid waste substances free from chips and shavings, so that complete solidity may be secured. Upon this substratum a mortar of gravel and cement should be spread, leaving a depth of one inch for half-inch tiles, and of one and a half inches for one-inch tiles. A floating of cement and sand, in equal proportions, should then be spread one-quarter of an inch thick, over the cement and gravel layer. Upon this, when hard, the tiling may be fixed.

2. The above method is equally applicable, as far as requisite, to places above a cellar or other opening below, provided a firm foundation is given by an archway of brick or stone, or other equally solid substance. But when there is only an ordinary floor or floor-joist, it is necessary that the surface of this floor should be four inches lower than the surface of the intended pavement. There being, at that depth, a strong flooring of plank or rough boards, the mixture of cement and gravel, as above, may be spread upon it, and finished in the same manner.

3. Where it is required to replace boarded flooring by tiles, and it is impracticable to lower the joists to the necessary depth, as mentioned in 2, the floor boards may be lowered by "cutting in" between the joists, securing them below by strips nailed to the sides of the joist, so as to leave a space three inches deep above the boards, and below the top of the joists. The space so obtained is then to be filled in between the joists with the cement and gravel mortar, raising it slightly above the joists, and finishing off with cement and sand, as described in 1. A flat, level surface of this last coating may be secured by striking off with a straight edge, sup-

ported at each end upon parallel strips either fixed to the walls, or otherwise secured on a level.

4. It is not advisable to lay tiling upon a floor of boards, as it yields so much as to loosen the tiles.

5. For affixing tiles to walls, it is best to remove the plastering, and replace it by a coating of cement mortar, upon which, after setting, the tiles are imbedded with cement. A space, one-quarter of an inch in depth, should be left for the purpose.

6. Placing the tiles. It is best to work from the centre of the space, and if the design is intricate, to lay out a portion of the pavement according to the plan, upon a smooth floor near by, fitting the tiles together as they are to be laid. Lines being stretched over the foundation, at right angles, the fixing may proceed, both the tiles and the foundation being previously soaked in cold water, to prevent the too rapid drying of the cement, and to secure better adhesion. The border should be left until the last. Its position, and that of the tiles, are to be obtained from the drawing, or by measuring the tiles when laid loosely upon the floor. The cement for fixing should be mixed thin, in small quantities, and without sand. It is best to float the tiles to their places, so as to exclude air and fill all the space between them and the foundation.

For fixing tiles in grate-cheeks, sides and backs of fireplaces, etc., equal parts of sand, plaster of Paris and hair mortar may be used. These materials should be mixed with hot glue to the consistency of mortar. The tiles should be well soaked in warm water.

Tiles may be cut in the following manner: Draw a line with a pencil or sharp point where the break is desired; then, placing the tile upon a form board, or imbedding it in sand on a flag-stone, tap it moderately with a sharp chisel and a hammer along the line, back and forth, or scratch it with a file. The tile may then be broken in the hand by a gentle blow at the back. The edges, if required, may be smoothed by grinding, or by rubbing with sand and water on a flat stone.

Cement should not be allowed to harden upon the surface of the tile if it can be prevented, as it is difficult to remove it after it has set. Stains of cement, or the thin coating which is almost unavoidable, upon the surface of the tiles after laying, may be removed by a dilute solution of hydrochloric acid, to be obtained of any druggist, and then washing with warm water.

Mosaic Pavements and Pictures.

The finest example of mosaic paving, at least upon a large scale, was to be seen in the vestibule of the Imperial Pavilion, laid down by Italian workmen.

In the Russian section, Alexander Froloff exhibited a picture of St. Catherine, and Jean Bouroukhine one of St. Anastasius, and of Jesus blessing little children. All of these mosaic pictures are from the original, by Professor Neff, and are intended for the Isaac Cathedral. The same artists, and others of the Imperial Mosaic Works at St. Petersburg, contributed largely to the Paris Exposition in 1867. The tesseræ are more vitreous than ordinary tile material, and are made at the Imperial Glass Works. The mosaic establishment was started in Rome in 1846, and was transferred to St. Petersburg in 1856, and connected with the Academy of Fine Arts.

Minton, Hollins & Company, exhibited three or more mosaic pieces, Nos. 85, 86, and 87, suitable for church or domestic pavements. They were in the form of slabs, with encaustic (inlaid) centre-pieces.

A considerable quantity of smaller mosaic tiles (tesseræ) were shown, but no information concerning them could be obtained. The form was triangular, about an inch on a side, and the colors chiefly blue and yellow. There were also large blue and white tiles, some with raised Moresque designs.

The art, as we have seen, was carried into Britain by the Romans, and appears to have been the forerunner of the tile pavements. It is not surprising, therefore, that the most perfect tesseræ are now made in Great Britain, and of the same materials used for the encaustic tiles. The colors and the methods of manufacture are the same, the difference being in the size. The sizes, as made by Messrs. Minton, Hollins & Co., vary from little cubes, one-sixteenth and one-eighth of an inch square to one-half of an inch square, and even larger for some purposes. They are made square, triangular, and of various shapes, and in all shades of color.

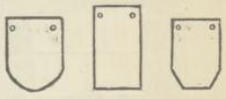
The difficulty and the cost of setting these tesseræ depend upon their size and the nature of the design. A given design being furnished, and the size of the mosaic when finished, the Messrs. Minton, Hollins & Co., form it in slabs, each measuring about one yard square and two and one-half inches in thickness, convenient to handle and transport and to place in the intended position. This is the method usually followed

for large pieces of work, such as the frieze at the Albert Hall. This firm has rooms with broad platforms, specially fitted up for this kind of art work, and, when desired, appropriate designs are furnished for any position or size of the intended mosaic.

This is an important branch of art, which is destined to occupy a much larger share of attention than has been hitherto given. The mosaics are especially adapted to reredos friezes, chancel pavements, entrance halls, doorways, porches, and in panels for mural decoration. A number of pictures and figures, worked at the rooms of Messrs. M., H. & Co., are exhibited in the South Kensington Museum. In the frieze of the Royal Albert Hall there are over five thousand square feet covered with mosaic, and the average size of the tesseræ does not exceed half an inch square. In the London International Exhibition of 1871 there was an interesting variety of specimens of mosaic work by Maw & Co., W. B. Simpson & Co., and Minton, Hollins & Co. The objects embraced such designs as the Lord's Supper, head of Isaiah, emblems of the evangelists, etc.

Roofing Tiles.

This firm also manufacture a very ornamental roofing tile, of three shapes, as shown by the figures, and of a variety of colors, — either those of the plain, unglazed body, such as black, chocolate, or red, or enamelled with opaque glaze, in blue, green, orange, or white. Such tiles are suitable for ornamental cottages where the roof is a conspicuous feature, for school-houses, boat-houses, turrets, conservatories, etc. They are very strong and indestructible, and make a good roof. The plain are sold as low as twopence each; the glazed at threepence, and the enamelled at fourpence each, all at the works. The large roof of St. Stephen's Church in Vienna is one of the finest examples of the use of colored tiles for roofing.



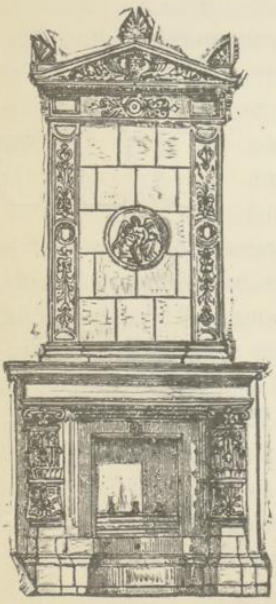
Some green bottle-glass tiles were seen in the Hungarian section, about 16 inches long, 5 inches wide, and $\frac{3}{8}$th inch thick. Each tile has a projection on the under side, which serves to hold it upon the roof.

Porcelain Stove Tiles.

The so-called "porcelain" or German stoves, familiar to those who have resided in Germany, Austria or Hungary, were extensively exhibited in the Austrian and Prussian sections. The material is not porcelain, but earthenware, moulded into tiles or hollow bricks about six or eight inches square and several inches thick. They are made in a great variety of ornamental forms, and are generally glazed on the outer or exposed face, either white,—which is most common, —or brown, red, green, or black. Besides the ordinary flat-faced tiles, they are made with incised or raised designs, or are moulded in high relief, so that when combined they form recessed panels or projecting fillets and mouldings, in a variety of architectural patterns.

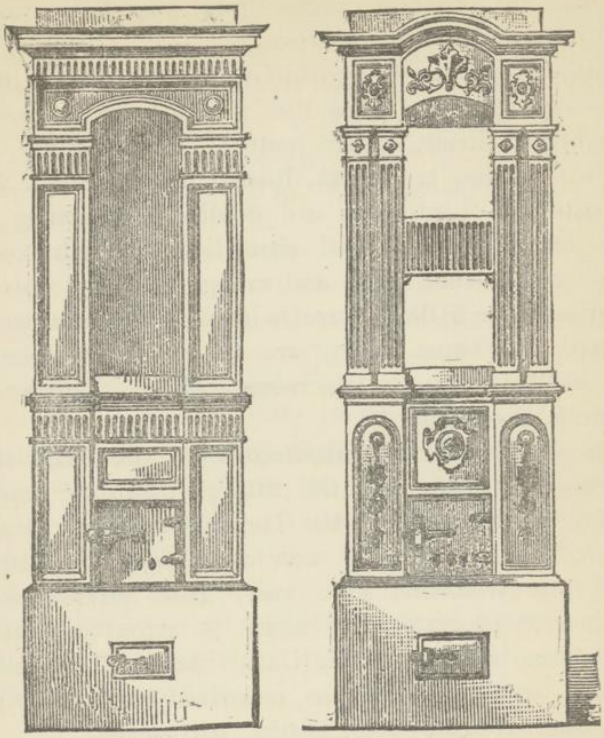
The back portion of the tile exposed to the fire or heated gases rising from it, is perforated and peculiarly shaped, so as to expose a large surface and make a series of tubular openings favorable to the absorption of the heat in the body of the tile.

The shape of the stove formed of these tiles varies with the taste of the fabricant and the demands of the consumer.



The annexed figure, from one of the stoves made by J. Fischer of Pesth, Hungary, and the succeeding illustrations, will give a good idea of the general appearance of such stoves. They are generally from six to eight or ten feet high, with a breadth of three or four feet. Usually there is a deep recess above the fire-space, or an opening quite through, the stove being divided in that portion, into the parts united above by an entablature and cornice. Cylindrical or columnar stoves are also made; indeed, the modifications are numerous, to conform to the varying taste or fashion of the time. Lower and broader stoves are now coming into use, with large openings in front, so that the fire may be

seen and enjoyed as in an open fireplace, while the heat is much better utilized. The accompanying figures are from



the designs exhibited in the Austrian section by Joseph de Ceute of Vienna, but give only a faint idea of the variety and beauty of the stoves which he manufactures. The lower and broader forms are from four to five feet across the front, and much resemble the modern low mantels for grates. The fittings in front, to close the openings, are of brass, highly polished. The exhibitor gives the following schedule of prices for the ordinary sizes of stoves, gray and white, delivered at the establishment in Vienna :—

Height, Inches.	Breadth of Base, Inches.	Price in Florins.		Height, Inches.	Breadth of Base, Inches.	Price in Florins.	
		Gray.	White.			Gray.	White.
61	18	35	38	74	26	80	90
65	20	42	45	78	26	90	100
68	22	50	55	82	28	100	120
72	24	60	65		30	120	140

The dimensions are given in inches, and the price, in Austrian florins, equivalent to about fifty cents in currency. The price of packing ranges from six florins upward, according to the size of the stove.

Another very interesting display of stoves of this description, and particularly of the tiles in great variety, was made by Bernhard Erndt, (court potter) Vienna, whose manufactory is in the ix. *Bezisk*, Rossau, Pramergasse, No. 25. The patterns of his tiles are peculiarly attractive, many being deeply recessed and enamelled in bright colors,—brown, green, blue, white and variegated. The stoves and stove-tiles made in Berlin are in high repute, and are even imported to Vienna. They are to be seen, among other places in that city, in the rooms of the Engineers and Architects' Association.

It is evident that the manufacture of "porcelain stoves," the tiles for them, and the fitting, constitute important branches of industry in the German speaking countries. Such stoves, especially as now made, and susceptible of further improvements, have many great advantages over other heating apparatus, and might be introduced with success in some sections of the United States. The following are some of their merits, as compared with the ordinary cast or sheet-iron stoves for heating apartments.

1. Not being good conductors of heat, they radiate it slowly and without sudden changes; and being bulky they retain heat for a long time, and maintain an equable, moderate temperature in the apartment, even long after the fire has burned out.

2. They do not scorch and "burn the air," or the floating particles of dust in it, as is the case with highly-heated metallic stoves.

3. They combine to a great degree the advantages of an open fireplace and of a stove, giving ventilation, permitting the fire to be seen, while most of the heat is utilized, being stored up in the mass of the tiles and slowly radiated. Doubtless such stoves would fail to satisfy those who require a red-hot surface, super-heated air, and little ventilation; but many improvements might be made, so that

all the heat which wholesome conditions require can be obtained without difficulty and with great economy.

