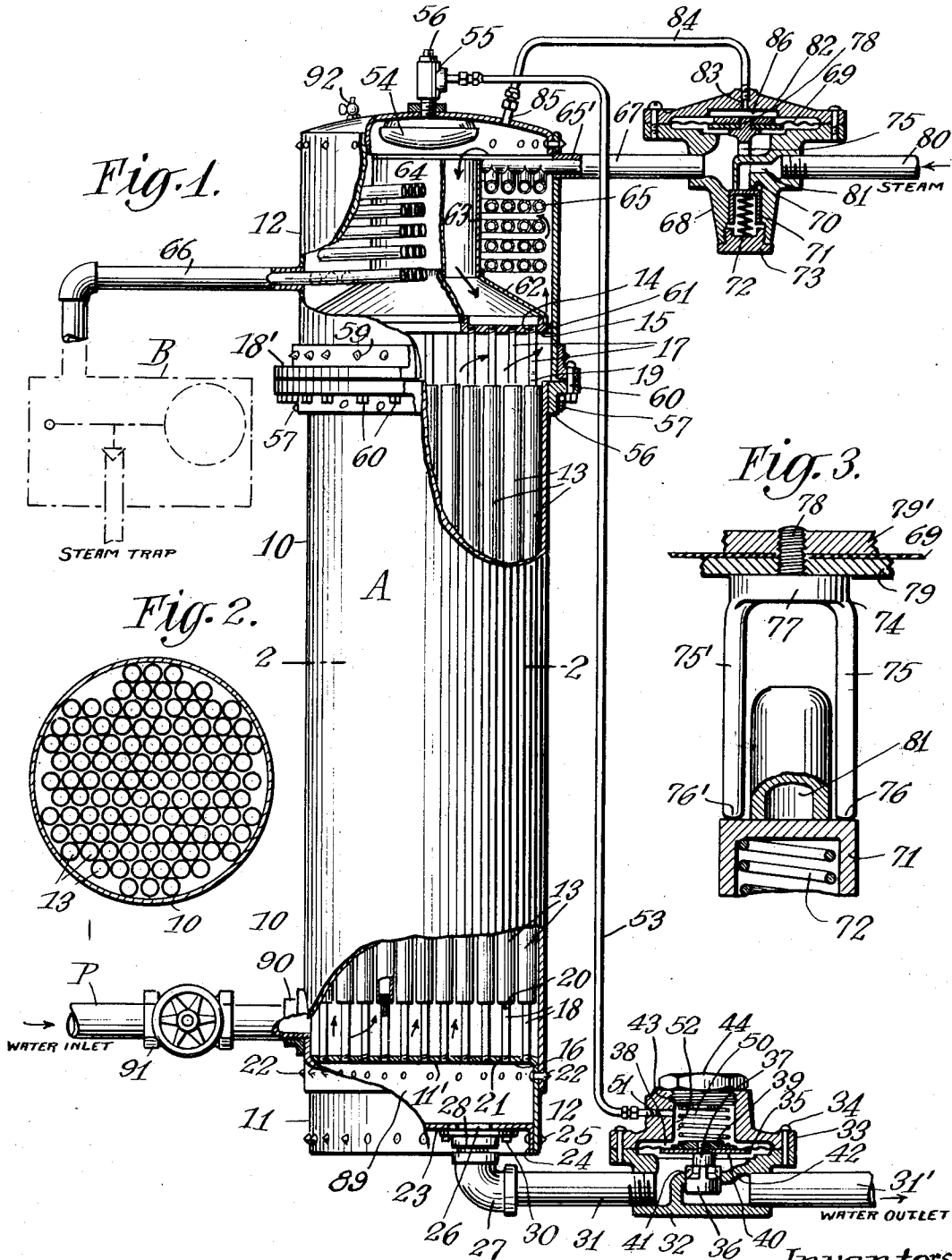


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STERILIZING APPARATUS.
APPLICATION FILED MAR. 1, 1917.

1,332,010.

Patented Feb. 24, 1920.



