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Your Pressure Cooker: How to Choose It and How to Use it for Canning

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- HOW TO CHOOSE IT
- HOW TO USE IT FOR CANNING

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Your Pressure Cooker
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FROM years of experience and research, authorities on canning are of the opinion that for safety all nonacid foods, such as meats and vegetables, should be processed at temperatures of at least 240 to 250 degrees Fahrenheit. For this reason the steam pressure cooker becomes an important piece of equipment, because by using steam under pressure these higher processing temperatures can be attained. However, it is essential that both old and new cookers be in perfect condition or they may have no advantage over the other types of processing equipment. Old cookers should be inspected at the beginning of the canning season and any faulty parts either repaired or replaced. New cookers should be closely inspected to determine their proficiency as canning equipment. Perhaps more people would be willing to use pressure cookers if they knew more about them and the way they should be operated. Briefly discussed in the following pages are some of the pertinent facts relative to the choice of a new cooker and to the operation of both old and new ones. For specific procedure pertaining to the preparation of foods, packing of cans, size and kind of containers, etc., and other methods of processing, consult Farmer's Bulletin 1762.[1]

HOW TO CHOOSE THE PRESSURE COOKER

The choice of a pressure cooker should be based upon the following: (1) the size and shape, (2) the material from which it is made, (3) the method of sealing and clamping, (4) the type of pressure gauge, (5) the type of safety valve, (6) the type of petcock, and (7) the possible use of a thermometer.

Size and Shape

The size of the pressure cooker should be governed by how it is to be used — whether primarily for cooking or primarily for canning. If it is to be used mostly for the cooking of meals for the average-sized family, a cooker with a capacity of 11 or 12 quarts will be found easiest to handle. The small-sized cookers are not as satisfactory for canning because they hold such a small number of jars at one time. This makes it necessary to reload the cooker more often and hence less food can be processed in a day because of the extra time necessary to heat and cool the cooker. For the average-sized family an 18-quart to 25-quart cooker should be adequate for canning. When a great amount of canning is done at one time it might be necessary to use a 40-quart canner; however, the 25- and 40-quart cookers are very heavy to handle when filled. The size of the cooker is usually given in terms of its liquid capacity; that is, a 12-quart

[1] "Home Canning of Fruits, Vegetables and Meats," Farmers' Bulletin 1762, U.S.D.A. This bulletin may be obtained from the Superintendent of Documents, Washington, D. C., for five cents.

cooker will hold 12 quarts of water, an 18-quart cooker will hold 18 quarts, etc., but in selecting a pressure cooker for canning, the important thing to know is how many cans or jars may be processed at one time. The approximate capacities of various sized cookers are listed below:

Size in quarts	*Pint jars*	*Quart jars*	*No. 2 cans*	*No. 3 cans*
40	24	16	30	21
20–25	17	7	18	10
18	9	7	15	8
12	7	4	10	5
9	5	3	5	3

Slight changes in capacities from those above may be expected for cookers of different makes because of variations in dimensions and shapes, especially for cookers in the 20-to-25 quart sizes. Typical pressure cookers of various sizes and shapes are shown in Figures 1 to 8 inclusive.

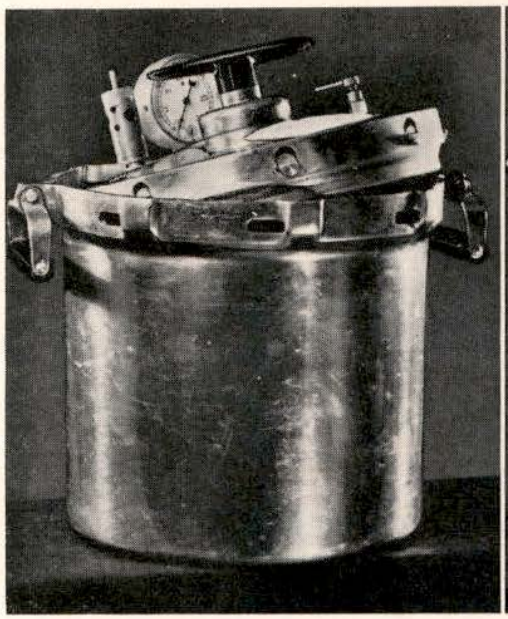

FIG. 1.—Cooker I, eleven-quart aluminum with central sealing device. Satisfactory dial on pressure gauge. The petcock was improved in the laboratory by adding a small bar which made closing and opening easier.