Reference should here be made to the highly ornamental tile stove exhibited by Messrs. Minton, Hollins & Co., No. 107 of their list, already referred to. It was specially designed for the cabin of a yacht, and was an example of the use of tiles for *overlaying* metal stoves, or frames, rather than as constituting the body of the stove or chief repository of the heat.

IV. Terra-Cotta—Brick.

At each succeeding great Exhibition, the importance of the industry of brick appears to be more fully recognized and represented. Always interesting to constructors, it becomes more generally so to the public as attention is more and more directed to ornamental forms and colors. This tendency happily exists, and, as we shall see, has already resulted in Europe in the production of a variety of very useful forms of building brick, of enamelled brick, and of elaborate decorative work in terra-cotta, both plain and enamelled, in colors.

Brick Industry—United States.

An idea of the magnitude of the brick industry in the United States may be obtained from the statistics collected for the last census. According to the reports, there are 3,114 establishments for making brick, with 372 steam-engines, aggregating 10,333 horse-power; 19 water-wheels, 218 horse-power, and 43,293 persons employed. Capital invested, $20,504,238; wages paid, $10,768,853; materials used valued at $7,413,097, and value of the product $29,-028,359.

Massachusetts has 107 establishments, 2,901 hands employed. Capital invested, $2,435,310; value of materials used, $978,508, and value of product, $2,251,984. Of brick and tilemakers together, 26,070 are reported; and the total value of the products, $29,302,016, against $12,263,147 in 1860.

Of common brick, 2,801,832,000 were made, and 37,428,000 pressed brick and 60,072,000 fire-brick. In the city of Philadelphia alone, the product is commonly believed to exceed one hundred millions (100,000,000) annually.

Terra-Cotta.

In the industry of architectural terra-cotta we have a revival of a most ancient art, practised by the Egyptians, Assyrians, and the Chaldeans; familiar to the Greeks and Romans; and not unknown in Europe in the middle ages. Terra-cotta enamelled decorated surfaces in colors are also ancient. Beckwith says: "The distinctive feature of Babylonian architecture is the profuse employment of colored decoration. The temple towers of the Chaldeans were built in many stories, faced with enamelled bricks of colors corresponding to the planets. In the Temple of the Moon at Mughier, bricks or tiles, glazed with a blue enamel, were fastened externally to walls of burnt brick. The domestic dwellings of the Chaldeans were ornamented externally by diapered patterns of colored bricks, and internally with colored cones of terra-cotta." * The colors used in ancient Egyptian decoration were red, yellow, blue and green. Black and white were added.

The greatly increased use of terra-cotta dates from the commencement of the last decade, and it has been steadily finding favor with architects and the public. When properly made it has great strength,—even greater than many kinds of stone used for building,—and, as regards durability, it is superior. Mr. Henry Cole says: "It is more durable than even ordinary granite, as may be seen on the lodge in Merrion Square, Dublin, which was built about 1786. The granite mouldings there are cut in stone from the Wicklow mountains; they are all worn away and rounded by the action of the rain, while Coade's terra-cottas, dated 1788, are as sharp as when they were first placed on this lodge." † Another example is found in Sutton House, in Surrey, which is covered with terra-cotta, ornamented about the year 1530

* Pottery, Terra-Cotta, Stoneware, Fire-Brick, etc., by Arthur Beckwith, p. 86.

† Reports on the Paris Universal Exhibition, 1867, II., 415.

by Torrigiano or his pupils. They still show the marks of the modelling tool. Terra-cotta, like bricks and tiles, is practically indestructible by ordinary agencies, and this quality alone should commend it particularly for fine ornaments, capitals, bas-reliefs, cornices, window-caps, etc. It is admirably adapted for, and is chiefly used in, combination with brick. Examples abound in the chief cities of Europe, notably in the modern public buildings of London, Berlin and Vienna. The Royal Albert Hall and the South Kensington Museum in London are familiar. It is now largely used in Vienna for decoration, especially for figures, balustrades, consoles, and bas-reliefs for insertion in walls.

The industry was largely represented in the Paris Exposition of 1867, in the London International Exhibition of 1871, and at the Exhibition in Vienna. It is gratifying that the industry is already firmly established in the United States, and that it bids fair to assume large proportions, particularly in the Western States, where suitable building stone cannot be readily and cheaply obtained.

Terra-Cotta at Vienna.

Vienna Brick and Building Company.—The great brick and tile company of Vienna—the "Wienerberger Ziegelfabriks und Baugesellschaft"—made an exhibition worthy of its reputation as the most extensive brick and terra-cotta manufacturing concern in the world. It erected an artistic triumphal arch at the eastern end of the space, partly enclosed by the art buildings,—a sort of gate-way or entrance to the Art Department from the east,—which not only added to the fine architectural effects of that group of buildings, but gave the company the opportunity to display their varied architectural productions to the best advantage. This arch, high and broad enough for a carriage-way and transverse arched portals, was constructed wholly of the red and drab bricks made by the company, with ornaments of terra-cotta, such as cornices, mouldings, statues, bas-reliefs, and medallions,—some plain, others enamelled in colors. The various forms of bricks were well displayed in this arch, in the cornices, in the door-jambs and vaulted roof, the bricks being so perfect in form and finish that, when well laid, no surface-

plastering or decoration is required. The joints of this work were made with great care, the mortar being freely used, but uniform in thickness in each course, and rounded over between the bricks.* The joints are striped in black, contrasting well with the buff color of the bricks. A variety of designs was introduced in the entablatures and pilasters, chiefly in the Rennaissance; those on one side being plain red, and on the other enamelled in colors. Medallions were inserted in the façade, and terra-cotta groups of figures adorned the top.

Within the area of this construction, below, there was room enough for the exhibition, on tables and counters, of the various articles made by the company. Bricks, of all the varieties and forms, were to be found there: some plain, some enamelled white, blue, or green; some wedge-shaped, for arches, and many with rounded, curved, and moulded angles, designed for the ornamentation of window-openings, for string-courses, and other parts of buildings. Here, too, were to be found a variety of decorative objects in bold relief, such as bas-reliefs, slabs, fillets, parts of cornices and medallions, designed for insertion in the façades of buildings, —the same, in fact, as were shown in their proper settings in the front of the archway. All these were noteworthy for their boldness and elegance of design, sharpness of relief and brilliant coloring, fitting them for decorative purposes high up in the fronts of buildings. The company also exhibited a variety of tiles for paving and for roofing purposes, the latter being either plain or glazed in a variety of colors, thus facilitating the chromatic decoration of roofs. There were also small hollow bricks with glazed faces. A majolica wall-fountain is worthy of mention, and was purchased by the Austrian Art Museum for its collection.

A large part of this collection—the smaller objects, bricks, tiles, fillets, etc.—was presented by the company to the

* The quantity of mortar used in laying bricks varies in different countries. Much, of course, depends upon the form of the brick. If they are warped or curved; if, as is generally the case even with pressed brick, the corners "droop," the thickness of the bedding must be sufficient to permit an average adjustment in the course to a level surface. In coarse work in France the ratio in volume of the joints or mortar to the whole mass of masonry is, as 17 or 18 to 100. But in finer work, where a better quality of mortar or plaster is used, the ratio is reduced to 10 or 12 to 100.

United States Centennial Commission for exhibition in 1876, and to be afterwards deposited in the Permanent Museum.

The enamelled plaques, panels, pilasters, and fillets are beautiful. In the façade, door-jambs and window-casings of the new university buildings in Vienna, they have been freely used, with fine effect.

It is gratifying to note this modern revival of the ancient art, kept alive in the sixteenth century by the genius of Luca della Robbia, and now capable of almost indefinite expansion, since the knowledge of the composition of colored enamels is no longer a secret. Of the beauty of such enamelled terra-cottas there can be no question, and their durability is established by experience. Witness the ancient enamels of Assyria and Egypt, as well as the works of della Robbia, preserved in collections. The South Kensington Museum has more than fifty examples. One of the choicest specimens is the medallion, eleven feet in diameter, supposed to have been made in the year 1453. It bears the arms of King René of Anjou, surrounded by a massive border of fruit and foliage. It was exposed to the action of the weather for more than four hundred years, fixed in the front wall of a villa near Florence. Good specimens of the della Robbia ware are to be found also in the Athenæum in Boston, and the Metropolitan Museum of Art in New York.

The terra-cotta ware, building ornaments, majolica, etc., of the Vienna Company is manufactured in a separate establishment at Inzersdorf. The clay of that locality produces a ware that not only has great strength and resists the weather, but has a pleasing stone color, which harmonizes so well with the usual tone of the buildings that the figures do not need coloring or painting.

The variety of the figures and decorative objects is very great. The sample-book contains 242 pages of closely printed lithographic designs, about 2,000 in number. The models, of which the company has a great number, are all made from drawings by the most eminent architects, and are exquisite in design. The possession of such a stock of patterns insures, practically, a monopoly of the business. A large proportion of the decorative figures seen in the façades of the splendid buildings adorning the Ring Strasse and over

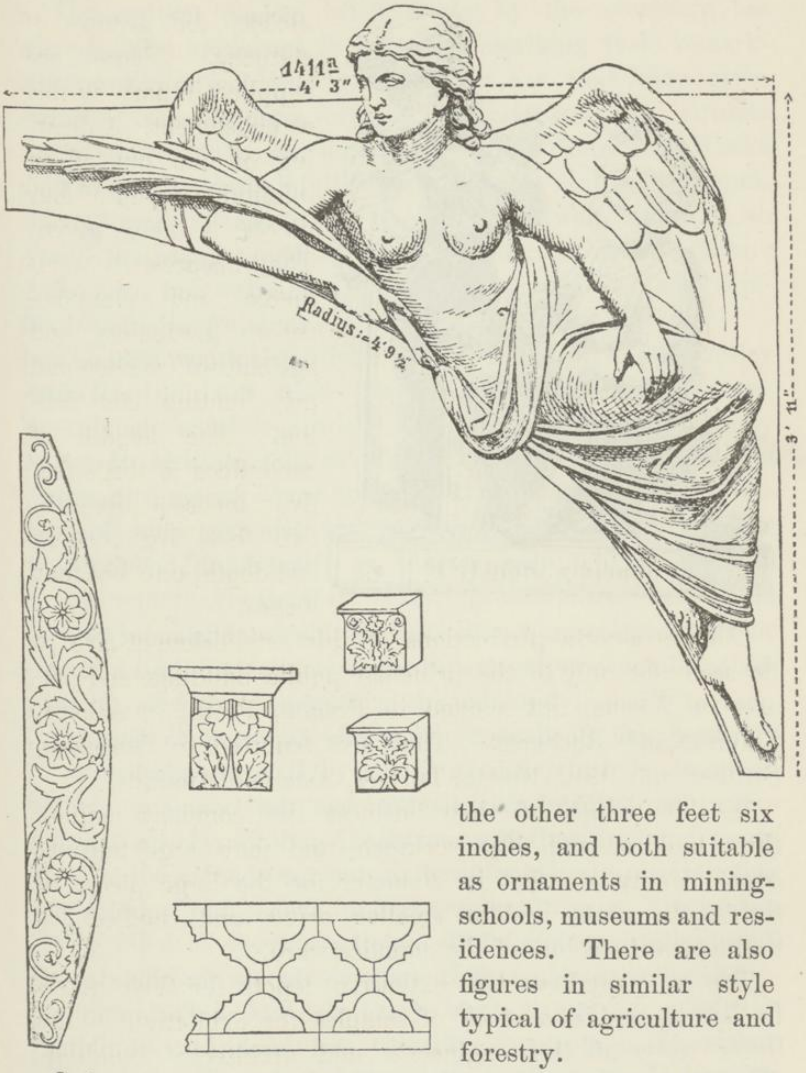
the arched portals is from this establishment. The list comprises a great variety of brackets, consoles, capitals, balusters,

medallions, reclining figures over arched openings, bas-reliefs, colossal figures of Apollo, Venus, Minerva, Flora, Hebe, etc.* A few illustrations selected from the sample-book are here introduced.

The figure of a miner in the established costume, with pickaxe over the shoulder,

* Of these beautiful figures, Dr. Barnard, in his admirable Report on the Industrial Arts of the Paris Exposition of 1867, observes, p. 359: "Mr. Drasche exhibited one of the most attractive collections of bas-reliefs statues, vases, architectural and other ornaments in the Exposition, all of them formed in terra-cotta. His display was as remarkable for the great number of beautiful objects which it contained as for the taste with which they had been designed. They were bought up by visitors with eagerness, and only a few weeks had elapsed after the opening of the Exposition before nearly every object in the whole collection bore the mark, which in all quarters grew more and more familiar every day, 'sold.' All these beautiful productions were baked in the Hoffmann furnaces of Mr. Drasche's establishment."

lamp in hand, and the leather apron behind. This is made of two sizes: the smaller being one foot two inches high,



the other three feet six inches, and both suitable as ornaments in mining-schools, museums and residences. There are also figures in similar style typical of agriculture and forestry.

Suits of armor, in a dozen or more different styles, are produced for the exterior decoration of the gateways of castles or vestibules and halls in the interior. Being practically indestructible by the weather, they can be freely exposed. It would be easy, if desired, to cover such groups for interior decoration with metallic paints or bronze-powders, in imitation of steel or iron.

