

COMMERCIAL METHODS OF CANNING MEATS.

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INTRODUCTION.

Modern canning methods may be said to date from the year 1795, when Nicholas Appert, a Frenchman, invented a process for preserving foods in hermetically sealed receptacles. Prior to this time drying and salting were the only methods employed to any extent for the preservation of foods.

Appert's process consisted in inclosing the articles to be preserved in glass jars, which were then corked and exposed to the action of boiling water in open kettles for varying lengths of time according to the nature of the article treated. Appert's process may be summed up in his own words, as follows:

It is obvious that this new method of preserving animal and vegetable substances proceeds from the simple principle of applying heat in a due degree to the several substances, after having deprived them as much as possible of all contact with the external air. It might, on the first view of the subject, be thought that a substance, either raw or previously acted on by fire, and afterwards put into bottles, might, if a vacuum were made in those bottles and they were completely corked, be preserved equally well as with the application of heat in the water bath. This would be an error, for all trials I have made convince me that the absolute privation of the contact of external air (the internal air being rendered of no effect by the action of heat) and the application of heat by means of the water bath, are both indispensable to the complete preservation of alimentary substances.

While Appert had no conception of the rôle played by micro-organisms in the spoilage of foods, his experiments clearly showed that a vacuum alone was not sufficient for the preservation of food-stuffs, and that the application of heat and the subsequent exclusion of the outside air were essential to their successful preservation. We now know that the air contains micro-organisms or germs which are responsible for the fermentation and putrefaction of foods.

The stimulus which prompted Appert's investigations was a prize offered by the French Government for a method of preserving foods for the use of the navy, and in 1809 the inventor was awarded the prize of 12,000 francs. The process was given to manufacturing firms in France and was soon carried to England.

At first the secret of the process was carefully guarded, but in time the employees of the different establishments became more or less familiar with the details of the process and in this way the method was carried from England to America about 1815 or 1818.

Ezra Daggett, originally in the employ of an English firm, is said to have first brought the secret to America, and as early as 1819, in partnership with his son-in-law, Thomas Kensett, was engaged in the packing of hermetically sealed food in New York City. Lobster, salmon, and oysters were among the first goods packed in America, but by 1825 fruits and vegetables were also canned.

In the early days of the canning industry glass jars were used, but owing to their bulkiness, cost, and easy breakage they were gradually abandoned for tin containers, which first came into use in 1825, when Thomas Kensett secured a patent on the use of tin cans in preserving food. The cans were at first made entirely by hand, and their early manufacture was crude, costly, and tedious, the making of 100 cans being considered a good day's work. The introduction of labor-saving machinery, however, has greatly lessened the cost of production, and the manufacture of cans has now become a distinct industry, although it is estimated that about 10 per cent of the cans used are still made by the canning establishments. Cans are now made entirely by machinery by means of complicated machines which cut the different parts and fit and solder them together, turning out the finished can with almost incredible rapidity. A single machine can now turn out as many as 90,000 cans in a day.

In the original Appert process the goods were cooked in open kettles in boiling water, 212° F. being, of course, the highest temperature obtainable. Later on higher temperatures were obtained through the addition of sodium and calcium chlorid to the surrounding water.

In 1874 A. K. Shriver, of Baltimore, invented a closed kettle for cooking the goods by superheating water with steam, and in the same year G. W. Fisher, also of Baltimore, invented an improved kettle in which dry steam was used, the principle being the same as that of the modern autoclave. By these methods, which are still in use, any desired temperature may be obtained and the time required for processing is materially reduced.

