The Story of the Tin Can

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As Told in Pictures

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The Story . . .

. . . of the Tin Can

When Nicolas Appert was making his experiments that led to the discovery of the art of canning, over one hundred and twenty years ago, he had to use bottles closed with corks, because no more suitable container was available. Those who undertook later to apply his discovery soon found that they must have a more satisfactory and cheaper container, one both efficient and easy to handle, if they were to make extensive use of this new way of preserving food. The search for such a container led to the development of the tin can.

It is a long way, of course, from the time when cans were made entirely by hand, and 60 cans was a good day’s output for an industrious workman, to the present time, when a single series of machines turn out better-made cans at the rate of 300 a minute. But these years of experiment, research and invention can be summed up in the simple statement that the modern tin can possesses all the qualities that the early-day canners thought a container should have, and in addition other qualities they did not realize would be advantageous. What are these qualities?

The can should be made of materials that do not affect the food. It should be the whole flavor of somenness or the food. It
container that can be sealed air-tight and that will remain air-tight. It should be of materials that conduct heat rapidly, so the contents may be heated and cooled quickly. It should be light in weight yet strong, able to stand comparatively rough handling without damage. It should be adaptable to products of different sizes and shapes. It should be a container that can be filled easily and rapidly and sealed both speedily and faultlessly. It should be inexpensive enough to make the canning of foods an economical method of preservation.

These are the requirements. How they are met in the modern tin can, and why it is practical and economical to manufacture billions of cans every year to be used only once, may be understood only when one knows of what cans are made and how.

Cans are simple, but their simplicity is the result of many inventions, of ingenious machines that do the work more rapidly and more accurately than hand labor. The story of the tin can thus becomes the story of tin, tin plate, and can making.

While the tin can is something comparatively new, tin itself was known and used in the prehistoric Bronze Age of man when tools and weapons were made of bronze—a combination of tin and copper. Thousands of years later, but still before the Christian era, Phenicians worked the mines at Cornwall, England, which still produce tin, although over three-fourths of the world’s output now comes from the far distant Federated Malay States, Dutch East Indies, and Bolivia. Our own country has no tin deposits of commercial importance. We use about half the world’s production of tin but we must depend on foreign countries to supply it.

Tin is not mined in pure metal form. The ore from which it is derived—tinstone or cassiterite—must be smelted and refined. The metal tin is soft, but not perceptibly dissolved by food products and is without detectible taste. The refined tin used in making tin plate for food cans is known as grade A, that is, at least 99.75 percent pure tin. Actually the tin used is generally purer than this, much of it being 99.9 percent pure tin.

Tin plate—steel sheets coated with a thin layer of tin, or about 98 percent steel and less than 2 percent tin—is said to have been first made in Bohemia late in the 13th century, and the industry was well established in England by 1655. This was long before the art of canning was discovered in 1810. Practically all the tin plate now used in making cans in the United States is produced in our own country.

Tin plate is so well suited for making cans, and cans have proved so satisfactory as food containers, that the manufacture of tin plate and cans have become large industries, using immense quantities of materials and providing employment for many thousands of people.

About 1,150,000 tons of tin plate are used annually to make cans of all kinds. Measured another way, that is five billion square feet of tin plate. To make this quantity of tin requires 1,692,000 tons of steel ingots, representing 1,880,000 tons of pig iron, which in turn require 3,420,000 tons of 55 percent iron ore. Ordinarily it takes a ton of coke to make a ton of pig iron, and it requires a ton and a half of coal for a
ton of coke. So, the making of the pig iron uses 2,320,-
000 tons of coal, while for heat and power in the various
refining processes that follow an additional 1,600,000
tons of coal are needed. Altogether, including the lime-
stone used for flux in the blast furnace, a mountain of
about 8,000,000 tons of minerals topped with 20,000 tons of tin is converted each
year into cans of various kinds.

In making tin plate the steel, which contains over 99 per cent of pure iron,
is cast in the form of ingots. These in-
gots are rolled into long “blooms,” which are in turn rolled into long sheet
bars which are sheared into shorter bars.
In the tin mill the sheet bars are cut into
small bars, and then follows a series of
heatings and rollings that eventually
bring the sheets to the desired thin-
ness. They are then pickled in a
hot acid bath to remove the “scale” of iron oxide which forms on the
surface of the sheet during the re-
peated heating and rolling opera-
tions, after which they are washed,
cold rolled to polish the surface,
and heated in a furnace to remove
the hardness caused by the cold
rolling process. Finally they are
given a dilute acid bath to remove the slight film of oxide
carried by the last heating and are again washed. They
are then ready for tinning. The finished sheets are about
one hundredth of an inch thick.

A recent practice is to roll the ingots into
slabs, which are reheated and rolled in a
continuous series of mills into strips, and
then into sheets. These and other modi-
fications of the process are being further developed.

Tinning is done by passing the steel sheets (called base
plate) through a bath (pot) of pure molten tin. With the
modern pots the sheets are fed into the pots mechanically
and carried through between rolls immersed in
the tin. The pot is di-
vided into two sections.
In the first section the molten tin is covered with
a layer of flux through which the steel sheets
pass as they enter the
molten metal. This flux cleans the surface of the sheets
so that the tin will adhere to them. The exit section of the
pot contains, above the layer of molten tin, a pure palm
oil, which coats the plate with a film of oil as it emerges
from the pot and keeps the surface bright by preventing oxidation and
the tarnishing of the hot tin by the
oxygen of the air. The thickness of the tin coating is governed by the
setting of the rolls and brushes
through which the plate passes in the
palm oil section of the pot.

