THE ART OF MAKING FINE *Glassware*

THE ART OF MAKING
Fine Glassware

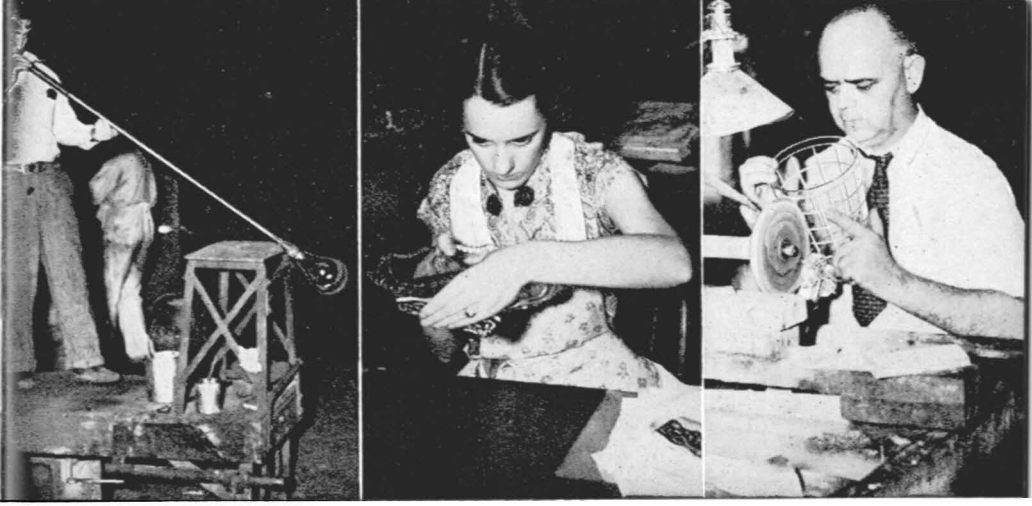
OF ALL the arts of man, there is none so fascinating to watch and wonder at as that of making fine glassware. Picture, if you can, a man dipping the end of a long, hollow rod into a seething pot of taffy-like substance and, with a few puffs of the breath, a few deft turns of the hand, shaping it into a scintillating piece of glassware . . . or a cutter, with only his hands and a cutting wheel, creating a beautiful design that catches every gleam of sunlight or candlelight.

What inspiration was it that led man to perform this first "miracle" of fusing sand and alkali, with intense heat, to produce glass? When and how did he learn that, by adding certain chemicals, seemingly illogical in their choice, he could create artificially the rich, luscious red of the ruby, the warm brown of the topaz, the flaming blue of the sapphire, the deep green of the emerald?

In this little booklet we try to trace the art of glassmaking from the time of the ancients to its present development and show how the art is practiced in a plant that produces much of America's choicest glassware.

The Cambridge Glass Company
CAMBRIDGE, OHIO

THIRTY-SIXTH PRINTING — 1956



AN ART THAT RANKED WITH THAT OF THE GOLDSMITHS

During the Middle Ages, when Venice was one of the art centers of the world and held a virtual monopoly on the making of glass, glass-workers were the aristocrats of artisans.

Banded together in a powerful guild, these glassworkers exacted privileges granted to few other craftsmen. If the daughter of a glassworker, for instance, married a nobleman, the latter did not lose his nobility. In turn nobles gave their daughters in marriage to glassworkers. The children of either union were counted of the nobility.

So zealously were the secrets of glassmaking guarded that the workers were held in virtual captivity on the Island of Murano, separated from the City of Venice by a small arm of the sea. And for many years only a few apprentices were taken in. No stranger could learn the art. Any workman who carried his skill to another country was followed and ordered back. It was even forbidden to export glass materials. Venice wanted no competition from other cities and countries and sought to keep the secrets of glassmaking to herself.

To us this all seems decidedly strange. Long association has dulled us to the "miracle" of glass. Yet almost a "miracle" it remains, that silicic acid, in the form of silica sand, when combined, under the influence of tremendous heat, with an

alkali such as lime, potash, soda ash or lead oxide, should cool to the crystal-clear substance, glass.

No one knows when the first glass was made, so far does it go back into antiquity. Tombs of the Egyptian kings of the fourth and fifth dynasties (4000 B. C.) show pictures of glass-blowers at work. In these same tombs were found the oldest known objects of glass, small glass beads.

Pliny, who died in Pomeii during the great eruption of Mount Vesuvius, locates the invention of glass at the mouth of the River Belus in Phoenicia. He relates that a boatload of traders with a cargo of nitrates was forced to land on the white, sandy beach in order to cook their food. No stones being available, they built a furnace of nitre blocks from their cargo, which melted with the heat of the fire to combine with the white sand to form a curious transparent material. Today, we call this material "glass."

Another narrator with vivid imagination, describes an intense forest fire along the edge of the great body of water. Under the terrific heat, ashes from the crashing trees fused with the sand to turn part of the beach into a mass of crystal.

How much of truth there is in these legends no one knows. The fact remains, however, that some place, somewhere, somehow, back in prehistoric times, man did discover the secret of making glass.

Historically, the first glass may have been made by the Egyptians. Knowing how to glaze pottery, they may have applied this knowledge to the making of glass, as the two processes are quite similar. Excavations of the tombs of their kings have uncovered small vases, bracelets, imitation precious stones, and even little bottles. However, their glass was not the smooth and transparent glass we know today.

Co-sharing honors with the Egyptions for early developments in glassmaking are the Phoenicians. They invented the method of blowing air into a lump of molten glass through a long, hollow pipe.

