

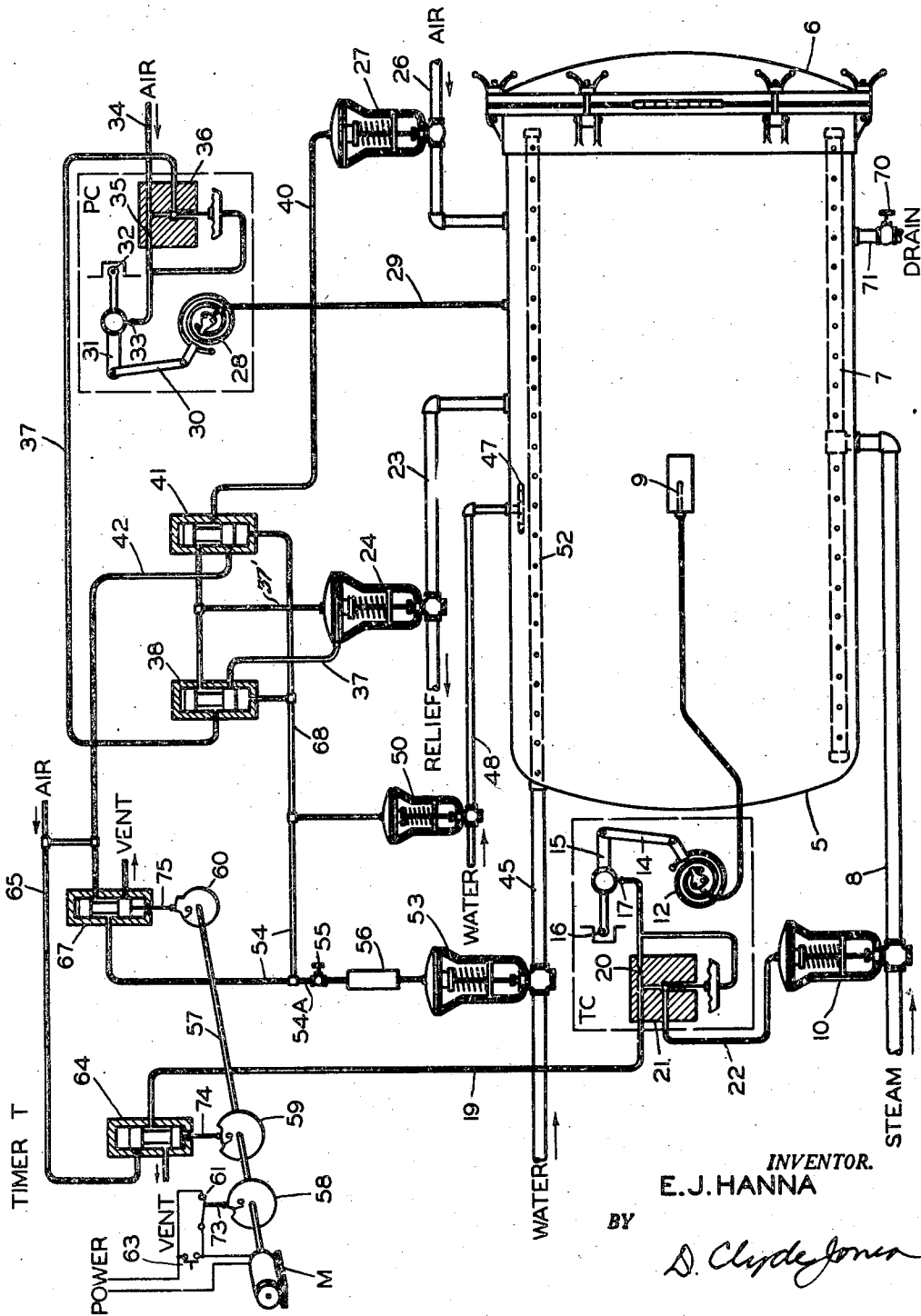
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APPARATUS FOR THE HEAT PROCESSING OF CANNED PRODUCTS

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APPARATUS FOR THE HEAT PROCESSING
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This invention relates to an apparatus for the heat processing of cooked canned products.