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UNITED STATES PATENT OFFICE.

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STERILIZING APPARATUS.

1,332,010.

Specification of Letters Patent.

Patented Feb. 24, 1920.

Application filed March 1, 1917. Serial No. 151,627.

To all whom it may concern:

Be it known that we, CHARLES F. WALLACE and MARTIN F. TIERNAN, citizens of the United States, and residents, respectively, of Tompkinsville, Staten Island, State of New York, and New Rochelle, county of Westchester, State of New York, have jointly invented a new and useful Improvement in Sterilizing Apparatus, of which the following is a specification.

Our joint invention relates to an improved apparatus for sterilizing liquids, and more particularly to an apparatus for sterilizing water. One of the objects of the invention is to provide a simple and efficient means for sterilizing liquids under pressure by heat and more particularly a means for sterilizing water under pressure by means of steam. Other objects will appear from the following description and claims.

Referring to the drawings in which the same reference characters indicate the same parts in the several views:

Figure 1 is a conventional view of our improved apparatus for use in carrying out our method, the said apparatus being shown partly in elevation and partly in section, various parts thereof also being broken away to clearly show the mechanical construction thereof.

Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 is an enlarged detail partly in section and partly in elevation of the steam valve.

In the drawings, A is a cylindrical casing of suitable sheet metal made similarly to the ordinary boiler casing. In our construction we provide for convenience of manufacture a plurality of sections, preferably three, as shown at 10, 11 and 12, the center section 10 containing the parallel tubes 13 mounted and secured at their ends in the openings 14 in the tube plates 15 and 16. The tubes may be described generally as being arranged and mounted in the usual manner as practised in the manufacture of water tube boilers. In our particular construction, however, the main tubes are provided at their ends with short sections of tubing 17 and 18 of smaller diameter than the main tubes, one end 19 of the tube 17 being fitted into one end of the tube 13, and the other end of which is fitted in an opening 14 in the diaphragm plate 15 and one end 20 of the tube 18 being fitted in the other end of

the tube 13, and the other end being fitted into an opening 21 of the tube plate 16. As each tube 13 with its respective smaller tubes 17 and 18 are the same in structure, and are mounted in the tube plates 15 and 16 in the same way, it is necessary to describe but one.

The section 11 is formed by closing one end of the cylindrical portion 10, by means of a sheet metal cylinder the outside diameter of which is equal to the inside diameter of the central closed portion 10, thereby enabling it to fit within an outer end of the central cylindrical section 10. The top 11' of the cylinder 11 of lesser diameter forms the tube plate 16, and it is provided with a sufficient number of openings to receive the ends of the small tubes as above described.

The two cylinders 10 and 11 are secured together by a series of rivets 22 as shown. The outer end of the cylinder 11 of lesser diameter is closed by means of a flanged plate 23, the diameter of which is such that the outer sides of the flange 24 of the plate exactly fit within the cylinder 11, the flange being secured to the cylinder by a series of rivets 25. An opening 26 is provided in the plate 23 for the passage of the sterilized water from the machine. For this purpose we provide an ordinary elbow joint 27, and a connection 28 as shown, bolted at 29 to the plate 23, and at the other end is attached the pipe 31 to carry the outflow to the point desired. To this pipe 31 is secured a valve fitting 32, as shown, of ordinary construction, to which is secured a fitting or casting 33, by means of bolts 34 for the purpose of holding a diaphragm 35 therebetween, which diaphragm is connected to the valve 36 by a valve stem 37. The fittings 32 and 33 are so fashioned as to form a space 38 between them for the reception of and to permit the operation of the diaphragm 35. Secured in any suitable way, as by superposed plates 39 and 40, to the diaphragm 35 at the center thereof, is the valve rod or stem 37 and attached to the other end of which is the valve 36 which fits in the valve seat 41 in the partition 42 of the fitting 32 attached to the pipes 31 and 31'.

In the top of the fitting 33 is an opening 43, into the outer end of which is fitted a screw plug 44.