It was left to the Assyrians to make the first known transparent glass, a vase with the name of their King Sargon on it. They also made fancy dishes and bottles of glass and even lenses.

Early examples of glass are also found among the Chinese,

the Indians, and the Persians. So impressed were the Chinese with the beauty of glass that they called it "thousand year old ice."

It was in Rome that the greatest development of the glass industry in ancient times took place. Military conquests had brought her in contact with all the civilizations of the Mediterranean world, so that a thriving glass trade rapidly developed between Egypt and Rome, so much so that Egyptian glassworkers were imported into Italy, and about 14 A. D. the first glass furnace was set up in Rome. The use of glass became quite general among people of wealth. Glass cups replaced gold ones on the Emperor's table. Square blocks of glass were used to pave floors. Thin slabs formed a veneer on the outside of one of the theatres.

The methods of these ancient Romans were not much different from those in practice today. They blew glass in a mold, cut it on abrasive wheels, decorated it with gold leaf, and were able to make their glass in a great variety of colors.

Ruins of glass furnaces have been found in every country that was part of the Roman Empire. In the early part of the fifth century, Roman soldiers introduced glass to the Venetians, who were to become the great glassmakers of the Middle Ages.

The Venetians made important improvements, developing, among other things, many formulae for coloring glass. They discovered the value of reheating to give added strength and lustre to newly formed articles. The Venetians were also the first to make mirrors by depositing a coat of silver on the back of a sheet of glass.

Under the constant stimulation of these discoveries, the Venetians made elegant cups and vases that would have been hard for the workmen of other countries to copy, even had they known the methods.

But such secrets cannot be kept indefinitely. The manufacture of glass spread to Germany and Bohemia. This glassware was of a different nature and the shapes were nothing like those of Venetian glass, even though they were probably the work of renegade workmen from Venice. Later, we find glassmaking thriving in France, Belgium, and England. Not much was done in the latter country, however, until the reign of Queen Elizabeth.

AMERICAN DEVELOPMENT

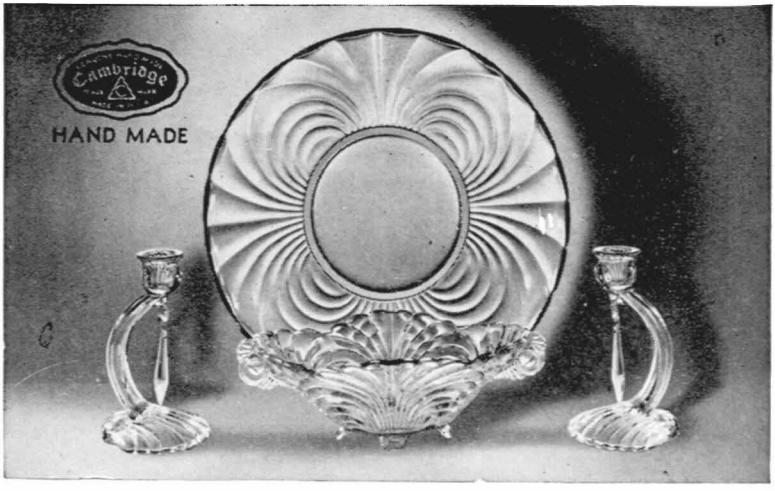
It is important, and possibly significant, that one of the first European industries to be established in the New World was that of glassmaking. The first settlers at Jamestown in 1608 established a small furnace about a mile outside of the stockade. In 1620 six workmen from Italy were brought to the Jamestown factory to make beads for use as money in trading with the Indians. This makes the little glass factory America's first mint.

The first glassworks in the Massachusetts colony appeared about 1639 to 1644. Little came of it, however, because the sand on the New England Coast was not particularly adaptable to good glassware, the clay did not make good pots, and the number of skilled workmen was few. Wealthy colonists still preferred the sumptuous product imported from England.

A little more than a hundred years later, about the middle of the eighteenth century, glassware was made in Pennsylvania by Baron Stiegel. Expressive of the charm of the Colonial period, these pieces are much sought by collectors today, both for their delightful shape and for their color, mostly dark blues and greens.

In 1827, a carpenter by the name of Deming Jarves at Sandwich, Mass., discovered a new method of pressing glass in a mold. This discovery served to put Sandwich far ahead in the manufacture of glassware and brought the use of glass within the reach of every purse. Constant improvements during the past century have further improved the methods until we have the delightful shapes in use by American manufacturers today.

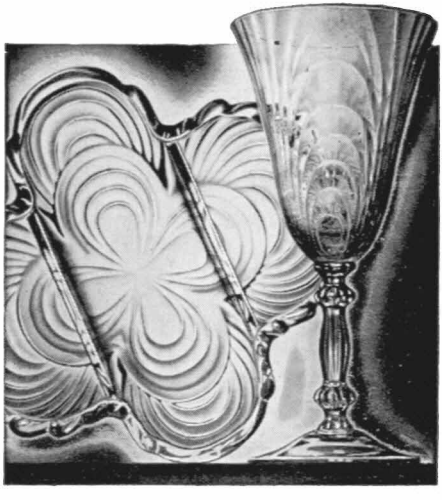
To give a complete history of the making of glassware in this country would take far more space than we have at our disposal. The first glass furnaces were established close to forests where a continuous supply of wood for fuel could be obtained. Later, when natural gas was discovered, these glass factories were moved farther west into Pennsylvania, Ohio, West Virginia, Indiana, Illinois, even into Oklahoma. Probably equally important as a reason for the glass and pottery industries centering in western Pennsylvania and eastern Ohio are the numerous clay deposits for making suitable melting pots and the discovery of a beautiful white silica or sand ideally suited for glass. This sand is equal, if not superior, to the sand in the famed beds at Fontainebleau in France.