In accordance with one way of processing canned products to be cooked, the cans are placed in a sealed retort into which steam is introduced as the heating medium. The pressure of this steam against the outside of the cans during the processing operation, is made to equal approximately the internal pressure within the cans so that distortion of the walls of the cans will be avoided. When the processing operation is to be ended, a cooling agent such as water is introduced into the retort to cool promptly the products within the cans and thereby prevent overcooking. Such introduction of water causes the steam in the retort to condense with the result that the steam pressure drops. However, the pressure within the cans does not drop as promptly as the external steam pressure so that there is a tendency for the cans to become distorted due to these unequal external and internal pressures. In the past, an attempt has been made to prevent such distortion by automatically introducing compressed air into the retort in amounts intended to compensate for the drop in steam pressure. In prior arrangements, it has been the practice for a responsible workman to operate manually a valve in the cold water supply pipe leading into the retort with the intent that the cold water will be introduced at such a rate that the pressure regulator can introduce compressed air in just the right amount to compensate for the drop in steam pressure.

In the drawing, the numeral 5 designates a horizontally extending, cylindrical retort herein illustrated as having one open end which can be sealed closed by a hinged cover or door 6. A steam jet 7, in the form of a perforated pipe, extends along the bottom of the inner surface of the retort. The jet is connected to an external pipe 8, leading to a source of steam (not shown) which is used to heat the contents of the retort, namely, cans (not shown) containing products to be processed.

A temperature controller TC, together with the bulb of its thermosensitive tube system extending into the retort and with the normally closed motor diaphragm valve 10 connected in the steam pipe 8, functions to admit steam into the retort in amounts as required to maintain a predetermined temperature within the retort during a processing period of predetermined duration. The tube system, which is filled with a thermosensitive medium, comprises the bulb 9, communicating through the capillary tube, with a Bour-

don spring 12 mounted within the case (indicated by the broken line rectangle) of the temperature controller TC. The free end of the Bourdon spring tends to unwind in response to an increase in temperature at the bulb 9, but tends to wind up in response to a temperature drop thereat. As the spring 12 unwinds or winds up, it acts through a link 14 to swing a baffle 15 about its fixed pivot 16 with respect to a nozzle 17. During the processing interval, compressed air is supplied to the nozzle under the control of a timer T to be described, through pipe 19 and restriction 20. It will be noted that under the condition illustrated in the drawing, compressed air is not being supplied to pipe 19. When, however, compressed air is supplied through pipe 19 and restriction 20 to nozzle 17, the back pressure at the nozzle will vary as the baffle approaches or recedes therefrom. It should be remembered that as the temperature at bulb 9 increases, the Bourdon spring unwinds to move the baffle toward the nozzle. As a result of this movement the back pressure at the nozzle increases causing the relay valve 21 to close a proportional amount. As the relay valve closes, it permits less compressed air to be applied from pipe 19 and through pipe 22 to the diaphragm motor of valve 10, tending to close this valve since it is of the type that is closed except when compressed air is supplied to its diaphragm motor to open it. On a temperature drop at bulb 9, the parts operate in the same manner but in the opposite sense.

It is intended, both during the processing period and also during the cooling period to maintain the pressure within the retort at a value such that the cans will not be distorted as a result of unequal external and internal pressures being applied to the walls of the cans. To this end, a relief pipe 23 is provided which connects the interior of the retort with the atmosphere, under the control of a pressure controller PC including a dual top diaphragm motor valve 24 which is opened by the application of compressed air to either or both of its diaphragm motors. The pressure controller and the valve 24 function during the heating period and also during the cooling period, to relieve any pressure in the retort in excess of a predetermined value.

During the cooling period when cooling water is being introduced into the retort as will be described, the steam therein condenses and the steam pressure tends to drop. In order to compensate for this drop, compressed air (herein referred to as a gas) from a source not shown, is introduced into the retort, through pipe 26

under the control of a diaphragm motor valve 27 connected in said pipe. The valve 27, which is of the type that closes on the application of compressed air to its motor, is also governed, during a part of the cycle, by the pressure controller PC.

