Glass and Ceramics

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Information Bulletin

Although the giant machines of most modern industry dwarf their creators, in the world of glass and ceramics production still depends on the hands and brains of men. This human factor is particularly dominant in the glass and ceramics industries of Germany, where highly-skilled techniques worked out through the centuries shape products admired the world over.

Not all of Germany's glass and ceramics products, of course, are produced by hand. Window glass, porcelain insulators or bathtubs are naturally a part of mechanized production. But the basis of the country's reputation in these two fields rests upon the knowledge she has added to the original simple handicrafts of glass blowing and clay shaping.

Personal creation of glass and ceramics objects has bestowed on them the special artistic qualities of their makers. It was not enough merely to produce a goblet that would hold water; it must also be pleasing in shape and perhaps decorated with interesting designs. As skills were learned, fathers gradually imparted a lifetime's knowledge to their sons; boys and girls worked with master technicians, watching and learning through apprenticeship. In some German glass industries, five generations have followed each other. In Bavarian porcelain plants it is not uncommon to find workers who have spent a half century contributing to Germany's reputation as master of ceramics.

This renown, interrupted by wars and a late 19th-century decline in artistic vigor, has continued for more than 200 years. Industries that started as handicrafts keep pace with modern demand for quantity production. The making of glassware, for example, is one of Germany's oldest techniques. Still, in 1938, Germany was one of the big three world producers along with the United States and the Soviet Union.

Like the porcelain industry, most German glassware plants sprang up near the Czech border. They parallel the frontier south of Selb in Bavaria. Early Bohemian glassmakers were available here to offer their skills. Also charcoal was needed for fuel and could be found in nearby forests. Up to 150 years ago charcoal was the principal fuel; only coal is used today. Although brown coal can be obtained to some extent from Czechoslovakia for the making of Bavarian artistic glassware, production of such items as sheet glass or bottles requires large amounts of coal. Newer plants, consequently, have been built up in other regions of Germany. Approximately half of Germany's industrial flat glass factories are in the British Zone while only a slightly smaller number of processing and finishing plants cluster near coal deposits in the Soviet Zone. In the glassware industry of West Germany there are 382 plants with 10 or more employees in January 1949.

Glass is often divided into flat (sheet, cast, mirror, colored flat and special flat) and hollow (bottles, preserving, packing, household and decorative, and chemical and technical) products. However, optical glass-making, a highly specialized craft, may be considered part of the production of technical instruments.

Glassmaking holds a fascination for its creators; although it is an early discovery, many facets of the craft are still unknown. Glass workers even today are learning new effects to be obtained from certain coloring agents and the results one gets from varying the quantity or variety of raw materials used.

Commercial glass is made up of 60 to 80 percent silica which is sand in its most common form. Sode, the most important glassmaking oxide next to silica, is usually added as soda ash. Germany's end-of-the-war and early postwar production of glass was hampered by a severe shortage of this raw material. Besides coloring agents, other raw materials needed to produce various types of glass include potash used as pearl ash, lime, lead oxide, barium oxide, zinc oxide, boron oxide and sometimes alumina.

Conversion of molten glass into finished products requires great skill. There are today five fundamental processes: blowing, pressing, drawing.

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rolling and casting. In the early days of glass-making, "offhand" production, which included blowing, was done without even the simplest mold equipment. It generally is used, sometimes in modified form, by German plants which make artistic ware. The tools needed for shaping these handmade objects are quite simple and almost unchanged from those of mediaeval times. Lack of machinery for postwar glassmaking has not been a serious problem, except in a few instances, such as bulbs for electric lamps.

The skills of glassmakers come only from practice. No one could learn to make a goblet by reading a book. First, the raw materials are melted in pots and allowed to cool several hundred degrees. The right amount of hot glass must next be gathered onto the end of a blow-pipe. The worker then blows and while blowing, the pipe is rolled back and forth and a bulb-shaped piece of hot glass is formed with a wooden paddle. More hot glass is added from the pot, and the stem is shaped. Another "gather" is added to form the base of the goblet and finally, the excess glass at the lip is sheared away like taffy candy.

A method known as lampworking—the heating of ready-made glass tubing over gas burners—is used for creating all kinds of glass novelties. Scientific and surgical apparatus also are made in this manner.

Molds for glass are usually of cast iron and in making such objects as tumbler bases or baking dishes the hot glass is dropped into the mold and then shaped by pressing a plunger down into the molten mass. Lacking iron, some of Germany's molds are made of wood.

