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[54] **FLOW CONTROLLING SYSTEM FOR COOKERS**
 13 Claims, 5 Drawing Figs.

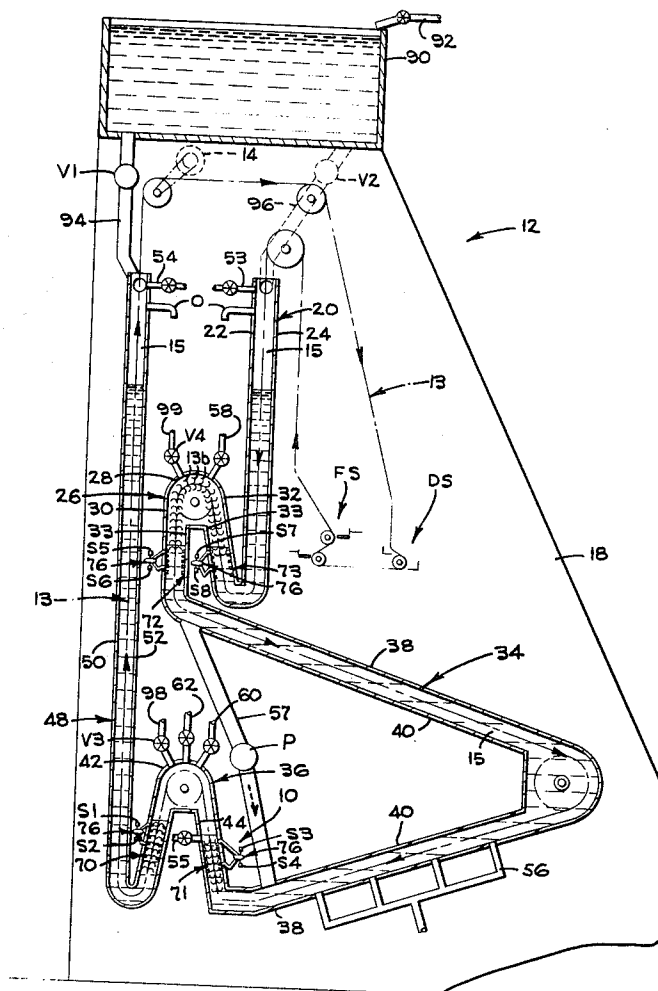
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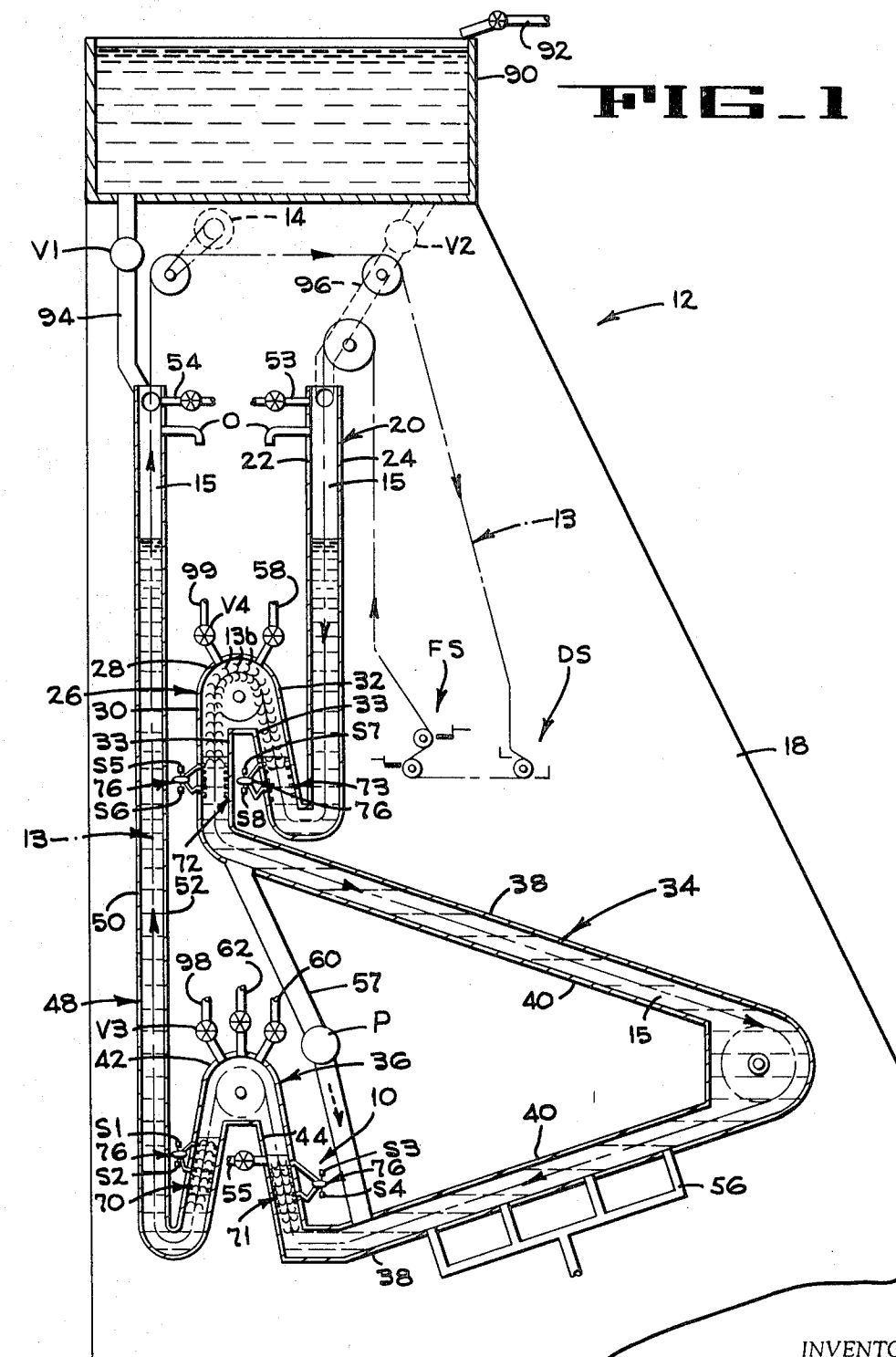
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ABSTRACT: A protective system for maintaining the fluids in a hydrostatic cooker in static balanced condition. The protective system includes several series of baffles which upon flow of fluids therepast due to unbalanced conditions in the cooker cause measurable pressure drops. A control system is provided to detect the presence of pressure drops and open selected protective valves to rapidly direct the appropriate fluids into appropriate chambers thereby correcting the unbalanced conditions.