FIG. 2.—Cooker II, twelve-quart aluminum conventional-type seal using yoke bolts and wing nuts. Satisfactory dial on pressure gauge. Safety valve and petcock combined. Small knob at left of pressure gauge is a safety plug.

Kind of Material

The majority of pressure cookers are made of aluminum, but household cookers which are made of steel and are designed primarily for canning may also be obtained. Whether the aluminum cooker is cast or stamped, the side walls and bottom should be of even thickness so that

the expansion due to heat will be uniform. Both the inside and outside of the walls should be smooth and free from pits. Steel cookers should be heavily tinned or finished in some manner that will make them rust-resistant. Steel cookers such as cooker V finished in porcelain enamel must be handled with care because porcelain enamel will chip.

Steel cookers are lighter in weight than aluminum ones of the same size, because they can have thinner walls and still have the same strength as the aluminum cookers. Another advantage of the steel cooker is its lower initial cost. An aluminum cooker may cost from $2.00 to $7.00 more than a steel one of similar size. With respect to price, keep in mind that as with all other equipment, some manufacturers ask exorbitant prices for cookers which are not superior to some of those at a lower price.

As an all-purpose cooker, aluminum seems to have an advantage because the steel cookers cannot be as successfully used where only a little water is needed. This would be particularly true for the enameled cooker if it were used for searing meat, because it would be more than probable that the intense heat would crack and chip the porcelain enamel.

As far as kind of material is concerned, both types of cookers have advantages and disadvantages, and a choice between them will be governed by factors other than material.

FIG. 3.—Cooker III, eighteen-quart aluminum, bead-and-groove-type seal using "C" clamps. Pressure gauge dial unsatisfactory because pointer movement is too small. Combined safety valve and petcock not the best because petcock must be held open to release air and steam.

Sealing and Clamping

The method of sealing and ease of clamping are important. Experience in the laboratory has shown that cookers IV and V were the easiest to clamp; that is, they required the least effort to make a tight seal. Next in order of ease of clamping is cooker II. It should be noticed on cooker II that the bolts swing away from the cover and that the wing nuts furnish a fair grip. In contrast to cooker II is cooker III, which has three disadvantages. First, the "C" clamps are hard to arrange so that they will not be in the way while one is removing the cover; second, the round knobs are hard to grip for tightening the cover; and third, the bead on the cooker could be easily dented, which of course would spoil the sealing qualities. The bead and groove are shown in Figure 4.

