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Bezrodny et al.

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[54] **APPARATUS FOR REGULATING PRESSURE INSIDE AN AUTOCLAVE**

[76] Inventors: **Konstantin Nikolaevich Bezrodny,** ulitsa Arsenieva, 6a, kv. 8; **Vladimir Nikolaevich Voit,** ulitsa Pecherskaya, 8, kv. 33, both of Vladivostok, U.S.S.R.

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[51] **Int. Cl.** **A61l 3/00,** G05d 16/08

[58] **Field of Search** ..... 21/91, 93, 94, 97, 98, 21/103; 99/212, 214, 359, 325; 202/160; 73/393, 4 R

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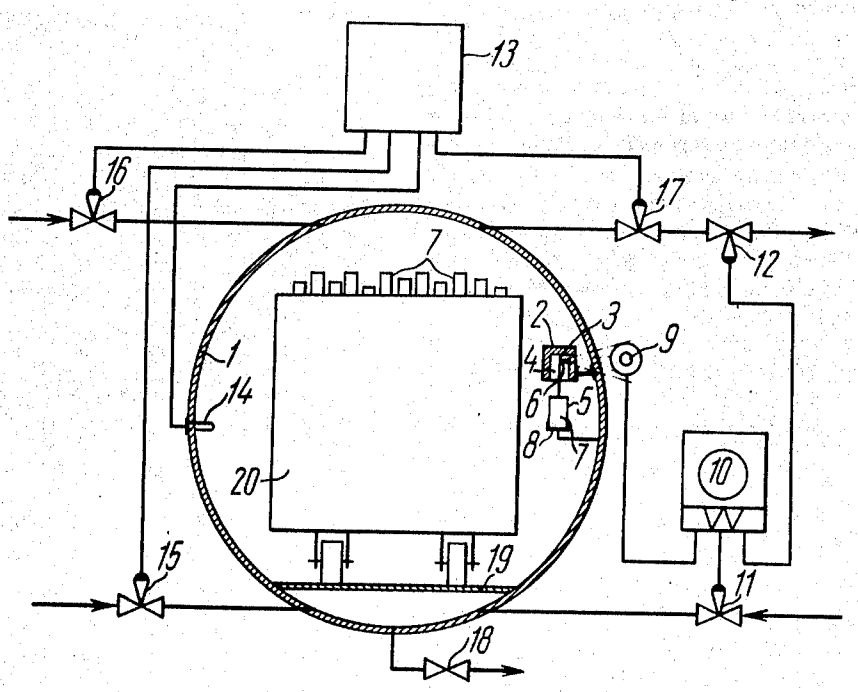
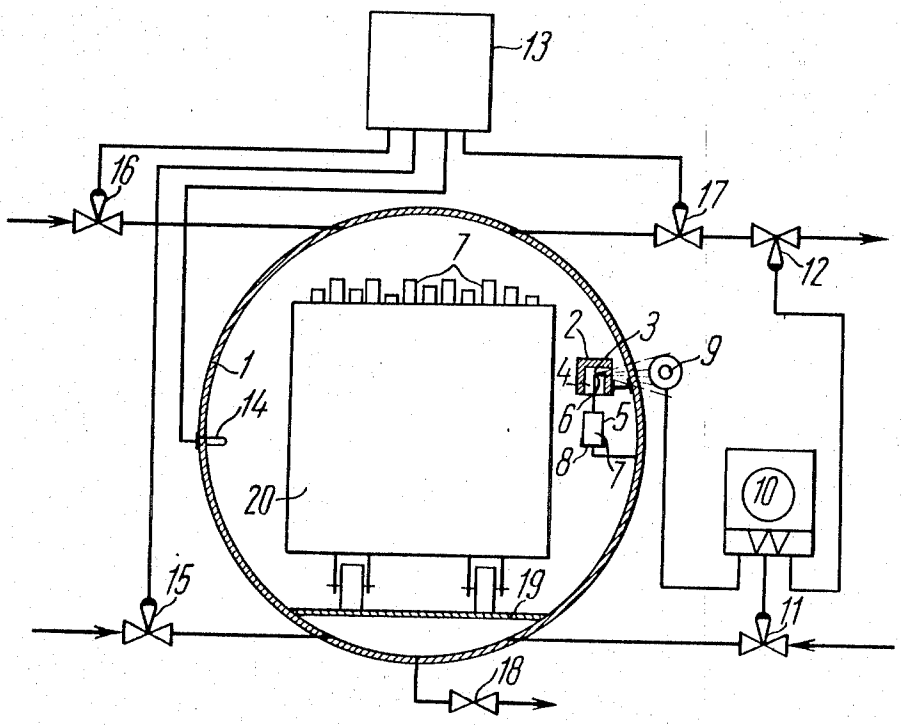
Primary Examiner—Joseph Scovronek
Assistant Examiner—Tim Hagan
Attorney, Agent, or Firm—Holman & Stern

[57] **ABSTRACT**

Pressure regulating apparatus in which the control maintaining the pressure inside an autoclave equal to the pressure inside containers holding the product being sterilized is connected to the output of the sensor means responsive to the pressure inside these sealed containers. The sensor means includes a probe carrying thereon a source of radioactive radiation and a detector of radioactive radiation. To effect the regulating operation, the probe is made to engage one of the containers being treated. Any displacement of the probe brings about a variation of the value of radioactive radiation being transmitted to the radiation detector, whereby the latter varies the output signal thereof, this signal controlling the operation of the control.

