

[54] STEAM STERILIZING APPARATUS

[76] Inventors: **Willi Knoblauch**, Nygatan 12, 440
60 Skarhamn, Sweden; **Hans-Peter
Baranowski**, Rathausplatz 6, 3005
Hannover-Westerfeld, Germany

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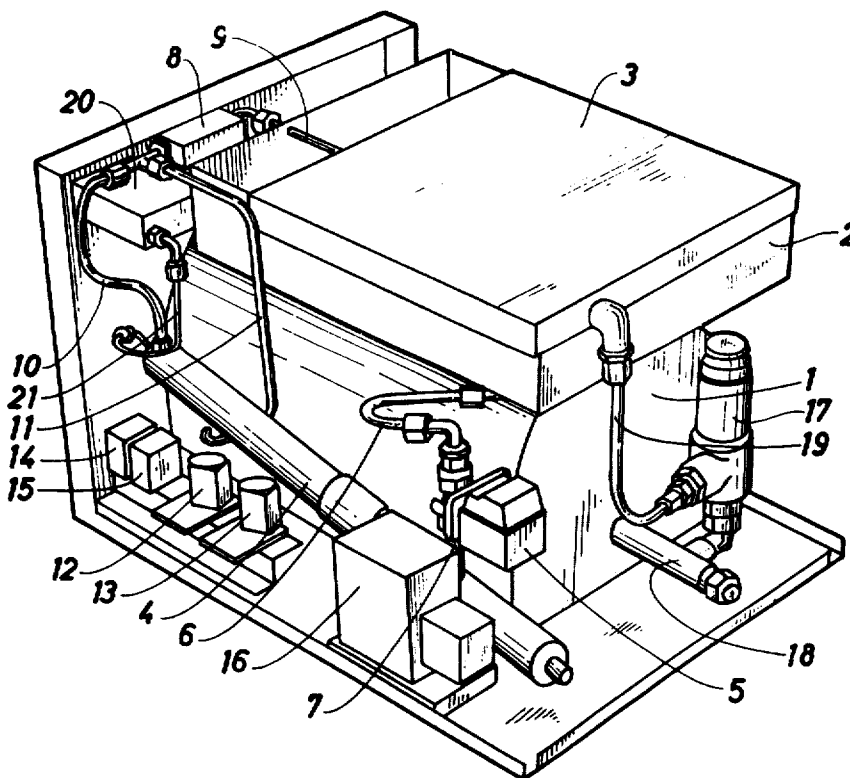
Primary Examiner—James H. Tayman, Jr.
Attorney, Agent, or Firm—Vlle C. Linton