The pressure controller PC includes a Bourdon spring 28, the interior of which communicates through pipe 29 with the interior of the retort. The free end of the Bourdon spring operates through the link 30 to swing the baffle 31 about its fixed pivot 32 to various positions relative to the nozzle 33. Compressed air is supplied to the nozzle through pipe 34 and restriction 35. The varying back pressure at the nozzle due to the approach and recession of the baffle 31 with respect thereto, throttles a relay valve 36 to vary the application of compressed air from pipe 34 to pipe 37 and thence under the control of pilot valve 38 in its normal position, to one of the diaphragm chambers of valve 24. In this way the valve 24 opens to relieve any excess pressure in the retort until the pressure therein reaches a predetermined value. The valve 27 is maintained closed during the processing period by compressed air applied to its diaphragm motor through pipe 40, thence through pilot valve 41 with its plunger in its lower position, pipe 42 which leads through timer T to the compressed air source (not shown).

Each of the pilot valves 38 and 41 includes a plunger which controls the several valve ports. The plunger is normally spring urged downward to a position as illustrated, but which rises to its alternate position against the action of its spring (not shown), when compressed air is applied to the bottom of the plunger, under the control of a timer to be described. It should be mentioned that with the plungers of both pilot valves 38 and 41 in their upper positions, variable opening or throttling of the motor valves 24 and 27 is effected under the control of the pressure controller PC.

In the past, the introduction of cooling water into the retort, has been effected by a workman manipulating a hand valve in a water pipe such as 45 which discharges into the retort. Due to such manual operation of the hand valve, the introduction of the cooling water was at best haphazard, with the result that all too frequently the water was introduced into the retort so fast that it condensed the steam and reduced the steam pressure, faster than the pressure controller PC could introduce compressed air to compensate for the drop in steam pressure. Under such a condition, the internal pressure and the external pressure applied to the cans would be unequal so that the can walls would become permanently distorted thereby rendering the entire contents of the retort unsaleable. The former method of introducing the cooling water into the retort, was further unsatisfactory because the hand valve was connected in a large size water pipe, for example, an inch and a quarter pipe. Consequently the workman was required to open the valve very slightly at first (commonly known as "cracking" the valve) until the pressure controller PC could properly compensate for the pressure drop in the retort. Then the hand valve was desirably opened wide so that the cooling water would be introduced into the retort in an amount so that the cooking action therein would be promptly stopped. It will be understood that when the hand valve is opened slightly as mentioned, the cooling water will trickle into the retort at such low pressure that relatively large

drops of water are presented to the steam. As a result of this, the pressure drop due to condensing of the steam, will be abrupt and therefore more difficult to compensate for.

As distinguished from the former practice of initially introducing cooling water into the retort at a haphazard rate for non uniform periods and at low pressures, in accordance with the method and apparatus of the present invention, the cooling water is first introduced into the retort at a predetermined slow rate and at a relatively high pressure for a given interval. Thereafter the cooling water is introduced into the retort at a substantially high rate but at a pressure which may be the same as that applied at first. The term "high pressure" as herein used means that the pressure is high enough so that the water will be initially introduced as a fine spray. In practicing the method of this invention, the water spray preferably in atomized form is introduced by a fine shower head 47 within the retort and connected to a relatively small pipe 48 (for example, one quarter inch in diameter), which communicates with a source of water (not shown) under the pressure of municipal system. A motor diaphragm valve 50 of the type that is opened by the application of compressed air to its motor, is connected in the pipe 48 to control the flow of water therethrough. After a predetermined delay following the start of the introduction of the fine water spray through pipe 48, cooling water is also introduced into the retort through a large water pipe 45 (for example, an inch and a quarter pipe), which terminates within the retort in a perforated section 52.

A diaphragm motor valve 53 of the type that is opened by the application of compressed air to its motor, is connected in the large pipe 45 to control the flow of water therethrough. It should be pointed out that pipe 54, which supplies compressed air to the diaphragm motor of valve 50 under the control of the timer T as will be described, also supplies compressed air to the diaphragm motor of valve 53. However, an adjustable needle valve 55 and a capacity tank 56 are connected in the portion of the pipe 54a between the motor of valve 50 and the pipe 54. Thus the operation of the valve 53 will be delayed with respect to the operation of the valve 50 for an interval determined by the adjustment of the needle valve 55 and by the selected size of the capacity tank 56.