2 Claims, 1 Drawing Figure

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APPARATUS FOR REGULATING PRESSURE INSIDE AN AUTOCLAVE

BACKGROUND OF THE INVENTION

The invention relates to apparatus for thermal treatment of products, and, more particularly, it relates to apparatus for regulating pressure inside an autoclave in the course of the sterilization of products received within sealed containers, or cans. The invention can be employed for treatment of foodstuffs, particularly when the latter are received within containers with thin walls, e.g., with wall thickness below 0.22 mm.

A known apparatus for regulating automatically the pressure inside an autoclave comprises a sensor means responsive to the pressure inside a container holding the product, and a control of the supply of compressed air into the autoclave. The pressure-responsive sensor means in this known apparatus includes a movable stem positioned to engage a sample sealed container and a hydraulic element in the form of, for instance, a sealed tube filled with a liquid, one end of this tube, serving as the input, being closed with a resilient diaphragm, the other end of this tube, i.e., the output one being associated with the abovementioned control. When an autoclave incorporates the abovedescribed sensor means, a special cavity is made in the wall of the autoclave to accommodate the sample sealed container, and the stem is made to extend through the wall of this cavity to the exterior of the autoclave, with the help of a suitable seal.

A disadvantage of this known structure is the fact that the bulk of the sealed containers being treated and the sample one are subjected to different physical conditions, which substantially reduces the accuracy of maintaining equality of the pressure inside and outside the sealed containers being treated, e.g., sterilized.

The external end of the stem being subjected to atmospheric pressure, while the internal end thereof is subjected to the gauge pressure inside the autoclave, there arises a necessity of providing a return spring. However, the presence of the return spring and of the seal increases the inertia of the operation of the apparatus.

SUMMARY OF THE INVENTION

It is an object of the present invention to improve the accuracy of maintaining equality of the pressure inside and outside sealed containers being sterilized in an autoclave, as well as to reduce the inertia of the operation of the pressure regulating apparatus.

This and other objects are attained in an apparatus for regulating pressure inside an autoclave in the course of an operation of sterilization of products received within sealed containers, comprising a sensor means responsive to the pressure inside one of said sealed containers, having the output thereof connected to a control adapted to maintain inside said autoclave a pressure equal to the pressure inside said one sealed container, in which apparatus, in accordance with the invention, said sensor means includes a probe positioned interiorly of said autoclave and adapted to engage said one sealed container, said probe carrying a source of radioactive radiation, said source being thus made to vary the position thereof in response to variation of the pressure inside said one sealed container, and a radiation detector mounted exteriorly of said autoclave, adapted to respond to the flow of radioactive radiation from said source and to vary the output signal thereof in response to a displacement of said probe.

With the apparatus constructed in accordance with the invention, the sensor means thereof provides for effecting pressure regulation by employing any one of the containers being treated as the sample one, all the containers in the autoclave being subjected to the same physical condition, whereby it becomes possible to improve the accuracy of maintaining the equality of the pressure inside and outside the containers.

Moreover, the absence of parts subjected to friction in the herein disclosed sensor means considerably reduces the inertia of the operation of the apparatus, as a whole.

In an apparatus for regulating pressure, constructed in accordance with the present invention, said radioactive radiation source carried by said probe is preferably received within a casing fixedly mounted interiorly of the housing of said autoclave, said casing having a channel perpendicular to a groove made therein, said groove serving as a guideway for said probe, said channel being intended for emitting the radioactive radiation from said casing, said radiation detector being mounted exteriorly of said autoclave, in opposition to said other groove.

BRIEF DESCRIPTION OF THE DRAWING

The present invention will be further described in connection with an embodiment thereof, with reference being had to the appended drawing illustrating schematically an autoclave incorporating a pressure regulating apparatus in accordance with the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In the drawing, the housing **1** of an autoclave has rigidly mounted on the internal wall thereof a lead casing **2** in the walls of which a perpendicular channel **3** and perpendicular groove **4** are cut. The groove **4** receives therein a movable probe **5** of which the upper portion carries a source **6** of radioactive radiation. In the course of a regulating operation the bottom end portion of the probe **5** is made to engage a container **7** supported by a support platform **8** mounted on the wall of the housing **1.** The autoclave being intended for sterilization of containers of different height, the support platform should be made movable in respect of the bottom face of the casing **2.** Mounted exteriorly of the housing **1,** in opposition to the channel **3** is a detector **9** of radioactive radiation. The movable probe **5,** the radioactive source **6** carried on the probe **5** interiorly of the casing **2,** and the detector **9** make up together a system responsive to the pressure inside the container **7** the source **6** the container **2** and detector **9** forming a means transmitting a signal indicative of the amount of displacement of the probe **5** which corresponds to pressure change. Connected to the output of the detector **9** is an electronic relay **10** operatively associated with the compressed air supply control **11** and with the steam and air exhaust control **12.**

The two abovementioned controls can be in the form of any suitable known control valves.