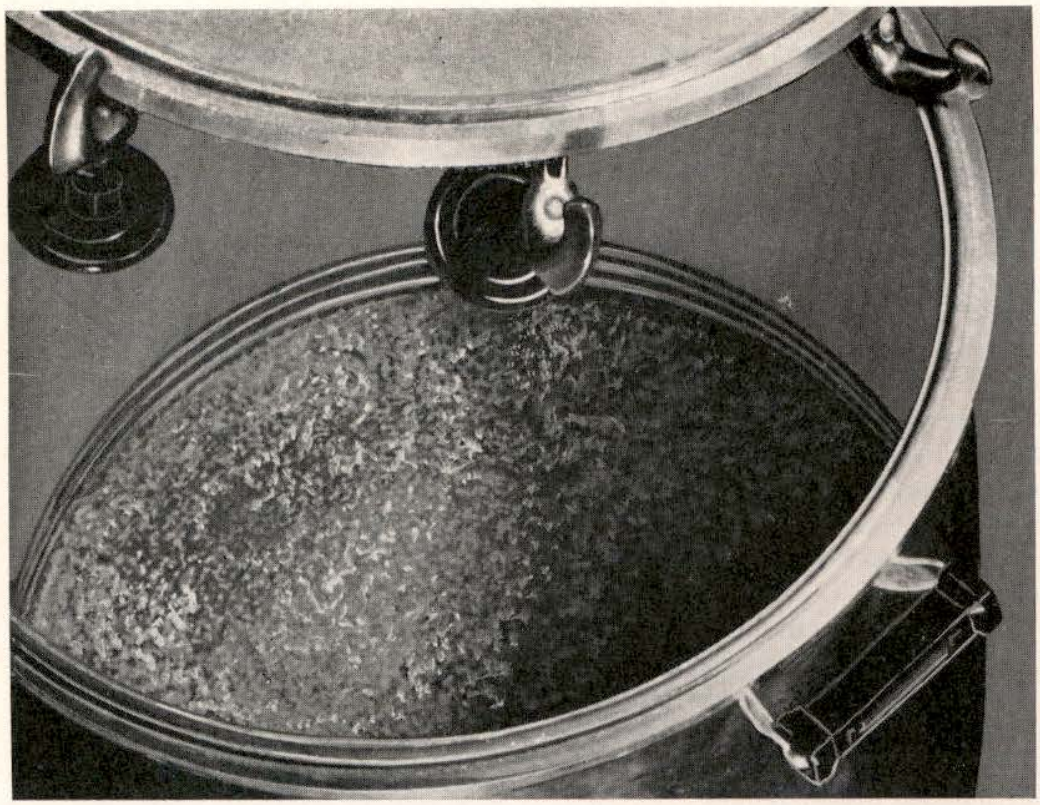

FIG. 4.—Cooker III, showing bead on body of cooker and groove on cover. This type of seal is unsatisfactory because the bead can be easily damaged.

Cooker I is convenient, because it is necessary to tighten only the one central handle, but it has been observed that this type of clamping is subject to excessive wear, causing the cap under the handle to catch. Both cover and body of all cookers should be marked clearly with arrows so that the cover can always be fitted in the same place. This is essential for good sealing. On steel cookers the seal between the body and cover is accomplished by means of a rubber gasket which may have to be replaced occasionally with a new one to keep the seal in good condition.

Of the two cookers V and VI, the seal on cooker V was found to be the better, because it has been observed that the rim on the cover of cooker VI is in some cases likely to spring enough to develop a leak, no matter how tightly the clamps are adjusted. With the type of clamping on cooker VI it is essential that the rim of the cover remain absolutely rigid. This cooker would have a better seal if at least eight clamps were used instead of six. These clamps would be easier to operate if the handles were two inches longer. At present, clamping can be made easier by using a piece of one-half inch gas pipe four or five inches long as an extension handle.

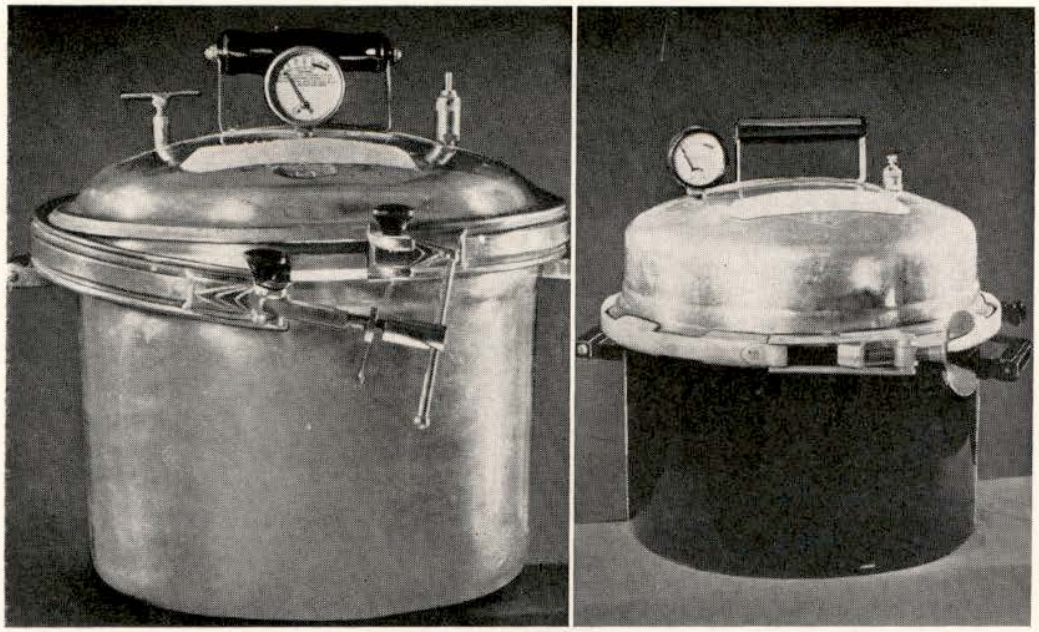

FIG. 5.—Cooker IV (left), nineteen-quart aluminum with band-type clamp. Pressure cooker dial unsatisfactory. Safety valve easy to clean but spring characteristics can be changed. Petcock same type as shown in Figure 13.

