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K. M. HENFREY

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STERILIZER AND CONTROL APPARATUS

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2 Sheets-Sheet 1

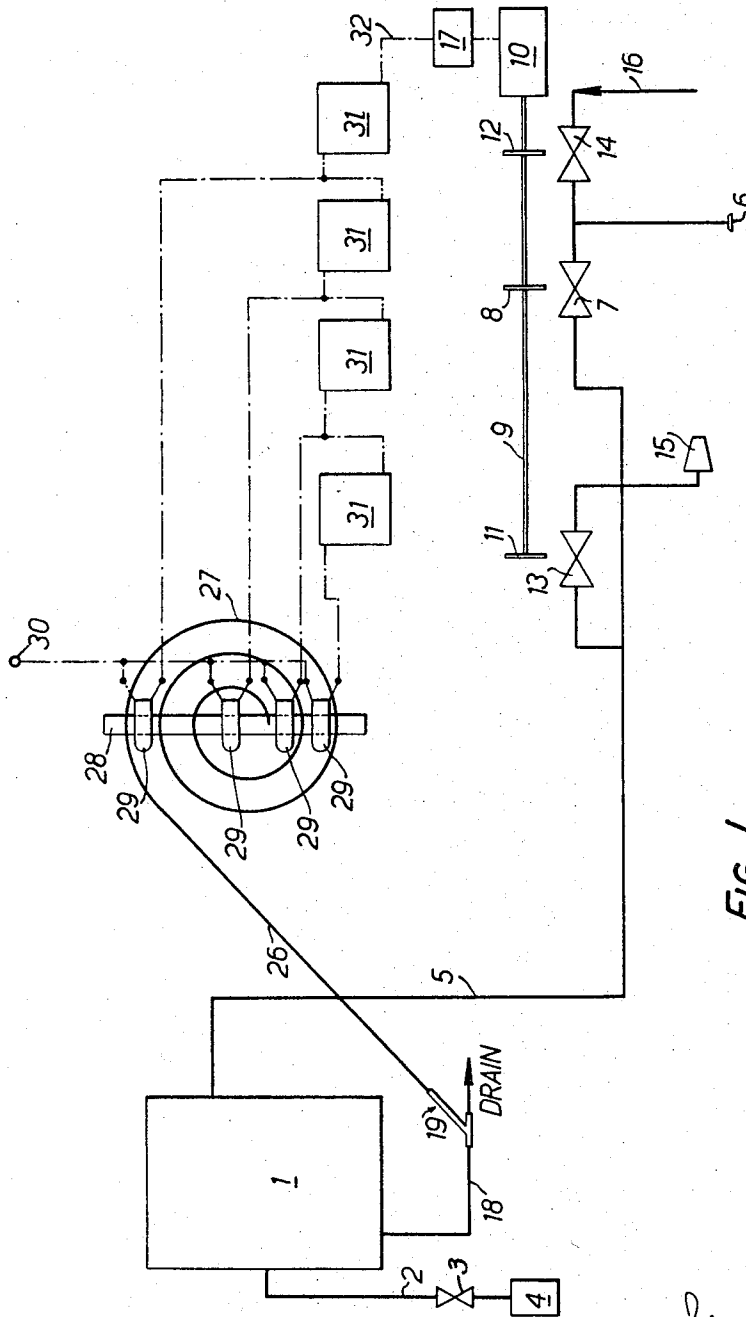


FIG. 1.