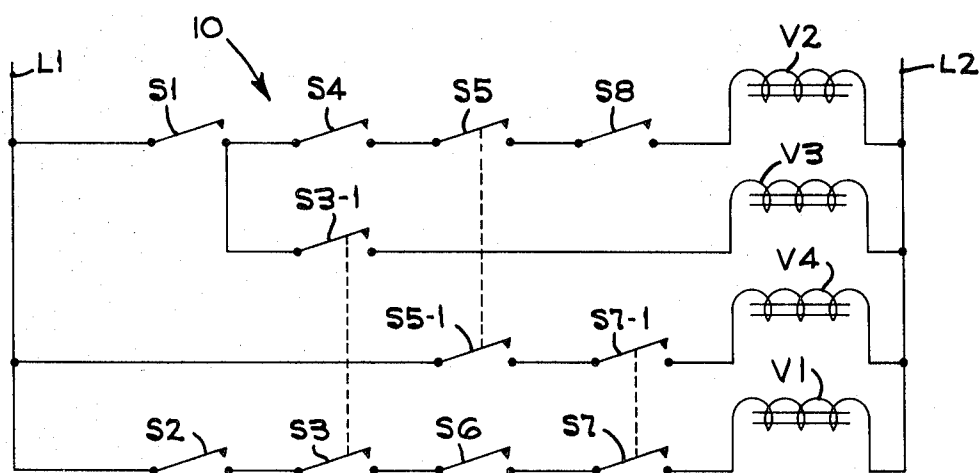
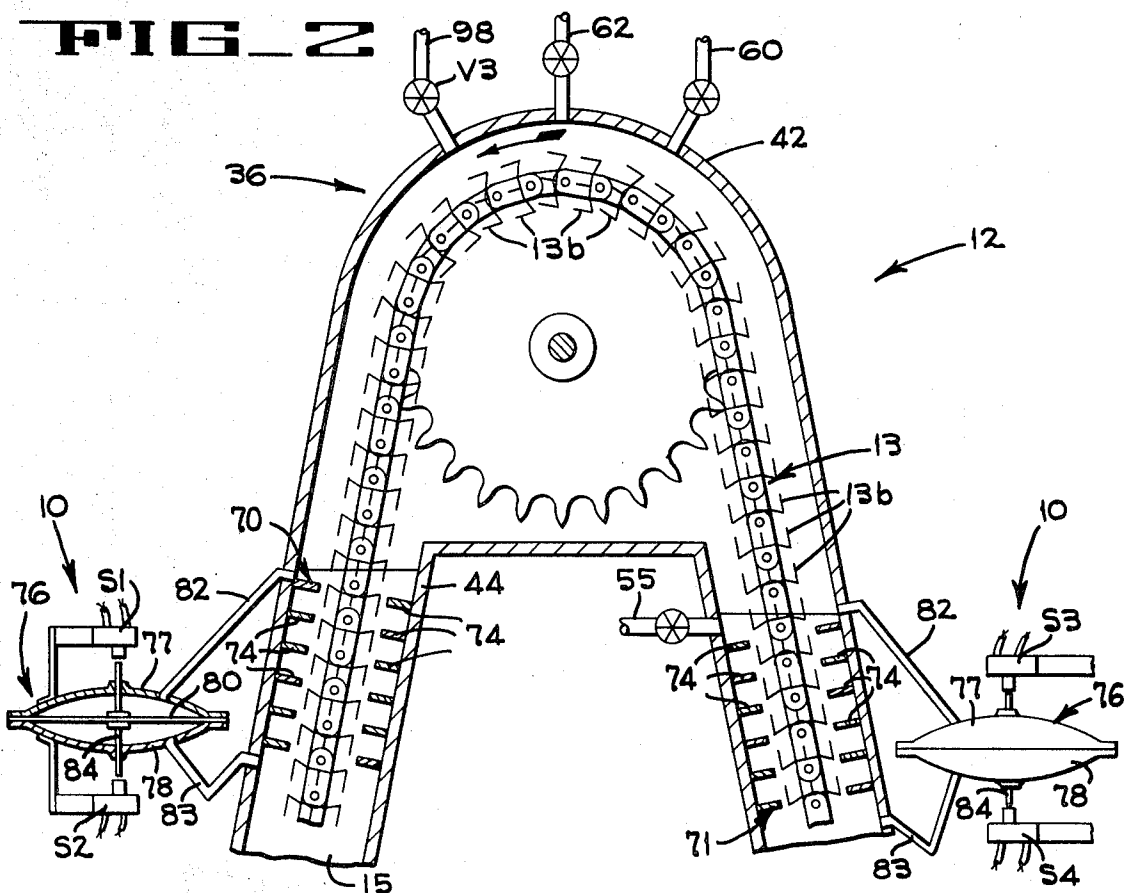