While the canning industry was established on a commercial basis in this country as early as 1825, it has only been within the last 25 or 30 years that the industry has become one of much importance. At first there was considerable skepticism on the part of the public in regard to the healthfulness of canned goods, and a more or less widespread prejudice existed against their use. This prejudice, however, has now largely disappeared, and the cost of production

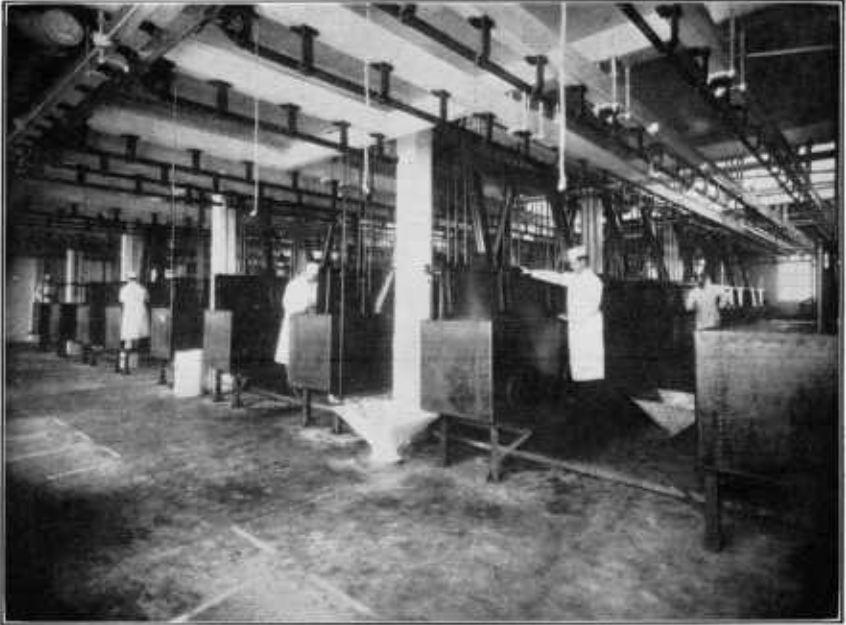


FIG. 1.—COOKING ROOM IN MODERN CANNING ESTABLISHMENT.



FIG. 2.—PREPARING CORNED BEEF FOR CANNING.
[Government inspector at center, Cutting machine shown at left.]



FIG. 1.—PREPARING PIGS' TONGUES FOR CANNING.
[Government inspector in foreground at right.]

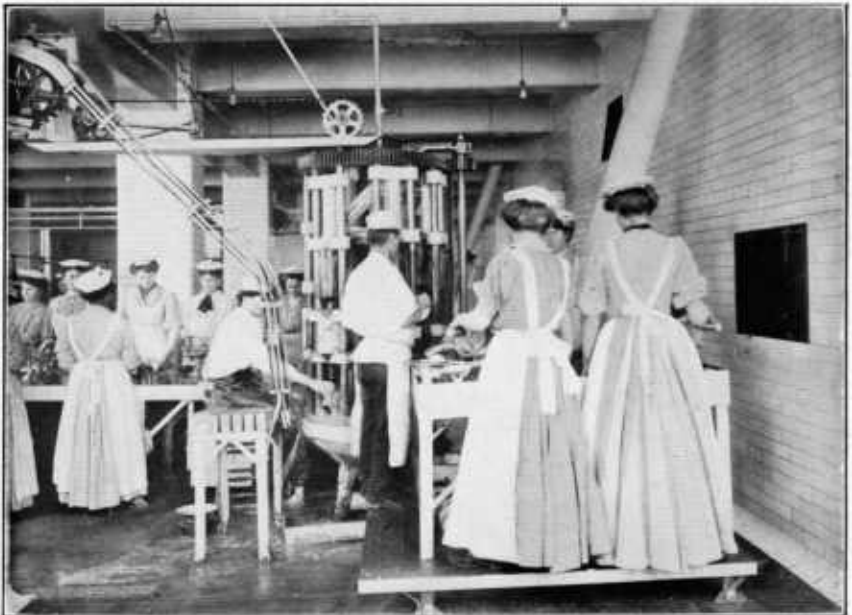


FIG. 2.—FILLING CANS WITH CORNED BEEF BY MACHINERY.



FIG. 1.—CAPPING THE CANS.