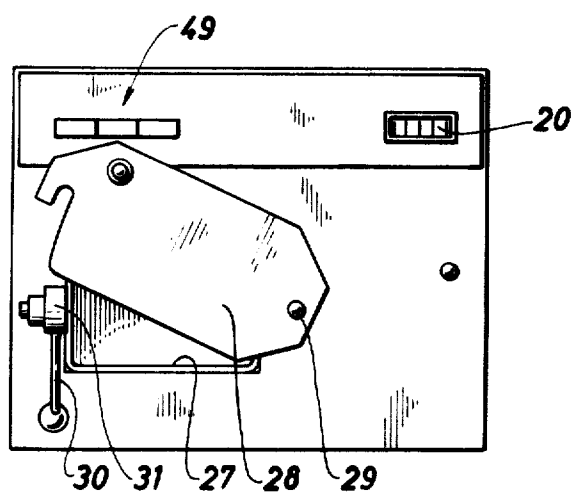
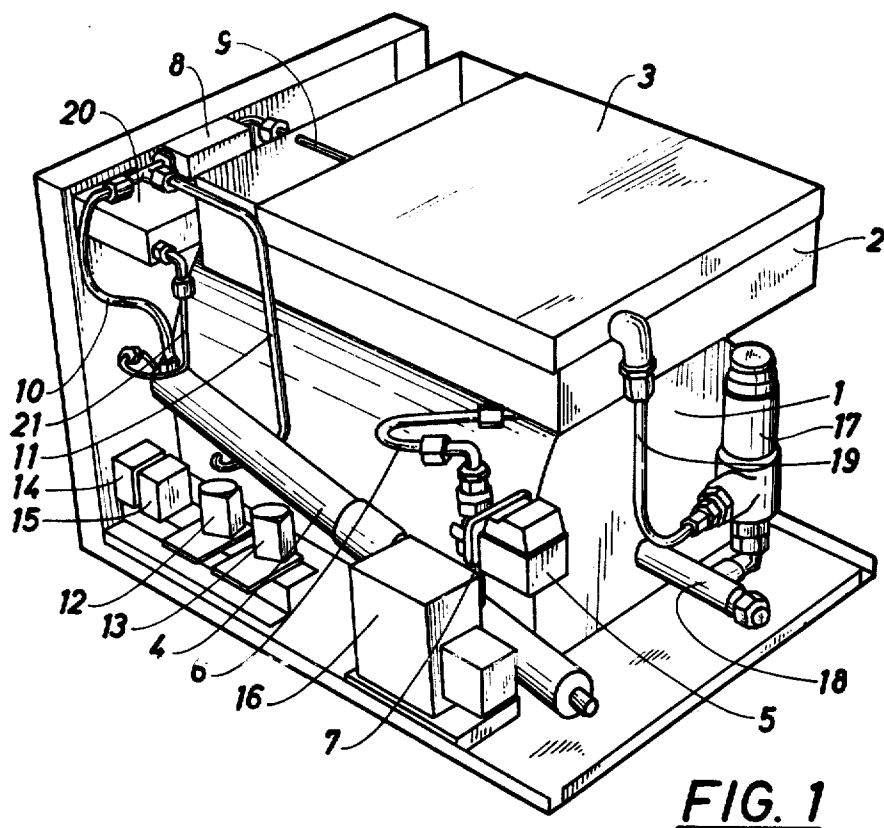
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ABSTRACT