For artistic ware, cut glass decorations are sketched on the finished item with a brush. Then a slowly revolving sandstone wheel cuts the design either in a hollow cut, bevel cut or a flat panel cut. The rough white surface which remains is returned to its former luster by hydrofluoric acid or polishing on felt wheels.

These final tasks of polishing, processing and finishing are the work of approximately two-thirds of west Germany's glass factories. Sometimes cutting, refining and decorating is done in the same plant which makes the item. In other cases little shops exist for decades in the shadow of large glassmaking factories.

A FEW west German plants resumed postwar production as early as the fall of 1945. Altogether, they had suffered less than four percent war damage. Military Government, anxious to relieve the critical shortage of flat glass needed for building purposes in the US Zone, put two plants into operation in September and October 1945. Decorative-type glass factories began producing in the summer of 1946. The wide variety of shapes and decorations of articles made it impossible to start regular export of these items before June 1947.

In 1936, the Bizon produced 222,096 metric tons of flat glass and 218,136 metric tons of hollow glass; in 1948, production reached 210,907 metric tons of flat glass and 191,333 metric tons of hollow glass. Soaring postwar prices, however, make 1948's lower production more valuable than that of 1936: the gross value of west German glass in 1936 was approximately $55,200,000 while in 1948 it was worth $77,220,000.

MOST of Germany's exports glass markets are in the United States and Canada where crystal glass, flat glass specialties and glass tinsel are in demand. Switzerland welcomes all kinds of glass products, but—like other foreign markets—she wants low prices and high quality.

This is one of the most serious problems confronting the German glass industry: how to cut production costs yet keep high standards to compete in world markets. Because a huge demand for glass products had existed in west Germany, many manufacturers have not yet faced this problem.

In 1943, the approximate percentage of distribution of the glass industry in the areas now comprising western Germany, the Soviet Zone and Polish-Administered Germany was as follows:

<table>
<thead>
<tr>
<th>Flat Glass</th>
<th>Processed and Finished Glass</th>
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<tr>
<td>Western Zones</td>
<td>71</td>
</tr>
<tr>
<td>Soviet Zone</td>
<td>16</td>
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This meant west German factories could not keep up with the demands of the British, French and US Zones. Approximately 80 percent of the better types of stemware and household glass items are sold within Germany. The need for flat glass in building far exceeds production. Why, manufacturers say, should we try to capture foreign markets when we have such a demand for our products at home?

SEVERAL members of the German Association of Glassware Manufacturers, however, foresee a time when export markets will be necessary. Demands are being supplied within the country; US Army orders are being eliminated. The immediate need for glass products in goods-starved countries of western Europe is easing. Ten new glass factories in west Germany which duplicate prod-

Exhibition of fine Bavarian glass at Haus der Kunst, Munich.
ucts of the East Zone must start looking to the future. It has been pro-
posed that the factories use profits made on home sales to cover losses on
export, but most companies still prefer to cultivate the German market.

Of special importance in the pro-
duction of hollow ware products—partic-
icularly crystal ware and decorated
products which are almost entirely for
export—is a better knowledge of cur-
rent styles and trends in other coun-
tries. It is estimated that the glass
industry is approximately three
years behind the China industry in
knowing what export buyers want.
Although decorative glass products of
Germany may be wrought with in-
finitesimal skill and delicacy, manu-
facturers are learning at foreign trade
fairs that their objects have been
created without thorough understand-
ing of style changes during the past
15 to 20 years. Through trade fairs and
travel in other countries to study new
designs, German manufacturers may
learn new ideas on how to compete
actively in world markets.

Allied to the glassware industry
are the Gablonz products produced by
10,000—15,000 Sudeten Germans
who trekked from Czechoslovakia since
the war with little or no equipment
to settle in the two areas of Bayreuth
and Kaufbeuren. The Gablonz work-
ers were extended $58,000 credit by JEIA
for the importation of raw materials,
which are now being used. Gablonz
workers when they lived in Czecho-
slovakia were largely home workers
producing in small groups. It has been
very difficult for them to organize and
follow an over-all plan of production.
In addition, their buttons, beads and
costume jewelry are comparatively
high-priced luxury items difficult to
sell at this time. From 1946 to 1948
their exports totaled $56,000.

The German ceramics industry is
not plagued by the particular difficul-
ties of the glassware manu-
facturers. It has made a swift postwar
recovery hampered only by shortages
of raw materials and trained workers.
Famous for centuries, ceramics pro-
ducts of Germany show technicians
have not allowed their skills to de-
teriorate through the decades. Also,
they seem able to discard out-of-date
styles and methods in favor of new
improvements.