Few patterns in handmade crystal have pleased so many women as Cambridge Caprice. Choose from over 150 open-stock pieces, in permanently brilliant Clear crystal.

Colonial Days live again in Cambridge reproductions of early American glass—diamond point Mt. Vernon, and Martha Washington thumb-print, each in over 150 open-stock pieces.

Never before has any crystal achieved such life and movement or held such fascination as Cambridge Caprice. It is today's most popular pattern.



The Miracle of Heat and Many Diverse Materials

In one of the tales of the ancient Greeks there is the story of Prometheus who stole fire from Mount Olympus, the home of the gods, and carried it to earth in a hollow staff. That deed was to make him the founder of civilization. For it is fire that makes our modern world possible . . . fire that savors our cooking, warms our homes, moves our machinery, makes our iron and steel. It is fire, too, that performs the "miracle" of melting sand, alkali, and other materials into glass.

And a "miracle" it is, that such diverse materials, so opaque, so incongruous, should, under the influence of temperatures as high as 2700° F., become the beautiful, scintillating glassware that graces our dining room tables.

The essential elements of glass are many, depending upon the kind and quality of glass to be made.

Silica The principal element is silica sand and "cullet," which is composed of all those pieces of glass which have failed to pass the eyes of the inspectors, the tops removed from blown pieces, and all the glass that adheres to the working tools.

While silica sand is found in practically all parts of the world, the pure sand, required for making Cambridge glass, is not so generously distributed. The best U.S. silica is in Pennsylvania, West Virginia and eastern Ohio.

You can see the necessity for this purity when you consider that only .06 of one per cent of iron in the sand inevitably produces an off-color and unsatisfactory glass.

But is not enough for the sand to be pure. In the Cambridge plant it must go through an exacting preparation process in which it is thoroughly washed and calcined so as to remove all impurities and vegetable matter and then ground up into a fine, white powder.

Lime Lime is used to furnish alkaline content, necessary to give the glass strength and workability. The form mostly in use is granulated quick lime; however either quick lime or hydrated lime may be used. Lime glass, commonly used by

makers of cheaper grades of glass, lacks the addition of those other materials, notably lead, which produce those qualities wanted by makers of finer glass.

Lead In the better, higher priced crystal glass, such as Cambridge makes, lead is used, usually in the form of red lead oxide. It gives to glass many valuable properties, increasing the density, resonance, and refractive index. Peddle, a well-known English authority on glass, says that lead is necessary to secure color, density, brightness, durability, easy melting, and easy working. Because of the comparative softness of lead glass, it has a lower melting point and is easier to plane, and consequently, freer from common defects such as "cord" and "seed". Beautiful designs can also be cut into lead glass.

The oxygen in the lead oxide performs another function. As lead oxide has the highest specific gravity of any of the materials used, it has a tendency to sink to the bottom of the pot, liberating bubbles of oxygen which carry to the surface any impurities or unmelted portions of the batch.

Litharge This material acts in much the same manner as the red lead oxide but is not as valuable for the reason that it does not contain as much oxygen.

Soda Ash Soda ash or sodium carbonate is used principally as a flux to start the batch melting. It also furnishes part of the alkali necessary for making glass.

Potash In the making of fine glass, potash is used in place of soda ash. It not only acts as a flux, but also imparts the resonance or ring which is characteristic of fine glassware such as Cambridge.

Borax Another flux, sometimes used, is borax. It also forms part of the alkaline content and gives to the glassware certain heat-resisting qualities.

Manganese This is used as a decoloring agent to offset or overcome the greenish tinge or "low color" caused by impurities such as iron in the batch. If too much manganese is put into the batch, however, the glass becomes pink and is said to have "high color." Manganese is

also used to produce a purple or pink glass, but if allowed to get too hot, turns the glass an unsatisfactory yellow or brown and finally green.

Arsenic Arsenic, which acts as a clarifying agent, is used as arsenious oxide or arsenate tri-oxide. It is associated with copper and is a by-product of the copper industry.

Other materials utilized in the manufacture of crystal glass are barium oxide, zinc oxide, alumina, feldspar, etc.

Mixing the Batch This whole mixture of silica sand, cullet, potash, lead or lime, etc., ready for charging into the pot or tank, is called "the batch."

Preparing this batch is a most exacting process, not to be achieved by any hit-or-miss methods.

In the making of Cambridge glass, this exactness begins with the setting up of the original specifications for a given kind of glass. It continues in the chemical laboratory where all incoming materials are tested and analyzed. It follows through to the mixing room where giant weighing machines measure out the heavy materials and sensitive balances parcel out the finer ones, often in quantities as small as a single ounce for a batch weighing 2,000 pounds. The result is that a given grade of Cambridge glass is always the same—today, tomorrow, five years hence.

These materials, having been most carefully proportioned, are placed in a steel car which remains in the mixing room until ready to be charged into the pot, when it is wheeled over to the furnace.

THE WEIRD CHEMISTRY OF *Coloring* GLASS

If this exactness is necessary in mixing the basic materials, it is even more necessary when measuring the mineral salts and oxides which give color to Cambridge colored crystal. Just a

pinch of some salts and oxides, for instance, will color an entire batch.

This chemistry of color is one of the most fascinating aspects of the making of glassware. The choice of coloring materials is seemingly so illogical, so contrary to what you would expect in the results each achieves.

For instance, cadmium sulphide, a silvery white, metallic element, produces yellow or canary glass. Selenium, a lead gray crystal which is an element of copper ore, produces a beautiful amber or a brilliant red, depending upon the quantity used. Black oxide of copper, black as its name implies, imparts a rich blue-green. And so it goes, practically every mineral salt or oxide used in coloring glass produces a color totally different from its own.