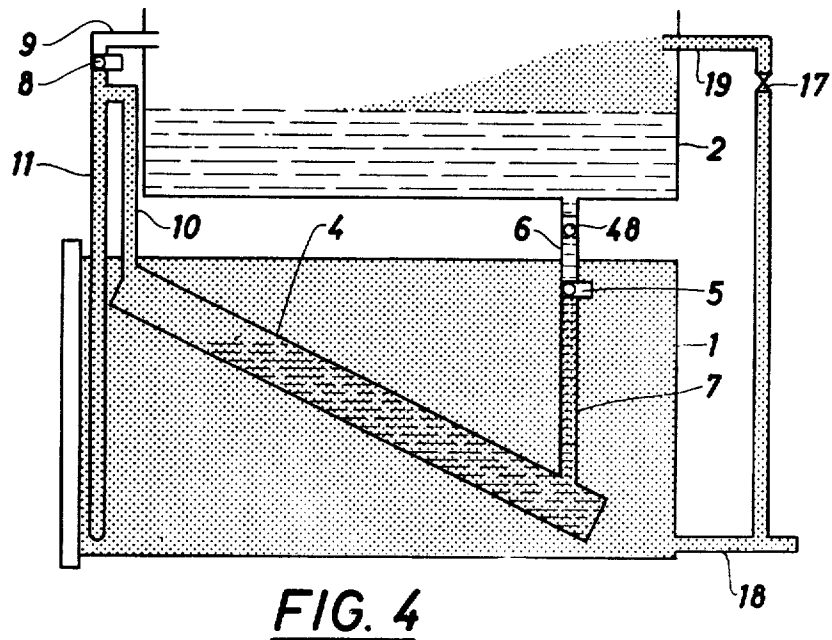
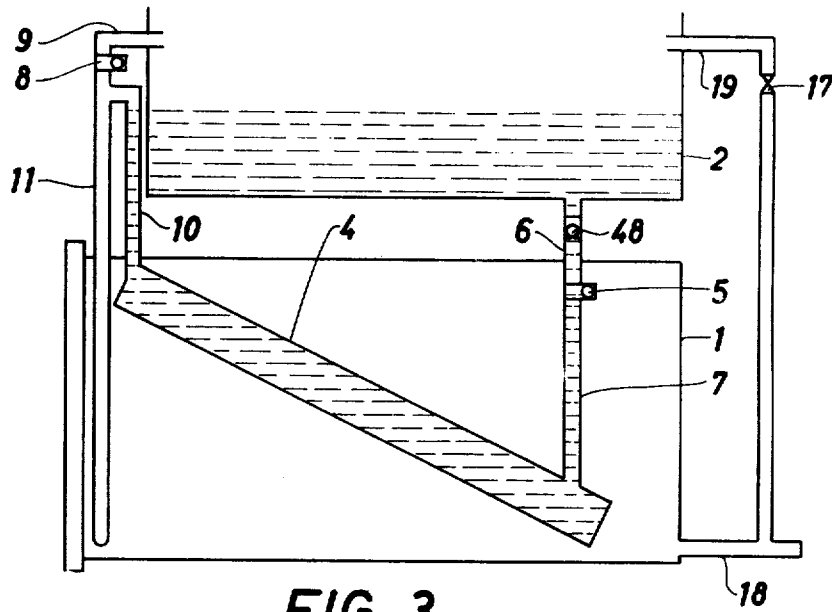
A sterilizing apparatus having interconnected sterilization chamber, a liquid evaporation tank and a liquid storage and condensation tank with said condensation tank located above said sterilization chamber and evaporation tank, communication means controlling the flow of liquid between said condensation tank and a lower end of said evaporation tank which communication is located at a lower level than the lowest level of liquid in said condensation tank during operation of the apparatus, means controlling communication between said sterilizing chamber, a high end of said evaporation tank and a portion of said condensation tank above the highest level of liquid in said condensation tank during operation and a means for maintaining the desired working pressure in said sterilization chamber without requiring the refilling of liquid in the apparatus when being used.

