

April 30, 1963

J. C. MONK

3,087,209

CONTAINER STERILIZING APPARATUS

Filed July 13, 1959

3 Sheets-Sheet 1

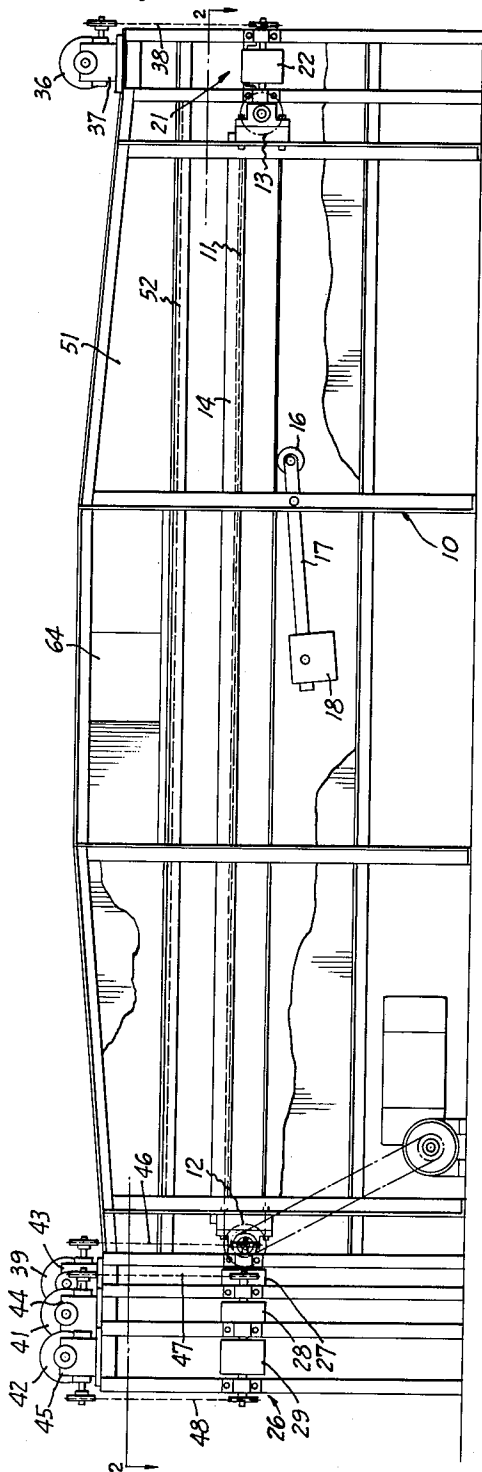


FIG. 1

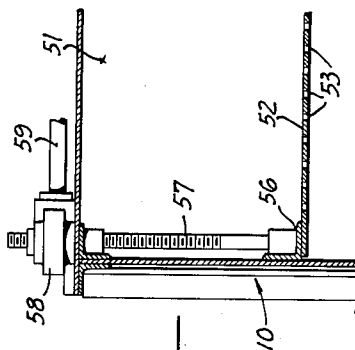


FIG. 3

INVENTOR.

