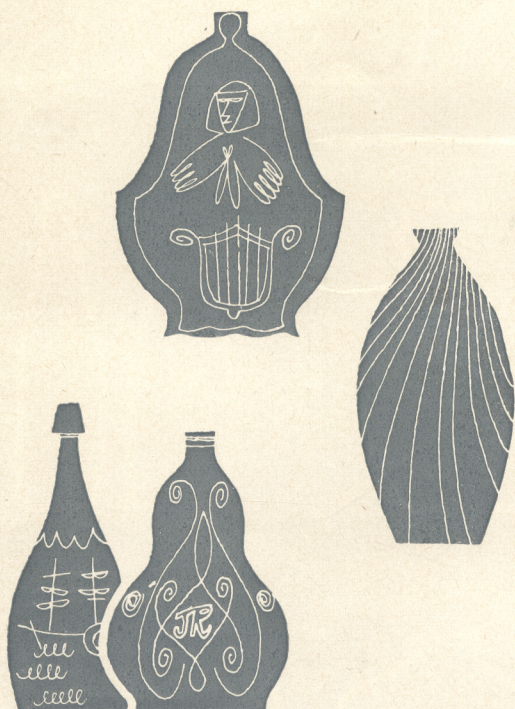




THE STORY OF
GLASS CONTAINERS
A UNIT FOR ELEMENTARY GRADES
PRESENTED BY GLASS CONTAINER MANUFACTURERS INSTITUTE, INC.





TO THE READER:

The story of glass—the oldest of man-made materials—stems from ancient days, reflecting its influence on everyday living through the ages. From a legendary beginning, its actual history can be traced back thousands of years. Once a luxury, glass has become today a common necessity in millions of American homes.

In the past fifty years, glassmaking has made tremendous progress. A “glassless” world is hard to imagine, for glass enters into almost every phase of modern living. One of the widest and most familiar uses of glass is for containers. First made by the Egyptians more than 4,000 years ago, glass containers today contribute much to the health, comfort, and welfare of the American way of life.

This educational unit, “The Story of Glass Containers,” is planned by the Glass Container Manufacturers Institute, Inc. to correlate with your Social Studies, Science, Health and Nutrition curriculum. It provides interesting information about the history and manufacture of glass containers and their contribution to Health, Science, Industry, and Home Life.



PART 1

Bottles

mysterious messengers of the sea

THE ocean was calm. Yesterday's storm and the ebbing tide had left the beach strewn with debris. The boys raced along the water's edge, jumping over long strands of seaweed and bits of wreckage. Tired and panting, they stopped to examine a strange shell.

"Bet I can hit that old board," said one boy. He tossed a smooth round stone at the floating timber. Plop! it splashed into the water far short of its mark.

"Ha, what an aim!" cried the other, scornfully. He looked around for something to throw and saw a bottle half buried in the sand. Prying it loose, he picked it up. "Watch me," he said, winding up like a big-league pitcher.

"Hey, wait!" shouted his friend. "There's something in it."

"Nothing but a piece of paper," he said peering into the bottle. "Anyhow, how can we get it out?"

"Here, poke it out with this stick—Gee, look! It's got writing on it. What's it say?"

Two heads bent eagerly over the paper, and slowly made out this message: "Our ship is sinking. The S.O.S. won't help. I guess this is it. Good-bye now—maybe this will reach the good old U.S.A."

This story is based on fact. In 1947, two boys actually discovered this signed bottle-message on the coast of Maine. Later, the U.S. Naval Intelligence

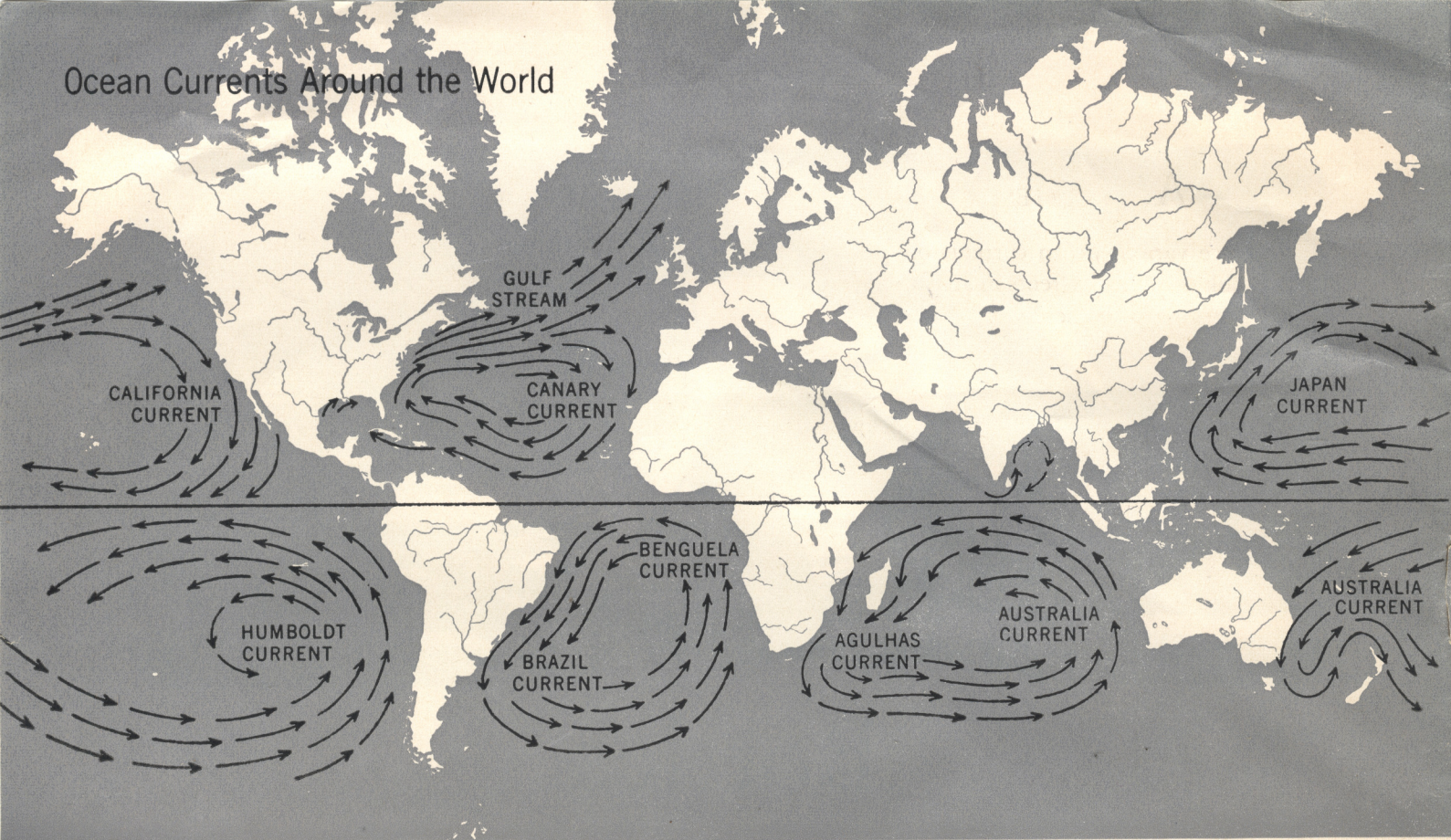
learned that the bottle and wreckage came from our destroyer, *Beatty*. On November 6, 1943, during World War II, the *Beatty* was sunk by an enemy torpedo as she was entering the Mediterranean with a convoy. Tossed from the sinking ship the bottle bobbed across the Atlantic. Four years later it arrived, bringing its message safely to our shores.