9 Claims, 7 Drawing Figures



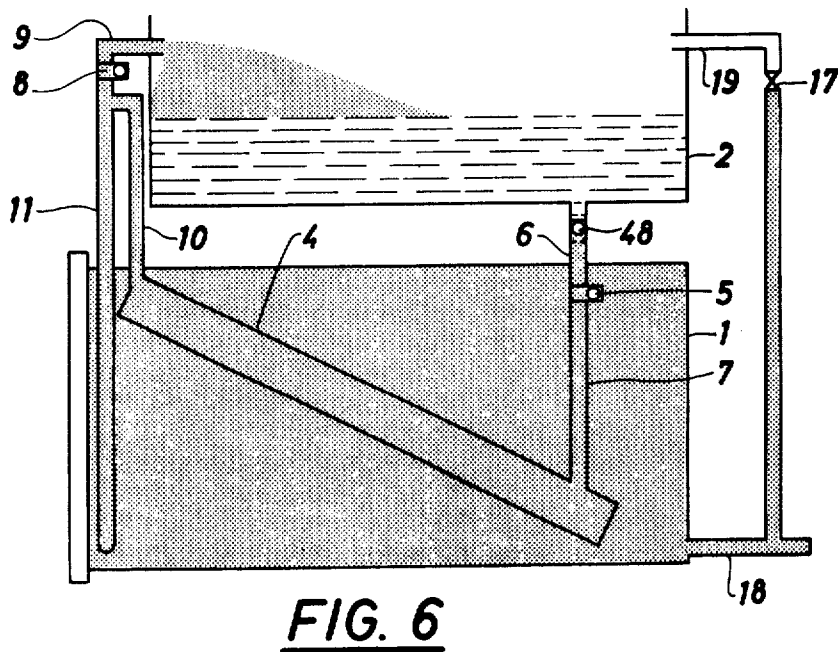
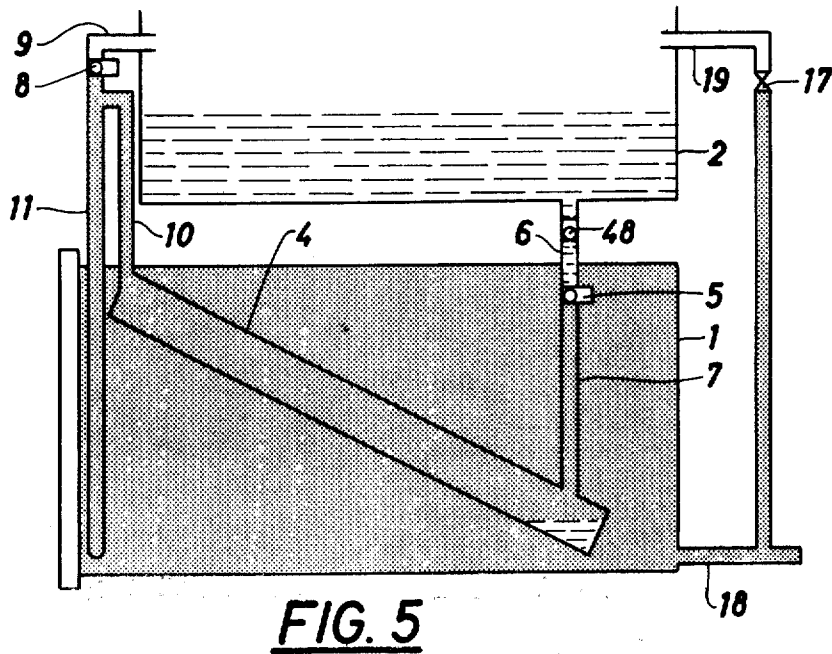


