

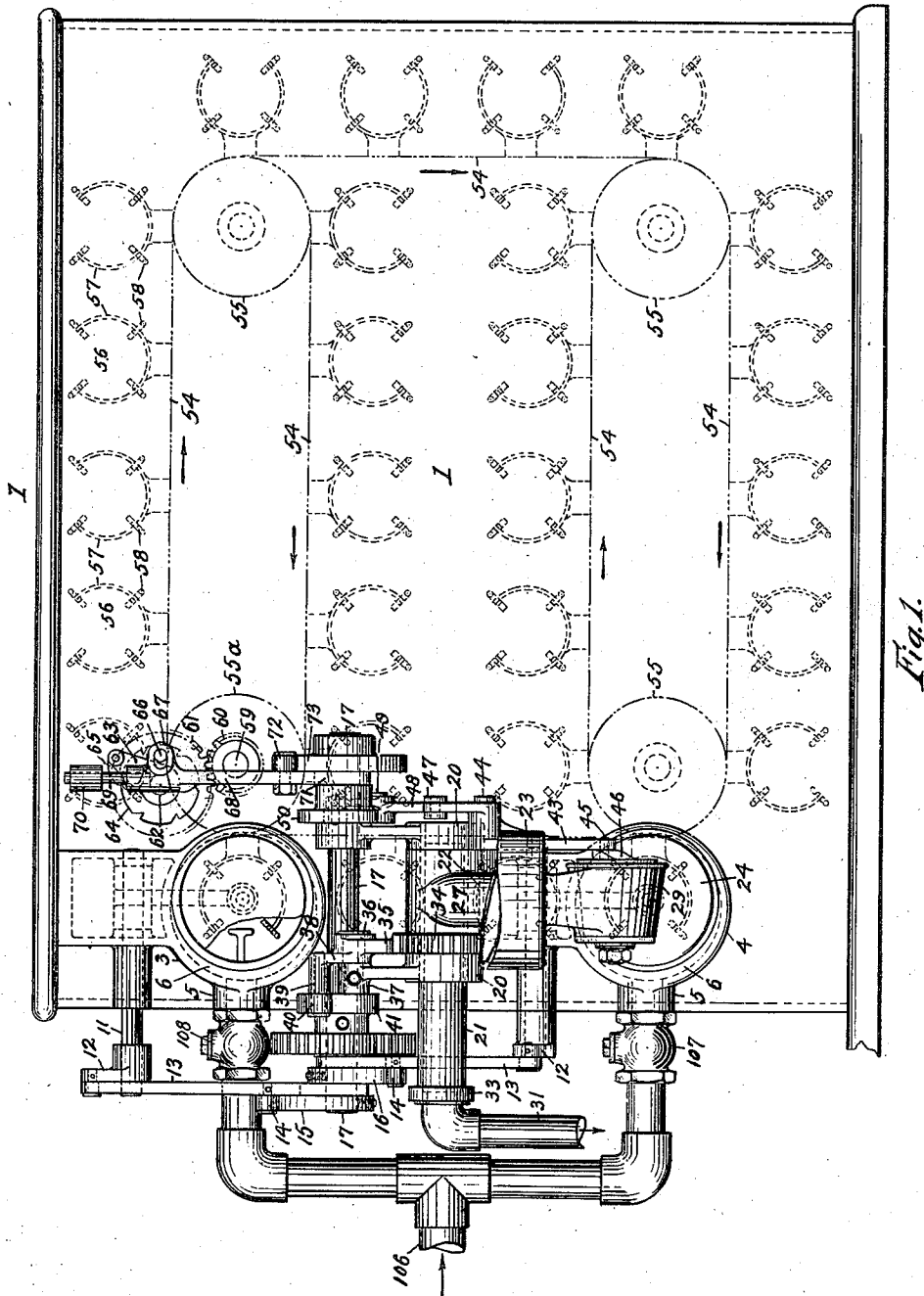
R. A. KIEFER.
PROCESS OF STERILIZATION.