Bottle messengers have been going to sea for over 2,200 years. Some have contained farewells from shipwrecked sailors. Others hold sermons or letters to be mailed. Many go on scientific voyages—and one carried a secret message in code.

This particular bottle was picked up over 350 years ago, when Elizabeth I was Queen of England. It was found by a fisherman on the beach at Dover. When he opened the bottle, he was amazed to see a strange message. Puzzled, he went to the authorities. They took a hasty look and sped to the Queen. It was a good thing they did, too! For, the bottle-message contained top secret information sent by a British spy from a passing ship. The Queen was alarmed. She realized that it would never do to have just anyone open bottles and learn state secrets. So she passed a law forbidding this, and appointed an Official Uncorker of Ocean Bottles!

The most important bottle messengers are those

Ocean Currents Around the World



sent to help scientists chart the seven seas. The first of these were recorded many years before Christ was born by Theophrastus, a Greek philosopher. He floated bottles in the Mediterranean to study currents.

Centuries later, Benjamin Franklin threw bottles into the Gulf Stream. They contained his name and address, and asked the finders to tell him where and when they were found. By gathering this information, Franklin was able to chart the speed and direction of the Gulf Stream.

Today, most of the leading nations of the world use bottles to gain scientific knowledge of ocean currents and drifts. The Hydrographic Office of the U.S. Navy sends out several thousand bottles every year. These are given to captains of American ships to set afloat in different parts of the world. Each bottle contains a card on which the captain records the name of his ship, the date, longitude and latitude. It also holds another card with instructions to the finder. These are printed in seven different languages, including Esperanto.

Many bottles are never found. Those that are recovered give valuable information. They have helped the Navy trace the course of stray mines, so that shipping could be warned away from danger zones. They

have enabled navigators to make use of the speed of currents and drifts to increase the speed of their vessels. Industry uses bottles to trace the disposal of wastes. Dumped into the water with waste material, they show whether or not certain areas or beaches are in danger of pollution.

Bottles are strong and durable, and when well-sealed make perfect containers. During storms they ride safely on giant waves, often a hundred feet high. They resist breakage when they are hurled to the shore by pounding surf, or dragged back into the sea across stones and sand.

Bottle messengers do not hurry. Twisting and turning, they meander on their way, sailing about ten miles a day. However, bottles carried by strong currents and blown by gales have been known to go eighty miles in twenty-four hours.

Some bottles travel only a few miles, returning to shore on the rising tide. Others travel thousands of miles. One bottle messenger has been sailing the oceans for twenty-five years. Nicknamed the "Flying Dutchman," it was first dropped into the North Sea by a trawler, and has been picked up and thrown back more times than you can count. It has been around the world several times, and most likely right at this very moment it is bobbing merrily over the waves.

ACTIVITIES:

1. Trace various ocean currents on a world map.
2. Look up ocean currents in an encyclopedia. Find out the meanings of these words:

surface currents	stream
deep-sea currents	drift
clockwise	counterclockwise

3. To find out how winds influence the direction of floating objects, try the following experiment: Fill a basin with water. Stir until water is whirling around the basin. Place a cork on the surface and blow it hard in the opposite direction from the moving water.

4. A well-sealed bottle or jar will protect its contents from moisture and weather changes.

Place various objects such as a piece of paper, a nail, cotton, etc., in a glass Mason jar. *Seal carefully.* (Make sure that inside of jar and contents are dry.) Then place out of doors in an exposed position, or bury it in the ground for the duration of the project. Dig up and make a written report on your findings.

5. If you live near a river, lake, or ocean, place a class message in a beverage bottle and send it on a journey. Be sure the bottle is *well-corked*. Write the name of your school, the address, the date, your grade, and explain why you are doing this experiment. Ask the finder to notify your school.

PART 2

The History of Glass

What words describe the Queen's mirror in Snow White and the Seven Dwarfs? *A magic looking glass!* That's right! Today, magic describes all kinds of glass. It is one of the world's most amazing substances.

Glass can be drawn into a fine fiber, or made so strong that it will support an elephant. Sometimes it is so tough as to be almost unbreakable, or so fragile that you can snap it easily between your fingers. It can keep heat or cold out and let light in. It can be molded or blown into all sorts of shapes.

This is the story of one of the most familiar uses of glass—bottles and jars.