While the entire process of making colored glass is too technical and complicated to go into, except briefly, in a booklet of this kind, here at least are a few colors and the materials used to produce them:

Blue Blue is secured in glass by using jaffre, an impure cobalt arsenate, made by roasting the crude ore or calcining it with excess air. This ore is found in Canada and the Belgian Congo. Cobalt oxide and smalt are also used to make glass blue.

Yellow or Canary Cadmium sulphide is one of the materials used to make glass yellow. Cadmium, a metal never found free in nature, is silvery white in color and soft at ordinary temperatures. Uranium, an element which is found with radium in pitchblende, used as sodium uranite, produces a canary yellow fluorescent glass.

Green Oxide of chrome is used to secure certain shades of green. It is made from sodium dichromate, which is produced from chromite ore and is found in several countries but principally in Asia Minor. Red oxide of iron, prepared either by precipitation or calcination, produces certain shades of yellowish green. Black oxide of copper is used for making blue-green glass.

Amber Selenium, cerium, and flowers of sulphur impart beautiful amber colors.

Red Selenium, which is an element from copper ore and is a by-product of the copper industry, is also used to produce red.

Gold, used as "purple of Cassius," produces a beautiful ruby glass. With different treatment it also makes the glass amber or purple.

These are only a few of the many materials used to give color to glass. Sometimes they are used alone, sometimes in combinations of several, depending upon the color and tint desired.

MELTING THE GLASS

There are two distinct methods of melting glass, depending upon the quality of the glass to be made.

The cheaper kinds of glass, known as tank glass, are made by feeding the materials to be melted into a large rectangular tank. The batch is fed into one end of this tank through an opening known as the "dog house". The molten glass is drawn off at the other end by workmen or machinery.

In the second method, used for making fine glassware like Cambridge, pots are used in place of tanks. As many as fourteen of these pots, each capable of holding a ton of molten glass, are grouped in a furnace and charged separately. During the process of melting, these pots are tightly covered so that no soot or dirt can enter and discolor the glass. So important is cleanliness, that in the Cambridge plant, where much of America's choicest glassware is made, even the gas that is used in the furnace is filtered of all soot and dirt. No precaution is too great to keep the batch clean.

The pots or crucibles are made of fire clay, thoroughly glazed on the inside, and allowed to season for several months before they are placed in use. Expensive to make and of problemtical life, these pots are warmed-in gradually to eliminate any tendency toward cracking. How long they last in service depends upon this initial care and the kind of glass made in them. When they have served their purpose, they are broken up and reground to make other pots. It seems that the more this fire clay is used and burnt, the better it becomes.

IN THIS MACHINE AGE
Shaping Fine Glass
IS STILL THE WORK OF HANDS

Human ingenuity has developed machines for many purposes, but it has yet to design the one that will make satisfactorily the delicate blown glass you want on your dining room table. That still is, and will probably remain for a long, long time, the work of the skilled hands of the artisan.

Let us single out a goblet and show how it is made, step by step. By the time the last of the batch has been tossed into the pot, the mixture is beginning to melt, taking on the consistency of putty. The heat rises, higher and higher until it finally reaches as much as 2700° F. The batch is boiling. It flows like thick molasses. Huge gas bubbles are rising rapidly. As time goes on, they dwindle in size until, about twenty-four hours later, tests show that the glass is ready. After cooling for a couple of hours, to bring it to proper consistency, it is ready for the blowers.

The operation of blowing glass begins with the "gatherer" who dips a long, hollow rod into the pot. Because this tube is cool, a small quantity of glass clings to it. His next step is to shape this blob of glass by rolling it on a steel table, called the marver, and to start a small bubble.

Quickly it is passed to the blower who works on a raised platform for greater convenience in handling the four-foot rod. He blows the bubble a little larger and then drops it into the optic mold which puts the little ribs or creases in the hot glass.

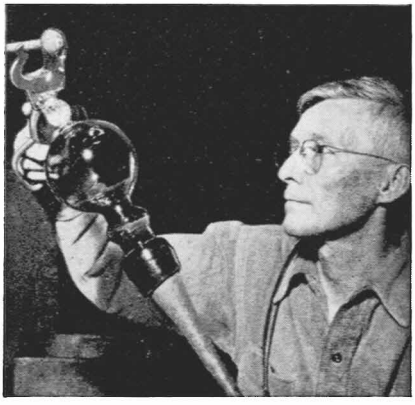
The whole bubble is then put into a paste mold which forms the shape of the goblet, and the blower exerts as much pressure with his breath as is possible.

While he blows, he rotates the glass in the mold. This causes the optic lines, which are at first on the outside of the glass, to be virtually rubbed right through the glass so that, when this bubble or bottle is taken out of the mold, these lines will be on the inside. The workman is very careful to rotate the bottle as much in one direction as in the other so that the optic lines are kept straight up and down and so that a seam

Cutting . . . the oldest decorative motif for glassware, reaches its highest modern expression in the matchless brilliance of Cambridge cuttings, first choice among connoisseurs of Cut Rock Crystal.

will not show in the article where the mold joins. Turning the glass all in one direction produces a swirl optic.

The hot, bottle-shaped bubble is then passed over to the operator of a machine that puts on the stem, which has been pressed into shape while the bowl was being blown.



We now have the bowl and stem of the goblet but no foot. We'll soon change that. But first we must reheat the goblet in a small blast furnace which quickly brings it up to a white hot temperature just short of the melting point.