The arched entrances to the Vienna buildings, leading into the interior courts, afford suitable places on either side, in niches, for groups of statuary. These are supplied in part by this establishment. A drawing of one out of an inimitable group of four pieces is here given. They represent commerce and manufactures, gardening and agriculture, science and art, hunting and fishing. The height of each piece is three feet five inches; breadth, two feet five inches; and depth, one foot four inches.

The terra-cotta productions of this establishment are to be seen not only in the principal public buildings and palaces of Vienna, but abound in Prague, Pesth, in Athens, Smyrna and Bucharest. They are exported to Germany, Switzerland, Italy, Russia, Turkey, Asia and America.

In this branch of their business the company employ three hundred and fifty workmen, and four large burning ovens twenty-two feet in diameter for the large pieces of terra-cotta ware, besides smaller ovens and muffles for burning-in the colors of the majolica ware.

The company have two extensive depots for their goods in Vienna, besides a stock of samples for exhibition in the lower story of the engineer's and architect's building. The transportation from the works is by railways, canals, and common roads. There are also local tramways, upon which horses are used. There are about nine hundred horses belonging to the company.

Vienna Brick Manufacture.

The nature of the brick made by the company has already been explained in part, in describing their remarkable exhibition. It is sufficient to say that they make almost every standard form of brick, for corners, cornices and arches, similar to those made by the Rennberg Works in Berlin, of which a full suite of figures is given beyond. The glazed and enamelled bricks appear well, and will, no doubt, be largely used in exterior and interior decoration; and, also, for walls of dairies, kitchens, stables, and similar places, the walls of which require washing.

The manufacture of bricks and tiles in the Vienna valley undoubtedly dates from the occupation by the Romans, seventy years after Christ. Excavations in the old city bring to light quantities of bricks, of various sizes and forms, and among them those of Roman make, bearing the date of xiii. (*gemini*) and x. (*pro fidelis*) Legions. The collections of antiquities at Vienna contain many of these bricks remarkable for their perfect preservation, every angle and line being as sharp as when they were taken from the kiln.* They are generally thin compared with their breadth, and are of large size and red color.

The excellent quality of the bricks made by this company is sufficiently attested by the large constructions in which they have been used, and without change after long exposure. In 1851, 20,000,000 bricks were furnished under contract to the Semmering tunnels for the railway, and another contract for 40,000,000 for the public works at Vienna was being filled at the same time. The following named well-known edifices are constructed of these bricks: The Imperial and Royal Arsenals (very large structures, wholly of red brick), the Greek Church, Synagogue, Protestant School, the Chemical Laboratory of the new University, and the Austrian Museum of Art and Industry.

* The most interesting of these collections is perhaps that in the fourth cabinet of the Q. & R. Medals and Antiquities, Petit-Belvédère. The greater portion of these bricks were found at Vienna and at Petronell. Some of them bear the mark VINDOB (onæ) and KAR (nuntum). In this collection there are two tile-like bricks from Bagdad, impressed with cuneform characters of the time of Nebuchadnezzar, seventh century B. C. Size, 12 by 13 by 3 inches.

The clay is found in inexhaustible quantities stratified in beds of the tertiary epoch, ranging from five to sixty feet in thickness. Some of these beds contain fine silicious sand, and others a small portion of lime. Some give light yellow, or cream-stone-colored bricks, and others red colored.

The usual size of the Vienna brick is 11 inches long, $5\frac{1}{2}$ broad, $2\frac{1}{2}$ thick, $= 290 \times 140 \times 65$ millimetres, being considerably larger than ours.

The strength of these bricks has been carefully ascertained by a series of experiments conducted by Professor Rebhau of the Polytechnic Institute, Vienna, and by Prof. J. Bauschinger of the Mechanical-technical Laboratory in Munich.

Resistance of Vienna Brick to breaking strain.

[Experiments by Professor F. REBHAU.]

DESCRIPTION OF THE BRICKS.	Breaking with a load of zoll (inch) pounds.	COEFFICIENT OF RESISTANCE.	
		Kilos per one square c. m.	Zoll (inch) pounds per one square inch.
Common, ...	1,419	42	603
Common arch brick, ...	2,417	52	737
Ordinary wall brick, ...	2,255	65	925
Red brick, ...	1,711	50	708
Yellow, ...	2,875	84	1,187
Machine made, ...	1,662	49	692
Machine made, hollow, with two holes, ...	1,785	54	766
Machine made, hollow, with three holes, ...	1,812	84	1,194
Hollow machine made arch brick with sixteen holes, ...	1,307	39	554

Tabular statement of the resistance to crushing of the bricks made by the Vienna Company.

[Experiments made by Professor J. BAUSCHINGER.]

NAME OF THE LOCALITY AND DESCRIPTION OF THE BRICKS.	Crushing load per brick in tons of 1,000 Kilos.	STRENGTH IN—	
		Kilos per square c. m.	Zoll (inch) pounds per one square inch.
Wienerberg.			
a. Ordinary hand-struck, . . .	77.5	188	2,613
b. Ordinary machine, ...	100.0	230	3,197
c. Ordinary wall brick, . . .	77.0	183	2,544
d. Yellow wall brick, ...	80.0	205	2,850
e. Yellow machine wall brick, . .	100.0	230	3,197
f. Red wall brick, ...	81.0	200	2,780
g. Red, ...	85.0	195	2,711
h. Ordinary arch brick, . . .	48.0	125	1,738
i. Porous arch brick, ...	10 0	27	375
k. Machine brick with three holes, .	19.5	50	695
l. Machine arch brick with three holes,	5.5	19	264
m. Clinker, ...	53.0	240	3,336
Vösendorf.			
Ordinary hand-struck, ...	74.5	180	2,502
Leopoldsdorf.			
Ordinary hand-struck, ...	71.0	175	2,433
Laaerberg I.			
Ordinary hand-struck, ...	96.0	236	4,281
Laaerberg II.			
Ordinary hand-struck, ...	76.5	196	2,725
Laaerwald.			
Ordinary hand-struck, ...	64.0	158	2,196
Guntramsdorf.			
Ordinary hand-struck, ...	65.0	162	2,252
Biedermannsdorf.			
Ordinary hand-struck, ...	78.0	200	2,780
Hernals.			
Ordinary hand-struck, ...	62.0	158	2,196
Ordinary machine, ...	90.0	205	2,850

The company published, in connection with their costly exhibition, a descriptive pamphlet, giving a short historical résumé of the brick and tile manufacture in Vienna, the

origin of the company, and the extent of its operations.* It is illustrated by maps and sections, and is altogether a most commendable contribution to the history of the industry in Vienna, and worthy of imitation by all wealthy corporations when, as in duty bound, they participate in great international exhibitions.

The great Vienna brick and tile company, as now organized, is based upon the union of several extensive establishments, dating back to the time of Maria Theresa, and before it, and conducted in succession by Miesbach and by Drasche. In 1851 the works of the Wiener-berg occupied an area of 264¾ English acres, while an area of 680 English acres supplied the clay. There were 24,930 feet in length of drying sheds for the manufacture of ordinary bricks, and 8,304 feet of moulding sheds for tiles, facing and ornamental bricks, with 43 kilns, calculated to burn 45,000 to 110,000 bricks per kiln, or 3,500,000 at one time. Six establishments at that time had a united production of 91,900,000 bricks annually; the Wiener-berg alone producing 65,500,000. There were 649 moulding benches, and 4,140 persons employed.

The present organization was effected in March, 1869, under a nominal capital of 7,000,000 florins (equal to 3,500,000 dollars), in 35,000 shares, at 200 florins each. Between 6,000 and 7,000 workmen are employed, besides 58 officers, 36 machinists and foremen. There are eight large establishments, where the bricks and tiles are made, viz. :—

1. Inzersdorf Wienerberger, the largest of all, in six sections; 2. Hernals; 3. Laaerberge; 4. Laaerwald; 5. Leopoldsdorf; 6. Biedermansdorf; 7. Guntramsdorf; 8. Vösendorf,—all in the vicinity of Vienna. The total area devoted to the manufacture is 882 joch, 65 square klafters, equivalent to about 1,254 acres. The annual production of the works is enormous. In the four years from the organization of the company to the end of 1872 the production and sale were as follows :—

* Die Wienerberger, Ziegelfabriks und Bau-Gesellschaft zur zeit der Wiener Weltausstellung, 1873. Wien, 1873. Selbstverlag der gesellschaft, Centralbureau: Wien 1; Elisabethstrasse 6. 8vo., p. 92, with maps and graphic chart.

Annual Production, Vienna Brick and Tile Works.

YEAR.	Production—pieces.	Sold—pieces.
1869, ...	134,674,930	122,117,000
1870, ...	149,457,000	118,512,000
1871, ...	147,549,375	167,418,328
1872, ...	166,849,000	164,313,466

The production can easily be carried to 200,000,000 of bricks annually. These great results are accomplished by the use of labor-saving machinery and furnaces continuously working, on Hoffmann's system, 33 of which are in use. Over one and one-third million hundred-weight of different kinds of brown coal and of coke are consumed yearly.

The receipts, expenditures, and profits are no less remarkable than the production, and are as follows :—

Profits for four years, in Austrian florins.

YEAR.	Receipts.	Expenditures.	Balance—profits.
1869, ...	2,946,548.15	1,917,914.22	1,028,633.93
1870, ...	3,608,467.87	2,558,795.61	1,049,672.26
1871, ...	4,199,500.32	2,769,657.84	1,429,842.48
1872, ...	5,256,335.85	3,119,327.90	2,137,007.95

The company divided per share in—

1869, florins 15, corresponding to annual interest of 15 per ct.
1870, " 15, " " " $12\frac{1}{2}$ per ct.
1871, " 20, " " " $16\frac{2}{3}$ per ct.
1872, " 30, " " " 25 per ct.

In addition, there were placed to the credit of the reserve funds, in—

1869, ... 76,870.98 florins.
1870, ... 90,572.34 "
1871, ... 141,153.67 "
1872, ... 259,358.34 "

The projectors and managers of this great enterprise have given special attention to the well-being of their employés. They have organized a pension system, hospitals, schools, and a kindergarten, concerning each of which, full details, with sanitary statistics, are given in the publication before mentioned as accompanying their exhibition, and presented to the international jury.

The establishment, before and since the organization of the company, has been honored by the following prizes or awards: At the Industrial Exhibition, Vienna, 1845, and at Pesth, Hungary, in 1846, the great gold medal; at the London Exhibition, 1851, the large gold medal; at Amsterdam, 1853, the great silver medal; at Munich, 1854, and at Paris, 1855, the large medal; so, also, the large medal at the Exhibition of the *Gartenbau-Gesellschaft*, in Vienna, 1858–1859; the great gold medal at the International Exhibition at London in 1862, and at Paris in 1867; the great prize medal at the International Agricultural Exhibition, Vienna, 1866; the large medal of the Agricultural Exhibition, Mödling, 1871.

Dithmer's Brick and Clay Ware Company.

The Actien Gesellschaft der Dithmerschen Ziegel und Thonwaaren Fabrik, *in Rennberg, Schleswig-Holstein, German Kingdom*, made one of the best exhibitions of plain and ornamental bricks and terra-cotta ornaments, particularly of cornice, coping, moulding and arch brick, for corners of buildings and door and window openings. There were also terra-cotta columns, capitals, pedestals and urns.

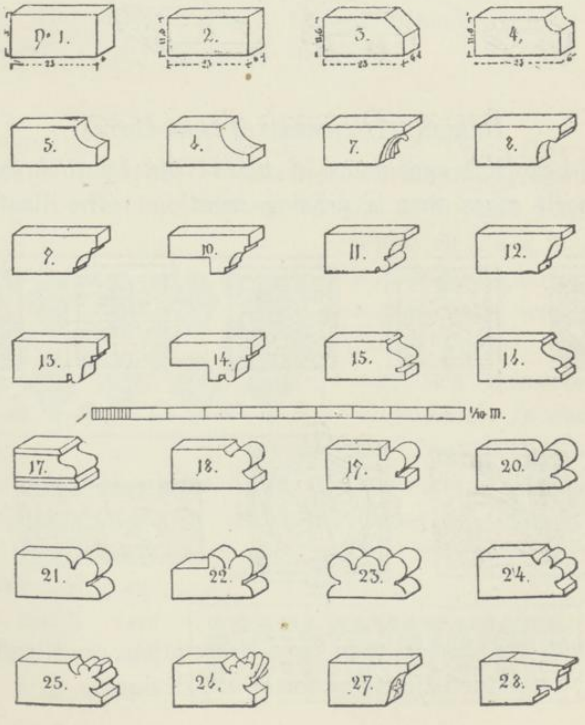
This establishment dates from 1782, and in 1871 produced 65,000 thalers' worth of bricks and ornaments, using 21,550 thalers in value of raw materials. There are four establishments, with 228 workmen and three steam-engines.