On one side of the diaphragm 35 in the opening 43 is a spiral spring 50 (the func-

tion and operation of which will be hereinafter described) one end of which rests against the screw plug 44 and the other end rests against the plate 39 secured to the center of the diaphragm 35. The position of this screw plug may be adjusted so as to effect the tension of the spring 50 which is seated between the adjustable screw plug and the diaphragm. To an opening 51 in the side of the fitting 33 leading into the chamber 52 between the screw plug 44 and the diaphragm 35, is secured one end of a pipe 53, the other end of which is connected by a fitting 55 to the end section 12 of the casing. At this connection there is provided inside of the boiler a thermostatic chamber 54 which is hermetically closed and which is normally partly filled with water poured therein through the fitting 55 in any suitable way, the same being provided with a valved or plugged opening 56 for that purpose.

The central portion 10 of the casing A is fitted at the end opposite to the combined inlet and outlet end, with an L-shaped fastening ring 56 secured thereto by rivets 57. The end portion 12 of the boiler structure is also fitted with an L-shaped fastening ring 18' secured thereto by rivets 59, and these fastenings or rings are secured to each other by bolts 60 as shown. Fitting within the end shell portion 12 is the tube plate 15 of less diameter than the shell portion 12 provided with a series of openings 14 for the reception of the tubes 17 which are secured thereto as above described in the ordinary way known in the art of boiler making. This tube plate is supported by struts or legs 61 to the inside of the section 12.

Extending from the tube plate 15 is a baffle plate 62 which is conical in shape and to the outer reduced end of which is secured a cylindrical tube 63 which also acts as a baffle, the outer end 64 of which extends nearly to the thermostatic chamber 54. A steam pipe coil 65 is fitted around the baffle tube 63 and leads by a pipe 66 to a steam trap B of the float type conventionally shown in dotted lines in Fig. 1. The other end of the steam pipe enters the casing A at 65' by means of a pipe 67.

To this pipe is secured a valve fitting 68 of particular construction. At the outer end of this valve chamber is clamped a diaphragm 69, as shown, and at the lower end of the valve chamber is fitted the valve seat 70. The valve consists of a cylindrical cup-shaped piece 71 which is so shaped as to seat itself and to be held seated by the pressure of a spiral spring 72 (the special function of which will be hereinafter described) exerting its pressure between the valve and the screw plug stop 73. The valve 71 is connected to and operates with the diaphragm 69 by means of a U-shaped structure 74, the legs 75 and 75' of which rest at each end 76

and 76' on the valve 71, and the other or bridge portion 77 is secured by a screw joint 78 and plates 79 and 79' to the diaphragm 69, as shown. A pipe 80 leads from the valve to the steam generating apparatus. An opening 81 leading from the pipe 80 to the valve seat is normally closed by the valve 71 when on its seat.

The upper diaphragm securing plate 82 is provided at its center with a small opening 83 to which is connected one end of a pipe 84 leading to the upper end of the casing A at 85 and secured at each end as shown by a suitable screw fitting. The fittings between which the diaphragm is clamped are fashioned or dished out to form a suitable diaphragm operating chamber 86, as shown.

It is seen from the above described construction and installation that both the water outlet valve and steam inlet valve are controlled not only by the operation of their respective diaphragms under pressure, but by the action of their respective spiral springs. The inlet pipe P is secured at the lower end of the section 10 at 90 as shown, said pipe being fitted with a valve 91 to regulate the entrance flow of the water to be sterilized. A pet cock 92 is fitted to the end of the section 12, as shown.

The flow of water to be sterilized will now be stated generally and then the applicability of our invention will be more particularly described.

The water enters through the pipe P, passes around the tubes 13, flowing in the general direction of the arrows in Fig. 1. As indicated, it then passes around the conical and cylindrical baffle plates 62 and 63, around the steam pipe coil 65 in the end section 12 of the structure A through the cylindrical baffle plate 63 in the direction of the arrows. At this point it has been heated to a sufficient degree to be sterilized and it then passes through the tubes 13 toward the point at which it enters the apparatus. It then passes out of the tubes into the chamber 89 and through the pipes 31 and 31', its final outlet being controlled by the valve 36.