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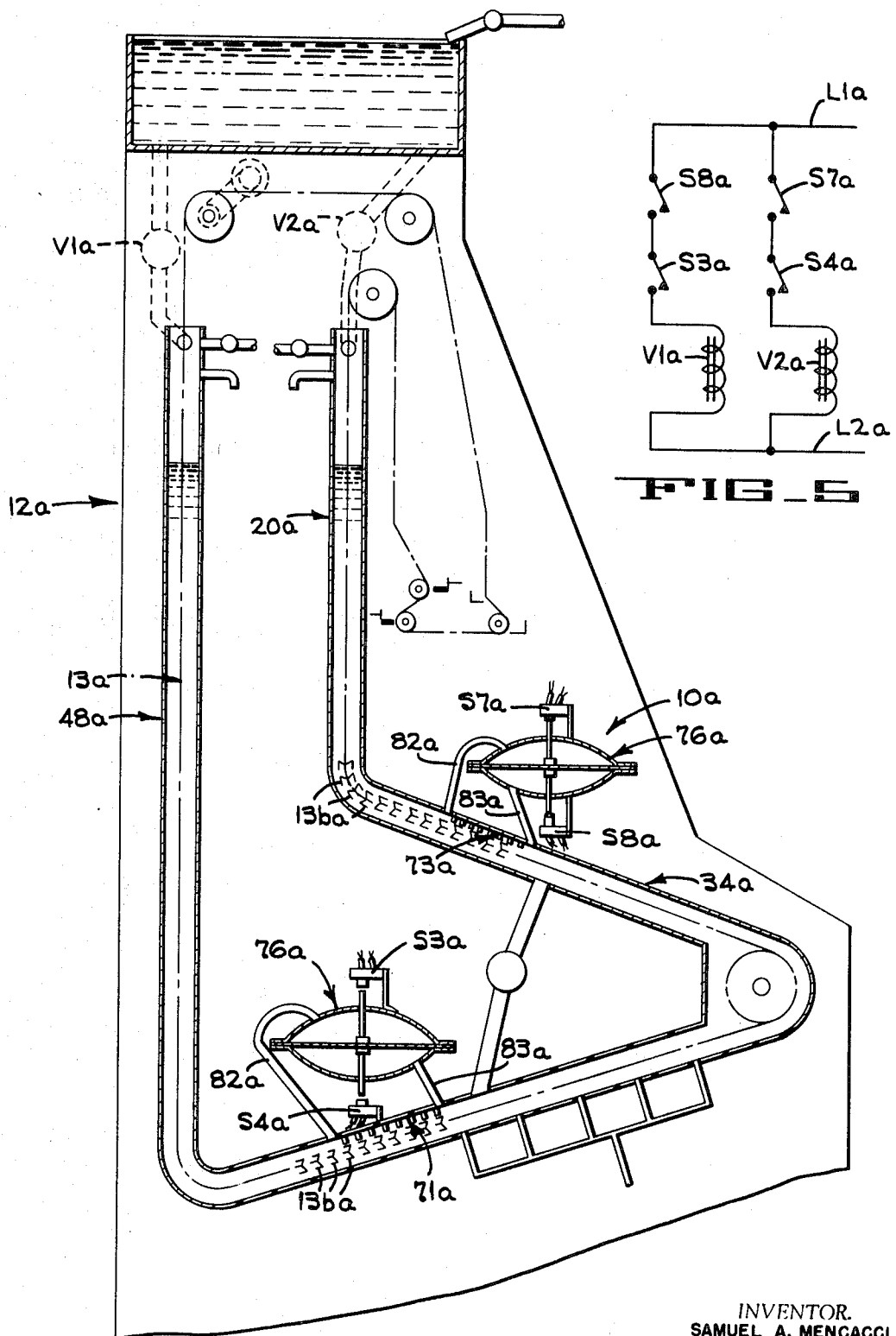