Temperature inside the autoclave can be controlled by a program-operated temperature regulator **13** including a commonly known balanced electronic bridge

circuit of which one of the arms includes a temperature-responsive resistor **14** mounted interiorly of the housing **1** of the autoclave. The output of the program-operated temperature regulator is connected to the steam supply control **15**, to the water supply control **16** and to the upper exhaust control **17**.

Mounted at the bottom portion of the herein disclosed autoclave is a water drain valve **18**. The autoclave is provided interiorly thereof with a floor **19** adapted to support a trolley **20** with containers **7** that are to be treated.

The herein disclosed apparatus operates, as follows:

Prior to a sterilization operation, a trolley **20** with containers **7** is positioned on the floor **19** of the autoclave, and one of the containers is put onto the support panel **8**. The probe **5** is made to engage physically the lid of the last-mentioned container **7**, with the probe **5** being so positioned that the radioactive source **6** carried thereby should be at the level of the lower edge of the channel **3**, so that the radiation from the source **6** should not reach the detector **9**.

Then the housing **1** of the autoclave is closed with a lid (not shown in the drawing), and the program-operated temperature control **13**, the temperature pickup **14** and the relay **10** are energized. Now the control valves **12, 15** and **17** are open, and the control valves **11** and **16** are closed. The drain valve **18** is also closed. The steam is supplied through the control valve **15** into the housing **1** where it heats up the containers with the foodstuff thereinside, whereafter the steam finds its way from the autoclave through the control valves **17** and **12**. The containers **7** are heated up to a preset sterilization temperature, whereafter the control valve **17** is closed, while the control valve **15** is alternately opened and closed to maintain the desired sterilization temperature within the housing **1**.

In the course of the sterilization operation the pressure inside the containers **7** rises until the gauge pressure thereinside drives the sealed lid of the container **7** (the one supported on the platform **8**) upwardly, whereby the probe **5** with the radioactive source **6** carried thereby is driven upwardly in the groove **4** of the casing **2**, and the source **6** becomes positioned at the channel **3**. The detector **9**, in response to the increased radioactive radiation, sends a control signal through the relay **10** to the control valve **11**. With the control valve **11** open, compressed air is supplied therethrough into the housing **1** until the pressure within the housing **1** equals the pressure within the container **7**. When this is achieved, the probe **5** with the radioactive source **6** returns to its initial position, whereby the corresponding output signal of the relay **10** brings about the opening of the control valve **12** and closing of the control valve **11**. However, in this case water is not drained from the housing **1**, because the control valve **17** connected in series with the control valve **12** remains closed.

In this way there is carried out the thermal sterilization stage of the canned foodstuff, throughout which the temperature within the housing **1** is maintained at a preset level, and the pressure thereinside is maintained equal to the pressure within the containers.

When the predetermined time interval elapses, the program-operated temperature control **13** closes the control valve **15** and opens the control valves **17** and **16**. Should the pressure inside the housing **1** fall below the pressure within the container **7** on the platform **8**, the lid of the container drives upwardly the probe **5**, making the latter rise together with the radioactive source **6** along the groove **4**. As a result, the beam of radioactive radiation intercepted by the detector **9** is increased, and the output signal of the latter makes the relay **10** send a control command to open the control valve **11** and to close the control valve **12** until the pressure inside the housing **1** equals again the pressure inside the sealed containers **7**.

The abovedescribed alternating opening and closing of the control valves **11** and **12** would be continued until the temperature and the pressure within the autoclave are brought down to the desired values.

The herein disclosed apparatus makes it possible to cut down considerably the time of cooling down of sealed containers inside an autoclave and also to positively prevent any irreversible deformation of sealed containers filled with a product to be sterilized.

What we claim is:

1. In an apparatus for regulating pressure inside an autoclave supplied with a working agent during sterilization of products sealed within a plurality of pressurized containers, comprising control means for controlling the supply of the working agent to maintain the pressure in the autoclave equal to the pressure inside said containers, a pressure sensor means including a movable probe positioned inside said autoclave, one end of said probe being in physical contact with one of said containers located on an individual platform in said autoclave, a signal transmission means for transmitting a signal indicative of the extent of movement of said probe in accordance with pressure changes in said control means, the improvement wherein said signal transmission means includes a source of radioactive radiation secured at the other end of said probe, a rigidly fixed casing means which is non-transparent to radioactive radiation and is adapted to movably receive that end of the probe carrying the source of radioactive radiation, said casing means being provided with a channel to permit the emission of radioactive radiation, and detector means for detecting the radioactive radiation and mounted exteriorly of said autoclave opposite to said channel and operatively connected to said control means so as to operate said control means in response to changes in the emission of radioactive radiation detected by said detector means.

2. An apparatus as claimed in claim **1**, wherein said radioactive radiation source carried by said probe is received within said casing means which is fixedly mounted interiorly of said autoclave, said casing means having in addition to said channel a groove made therein, and said groove serving as a guideway for said probe.

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