FIG. 6.—Cooker V (right), fourteen-quart enameled steel body, tinned steel cover. Band-type clamp. Canning capacity equivalent to 20-quart cooker. The petcock on the combined safety valve and petcock must be held open to release air and steam. Dial on the pressure gauge unsatisfactory. The band on this cooker is supposed to act as a safety plug letting steam escape at 30 pounds per square inch pressure.

Pressure Gauges

The pressure gauge is the heart of the pressure cooker, for it is the instrument that indicates the pressure within the cooker and consequently when correctly used it indicates the processing temperature for live steam.[2]

All gauges on household pressure cookers operate on the same principle, but they differ in the manner of coupling the internal mechanism to the pointer. In Figure 9 the dials on two gauges have been removed so that the internal mechanism is shown. The center gauge has a gear coupling so that for the same pressure its pointer moves almost five times as far as the pointer on the gauge at the left. This is evident by comparing the pointer positions in Figure 9 with reference to the white marks on the glass. With the gear-coupled pointer the dial can be marked like the dial on the gauge at the right in Figure 9. This dial is graduated in intervals of one pound of pressure per square inch.

With the other type of coupling the dials are graduated in five pounds per square inch intervals and readings of one pound per square inch are

[2] "The Accuracy of Pressure Gauges Used on Household Steam Pressure Cookers," Research Bulletin 99, Agr. Exp. Sta., University of Nebraska.

FIG. 7.—Cooker V (left), showing inside of cover. The rubber gasket can be replaced when the old ones become imperfect.

FIG. 8.—Cooker VI (right), eighteen-quart tinned steel cooker. Pressure gauge dial satisfactory. Combined safety valve and petcock satisfactory. The seal on this cooker would be better if at least eight clamps were used instead of six.

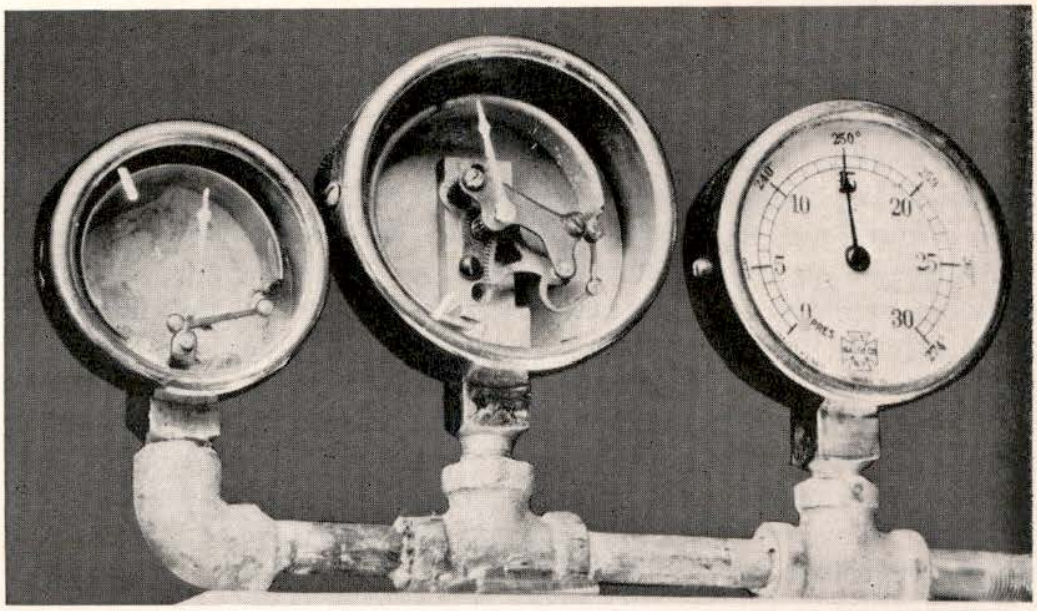

FIG. 9.—Pressure gauges with dials removed to show internal mechanism. The pointer on the center gauge has moved about five times as far as the pointer on the left-hand gauge, as is shown by the distance the pointers are from the white marks on the glass. The dial shown on the right-hand gauge is satisfactory. Temperature readings on the dial should be disregarded because they are only true for average barometric pressure at sea level.