FIG. 4

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FLOW CONTROLLING SYSTEM FOR COOKERS

CROSS REFERENCE TO RELATED APPLICATIONS

The subject flow control system of the first embodiment of the invention is designed for use with the type of hydrostatic cooker disclosed in application Ser. No. 623,068 to Mencacci et al. which was filed on Mar. 14, 1967, and which issued on Nov. 5, 1968 as U.S. Pat. No. 3,408,922 and a second embodiment of the invention is designed for use with the type of hydrostatic cooker disclosed in U.S. Pat. No. 3,252,405 which issued to Mencacci on May 24, 1966.

BACKGROUND OF THE INVENTION

This invention pertains to hydrostatic cookers which utilize tall inlet and discharge water legs to apply sufficient hydrostatic pressure to a sterilizing chamber so that the heat treatment medium, preferably hot water, in the sterilizing chamber can be heated to a temperature above the boiling point of water at atmospheric pressure. If the temperature of the water in the sterilizing chamber is inadvertently raised to a temperature wherein the corresponding saturated vapor pressure is greater than the pressure exerted by the height of the water leg, portions of the hot water will flash into steam. The steam pockets will then flow upwardly and expand causing water in one of the water filled hydrostatic legs to flow out the open upper end thereof.

Because of this problem, in certain cooker installations such as disclosed in the aforementioned Mencacci et al. application, air locks have been provided between the sterilizing chamber and the inlet and the discharge water legs. However, if the normal air supply to the air locks is interrupted the air locks may fill with liquid and permit flow of hot water therepast; or, if the height of water in one of the legs is inadvertently lowered, for example due to water supply failure, the air in an air lock would in effect be revolved out of the lock and would, along with pockets of steam and entrained water, flow upwardly through the unbalanced leg.

Other cooker installations, such as disclosed in aforementioned Mencacci patent, do not use air locks but instead rely on extra tall hydrostatic water legs to apply a sufficient overriding pressure on the sterilizing chamber to prevent the hot water in the sterilizing chamber from flashing into steam.

SUMMARY OF THE INVENTION

The protective flow control system of the present invention is provided as a protective system which is used in addition to the normal control system for maintaining the proper water levels and/or air pressures in the air locks. The protective flow control system includes one or several series of baffles or orifice plates disposed in the fluid flow passages in the cooker between the sterilizing chamber and one or both water legs.

Each series of orifices is ineffective if the fluid in the cooker is static. However, if the fluid in the cooker becomes unbalanced and rapidly moves past the baffles, the baffles will cause a pressure drop in the system from the upstream side to the downstream side of the series of baffles. The pressure differential due to movement of liquid past the several series of baffles is detected by suitable control means which open appropriate dump valves in a water supply reservoir if the water levels are inaccurate; or, opens emergency air valves to an auxiliary air supply if the normal air supply system becomes defective.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a diagrammatic central vertical section illustrating a hydrostatic cooker with air locks having the protective flow system of the present invention associated therewith.

FIG. 2 is an enlarged vertical central section taken through one of the air locks and diagrammatically illustrating a portion of a protective control system and two series of baffles.

FIG. 3 is a control circuit for the protective system of FIGS. 1 and 2.

FIG. 4 is a diagrammatic vertical central section illustrating a hydrostatic cooker without air locks and having a second embodiment of the protective system associated therewith, the pressure controlled protective system being illustrated at an enlarged scale.

FIG. 5 is a control circuit for the protective system of FIG. 4.

DESCRIPTION OF PREFERRED EMBODIMENT

The protective flow control system 10 (FIGS. 1-3) of the present invention is associated with a hydrostatic cooker 12 having a continuously driven endless conveyor 13 which carries rows of containers to be processed through the several processing chambers of the cooker 12 in the direction indicated by the arrows thereon. The conveyor 13 is driven by a motor 14 and includes a plurality of elongated carriers 13b each of which receives a double row of containers at feed stations FS, and after processing the containers, discharges the rows of containers at discharge stations DS. The apparatus for feeding and discharging the containers is well known in the art.

The hydrostatic cooker 12 includes a pair of spaced vertical sidewalls 15 (only one being shown) that are supported about 6 feet apart in spaced parallel relation by a frame 18. A vertically extending inlet housing 20 which defines an inlet water leg, is open at its upper and lower ends and is defined by portions of the walls 15 which are welded in fluid tight engagement to transversely extending spaced walls 22 and 24. The open lower end of the inlet housing 20 communicates with a first air lock housing 26 which is defined by a dome 28, and sidewalls 30 and 32, all of which are welded to the sidewalls 15 in fluid tight engagement. A centrally disposed vertical partition is defined by wall members 33 and is welded to the sidewalls 15 and extends upwardly within the first air lock housing 26 to divide the air lock housing into two legs.