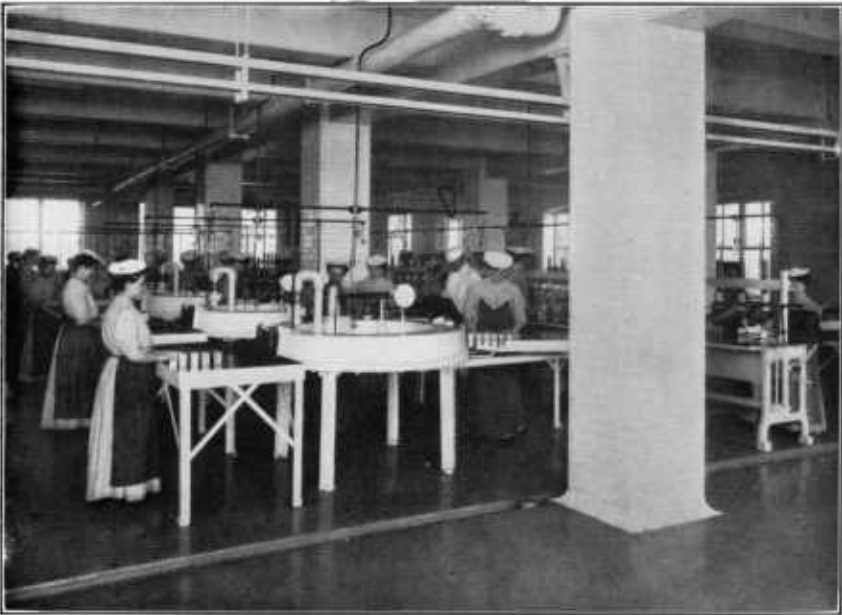


FIG. 2.—SEALING CANS IN VACUUM.

has been greatly lowered through the introduction of labor-saving machinery; consequently canned goods have now come into general use and the industry has become one of great economic importance.

In the canning of meats the great variety in the products prepared necessitates considerable variation in the methods employed, each product requiring a somewhat different treatment. The different packing establishments also have different methods of handling the same product, each establishment being inclined to view its own methods as somewhat better than those of other houses. It is impossible, therefore, to give a detailed description of the various methods employed, and in this article only a general description of the more important processes will be given.

PREPARATION OF THE PRODUCT PRIOR TO CANNING.

In the case of meats which are "processed" or heated in the can, it is customary to subject the meat to a preliminary cooking or parboiling before placing it in the cans. This is done in order to partly cook and at the same time to shrink the product.

The cooking is carried on in large iron tanks, fitted with iron tops, usually hinged, which may be raised or lowered. Sufficient water is used to cover the meat, and the water is heated by means of perforated steam coils in the bottom of the tank. A view of a cook room with tanks is shown in Plate XXXIV, figure 1.

When the meat has been sufficiently cooked it is removed from the boiling water by means of large metal forks and transferred to the "trimming bench," where the gristle, surplus fat, and bone are trimmed off. The meat then goes to the cutting machine, which cuts it into pieces, according to the size of the cans to be filled. After it is cut to the proper size the meat is passed down through a chute to a lower floor, to be packed in the cans. In Plate XXXIV, figure 2, the preparation of corned beef is shown.

In this connection it is interesting to note that gravity is utilized as much as possible in handling the meats. Thus the cooking is usually done at the top of the building, and the meat is then passed down through metal chutes from floor to floor, being subjected to the various manipulations of the canning process on its downward journey.

FILLING AND CAPPING THE CANS.

In the case of products like tongue and Vienna style sausage, where the form of the product is to be preserved, it is necessary to fill or "stuff" the cans by hand. In Plate XXXV, figure 1, the preparation of pigs' tongues is shown.

As will be seen from the illustrations, the work in the canning rooms is largely done by girls, who become wonderfully quick and adept in the work. The girls are furnished by the establishments with clean, washable uniforms, and present a very neat and tidy appearance. Most of the larger plants also employ manicurists to care for the girls' hands and see that they are kept clean.