John C. Monk

BY

Flannery Swain

ATTORNEYS

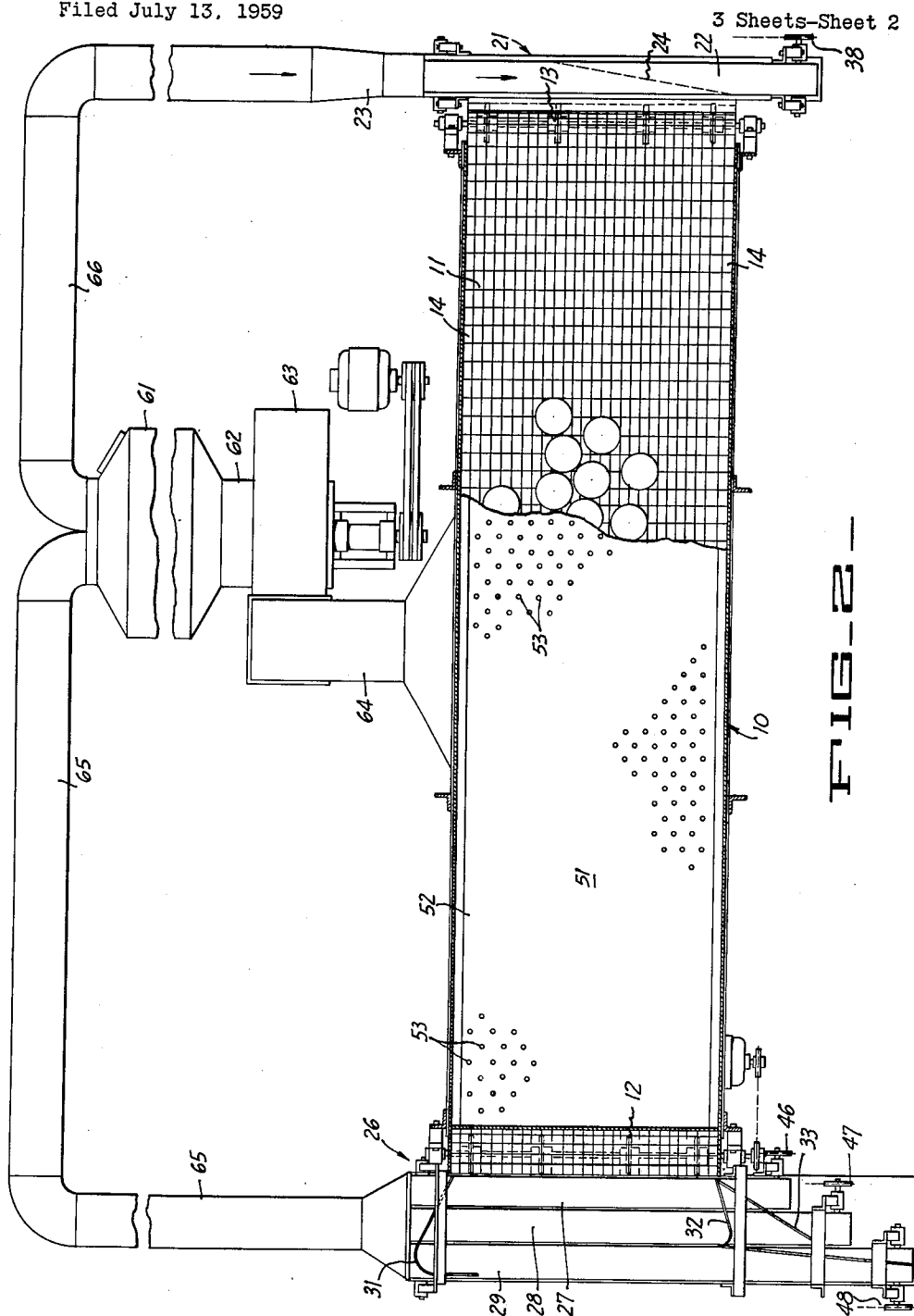
April 30, 1963

J. C. MONK

3,087,209

CONTAINER STERILIZING APPARATUS

Filed July 13, 1959



INVENTOR
JOHN C. MONK
BY *Flaherty & Serain*
ATTORNEYS

April 30, 1963

J. C. MONK

3,087,209

CONTAINER STERILIZING APPARATUS

Filed July 13, 1959

3 Sheets-Sheet 3

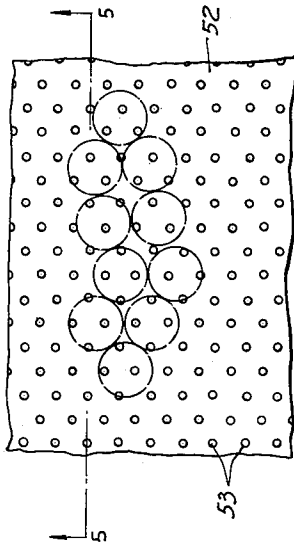
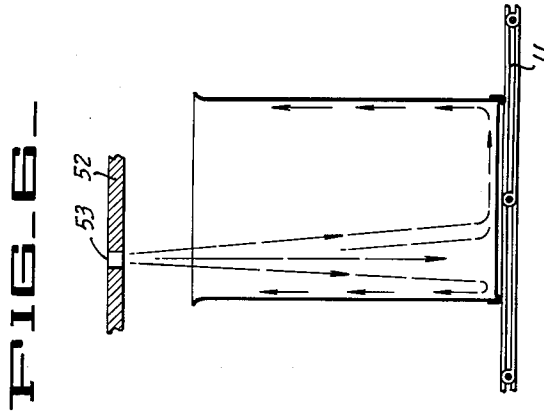