A downwardly inclined sterilizing housing 34 has its upper end connected to the first air lock housing 26 and its lower end connected to a second air lock housing 36. The sterilizing housing 34 is defined by an outer wall 38 and an inner wall 40 welded to the sidewalls 15. The second air lock housing 36 is defined by an inverted U-shaped wall 42; and an inverted channel shaped wall 44 which defines a partition that projects into the air lock housing and serves to separate two columns of water communicating therewith. The walls 42 and 44 extend between and are welded to the sidewalls 15. The second air lock housing 36 communicates with an elongated vertically extending outlet water leg or housing 48 which is defined by walls 50 and 52 welded to the sidewalls 15.

The inlet housing 20, outlet housing 48 and sterilizing housing 34 are filled with water from conduits 53, 54 and 55, respectively, of a standard liquid supply system. The water in the sterilizing housing 34 is heated by steam from a manifold 56 to a temperature of about 250°F. A pump P is connected by a conduit 57 between the upper and lower ends of the sterilizing housing 34 and circulates the water therein in a counter-clockwise direction as viewed in FIG. 1. The water in the inlet housing 20 is heated and maintained at temperatures which gradually increase from about 160°F at the upper end to about 212°F at its lower end. Similarly, the temperature of the water in the outlet housing 48 is controlled to gradually decrease from about 212°F at its lower end to about 86°F at its upper end.

It will be recognized that if the water temperature at any level in the cooker exceeds the boiling point at that level, the water will flash into steam and accordingly will rise in the chamber in which this condition occurs thus causing the hydrostatic system to become unbalanced with the result that much of the water is "blown out" the upper end of the associated inlet housing 20 or outlet housing 48. This "blow out" situation is minimized by directing high pressure air into the air lock housings 26 and 36 through valved conduits 58

and 60, respectively, at pressures which will support the weight of water in the inlet housing and outlet housing, respectively. Cooling water is also sprayed from the standard water supply system through a valved conduit 62 into the second air lock housing 36 to aid in cooling the containers and condensing steam that thermally raises into the housing 36.

The protective flow control system 10 of the present invention is provided in addition to the above mentioned standard fluid supply system which normally supplies the water, steam and air to the different heat treatment housings and maintains the temperatures and pressures at the proper level to hold the fluids in static balance. The protective system 10 becomes operative only in the event the normal supply system fails in some manner thus rendering the normal static balance of the system unstable causing flow of fluids within the housing.

As illustrated in FIG. 1, the protective system 10 comprises four series 70, 71, 72 and 73 of spaced baffles 74 or orifice plates which are normally disposed below the water level in the associated air lock housings 36 and 26. Each series of spaced baffles 74 is secured to the inner walls of the associated housings and project inwardly to a position closely adjacent the path of movement of the carriers 13b of the processing conveyor 13. Thus, an unbalanced condition of the fluid within the cooker will cause a rapid flow of fluid, either water, air or steam past one or more of the series of baffles. This rapid flow of fluid will cause a pressure drop to occur between the upstream baffle and the downstream baffle of each series of baffles, and the pressure drop will occur when the fluid is flowing either upwardly or downwardly as viewed in FIG. 2.

As illustrated in FIG. 2, the fluids within the several housings which define the processing chambers of the cooker are in balance. Each series of baffles 74 has a diaphragm type pressure controller 76 connected thereto as diagrammatically illustrated in FIG. 2. Each pressure controller 76 includes an upper portion 77 and a lower portion 78 separated by a flexible diaphragm 80. The upper portion 77 is connected by a conduit 82 to a point adjacent the upper baffle of the associated series of baffles, and the lower portion 78 is connected by a conduit 83 to a point adjacent the lowermost baffle. A switch actuating rod 84 projects through openings in the upper and lower portions of the pressure controller 76 and is connected to the diaphragm 80 for movement therewith. When the actuating rod 84 of the pressure controller 76 that is associated with the series 70 of baffles moves upwardly in response to upward flow of fluid therepast, a switch S1 is closed. Conversely, when the fluid moves downwardly past the series 70 of baffles, the pressure below the diaphragm 80 is lowered relative to the pressure above the diaphragm thereby closing a switch S2.

The pressure controllers associated with the other series of baffles operate in the same manner. Thus, upward movement of fluid past the series 71 of baffles closes switch S3 and downward movement of the fluid closes switch S4. Upward movement of fluid past the series 72 (FIG. 1) of baffles closes switch S5 and downward movement of fluid therepast closes switch S6. Upward movement of fluid past the series 73 of baffles closes switch S7 and downward movement of the fluid closes switch S8.