APPLICATION FILED DEC. 16, 1911. RENEWED OCT. 8, 1912.

1,062,404.

Patented May 20, 1913.

2 SHEETS—SHEET 1.



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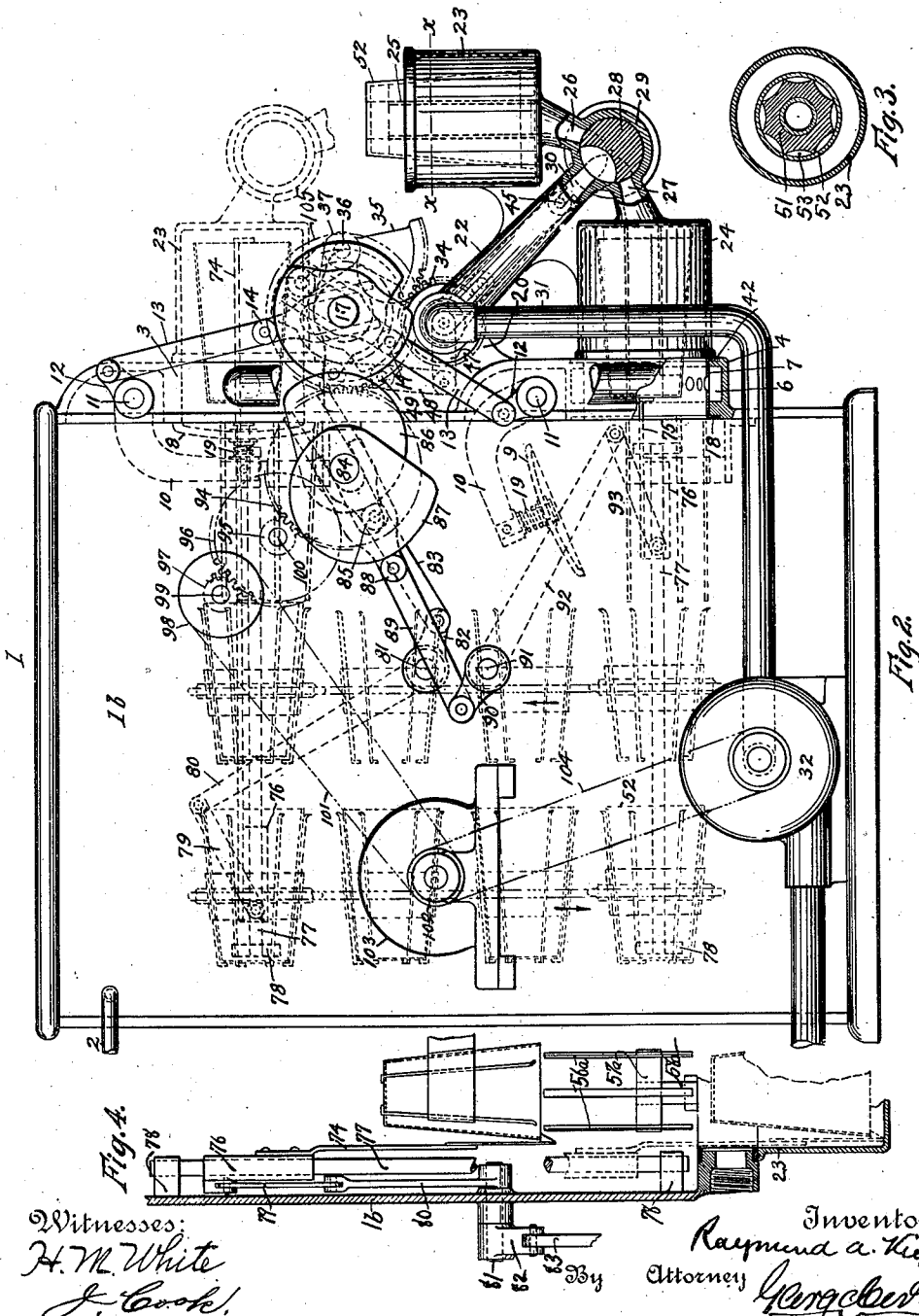
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UNITED STATES PATENT OFFICE.