FIG-4-

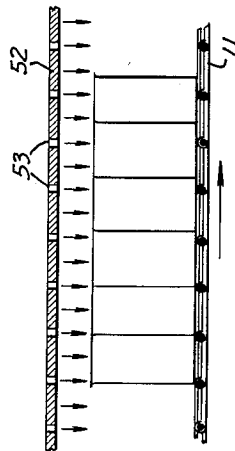


FIG-5-

INVENTOR.
John C. Monk

BY
Flcher & Swain
ATTORNEYS

1

3,087,209

CONTAINER STERILIZING APPARATUS

John C. Monk, San Francisco, Calif., assignor to Foremost Dairies, Inc., San Francisco, Calif., a corporation of New York

Filed July 13, 1959, Ser. No. 826,658

3 Claims. (Cl. 21—80)

This invention relates generally to apparatus for the sterilization of open cans or other containers, preparatory to introduction of a food product.

In so-called aseptic canning operations a food product such as milk is sterilized and introduced into sterile cans or other containers, after which sterile lids are applied, and the cans sealed. The apparatus presently available for sterilizing the open cans or containers is not satisfactory for modern high capacity canning operations. Particularly the capacity of such equipment is inadequate, thus interfering with the development of high capacity and low cost plant operations. In addition, the methods employed for heat exchange between the hot sterilizing fluid (e.g. steam or air and steam) do not insure complete destruction of heat resistant organisms or spores that may be present. Also there is considerable loss of heat due to the absence of recirculation of the sterilizing fluid, thus making for poor thermal efficiency.

In general it is an object of the present invention to provide an improved apparatus for the sterilizing of open cans or other containers.

Another object of the invention is to provide apparatus of the above character which is characterized by high capacity.

Another object of the invention is to provide an apparatus and a sterilizing method which insures complete destruction of heat resistant organisms or spores that may be present upon the inner surfaces of the containers.

Another object of the invention is to provide apparatus of the above character which is characterized by simplicity of construction, which can be made without undue expense, and which is simple to operate and maintain.

Additional objects and features of the invention will appear from the following description in which the preferred embodiment has been set forth in detail in conjunction with the accompanying drawing.

Referring to the drawing:

FIGURE 1 is a side elevational view illustrating equipment in accordance with the present invention.

FIGURE 2 is a plan view of the equipment shown in FIGURE 1, with the housing cover removed to expose the inner conveyor.

FIGURE 3 is a cross sectional detail on an enlarged scale showing means for adjusting the lower wall of the plenum chamber.

FIGURE 4 is a planned schematic view illustrating the disposition of cans below the bottom wall of the plenum chamber.

FIGURE 5 is a cross sectional view taken along the line 5—5 of FIGURE 4.

FIGURE 6 is an enlarged view schematically illustrating disposition of a jet of gas into a can on the conveyor.

The present apparatus consists of a structural steel frame 10, made by fabricating methods, and serving to mount the various operating parts and enclosing walls.

Within the frame there is an endless belt conveyor 11 that is of sufficient width to extend entirely across the frame as shown in FIGURE 2, and which has looped ends engaging the rollers 12 and 13. Structural steel angles 14 can be provided for forming side guide shoulders, which support the side edges of the upper run of the conveyor belt. A roller take-up means 16 is shown engaging the lower run of the belt and is carried by pivoted lever

2

17, which in turn is provided with the weight 18, whereby the roller is urged upwardly against the conveyor.

The conveyor is of the foraminous type, such as a link belt of the metal mesh type as shown in FIGURE 5. Such belts are commonly used in the food industry, and their construction is such as to offer little resistance to flow of gas through the same.