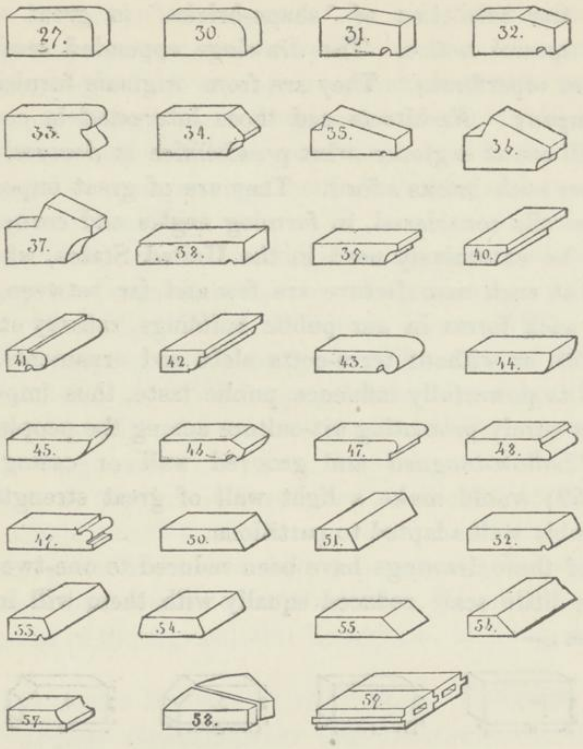
There are three standard colors—yellow, red and gray—in which the various articles are made, but they are also enamelled or glazed, in almost any desired color; but browns, greens, yellow and lilac are the most common. All the glazed bricks shown were perfect in form, with an even coating of color, and seemed particularly well adapted for decorative purposes and for walls where a clean, smooth surface, capable of being washed indefinitely, is desired.

The fine exhibition of "shape-bricks," in great variety, merits special notice. The drawings appended render description superfluous. They are from originals furnished by the company. Architects and those interested in construction will see at a glance what possibilities in decorative construction such bricks afford. They are of great importance, economically considered, in forming angles and corners, and should be extensively used in the United States, where attempts at such manufacture are few and far between. The use of such forms in our public buildings, railway stations, etc., with or without terra-cotta slabs and ornaments, could not fail to powerfully influence public taste, thus imperceptibly but surely promoting art-culture among the people.

The hollow-tongued and grooved wall or casing brick (Fig. 59) would make a light wall of great strength, and is probably well adapted to partitions.

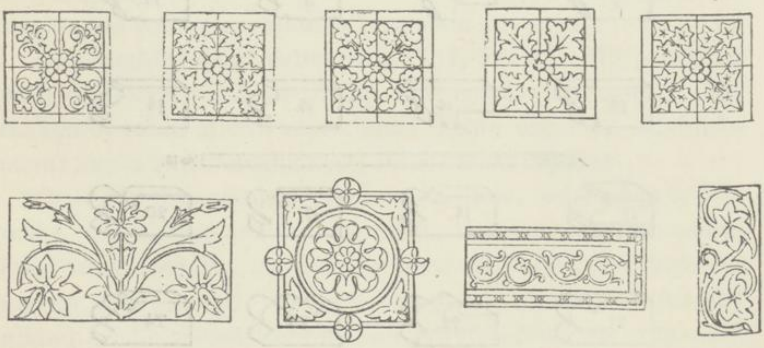
All of these drawings have been reduced to one-twentieth, but the little scale reduced equally with them will indicate the sizes :—





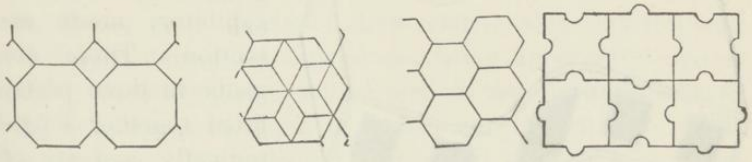
BERLIN—DITHMER'S TERRA-COTTA.

The beautiful specimens of terra-cotta by this exhibitor also merit more than a passing mention. The illustrations



presented are better than any description, and suffice to show the high artistic character of the designs.

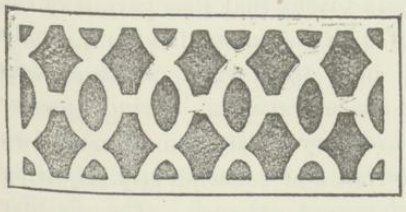
The following drawings show the forms in which the company manufacture paving tiles of excellent quality, far better than the ordinary paving brick in common use in the United States, for want of forms better adapted to the purpose.

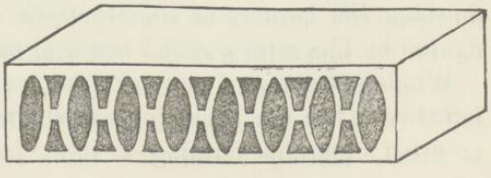


RINGOFEN-ZIEGELEI DER STADTGEMEINDE, *Troppau*. This establishment exhibited in the Austrian court a series of remarkably smooth and well-formed pressed red brick, and square slabs, and paving tiles. The latter were both yellow and red, in hexagons, about eight inches across; and in rhombs, same size, and two and a half inches thick. A fine effect is produced by laying the two colors alternately. The large slabs were twelve inches square and three inches thick. A variety of angle and cornice bricks were also shown. The ordinary brick shown measured about $11\frac{3}{4} \times 6 \times 3$ inches, or say $12 \times 6 \times 3$ inches.

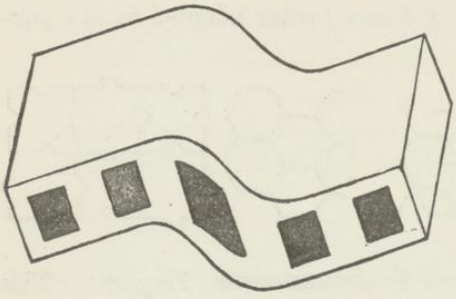
PERFORATED BRICK—*England*.

GEORGE JENNINGS POOLE, *Dorset*, *England*, exhibited a variety of perforated bricks, red and of a light gray color, about $9 \times 3 \times 2$ inches, and some square slabs 9 inches each way and 2 inches thick. The openings are numerous and ornamental, as shown in the annexed cuts, and extend through the brick from side to side. These bricks are evidently made in machines similar to those used for drain tiles. They are very light, require much less material than solid brick, and appear





to be strong. Some perforated curved bricks like the figure, $16 \times 4 \times 2$ inches, were also in the collection.



Curved channel tiles for open drains or gutters, by the same exhibitor, merit attention. These are made in three parts, fitted together longitudinally, and are of several sizes, all of them with large openings in the body, effecting a great saving of material and giving lightness and strength.

Dovetailed Bricks.—*France.*

Mr. E. Pavy, of *Chateau du Claveau*, near *Mézières-en-Brenne (Indre)*, France, exhibited a novel invention, for which he has taken out a patent in France, consisting of bricks formed with dovetailed recesses in each end, so that two bricks may be locked together by a third piece which fits into the two opposite openings.

The dimensions of the ordinary bricks are stated as $0^{m} \cdot 25 \times 0^{m} \cdot 12 \times 0^{m} \cdot 06$, which is about $9\frac{3}{4} \times 4\frac{3}{4} \times 2\frac{3}{8}$ inches. The locking-piece or dovetail is about five inches long.

The inventor claims for these bricks that they permit of the rapid construction of walls of a single course having not only lightness but great strength; or of thick walls, of two courses of the brick, with an air-space between, giving greater strength than is obtained in ordinary constructions using two or three times as much material, and consequently requiring more carting, more time, labor and expense. The circular brick are designed for round towers and chimneys, and appear to be favored by the exhibitor as an attractive mode of finishing the corners of constructions, an ideal house being figured by him with a round tower at each corner.

Window frames of oak, or iron, are made with a dovetailed recess in the sides, into which the small locking-piece is fitted, thereby forming a tight joint and holding the

frame firmly in its place. For rectangular buildings, without towers at the corners, angle bricks are specially made.

The inventor claims that the circular brick are especially valuable for towers, tall chimneys, light-houses, reservoirs for grain and for water conduits, cisterns, tubs for distillers, dyers, etc. Some of these claims seem fanciful and not duly sustained by experience, being apparently suggestions. For example, a tall cistern is represented, built to hold five metres in depth of water, and warranted to resist the pressure. The walls are double and connected at intervals with tie-bricks, leaving an air-space between. The bottom is to be of sheet iron "three to five millimetres" in thickness, with the edges turned up so as to hold the lower course of bricks and to prevent the iron from drawing in by sagging.

It is proposed to make roofs and arches of these brick, each brick with six dovetail joints, and $0^{m}{\cdot}320$ by $0^{m}{\cdot}190$ by $0^{m}.060$. These, it is stated, can be laid for seven francs the square metre, including the cement and fifteen bricks at twenty centimes each. The average price is about seventy-five francs the thousand for bricks, twenty-five centimetres by twelve centimetres by six centimetres. The mean price per square metre of wall built of a single thickness of brick $0^{m}.14$ thick, is stated to be nine francs seventy-five centimes; and of a square metre of double wall with bricks $0^{m}.075$ broad, fourteen francs.

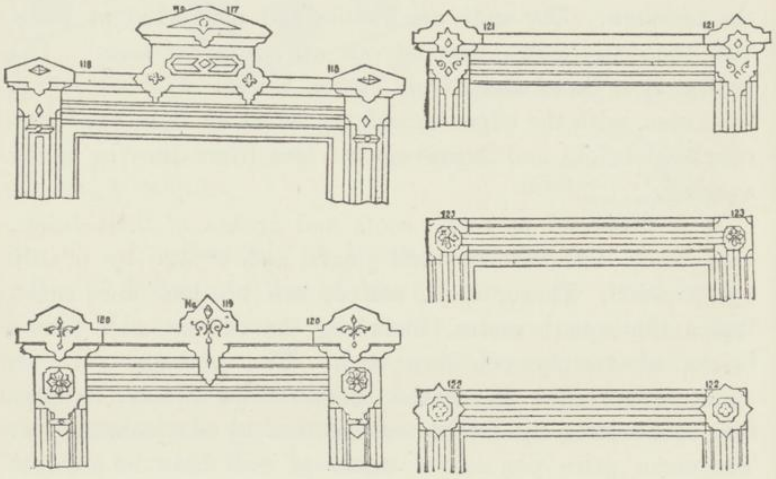
There was no opportunity of verifying any of these statements, and no references were made to any constructions made in this manner.

Terra-Cotta from India.

The Madras School of Art sent forty-two terra-cotta casts of Hindoo temple ornamentation, consisting of ornamental pillars, scrolls, running and border ornaments, perforated panels, circular and star patterns, all of great interest to art, and, at the same time, good examples of the ease of reproducing architectural designs and details in terra-cotta.

Chicago Terra-Cotta Company, *Chicago*. This establishment has, for the past eight years, been engaged in the

manufacture of terra-cotta building ornaments, vases, pedestals, statuary, etc. The market for the architectural pieces is very large, they being used in the erection of public and private buildings all over the West. They are sent as far south as Texas, west to Salt Lake, and as far north as the railways extend. The demand is constantly increasing and with every prospect of its continuing to increase, for in many parts of the West stone is very scarce,



and it is too costly to transport it great distances. The terra-cotta ware being hollow and light, bears the cost of transportation to almost any required distance. Again, where stone is found it costs more to work it than to pay the cost and transportation of the terra-cotta. It has become, to a great extent, a building necessity. In Chicago there are miles in length of fronts ornamented with the terra-cotta work of this establishment. During the summer of 1873, about $40,000 worth of trimmings were furnished to the new Illinois State House, in Springfield, consisting chiefly of dormer windows, balustrades, and open tracery work. The above illustrations show some of the styles of window-frames. Much of the work in Chicago and the larger cities is produced from designs furnished by architects, and specially adapted to some particular building, but the company has a large stock of moulds

from which it is not difficult to select objects suitable for most of the smaller constructions, thereby saving a considerable item of cost for new patterns. The superintendent of the works (Mr. Taylor) was formerly employed in the works of Mr. Blashfield, Stamford, England. This establishment exhibited largely, and with great credit, at the Paris Exposition in 1867, and is making the ornaments for the Art Museum now building in Boston.

Refractory Bricks, Retorts, Crucibles, etc.

In refractory materials of all kinds, for construction of furnaces and various metallurgical purposes, the Exhibition was particularly rich. The amount and variety of such goods were far greater than at Paris in 1867, and there was a notable advance in the art, especially in the production of special forms of large dimensions, and the increasing use of them in the construction of furnaces. Attention may be directed to the exhibits of fire-brick for the hearths and crucibles of blast-furnaces and for the stack complete, which are now being made at several establishments at very moderate prices. The formation of tubes and retorts of superior density and strength, by hydraulic pressure, is also worthy of attention.

H. J. Vygen & Co., *Duisburg, Rhein-prov. Deutsches, Reiches*, exhibited fire-brick and blocks for blast-furnaces, cast-steel melting furnaces, reheating furnaces, gas-retorts, and for smelting purposes generally. The plumbago-pots for cast-steel from this establishment are formed as in the annexed outline, and stand about two feet high.

These works were founded in 1856. The value of their products in 1871 was 200,000 thalers for 360,000 cwt. of goods, being the heaviest production of large pieces in Germany. There are 266 workmen employed, and 3 steam-engines of 130 horse-power.

C. Kulmiz, *Marienhütte*.—Fire-bricks and fire-clay, gas-retorts and drain-tiles were exhibited by this firm. The value of their products in 1871 was 150,000 thalers, and, in

addition, they raised 370,000 cwt. of fire-clay. Employ 345 workmen and 4 steam-engines.