RAYMOND A. KIEFER, OF RAMSEY, NEW JERSEY.

PROCESS OF STERILIZATION.

1,062,404.

Specification of Letters Patent.

Patented May 20, 1913.

Application filed December 16, 1911, Serial No. 636,315. Renewed October 8, 1912. Serial No. 724,675.

To all whom it may concern:

Be it known that I, RAYMOND A. KIEFER, a citizen of the United States, and a resident of Ramsey, in the county of Bergen and State of New Jersey, have made and invented certain new and useful Improvements in Processes of Sterilization, of which the following is a specification.

My invention relates to an improved process of sterilizing or disinfecting articles, such, for instance, as drinking cups, glasses, bottles, etc. Heretofore in the sterilization of such articles, particularly where the sterilizing agent or medium is in the form of a gas, it has been the common practice to subject the article to the action of the gaseous germicide in a closed chamber, to permit it to remain there for the requisite length of time, then to remove it, allowing the gas from the sterilizing chamber to escape into the atmosphere, and finally, by washing or other second treatment, to remove the odor attaching to the article. This process is objectionable for many reasons, particularly because of the great waste of the sterilizing medium; secondly, because of the objectionable odor, and the effect of the gas upon those engaged in the work, and thirdly, because such method is necessarily a slow and expensive one.

The object of the present invention is to provide a method which may be carried on either continuously or intermittently, as desired, and whereby the work may be carried on without permitting the escape of gas into the surrounding atmosphere, or into the room wherein the work is performed, and thereby prevent the loss or waste of the sterilizing medium.

A further object of the invention is to provide a method wherein the odor, attaching to the article after being subjected to the sterilizing agent, shall be removed or neutralized prior to the removal of the article from the apparatus employed, the method further contemplating advantages hereinafter fully described.

It will be understood, of course, that the process may be carried on by means of various forms or types of apparatus, the construction of such depending somewhat upon the nature of the article to be treated, and whether the process is intended to be continuous or intermittent.

In the accompanying drawings, I have

illustrated one form of apparatus designed for the sterilization of drinking glasses, the several steps in the process being carried on continuously and automatically.

In these drawings, Figure 1 is a side elevation of the sterilizing device embodied in the present invention; Fig. 2 an end elevation of the same; Fig. 3 a transverse section through the work-case on line *x-x*, Fig. 2; Fig. 4 is a partial sectional ground plan of the gas chamber, showing means for introducing the work therein.

Numeral 1 designates a closed gas chamber, provided with a convenient source of gas supply, as indicated by the pipe connection 2. The front wall of the chamber is formed with projecting mouths 3 and 4, respectively constituting passages for the introduction and the discharge of the work. On one side of each mouth exteriorly of the chamber, is formed inlet-connections 5, leading to an inner annular recess 6, which communicates with an interior perforated annular lining 7, shown in section in Fig. 2, through which air or gas is periodically admitted in a distributed manner to the central work-passage. For periodically opening and closing the passages on their inner or chamber side, doors 8 and 9 are provided within the chamber, and are supported for a yieldingly slidable movement upon stems fixed to the arms 10, the latter being secured to rock-shafts 11, mounted in bearings formed in the wall of the chamber and provided exteriorly of the chamber with actuating arms 12, motion being communicated thereto through the connection rods 13 and rollers 14 from the cams 15 and 16, fixed upon the rotatable cam-shaft 17. At each revolution of the cam-shaft, the doors are adapted to be alternately opened and closed, the latter movement effecting a seating action of the doors against their corresponding packing-rings 18, secured in annular recesses in the work-passages, the seating action maintaining a close gas-tight joint for the door through the action of the compression springs 19, interposed between the doors and their supporting-arms. Extending outwardly from the front wall of the chamber, are bearings 20, supporting for rocking movement a tubular shaft 21, upon which is fixed between the bearings an arm 22, integrally formed with the work-cases 23 and 24, the former adapted to receive the