A large reservoir 90 is mounted on frame 18 above the upper ends of the water filled inlet housing 20 and outlet housing 48 and is normally filled with water through a valved water supply conduit 92. A conduit 94 having a normally closed, large capacity solenoid operated dump valve V1 therein is connected between the reservoir 90 and the upper end of the outlet housing 48. A similar conduit 96 having a normally closed, large capacity solenoid dump valve V2 therein, is connected between the reservoir 90 and the upper end of the inlet housing 20.

An auxiliary high pressure air supply system (not shown) is connected to the air lock housing 36 by a conduit 98 having a solenoid operated valve V3 therein. Similarly, the auxiliary air supply is connected to the air lock housing 26 by a conduit 99 having a solenoid operated valve V4 therein.

In operation of the protective system 10 of the first embodiment of the present invention illustrated in FIGS. 1 to 3, the inlet housing 20, the discharge housing 48, and the sterilizing housing 34 are filled with water from valved conduits 53, 54 and 55 of the standard fluid supply system. Air is directed into the air lock housings 26 and 36 through conduits 58 and 60, respectively, and the water in the sterilizing housing 34 is heated to the desired temperature by steam issuing from steam manifold 56. The motor 14 is then started and moves rows of containers supported in carriers 13b through the several housings of the cooker in the direction indicated by the arrows on conveyor 13 in the usual manner. The temperature and pressure controlling means of the standard fluid supplying system normally maintains the fluids in the cooker at the proper temperatures and in static balance thus rendering the flow control system 10 of the present invention ineffective.

It will be understood that the pump P circulates the liquid in the sterilizing housing 34 in a direction opposite to that of the conveyor. However, this circulation does not cause flow of liquid past the series of baffles and accordingly does not disturb the static balance of the system.

However, if, for example, the controls which maintain the desired liquid level in the inlet housing 20 become defective and the water level in this housing drops sufficiently to allow the water in the sterilizer housing to flash into steam because of insufficient pressure acting thereon, the steam pockets thus formed will entrain water therewith and flow upwardly in the sterilizing housing 34 and tend to flow out the upper end of the inlet housing 20. This pressure unbalance will cause fluid to flow in a generally clockwise direction through both air lock housings 26 and 36 and past the four series 70, 71, 72 and 73 of baffles 74 associated therewith. Movement of the fluid in this direction past the four series of baffles 70, 71, 72 and 73, creates pressure drops which activate the several diaphragm pressure controllers that, in turn, close switches S1, S4, S5 and S8. As indicated in FIG. 3, switches S1, S4, S5 and S8 are connected in series with solenoid valve V2 between main lines L1 and L2, and accordingly, energize and open the valve V2 thereby rapidly dumping a large volume of cool water into the inlet housing thus stopping upward flow of fluid therein and returning the fluids in the cooker to static balanced condition. The cool water dumped into the upper end of the housing 20 also tends to condense the steam pockets thus diminishing their tendency to move upwardly and out of the upper end of the housing 20. When flow in the cooker housings stop, the several pressure controllers 76 return to a neutral position as illustrated in FIG. 2 thus permitting switches S1, S4, S5 and S8 to open thereby deenergizing valve V2.

If the head in the discharge housing 48 drops to such an extent that steam pockets form and cause a flow of fluids in a direction which tends to cause steam and entrained water to blow out of the upper end of the discharge housing 48, the four series of baffles 70, 71, 72 and 73 will create a pressure drop measured by the diaphragm pressure controller 76 which causes switches S2, S3, S6 and S7 to close. These switches are connected in series with solenoid dump valve V1 (FIG. 3) thereby opening the valve V1 and rapidly dumping a sufficient quantity of cool water into the upper end of the discharge housing 48 to terminate upward flow therein and return the system to a static balance.

If the normal air supply flow from conduit 60 to the air lock housing 36 should become defective causing an upward flow past both series 70 and 71 of baffles that are associated with air lock housing 36, the associated diaphragm pressure controllers 76 would close switches S1 and contact S3-1 of switch S3. Closing of switch S1 and contact S3-1 which switch elements are connected in series with solenoid valve V3, causes the valve V3 to open thus rapidly directing sufficient high pressure air into air lock housing 36 to correct the unbalance. When rapid flow past the series of baffles ceases, the pressure will equalize on opposite sides of the pressure controller 76 thereby permitting the switches S1 and S3-1 to return to their normal open position thus deenergizing solenoid operated valve V3.

An abrupt reduction of pressure in the air lock housing 26 (FIG. 1) causes rapid upward flow of fluid past both series 72 and 73 of baffles associated therewith thereby closing switch elements S5-1 and S7-1 (FIG. 3).

Switch elements S5-1 and S7-1 are in series with solenoid valve V4, and closing of the switch elements energizes and opens the solenoid valve V4 thereby directing high pressure air into the air lock housing 26 until fluid flow past the series 72 and 73 of baffles terminates.