Inventor
Kenneth Marden Henfrey
By
Thomson & Schover
Attorneys

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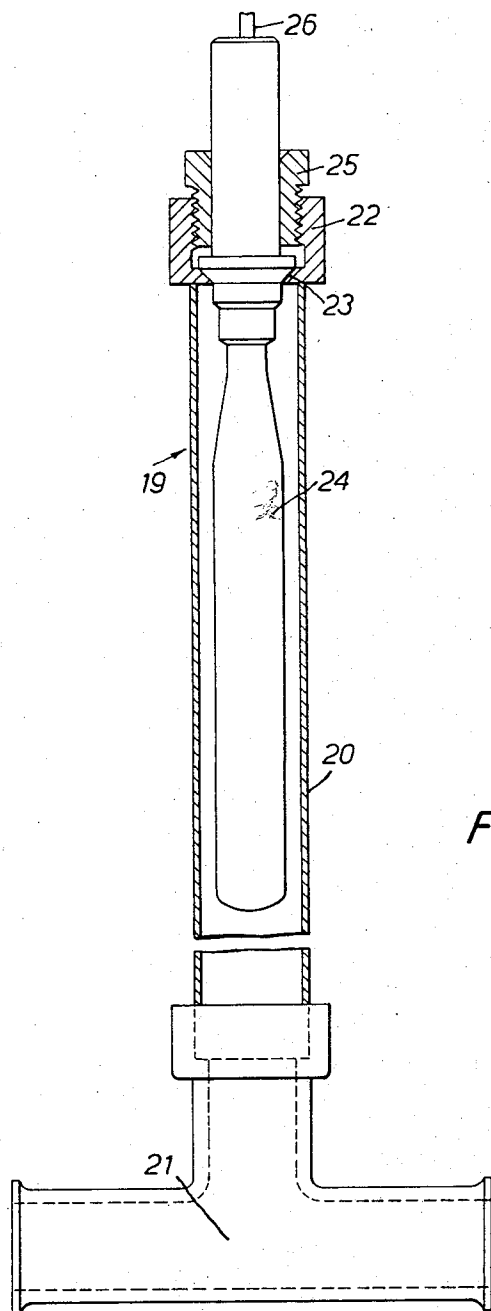


FIG. 2.

Inventor
Kenneth Menden Henfrey
By Thomson & Schone
Attorneys

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STERILIZER AND CONTROL APPARATUS

Kenneth Marden Henfrey, Pyrford Woods, near Woking, Surrey, England, assignor to Drayton Castle Limited, West Drayton, Middlesex, England, a British company
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Claims priority, application Great Britain, Aug. 23, 1962, 32,467/62

4 Claims. (Cl. 21—94)

ABSTRACT OF THE DISCLOSURE

I provide a device for simulating air entrapment conditions in a load within a sterilizer vessel, which device includes an elongated static chamber formed from a length of tubing 20. There is a temperature sensitive bulb 24 in the static air chamber responsive to temperature conditions indicating relative air and steam proportions in the closed end of the static air chamber for controlling the sterilizing time.

The present invention relates to sterilizers, more particularly sterilizers of the type comprising a container or vessel adapted to receive the articles to be sterilized, means for evacuating air from the container, and means for admitting steam to the evacuated container.

The sterilizing time in such sterilizers is controlled in dependence on the temperature within the vessel, usually by means of a temperature responsive probe positioned in the chamber drain of the vessel. When sterilizing fabrics it is found that such method of control is not entirely satisfactory since due to the air which remains entrapped in the fabrics, the temperature recorded in the chamber drain is higher than that existing within the contents of the sterilizer. Furthermore any air entrapped in blind ends of pipes connected to the vessel will result in discrepancies between the recorded temperature and the temperature of the steam surrounding the fabrics.

According to the present invention there is provided a device for attachment to or incorporation in a sterilizer of the type referred to, which device comprises a chamber adapted to be connected with the interior of the sterilizer in such manner that the relative proportions of air and steam in the chamber correspond to the relative proportions of the air entrapped in a fabric load within the sterilizer and the steam surrounding the fabric load, and means responsive to the temperature in the said chamber for controlling the sterilizing time.

The said device thus simulates the steam-air proportions pertaining within the sterilizer and may be referred to as a load simulator, the average temperature during the sterilizing period as recorded in the load simulator being equal to or slightly lower than the lowest temperature reached during the said period within the sterilizer load. In addition the temperature recorded in the load simulator will give an indication of any leakage of air into sections of pipework connected to the sterilizer and which are subjected to vacuum.

Conveniently, the chamber of the load simulator is formed by a length of tubing adapted to be supported in an upwardly inclined position and to be connected at its lower end with the drain of the sterilizer vessel. The upper end of the tubing is closed and supports the temperature responsive bulb of a thermostatic system, the said bulb extending downwardly into the tubing concentrically thereof. The thermostatic system, in conjunction with a timing means, controls the actuation of a valve for terminating the admission of steam to the sterilizer thereby to vary the sterilizing time in accordance with the temperature reached in the chamber of the load

simulator and sensed by the bulb, which temperature will vary according to the amount of air entrapped in the simulator. If a comparatively large quantity of air is entrapped in the sterilizer load the temperature within the load will be correspondingly low but there will likewise be a considerable amount of air entrapped in the simulator so that the temperature sensed by the bulb will also be low and the sterilizing time will be extended. If substantially all air is extracted from the load, there will be a negligible quantity of air in the simulator and both the temperature within the load and the temperature sensed by the bulb will correspond approximately to that of the steam admitted to the sterilizer and the sterilizing time will accordingly be reduced to a required minimum.