untreated work and convey it to the gas-chamber, and the latter adapted to receive and deliver the finished work. Central tubes 25, provided with free open ends, are fixed within the work-cases and communicate with air-passages 26 and 27, which lead to a valve-plug 28, mounted to rock in a casing 29, integrally formed with the arm 22. By the movement of the plug the air-passages may both be cut off, as shown, or they may be alternately connected to an air-passage 30, extending centrally through the arm and leading to the bore of the tubular shaft 21, by which communication is had through the fixed pipe 31 to the suction-pump 32, a slip connection 33, of well-known form, being interposed between the adjacent ends of the fixed pipe 31 and the tubular rock-shaft 21, the opposite end of the latter being closed to the atmosphere.

For imparting a rocking movement to the arm 22, a gear-section 34 is fixed upon the hub of the former surrounding the rock-shaft 21, and meshing with the gear-section is a gear-segment 35, pivotally mounted by the pin 36 to the fixed boss 37. A lever-arm 38 is integrally formed with the gear-segment 35, and is provided at its free end with an extended boss 39, carrying a roller 40, which is engaged by a cam 41, fixed upon the cam-shaft 17, the latter acting through the several members at each revolution to raise and lower the arm 22. In its lower position, as shown in full lines, the free end of the work-case 24 is seated against an annular gasket 42, secured in a recess formed in the projecting mouth 4, and is adapted to form a gas-tight joint therewith. In the upper position of the arm 22, the work-case 23 assumes the position indicated by the dotted lines, and forms a close joint with the mouth 3 in a manner similar to that of case 24. During the upward and downward movement of the arm and connected work-cases, the valve 28 remains inoperative with the passages 26 and 27 cut off as shown. For effecting the timely operation of this valve, a lever 43 is pivoted intermediate its ends upon a stud 44, fixed to the arm 22, the outer end of the lever being provided with a slot which engages a crank-pin 45, fixed in the end of a crank 46, integrally formed on the larger end of the tapering valve-plug 28, a nut and washer being provided for the opposite end thereof in the usual manner to position the same within the case. The opposite or inner end of lever 43 is pivotally connected to an actuating-link 47, the pivotal center in its central position of movement coinciding with the axis of rock-shaft 21 and corresponding with the cut-off position of valve to permit the movement of arm 22 in opposite directions without affecting the operative position of the valve. For the necessary movement of the

latter at the extreme positions of the arm 22, as hereinafter set forth, the opposite end of the actuating-link 47 is pivoted to one end of a bell-crank lever 48, mounted to rock upon a fixed stud 49, the opposite end of the bell-crank carrying a roller arranged to engage a cam 50, fixed upon the shaft 17, the cam being so shaped that at each revolution thereof the lever 43 is actuated to effect an alternate communication of the passages 26 and 27 with the passage 30.

For supporting and positioning the articles to be treated within the work-cases, forms 51 are provided, surrounding and carried by the central tubes 25. The shape of these forms corresponds with the interior shape of the treated articles, which, as herein shown, consists of the conical drinking-glasses 52. The external surface of the forms are provided with air-channels 53 which lead to the tubes 25 and serve to direct the flow of air or gas against the inner surface of the articles, the forms being also adapted to provide a passage for said flow entirely around the articles by suitably supporting the latter in spaced relation to the walls of the work-cases.