hard to estimate. Such dials are shown on cookers III, IV, and V. For ease of reading, the dial on the pressure gauge should be at least two inches in diameter. It should be clearly marked in one-pound-per-square-inch divisions and have the markings from 0 to 20 spread over at least half of the dial face. However, it should be noted that gauges with either type of pointer movements are liable to become inaccurate after they have been used, and consequently gauge accuracy will depend on more than pointer movement. Refer to the section on gauge corrections.

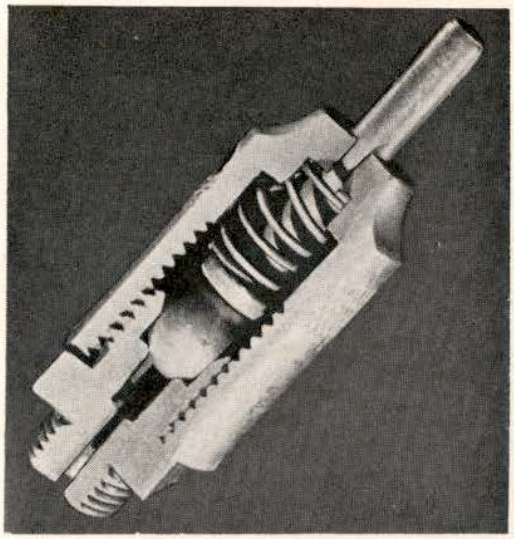

FIG. 10.—Ball-and-socket-type safety valve. This type of valve is easy to clean. The steel ball and valve seat should be kept shining clean.

Safety Valves and Petcocks

The safety valve on a pressure cooker does just what its name implies; it releases the steam if the pressure goes beyond a certain point. Usually safety valves are adjusted to "blow off" at pressures of about 22 to 25 pounds per square inch. A ball-and-socket type valve is shown in Figure 10 and a modified needle valve type which is also a combined safety valve and petcock is shown in Figure 11. With the handle in the upright position, a center needle valve is raised. This portion of the valve is the petcock and is shown removed in Figure 12. This valve is a good example of a combined safety valve and petcock, but it has the drawback that the valve is difficult to remove for cleaning. The combined safety valve and petcock shown on cookers III and V are inconvenient to use because it is necessary to hold the petcock open in order to release air and steam. Safety valves must be kept clean and free from corrosion. They should always be chosen with this fact in mind. Also the spring should be heavy enough to prevent distortion by pressing or stretching with the fingers, since such distortions will change the "blow-off" characteristics of the valve.

FIG. 11.—Modified needle valve, also a combined safety valve and petcock. This is satisfactory but has the drawback that the valve seat is hard to clean.

As an added safety precaution it is well to have the cooker equipped with a safety plug. These plugs release the pressure in case the safety valve becomes injured and usually act at pressures of 40 to 50 pounds per square inch.