The second embodiment of the protective flow control system 10a (FIGS. 4 and 5) of the present invention is disclosed in conjunction with a hydrostatic cooker 12a of the type disclosed in my aforementioned U.S. Pat. No. 3,252,405. The hydrostatic cooker 12a is quite similar to the hydrostatic cooker 12 of the first embodiment of the invention except that the air locks are omitted in the cooker 12a thus rendering the cooker less stable than cooker 12. Because of the close similarity between hydrostatic cookers 12 and 12a, parts of the cooker 12a which are equivalent to parts of the cooker 12 will be assigned the same numerals followed by the letter a, and only the parts which differ from the cooker 12 will be described in detail.

The hydrostatic cooker 12a includes an upper series of baffles 73a and a lower series of baffles 71a which are disposed closely adjacent the path of movement of the carriers 13ba of conveyor 13a. A diaphragm type pressure controller 76a is associated with each series of baffles and is connected to opposite ends of the associated series of baffles 73a or 71a by conduits 82a and 83a.

If unbalanced conditions of the water in the housings 20a, 34a, and 48a occur so as to cause steam pockets to form and tend to flow upwardly out of the upper end of the inlet housing 20a, both series of baffles detect the flow of fluid therepast and create a pressure unbalance which causes the pressure controllers 76a to close switches S7a and S4a. As indicated in FIG. 5, switches S7a and S4a are connected between main lines L1a and L2a in series with solenoid operated dump valve V2a.

Closing of switches S7a and S4a energizes and opens solenoid valve V2a thereby rapidly dumping cool water into the upper end of inlet housing 20a and stopping upward movement of the fluid in housing 20a. When the static unbalance is corrected, and upward flow of fluid in housing 20a stops, the pressure will equalize on both sides of each pressure controller 76a thereby allowing the switches S7a and S4a to return to their normal open position.

If an unbalance occurs in the cooker 12a which causes steam pockets to form and starts the steam pockets and entrained liquid to flow in a direction which will tend to blow the liquid out the upper end of the outlet housing 48a, the flow past the series of baffles tends to restrict the flow of fluid and also creates a pressure drop which will cause the pressure controllers 76a to open switches S8a and S3a. Switches S8a and S3a are connected in series with solenoid operated dump valve V1a thus opening the valve and rapidly dumping a sufficient quantity of cool water into the upper end of the outlet housing to terminate upward flow of fluid and return the fluids in the cooker 12a to a static balanced condition. Upon reaching the balanced condition, the pressure controllers 76a return to their neutral position thereby opening switches S8a and S3a and deenergizing dump valve solenoid V1a.

Although in the preferred embodiments of the invention a plurality of series of baffles and associated controls are used, it will be apparent that the use of a single series of baffles and associated controls fall within the scope of the invention.

As mentioned previously, the series of baffles of the type disclosed in either the first or second embodiments of the invention resist flow of fluid therepast and, accordingly, create a pressure drop from the upstream to the downstream ends of the series of baffles. Thus, if the pressure controllers 76 (FIG. 1), 76a (FIG. 4) become defective, or if the hydrostatic cooker is provided with one or more series of baffles but without the aid of pressure controllers, dump valves and special water supply reservoirs, the baffles themselves will pro-

vide protection from uncontrollable "blowout." For example, if a hydrostatic cooker of the type disclosed in the first embodiment of the invention is provided without any pressure reducing baffles and a pressure unbalance occurs, steam and water rising from the sterilizing housing 34 will rapidly move upwardly in the inlet housing 20 and/or outlet housing 48 and will uncontrollably flow out of the upper ends thereof at an estimated rate of about 600 gallons per minute or larger. Such an abrupt "blowout" of hot water is apt to cause injury to personnel in the area.

If, however, the same hydrostatic cooker is provided with the series of baffles 70, 71, 72 and 73 (FIG. 1) but without any additional controls, the pressure drop created across each series of baffles will considerably reduce the rate of flow of fluid therepast and will result in an estimated maximum upward flow of fluid in the inlet and/or outlet housings, of for example, about 40 gallons per minute. Although under these conditions the fluids in the cooker will remain unstable until the unbalance is corrected, the 40 gallon per minute flow can easily be accommodated by overflow conduits 0 (FIG. 1) which are connected to the upper ends of the housings 20 and 48 and will direct the overflow to suitable collecting means or the like (not shown). Thus, the provision of one or more series of baffles alone and without the aid of additional controls will provide means for controlling the maximum upward flow of liquid in the housings and will be effective to reduce such flow to a manageable rate.

From the foregoing description it will be apparent that the protective systems of the present invention include one or more series of baffles which resist the flow of fluid therepast and also cause a pressure drop to occur when the normally static condition of the fluid within the processing chambers of the cooker becomes unbalanced and flow occurs in either direction past the series of baffles. The pressure drop may be detected by one or more pressure controllers which open selected dump valves that rapidly direct sufficient amounts of fluid into appropriate chambers thereby correcting the unbalance.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention as set forth in the appended claims.