The Beginnings of Glass

Glass is the oldest manufactured substance in the world. Long before man came on earth, glass was being produced by nature. Lightning often makes glass when it strikes sand. This appears as either a hard thin crust, or goes deep down into the earth like glass rods or roots.

Red-hot lava pouring over the sides of volcanoes sometimes forms into glass. This of course depends on the materials in the molten lava, and the speed with which it cools. Obsidian, a natural glass formed in this way, was used by cave dwellers and Indians to make knives and arrowheads. There is a great cliff of this substance in Yellowstone National Park.

The Legend of the First Man-made Glass

Pliny, the Roman historian, tells this story of how the Phoenicians discovered glass many thousands of

years ago. The ancient Phoenicians were great seafaring merchants. They sailed far and wide, trading among the nations of the Old World.

One day, the crew of a trading vessel carrying a cargo of natron (soda ash) landed on a sandy beach along the Mediterranean Sea. The sailors were hungry and decided to cook their meal. They gathered driftwood to make a fire, and looked around for rocks on which to support their cooking kettle. There were none. Then they had an idea! Why not use a few of the big lumps of mineral on board the ship?

Several men went to the boat and brought back the natron. They built a crude fireplace, and soon the kettle was boiling over a hot fire. After the men had eaten, they heaped more fuel on the fire, for it was cool. The flames blazed high, fanned by the sea breeze. The heat felt good. The sailors sat around talking lazily, and soon fell asleep. The fire died down, then went out.

When the men awoke, they noticed something shining in the ashes. It was hard and glittered like ice. What was this strange substance, they wondered? Where did it come from? They admired it greatly and took it back to their homes showing it to everyone.

Later, it was discovered that the hot fire had melted the beach sand and the soda to form glass. From that time on, the Phoenicians knew the secret of glass-making.

No one knows for sure whether this story is true. It is likely, though, that the first glass was made quite accidentally.



Egyptian glass blowers

The First Glassmakers

The earliest examples of man-made glass that we know about were found in Egypt. They are stone beads covered with green glass glaze and are older than we can imagine. Scientists believe they were made in Mesopotamia over 14,000 years ago! About 5,000 years later, solid glass was made. This was molded into little blue charms, which also were thought to have come from Asia.

The world's first glass containers were made in Egypt about 2,000 B.C. These little jars and bottles are brilliantly colored, but not transparent. They were used for cosmetics, perfumes, and ointments. Special tear-bottles were made to catch the tears of mourners, and were buried in the tombs. These bottles are so tiny that you could easily hide one in the palm of your hand. Because of the durability of glass, these little containers—buried for thousands of years—can be seen in museums today.

Early Egyptian glassmaking was tedious. It took a long time. With a metal rod, workmen pulled fine strands from a kettle of molten glass. This was wound, strand by strand, around a mold made from sand. After the glass was hard, the sand was scraped away. Another method was to dip the sand mold again and again into the molten glass. Each new layer of glass was shaped with a wooden paddle.

The Invention of the Blowpipe

For hundreds of years glass was made in this way. Finally, about 300 B.C., the blowpipe was invented. No one knows exactly how this happened. Perhaps a tired glassmaker blew out a deep breath into the hollow rod used to dip out the molten material. Imagine how surprised he would be at the result—a big glass bubble!

The invention of the blowpipe opened the way to new uses of glass. Modern machines use this same principle to turn out thousands of bottles and jars an hour.

To blow glass, the end of the blowpipe was dipped into the molten mixture. A small gob of glowing glass was gathered and shaped roughly on a marble slab. Then the glass blower lifted the pipe to his lips and blew. At the same time he whirled the pipe in big

circles to shape the glass by centrifugal force. This required great skill and lung power!

Later, molds were used. Instead of shaping bottles and jars in the air, the gob was blown into a mold. The combination of blowpipe and mold was another milestone in the history of glass. Now it was possible to make larger and more uniform glass containers in much less time.

The First Golden Age of Glass

After the invention of the blowpipe, new uses for glass were discovered. Merchants found that glass jars were waterproof, did not affect the taste or the flavor of their contents, and could be used again. So, they shipped oils, wine, honey, and other products in glass on long sea voyages to other countries. The peoples of the Mediterranean saw the advantages of these containers, and began to make glass.

When Augustus Caesar conquered Egypt, he demanded a tribute of glass. Then he ordered Egyptian craftsmen to come to Rome to train glassmakers in their art.

Soon glass containers began to replace pottery ones. Alchemists, the scientists of those days, used them to hold chemicals and medicine, and to conduct experiments. Women carried tiny glass bottles and jars of cosmetics. Goblets, vases, and bottles were used at tables, and durable glass urns were used for burial purposes.

The Second Golden Age of Glass

After the downfall of Rome, glass continued to be made in other countries. However, as Venice grew in wealth and power, the art of glassmaking flourished. Guilds were formed and craftsmen guarded their secrets closely. Nevertheless, by the 17th century, other countries of Europe were producing beautiful glassware. In England the secret of making the first colorless and transparent glass was perfected.

Early Glassmaking in America

The year after Jamestown was settled—1607—a ship sailed into the harbor. The excitement was great, as the colonists gathered on the shore. Here, at last was news from home, and more important, a “second

supply" of settlers, food, tools, guns, and other necessities.

With the exception of "Mistresse Forrest and Anne Buras, her maide," the first women to arrive in Jamestown, the newcomers were skilled in some particular kind of work. Among these were makers of pitch, tar, soap ashes, clapboards, and eight glassmakers.

Under the direction of Captain John Smith, president of the council, the new settlers immediately set to work. The glassmakers and their helpers selected a site "in the woods neare a myle from James Towne." Here they built a "goodly" glass house. And in the autumn of 1608, almost twelve years before the Pilgrims landed in Plymouth, the *first factory* in America was producing glass.

Not only was the manufacture of glass the *first American industry*, glass was part of the *first cargo* exported from the new land. For later that year Captain John Smith wrote in a letter, "We sent home ample proof of Pitch, Tarre, Glasse. . . ."