The right hand end of the apparatus (as shown in FIGURE 2) is provided with container feed means 21, of the belt conveyor type. This feed means consists of an endless belt conveyor 22 extending horizontally adjacent the feed end of the conveyor 11, and serving to receive open cans from the gravity feed device 23. A deflector 24 serves to crowd the cans upon the conveyor 11. Suitable means are employed in connection with the conveyor 22, such as known types of magnetic devices, to retain the cans upright.

Can discharge means 26 is used at the other end of the conveyor 11. The particular means illustrated consists of the three endless belt conveyors 27, 28 and 29. These conveyors are operated at increasing speeds. For example, conveyor 27 can be operated at 30 feet per minute, conveyor 28 at 50 feet per minute, and conveyor 29 at 120 feet per minute. The upper runs of belts 27 and 28 move in one direction, and belt 29 in an opposite direction toward the discharge port. Conveyor belts 28 and 29 can be provided with underlying magnetic means to retain the cans upright. By virtue of overlying deflector guides 31, 32 and 33, all of the cans are fed to the high speed conveyor belt 29, which delivers the cans to the discharge port and can filling means. Jamming of the cans at the discharge port is prevented by operating the conveyors in opposite directions as explained above.

Conventional driving means can be provided for the feed and discharge conveyors. Thus conveyor 21 is shown driven by motor 36, which connects through gear box 37 and the chain and sprocket connection 38, to one of the rollers serving to carry the conveyor 22. Preferably motor 36 is of the variable speed type whereby containers are supplied as required by the filling and can sealing operations, with the motor speed being controlled automatically.

Conveyors 27, 28 and 29 similarly can be driven by the electric motors 39, 41 and 42, which operates through gear boxes 43, 44 and 45, to drive the corresponding conveyors through the chains 46, 47 and 48.

Extending horizontally over the upper run of the conveyor 11 there is a plenum chamber 51 adapted to receive hot sterilizing fluid. The lower wall 52 of this plenum chamber extends horizontally and parallel to the upper run of conveyor 11, and is provided with a plurality of openings 53 as shown in FIGURE 4. By way of example, these openings can be of the order of 1/2 inch in diameter, and their centers may be spaced two inches apart.

When the apparatus is constructed for use with cans or other containers which do not vary greatly as to height, the wall 52 can be a fixed vertical distance from the upper run of conveyor 11. However, when it is desired to have the apparatus adjustable for cans or other containers varying considerably as to height, the wall 52 can be attached to a special frame 56 as shown in FIGURE 3, with this frame being attached to a plurality of devices for raising and lowering the same. Thus, as illustrated, the frame at various points is attached to a threaded rod 57, the exterior portion of which passes through a housing 58, provided with gears and a rotatable nut engaging the rod. By turning shaft 59, the nut is turned to raise or lower the rod 57. All such raising and lowering devices can be connected to common operating means.

In conjunction with the apparatus described above, I provide means for generating hot sterilizing gas, and for circulating it through the apparatus. This means consists of a gas generator 61, having an outlet 62 connected to the inlet blower 63. Conduit 64 connects this blower to one side of the plenum chamber 51. Duct 65 connects the inlet side of generator 61 with the discharge end of the sterilizing apparatus, and duct 66 connects the inlet side of generator 61 with the feed end of the apparatus. At the discharge end the duct 65 communicates through a side wall of the apparatus, at a point below the conveyors 27, 28 and 29. Similarly the feed end of the duct 66 communicates to a side wall of the apparatus in a region below the conveyor 22. Thus in general gas is taken from a region below the conveyor 11, and is delivered to the generator 61. From the generator hot sterilizing gas is delivered into the plenum chamber 51, to discharge through the openings 53 downwardly toward the conveyor 11.