The inflow of steam to the heating coil is controlled by the valve 71 and the water of condensation passes to the steam trap B and is removed from the system by the trap, as will be understood. The cold water upon entering at 90 will tend to cool the hot water as it passes out of the apparatus after being sterilized, so that the water may be in a more fit condition for use.

The operation of our invention and the beneficial results accruing therefrom will now be described, the fluid operated upon being water which it is desired to sterilize for drinking purposes.

The thermostatic chamber and line is first filled to the desired degree or "loaded" with water. The water to be sterilized is then

turned on, and the pressure of the water will act through the pipe 84 upon the diaphragm 69 to open the valve 71 and turn on the steam, whereupon the steam coils will
 5 raise the temperature of the water. The water in the thermostat 54 is thus heated by the water being sterilized until steam is formed and attains a pressure which, acting through the thermostatic line 53, exerts sufficient pressure to operate the diaphragm 35
 10 and open the water outlet valve 36, thus permitting a flow of sterilized water from the device and to the place of consumption. In the event that the flow of water to be
 15 sterilized is greater than the capacity of the steam coil to heat it to the required sterilizing temperature, then the temperature to which the thermostat 54 is heated will fall, and the pressure in the thermostatic line will be insufficient to keep the diaphragm 35 depressed and the water discharge valve will close on its seat; thus preventing the flow of insufficiently sterilized water through the apparatus even though
 20 the water may be turned on and live steam may be present in the heating coils.

The steam coil will at once heat the flowing water and establish an equilibrium. The steam pressure in the thermostatic line
 30 assisted by the pressure exerted by the spring operates upon one side of the diaphragm to open the water valve against the water pressure upon the other side of the diaphragm. Therefore, when the valve
 35 opens the pressure of the steam in the thermostatic valve will be less than the pressure of the water by an amount substantially equal to the pressure exerted by the tension of the spring.

The steam valve is closed when there is no pressure in the water system. It is opened by the pressure of water acting on the valve diaphragm 69, against the action of the spring and the steam pressure in the coil.
 45 The steam pressure in the coil acting on one side of the diaphragm and the water pressure acting on the other side of the same diaphragm will of course balance each other for equal pressures. The steam pressure permits the pressure due to the tension of the spring to operate to close the valve; therefore, at all times the pressure of the steam will be less than the water pressure by an amount substantially equal to the pressure exerted
 55 by the tension of the spring, which latter pressure is constant.

Since the pressure of the steam in the coil is less than the water pressure surrounding the coil the temperature of the water
 60 surrounding the coil will be always less than its boiling point for that pressure.

It will thus be seen from the above that by the operation of our invention we attain the following new and beneficial results in
 65 this art,

1. An efficient heat interchange between the incoming and outgoing water.

2. The raising of the temperature of water during its passage through the apparatus to a temperature which is a predetermined degree lower than the boiling point of water
 70 at the existing water pressure.

3. The provision of means for preventing the flow of the water through the apparatus until it is heated to the desired temperature.
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4. The provision of means for controlling the temperature of the water by varying the adjustment of the valve devices which control the supply of steam to and the flow of water from the device.
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5. The provision of means controlled by the pressure of the water to heat up the water while under pressure to a predetermined temperature, which is less than the boiling point of the water for that pressure; which means is automatically operated for
 85 securing a temperature corresponding with any pressure between a minimum of a few pounds above atmospheric pressure and a maximum of a few pounds below the steam
 90 pressure.

6. The maintaining of a constant difference of pressure between the steam employed for sterilizing and which may be under a constant or a variable pressure, and the water being sterilized which may also be under a constant or a variable pressure, to the end that the water is prevented from being converted into steam.

7. The provision of a thermostatic control valve for controlling the flow of water, the operating temperature of said thermostatic valve controlling means being controlled by the pressure of the water and steam employed for sterilizing acting
 100 jointly.
 105

8. The provision of a thermostatic control valve for controlling the flow of water, the operating temperature of said thermostatic controlling means being held for a given
 110 water pressure at a constant and predetermined temperature which is less than the boiling point of said water at said pressure.