The glass factory in the forest was little more than a rude hut. It had a main furnace and three small ones. All were built of rough boulders. What articles were produced is not known exactly. But from pieces of green glass found in the ruins, it is thought they were vials, bottles, and drinking glasses. Also, it is probable that glass beads were made for use in trading with the Indians.

Unfortunately, in the fall of 1609, Captain Smith was dangerously burned by a gunpowder explosion, and was forced to go back to England. After he left, the colonists suffered from sickness, starvation, and

Indian attacks. Many people died. Work slowed down in the little glass factory—then stopped.

Twelve years later, Captain William Norton brought a few Italian glassmakers to Jamestown. The factory was started again. Things went badly, and after two years it was closed permanently.

In 1632, two men started a glass factory on borrowed money in Salem, Massachusetts. They made glass bottles in which cider was shipped to Carolina and the West Indies. This plant lasted for more than 35 years.

The first really successful glass industry was started by Caspar Wistar, in Salem County, New Jersey, in 1739. Wistar was born in Germany and came to this country when he was 21.

At first Wistar made bottles. These were sold to traders, who smuggled West Indian molasses to America in order to evade British trade regulations. After a while, he began to manufacture all sorts of glassware—bowls, drinking glasses, preserve jars, and sweetmeat bottles. Some had covers, some did not.

Wistar made America's first flint glass. He produced lovely glass in many colors. Martha Washington carried one of his tiny scent bottles tucked in her glove. It was yellow flecked with turquoise blue.

Meanwhile, another famous glassmaker had started a glass industry in Pennsylvania in 1765. He was William Henry Stiegel. Like Wistar, he was born in Germany, and came to this country as a young man. He was called "Baron" because he was such a dashing, colorful character.

Stiegel hired the best glassmakers he could find.



Glassmaking at Jamestown

They came from many countries. He operated three plants and produced beautiful glass that is highly prized today. Stiegel made hundreds of different kinds of bottles, flasks, and decanters with stoppers. There were tiny ones for "smelling salts," large double gallon ones, and all the in-between sizes. He made mustard jars, ink bottles, cruets, tumblers, and other things too numerous to mention. Stiegel's business lasted until the Revolution, when he went bankrupt.

In the early 1800's another kind of a bottle appeared. This was the "Memorial" flask. They were blown into molds on which were carved heroes and famous persons. Some of the bottles have American eagles and the motto of our country. Others commemorate the building of a new canal, the first railroad, the steamboat, presidential candidates, and so on. Originally these bottles were made to hold cider or liquors. But housewives treasured them and they were refilled again and again with other liquids, or used as ornaments.

Historical bottles did much to make glass containers popular, and the 19th century saw many new uses for bottles and jars. During this time the first nursing bottle was patented. Then came the Mason jar with its tight, screw-on cap. And Dr. Harvey Thatcher perfected the first milk bottle.

Until this time, milk had been delivered in big cans by horse-drawn wagons. At each house, the milkman filled the housewife's pitcher or pail from the cans. Flies swarmed around the horses and the sweet-smelling milk. Dust and germs settled on the open containers. Many people contracted sickness in this way. How different it is today, and how lucky we are to have sanitary, tightly-sealed glass milk bottles, each delivering accurate measure!

In France, in the early part of the 19th century, Nicolas Appert had discovered how to preserve food by cooking it in airtight glass jars. This was the start

of the canning industry. In America, food was first preserved in this fashion in 1819. Fruits, pickles, and condiments were packed by Underwood in Boston. In New York, Thomas Kennett and Ezra Daggett packed the first fish and shellfish.

The Twentieth Century

All this time glass bottles and jars were made exactly as they had been for two thousand years. Although the demand for glass containers increased tremendously, the most that one glass blower and four assistants could make was 18 dozen bottles a day. This was not nearly enough.

A number of mechanical improvements were tried out by different craftsmen. Then, in 1903, the first fully automatic bottle machine was invented by Michael Owens. After three years of experimenting and hard work, he had achieved success. The invention of this machine marked the beginning of mass production. At last, man had devised a way to make one machine with many mechanical arms and compressed air do the laborious work of dozens of glass blowers and their assistants.

Of course, there have been many improvements on this machine since its invention. Today there are automatic machines in more than 90 glass container plants in the United States. Some producing bottles and jars at the astonishing rate of 250 a minute!

The Importance of "Closures"