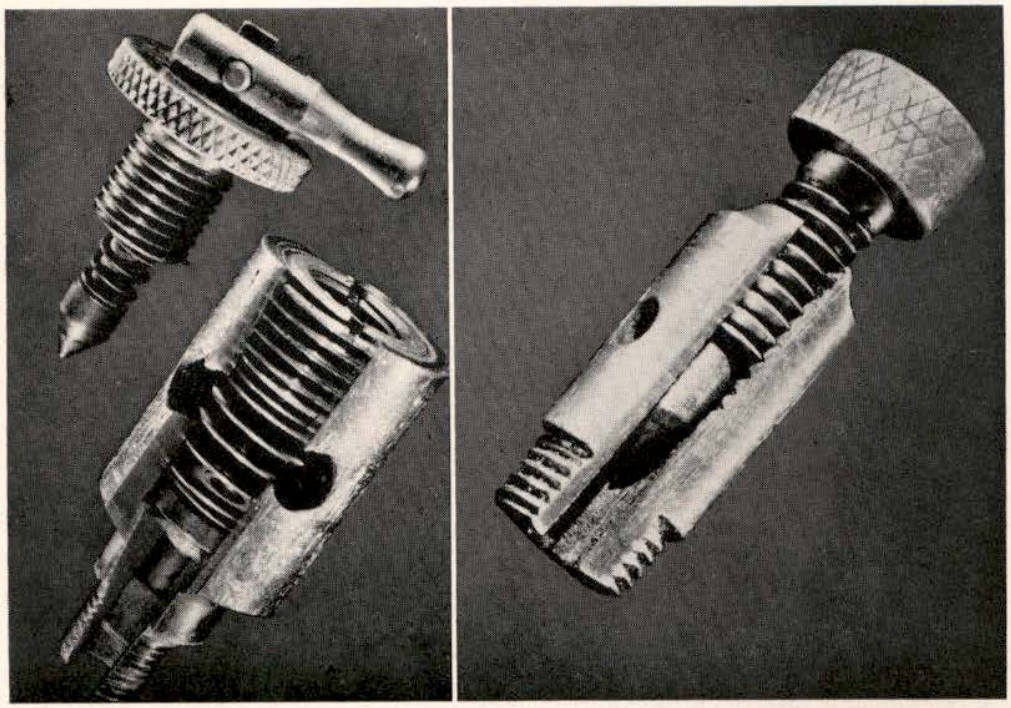

FIG. 12.—Combined safety valve and petcock (left) showing petcock portion removed.
FIG. 13.—Needle-type petcock (right). This petcock would be better if the knob were larger and made of wood or other non-heat-conducting material.

Caution! To keep your safety valve in good working condition, *keep all parts shining clean,* and do not tamper with the spring.

Where the petcock is not combined with the safety valve, petcocks like those in Figures 13 and 14 are commonly used. The petcock in Figure 13 is easier to close and open than the petcock in Figure 14. The plug in the petcock in Figure 14 must be kept tight, and this makes it difficult to turn the handle with the fingers. However, aside from ease of operation, either type is satisfactory.

A Thermometer for Pressure Cookers

While it is not necessary that a pressure cooker be equipped with both pressure gauge and thermometer, it will be found that the thermometer is a worthwhile instrument to add. At present the cost of adding a thermometer is about $5.00. With the thermometer all processing can

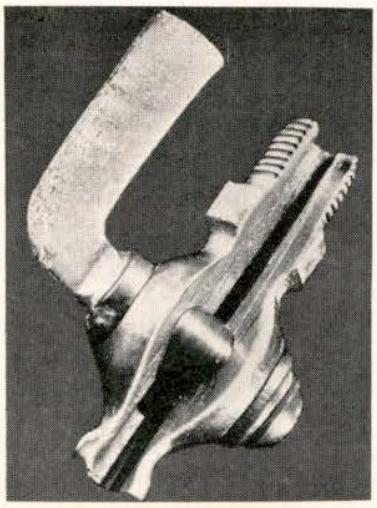

FIG. 14.—Plug-type petcock showing plug valve. Because the plug must be kept tight to prevent leaks, this valve is hard to open and close.

be done directly in terms of temperature and this will eliminate the uncertainty of processing with a faulty pressure gauge. It is possible that the mercury column in the thermometer might be separated when it is first received but this can be easily rejoined by putting the bulb of the thermometer in an ice and salt mixture. After leaving it there for a few minutes a gentle tapping of the thermometer frame will rejoin the mercury.

The usual household pressure cookers do not have the necessary hole for adding a thermometer but any plumber can easily install it. The thermometer used on household cookers requires a hole tapped with $\frac{3}{8}$-inch pipe threads. A cooker equipped with a pressure cooker thermometer is shown in Figure 15.