Compressed air could be admitted manually into pipe 54 but it is preferred to control the admission of air thereto as well as to other portions of the controlling system at properly scheduled periods by means of a suitable timer T. This timer, which is herein illustrated in part diagrammatically and in part isometrically, comprises a shaft 57 which is preferably driven by a synchronous motor M. The shaft has secured thereon, three cams respectively designated 58, 59 and 60. The cam 58 controls a sustaining circuit for operating motor M through one complete cycle to the starting point indicated by the radial line on each of the cams. This circuit is extended through the cam closed contacts 61 after the motor has rotated the shaft through a given arc, by reason of an operating circuit initially completed through the manually depressed push button 63. The raised portion of cam 59 opens a timing valve 64 which supplies compressed air from the supply pipe 65 to pipe 19 of the temperature controller TC which, in turn, controls the admission of steam for the

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length of heating interval determined by the cutting of this cam. The raised portion of cam 60 at the end of the heating cycle, operates the timing valve 67 to supply compressed air to pipe 54 and 54a, as well as to pipe section 68. The admission of air to pipe 54 effects the introduction of cooling water into the retort and also the admission of compressed air into pipe 58 to control the introduction of compensating air pressure into the retort as the steam pressure drops therein.

A summary of the operation of the system is as follows: Let it be assumed that the hand valve 70 in the drain pipe 71 has been closed. Let it further be assumed that the retort 5 has been charged with cans to be processed and the door 6 sealed closed. The operator depresses the push button 63 of the timer T, to close the initial operating circuit of the motor M and holds this button depressed until the motor rotates its shaft 57 to a position where the contacts 61 are closed by the actuator 73 and cam 58. The contacts 61 complete a self-sustaining circuit for operating the motor until the actuator 73 for these contacts again rests on the low portion of the cam 58, indicating that the shaft has been rotated through one complete cycle.

As the shaft rotates, the cam 59 thereon raises the actuator 74 to open the timing valve 64 which supplies compressed air from pipe 65 through pipe 19 to the temperature controller TC. This controller, as long as compressed air is supplied thereto, namely, during the heating process, throttles the motor diaphragm valve 10 in the steam pipe 8, as described above, to maintain a predetermined temperature in the retort. At the end of the heating period, the actuator 74 will drop into the low portion of the cam 59 (as illustrated), causing the timing valve 64 to disconnect compressed air from pipe 19 and the temperature controller TC. Under this last-mentioned condition, the temperature controller causes the valve 10 to shut off steam from the retort.

During the heating period, the actuator 75 is riding on the low portion of the cam 60 so that the plunger of the timing valve 67 is in its lower position wherein it prevents compressed air from being supplied from pipe 65 to pipe 54. However, at this time the pipe 54 which communicates with the diaphragm motors of valves 50 and 53 vents to the atmosphere through timing valve 67. Thus the valves 50 and 53 are closed at this time to prevent introduction of cooling water into the retort during the heating period. Throughout the heating period, compressed air is not supplied through pipes 54 and 68 to the bottoms of pilot valves 38 and 41 so that plungers thereof remain in their lower position. It will be noted that the plungers of these valves are illustrated in their upper positions. In the lower position of the plunger of valve 41 compressed air is supplied directly to the motor of valve 27 so that valve 27 is maintained closed during the heating period whereby compressed air is not supplied to the retort during the heating period. Throughout the heating period and also during the cooling period, to be described, the relief valve 24 is governed through pipes 37 and 37' by the pressure controller PC in the manner already described to maintain a predetermined pressure within the retort 5.