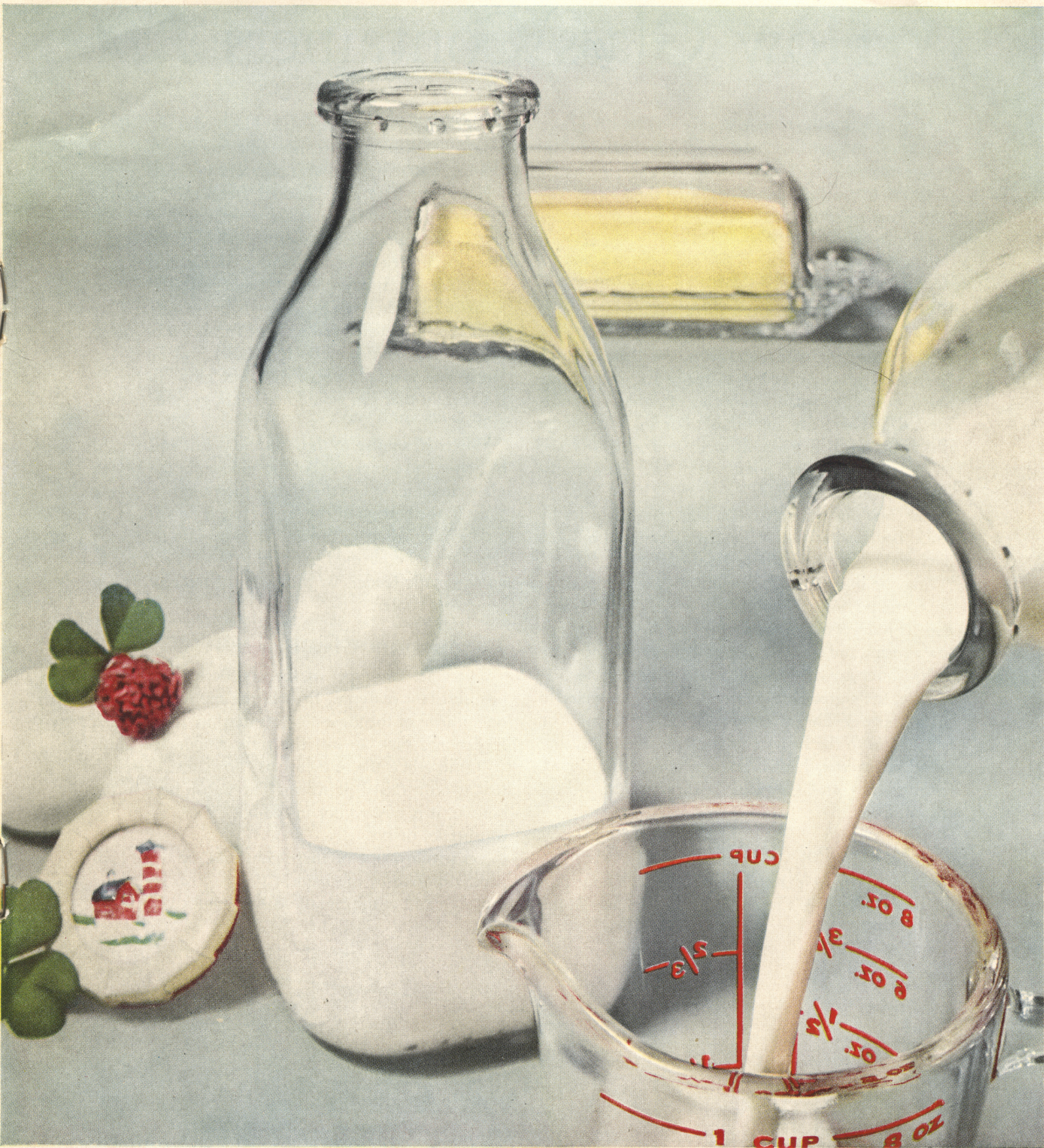
Another important step in the making of glass containers was the development of "closures." These are the caps and corks that seal our bottles and jars. They are most essential. Today, all sorts of closures are used—screw caps, and the kind that pry off, crown caps, lug caps, friction caps, rubber stoppers, and cork stoppers. And each fits and seals a particular container perfectly.

ACTIVITIES:

1. Visit a museum's historical glass collection.
2. Look for pictures and stories about early glass in encyclopedias. Also look in your local library for books on glass.
3. Collect advertisements about glass containers for a scrapbook.
4. Make maps showing the spread of glassmaking from Egypt to Rome—to Venice—to Europe—to England—to America.
5. Make a time line showing the history and de-

velopment of glassmaking through the centuries.

6. Write biographies about
 - a. Caspar Wistar
 - b. Baron Stiegel
7. Write an imaginary letter from a Colonial boy or girl telling a friend in England about glassmaking in America.
8. Start a classroom collection of pretty and unusual bottles and glass containers.
9. Make a wallboard display of as many different types of "closures" as you can find.
10. Make some designs using bottle caps.



How Glass Containers Are

If you were going to make a cake you would do two important things. First, you would measure the ingredients carefully. Then, you would cook the batter at the right temperature. These two things are even more important in glassmaking—for *each must be exactly right*.

The Ingredients of Glass

Most glass is made from three main ingredients. They are: pure clean *sand* that is mostly silica; *soda ash* (sodium carbonate); and *limestone*. *Cullet*, which is crushed glass, is added to make the ingredients more workable. Small quantities of other materials are used. These are important. For instance, some make the finished glass stronger and able to resist temperature changes. Some make the glass transparent. Others add color.

The raw materials arrive at the glass factories by truck, boat, or railroad. Here they are stored in huge bins until they are ready to be used.

Imagine mixing 4,000 pounds of cake batter all at once, and getting each ingredient exactly right! Glass-makers today work in such huge quantities. They follow a recipe and measure the ingredients on automatic scales. They are correct to the very ounce.

After the ingredients are weighed, they are mixed in giant hoppers. This mixture is called a "batch." The batch rides to the furnace on belts or in buckets that travel on overhead rails. Here it goes into an automatic machine and is fed into the furnace. This process is continuous.

The Melting Pot

A glass furnace is enormous. It is really a huge pot, or "tank." The fire is forced through openings in the

walls and burns over the batch. The heat is extreme—over 2,700 degrees Fahrenheit. Imagine heat like that! Boiling water, you know, is only 212 degrees.

The temperature is checked frequently, and the heat is controlled, for it must be exactly right at all times. The furnace runs continuously day and night, week after week without stopping. Although the tanks are made of special heat-resistant materials, they actually burn themselves out in about two years.

When the batch is fed into the furnace it begins to melt almost immediately. It bubbles and boils violently, and gives off a brilliant white glow. In fact, it is so bright that you would need dark goggles to look at it.