9. The provision of a thermostatic control valve in a sterilizing system, without the
 115 necessity of providing a stuffing box construction for said valve.

Our invention may be installed and operated at any place on land where it is found desirable or necessary to sterilize the
 120 water for drinking purposes, but it is found to be especially desirable and useful on ship board for that purpose.

It is to be understood that we do not limit ourselves to the particular shape or form of
 125 any part shown, neither do we limit ourselves to the precise arrangement of the parts with respect to each other.

It is to be further understood that the above description and drawings are merely
 130

illustrative, and that the invention is not to be limited in any respect, except as defined in the subjoined claims.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a sterilizing apparatus, the combination of means for confining and controlling the flow of water to be sterilized and means controlled by the pressure of the water for heating the water, when under a given pressure to a constant temperature less than the boiling point for that pressure.

2. In a sterilizing apparatus, means for confining and directing the flow of water under pressure to be sterilized, means for heating the water, a thermostatic valve for controlling the flow of said water, and means for controlling the operating temperature of said thermostatic valve by the pressure of the water.

3. In a sterilizing apparatus, means for confining and directing the flow of water to be sterilized, a thermostatic valve for controlling the flow of the water under pressure, and means the operation of which is dependent upon the pressure of the water being sterilized for holding the operating temperature of said thermostatic control valve at a constant and predetermined amount less than the boiling point of the water at said pressure.

4. In a sterilizing apparatus, means for confining and causing the water to be sterilized to flow in opposite directions, said means being provided with an inlet and an outlet adjacent each other, means for heating the flowing water at a point removed from the inlet and outlet, a valve controlling the outflowing water, means controlled by the temperature of the water being sterilized for controlling the operation of said valve, a valve for controlling the supply of the heating medium, and means controlled by the pressure of the water for controlling the operation of said last mentioned valve.

5. In a sterilizing apparatus, liquid heating means having a conduit through which a heating medium may flow; a valve for controlling the flow through said conduit, valve operating means subjected to the pressure of the liquid being sterilized, and which means is operatively connected with said valve to thereby control the flow of heating medium aforesaid, a conduit through which the liquid being sterilized flows after its sterilization has been effected, a valve for controlling the flow of liquid through said conduit, a diaphragm operatively connected with said valve and one side of which is exposed to the pressure of the liquid being sterilized, a thermostatic chamber exposed to the liquid being sterilized so as to be heated thereby, and which chamber is adapted to contain a fluid, and means for subject-

ing the other side of said diaphragm to pressure due to the heating of a fluid within said thermostatic chamber.

6. In a sterilizing apparatus, means for supplying steam to heat the water to be sterilized, a valve for controlling the supply of steam, a spring for holding said valve in its seat, means for adjusting the tension of the spring, a diaphragm, one side of which is exposed to the pressure of the water to be sterilized and the other to the pressure of the steam whereby the water is sterilized, and means for connecting the diaphragm to the valve.

7. In a sterilizing device of the class described, liquid heating means; means for causing a stream of liquid to flow past said liquid heating means, means controlled by the pressure of the liquid flowing past said liquid heating means for controlling the operation of said liquid heating means, and means controlled by the temperature of the liquid flowing past said liquid heating means for controlling the flow of liquid past said liquid heating means.

8. In a sterilizing device of the class described, a casing, a liquid supply conduit leading thereinto, a liquid discharge conduit leading from said casing, a heating device past which the liquid flowing through said casing flows, pressure operated means the operation of which is dependent upon the pressure of liquid within said casing for controlling the action of said heating device, means for controlling the flow of liquid from said casing through said liquid discharge conduit, and means the operation of which is dependent upon the temperature of the liquid within said casing for controlling said flow controlling means.