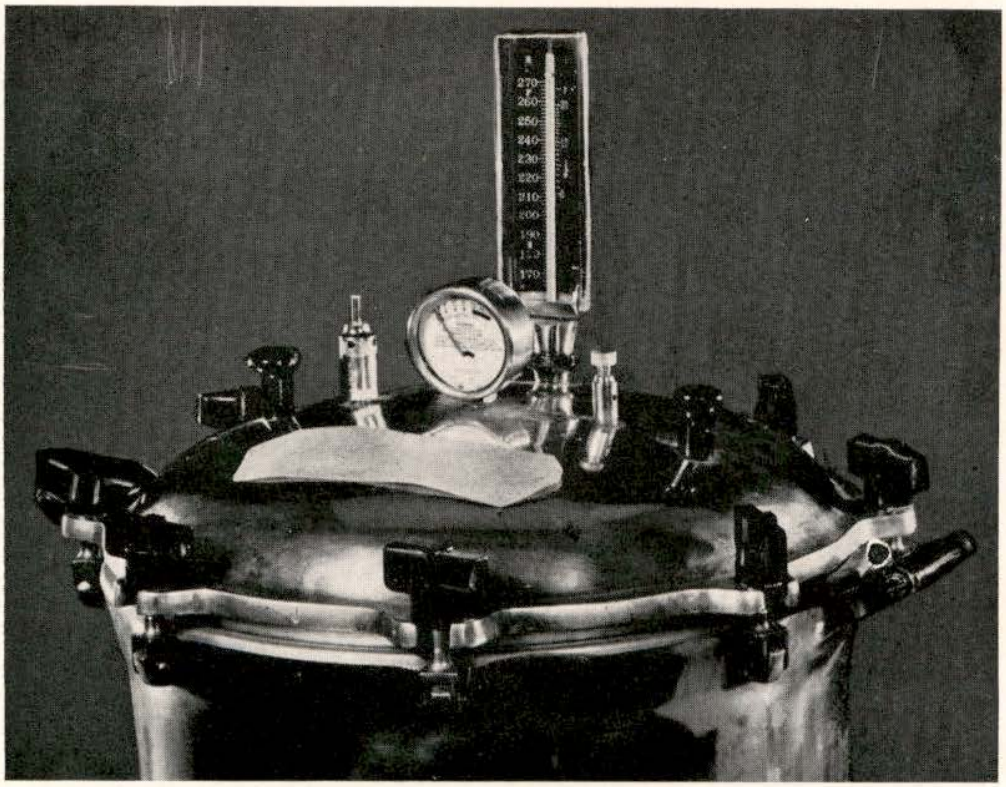

FIG. 15.—Pressure cooker equipped with a pressure cooker thermometer.

USING THE PRESSURE COOKER FOR CANNING

The Reason for Using the Pressure Cooker

With the water bath and oven methods of processing it is impossible to obtain a higher temperature than the boiling point of water and canning authorities agree that nonacid foods should be processed at higher temperatures than 212° F. to eliminate the common causes of spoilage. These higher temperatures can only be obtained by using steam under pressure. In the pressure cooker when the water first begins to boil the temperature will be the same as it would be in an open kettle, but since the steam which is formed cannot escape from the pressure cooker, the pressure above the water will be increased and consequently the boiling point will be raised. As more heat is added this process continues until the pressure is sufficient to raise the boiling point of the water to any desired temperature. For processing food the desired temperature is usually 250° F. At sea level a temperature of approximately 228° F. can be obtained by raising the pressure 5 pounds per square inch and a temperature of 240° F. will be obtained if the pressure is raised 10 pounds per square inch and similarly the temperature will be 250° F. if the pressure is increased to 15 pounds per square inch. These are the pressures that are read on the pressure gauge of the pressure cooker.

Altitude Correction

Everyone knows that it takes a longer time to cook food by boiling in the mountains than it does at sea level. This is because the barometric pressure in the mountains is less than at sea level, and consequently the temperature of boiling water is less. Likewise when the pressure cooker is used in the mountains the water starts to boil at a lower temperature than it does at sea level and to raise the temperature of the water or steam to 250° F. the pressure as indicated by the pressure gauge must be greater than it was at sea level. For instance, at an elevation of 5,000 feet this gauge pressure would have to be 17½ pounds per square inch to give a temperature of 250°. Many people forget that in using the pressure cooker any decrease in barometric pressure must be compensated by increasing the pressure shown by the pressure gauge. *It should be remembered that when the processing is being done at altitudes of 1,000 feet or more the gauge pressure should be increased a half pound per square inch for each additional 1,000 feet in elevation.* This correction is commonly called the altitude correction.