INVENTORS
 WILLI KNOBLAUCH AND
 HANS-PETER BARANOWSKI
 BY
Linton and Linton
 ATTORNEYS



INVENTORS
WILLI KNOBLAUCH AND
HANS-PETER BARANOWSKI
BY

Linton and Linton
ATTORNEYS



INVENTORS
WILLI KNOBLAUCH AND
HANS-PETER BARANOWSKI
BY
Lenton and Lenton
ATTORNEYS

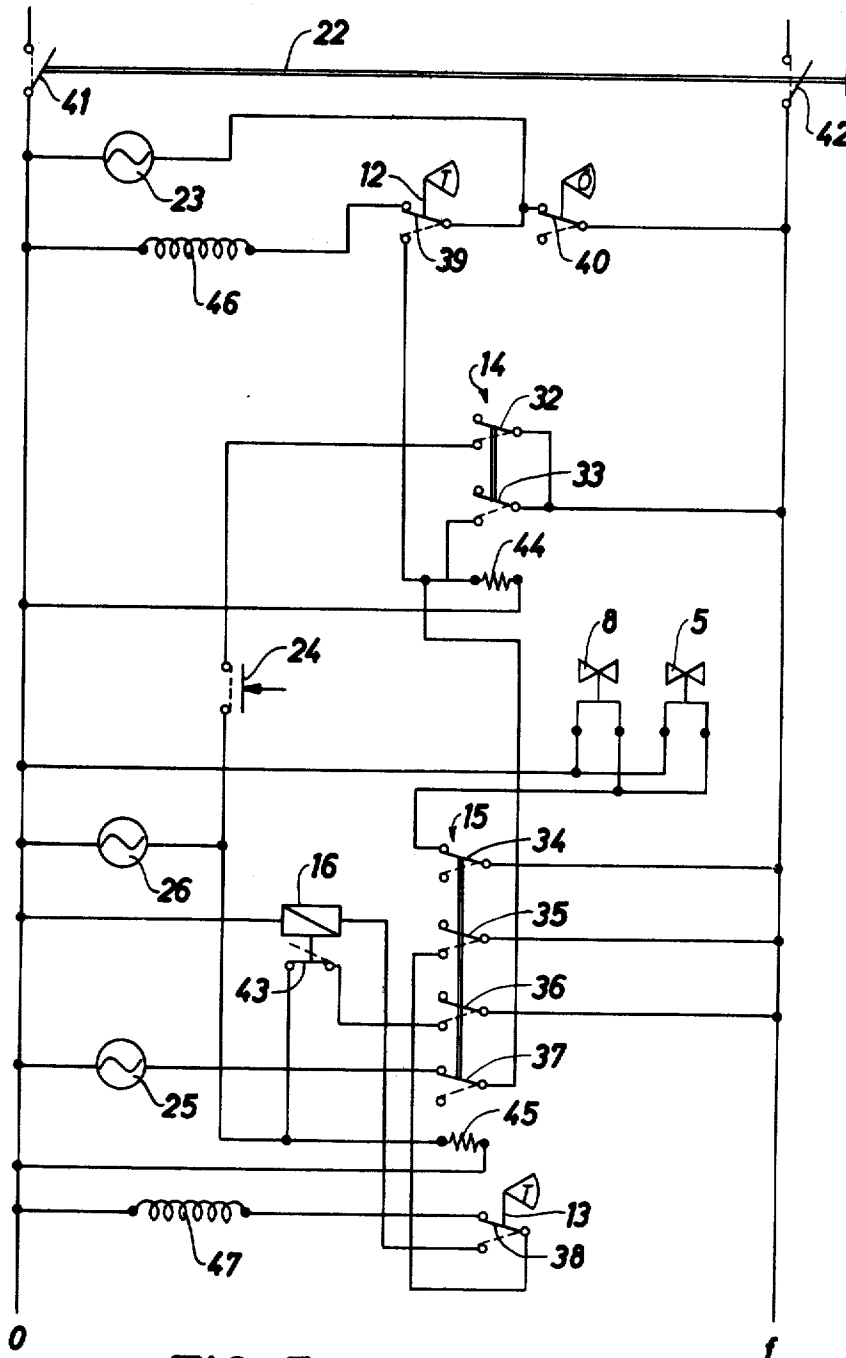


FIG. 7

INVENTORS
WILLI KNOBLAUCH AND
HANS-PETER BARANOWSKI
BY

Linton and Linton
ATTORNEYS

STEAM STERILIZING APPARATUS

The present invention relates to an apparatus for sterilizing by steam.

The principal object of the invention is to provide a sterilizing apparatus of rapid and reliable operation, it not being required to connect said apparatus to any water work system or to refill the apparatus with liquid each time the equipment is going to be used, which is the case when operating with equipment of the prior art.

By means of an apparatus made according to the invention said object is realized, such apparatus being characterized by the combination of

- a separate evaporation tank arranged to receive in its inner hollow chamber the liquid to be evaporated,
- another tank for liquid and condensate located at a higher level than the sterilization chamber and the evaporation tank,
- installations serving the purpose to establish a connection between the tank for liquid and the interior hollow chamber of the evaporation tank with means permitting interruption of the flow, said communication being located at a lower level in said tank for liquid than the lowest level of the liquid therein under operating conditions,
- located at a low level in the evaporator, installations, which establish for one part a communication between the sterilizing chamber and the inner hollow chamber of the evaporator at a high level in the latter one, and for another part a communication between on the one hand the sterilization chamber and said high level portion of the inner hollow chamber of the evaporator respectively, which communication is provided with means for interrupting the flow, and on the other hand the tank for liquid and condensate at a point located above the highest level of the liquid in said tank under operating conditions,
- and a valve connected with the sterilization chamber in order to permit the maintenance of the desired working pressure in said chamber.