After the sheets come from the
tin pot they pass through a cleaning
machine, which removes the oil and
also buffs or polishes the surface of the plate. Absorbent
material such as wheat or rye bran is used in the cleaning
machine for removal of excess oil. The plate is carefully in-
spected for
imperfect
sheets re-
defects, the
sheets are
then ready
the prime
for use in can making. Tin plate is graded according to the weight of the tin coating on the surface. The average amount of tin on the plate most commonly used for food cans is 1.35 pounds per “base box.” A “base box” is such quantity of tin plate as, regardless of dimensions, has on one side a total surface area of 31,360 square inches, and it weighs around 100 pounds. Both sides of the sheet are coated, of course, and on this grade of plate, which is termed “coke” plate, the 1.35 pounds of tin cover a total area of 62,720 square inches, or about 43½ square feet. Heavier coated plate, carrying from 2 pounds upward of tin per base box, is known as “charcoal” plate and is used for the more acid foods.

Cans are of many different shapes and sizes, but a description of the way an ordinary cylindrical can is made will show the care and ingenuity that go into the production of what seems so simple a thing.

The bodies (sides) and ends (tops and bottoms) of the cans are cut from sheets of tin plate of such size as will result in the least waste.

The first step in making the can bodies is to feed the flat sheet of tin plate through a machine that cuts the plate into smaller pieces, or body blanks as they are called, exactly the right size. Variations in the size of these blanks must be kept within a few thousandths of an inch.

The blanks are then fed into another machine called a body maker, which performs several different operations.

First, it notches the blanks at each corner of one end to remove part of the tin plate that would otherwise prevent proper sealing of the can. At the other end it cuts slits so that the end can be folded back in a subsequent operation.

The machine then turns back each end of the blank to form a narrow hook. As will be noted, the ends are turned back in opposite directions so that they will lock when the blank is bent to the form of a cylinder and the hooks are brought together. If the illustration is examined closely the reason is seen for notching the corners at one end of the blank. If the corners were not notched there would be four layers of tin plate at the end of the side seam, and this would make difficulty in sealing on the top and bottom.

Next, the machine applies flux for soldering. As will be seen later, both solder and flux are applied on the outside of the can.

The seam made by bringing the hooks together is then pressed, or rather, “bumped” tight. The appearance of this seam, if it is cut across and magnified, is shown by the illustration. The extra thickness occasioned by pressing the hooks together is on the inside of the cylinder, or body. On the outside of the seam is only a slight depression where the edges come together.

The body now passes over a second flux bath and then a bath of molten solder, and solder is applied only to the outside of the seam, thus ensuring that it is absolutely air tight and that the food in the can will not come in contact with the solder. The final step in making the body is to pass it through a machine called a flanger, which curls the rim outward at each end.

The body is now ready for the ends to be sealed on. One end (the bottom) is put on, of course, by the can manufacturer. The other end, or top, is sealed on by the canner after the can is filled with the product it is to contain. The same method of sealing is used for both top and bottom.

Ends for the cans are punched from the sheets of tin.
plate by a punch press. They are then passed through a machine that curls the rims.

A second machine then applies a thin film of rubber composition in this curl, and the end is ready, after careful inspection for possible defects, to be sealed on the body.

The purpose in making a flange on the body, curling the rim of the ends, and placing rubber composition in this curl, is shown by the enlarged illustration of the way the end and body come together.

The appearance of this point after a machine called a double-seamer crimps the end on the body explains why the seam is air tight. The curled rim of the end and the flange of the body are folded tightly together with the rubber composition between them. This makes it unnecessary to use solder in sealing on either the bottom or top of the can.

The final operation is to pass the can through an air-tester, which automatically removes any can that may be defective.

Can making is thus seen to be the operation of one machine after another. Each machine has an exact job to do and does it both accurately and rapidly.

Cans that are enameled on the inside are made in the same way as plain cans, the enamel being applied to the sheets of plate before they are cut into bodies and ends. The enamel is applied in a thin film by rolls, after which the sheets are carried by an endless chain conveyor through an oven that bakes the enamel on the plate.

Two types of enamel are in common use, both a golden yellow color. One type is used to prevent the bleaching of red fruits and also to protect the tin coating. The other is used to prevent the discoloration of the contents and the staining of the inside of the can such as occurs with some vegetable and meat products when packed in plain cans. Some foods contain sulphur and under heat this sulphur discolors the tin plate for the same reason that it discolors a spoon left in contact with a cooked egg. The stain is harmless but unattractive.

From this story of what goes into the making of the ordinary style of can, and the way the can itself is put together, it will be seen how well the tin can meets the requirements for a food container.

Steel and tin combine in tin plate to provide a material that is both strong and light, easy to form in different shapes and sizes, a good conductor of heat, and withal a material that does not affect the wholesomeness of the food in the can.

The way the can is constructed provides an air-tight seal—the chief requisite of a food container—and at the same time makes easy the operation of filling and closing the can.

Both the materials and the construction of the can lend themselves to machine production, and this permits a production cost that makes the tin can, though used but once, an economical container.
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