In the case of corned beef and potted or deviled meat the cans are filled by machinery. The stuffing machines, which usually work on the rotary principle, consist of a series of pistons and cylinders. The cans are placed beneath the cylinders, and the meat is fed into the cylinders from above and is forced down into the cans by the pistons. In Plate XXXV, figure 2, one of these machines is shown in operation. The meat is fed into the stuffing machine with scoops in which the proper amount of meat for each is weighed approximately. When the can leaves the stuffing machine it is weighed and adjusted to the proper weight by adding to or taking out a little of the meat.

After the can has been weighed and the necessary adjustment made in the weight, the top is wiped and any projecting particles of meat are shoved down into the can so as not to interfere with the cap. The cap is next put in place and soldered under a rotary soldering machine. The process of capping the cans is shown in Plate XXXVI, figure 1. The capping machines consist of a series of small revolving tables upon which the cans are placed with the tops laid loosely in position. The caps are then clamped down from above and are soldered either by hand or by automatic soldering irons. When the cans leave the capping machine they have been completely sealed except for the small ventholes in the top, through which the air within the cans is to be later exhausted.

The cans are next inspected for cap leaks (i. e., leaks in the solder holding the cap), and these are repaired by hand.

SEALING THE CANS UNDER VACUUM.

The next step in the canning process consists in exhausting the air from the interior of the can, and this is usually effected by means of vacuum machines. The usual form of vacuum machine is shown in Plate XXXVI, figure 2, and consists of a large circular iron box with air-tight doors and a small glass window through which the vents are sealed by means of an electric soldering iron. The machine is filled with cans and closed, the vacuum is then applied, and the vents are sealed as the cans are brought beneath the window on the movable bottom of the machine.

From the vacuum machine the cans are run out on tables and again inspected for leaks. Any leaks that are found are at once repaired

by hand, the vents of these cans are then reopened, the cans replaced in the vacuum machine, and the vents resealed under vacuum. The cans are now ready to be processed.

PROCESSING THE CANS.

Processing consists in heating the cans to a sufficiently high temperature to insure the preservation of their contents, and constitutes one of the most important steps in the whole canning process. Two general methods of processing are followed, known as the "retort process" and the "water process."

In the retort method of processing the cans are placed in large iron or steel boilers, known as retorts, which can be securely closed by means of bolts. In these retorts the cans are subjected to the action of steam under pressure, and in this way high temperatures can be secured. The length of time the cans remain in the retorts and the temperatures employed depend upon the nature of the product and the size of the cans.

In the water method of processing the cans are placed in large open kettles or tanks filled with water, which is raised to and maintained at the boiling temperature by means of steam pipes. The cans remain in the boiling water for varying lengths of time, depending upon the size of the can and the nature of the product.

SPRAYING AND WASHING.

After they have been processed the cans are placed under a cold spray and allowed to remain until thoroughly chilled. When they leave the retorts or kettles in which they are heated the ends of the cans are bulged outward, owing to the expansion of the contents by the heat to which they have been subjected, but after they are chilled the ends of the cans draw in and present a slightly concaved appearance. The cans are now subjected to another inspection, and any that are defective or leaky may be readily detected, as in these cans the ends remain bulged after chilling.

The cans are next passed through a washing machine, which consists of a long iron tank fitted with a movable carrier, by means of which the cans are slowly passed through a hot solution of caustic soda. This is done to remove any fat or grease that may adhere to the cans and is necessary in order that the cans may be subsequently painted. After passing through the soda solution the cans are washed with hot water in order to remove the alkali.

The cans are now ready for painting and labeling, but before being transferred to the paint and label rooms they undergo another inspection at the hands of experts, who feel and tap each can. All cans which emit a hollow sound when tapped are cast aside.

PAINTING, LABELING, AND PACKING.

Painting and labeling constitute the finishing touches whereby the cans are transformed into the attractive packages which we see on the shelves of the grocery stores. The painting is done by hand, as no satisfactory machine has yet been devised for applying the paint to the cans. The cans are painted on long, slat-topped tables, upon which they are stacked in great piles with spaces between the cans to allow for drying. Beneath the tables are steam pipes to hasten the drying. The girls who paint the cans are quite expert in detecting leaky cans, so that the cans really get another inspection at this time.