Steinberger Gewerkschaft, *Grossalmerode bei Cassel, Deutsches, Reiches*, exhibited fire-brick and slabs for blast-furnaces. The production of this company in 1871 was 35,000 cwt. of clay and 54,000 cwt. of fire-brick, worth 30,500 thalers. One hundred and thirty-one workmen, and two steam-engines. The samples of tuyeres for Bessemer converters appeared to be excellent in quality. The largest, with nine holes, were 20 inches long and 5 inches in diameter at the small end.

Smal-Smal & Co., *à Andennes (province de Namur), Belgium*, exhibited fire-brick and flags for the hearths and crucibles of blast-furnaces and for a furnace complete; also, bricks specially adapted to the needs of steel-works, glass-works, and zinc-works. The blast-furnace brick were specially interesting, and they are supplied at the following rates per ton (1,000 kilogrammes), loaded upon cars at Andennes:—

Bricks for the hearth and crucible,			75	francs.
"	"	boshes, . .	65	"
"	"	interior lining, .	55	"
"	"	outer casing, .	50	"
"	"	a furnace complete,	65	"

Slabs or tiles, for the bottoms of soda-furnaces, are supplied at 80 francs, and other fire-brick, for steel-works, glass-works, puddling furnaces, etc., at 40 francs the ton (about $8 gold). Crude and calcined clay, for the use of glass and zinc works, is sold at from 14 to 28 francs the ton.

Société Anonyme des Terres Plastiques et Produits Refractaires, *d'Andennes, lez-Namur. Directeur gérant:* M. Francois Bertrand.—This establishment made an extensive display of retorts, cylinders, and of bricks for condensation chimneys for acid works; bricks for Siemen's furnaces, Bessemer converters and high furnaces. The following is a short description of some of the principal objects, with the prices per piece, or per ton:—

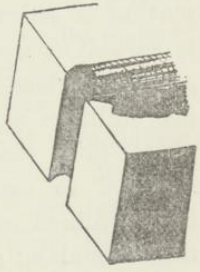
Retort, $3^{m}.12$ long $\times$ 0.66 $\times$ 0.40, weighing 810 kilog. = 1,620 lbs.; price, 100 francs = \$20. Retort, $2^{m}.75 \times 0.545 \times 0.315$, weighing 560 kilog. = 1,120 lbs.; price, 70 francs. Refractory bricks, for the crucible and boshes of blast-furnaces; price, 65 francs per 1,000 kilos = per ton. Bricks for rolling mills, Siemen's furnaces, Bessemer steel-works, coke-ovens, etc., at 35 francs per 1,000 kilos. = about \$7 per ton. Bricks—"artificial sandstone"—for chimneys and towers for the condensation of acids, at 50 francs per 1,000 kilos. *Cascade denitrante*, in artificial sandstone, at 130 francs per piece. Cylinder, in artificial sandstone, with bottom, $1^{m}.05$ high $\times$ $1^{m}.00$ in diameter, for condensing acids, at 85 francs per piece. Cylinder, in artificial sandstone, without bottom, $1^{m}.00 \times 1^{m}.00$ in diameter, for condensing acids, at 65 francs each.

This company also make a specialty of supplying furnaces and metallurgical establishments with refractory materials of the best quality, at the following rates: For glass-works' pots, crucibles, etc., 15 and 18 francs per 1,000 kilogs. Calcined earths for crucibles, at 28 to 35 francs. Calcined quartz, at 20 francs per 1,000 kilogs.

The establishment was founded in 1856, and it has received awards at several of the great exhibitions.

TONGUED AND GROOVED FIRE-BRICK.

A novelty, in the form of tongued and grooved fire-brick, was seen, but the exhibitor's name was not obtained. The annexed outline will give an idea of the form.



RETORTS FOR THE DISTILLATION OF ZINC.

N. J. DOR, *Director of the mines and works of M. L. de Lamine, à Ampsin près Huy (province de Liége)*, exhibited improved crucibles for the distillation of zinc, made under hydraulic pressure, in a machine specially designed for the purpose, invented by the exhibitor. This machine has been in operation for five years at the works of M. de Lamine, and similar machines are used at Vielle-Montagne and other establishments. The crucibles made in this manner are remark-

able for their superior density, compactness, freedom from flaws, and their cheapness,—the machine effecting a great saving over hand-labor. The appearance of the crucibles justifies these claims for excellence. The details of the machinery, as shown by working-drawings, were highly interesting, and are suggestive of much that may be accomplished in the art of forming clay ware by the use of hydraulic power.

Fire-Bricks and Clay—England.

An interesting report on the fire-clay goods of the London International Exhibition of 1871, was made by Lieut. Grover, R. E. He states that the trade in English products of this class has marvellously increased in the past thirty years. Over 30,000,000 of fire-bricks are annually made at Stourbridge, instead of 14,000,000 as formerly. Newcastle produces 80,000,000 instead of 7,000,000. The export trade increased sixfold since 1862.

The celebrated Stourbridge clay, obtained about twenty miles south-west of Birmingham, is dug from shafts in the coal measures, generally below three workable seams of coal, and between marl, or rock, and an inferior clay. The seam averages three feet in thickness. The middle portion is selected. After hoisting to the surface, the clay is sorted by women, the best lumps, or kernels, being laid aside for glass-house pots. This selected clay costs fifty-five shillings a ton. Ordinary fire-clay costs, at the same place, only ten shillings a ton. About four tons are required to make a thousand nine-inch fire-bricks. The clay is mined over an area of about nine square miles, and there are about a dozen establishments.

The percentages of the important ingredients of the Stourbridge clays are shown in the following analyses made by Mr. F. A. Abel, F. R. S., chemist to the War Department, England :—

Analyses of Stourbridge Clay.

	Silica.	Alumina.	Peroxide Iron.	Alkalies, loss, etc.
1, ...	66.47	26.26	6.63	.64
2, ...	65.65	26.59	5.71	2.05
3, ...	65.50	27.35	5.40	1.75
4, ...	67.00	25.80	4.90	2.30
5, ...	63.42	31.20	4.70	.68
6, ...	65.08	27.39	3.98	3.55
7, ...	65.21	27.82	3.41	3.56
8, ...	58.48	35.78	3.02	2.72
9, ...	63.40	31.70	3.00	1.90

Lieut. Grover very justly points out "that the infusibility of any substance depends not merely upon the chemical nature of its constituents, but also upon the manner in which those constituents are combined with one another. For example, granite *per se* is infusible at ordinary high temperatures, whilst pounded granite can be readily melted by the same degree of heat. Thus it would seem that a porosity in structure, brought about by a coarseness of elementary particles, would enhance the chemical infusibility of a material; and that in fire-clay goods a close uniform structure, though pleasing to the eye, is not favorable to their refractory powers, since the component particles should have a facility for contraction or expansion under high temperature, and the air cavities act as valuable non-conductors of heat. Hence it will be evident that to determine accurate conclusions respecting these wares, a fire test is as essential as chemical analysis."

Hollow Brick.

Much attention has of late been given to the manufacture of hollow brick, to enclose air-spaces between the

interior and exterior surfaces of walls, so as to exclude dampness and secure greater warmth. This is of great importance, and especially where "furring off" the wall is avoided, as it should be for many good reasons. But the great cause of dampness, and consequent great conducting power of walls, is not likely to be avoided by even hollow brick of the best construction, unless access of water to the outside and the foundations is prevented by impervious materials. The capillary power of raising water in walls is well known, particularly in Paris, where dampness has been observed to rise thirty-two feet above the foundations. Long, driving rains fully saturate brick walls and chimneys, and exudations of water are found inside of dwellings about chimneys where no leak can be discovered. The capacity of absorption of water by bricks is probably not less than a pint to each one. Mr. Chadwick, in his "Report on Dwellings for the Poor," says that in England common bricks absorb as much as a pint or pound of water; and supposes a case of a cottage wall consisting of twelve thousand bricks, which would be capable of holding fifteen hundred gallons, or six and a half tons of water when saturated. To evaporate this would require a ton of coal. Sandstone and granite also hold quantities of water in their pores. Prof. Ansted states that granite, in a dry state, is rarely without a pint and a half of water in each cubic foot. Sandstone may contain half a gallon, and loose sand two gallons.

The absorptive capacity of bricks varies with their density, depending upon the process of manufacture. This has been shown by Cyrus Chambers, in experiments upon bricks made by the machine of his invention and on hand-made bricks, the results of which are given in the annexed table:—

Table showing the Percentage of Water absorbed by various Bricks after Thirteen Days' submersion.

Number.	Degree of Burning.	Locality of Clay.	The Process of Manufacture.	Weight in pounds and ozs. before submersion.	Weight in pounds and ozs. after submersion.	Gain in weight in ounces.	Percentage of whole weight gained.
1	Hard, . .	Pea Shore, N. J., .	Chambers' machine,	5 0	5 2	2	2.5
2	Dark, . .	" " " .	" "	4 15	5 7	8	10.12
3	Light, . .	" " " .	" "	4 14	5 10	12	15.4
4	Salmon, .	" " " .	" "	4 14	5 12	14	17.95
5	Very hard,	" " " .	Hyd. Press, 600 tons pressure, . .	2 4	2 6	2	*5.55
6	Dark, . .	" " " .	Dry Press, . .	4 13	5 7	10	13.
7	Salmon, .	" " " .	Dry Press,† . .	2 8	3 1	9	22.5
8	Dark, . .	Hestonville, Phila.,	Chambers' machine,	5 3	5 15	12	14.46
9	Dark, . .	" "	" "	5 5	6 3	14	16.47
10	Light, . .	" "	" "	5 3	6 0	13	15.66
11	Salmon, .	" "	" "	5 8	6 8	16	18.18
12	Salmon, .	" "	Hand, . . .	4 8	5 8	16	22.22
13	Light, . .	" "	" . . .	4 10	5 8	14	18.91
14	Hard, . .	" "	" . . .	4 12	5 8	12	15.78
15	Salmon, .	Neck, Phila., . .	" . . .	4 8	5 7	15	20.83
16	Light, . .	" " . .	" . . .	4 13	5 9	12	15.58
17	Hard, . .	" " . .	" . . .	4 11	5 2	7	9.33
18	Hard, . .	" " . .	" . . .	4 10	5 3	9	12.16
19	Dark, . .	Hudson R., N. Y.,	Hall's machine, .	4 3	4 6	3	4.47
20	Light, . .	" " "	" " .	4 2	4 12	10	15.15

* This brick, in the process of manufacture, was submitted to a pressure under a hydraulic press of 121,695 pounds to the square inch.

† This brick was made by the *dry-clay* process, of the same clay as No. 1, and was exposed one winter to the action of the frost, and had partially fallen, none of the angles being left.

This shows a gain in weight of from two to sixteen ounces, or from $2\frac{1}{2}$ per cent. to $22\frac{1}{2}$ per cent.

The capillary power of bricks is such that even if made hollow in the best manner, the inner surface must become as fully saturated with water as the outer; and there is no remedy except to protect the outer surface by an impervious glaze, or enamel, or to thoroughly isolate the inside wall, or layer, from contact with the outer. Even headers, or tie-bricks, at intervals, serve to convey the moisture and destroy the efficacy of a hollow wall.

Sizes of Bricks.

There was a variety of sizes of bricks shown at Vienna. In general, they are broad and not thick. In the United States there is no standard size. In the Eastern States bricks are short, narrow, and very thick. The latter make a

wall thick enough to pass inspection, while the thickness promotes rapid laying. As a general rule the dimensions increase in breadth and length southward, and decrease in thickness. For example, a Boston brick is about $2\frac{1}{2}$ by $3\frac{1}{2}$ by $7\frac{1}{2}$ inches. In Valparaiso, Chili, they are made $1\frac{1}{2}$ by 10 by 18 inches. Cuban brick are about $3\frac{1}{2}$ by 6 by 13 inches. New Orleans, $2\frac{3}{4}$ by $4\frac{3}{8}$ by 9 inches. Philadelphia (common) are usually about $2\frac{1}{8}$ by 4 by $8\frac{1}{2}$ inches.

A Philadelphia brick contains about 85.6 cubic inches of clay. A Boston, or a Hudson River brick, contains about 69.12 cubic inches; therefore, twenty-five thousand (25,000) Philadelphia bricks have the volume of thirty thousand nine hundred and thirty-two (30,932) of the Eastern bricks.

M. Paul Bonneville, in his Report upon the Bricks and Tiles of the Paris Exposition, 1867, gives the following table showing the—

Dimensions of Bricks of several Countries.

LOCALITY.	Length.	Breadth.	Thickness.	Volume.
	m.	m.	m.	c. c.
Burgundy,	0.220	0.110	0.060	1,452
Montereau,	0.220	0.110	0.055	1,331
Larcelles, red, largest,	0.220	0.110	0.050	1,210
Larcelles, red, seconds,	0.190	0.100	0.045	940
"Country brick," Paris,	0.220	0.110	0.050	1,210
"Country brick," Paris,	0.220	0.100	0.060	1,320
Flemish,	0.210	0.110	0.047	1,085
English,	0.250	0.110	0.060	1,650
English,	0.238	0.115	0.077	2,107
English,	0.254	0.124	0.076	2,400
Holland,	0.260	0.120	0.054	1,684

Experiments made upon French brick show that the resistance to breaking strain ranges from eight kilogrammes the square centimetre for ordinary soft brick, to twenty kilogrammes for brown Burgundy bricks, which will also bear one hundred and ten to one hundred and fifty kilogrammes before crushing.