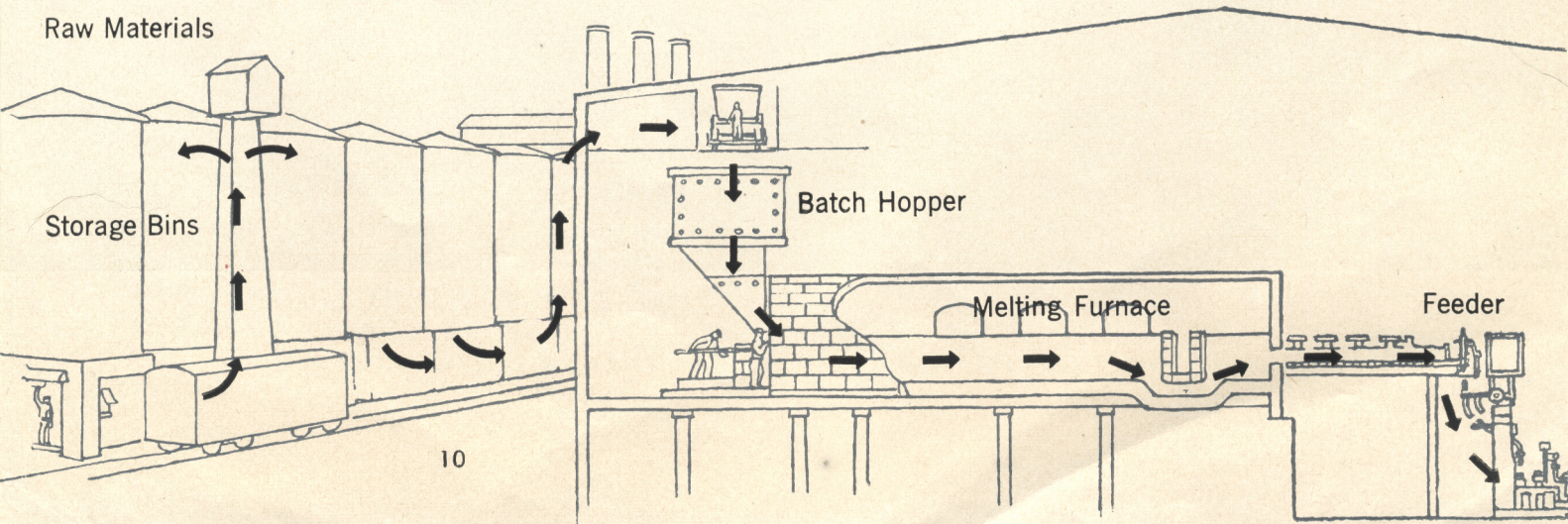
Currents, similar to those in the ocean and caused by hotter and cooler parts of the tank, make the molten glass circulate. When the glass is thoroughly melted it sinks to the bottom of the tank. Here it flows through an opening called a "throat," then up into a refining chamber to be purified. After this process it flows to an automatic feeder. By this time the molten glass is somewhat cooler.

The Automatic Glass Blower

There are two types of feeders. Both are made of heat-resistant material. In one, the molds which are on the arms of the glass-blowing machine, dip into the feeder and suck up just the right amount of glass.

In the other, the molten glass flows into a trough that is on a raised platform. Through a hole in the bottom, it is pushed out in red-hot "gobs" about the consistency of hot taffy.

Let's follow one of these gobs and see what happens. Cut free by mechanical shears, it drops into a waiting mold at the end of an arm. Quickly the mold



Made

presses it into the rough shape of the finished container. It opens. Immediately the jaws of the finishing mold close around the roughly shaped gob. Swish! Compressed air forced through the arm of the mold blows it into its final shape. The jaws open, and there is your bottle or jar. Just like that!

Of course, it really isn't as easy as it sounds. In the first place, there must be a continuous supply of molten glass ready and waiting for each mold. Secondly, the machines are very complicated. Some of these have as many as 15 arms containing molds. Sometimes the arms are on circular machines that turn round and round. Others have several arms in a straight line. But, the most amazing thing about these machines is that they can and do produce container after container all exactly alike.

Cooling the Containers

When your glass bottle or jar comes from the automatic blowing machine, it is not ready to use. *It is still red-hot*, and must be cooled. This process is just as important as any other part of glassmaking. If glass is cooled too quickly it becomes very brittle. If you touched it, it might fly into millions of pieces.

ACTIVITIES:

1. Visit a museum to see specimens of feldspar, limestone, barite, borax, and other materials used in glassmaking. Make a report.
2. Collect samples of various sands. Examine under a microscope or magnifying glass.
3. Blow bubbles with a bubble-pipe to demonstrate how molten glass is shaped by air pressure.

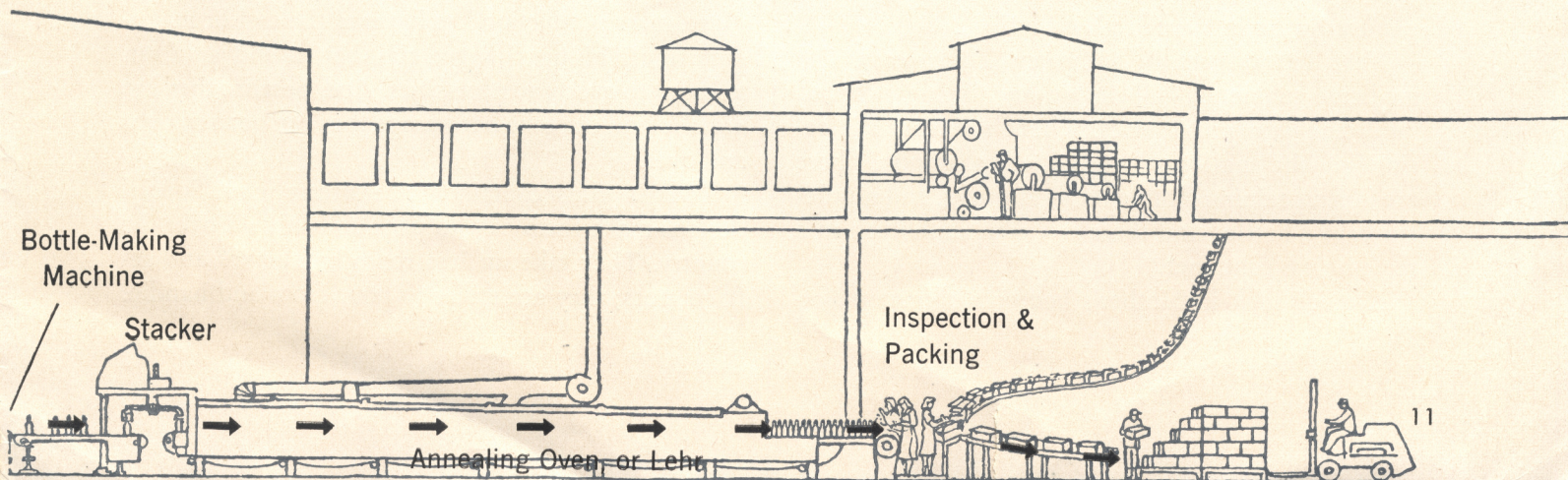
A "knock-off" or "take-out" arm sends the containers from the blowing machine onto a conveyor belt. This moving metal belt takes an endless parade of containers through the annealing "lehr," or cooling oven. The lehr looks like a long tunnel. In the first part of the oven the temperature is 1,000 degrees F.—hot enough to make a piece of paper burst into flame instantly. As the containers move through the lehr they grow gradually cooler and cooler. When they finally reach the other end they are just right to touch.