An embodiment of a sterilization apparatus according to the invention is described hereinafter with reference to the accompanying drawings, in which

FIG. 1 is a perspective view of an autoclave made according to the invention,

FIG. 2 is a front view of the same autoclave,

FIGS. 3 - 6 schematically illustrate the apparatus shown in FIGS. 1 and 2 during different stages of its operation, and

FIG. 7 is a wiring diagram of the electric installation of the same apparatus.

In FIG. 1 a tank housing the sterilization chamber is indicated by the digit 1, the wall of said tank being provided with heating coils for its heating. Above the sterilization tank 1 a tank 2 for liquid is located housing a condenser not shown in the drawing, said tank partly being covered with a cap 3. In the hollow interior of a long cylinder 4 a heating rod or similar heating device not shown in the drawing, is arranged in order to evaporize liquid introduced into the cylinder cavity. In order to obtain a controlled movement of steam generated in the cylinder 4 said cylinder is given an inclined position as is evident from the drawing. The body of a magnetically controlled shutoff valve 5 is by means of

a pipe 6 connected with the tank 2 for liquid at the lower portion thereof and by means of a pipe 7 connected with the lower portion of the cavity of the evaporizing cylinder 4. The body of another magnetically operated shutoff valve 8 is on one hand via a pipe 9 communicating with the tank 2 for liquid and on the other hand via a branch pipe 10 communicating with the interior chamber of the evaporizing cylinder 4 at its upper portion, and via another branch pipe 11 of a total of two such branches communicating with the sterilization chamber. Digits 12 and 13 indicate two thermostates, and two relays are indicated by 14 and 15 respectively. A time relay is indicated by 16. The inlet port of a security valve 17 is via a pipe 18 connected with the sterilization chamber, the outlet port of said valve via a pipe 19 being connected with the tank 2 for liquid and the condenser located therein. A pressure gauge 20 via a pipe 21 registers the pressure of the evaporizing cylinder 4. An entire group of controls and indicator lights comprising on one hand a main switch 22, an indicator light 23 for the main power circuit, a normally open starting switch 24, a light 25 giving a signal, when the sterilization can be started by actuating the starting switch 24, and a light 26 indicating that the sterilization process is going on, is indicated by 49. The interaction between the switches and the indicator lights 22 - 26 is best evident from the wiring diagram illustrated in FIG. 7, which will be described in detail below.

In the embodiment illustrated in the drawings the opening 27 of the sterilization chamber can be covered by a pivotable door 28 arranged to pivot around a pin 29, and which door can be locked in its pivoted position by means of an eccentric 31 operated by means of a stick 30. The thermostates 12 and 13 record the temperature of the sterilization chamber.

In FIG. 7 two contacts of the relay 14 are indicated by 32 and 33. Four contacts of the relay 15 are indicated with 34 - 37, a contact of the thermostat 13 is indicated by 38, a contact of the thermostate 12 by 40, two contacts of the main switch 22 by 41 and 42 respectively, and finally magnetic coils of the time relays 14 and 15 are indicated by 44 and 45. The heating coil laid around the wall of the sterilization chamber is indicated by 46 and the heating rod of the evaporizing cylinder 4 by 47, which rod as a matter of course instead can be substituted by a heat coil surrounding the walls of the evaporizing cylinder without therefore departing from the fundamental idea of the invention.

The wiring diagram of FIG. 7 corresponds to a non-operating stage of the sterilization apparatus.

When the contacts 41 and 42 respectively of the main switch 22 in the circuit 0 and the phase circuit respectively are moved to the position indicated by broken lines, the circuit via the light 23 and the normally closed contact of the thermostat contact 40 against overheating is closed at the same time as the circuit via the heating element 46 and the thermostat contacts 39 and 40 is closed. Thereby the heating of the heating element 46 is started and consequently also the heating of the jacket of the sterilization chamber 1. When the temperature of the sterilization chamber has gone up to about 138° C the thermostat 12 is actuated, and the contact 39 moves to the position indicated by the broken line resulting in the current via the heating element 46 being interrupted at the same time as the circuit via the magnetic coil 44 of the relay 14 is closed, which results in the contacts 32 and 33 being moved to the posi-