The invention finds special application to sterilizing apparatus of the type in which there is effected automatically a sterilizing cycle consisting of a prevacuum period during which the sterilizing vessel is evacuated, a sterilizing period during which steam is admitted to the evacuated vessel, a post vacuum period during which the vessel is again evacuated and a vacuum breaking period during which air is admitted to the sterilizing vessel. One such application of the invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 shows in purely diagrammatic form a sterilizing apparatus of the type above mentioned and incorporating a load simulator according to the invention; and

FIGURE 2 is a longitudinal sectional elevation drawn to an enlarged scale of the load simulator of FIGURE 1.

Referring firstly to FIGURE 1, there is shown diagrammatically only such elements of the sterilizing apparatus which are necessary for an understanding of the present invention and which comprise a sterilizing vessel 1, a pipe 2 connecting the interior of the vessel through an isolating valve 3 to a vacuum pump 4, and a main steam inlet pipe 5 for admitting steam to the vessel from a steam inlet 6 and through a valve 7 operated by a cam 8 secured on a cam shaft 9 driven by an electric motor 10. The cam shaft 9 also carries further cams 11 and 12 for operating valves 13 and 14 respectively, the valve 13 connecting an air inlet 15 to the main inlet pipe 5 and the valve 14 connecting the steam inlet 6 through pipe 16 to a motor operated valve (not shown) for injecting a series of short bursts of steam into the vessel 1 in the manner described in my co-pending application Ser. No. 304,066 filed Aug. 23, 1963. The said motor operated valve is shown at 12 in the drawings accompanying the said co-pending application. Furthermore and as also described in my said co-pending application, the motor 10 is actuated in known manner by suitable control means 17, responsive to conditions of pressure and/or temperature in the sterilizing vessel to effect a cycle of operation of the valves 7, 13 and 14 whereby the valve 14 is opened during the pre-vacuum period to cause a series of short bursts of steam to be injected into the vessel 1 as described in my aforesaid co-pending application; at the termination of the pre-vacuum period the valve 14 is closed and the valve 7 opened to supply steam to be evacuated vessel, and at the end of the sterilizing period the valve 7 is closed, the valve 3 opens and steam is evacuated from the vessel, after which the valve 3 is closed, and the valve 13 opened to admit atmospheric air to the vessel.

At 18 there is indicated the drain pipe of the sterilizer vessel which has connected thereto the load simulator of the present invention which is indicated generally at 19 in FIGURE 1 and which as shown in FIGURE 2 comprises a length of tubing 20 forming an elongated chamber the said tubing having at one end thereof a T junction 21 for connection in the drain pipe 18 so that the

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tubing 20 inclines upwardly therefrom as shown in FIGURE 1. The other or upper end of the tubing 20 has secured thereto as by welding an apertured cylindrical plug 22 providing a seating 23 for the neck of a thermostat bulb 24 extending downwardly into the tubing 20, the plug 22 being closed by a screw-threaded gland 25 which sealingly engages the neck of the bulb 24.

The bulb 24 is connected by a small bore tube 26 to a Bourdon tube 27 which in known manner expands or contracts with variation of the temperature sensed by the bulb 24. The Bourdon tube has secured thereto a normally vertically extending plate 28 which is thus angularly displaceable upon expansion or contraction of the Bourdon tube and which has secured thereon a plurality, for example four as shown in FIGURE 1, of mercury switches 29 arranged so that in the normally upright position of the plate 28 all the switches 29 are open and upon angular displacement of the plate in a clockwise direction as viewed in FIGURE 1 the switches operate in sequence to the closed condition commencing with the lower most switch.

A common electrical input 30 is connected in parallel to the respective input terminals of the switches 29 and the output terminals of the switches are connected individually to the inputs of four timing devices 31 connected in series one with another and to the motor control means 17. Each timing device 31 is arranged in known manner to give an output a predetermined time after the application thereto of an electrical input and the output of one device is connected to the input of the immediately succeeding device while the output of the last device in the series is connected over lead 32 to the motor control means 17. Thus an input to the first of the timing devices 31 results in an output from the last device which is delayed by a time period corresponding to the cumulative time delay of the four timing devices 31. By means of the switches 29 however, one or more of the devices 31 is cut out and the said time delay correspondingly shortened.