Ceramics production for con-
venience is sometimes divided into
categories: earthenware and stone
ware, tiles, technical and chemical
ware, abrasives, and household
and decorative porcelain. In
January 1949
there were 429
plants in west
Germany with
49,000 workers
making these
products.

Although the
story of Ger-
mans' china ind-
ustry comes first
to mind, other
products have
also held a val-
ued place in Ger-
man ceramics
production.

Earthenware and
stone ware, for
example, also
have an early
history in Ger-
many. Artistic
stone ware first
appeared about
1540 at Cologne.
At that time it
was recognizable
by the brown
stain of its salt
glaze. German
items gradually
spread to Eng-
land from the Rhine region. Today,
western Germany's production in
this field—including such objects as
flower pots, crockery and food con-
tainers—is largely for home consump-
tion. There were 10,365 metric tons
of earthenware and stone ware pro-
duced in 1948.

Earthware plants also turn
out floor and wall tile, the two
largest plants being in Bremen. The
making of stove tiles is an important
industry for home consumption dat-
ing back to the invention of the popular
"Nuremberg Stove" in the 17th cen-
tury. This large coal-burning stove,
covered with ornate tiles, is still a
favorite method of single-room space
heating in Germany.

Technical and chemical ware and
high and low tension electrical ma-
terials are also finding large markets
at home. The most important tech-
nical-producing factories in western
Germany are owned by the Rosen-
thal Company, also famous as pro-
ducers of china. The technical por-
celain industry leaped ahead during
the war when porcelain—pipes and
even steam radiators—took the place
of former metal products. Postwar
metal shortages have increased the
demand. Technical and chemical ce-
ramics plants produced 3,278 metric
tons during 1948. Factories making
sanitary ceramics could not keep up
with civilian requirements during the
same year when they produced
12,638 metric tons. Perhaps the most
important items in the technical field
are electrical porcelain insulators. A
large part of the 14,219 metric tons
of high and low tension material made
in 1948 is sold in home markets.
In fact, only 10 to 15 percent of all tech-
nical porcelain can be exported be-
cause of west German needs.

In the abrasives industry the manu-
ufacture of tiles and grinding wheels
in the Frankfurt area accounts for the
major output. Agricultural whetstones
and sized abrasives also form an im-
portant part of the products. The
Rhineland supplies artificial corundum,
and Bavaria carborundum as raw
materials. (Continued on next page)
Worker sponges glaze on bowl before firing.

Ceramics from 45 plants on display at Haus der Kunst, Munich.

German ceramics plants displayed.
Dinnerware set from well-known Selb plant of Hutschenreuther.

After firing, china is removed from firestone.

Wares at St. Eric’s Fair, Stockholm.
Basis for all these products was the discovery of porcelain which long ago gave Germany the lead in ceramics on the European continent. It especially gave her the foundation for her world-famous china industry.

While the Europeans were still dabbling with clay and earthenware the Chinese during the 15th and 16th centuries perfected porcelain—a glazed, hard-fired, translucent product which was examined with wonder when it reached Europe. Alchemists and pottery-makers tried in vain to learn the process of making the new white material. Artificial porcelain was made in Florence in 1575-85 by workers under the patronage of Francesco de Medici. But not until 1709 was true porcelain made. In this year Johann Friedrich Boettger discovered a hard-paste porcelain. Boettger thought he could change base metals into gold—a common belief at that time—and Augustus the Strong, King of Saxony, kept him a virtual prisoner while he conducted his experiments. Boettger's first porcelain was smoky in tone and was decorated with acanthus leaves, masks and rich decorations.

The next year the plant moved to Albrechtsburg at Meissen (Saxony, now in Soviet Zone) to become the oldest porcelain manufacturing plant on the continent. However, it was not until 1715 that the making of white porcelain was fully mastered.

Although Augustus tried to keep the discovery secret it was impossible.

In 1718 a runaway Meissen worker betrayed the secrets and a factory was established in Vienna. Gradually plants were built all over Germany—at Berlin in 1752, at Hoechst around 1746, in Fuerstenberg in Brunswick in 1753, in Neudeck at the city limits of Munich in 1747. The Neudeck factory, state-sponsored, was transferred in 1761 to Nymphenburg, a suburb of Munich. The Meissen plant and the Nymphenburg plant are the only original factories of this era in existence today. The Meissen plant produces largely for export to the Soviet Union. The Nymphenburg factory, famous for its decorative porcelain and fine chinaware, is reestablishing contact with former markets in Europe and the United States.