tion indicated by broken lines, whereby the current circuit via the magnetic coil 44 is maintained closed by the contact 33 irrespective of the position, which the contact 39 of the thermostat 12 later on may occupy. When the circuit via the magnetic coil 44 is closed and the contacts of the relay 15 are in the position indicated by full lines, the circuit via the light 25 is closed via the contact 37, whereby an indication is received that the sterilization can start. Until this moment the shutoff valves 5 and 8 have been closed. The sterilization is started by pushing the button of the normally open starting switch 24, whereby the circuit via the magnetic coil 45 of the relay 15 is closed, resulting in the withdrawal of said relay and its contacts changing over to the position indicated by broken lines. Via the contact 36 and the normally closed contact 43 of the time relay 46 the circuit via the magnetic coil 45 is maintained closed also when the switch 24 has changed over to its open position. By the changeover of the contact 37 to the position indicated by the broken line, the circuit via the light 25 is disconnected resulting in said light consequently going out. In the position of the switch 35 indicated by broken lines the circuit via the heating rod 47 is closed via the contact 38 of the thermostat 13, said contact still being in the position indicated by an unbroken line. When the relay 15 is moved, which means that also the contact 34 changes over to the position indicated by broken lines, the circuits via the valve coils 5 and 6 are disconnected, which means that said valves are closed. As long as the relay 15 is withdrawn and consequently the circuit via the magnetic coil 45 is closed, the light 26 is turned on, which indicates that the sterilization is going on. When the desired temperature, about 138° C, has been reached in the sterilization chamber the contact 38 of the thermostat 13 changes over to the position indicated by broken lines, whereby the circuit via the heating rod and consequently the heating up of the evaporizing cylinder 4 is interrupted, this at the same time as the control circuit via the time relay 16 is closed, and said time relay starts counting. After a predetermined time interval the contact 43 of the time relay 16 changes over to the position indicated by broken lines, which means that the circuit via the magnetic coil 45 is disconnected and the contacts 34 - 37 return to the position indicated by unbroken lines in the drawing, resulting in the light 26 being without current and the opening up of the shutoff valves 5 and 8, whereby steam via the pipe 11 flows from the sterilization chamber out to the condenser tank 2.

A check valve is arranged between the magnetic valve 5 and the tank 2 for liquid intended to prevent liquid from flowing into the tank 2 via the pipe 6. Because thereof, no liquid can flow through this pipe in spite of the valve 5 being open, until the atmospheric pressure has been reached in the evaporizing cylinder 4, when the ball valve is opened and the evaporizing cylinder 4 is refilled with liquid flowing down from the tank 2 for liquid. The security valve 17 is set for a pressure, which somewhat exceeds the desired working pressure in the sterilization chamber.

For the sake of clearness the operation sequence of the sterilization apparatus will now be described with reference to the drawings 3 - 6. FIG. 3 illustrates the sterilization apparatus in the condition it has before the start. The check valve 48 arranged between the magnetic valve 5 and the tank 2 for liquid is open, which is the case also with the magnetic valves 5 and 8. The

tank 2, the evaporizing cylinder 4 and the pipes 6, 7 and 10 contain the liquid intended for evaporation, which liquid suitably can be water. At this stage the sterilization chamber housed in the pressure tank 1 and the pipes 11 and 9 contain air of atmospheric pressure.

In the stage illustrated in FIG. 4 the desired temperature in the jacket of the pressure tank 1 has been reached, and the sterilization has begun. The magnetic valves 5 and 8 are closed. By heating up the evaporizing cylinder 4, steam is generated therein, which via the pipes 10 and 11 is introduced into the sterilization chamber, in which the pressure increases up to the opening pressure of the security valve, which as a consequence opens up and lets through steam and air from the sterilization chamber to the tank 2 for liquid.