Inspection

But wait—your bottle or jar is not ready! Why? Because it must be inspected first. In order to protect its contents, each glass container must be perfect. Each container is examined carefully, and a bottle or jar with the tiniest flaw is sent back to be broken up and used as cullet.

Other tests are made constantly by trained technicians. Containers are taken from various parts of the line to laboratories and tested. These tests tell when adjustments should be made in melting, molding, blowing, or cooling.

4. Compare work done by machines with work formerly done by hand. Discuss uniformity of products, speed with which they are made.
5. Make a mural showing how glass containers are made.
6. If possible, arrange a visit to a glass container manufacturing plant.
7. Make a collection of different kinds of glass containers. Compare shapes, thickness of glass, color



Bottles and Jars

The Story of the Glass Containers in Our Lives

Glass Containers in Our Homes

How many glass bottles and jars do you think we use every day? Five—ten—twenty—or more? Let's take an imaginary trip around our homes and see how many we can find.

We'll start in the kitchen, and take a peek into the refrigerator. Look, there are glass bottles of milk and soft drinks. There's a glass of cheese, a jar of mayonnaise, and butter and leftover vegetables in covered glass containers. And, don't forget that bottle of vitamins, or baby's formula in the sterilized bottles.

Now let's look in the cabinet under the sink. See, there's a bottle of ammonia, a detergent, another of bleach, and—oh—we almost missed the jar of silver polish.

But that's just the beginning. We must glance at the pantry shelves. What a lot of bottles and jars! We know what some of them are just by the shape. Not that it matters, for we can look right through the glass and see what they contain. There's a whole row of pickles, olives, hot dogs, chicken, and other tasty snacks awaiting our pleasure. There are jams and jellies in pretty glasses, applesauce, and some of Mother's home-preserved fruit and vegetables. There are bottles of tomato juice, syrup, prune juice, peanut butter, catsup, and chili sauce. There are wide-mouthed glass jars in which Mother has stored rice, tapioca, and spices. Just one look in the pantry makes you feel hungry.

Can you think of any bottles or jars that are found in the living room? Of course you can. Here on the desk is a bottle of ink. Right near it is a bottle of glue with one of those special spreader tops. And what's that over on the window sill? Isn't it Mother's ivy plant growing in a green glass bottle?

Next, let's inspect the bathroom. This is easy. The medicine cabinet is full of big and little bottles of medicine and antiseptics. There's Father's nice-smelling shaving lotion, and Sister's shampoo. There are jars containing ointments, swab sticks, and nipples for baby's bottle. And there is a new toothbrush in a sealed glass container.

A quick look in Mother's bedroom shows us bot-

tles and jars of fragrant perfumes and cosmetics.

Down in the cellar we find all sorts of bottles and jars; some full, some empty. There are empty Mason jars; old jars containing nails, screws, washers, and a number of things. There is a bottle of liquid bluing, a gallon of cleaning fluid, and even a bottle of liquid shoe polish.

And so it goes. In almost every room in the house you will find glass containers of one kind or another. It might be fun sometime to count them. For enough glass containers are manufactured each year so that every man, woman, and child in America could average 112 for his own use.

Why Glass Containers Are Used

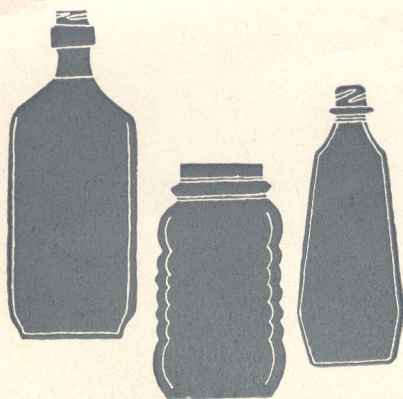
Can you multiply 112 times 160 million people to find out how many glass containers were produced last year? Well, the answer is *18 billion*! If these were placed side by side they would stretch around the world more than *22 times*! Why do you think this astounding number of bottles and jars are needed and used?

There are many reasons. Modern glass is *strong* and *tough*, not only because of its special ingredients, but also because of the way it is made and cooled. As a result glass containers can withstand temperature changes, resist pressure and corrosion. Glass is *non-porous*. Therefore, well-sealed bottles and jars are airtight and moistureproof, allowing their contents to be stored over a long period of time. Glass has *no odor*, so that it cannot make things taste. Because of its *hard, smooth* surface, it cannot absorb odors, and is easy to wash and sterilize.

Glass containers are *economical*, too. In the first place, mass production has lowered the cost of manufacturing. This has changed glass bottles and jars from luxuries to everyday necessities. And, because they are *durable* and can take hard usage they can be used over and over.

Today's glass containers are streamlined. Special designs make them easy to pack and ship all over the country. They take up less room on shelves and refrigerators; they are easier to pour from and handle.





Most glass containers are *transparent*. This makes the contents easier to see. Special colors, such as dark green and amber, or opaque glass, are used when necessary to *protect* the contents from light or from the sun's rays.

Modern glass containers are *pleasing to the eye*. They come in various shapes and colors. Some foods are served at the table from the same bottles or jars in which they came from the store. Many containers are saved and are used as drinking glasses, vases for flowers and plants, decanters, spice jars, and all sorts of things.