An output over lead 32 causes the motor 10 to rotate the cam shaft 9 to a position closing the steam admission valve 7. The isolating valve 3 then opens thereby terminating the sterilizing period of the sterilizer. It will be apparent therefore that as the temperature sensed by the bulb 24 increases, the sterilizing period will be shortened by the cutting out of one or more of the timing devices 31.

In one specific example the Bourdon tube and mercury switch assembly is arranged so that at a temperature in the load simulator of 250° F. the lowermost switch 29 operates to close a circuit from the electrical input 30 to the input of the first timing device 31; at a load simulator temperature of 258° F. the next to lowermost switch 29 operates to close a circuit from the electrical input 30 to the input of the second timing device 31 thus short-circuiting the first timing device. At a load simulator temperature of 266° F. the next to uppermost switch 29 operates to connect the electrical input 30 to the input of the third timing device 31 thereby short-circuiting the first and second timing devices while when the load simulator reaches a temperature of 274° F. the uppermost switch 29 connects the electrical input 30 to the input of the fourth timing device and short-circuits the first three timing devices.

It will be apparent therefore that depending on the temperature sensed by the bulb 24 there will be a delay in causing the motor 10 to terminate the sterilizing period, the said delay varying from a maximum corresponding to the cumulative delay of the four timing devices when only the lowermost switch 29 is operated to a minimum corresponding to the delay of one timing device 31 when the uppermost switch 29 is operated.

As hereinbefore mentioned, if a large quantity of air is entrapped in the sterilizer load the temperature with-

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in the load will be correspondingly low but there will likewise be a considerable amount of air entrapped in the tubing 20 of the simulator so that the temperature sensed by the bulb 24 will also be low and the sterilizing time will be extended by the delay introduced by the timing devices 31. If substantially all air is extracted from the load there will also be a negligible quantity of air in the simulator tubing so that the temperature sensed by the bulb 24 will approximate to that of the steam admitted to the sterilizer vessel and the sterilizing time will be reduced to a required minimum determined by the delay time of the last timing device 31.

It will be understood that the invention is not limited to the above described specific embodiment thereof and for example the Bourdon tube and mercury switch assembly may be replaced by other suitable means for selectively connecting the electrical input 30 to the input of one of the timing devices 31 in dependence on the temperature sensed by the bulb 24. Furthermore the load simulator could be connected directly with the interior of the sterilizing vessel and, for example, could be secured on the wall of the sterilizing vessel, the wall being apertured to communicate the load simulator with the interior of the vessel.

I claim:

1. A load simulator for simulating conditions in the pressure chamber of a pressure vessel, comprising a first pressure chamber, a separate smaller static fluid pressure chamber means having a lower end and an upstanding tubular section said lower end communicating with said first pressure chamber and constructed for statically accumulating fluid from said first pressure chamber throughout a selected sterilizing period, including means maintaining said smaller chamber throughout said period communicating only with said first pressure chamber, means for continuously discharging condensate from said smaller chamber, responsive means only within said smaller chamber positioned therein free of condensate being discharged from said smaller chamber and being responsive to a selected condition within said smaller chamber for actuating selected controls.

2. A load simulator for simulating the steam-air proportions in a sterilizing chamber comprising, a sterilizing chamber, a separate elongated chamber adapted to accumulate a static atmosphere of steam-air and having a lower end and an upstanding tubular section and connected at a lower end with the sterilizing chamber and closed at an upper end and means to continuously discharge condensate from said elongated chamber, and temperature sensing means only within said elongated chamber and positioned therein free of condensate being discharged from said elongated chamber and being responsive for sensing the temperature within the upper end of the said elongated chamber.

3. A load simulator in accordance with claim 1 including a steam admission valve and means connecting said temperature sensing means to said valve for closing the steam valve when the temperature sensed by said sensing means reaches a predetermined value.

4. A load simulator in accordance with claim 1 including a discharge line from said sterilizing chamber, and said elongated chamber communicating with said discharge line.

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JAMES H. TAYMAN, Jr., *Primary Examiner.*