9. In a sterilizing device of the class described, a vertically extending casing, a liquid supply conduit discharging into the lower portion of said casing, a liquid discharge conduit leading from the lower portion of said casing, means for directing the flow of liquid entering through said supply conduit upward toward the upper end of said casing, and then downward toward said discharge conduit, a steam heated heating device located at the upper end of said casing and past which the liquid operated upon flows, a conduit through which steam is supplied to said heating device, a valve for controlling the flow through said conduit, a yieldable diaphragm exposed to the pressure of the liquid within said casing and which diaphragm is operatively connected with said valve, and means the operation of which is dependent upon the temperature of the liquid operated upon for controlling the flow of liquid through said discharge conduit.

10. In a sterilizing device of the class described, a casing, a liquid supply conduit discharging into said casing, a liquid dis-

charge conduit leading from said casing, a steam heated heating device past which the liquid operated upon flows, a conduit through which steam is supplied to said heating device, a valve for controlling the flow of steam through said conduit, a spring acting upon said valve to close it, a diaphragm operatively associated with said valve to open the same, and which diaphragm is exposed to the pressure of the liquid operated upon, a second valve for controlling the flow of liquid through said liquid discharge conduit, and means the action of which is dependent upon the temperature of the liquid operated upon for controlling said last mentioned valve.

11. In a sterilizing device of the class described, a casing, a liquid supply conduit discharging into said casing, a liquid discharge conduit leading from said casing, a steam heated heating device past which the liquid operated upon flows, a conduit through which steam is supplied to said heating device, a valve for controlling the flow of steam through said conduit, means the operation of which is dependent upon the pressure of the liquid within said casing for controlling the operation of said valve, a second valve for controlling the flow of liquid through said liquid discharge conduit, a yieldable diaphragm operatively connected with said last mentioned valve and which diaphragm is exposed on one side to the pressure of the liquid operated upon, a spring acting upon the other side of said diaphragm, a thermostatic chamber so located as to be heated by the liquid operated upon, and a conduit leading from said chamber and through which pressure due to the heating of a fluid contained therein is caused to act upon said diaphragm to open said last mentioned valve.

12. In a sterilizing device of the class described, a casing, a liquid supply conduit discharging into said casing, a liquid discharge conduit leading from said casing, a steam heated heating device past which the liquid operated upon flows, a conduit through which steam is supplied to said heating device, a valve for controlling the flow of steam through said conduit, a spring acting upon said valve to close it, a diaphragm operatively associated with said

valve to open the same, and which diaphragm is exposed to the pressure of the liquid operated upon, a second valve for controlling the flow of liquid through said liquid discharge conduit, a thermostatic chamber so located as to be heated by the liquid operated upon, a yieldable diaphragm operatively connected with said second valve and exposed on one side to the pressure of a fluid within said thermostatic chamber, and on the other side to the pressure of the liquid operated upon, and a spring acting upon said second mentioned valve and tending to open the same.

13. In a sterilizing device of the class described, a vertically extending casing, a liquid supply conduit discharging into the lower portion of said casing, a liquid discharge conduit leading from the lower portion of said casing, means for directing the flow of liquid entering through said supply conduit upward toward the upper end of said casing, and then downward toward said discharge conduit, a steam heated heating device located at the upper end of said casing and past which the liquid operated upon flows, a conduit through which steam is supplied to said heating device, a valve for controlling the flow through said conduit, a yieldable diaphragm exposed to the pressure of the liquid within said casing and which diaphragm is operatively connected with said valve, a thermostatic chamber located at the upper end of said casing and so arranged as to be heated by the liquid operated upon, a second valve for controlling the flow of liquid through said discharge conduit, a second yieldable diaphragm operatively connected with said second valve and exposed on one side to the pressure of a fluid within said thermostatic chamber, and on the other side to the pressure of the liquid operated upon, and a spring acting upon said last mentioned valve and tending to open the same.

Signed at the borough of Manhattan, city and State of New York, this 27th day of February, 1917.

CHARLES F. WALLACE.
MARTIN F. TIERNAN.

In presence of—

HAROLD CROCHERON,
ISABEL R. RICHARDS.