The gas generator 61 is preferably of the type which is supplied with a fuel burner to which a fuel gas and combustion supporting air are supplied. All gaseous products of combustion merge with the recirculated gas in the outlet 62. In practice the pressure of gas in the plenum chamber is above atmospheric (e.g. 10 inch W.P.) and in other parts of the apparatus a pressure slightly above atmospheric is maintained. With some gas leakage from the system, the oxygen content of the gas is reduced to a low value in a short period of initial operation, thus providing a sterilizing gas that is substantially devoid of oxygen. As supplied to the plenum chamber the gas may be at a temperature of the order of 350 to 410° F. The gas returning through the ducts 65 and 66 may be from 5 to 10° lower than the inlet temperature. Thus the apparatus is maintained at a temperature well above that required to maintain sterile conditions.

Operation of the above apparatus is as follows: Cans are supplied to the feed end of the apparatus, and are delivered by the conveyor 22 to the feed end of the conveyor 11. In practice crowd feeding is used, whereby the cans are caused to distribute themselves over the entire width of the conveyor, and in close physical contact. No effort is made to maintain the cans in well defined rows. As the cans are delivered from the discharge end of the conveyor 11, they are discharged from the apparatus by the conveyors 27, 28 and 29. Assuming that the entire upper run of conveyor 11 is occupied by cans, the upper open ends of these cans are exposed to hot sterilizing gas discharging downwardly through the openings 53 from the plenum chamber. The speed of operation of conveyor 11 is so adjusted that during the time required to move the cans from one end of the apparatus to the other (e.g. 2 to 3 minutes with at least 2 minutes under direct heating), sterilization is completed. During a short initial part of this time (e.g. 2 to 5 minutes) the containers are being heated to sterilizing temperature.

A special and unique method is used in the operation of the apparatus. FIGURES 4 to 6 illustrate schematically how the cans are carried along the conveyor 10, below the wall 52. FIGURE 4 illustrates generally a typical arrangement of openings 53, and a typical distribution of cans below these openings. It will be noted that the cans as they move along are presented to jets discharging from openings 53, and that at any one instant, at least one jet is discharging into a given can. As the can moves below a particular jet, there is in effect relative movement between the jet and the can whereby the jet commences to discharge into a can near one edge portion of the same, and then progresses to across the can to another edge or lip portion. The jet may not be symmetrical with the can, but may be off center whereby the locus of relative movement between the jet and the can is a chord (as the can is viewed in plan). When a jet of hot gas is delivered into a can in the typical instantaneous relationship shown, for example, in FIGURE 6, it impinges upon the

bottom wall of the can, and then flattens out with high velocity discharge over the bottom to strike the bottom corner. Thereafter the hot gas passes upwardly along the inner surfaces of the side walls. All of the gas leaving the cans passes downwardly to the spaces between the cans, and thence through the foraminous conveyor for return to the gas generator.

A feature of the present invention is that the velocity of hot sterilizing gas being jetted downwardly into the cans is relatively high. This makes possible effective sterilization with gas which contains a minimum amount of moisture. Heretofore it has been considered that the presence of steam or water vapor is desirable or essential to destroy certain heat resistant organisms. I have found that by utilizing gas flow of high velocity, such organisms can be destroyed, although the sterilizing gas may be relatively anhydrous. In the present method the downwardly directed jets have a velocity of the order of 60 to 120 feet or more per second, at which velocity there is noticeable direct impingement upon the bottoms of the cans, with the development of downwardly direct thrust which is advantageous in that it tends to hold the cans in place. Such high gas velocity is an aid in obtaining rapid heat transfer from the gas to the walls of the cans, and, as mentioned above, it aids in destroying heat resistant organisms which may be present upon the inner surfaces of the can. In general, such high velocity jets make for high velocity flow of sterilizing gas over all of the inner can surfaces, thus rapidly bringing all portions of the container to a sterilizing temperature and effectively causing sterilization of heat resistant organisms.