The cans remain in the paint rooms, as a rule, for several days at a temperature favorable to the growth of bacteria, and this gives an opportunity for the development of what are known as "slow leakers." A slow-leaking can is one that contains a small leak, through which the air gains entrance to the interior of the can. In time such cans become "swellers," owing to the development within the cans of bacteria, which set up putrefactive changes, resulting in the formation of gases, which cause the cans to swell. A swelled can is one in which the ends are bulged outward, and such cans give a hollow or drumlike sound when struck.

After they have been painted the cans are ready for labeling, and this, like the painting, is mostly handwork. Machines have been devised for attaching labels to the smaller cans, but do not seem to be altogether satisfactory. The girls who attach the labels become wonderfully adept, however, and the machinelike rapidity with which they work is truly astonishing.

After they have been labeled the cans are usually packed in crates or cases and placed in stock. The men who do the packing, like the girls who do the painting and labeling, are quite expert in detecting leakers, so that the cans thus undergo still another inspection before they are packed. The operations of painting, labeling, wrapping, and packing occupy several days, as a rule, and this gives an opportunity for the development of the slow leakers, which have been described.

GOVERNMENT INSPECTION AND THOROUGHNESS OF THE METHODS
EMPLOYED.

The canning of all meats at establishments which conduct interstate or foreign trade is carried on under the supervision of Government meat inspectors, who watch the process from start to finish. The Government inspectors are men who have had years of practical experience in the canning of meats and have at their fingers' ends the details of the various processes employed. These men not

only watch the condition and quality of the meats that go into the cans, but are careful to see that the meats are handled in a cleanly and sanitary manner and that the methods of processing are adequate and thorough.

The proper methods of processing the various meat products have been carefully worked out and perfected by the different packing establishments. As a check on their methods of processing, however, most establishments maintain test rooms or hot rooms, which are small rooms fitted with tiers of open-work metal shelves and maintained usually at a temperature of 100° to 110° F. A sample batch of each run of canned goods is placed in the test room and kept there for a week or 10 days, and if at the end of this time the cans show no signs of swelling the packer feels sure that his cans have been properly processed and that they will withstand even the summer temperature of a warm climate.

Occasionally, in spite of the frequent inspections and tests which the cans receive before they leave the canning establishment, a slow leaking can will get out on the market, and if the weather is warm or the can goes to a warm climate it may later develop into a sweller upon the shelf of the retailer. In this case the retailer will usually notice the condition of the can and either return it to the packing establishment from which it came or charge the latter with the loss. It is just as well, however, for the consumer of canned goods to know the difference between a sound can and one that is not sound, and this can be determined even by the layman. If the ends of the can are slightly drawn in or concaved and the can emits a dull sound when struck on the top and bottom, the can may be considered a sound one. When, however, the ends of a can are bulged outward and the can emits a hollow or drumlike sound when struck on the top or bottom such a can should be regarded with suspicion, and if, on making a small puncture in such a can, the sound of escaping gas can be heard, it is proof positive that the contents have undergone putrefactive changes resulting in the formation of gases, and such cans, of course, should be rejected. However, the chief concern in packing establishments is to see that no defective or leaky cans get out on the market, and in view of the frequent inspections which the cans receive in the course of preparation it is safe to say that very rarely does a defective can reach the consumer.

VALUE AND USEFULNESS OF CANNED GOODS.

In the canning of meats under Government inspection no preservatives are used; in fact, they are not necessary, as meats can be readily preserved by the aid of heat alone. As to the value and wholesomeness of canned meats there can be no question. They fill

an especially useful rôle in the provisioning of armies and navies, and our great packing establishments claim with a considerable degree of truth that they must be considered an important factor in the conduct of a successful campaign by contending nations. In the Russo-Japanese war the Japanese forces were supplied with canned meats obtained chiefly from the United States. For exploring and camping expeditions, in mining and logging camps, and for field work generally, canned goods are now almost indispensable. Aside from these uses, however, canned goods are being used more and more in the homes of the people, and statistics show that the canning industry has come to fill an important place in the feeding of the race.