Meanwhile another operator has been gathering a small lump of molten glass from the pot. By the time the footless goblet has been sufficiently reheated, he is ready. He drops this small blob of hot glass onto the bottom of the stem and the finisher completes the shaping of the goblet, one of the most interesing steps in the entire process of making a goblet. He lays the long hollow tube to which the goblet is attached over the two extended arms of his bench and, with the palm of his hand and forearm, rapidly revolves it, while with his other hand and a cherry or apple wood finisher he forms the attached blob of glass into a foot.

The top of the goblet, still rounded like a bubble, remains sticking to the blowpipe, but a light touch of a cold iron removes it and the operator places it in a special fork with which it is carried to the annealing lehr where internal strains are removed.

In making a goblet with a drawn stem, much the same procedure is followed except that a stem is drawn out from the bottom of the bubble with a special tool that looks somewhat like a pair of pliers—a skillful piece of work that requires long training.

The Annealing Lehr

Naturally, when glass starts to cool, the surface cools more rapidly than the inside, thereby creating terrific internal strains that would cause the glass to crack with the least blow or quick change of temperature. The annealing lehr, which is a long oven with a moving floor, removes these strains by first reheating the glass to almost melting point and then allowing the entire piece to cool gradually and uniformly under controlled heat. At the end of the lehr, two hours later, the piece is cool enough to handle and has developed all its inherent strength.

As it leaves the lehr, a trained Cambridge inspector carefully examines each piece for any defects. Those that fail to pass this inspection, often for a defect that even the most critical would fail to see, are tossed aside to become "cullet" for another batch. The others pass on to the next operation.

You must remember that up to this point the cup of the goblet is shaped like an egg and is completely enclosed at the top. The removal of this top is quite an interesting procedure. The glass is first scratched with a diamond point at the desired height, much as you would in cutting a windowpane. It is then rotated in front of hot jets of flame which touch the glass along the scratch. The top can be lifted off and is tossed into the cullet bin.

Naturally, the edge of the glass is still quite sharp and rough. This is soon corrected by grinding on special flat stones which revolve in one direction while the goblet, in a special holder, is rotated in another. It then goes to another lehr,

called the glazing lehr, which shoots down hot flames from the top as the glass passes through on an endless conveyor. This process glazes the top and, by slightly melting the edges, rounds them. It also fire-polishes the glass and completes the annealing, all in a single operation.

The goblet is then thoroughly washed and is ready to ship or to go to other departments for decoration.

Pressing Glass

Heavier pieces of Cambridge glass, such as cups, saucers, bowls, plates, pitchers, and similar articles, are usually formed by pressing in a mold.

The workman takes a steel rod about four feet long, called a pontil or punty, and thrusts the end into the pot where it picks up a quantity of molten glass. He drops this into the mold already heated in a mold oven.

The white hot glass streams off the end of the pontil rod until another workman, who has charge of this part of the process, cuts the stream with a pair of shears. This must be gauged most carefully lest he overflow or fail to fill the mold, either of which would spoil the piece.

In cutting off this stream of glass with comparatively cold shears, there is always a mark on the glass which the workman tries to place so that it will be pressed out or at least not be too conspicuous. This mark is called the "shear mark" and is the small hair-like mark sometimes found on the bottom of a bowl or plate. It does no harm to the piece unless it is too obvious, in which case the article is rejected.

The mold is made of jointed sections in two or more pieces and locked before inserting the pressure plunger. After the

hot glass has been dropped into the mold, the plunger is brought down and the workman, by means of a lever, exerts pressure on it which forces the molten glass into every part of the mold. Long experience and skill are the only guides in knowing when this pressure has been exerted long enough and the glass pressed out entirely to fill the mold. The plunger is then removed and the mold opened. The article is then allowed to cool for a few seconds before it is taken out.

Very rarely is any article so pressed into the shape that it is designed to take eventually. There is usually much hand shaping still to be done. Therefore, the article is placed on a "sticking-up punty." This is a special tool, made of iron, with a table or base large enough for the glass piece to adhere to, which it does because the already hot glass is slightly melted by the metal, which previously has been heated to a cherry red.

The next step is in reheating the article in the "glory hole," an open furnace, very hot, where glass may be heated quickly both for fire polishing and for reshaping.

When the glass has been brought to the proper temperature, it is carried to a workman, equipped with calipers, cherry or apple wood finishers, and other tools. With deft motions of his hands he quickly gives the article any desired shape.

It is then detached from the "sticking-up punty," and, by means of forks or special tools, taken to the annealing lehr for controlled cooling.

MAKING BEAUTIFUL GLASSWARE *More Beautiful*

A piece of Cambridge Crystal is a beautiful thing, just as it comes from the lehr. However, there are many pieces which are made more beautiful through etching, cutting, or decorating with gold, silver, or platinum.

Etching

Etching is of three kinds: Needle Etching, Pantograph Etching, and Deep Plate Etching.

In "Needle Etching," the article to be etched is dipped into a special wax, formulated to resist the action of the hydrofluoric acid of the etching bath, and then placed in a machine where needle points cut off the wax in the design to be etched.

"Pantograph Etching" is done in much the same manner except that the needles follow a key or master pattern. Pantograph Etching can usually be recognized by its conventional lines, lops, and curves. It is impossible, however, with either Needle or Pantograph Etching to achieve the beauty and delicateness of the Deep Plate method.

All etched Cambridge glass is finished with the "Deep Plate," by far the most complicated and expensive method, resulting in exquisite designs and shading impossible by any other process. But the results justify the additional cost, as you will easily see the first time you pick up a piece of Cambridge Rose Point, or Wildflower, and examine it thoroughly.