By way of example, in one instance the method was operated as follows: The conveyor 11 was operated at speeds of from 3 to 5 feet per minute and had an effective length of about 10 feet to afford an over-all treatment period of 2 to 3 minutes for movement of a can from one end of the conveyor to the other. Natural fuel gas was supplied to the generator 61 together with combustion supporting air to effect substantially complete combustion. After a short initial heating period of operation, the oxygen content of the gas was of the order of 1.0% or less, and the gas contained the gaseous products of combustion (e.g. CO₂, etc.) together with nitrogen. Such gas was delivered to the plenum chamber 51 at a temperature ranging from 350 to 410° F. and was withdrawn through conduit 65 at a temperature ranging from 5 to 10° lower. Standard cans were employed of 300 x 400 size. The wall 52 forming the bottom of the plenum chamber was spaced about 2 inches from the upper open ends of the cans. The openings 53 were ½ inch in diameter and spaced 2 inches between centers. The cans were crowd-fed upon the conveyor 11 whereby they were distributed in close side by side contact over the entire width and length of the conveyor. The pressure maintained in plenum chamber 51 provided a jet velocity from each opening 53 of about 100 feet per second. As the cans moved along the conveyor 11 they were acted upon by the downwardly discharging jets with effective heat transfer to quickly raise the temperature of the cans to a level ranging from about 340 to 400° F. Cans discharged from the apparatus were effectively sterilized with respect to all organisms and spores, including particularly organisms considered to be difficult to destroy by heat sterilization.

It will be evident from the foregoing that my apparatus and method make possible high capacity sterilizing operations such as are desired for high capacity, low cost plant operation. The apparatus is relatively simple in its construction and operation, it can be made without undue expense, and is relatively simple to operate and maintain. The method employed makes for complete, effective sterilization and complete destruction of heat resistant organisms or spores. Due to the use of recirculation, heat loss is reduced to a minimum, whereby the apparatus has

5

good thermal efficiency ranging from 15 to 85% better than prior sterilizers.

I claim:

1. In can sterilizing apparatus, a conveyor for continuously progressing upright open cans resting upon the same between can feeding and discharge stations, said conveyor forming a common conveyor path having a width many times the diameter of the cans being conveyed whereby upright open cans resting on the conveyor occupy substantially the entire area of the same, said conveyor being foraminous whereby gas may pass downwardly through the same, means overlying said conveyor path for discharging jets of hot sterilizing gas downwardly into the open ends of the cans and between the same, and means below the conveyor for removing said gas after it has passed downwardly through said conveyor, the cans being urged against the conveyor by the sterilizing gas impinging upon the same.

2. In a can sterilizing apparatus, a conveyor of the endless belt type for progressing upright cans between can feeding and discharge stations, said conveyor being foraminous for passing of gas therethrough with the upper run of the conveyor forming a conveyor path having a width many times the diameter of the cans being conveyed, whereby cans on the upper run of the conveyor may occupy substantially the entire area of the same with the cans crowded together in direct contact, a wall directly overlying said conveyor path and extending parallel thereto for the entire width of the same, said wall having plurality of holes formed therein, the holes being distributed over an area equal to the width of the conveyor path and extending for a substantial distance in the direction of movement of the cans, means for continuously introducing hot sterilizing gas into the space overlying

6

said wall whereby jets of sterilizing gas are delivered downwardly into the open ends of the cans and between the cans, as the cans move continuously through the apparatus, and means for removing the gas so introduced from the space underlying the upper run of the conveyor.

3. In can sterilizing apparatus, a conveyor of the endless belt type, the upper run of said conveyor serving to continuously progress upright cans between can feeding and discharge stations through a conveyor path, said conveyor path having a width many times the diameter of the cans being conveyed whereby cans on the conveyor may occupy substantially the entire area of the same with the cans in direct contact, means forming a plenum chamber overlying said conveyor path, said plenum chamber being defined by a lower perforated wall extending above and parallel to the upper run of said conveyor, the openings in said wall being spaced apart a distance which is not greater than the diameter of the cans, means for supplying hot sterilizing gas to said plenum chamber, whereby jets of hot sterilizing gas are delivered downwardly into the open ends of the cans and between the cans, and means for continuously removing the gas so delivered through said openings from the space immediately underlying the upper run of said conveyor, whereby all of said gas is caused to flow downwardly through the same.

References Cited in the file of this patent

UNITED STATES PATENTS

2,592,687	Halmrast	Apr. 15, 1952
2,771,645	Martin	Nov. 27, 1956
2,835,003	Abrams	May 20, 1958