Factories also grew up in western Bavaria—the Selb region—where Bohemian workers and raw materials were at hand. Brown coal was present in nearby mines and a special china clay called kaolin.

For probably a hundred years the porcelain industry flourished. Plants created a variety of forms, many highly intricate and ornate. Individual factories came to be known for a special style; for example, the

Sans Souci china pattern of the Rosenthal Company or the basket pattern of Nymphenburg. One of the greatest artists in the field of decorative porcelain was Franz Antony Bustelli who, for eight years, created highly artistic figurines and china designs for the Nymphenburg plant. His whole set of characters taken from Dante's Divine Comedy show so much life and character that reproductions from his models, over 150 years old, are still popular today.

The latter half of the 19th century saw a decline in the freshness and originality of German porcelain products. Court tradition was crumbling yet the ceramics industry still kept the accepted styles. Factory artists seemed to lack the ability to think up new ideas. A revival in artistic creation appeared in the 20th century centering largely in two men—Thomas Schmutz-Baudisz and Max Laeuger. Both learned from potters in the Black Forest and were attracted to the simpler peasant designs. Laeuger worked in Karlsruhe (then in Baden), making jugs and vases of deep, even color with applied motifs from nature in a different color. He also designed a large number of tile decorations. Schmutz-Baudisz sought to free the Berlin factory where he worked of its dependency upon court taste. His decorations are more stylized than those of Laeuger. He also introduced a method of painting before glazing at the Berlin plant.

Some impartial experts maintain that the Nymphenburg plant has shown more continuous artistic progress than any other porcelain factory in Germany. In 1887, when

Alter figurine parts are removed from molds separate pieces must be carefully joined in preparation for firing.
Kaolin, quartz and feldspar are basic raw materials from which fine porcelain objects are made.

Albert Baueuml became plant director, young artists with new ideas were brought into the foregroup. Painstaking experiments were made to reproduce and improve the china of the 18th century. Most of the "new" artists brought to Nymphenburg was Josef Wackerly who pioneered in producing life-like peasant groups rather than the rococco forms of an earlier day.

World War II left the china industry almost unscathed. As a whole, not more than six percent damage was suffered by porcelain plants during the war. The Nymphenburg plant was about one-half destroyed, but most factories located in the Seb region near the Czech border were near no important war-producing industries.

Because of their value as an exporting group and their lack of damage, the china industries were encouraged to reenter world markets as soon as possible. Chosen as a "pilot industry," China manufactories in the US Zone were able to reacquire raw materials bought by Military Government with $7,500,000 lent by US Commercial Corporation.

In those early days shortages were common. There are approximately 35 different materials needed in the making of china ware including turpentine from France, flints from Denmark, fine sponges from Greece, china clay from Czechoslovakia, manganese ore from Holland, fine gold from the United States, metallic cadmium from Australia, and antimony oxide from China and Bolivia.

With raw materials needed from all corners of the world it was almost impossible for one plant to have all the products necessary. Factories, therefore, bartered among themselves to keep production moving.

As a result, china manufacture was one of the first post war industries to produce in volume. For a year, from Feb. 1948 until Feb. 1949, JEIA established a bonus system which further promoted its growth. Manufacturers were allowed to spend 10 percent of all foreign exchange earned—five percent for raw materials or factory improvements, and five percent to accrue to workers for essential foods and clothing.

Although the industry's output still is only approximately half that of 1936—45,300 metric tons in 1936; 22,551 metric tons in 1948—products are equal in quality. This is a good record considering raw material shortage and the need for highly-skilled workers who have the intricate knowledge of porcelain making.

Making a high-quality piece of china is a carefully-planned process. Production at the Nymphenburg factory is perhaps typical. In the factory mill, 50 percent kaolin, 25 percent quartz and 25 percent feldspar are pulverized together. The water is pressed out of the creamy mass so that it may be formed into square cakes. These cakes are then aged for 14 to 16 months in a storeroom at an even temperature of 50 to 53.6 degrees Fahrenheit.

After aging, the cakes are thrown into a kneading machine which in two hours makes the "dough" pliable for the turners' room. As in the earliest days, the potters' wheels of Nymphenburg are waterpowered. After shaping by hand the plate or vase is placed over a gypsum alabaster mold for about a day and then removed for final trimming or smoothing. The more complicated figurines are made in parts with a special mold for each leg, arm, or head. The same raw material is used for figurines except that it is of a more liquid consistency and can be poured into the mold. The figure is removed from the mold and after the parts are smoothed and joined the object is ready for firing, where it will shrink about 14 percent.