Within the gas-chamber a work-carrier is provided consisting of an endless chain or band 54, supported upon a series of wheels 55, mounted upon studs or shafts carried by the walls of the chamber. Upon the chains are fixed a plurality of similarly-constructed and equally-spaced work-holders 56, each comprising a spring metal supporting-band 57, provided with transverse spring-wire grippers 58, suitably shaped to longitudinally engage and hold the work in a yielding manner. The direction of movement of the carrier is indicated by the arrows, the same presenting a vertical path adjacent the mouths or work-passages formed in the front wall of the gas chamber, the spacing of which passages conforms with the position of the work-holders to facilitate the transfer of the work to and from the latter. Intermittent movement is provided for the carrier by means of the wheel 55^a, which is fixed upon the shaft 59, rotatably mounted in and extending through the front wall of the chamber. A small gear-wheel 60 is fixed to the outer end of the shaft, exterior of the chamber, and is engaged by a larger gear 61, loosely mounted upon the fixed stud 62, upon which is also loosely mounted a rocker-arm 63, and a ratchet-wheel 64, the latter being fixed to and rotatable with the large gear 61. For actuating the ratchet-wheel, a pawl 65 is hinged to the upper leg of rocker-arm 63, the side leg of the latter being provided with a fixed projecting pin 66 which in turn is engaged by a slotted side driving-lug 67, formed on the vertically-reciprocating connection-rod 68. At its upper end the connection rod is provided with a stem 69, 130

arranged to slide in a block 70, fixed to the front wall of the chamber, and at its lower end the connection-rod is provided with a fork 71, which slidably embraces the cam-shaft 17. A roller 72 is mounted upon the connection-rod for engagement by a cam 73, fixed to the shaft 17; the latter at each revolution serving by the action of the cam to positively raise the connection-rod and allowing it to fall by gravity. At each upward movement of the connection-rod, the ratchet-wheel 64 and its connected gear 61 are partially rotated, the movement of the latter serving to rotate the small gear 60 and the carrier-wheel 55^a for the advancement of the work-holders an amount equal to the distance of the spacing thereof upon the chain.

For introducing and discharging the work to and from the gas-chamber, reciprocating finger-rods 74 and 75 are employed which are fixed upon heads 76, mounted to slide upon the rods 77, fixed interiorly of the chamber upon the end wall 1^b by the brackets 78. The upper finger-rod 74 is reciprocated at its head 76 through a pivotally-connected link 79, also connected by a pivot to the upper end of an actuating arm 80, fixedly secured within the chamber upon a short rock-shaft 81, mounted to turn in and extending through the end wall 1^b. On the outer end of the rock-shaft, exterior of the chamber, a crank 82 is fixed which is pivotally connected at its free end to a forked connection-rod 83, arranged to embrace a shaft 84, rotatably mounted in a bearing suitably supported from the end wall. A roller 85 is carried by the forked rod 83 and is engaged by a cam 86, which is fixed upon the shaft 84 and serves through the above connections to reciprocate the upper finger-rod once at each revolution of the shaft. In like manner the lower finger-rod 75 is reciprocated from the shaft 84 by the similarly arranged cam 87, roller 88, forked connection-rod 89, crank 90, rock-shaft 91, actuating-arm 92, and link 93. For supporting the work in its passage between the carrier and work-cases, guide-frames are provided, each consisting of a series of wires 56^a, connected together by a band 57^a, the latter being fixed by a bracket 58^a.

Rotary motion is imparted to the cam-shaft 84 by a gear 94, which receives its movement through a series of reduction-gears 95, 96, 97, the latter gear being fixed to belt-wheel 98, with which it is arranged to run loose upon a stud 99, fixed to the end wall of the chamber, the gears 95 and 96 being likewise fixed together and arranged to run loose upon a fixed stud 100. The belt-wheel 98 is driven by the belt 101 from the wheel 102, fixed upon the shaft of the motor 103, which also drives the suction-pump 32 by means of the belt 104. Motion