Brick-Making Machinery.

Space and time both prevent the consideration of this subject in detail, permitting only brief notices of some of the machines.

The two principal types are the piston machines, and those for continuous delivery through dies of the size and form of the section of the brick. Of the former there was an example in the United States section, and of the latter in the Austrian.

Gregg's Excelsior Brick Press.—The celebrated brick press, invented by William L. Gregg, of Chicago, and which was honored with a prize medal at Paris in 1867, was exhibited in model. This invention, which has been improved since 1867, is competent to produce fifty-six bricks per minute, or twenty-six thousand to thirty thousand bricks in a day of ten hours. And it is claimed by the inventor that bricks of the lower grades can be made by this machine for less than one-half, and face or front bricks for about one-third the cost of making by hand.

The machine has two sets of moulds, seven in each set, fixed upon a movable table which passes back and forth under a feeder through which clay is forced into the moulds. When filled, the contents receive, in the movement, two distinct downward pressures from a wheel above. The bottoms of the moulds are movable, and are attached to a piston which slides up on an inclined plane as the carriage or table moves out from under the wheel. This forces the bottom of each mould upward, carrying with it the brick, and when all are out of the moulds they are swept off to one side, the empty moulds return under the hopper and the process is repeated. The clay is taken directly from the bank, and is prepared for the moulds by two grinding rollers. From the discharge of these rollers it is elevated to the hopper of the machine.

The rapidity of the production of the moulded clay bricks is not the only great advantage of this system. The clay need not be so wet as is necessary for hand-moulding, and thus a great saving of time in drying results. Hand-made bricks as they come from the moulds must lose twenty-five per cent. of water by artificial drying or spontaneous evaporation before it

is safe to burn them, but the machine-made bricks, it is claimed, do not contain more than one-eight this amount of water. This permits expensive sheds and drying floors to be discarded, and renders it possible to manufacture continuously throughout the year.

In Chicago, in 1872, there were some 400,000,000 of bricks made and used, and about half that number in 1873. The clay for the common brick is obtained from the excavations made for docks and slips along the river in the city. Fine front or facing bricks are made from clay procured at Gregg Station, eighteen miles from the city, on the Chicago, Burlington and Quincy Railroad. Brick made from this clay in the Excelsior Press are surpassed in color only by the finer grades of Philadelphia and St. Louis brick, but are as strong as any.

Chambers' Continuous Delivery Machine.—There were brick-making machines exhibited, belonging to the class of tempered clay continuous delivery machines, in which the clay, being properly mixed, is forced through a rectangular die in a continuous stream or column of clay, of the breadth and thickness required for brick. From this column of clay, bricks are cut off at proper intervals by wires, stretched in a frame, or by knives. The principle is the same as that of the machine invented and patented in the United States, by Cyrus Chambers, Jr., of Philadelphia. These machines have been in operation for several years, and have produced many millions of brick.

The machine is constructed almost wholly of iron, and is made very strong. It receives the clay direct from the bank, tempers it with water, and forms it into bricks, with well-defined corners, and smooth, straight surfaces, at the rate of from fifty to eighty per minute, or from twenty-five to thirty-five thousand per day for ten hours.

The tempering portion of the machine consists of a strong iron case, in which revolves a horizontal shaft, into which are set spirally, strong tempering knives, or blades of steel, so that, as they pass through the clay, they move it forward their thickness, or whatever distance they may be *set* to do. The clay being stiff, and not having much water on it, is not

liable to *slip* before the knives, but is cut through and through, and *thoroughly* mixed; so that by the time it reaches the small end of the tempering case it is ready to be formed into bricks.

On the end of the tempering shaft is secured a conical screw, which revolves in a cast-iron conical case, the inside of which is pitted, checked, or ribbed, so as to prevent the clay from revolving in it, and is chilled, to prevent wearing.

The screw being *smooth* and very hard, the clay slides on it, thus becoming, as it were, a *nut;* the screw revolving, and the clay thus not being allowed to move backward, it *must* go forward.

This operation further tempers the clay, and delivers it, in a solid, round column, to the *forming die*, which is of peculiar construction and form, and so designed as to reduce the round column to a rectangular one, whose breadth and thickness is the *proper breadth* and *thickness* for a brick, while at the same time *the clay is forced into the corners* of the finishing part of the die, so that the angles of the bar of clay are made full, solid and sharp. This column of moulded clay, as it issues from the die, is conducted by an endless belt, supported on rollers, to the cutting device, which consists of a thin blade of steel, secured to the periphery of a wheel, passing through the bar of clay, and being guided by steel plates, so arranged as to move with the clay while the knife is passing through it, and so as to support the under-side and edge of the bar while being cut.

The bricks are then dusted with fine sand, and are conveyed on cars or barrows to the packing-floors or drying-chambers.

One of these machines will make from twenty-five thousand to thirty-five thousand bricks regularly, in ordinary clays, per day of ten hours; or from fifty to eighty bricks per minute.

Messrs. Chambers & Brother made some experiments to determine the crushing pressure of bricks made by this machine out of New Jersey and Philadelphia clays, with the following results:—

Table showing the Pressure different Bricks are capable of sustaining in various positions.

No.	Degree of Burning.	Locality of Clay.	Process of Manufacture.	Position—pressure.	The material between which the bricks were placed.	Number of pounds pressure at which the bricks crushed.
1	Salmon,	Pea Shore, N. J.	C. B. & Co. Machine.	End.	Ash wood.	8,960= 4 tons.
2	Salmon, .	"	"	Edge.	" "	15,680= 7 tons.
3	Salmon, .	"	"	Side.	" "	40,320=18 tons.
4	Light Stretcher,	"	"	Edge.	" "	13,440= 6 tons.
5	Hard, .	"	"	Side.	Cast iron.	134,400=60 tons, without crushing.
6	Salmon,	Philada. Neck.	By hand, .	Edge.	" "	11,200= 5 tons.
7	Light Stretcher,	"	" .	Side.	" "	33,600=15 tons.
8	Hard, .	"	" .	Side.	" "	67,200=30 tons.

The first four experiments were made with the bricks laid between hard ash planks, but the wood crushed and spread out, carrying the edges of the bricks with it, so that the pressure at which they crushed may be considered far under the actual pressure the bricks are capable of sustaining. The last four experiments were made with the bricks between plates of cast-iron, without any cement, or anything between them, the rough, uneven surfaces coming in contact; consequently, they were much more severe than though the bricks had been laid in cement, so as to allow the pressure to be evenly distributed over the whole surface.

Display of Brick Machines at Former Exhibitions.

At the Exhibition in Paris, 1867, several brick machines were shown, and were reported upon specially by M. Paul Bonneaville, Engineer of Arts and Manufactures, with drawings.*

The London International Exhibition in 1871 was particularly rich in all forms of the potter's art and appliances, and the brick and tile machinery of Europe was well shown. It is described in some detail by Peter Bawden, Esq.,† and also by Arthur Beckwith of New York. Salvetat and Ebelmen,

* Etudes sur L'Exposition, Lacroix, VII., 350.

† Official Reports (British) on the London International Exhibition, I., 345.

in their report upon pottery at the Exhibition of 1851, give a very full list of works, publications, and patents connected with brick-making machinery. Those specially interested in this branch of the subject may find in the above-cited authorities the most accurate available information, at least from the European point of view.*

Hoffmann's Furnace.

The great establishment for the manufacture of bricks in Vienna now has thirty-three of Hoffmann's patent "ring-ovens" or annular brick-kilns in use. They are said to mark a new era in the history of the works, effecting a great saving of fuel, and consequently increasing the profits. They are equally applicable to burning brick, lime, earthenware, cement, and gypsum. The inventor states that over one thousand are now in use, and claims to effect a saving of two-thirds of the fuel required by the old methods of burning. Inasmuch as a very good description of the apparatus has been given by Dr. Barnard in his report on the Paris Exposition,† it is sufficient to direct attention to this furnace, which does not appear to have found favor in the United States. One objection given against its use is the greater scale upon which our brick manufacture is conducted. When a kiln of the ordinary form is opened there is room enough for carts and horses to drive in and load with brick of any desired kind,—either hard-burned, pressed, or soft, or "salmon brick." This objection might, however, be readily overcome by making the chambers of greater size.

Clay Pipes.

The manufacture of clay pipes is a branch of ceramic art of no small importance, industrially. The establishment of Messrs. McElroy & Co., in Philadelphia, turns out about a thousand gross of pipes weekly. About twenty different styles are made, ranging in price from 85 cents to $1.35 the gross. A clay of peculiar excellence is required.

* Pottery—Terra-Cotta Stoneware, Fire-Brick, etc. Van Nostrand, 1872.

† Industrial Arts, by Frederick A. P. Barnard, LL. D.

V. Materials for Pottery.

The materials used in the manufacture of pottery were exhibited in several of the sections, notably from Japan. Much more attention has been given abroad to explorations for clays and to their examination chemically, and experimentally in the furnace, than in the United States. Collections are made under government auspices to illustrate and promote the potter's art. The Museum of Practical Geology in London contains very full collections, illustrating the qualities of the clays and plastic strata of Great Britain, selected with a view to their applicability to ceramic manufactures. There are over one hundred and twenty-three localities represented in the series, and each set of specimens contains six examples. They are all arranged in geological sequence, commencing with the newer deposits and ranging downwards.

As already stated in the general survey, there is no lack in the United States of suitable clays for pottery. They are widely distributed, not only in recent deposits along the granite ranges of the country, but in the tertiary and older formations. They result from the gradual disintegration and decay of feldspathic rocks. This decay and softening is seen on a grand scale in the Southern States, but at the North the decayed portions appear to have been removed by the mechanical force of ice. The antiquity of the decomposition and its great extent in past geological ages, has been pointed out by Prof. T. Sterry Hunt, who believes it to have been accomplished in great part by an atmosphere of carbonic acid, aided by warmth and moisture. He connects it with the slow purification of the atmosphere which has been in progress from very early times. The alkalies, lime and magnesia, set free by the decomposition, absorbed the carbonic acid, and carried in solution to the ocean, gave rise to limestones, dolomites and common salt.

In New England the principal known deposits of clay suitable for potters' use, are along the western base of the Green Mountains in tertiary deposits. They have been worked at Brandon, and Monkton, in Vermont. From the former place quantities have been taken for fire-brick and for putting into

paper. In Massachusetts, clay is cited as occurring at Northampton, and at Martha's Vineyard. Granular quartz, another important ingredient of the body, is mined in Berkshire County.

The early exportation of samples of clay from the Southern States to England, has been noticed. No doubt extensive deposits of valuable clays exist there. Good clays are found in California.

Extensive deposits of the finest clays for pottery purposes are found at many points in the State of New Jersey, and including the varieties known as fire-clay, paper-clay, and alum-clay, they form a continuous belt extending obliquely across the State from Raritan Bay and Staten Island Sound on the east, to the Delaware River on the west.* The pits dug for these clays are chiefly within areas of no great extent near Woodbridge, Amboy, Bonhamtown, Washington and Trenton, but explorations have shown the existence of other places where they can be dug with profit. They are, in general, overlaid with superficial beds of drift of sand and gravel. The beds are extensively mined, not only for pottery and fire-brick, but for shipment. Large quantities are used in New York, Philadelphia and Boston, for the manufacture of alum. Much of the whitest and purest is sold to the manufacturers of paper-hanging for facing wall-papers. By far the greatest consumption is in the manufacture of fire-brick, especially at Perth Amboy, South Amboy, and at Trenton. In one township, Woodbridge, over fifty thousand tons of clay were raised in 1865.

Fire-sand, moulding-sand, kaolin and feldspar, often occur with these beds of clay and in workable quantities. The materials used for fire-brick consist of about five-eighths raw

* The limits of this belt are defined by the state geologists of New Jersey, as follows: "The northern limit is marked by the outcropping red shale and sandstone of the triassic formation, following an almost straight line from Woodbridge, southwest by Bonhamtown, to the mouth of Lawrence's Brook on the Raritan River; along this stream, nearly to the Monmouth Junction, and thence north of the railroad near Penn's Neck and Baker's Basin, to the Delaware River at Trenton. The southern boundary of this sub-division of the cretaceous formation is not well defined in consequence of the superficial beds of drift which cover it. Near Raritan Bay they are not so thick, and the division line between the plastic clays and the clay marls is accurately located near the mouth of Cheesquake Creek. But towards the south-west the overlying drift is so deep that it is impossible to draw the southern boundary with much certainty."—*Cook, Geol. Rept.*, 1873, *p.* 103.

clay, one-eighth cement, one-eighth kaolin, and one-eighth fire-sand. The "cement" is a burned fire-clay.

In the best New Jersey clays no grit can be perceived when tested between the teeth. Analyses of good specimens show the following ingredients[1]:—

	1.*	2.†	3.‡	4.‡
Silica,	43.20	45.30	46.32	46.29
Alumina,	39.71	37.10	39.74	40.09
Zirconia,	1.40	1.40	–	–
Potash,	.37	1.30	–	–
Lime,	–	.17	.36	.50
Magnesia,	–	.22	.44	–
Peroxide of iron,	.74	1.30	–	–
Protoxide,	–	–	.27	.27
Water,	14.25	13.40	12.67	12.67

* White clay from Burt's Creek near South Amboy.
† White clay from Trenton. ‡ Cornwall, England.