In the Deep Plate method, the master etching is first made on a metal plate. If you were to examine one, you would instantly recognize the design executed in raised metal, just like the letters on printer's type. Because of the variation in sizes of different pieces, it is necessary to have a separate master plate for each size of piece—goblet, wine glass, tumbler, plate and whatever others are to be etched in this particular pattern.

This plate is first covered with a special black wax or ink

and the excess then scraped off, exposing the raised portions of the metal which constitute the design, while the hollows which are not to be etched remain covered with the black wax.

A special tissue paper is then laid over the plate and firmly pressed down so that when the paper is stripped off, the wax or ink adheres to it, completely covering the paper except in the lines of the design from which all wax has previously been removed by the scraping of the metal plate. After trimming away the excess, this paper is then wrapped around the glass to be etched. The wax hardens and the paper is then softened with a special liquid and stripped off. This leaves the portion of the glass which is to be decorated covered with wax except where the design occurs. Wax is then applied to protect those portions of the glass which are not involved in the design, such as the inside of goblets, the top of plates, etc.

This placing of the design on the glass is a very delicate operation and must be done with extreme accuracy. Pick up a Cambridge Etching, examine it very thoroughly. You'll find it exceedingly difficult to find any break in the design to indicate where it began and where it left off.

The article is then ready for the hydrofluoric acid bath, which eats away, or etches, only the exposed glass wherever it is not covered with protective wax, namely in the lines of the design from which the wax was scraped off while it lay on the original master plate.

In the Cambridge plant the greatest care possible is used in formulating the etching solution and in allowing the piece to remain in the bath just the right length of time. In consequence there is a depth, clarity and brilliance to the Cambridge

etched piece which you do not find in ordinary etchings. The decorative pattern formed by the etched glass is literally alive with light, reflected from a million tiny surfaces. It has a delicacy of line that catches every glint of light. In its delicacy of detail it resembles the world of the old master etchers whose work is prized by connoisseurs of art, with a value almost above price. If you compare a Cambridge Etching beside the rather lifeless, frosted etchings found on much expensive crystal, you will be amazed at the great difference, which is plain to the most casual eye.

From the acid bath, the glass goes to the automatic washing machines, where hot water removes all wax and reclaims it for further use. The glass is again inspected, this time for acid spots, thoroughly polished with sawdust, and wrapped for packing.

Cutting

Cutting is the method of beautifying glass most used by the ancient Romans, the Venetians, and the English. It is still one of the most effective. With rapidly revolving carborundum wheels of different sizes, or copper wheels supplied with a steady stream of emery dust and oil, skilled workmen follow designs which have been placed before them or previously stenciled on the glass. With their wheels they are able to cut any desired design much as an artist would draw a picture with a pencil.

When the piece comes from the cutting room, the cuttings are gray and must be polished, either by buffing wheels or by immersing in a solution of hydrofluoric acid. The acid method is most generally followed in America. The acid dissolves a portion of the surface, smoothing it out and giving a beautiful, polished appearance. It is more satisfactory in many ways than the old style buffing process which, if not carefully done, causes spreading or pulling of the design and distortion of the pattern

Rock Crystal

Repeatedly the question comes up, "Is this genuine Rock Crystal?" Strictly speaking, no glassware is rock crystal. The only rock crystal is the natural quartz as Mother Nature made it. Large pieces of quartz have been formed into cups, chalices and molds. Almost invariably these are museum pieces. So, if one desires to be absolutely correct, they are the only pieces of genuine rock crystal. However, in common usage, Rock Crystal is fine handmade glassware that has been cut and polished.

Others ask the question, "Is this Crystal or is it just Glass?" Originally, crystal referred solely to the color of glass and, regardless of its quality, crystal glass was clear glass, to differentiate it from colored glass. However, in recent years the word "crystal" has been adopted by the public to indicate any fine handmade glass in contrast to cheap, machine-made glass, regardless of color. More and more you will hear the word "crystal" applied not only to clear or colorless glassware of fine, handmade quality, called "Clear Crystal," but also to the same grade of colored glassware such as "Ruby Crystal," "Moonlight Crystal," "Amber Crystal," etc.

Decorating

Decorated glassware is that which has been enhanced in beauty by applying colors or designs by means of precious metals, enamels, and paints, and then making them permanent with the aid of heat.

One type, called "Silver Deposit," is accomplished by putting the base for the metal on the glass, much like the process of etching, and burning it onto the glass. The piece is then placed in an electroplating bath, much the same as any other silver plating is done. The metal in the bath adheres only where a base has been provided for it, leaving the rest of the piece untouched. This silver deposit can be made tarnish-proof by plating over it with rhodium.

In gold encrusting, the gold, in liquid form, is put on with a brush and then fused into the glass in the heat of the decorating kiln. The gold decoration comes from the kiln dull and lifeless but is soon burnished to a rich lustre with exceedingly fine sand. All Cambridge encrustations are of 22-karat gold and, with care, are very durable.

Platinum is put on in much the same way, but requires a much hotter fire, which necessitates a special glass to withstand this extreme heat.

Enameled decorations may be painted on or applied by a new screen process. The enamel is then baked. The heat burns it into the glass so that it becomes a permanent part of the piece. Decorations on cheaper glassware are merely painted on and allowed to dry.