is also communicated to cam-shaft 17 by its fixed gear 105, which is engaged by the gear 94, secured upon cam-shaft 84. These two cam-shafts are driven at a common rate of speed, and the cams thereon are so shaped and timed that at each revolution thereof a glass is introduced and discharged to and from the gas-chamber in the following order: As indicated in the drawings, the upper work-passage 3 of the gas-chamber has been closed by the inside door 8, the work-case 23 is in its lowermost position, with an untreated glass inserted bottom-upward therein, the carrier within the gas-chamber is at rest, its actuating connection-rod 68 being idle, or in its downward or return movement, the work-case 24 is seated against the lower work-passage 4, the inner door 9 thereof having been opened to admit a glass from the carrier. Upon the continued movement of the cam-shafts, the lower finger-rod 75 is returned to its backward position to later engage the bottom of a succeeding glass, the door 9 is closed against its seat, and the valve 28 is moved to make communication between the passages 27 and 30, permitting the action of the rotary suction-pump 32, which causes a circulation of air or gas through the work-case 24, admitted through the perforated lining 7 and inlet 5 of the mouth 4, and the exterior admission-pipe 106 and check-valve 107. After a sufficient quantity of air or gas has been circulated through the work-case 24 for the removal of all trace of the contained sterilizing agent or odor therefrom, the valve is returned to its intermediate or cut-off position, the work-case 23 with its untreated glass is raised and seated against the mouth 3 of the gas-chamber, as shown in dotted lines, during which movement the treated glass is discharged from the work-case 24 upon a convenient rack or runway, not shown. After the work-case 23 is securely seated, the door 8 is opened, and the glass within the case is transferred to the adjacent work-holder on the carrier by the finger-rod 74; the door is then closed and the sterilizing gas previously admitted to the case is removed therefrom by the circulation of air effected by the movement of the valve 28, connecting the passages 30 and 26 leading from the suction-pump, which causes the check-valve 108 to raise and admit air through the pipe 106. Upon the complete removal of the effect of the sterilizing agent from the case, the valve is again moved to its cut-off position to arrest the circulation of the air, and the case is lowered to its original position for the reception of a new glass, while case 24 is at the same time seated against the lower mouth 4. Also after the closing of the door 8, the carrier containing the work to be treated is advanced by the upward movement of con-

nection-rod 68 to present a successive empty work-holder to the upper mouth or work-passage 3, and a successive holder carrying a treated glass to the lower mouth 4. The cover 9 for this lower mouth is then opened, and the treated glass is transferred from the holder through the mouth into the lower work-case by the finger-rod 75, which engages the bottom of the glass, thus completing a cycle of the machine and a complete revolution of the two cam-shafts.

While I have indicated the pipe-connection 2 as leading from a source of gas-supply, it is to be understood that any approved form of gas-generator may be employed for the production of any suitable kind of gas. Also, the generator may be located within the gas-chamber and utilized to heat the same if required, or the heating thereof may be effected independently of the generator.

Depending upon the nature of the sterilizing agent employed, the admission-pipe 106 may either be left open to the atmosphere for a supply of ordinary air for clearing the work-cases, or the pipe may be led from a source of neutralizing gas adapted to combine or mix with the sterilizing agent to effect the latter's removal and deodorization.

In order to thoroughly remove any and all traces of the sterilizing gas from the article after being treated, I prefer to connect the pipe 106 to a suitable source of supply of gas or vapor such, for instance, as ammonia, or the vaporized essential oils, particularly, in the event of the use of formaldehyde gas as the sterilizing medium, as it is almost impossible to remove the traces of such by exposing the articles to the atmosphere only except for a considerable length of time.

As before stated, the apparatus hereinbefore described forms no part of my present invention, but has been illustrated and described as one means for carrying into practice the method forming the subject matter of this application, which consists briefly in subjecting the article to the action of a gaseous germicide in a closed chamber, transferring the article with a small part or portion of the gas from said chamber directly into a second closed chamber, then removing from the second chamber the gas which has escaped thereinto from the first-mentioned chamber, and finally subjecting the article in the second closed chamber to the action of a neutralizing innocuous gas to remove all traces of odor attaching to the article prior to its removal into the atmosphere.