At the end of the heating period, the cams 58, 59 and 60 will be in the positions illustrated. Cam 59 permits the actuator 74 to allow the plunger of timing valve 64 to drop to its lower

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position. This results in cutting off compressed air from pipe 19 and the consequent disabling of the temperature controller TC. The disabling of the controller shuts off the steam through pipe 8 to the retort. Also, at the end of the heating period the cam 60 and actuator 75 raise the plunger of timing valve 67 so that compressed air from pipe 65 is supplied to pipe 54 leading directly to the diaphragm motor of valve 50. Valve 50 opens wide so that the full pressure of the water source in the small diameter pipe 48 is supplied to the spray head 47 within the retort. This head distributes a mist or atomized water spray within the retort for an interval determined by the amount of opening of the needle valve 55 and the selected size of the capacity tank 56. However, at the end of this interval, compressed air from pipes 54 and 54A is applied to the diaphragm motor of the valve 53 whereby this valve opens wide to supply water through pipe 45 to the sprinkler section 52 within the retort. The pressure of the water in the pipes 45 and 48 can conveniently be at the same value. Also, at the end of the cooking cycle compressed air in pipes 54 and 68 will be applied to the bottoms of the plungers 38 and 41 to raise these plungers to their upper position as illustrated. With these plungers in their upper positions as illustrated, the pressure controller PC throttles the valve 27 to admit compressed air into the retort through pipe 26 and also governs the relief valve 24 to vent to the atmosphere excess pressures in the retort 5. In this way, as the steam pressure drops due to the condensing of the steam when cooling water is introduced into the retort through valves 50 and 53, the valve 27 in the compressed air line 26, and the valve 24 in the relief line 23, cooperate to maintain the pressure in the retort at the predetermined value. At the end of the cycle, which includes the cooling period, the cams 58, 59 and 60 will be rotated to their zero or starting position wherein the actuators or followers 73, 74 and 75 rest on the low portions of their respective cams. In this position compressed air is supplied through pipes 65, 42 and 40 to the motor of valve 27 causing it to shut off from the retort 5, the compressed air in pipe 26. The pressure in the retort will now be low and the hand valve 70 in drain pipe 71 can be opened to drain away any water in the retort and to open the retort to the atmosphere. The door 6 of the retort can now be opened and the processed cans therein can be removed. This completes the cycle of operation.

I claim:

1. In combination, a retort arranged to have containers temporarily sealed therein for processing, means for introducing steam into said retort in amounts to maintain a desired temperature condition therein, means for maintaining a substantially given pressure condition within said retort, means for introducing into the retort a cooling liquid in the form of a spray and subsequently in the form of a stream whereby the steam within the retort tends to condense with the resultant reduction in its pressure, and means for introducing a compressed gas into the retort in amounts tending to compensate for the reduced steam pressure therein.

2. In combination, a retort arranged to have containers temporarily sealed therein for processing, means for introducing steam into said retort in amounts to maintain a desired temperature therein, means for maintaining a substantially given pressure condition within said retort,

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means for introducing into the retort a cooling liquid in the form of an atomized spray and subsequently in the form of a stream whereby the steam within the retort tends to condense with the resultant reduction in its pressure, means for introducing a compressed gas into the retort in amounts tending to compensate for the reduced steam pressure therein, and timing mechanism for scheduling the sequence of operation of said means.

3. In combination, a retort arranged to have containers temporarily sealed therein for processing, temperature-controlled means for introducing steam into said retort in amounts to maintain a desired temperature condition therein, means for relieving pressure within the retort in excess of a given value, primary cooling means including a spray head for introducing a cooling liquid in the form of a mist into the retort, secondary cooling means for introducing cooling liquid into the retort in the form of a stream whereby the steam in the retort tends to condense with the resultant reduction in pressure, means for delaying the operation of the secondary cooling means for a predetermined interval following the initiation of the operation of the primary cooling means, and means for introducing a compressed gas into the retort in amounts tending to compensate for the reduced steam pressure therein.

4. In combination, a retort arranged to have containers temporarily sealed therein for processing, temperature-controlled means for introducing steam into said retort in amounts to maintain a desired temperature condition therein, means

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for relieving pressure within the retort in excess of a given value, primary cooling means including a spray head for introducing a cooling liquid in the form of a mist into the retort, secondary cooling means for introducing cooling liquid into the retort in the form of a stream whereby the steam in the retort tends to condense with the resultant reduction in its pressure, means for delaying the operation of the secondary cooling means for a predetermined interval following the initiation of the operation of the primary cooling means, means for introducing a compressed gas into the retort in amounts tending to compensate for the reduced steam pressure therein, and timing mechanism for controlling the periods of operation of all of said means.

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