In the stage illustrated in FIG. 5 the desired temperature, about 138° C, has been reached in the sterilization chamber, and the heating of the evaporizing cylinder 4 has been interrupted. The magnetic valves 5 and 8 remain closed.

In the stage illustrated in FIG. 6 the predetermined time interval for the sterilization process has expired, and the valves 5 and 8 are opened up. On account of the high pressure in the evaporizing cylinder 4 the check valve 48 is closed, while the steam is permitted to freely flow via the pipes 10, 11 and 9 out of the evaporizing cylinder as well as the sterilization chamber into the tank 2 for liquid to be condensed whereby the pressure in the sterilization chamber and the evaporizing cylinder 4 goes down to atmospheric pressure. When the atmospheric pressure is reached the check valve 48 opens up and a refill of the evaporizing cylinder 4 takes place.

By the arrangement described above and illustrated in the drawings, involving the magnetic valve 8 and the pipes 9, 10 and 11 connected with said valve and moreover the valve arrangement in the pipe system 6, 7, water is prevented from being drawn into the sterilization chamber during the cooling period.

By the arrangement described above an autoclave is provided, which among other things is very cheap to manufacture and operate.

The invention is not limited to the embodiment described above and illustrated in the drawings only by way of example, but can be varied as to its details within the scope of the following claims.

We claim:

1. Steam sterilizing apparatus comprising a sterilization chamber, a liquid and condensing container located at a higher level than said sterilization chamber, an evaporation container located at a lower level than said liquid and condensing container, means providing communication between said evaporation container and said sterilization chamber being permanently open and having a common point being located at a higher level than the highest level of the liquid in said liquid and condensing container during the operation of the sterilizing apparatus, an interruptable air escape way between said common point and the liquid and condensing container, interruptable communication means between at the one hand a point in the liquid and condensing container being located at a lower level than the lowest level of the liquid in the latter during the operation of the sterilizing apparatus and at the other hand said evaporation container, means for directing the liquid stream towards said evaporation container

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and separate means for heating a jacket surrounding said sterilization chamber.

2. Apparatus as described in claim 1, comprising controllable means for introducing steam in said sterilization chamber which means can be controlled to permit the steam to be introduced in said chamber only when the average temperature has reached almost its operation value.

3. Apparatus according to claim 1, characterized in that the first mentioned communication between the sterilization chamber, the evaporizing tank, and the tank (2) for liquid and condensate comprising pipes (9 - 11), which only exhibit horizontal or upwards directed parts.

4. Apparatus according to claim 3, characterized in that the pipes (10, 11) parting from the upper portion of the inner hollow chamber of the evaporizing cylinder (4) join together in a common pipe (9) at a point located before the tank (2) for liquid, by a first shutoff valve (8) being arranged in the common branch, and by a second shutoff valve (5) being arranged in a pipe (6, 7) forming the communication between the lower portion of the interior cavity of the evaporizing tank and the liquid tank.

5. Apparatus according to claim 4, characterized in that a check valve (48) is arranged in the last men-

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tioned pipe, which control valve is intended to prevent liquid from flowing in the direction from the evaporizing tank (4) to the tank (2) for liquid and condensate.

6. Apparatus according to claim 4, characterized in that said shutoff valves (5, 8) are actuated by controlling means in such a way that said valves are kept closed during the heating period of the evaporizing cylinder (4) and until the sterilization chamber has reached the desired sterilization temperature, whereafter they open up with a predetermined delay of time, and thus the communication between the sterilization chamber and on one hand the evaporizing tank and on the other hand the tank (2) for liquid and condensate is opened.

7. Apparatus according to claim 1, characterized in that the evaporizing tank (4) exhibits a greater cubic content than the one required for the maximum volume of liquid to be evaporated for sterilization.

8. Apparatus according to claim 1, characterized in that the evaporizing tank (4) is a long cylinder occupying an inclined position in the vertical plane.

9. Apparatus according to claim 8, characterized in that a heating rod is arranged in centric position in the evaporizing cylinder and extending in longitudinal direction in said cylinder.

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