Prof. Cook, state geologist of New Jersey, says of the potter's clay, that it is tenacious, of a light-blue color; a little gritty when tried between the teeth. When highly heated it becomes partially vitrified without losing its shape, and is thus well adapted for earthenware. And it can be heated sufficiently for salt-glazing without injury. The following analyses show composition at several localities:—

	1.*	2.†	3.‡	4.§
Silica,	71.80	68.00	65.62	75.55
Alumina,	19.05	23.66	20.88	19.04
Potash,	.61	1.19	1.95	.10
Lime,	.31	–	–	–
Magnesia,	.79	–	.30	–
Oxide of iron,	1.31	1.17	1.23	.71
Water,	6.08	6.40	8.10	4.85
	99.95	100.42	98.08	100.25

* Morgan clay, pits near South Amboy.
† Bank of Rancocas Creek, near Bridgebora.
‡ Billingsport, on the bank of the Delaware, below the mouth of Mantua Creek.
§ Raccoon Creek, a mile above Bridgeport.

[1] These and the following analyses for comparison are taken from the Geology of New Jersey, 1868, p. 683. Analyses 3 and 4 from Percy's Metallurgy.

He observes that the clay pits about South Amboy furnish a large amount of this useful substance every year, and that the market is continually widening. It sold for from $1.50 to $5.00 per ton. Any needed amount of clay can be had from the pits along the Delaware and its branches. Clay suitable for making water-pipes is dug near the Woodmansie Station on the Raritan and Delaware Bay Railway. Light colored clays of the tertiary formation are found at many points in the southern part of the State, suitable for making a common quality of fire-brick and for other purposes.

Coarse clays, superior to brick clays, occur in inexhaustible quantities over and under the fire-clays. They are well adapted to the manufacture of coarse pottery, sewer-pipes, drain-tiles, etc., for which they are already, to some extent, utilized.

For the manufacture of glass-pots, which require a peculiar and excellent quality of clay, it was formerly thought that none of a suitable composition existed in the United States, and that only English and German clays could be relied upon. Experiments were made at Wheeling, Virginia, on clays obtained at the Mt. Savage Iron Works, and the measure of success attained encouraged the belief that the glass-works might become independent of foreign sources for this material. Soon after, a clay was obtained from Missouri which proved to be equal to, if not superior, to any other known clays for such purposes.

The fire-clays of St. Louis, according to Dr. Litton, have the following composition :—

	1.*	2.†
Silica,	61.02	59.60
Alumina,	25.64	26.41
Oxide of iron,	1.70	1.61
Lime,	.70	1.00
Magnesia,	.08	.07
Potash,	.48	.29
Soda,	.25	.16
Sulphur,	.45	.38
Water,	10.00	10.36

* Raw clay.

† Prepared, probably washed.

China Clay—*England.*

The following tabular statement shows the extent of the production of China stone and China clay in Cornwall, for a series of years* :—

Shipments of China Clay and China Stone from Cornwall, England.

YEAR.	Kaolin (China Clay).	China Stone.	St. Agnes Clay.
1865, ...	97,750	25,500	1,566
1866, ...	105,000	35,000	1,524
1867, ...	127,000	33,500	1,316
1868, ...	100,000	29,000	979
1869, ...	105,700	28,500	875
1870, ...	110,520	32,500	946
1871, ...	125,000	33,000	774

At St. Agnes there were also, in 1871, about four hundred tons produced for candle-clay, used in the mines for supporting the candles.

In Devonshire, 19,000 tons were produced, in 1871, at the Lee Moor, and other china-works, and 47,639 tons of pipe and potter's clay were shipped at Teignmouth, the production of Newton and neighborhood. Of a total of 57,670 tons exported from Poole, Devonshire, in 1871, the greater portion was sent to London and Runcorn, and to Quebec 200 tons.

Of potter's material (clay, flint, chert, etc.) there were imported into the potteries by Trent and Mersey navigation, 144,588 tons, and by the North Staffordshire Railway, clay, flint, chert, etc., 11,345 tons.

The demand for porcelain clays sustains a very considerable mining industry in Cornwall and Devonshire. The official mineral statistics of the United Kingdom contain a list of no less than one hundred and five separate clay-works in Cornwall, seven in Devonshire for porcelain clay, five of "Teignmouth clay," and six of "Poole clay." In Staffordshire there are nineteen works producing Stour-

* Compiled from Hunt's Mineral Statistics of Great Britain.

bridge clay. The following analyses show the composition of the celebrated Stourbridge and other foreign clays :—

	1.*	2.†	3.‡	4.‡
Silica,	65.10	73.	50.20	51.90
Alumina,	22.22	19.93	34.13	30.03
Potash,	.18	.89	.39	.89
Lime,	.14	.39	.30	1.60
Magnesia,	.18	–	–	.18
Protoxide of iron,	1.92	.87	.87	–
	–	–	–	1.50
Phosphoric acid,	.06	–	–	–
Water and organic matter,	9.86	6.40	13.70	13.90

* English Stourbridge, Percy.
† German clay for glass-pots, from Bremen, Germany.
‡ Coblentz, for glass-pots.

NOTE.—Numbers 2, 3 and 4, made in the New Jersey State Laboratory.

CERAMIC ENAMELS.

CHEMISCH-TECHNISCHE FABRIK BEI ELBOGEN IN BÖHMEN. *Director, Max Rösler. C. F. Merker, Agent, 1 Getreidemarkt*, Vienna. There was from this source a very interesting exhibition of coloring materials for the use of potters and decorators, which was honored with the Progress Medal. The highest skill of the chemist is called for by this art, and the demand is such that the manufacture of standard colors, or enamels, ready for use, has become an important industry. A large glass case was filled with a collection of the manufactures of their establishment, consisting of fluxes, glazes, colored glazes and enamels, and metallic oxides for glass, porcelain, stoneware and majolica. These are accompanied by proof-tiles, upon which the colors have been tested by burning, showing all the colors and shades of color—the greens, blues, red, rose, yellow, etc., etc. All the preparations of chromium, copper, mercury, gold and cobalt were beautifully displayed. By the courtesy of the director I have been favored with a price-list, from which I make the following extracts for the benefit of amateur decorators and others, who have found difficulty in getting such materials in the United States.

Lustres for Porcelain, Stoneware and Glass (Glass Ornaments and Pearl ditto).

No.		Per half oz. in silver krs.	Cheaper price—per lb. in silver florins.*
1	Flux,	25	6
2	Pearl white,	30	7½
3	White,	35	9
4	White,	30	7½
7	White,	30	7½
8	White,	30	7½
10	White,	30	7½
11	Gray,	35	9
12	Gray,	40	10½
13	Gray,	75	20
5	Dove color,	40	10
14	Rose,	85	22½
17	Light green,	60	15
18	Green,	70	18
19	Yellow green,	55	13½
36	Dark blue green,	170	45
32	Gold lustre,	170	45
35	Purple lustre,	280	75
33	Blue,	85	22½
21	Yellow,	35	9
	Bright gold,	430	120
22	Gold yellow,	35	9
24	Orange,	45	12
27	Russet,	30	7½
25	Yellow brown,	30	7½
26	Iron red,	25	6
29	Tawny brown,	60	15
28	Dark brown,	90	22½
31	Platinum,	170	45
30	Bright silver,	280	75
34	Bright silver,	400	112½†

* The prices given are in Austrian silver florins, 1=100 kreutzers=50 cents U. S.

† The above list will give an idea of the colors furnished and the prices. As any parties interested can obtain a catalogue by addressing the works, we do not think it necessary to complete the list in these pages. The catalogue includes some two hundred colors for enamelling, transparent bases, glazing, &c.

MARKS AND MONOGRAMS, PORCELAIN AND FAIENCE.*

ENGLAND.

WEDGWOOD	STAFFORDSHIRE, i. 1759.
TURNER	STAFFORDSHIRE, i. 1762.
ADAMS	STAFFORDSHIRE.
ROGERS	STAFFORDSHIRE.
WOOD and CALDWELL	STAFFORDSHIRE.
DAVENPORT	STAFFORDSHIRE, i. 1793.
LONGPORT	STAFFORDSHIRE.
SPODE	STAFFORDSHIRE.
C and Q	STAFFORDSHIRE, Copeland & Qarrett.
Richard Chaffers 1769	LIVERPOOL, i. 1752.
SADLER 1756	LIVERPOOL, i. 1756.
HERCULANEUM	LIVERPOOL, i. 1756.
	PLYMOUTH, i. 1760, by Cookworthy.
Absolon Yarmth	YARMOUTH, Absolon.
SWANSEA	SWANSEA, i. 1750.
	SWANSEA, red stamp.
Nantgarw	WALES, red.
C G	LEEDS, Chas. Green, 1770.
	LEEDS, same Manuf.
	BRISTOL, i. 1772.
	BRISTOL, 1772.
1776 I	BRISTOL, removed to Staffordshire, 1777.
	BOW, i. 1740.
	BOW. This also is considered a Bow Mark.
	BOW or BRISTOL.
	CHELSEA, i. 1740, s. p. the oldest Mark.
	CHELSEA, red mark.
	CHELSEA, the best quality marked in gold.
	CHELSEA, DERBY, s. p. 1765, blue used.
	CROWN DERBY, a later blue mark.
	DERBY or WORCESTER.
	WORCESTER, i. 1751, the oldest mark.
	WORCESTER, usually Chinese pattern.
W	WORCESTER, 1751.
C Flight	WORCESTER, Flight, 1783.
Flight Barr & Barr	WORCESTER, Flight, Barr & Barr, 1807–1813.
	WORCESTER, 1857–1862.
	SHROPSHIRE, E. Caughley, 1772.
S	SHROPSHIRE, Broseley, 1780, Willow Pattern.
CB	SHROPSHIRE, Cole Brook Dale.
MINTONS	STAFFORDSHIRE, Stoke on Trent.

* From Carl Barth's Pocket Chart, Stuttgart, 1873.

FRANCE.

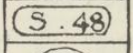
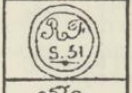
	ST. CLOUD, 1st Period, s. p.
	ST. CLOUD, Trou. 1715-1730.
	CHANTILLY, e. 1735, s. p. Blue, red or green.
	ARRAS, e. 1782, s. p. Blue pattern.
	MENECY, i. 1735, s. p. Prince of Villeroy.
	ETIOLLES, i. 1768, s. p. Monnier Manufr.
	BOUR-LA-REINE, i. 1773, s. p.
	SCEAUX-PENTHIÈVRE, i. 1751, s. p.
	CLIGNANCOURT. A mark used by Deruelle before 1775.
	CLIGNANCOURT, f. 1780. In leather color.
	CLIGNANCOURT, h. p. Called porcelain of Monseur, 1775.
	ORLEANS, h. & s. p. Under the protection of the Duke of Orleans, 1750-1770.
	ORLEANS, h. p. Blue Mark.
	PARIS, Pont-aux-Choux, i. 1756, h. p.
	PARIS, Pont-aux-Choux, Another style.
	PARIS, Rue Fontaine au Roi. i. 1773, M. Locré, h. p.
	PARIS, Faubourg St. Lazare. Hannong, 1773, h. p.
	PARIS, Faubourg St. Antoine Morelle, 1773, h. p.
	PARIS, Faubourg St. Antoine Souroux, 1773, h. p.
	PARIS, "Gros Caillou," h. p. advent of Lamarre, 1773.
	PARIS, Rue de Clichy.
	PARIS, stamped with Caduceus.
	PARIS, Rue Thirous, 1778. "Porcelain de la reine" (Antoinette.)
	PARIS, Rue de Bondy, 1780. Duke of Angoulème.
	PARIS, 1780, Angoulème.
	PARIS, Christ'r Potter, called "Prince of Wales," 1789.
	BELLEVILLE, Jacob Petit, i. 1796, h. p.
	PARIS, Rue de Bondy. Dihl, maker.
	ROUEN, under Louis XIV.
	SCEAUX-PENTHIÈVRE. The word Sceaux often appears underneath.
	LILLE, h. p., e. 1783. Red mark.

FRANCE (SÈVRES).

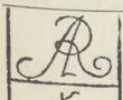
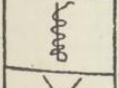
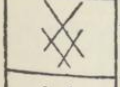
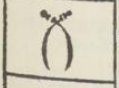
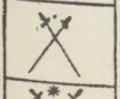
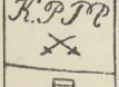
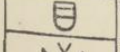
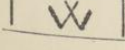
	SÈVRES. I. at Vincennes, 1753. The oldest mark.
	Alphabetical, from 1753-1776.
	Double letter, from 1777-1793.
	French Republic, 1792-1799.
	SÈVRES. Another style. 1792-1799.
	Another style. 1792-1799.
	The monogram out of use, 1798-1802.
	The Consular Period, used 1801-1804.
	v. 1804-1809, generally red with color.