HOW TO RECOGNIZE *Good* GLASSWARE

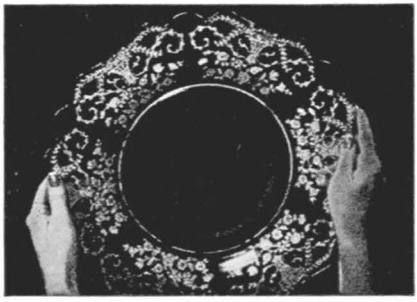
Naturally, in selecting glass for your home, the first consideration should be the shape and kind to harmonize with the chinaware or other furnishings in the room in which it is to be used. You will have no difficulty in making a selection of Cambridge. A complete display of the Cambridge line would show more than 5000 separate items, each different in shape or size or embellishment. Many popular patterns are available in as many as 150 different pieces.

Often the question is asked, "Isn't clear crystal always the most appropriate and best glassware to buy?" The answer is very emphatically, "No." If a color best suits the motif of the room and of the table, then of course that is what you should select. Moreover, color brings variety and distinction to many settings. Glassware is something you will live with for years, and many people spend years acquiring a satisfactorily balanced selection. Any extra time or care you spend in selecting it will be a good investment.

In order to give infinite variety to their table appointments, accomplished hostesses like to have several complete services of both colored and clear crystal. The well-equipped crystal cabinet does much to earn for the housewife the reputation for being a "marvelous hostess."

In selecting your crystal there are three simple rules which, if followed, will enable you to recognize *good* glassware. These three rules are shown on the next page. The next time you buy glassware, or if you wish to "test" your own, be sure to apply them.

Look The first requisite is beauty in the material itself. Colored crystal should be rich and sparkling. Clear crystal should be clear like spring water or a fine diamond. No amount of cutting or decorating will cover up a muddy or yellowish appearance. The true and lasting brilliance for which Cambridge Crystal is noted can be observed by comparison with ordinary glass.



Listen Tap the edge of a goblet with your finger nail. Listen to the ring, the bell-like tone which indicates that the glass contains lead and potash, and two ingredients which give the strength and permanent brilliancy which fine glass should have. Lime glass has little or no ring when you tap it.

Learn The third point to consider is the kind and quality of embellishment. If it is an etched piece, even the most delicate detail should be clear and distinct, with no acid spots, with no unwanted breaks in the delicate lines, and with a real brilliance entirely lacking in inferior etchings. If it is a cut piece, the cuttings should be sharp and true. The best assurance of all, however, is the trademark of the manufacturer. Every piece of Cambridge glass carries the Cambridge seal, guaranteeing that it is a piece of handmade crystal of finest quality.

HOW TO CARE FOR *Your Fine* GLASSWARE

Here are a few suggestions which, if followed, will increase the enjoyment you derive from your fine crystal and add materially to its life.

Do not hold a piece of fine stemware under the hot water faucet. This quick and uneven application of heat puts too much strain on the glass from the expansion. It may cause the piece to crack.

If you are using glass cups and saucers, put a silver spoon into the cup before pouring in any boiling liquids. This will protect against cracking, for silver instantly absorbs much of the heat.

When you serve ice cream on a glass plate, first be sure to place a paper doily or similar protection on top of the plate to safeguard it from cracking caused by sudden temperature change.

Wash metal encrusted glassware only in mild soapsuds. Ammonia or caustic washing powders will not only dim the polish on the metal but may even cause it to come off entirely. A mild solution of ammonia is all right for plain glassware, but it is highly undesirable on metal decorations.

In handling glassware, the edges should not be permitted to bump or strike anything. This will cause nicks, as you have no doubt already discovered. Should you be so unlucky as to get a nick in one of your cherished pieces, the only thing to do is to discard it. However, if the nick is very tiny, take a piece of 00 emery paper, wrapped around the handle of a small object like a tack hammer, and work it back and forth across the nick. With much patience and perseverance you may make it smooth. This process leaves the edge frosted in appearance, which in turn can be removed by putting a little polishing rouge on a leather strap and rubbing just as you did with the emery paper.

Often times two glasses, when inserted one in the other, stick together. Don't try to force them apart; you may only break the glass. Instead, fill the inner glass with cold water while you immerse the outer one in warm water. The two will come apart quickly and easily.

In washing your glasses, put a soft tea towel on the porcelain drainboard of your sink. This is also a good suggestion for the bottom of your dishpan.

Often we are asked what is the best way to wash glasses. The old method was to wash the glassware in hot water and dry it with much of the soapsuds still remaining on the glass. This is the principal cause of streaky glasses. The modern way is to wash the glasses as you do now, in a mild solution of soapsuds and rinse them thoroughly in cool water, not warm water, and allow them to dry of their own accord. If the glass is of good quality, like Cambridge, it will dry naturally to a lustrous sparkle.

THE *Correct Service* FOR THE TABLE

Articles for table setting should be arranged as follows:

A. Napkins:

1. Placed to the left of service plate.
2. Folded so as to show their embroidery to the best advantage.

B. Silver:

1. Knives, spoons, oyster forks to the right of service plate.
2. Other forks on the left.
3. Sharp edge of knife should face the plate.
4. All silver should be arranged according to order of its use; those to be used first to be farthest from the plate.
5. All silver required up to dessert course should be on the table at beginning of meal, unless, besides oyster fork and butter knife, more than three knives and three forks will be needed. The extra silver should be brought in when needed.
6. Butter knife should rest on butter plate, parallel to edge of table (may be omitted at a formal dinner).
7. Dessert silver usually brought in with the dessert or may be placed just before serving.

C. Placing:

The edge of service plate, tips of handles of all silver, and edge of napkin should form a straight line one inch from edge of table. Covers should be opposite each other. The stardard spacing for the covers is 24 inches from center of next. Varies with size of table and number of guests.