Porcelain is baked two times in the kilns—the first time at 1,652 degrees Fahrenheit to harden it. Then it is dipped in glaze—almost the same material except that more feldspar has been added—and fired again, this time at 2,372 degrees Fahrenheit.

Placing objects in the kilns and keeping the fires going is in itself a time-consuming process. Each piece of porcelain must have a firestone mold around it for protection. Some factories add fillers to the kilns, such as forms for rubber gloves and other technical items, so that space and fuel will not be wasted.

For fuel, many factories use two-thirds brown coal and the remainder hard coal from the Ruhr. It requires five to seven tons of coal to produce one ton of finished ware. The Nymphenburg plant uses peat from fields near Munich. The fires must be kept going for about 48 hours and must be replenished every 10 minutes during that time. For four or five days afterward the kilns are allowed to cool.

If the object is to be decorated, special metal oxide colors are used and the porcelain is fired a third time at 1,652 degrees Fahrenheit for 12 hours. Then, when the gold designs are polished the porcelain at last is ready for sorting and shipping.

China is examined carefully for flaws which would damage the reputation of the factory. Hand painting on china may sometimes cover small

(Continued on next page)

Liquid raw material is poured into mold; allowed to stand for about two hours until shape of vase is formed.
discolorations in the porcelain, but a reputable factory does not hide real flaws with paint. Plates are stacked to discover warping of the edges, and when held to the light a good porcelain piece shows an even translucency comparable to its thickness.

Finding skilled workers has been a problem in the post war years, for there are small "tricks" to making good porcelain which only time and observation can teach. In the turners' room and among the artists in the painting shops of most China plants are apprentices who will work beside masters in the trade for three years. Even after they have worked for years workers must perform their work with infinite patience and skill. Nothing is accomplished in haste. A Nymphenburg artist, for example, who was to create a porcelain monkey studied the animal's movements and expressions for three-quarters of a year before an acceptable figure was created.

Because they must use workers who are not thoroughly trained, some factories report that about 60 percent of the china now made is of superior quality, 30 percent is inferior and 10 percent must be broken up and recast.

Besides a shortage of trained workers, securing brown coal and kaolin from Czechoslovakia has been a problem. Plants have been geared to formulas requiring Czech kaolin. Kilns were constructed years ago for the use of Czech brown coal. But today, it is becoming increasingly difficult to get enough of either of these raw materials.

**WITH FUTURE imports uncertain, factories are beginning to make experiments with kaolin from other parts of the world including Belgium and Holland. The Rosenthal plants are experimenting with a special clay from Florida which promises to be of good quality for porcelain products. Experiments take from one to two years, however, before the factory can make certain that a new kaolin is usable. Ruhr coal also is being used to take the place of constantly dwindling amounts of Czech brown coal imported.

Lack of markets, however, is not a serious problem. Although only 10-20 percent of the china produced is of modern design, foreign buyers seem eager to get famous traditional patterns. The most popular dinner ware sets are those which are "medium-priced" and cost $38 to $75 at the German factory. This figure must be multiplied by four to reach the retail price asked in the United States. Baroque and rococo designs are especially popular among US customers. Rosenthal reports that a baroque, flowered design, Sans Souci, is now its US favorite.

"Gemmo" china, manufactured by Heinrich and Company, Selb, is a new export type. It features the completely new idea of decorating chinaaware by cutting as on crystal glassware. Experiments in cutting china have failed for some 300 years because of the brittleness of the porcelain.

**SALE of German porcelain in the United States and Canada is meeting some competition from Japan which can produce fine designs and patterns at one-third the German price. German china factories, therefore, are finding competition ever more keen. However, the household and decorative porcelain industry is expected to maintain its world standing because of its high quality products and its flexibility in meeting the demands of world markets.

Prices and Black Market

The Schwabische Landeszeitung (Augsburg, Bavaria) rejoiced in the fall of the black market:

"This time it really appears to be on the run. Prices are falling throughout West Germany, which would appear to indicate that this development is not merely due to temporary local conditions. The black market is on the defensive all along the line... The average citizen must need have recourse to it in only exceptional instances now.

"The black market now only has a chance in cases where shortages still exist, as with fats, for instance; or in cases where the state is too greedy with taxes — coffee, tea, cocoa... Due to the steady revival of West German economy and the Marshall Plan deliveries, supply is becoming more and more abundant — to the dismay or black marketers. For others, including countless children, so long at their mercy, this means the long hoped-for ray of hope."

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