Correction for Faulty Gauge

If the gauge is accurate the altitude correction is the only one that is needed, but unfortunately many old and new gauges are inaccurate and a gauge correction must be added to the altitude correction to obtain the pressure that will give the processing temperature desired. Sometimes there is an error in the gauge that is obvious. This is the case when the pointer does not rest upon the zero mark when the cooker is not being used. Since some new gauges are faulty when purchased and others

develop an error with use, it is recommended that the pressure gauge should be checked at the beginning of each canning season. The recommendation is based upon a study of both old and new gauges which showed that only 25 per cent of the gauges tested were correct to within one-half pound per square inch. Gauges may be checked by removing and mailing them to this Experiment Station, Household Equipment Laboratory, or by returning them to a manufacturer who advertises such service. Whenever a gauge has been sent away to be checked there should be returned with it a statement showing what dial readings correspond to actual pressures of 5, 10, and 15 pounds per square inch.

Temperatures

The temperatures indicated on the pressure gauge should not be used as indicators of the processing temperatures, because these temperatures are correct only for processing at sea level with an accurate gauge. It is best to follow the policy of doing all processing in terms of the correct processing pressure. If it is desired to process in terms of temperature readings, the pressure cooker should be equipped with a pressure-cooker thermometer.

General Procedure for Processing

The general procedure for processing food in a pressure cooker is well standardized but certain instructions should be emphasized. A brief outline of procedure is worth repeating.

Amount of water needed.—Remember that water is necessary for the production of steam. The canner should contain boiling water to a depth of about one inch or at least to a level just below the canning rack. After processing each load, replace the water lost by evaporation so that the cooker will not boil dry.

Loading the cooker.—A free circulation of steam around the containers is essential. The method of placing the cans will depend upon the shape of the cooker. Tin cans may be arranged in tiers if a wire rack is used.

Sealing the cooker.—After loading, the cover should be fastened securely. Both the cover and cooker body should be marked with an arrow to make sure that the cover is always adjusted in the same place on the cooker. For cookers of the type shown in Figures 2 and 3, start clamping by moderately tightening opposite pairs of clamps and then repeat until each opposite pair is tightened securely. The method of sealing will do much to prevent the escape of steam from around the rim. There should be no escape of steam from a new cooker except from the petcock. However, where there are small leaks from around the rim or from the safety valve, add extra water to compensate for this vapor loss so that the cooker will not boil dry. Small leaks will not interfere with the processing if the correct pressure can be maintained.

Exhaustion of air.—It is absolutely essential that all air be exhausted from the cooker. With air in the cooker, even though the correct pressure is maintained, the temperature of the steam may not be uniform because of air-pockets. Until an automatic air-release valve is designed for

pressure cookers it will be necessary to let steam escape from the petcock for at least four minutes in a *steady stream*. After all the air is exhausted close the petcock and let the cooker come to the desired processing pressure.

Processing period.—Begin counting time at the moment the desired pressure is reached. Regulate the heat so that there will be no fluctuation in pressure, because a variation of from three to five pounds per square inch may cause some loss of liquid from glass jars. Be particularly careful not to let the pressure reach the point where the safety valve will release or "blow off," because the resulting sudden rapid decrease in pressure will cause even greater loss of liquid from glass jars.

Releasing pressure after processing.—When the processing is completed, remove the cooker from the stove but do not open the petcock if using glass jars and No. 3 or larger tin cans. A rapid release of pressure might cause a loss of liquid from glass jars and a buckling of large tin cans. Let the pressure come to zero by natural cooling of the cooker and then open the petcock gradually so that a vacuum will not be created. Do not hasten the cooling by using cold water or wet cloths, because there is a possibility that such cooling might warp or crack the cooker. For No. 2½ or smaller tin cans the pressure may be reduced by gradually releasing steam from the petcock.

Cleaning the cooker.—After use it is essential that the cooker be thoroughly cleaned. Special attention should be given to the rims of the cooker and cover, which make the sealing joint. Besides being kept clean these surfaces must not be dented or marred in any manner, because this will injure the sealing qualities. Make sure that the valve seat on the safety valve is clean and free from corrosion, because it is at this point that most serious leaks in the cooker start. Also, it must be remembered that dirt in the safety valve might cause it to stick and thus fail to release if a critical pressure is reached. Silver polish may be used to keep valve and valve seat shining clean. After cleaning, the valve should be thoroughly dried to prevent the rusting of any steel parts. Keep the petcock clean and working freely. Keep the opening into the pressure gauge clean and do not immerse the pressure gauge in water. The cooker should be stored with the cover turned upside down with a paper over the top to keep dust out of the openings. This will insure air reaching the inside of the cooker and prevent a stale odor from forming.

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