What I claim is:—

1. The sterilizing process hereinbefore described, consisting in first, subjecting the article to be treated to a gaseous germicide in a closed chamber; secondly, removing the article from said chamber with a portion of

the gas to a second chamber, and finally removing the gas from said second chamber to deodorize the article.

2. The sterilizing process hereinbefore described, which consists in first, subjecting the article to be treated to a gaseous germicide in a closed chamber, then directly transferring the article with a portion of the gas to a second chamber and finally withdrawing the gas from said second chamber and neutralizing the odor attaching to the article.

3. The process of sterilizing which consists in subjecting an article to be treated to the action of a gaseous germicide within a closed chamber, transferring the article from said chamber to a second closed chamber, and removing residual germicide from the article while it remains within said second chamber.

4. The process of sterilizing which consists in subjecting an article to be treated to the action of gaseous germicide within a closed chamber, transferring the article from said chamber to a second closed chamber, removing the gaseous germicide from said second chamber, and establishing a flow of innocuous gas past the article while the latter is in said second chamber.

5. The process of sterilizing which consists in subjecting an article to be treated to the action of a gaseous germicide within a closed chamber, transferring the article from said chamber to a second closed chamber, exhausting the gaseous germicide from said second chamber, and establishing a flow of air past the article while the latter is in said second chamber.

6. The process of sterilizing which consists in subjecting an article to be treated to the action of a gaseous germicide within a closed chamber, transferring the article from said chamber to a second closed chamber, and establishing a flow of air through said second chamber and past the article.

7. The process of sterilizing which consists in subjecting an article to be treated to the action of a gaseous germicide within a closed chamber; transferring the article from said chamber to a second chamber, and subjecting the article to an innocuous gas while it remains within said second chamber.

8. The process of sterilizing which consists in subjecting an article to be treated to the action of a gaseous germicide within a closed chamber, transferring the article from said chamber to a second closed chamber, withdrawing the gaseous germicide from said second chamber, and subjecting the article to an innocuous gas while it remains within said second chamber.

9. The process of sterilizing which consists in subjecting an article to be treated to the action of a gaseous germicide within a closed chamber, transferring the article from

said chamber to a second chamber, and establishing a flow of innocuous gas past the article while it remains within said second chamber.

- 5 10. The process of sterilizing which consists in introducing articles to be treated in succession into a closed chamber, supplying a gaseous germicide to said chamber to maintain a substantially constant quantity
10 of such therein, transferring the articles in succession from said chamber to a second closed chamber, and removing residual germicide from the article while it remains within said second chamber.
- 15 11. The process of sterilizing which consists in introducing articles to be treated in succession into a closed chamber, supplying a gaseous germicide to said chamber to maintain a substantially constant quantity
20 of such therein, transferring the articles in succession from said chamber to a second closed chamber, and exhausting the gaseous germicide from said second chamber.

- 25 12. The process of sterilizing which consists in introducing articles to be treated in

succession into a closed chamber, supplying a gaseous germicide to said chamber to maintain a substantially constant quantity of such therein, transferring the articles in succession from said chamber to a second 30 closed chamber, removing residual germicide from about each article in succession while it remains within said second chamber, and establishing a flow of innocuous gas through said second chamber and past each 35 article as it remains therein.

13. The sterilizing process hereinbefore described consisting in first subjecting the article to be treated to a gaseous germicide in a closed vessel, secondly in transferring 40 the article directly to a second chamber, and finally treating the article while in said second chamber to deodorize the same.

Signed at Ramsey, in the county of Bergen, and State of New Jersey, this 12th day 45 of December, A. D. 1911.

RAYMOND A. KIEFER.

Witnesses:

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SETH WANAMAKER.