The present invention and the manner in which the same is to be used having thus been described, what is claimed as new and desired to be protected by Letters Patent is:

I claim:

1. A protective flow controlling system for a hydrostatic cooker having means defining a processing chamber with tall vertically extending water filled legs for normally maintaining a sterilizing medium in a sterilizing housing of said processing chamber in a balanced condition and under superatmospheric pressure, and a driven endless conveyor having carriers thereon for moving containers through said chamber; the improvement which comprises a series of spaced baffles connected to the chamber defining means and projecting inwardly thereof to a position immediately adjacent the path of movement of said carriers, a pressure controller connected to points at opposite ends of said series of baffles whereby a pressure drop created by a rapid flow of fluid past said series of baffles is detected by said controller, and control means responsive to the detection of said pressure drop for rapidly directing a quantity of fluid into the chamber on the detected low pressure side of said baffles to increase the pressure on said low pressure side thereby returning the fluids in said processing chamber to a balanced condition.

2. An apparatus according to claim 1 wherein said series of baffles resists the flow of fluid therepast thereby aiding in returning the fluid to a balanced condition.

3. An apparatus according to claim 1 wherein said sterilizing medium is water which communicates directly with the water in said tall water filled legs.

4. An apparatus according to claim 3 wherein said series of baffles is disposed adjacent the lower end of one of said tall water filled legs, and additionally comprising a second series of baffles disposed adjacent the lower end of the other water filled leg, a second pressure controller connected to points at opposite ends of said second series of baffles whereby a pressure drop created by rapid flow of water past said second series of baffles is detected by said second controller, and means responsive to the detection of a pressure drop across both series of baffles for rapidly directing a quantity of water into the upper end of the particular water filled leg that is on the low pressure side of both series of baffles to increase the pressure on the low pressure sides thereof to thereby return the water in said processing chamber to a balanced condition.

5. An apparatus according to claim 1 wherein said processing chamber additionally comprises a first air lock housing between one of said vertical legs and said sterilizing housing, and a second air lock housing between the other vertical leg and said sterilizing housing, means for directing air under pressure into said air lock housings, and a plurality of said series of baffles being provided with at least one series of baffles disposed immediately adjacent each of said air lock housings, one of said pressure controllers being associated with each of said series of baffles, said control means being connected in series with all of said pressure responsive means and being effective to direct fluid into the detected low pressure side only upon detection of fluid flow toward the same vertical water filled leg to increase the pressure on the low pressure side thereby returning the fluids in said processing chamber to a balanced condition.

6. An apparatus according to claim 5 wherein each series of baffles includes baffle members disposed on both sides of the path of movement of said carriers which members resist the flow of fluid therepast thereby aiding in returning the fluid to a static condition.

7. An apparatus according to claim 6 wherein said sterilizing medium is water which is separated from the water in said water legs by said air lock housings.

8. An apparatus according to claim 7 and additionally comprising means for directing a cooling medium into one of said air lock housings for inducing thermal rise of steam pockets into said one air lock housing and for condensing the steam

entering said one air lock housing.

9. An apparatus according to claim 6 wherein said fluid being directed into the detected low pressure side of said processing chamber is cool water which is rapidly dumped into the upper end of the particular water filled leg that is disposed on the low pressure side of said chamber.

10. An apparatus according to claim 7 wherein two series of said baffles are associated with each air lock housing, and wherein said control means is effective.

11. A protective flow controlling system for hydrostatic cooker having means defining a processing chamber which includes a sterilizing housing, planar portions and tall vertically extending water-filled legs connected to opposite ends of said sterilizing housing for normally maintaining a sterilizing medium in the sterilizing housing of said processing chamber in a balanced condition and under superatmospheric pressure and whereupon an unbalanced condition occurs at the lower end of one of said legs when a reduction of water pressure or a rise in sterilizing temperature causes some of the water to flash into steam pockets, which pockets rapidly move upwardly in said one of said water filled legs and causes additional water to flow upwardly, and a driven endless conveyor having carriers thereon for moving containers through said chamber along a path which includes linear portions; the improvement which comprises a series of closely spaced stationary baffles connected to a planar portion of the chamber defining means at a point adjacent said lower end of said one leg and projecting inwardly thereof to a point immediately adjacent to but spaced from a linear portion of the path of movement of the carriers, said series of baffles being arranged to create a pressure drop in response to a flow of fluid therepast for preventing said unbalanced condition from causing an uncontrollable upward flow of water out of said one leg by reducing the flow therein to a manageable rate.

12. An apparatus according to claim 11 wherein a plurality of series of baffles are provided in said chamber near the lower ends of said legs and adjacent both ends of said sterilizing housing.

13. An apparatus according to claim 11 wherein the number of baffles in said series of baffles is sufficient to restrict the rate of upward flow of fluid in either of said water filled legs to a maximum of about 40 gallons per minute.

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