D. Glassware:

1. If there are three glasses, it is usual to arrange them in a triangle. Water goblet in front of knife.
2. All glasses should be filled only ¾ full.
3. Wine glasses are removed after each course if different glasses are being used; if same wine is used then glasses are refilled just before each course is served.

4. Glasses should not be lifted from the table when being refilled.

5. Service Plate—This is removed just before the main course is served.

6. Salad Plate—If salad course is served with the main course, the salad plate is placed on the more convenient side. As there are usually several glasses on the right side, the left side is more suitable.

7. Courses are removed only to be replaced immediately with next course. There must always be a plate be-before the guest until dessert is ready to be served. When table is cleared of all silver and dishes and is crumbed, the dessert is brought in.

8. Fingerbowls:

   (a) If needed after fruits at beginning of meal or after any food that demands use of fingers, fingerbowls may be placed to the left of the cover when table is laid—or it may be brought in toward the end of the course and placed to the left of the cover.

   (b) If dessert plate and fingerbowl are served together, the fingerbowl is placed on the dessert plate and dessert silver is placed on the sides of the plate (fork on left, knife or spoon on right). The guest removes the silver, then the fingerbowl, which he places at the left of the cover.

   (c) If dessert is served in individual portions, the fingerbowl on a plate with a doily is placed in front of the guest after the last course.

E. Different types of service.

1. Russian Service.
   Food served from the side in individual portions or from serving dishes for each guest to help himself.

2. English or family service.
   All food belonging to one course is placed in serving dishes before the host or hostess and served from table.

3. Combination Service.
   Soups, salads or dessert served from the kitchen and the main dish served from table.

Beautiful as BRIDAL LACE

FROM A SUPERB SELECTION OF EXCLUSIVE

Highlighted Etchings

The traditional beauty of old Rose Point lace is here faithfully translated to the graceful forms of fine Cambridge Crystal. By a special technique, Cambridge handcraftsmen capture in every delicate tracery a rich, luminous glow wholly unlike ordinary frosted etchings. In addition to designs shown, good stores also feature PORTIA, ELAINE and CANDLELIGHT. The Cambridge Glass Co., Cambridge, Ohio.

Cambridge *Hand Made Crystal*

The Cambridge Glass Company

Back in 1901, Arthur J. Bennett of New York City had a vision of a glass manufacturing plant that would produce glass of even superior quality to the finest English ware with which he had long been familiar. He searched the country over for a desirable site, which would be at once within easy access to the natural gas fields of West Virginia and of the famed sand beds of western Pennsylvania and eastern Ohio.

He found his spot at Cambridge, Ohio, where, in 1901, he started to manufacture glassware. The first piece was the glass pitcher, now a treasured piece.

Today, there are more than 5000 separate items in the Cambridge line. Its quality is known from one end of the world to the other. And Europe, at one time the great exporter of glassware to the United States, now imports no small amount of Cambridge glass.

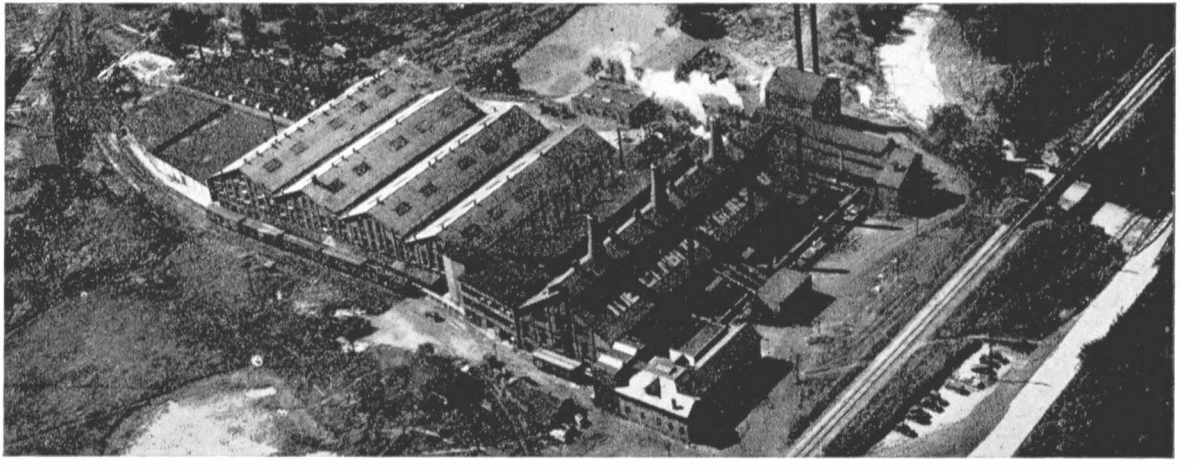
All of the glassware turned out by Cambridge is made by hand. There are four regenerative furnaces of fourteen pots each, and all of the necessary lehrs or annealing ovens and equipment to operate a working force on a day and night basis.

At the present time, nine different colors are being produced regularly. In addition, there are several others which are made only on special contract. The etching department is one of the best equipped in the country. The large cutting department produces a product that well rivals that of the famed English glass cutters. Gold, silver, and enamel decoration are handled in a special daylight department, especially designed for this purpose.

So high are Cambridge standards that it is only the perfect piece that is worthy to bear the Cambridge seal, your assurance of the very finest glassware that it is possible to make.

Visitors are always welcome at the Cambridge factory. If this little booklet has proved helpful and interesting to you in showing you a little of the romance of making fine glassware, a trip through the factory, seeing these operations at first hand, will be even more so. We'd like to welcome you, any day.

THE HOME OF CAMBRIDGE GLASS



The Cambridge Glass Co.

CAMBRIDGE, OHIO