The Importance of Glass to Everyone

Glass containers are important to all Americans. From tiny medicine bottles to huge carboys they play a necessary part in our lives. They help to keep us healthy and bring us enjoyment. They serve us in medicine, in science and industry.

Last year more than 7,000,000,000 bottles and jars held the food we ate. Almost every kind of food can be purchased in glass. And we know our health is safeguarded by these containers, because they keep their contents pure, free from spoilage, and full of nutriment.

Everyone enjoys a good time. Soft drinks and other beverages give added pleasure to most of us. These came to us in more than 4,000,000,000 bottles.

About 4,000,000,000 bottles and jars were used to package medicines and drugs. The Red Cross and hospitals use glass bottles for blood plasma and serums. Special bottles protect life-giving or life-preserving drugs like Dr. Jonas Salk's polio vaccine.

Scientists as well as students use retorts, test tubes, flasks, bottles and jars—all made of glass—in research.

In industry, there are many times when it is necessary to use glass containers. Acids are often shipped in large carboys (huge glass containers). Volatile chemicals which must be stored need the protection of glass containers. Acids, dyes, reagents, solvents, in-

secticides, ammonia, and hundreds of other things are packed in glass bottles for safekeeping.

Many thousands of years ago only the richest people could have glass containers. Today we know they are a necessity, and as such contribute much to the health, comfort, and welfare of our daily lives.

However, as is the case with all useful and important things, certain responsibilities go with them. Naturally you want to be a good citizen in your community. So it is your duty to help keep your community clean and neat. That means seeing that all debris—including glass containers—is properly disposed of.

Keep America Beautiful

Have you ever been a litterbug?

A litterbug is a trash-thrower. He is a thoughtless, careless, and untidy person. He is the one who leaves all sorts of debris behind on picnics and hikes. He throws gum, candy wrappers, or banana skins to the ground wherever he happens to be. He tosses bottles, cans, paper containers and papers from car windows. He is the person who pitches trash *at*, not *in*, a wastebasket. Because he is ill-mannered and inconsiderate, he lets it stay where it falls.

Unfortunately, there are thousands and thousands of litterbugs in our country. We know this because we have seen where they have been—along our roadsides, on the beaches, in our favorite picnic spot. We've seen them, too, on our city streets, in the schoolyard, in public buildings—even in our own back yards and homes. Of course, all of us have been guilty of being litterbugs at one time or another. Not that we mean to be; we just did not think.

Littering is a problem that concerns every one of us. Not only is it unpleasant to look at, but it is a menace to our health and safety. It breeds flies and spreads disease, and has caused falls, cuts, and other injuries to people. Trash and other debris clog storm sewers so that they cannot carry off heavy rains. When this happens, erosion takes place.

Littering is costly. Every year more than \$30,000,000 is spent just to clean up our streets and highways! Think of this unnecessary expense! How much better it would be if this money could be used in some beneficial project.

Let's make the litterbug vanish. We can all help, by remembering three simple rules:

1. To be well-mannered and respect the rights of other persons.
2. To be neat and tidy at all times in all places.
3. To dispose of trash in the proper way.

If everyone does his patriotic best, then we can with pride call our country "America, the Beautiful."



ACTIVITIES:

1. Make a list of the glass containers in your home.
2. Visit a dairy, creamery, or bottling plant to see the sanitary methods taken to protect your health.
3. How many of the Basic Seven foods come in glass jars and bottles? Make a list of as many as you can think of. Plan a nutritious luncheon using this list. (Example: Tomato juice, creamed chipped beef, peas or other vegetables, olives, stewed fruit, and milk.)
4. Write a story telling how glass containers are useful in good nutrition.

5. Decorate glass bottles and jars with enamel paints. Use as decanters or containers for ivy, etc.
6. Make a survey of present litter conditions in: your schoolroom, school building, playground, neighborhood and community. What is the cause?
7. Make posters and signs promoting clean neighborhoods.
8. Plan and carry through clean-up campaigns: on school grounds, a vacant lot, your neighborhood.
9. Design and make trash receptacles; a litter container for your car.
10. Collect empty soft drink bottles, and return to the store. Use money for a school project.

culminating activity: A "Keep America Beautiful" Assembly—

1. Plan a school assembly program as part of an anti-litter campaign.
2. Check on what community resources and organizations are available to assist with literature and materials—such as American Farm Bureau Federation, Boy's Club, Boy Scouts, Girl Scouts, Campfire Girls, 4-H Clubs, Garden Club of America, National Grange, National Wildlife Federation, U.S. Junior Chamber of Commerce. Or, you may wish to write di-

- rectly to the national headquarters of Keep America Beautiful, Inc., at 100 Park Ave., New York 17, N.Y.
3. Invite the head of one of the local organizations listed above to speak at your assembly.
4. Write invitations, asking parents to attend.
5. Prepare posters and other display material about "Keep America Beautiful."
6. Begin program with the Salute to the Flag, and end with singing "America, The Beautiful."

reprints
of this unit
are obtainable
from

Glass Container Manufacturers Institute, INC.

99 PARK AVENUE, NEW YORK 16, N.Y.

Reprinted from *Grade Teacher Magazine*

BIBLIOGRAPHY

Britannica Junior—see under *Glass*.

Compton's Encyclopedia—see under *Glass*.

Encyclopedia Britannica—see under *Glass*; *Bottle*; *Bottle Manufacture*.

World Book Encyclopedia—see under *Glass*; *Bottles in the Making*.

American Glass—by George and Helen McKearin. Crown Publishers, Inc., 419 Fourth Ave., New York 16, N. Y.

Glassmaking at Jamestown—by J. C. Harrington. The Dietz Press, 109 East Cary St., Richmond 19, Va. (booklet, 50 cents)

How Much Do You Know About Glass?—by Harlan Logan. Dodd Mead & Co., 432 Fourth Ave., New York 16, N. Y.

The Story of Glass—by Freda Diamond. Harcourt Brace & Co., 383 Madison Ave., New York 17, N. Y.

Printed in U.S.A.