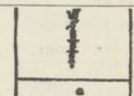
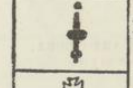
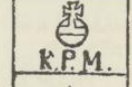
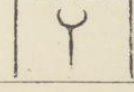
FRANCE (SÈVRES)—CONTINUED

	SÈVRES. The Imperial Eagle, generally from 1810–1814.
	The royal cipher before 1814–1823 used again.
	Charles the X., the marks show the year.
	Same reign, another style.
	Same reign, another style.
	Charles X., 1830. On common ware.
	On decorated pieces, 1829–1830.

	SÈVRES. Used 1830, from August.
	Louis Phillippe, f. 1830–1834.
	Initials of Louis Philippe from 1834–1848, common.
	Chateau D'Eu service, sometimes in gold, dated from 1837.
	Cipher of Louis Phillippe, printed marks, 1845–47.
	1848 & 1851, in decorated pieces.
	French Republic, 1848–1851.
	Imperial Eagle, 1852.
	Monogram of Louis Napoleon III., 1854.

GERMANY AND AUSTRIA.

	DRESDEN, Meissen, 1709–1726, in blue generally.
	DRESDEN, 1712–1720, blue mark.
	DRESDEN, to 1720, blue mark.
	DRESDEN, 1730, blue mark.
	DRESDEN, 1770, blue, Royal period.
	DRESDEN, 1796, Marcolini period.
	DRESDEN, Royal Porcelain Manufacture.
	WIEN, i. 1718, generally to 1744.
	BERLIN, 1751–1761, Wegely's mark.

	BERLIN, sometimes an eagle added.
	BERLIN, another form of sceptre.
	BERLIN, special mark, particularly of 1830.
	HÖCHST, Nassau, i. 1740, gold or color.
	HÖCHST.
	HÖCHST.
	FRANKENTHAL, h. p. first Period, 1755–1761.
	FRANKENTHAL, h. p. second Period Carl Theodor. (+1799.)
	FRANKENTHAL, this mark is allotted to Franz Bartold.

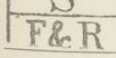
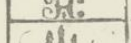
GERMANY AND AUSTRIA—Continued.

	FRANKENTHAL, Philipp Hanong.
	FRANKENTHAL, Joseph Adam Hanong.
	FRANKENTHAL, Joh. Hanong.
	FRANKENTHAL, Franz Bartold.
	NIMPHENBURG, near Munich, i. 1747, h. p.
	NIMPHENBURG, printed in colors.
	NIMPHENBURG, h. p. earlier mark.
	FÜRSTENBERG, i. 1750.
	FÜRSTENBERG.
	LUDWIGSBURG, or KRONENBURG, i. 1758–1806.
	LUDWIGSBURG, 1st Period.
	LUDWIGSBURG, 2d Period.
	LUDWIGSBURG.
	LUDWIGSBURG.
	FULDA, i. 1763–1780, h. p.
	FULDA.
	RUDOLSTADT. i. 1758.
	RAUENSTEIN, h. p.
	LIMBACH, h. p.
	LIMBACH.
	LIMBACH.
	GROSSBREITENBACH, h. p.
	GROSSBREITENBACH.
	KLOSTER VEILSDORF, coat of arms, often with C. V. added.
	VEILSDORF.
	VEILSDORF, another mark.
	ANSBACH.
	ANSBACH, often with the letter A joined.
	ANSBACH.
	ANSBACH.
	GOTHA.
	GERA.
	GERA.
	ALT-HALDENSLEBEN, h. p. M. Nathusius.
	CHARLOTTENBURG, i. 1790. M. Pressel.
	BADEN, E. 1793. Cut of an axe in gold.
	COELN, M. Cremer.
	POPPELSDORF, M. Wessel.
	STRASSBURG, lately so marked.
	NIEDERVILLERS, i. 1768, h p. F. Lanfray.
Sarguemines	SAARGEMÜND Dep't of the Moselle. M. Utz-Schneider

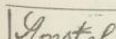
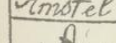
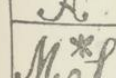
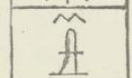
SWITZERLAND.

	NYON, h. p., i. 1790.
	ZÜRICH, h. p., i. 1763, blue mark.

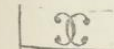
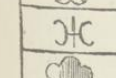
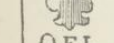
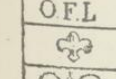
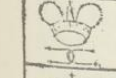
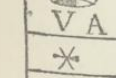
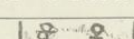
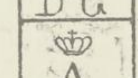
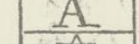
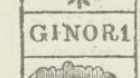
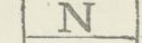
RUSSIA.

	POLEN, h. p. manufacturer. Korzec, 1803.
	ELBOGEN, h. p. In Bohemia marked Haidinger.
	COPENHAGEN, i. 1772. h. p.
	SCHLACKENWALD, h. p. 1812, in gold.
	LE HAMMER, h. p. stamped.
	MOSKAU. Apaporé.
	ST. PETERSBURG, blue mark.
	ST. PETERSBURG, i. 1762. Katharina.
	ST. PETERSBURG, Monogram Nikolus d. 1st 1828.
	ST. PETERSBURG.

HOLLAND AND BELGIUM.

	AMSTERDAM, h. p., i. 1782. in blue.
	AMSTERDAM, h. p. in blue.
	AMSTERDAM, blue mark.
	TOURNAY, s. p., i. 1750. This mark is a kiln.
	TOURNAY, s. p. gold mark.
	TOURNAY, s. p. another mark.
	LA HAYE, h. p. gray mark.

SPAIN AND ITALY.

	MADRID. Buen Xetiro s. p., i. 1759.
	MADRID, cheap kind.
	MADRID, s. p. blue mark, best quality.
	MADRID, s. p. best quality.
	MADRID, Monogramm Karls III. of Gründers.
	VISTA ALEGRE, h. p. in gold or colors.
	LE NOVE, s. p. blue or red mark.
	VENICE, red mark.
	VENICE.
	VENICE, h. p.
	VENICE, s. p. red mark.
	TURIN, h. p. conducted by Dr. Gioanetti.
	VINEUF near TURIN, i. 1750.
	DOCCIA, h. & s. p. 1727.
	DOCCIA, i. 1727.
	DOCCIA, pressed mark, 1770.
	NAPLES, s. p., i. 1759, A. 1821.
	NAPLES, s. p. decorated or painted.
	NAPLES.
	MILAN, red mark.

NOTE.—The abbreviations are: h. p. hard paste; s. p. soft paste; i. introduced.

CHRONOLOGICAL TABLE OF THE SÈVRES PRODUCTIONS.

MARKS.	YEAR.	MARKS.	YEAR.
A Vincennes, . .	1753	HH	1785
B " . .	1754	II	1786
C " . .	1755	JJ	1787
D	1756	KK	1788
E	1757	LL	1789
F	1758	MM	1790
G	1759	NN	1791
H	1760	OO	1792
I	1761	PP	1793
J	1762	QQ	1794
K	1763	RR	1795
L	1764	T 9	1801
M	1765	X	1802
N	1766	H	1803
O	1767	//	1804
P	1768	1	1805
Q	1769	=	1806
R	1769–70	7	1807
S	1771	8	1808
T	1772	9	1809
U	1773	10	1810
V	1774	o. z.	1811
X	1775	d. z.	1812
Y	1776	t. z.	1813
Z	1777	q. z.	1814
AA	1778	q. n.	1815
BB	1779	s. z.	1816
CC	1780	d. s.	1817
DD	1781	18	1818
EE	1782	19	1819
FF	1783	20	1820
GG	1784	21 etc., . . .	1821

CHRONICLE OF THE PRINCIPAL EVENTS DIRECTLY CONNECTED WITH THE MANUFACTURE OF POTTERY.

B. C. 600 to 900 years. Manufacture of enamelled bricks in Nineveh and Babylon. The Museum of Practical Geology, London, contains several specimens of enamelled bricks from Babylon, dating some 600 to 900 years before Christ.

B. C. 185. Manufacture of porcelain supposed to have commenced in China between this date and A. D. 87, during the Han dynasty.

A. D. 600. Porcelain in common use in China, and supposed to have reached its greatest perfection about the year 1000.

1115. Moorish tiles probably introduced in Italy at the conquest of Majorca by the Pisans.

1200–1300. Colored tiles believed to have been in common use in Persia.

1273–1302. Earliest tiles of the Alhambra.

1310. Delft ware successfully manufactured in Holland.
Incised or Sgriffiato ware largely produced by the Italian artists.

1400. Luca della Robbia born; the sculptor, painter on faience, modeller in bronze, and supposed to have been the first to employ stanniferous glazes in Italy.

Encaustic tiles manufactured in Great Britain, at Malvern Hills and other localities.

1475. Earliest date noticed on any piece of lustred Majolica of the manufacture of Maestro Georgio. Fortnum considers a piece in the Sèrves Museum, dated 1489, to be the earliest piece of lustred ware on record.

1500. About this time oriental porcelain was imported to Europe by the Venetians and Portuguese, and in the following century the Dutch imported great quantities.

1510. Bernard Palissy born about this date, at La Chapelle Biron, Perigord.

1540–1560. Manufacture of majolica in a flourishing state.

1540–1620. Flemish ware, commonly known as Grès de Flandres, in great esteem in Great Britain.

1580. About this date, the earliest known production in Europe of pieces of porcelain in the laboratory of Duke Francesco de' Medici at Florence.

1581. Soft porcelain discovered in Italy by Francis, Grand Duke of Tuscany.

1585. Gold purple or precipitate of cassius discovered.

1589. Palissy died in confinement in the Bastile.

1671. Earliest efforts to manufacture Porcelain in England, by Mr. John Dwight, at Fulham.

1674. Manufacture of pottery established in Liverpool before this date.

1680. Salt glazing said to have been discovered in Staffordshire by accident.

1690. Crouch ware first made by Burslem potters.
Dresden (Meissen) porcelain manufactory established by Augustus II., Elector of Saxony.

1706. Commencement of the experiments of Tschirnhaus and Böttcher, two alchemists in the service of the Elector of Saxony, leading to the production by Böttcher of the first hard or true porcelain in Europe, but of a dark color.

1709. White porcelain made by Böttcher.

1710. Böttcher appointed director of the manufactory at Meissen.

1715. White porcelain of good quality commonly made.

1720. Paintings on porcelain, and gilding, produced at Meissen.

1730. Josiah Wedgwood born at Burslem, England; died 1795.

Bow works, England, commenced manufacture of porcelain.

1731. Kandler, the sculptor, superintended the modelling of groups and figures at Meissen.

1744. St. Petersburg porcelain works founded by the Baron Ivan Antinovitsh.

1745. Cookworthy in a letter mentions that a person had discovered both kaolin and petuntse in the State of Virginia, and had made from them specimens of porcelain. The same party professed to have purchased the whole region from the Indians.

1747. Porcelain works of Blanquier, Vienna, Austria, purchased by the Empress Maria Theresa, and made an imperial establishment.
Porcelain works established at Neudeck, Bavaria.

1750. Decoration of earthenware and porcelain by transfer from copperplate prints, believed to have originated with John Sadler, of Liverpool.

Swansea earthenware works established.

From about this date the true Sèvres *pâte tendre* was manufactured with habitual success.

Manufacture of porcelain commenced at Berlin by Wegely.

1751. Worcester porcelain works established at Worcester, England.
Foundation of the Derby porcelain works, England, by Mr. William Duesbury.

1755. Discovery of kaolin in Cornwall, by William Cookworthy, whose attention appears to have been directed to the subject by a citizen of Virginia, in 1745.

Works established at Coxside, Plymouth, England, by Cookworthy and Lord Camelford, about 1755, soon after the discovery of the materials at Cornwall. Transferred to Bristol, 1774.

1756. Porcelain works removed from St. Cloud to Sèvres.

Manufacture of porcelain attempted at Lowestoft. 1770–1800 period of greatest prosperity. Works abandoned in 1802.

1757. Rockingham porcelain and brownware made at Swinton, on estate of Charles, Marquis of Rockingham.

1758. Neudeck manufactory, Bavaria, transferred to Nymphenburg, near Munich.

1760. Louis XV. became proprietor of the Sèvres establishment.
Isleworth pottery established by Joseph Shore, of Worcester.

1763. Frederic II. bought the Berlin porcelain works and converted them into a royal manufactory.

1765. Discovery of kaolin in France, by Guettard, who gave an account of it in this year to the *Académie des Sciences*.

1766. Kaolin was found near Limoges at St. Yrieix, in abundance and of good quality.

1769. Hard body porcelain introduced at Sèvres manufactory.

1772. Porcelain of superior quality manufactured at the Shropshire potteries, under Thomas Turner, from the Worcester works.

1795. Pinxton porcelain works established near Alfreton, England. Closed about 1812.
Wedgwood died.

1796. The "Marcolini period" at Meissen commenced.

1800. Calcined bones introduced by Spode into the paste of his porcelain at Stoke-upon-Trent, England.

1812. Inspection of the porcelain works at Meissen by M. Brongiart, on the requisition of Napoleon I. The greatest secrecy maintained until that time.

1813. Nantgarw (near Cardiff) porcelain manufactory established.

1840. Foundation of the tile manufacture of the Mintons, Stoke-upon-Trent, England.

1864. The Austrian imperial porcelain works discontinued.

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