

Sept. 17, 1935.

F. STEGEMANN

2,014,750

APPARATUS FOR STERILIZING CONTAINERS

Filed Dec. 29, 1932

3 Sheets-Sheet 1

Fig. 1

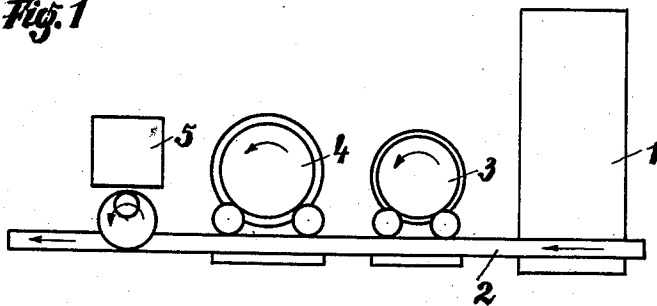


Fig. 2

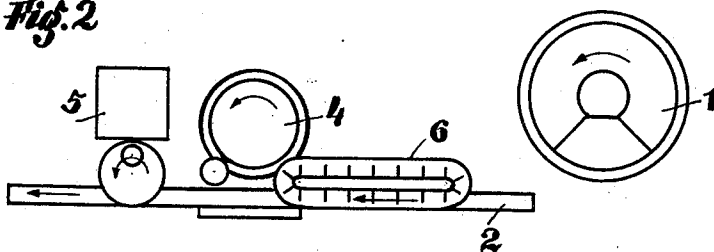
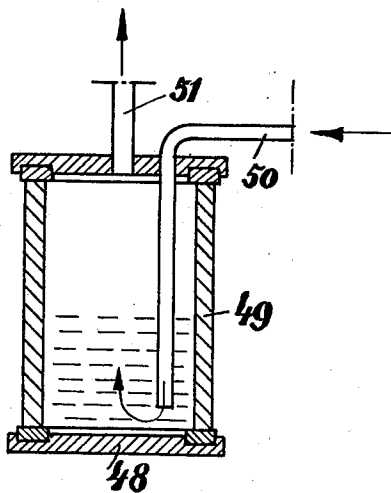


Fig. 7



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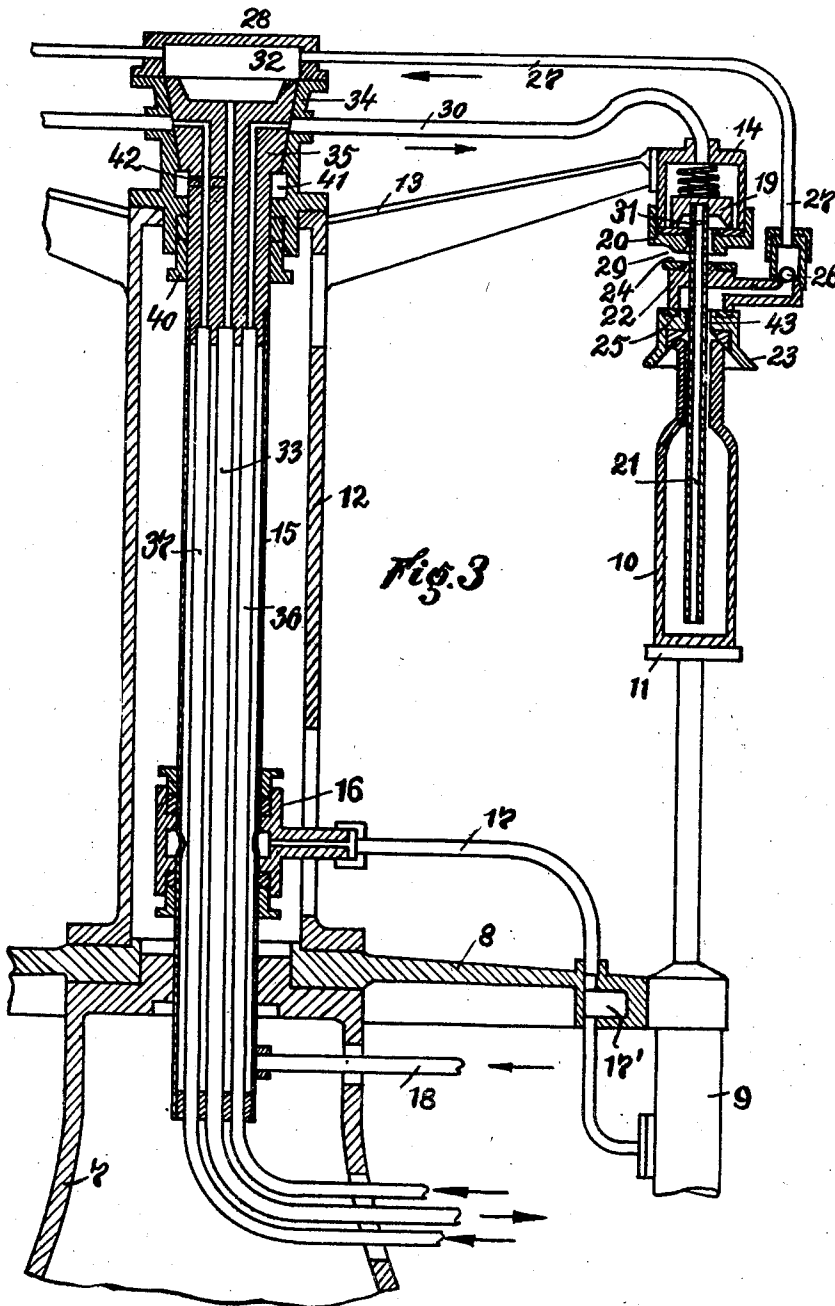
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3 Sheets-Sheet 2



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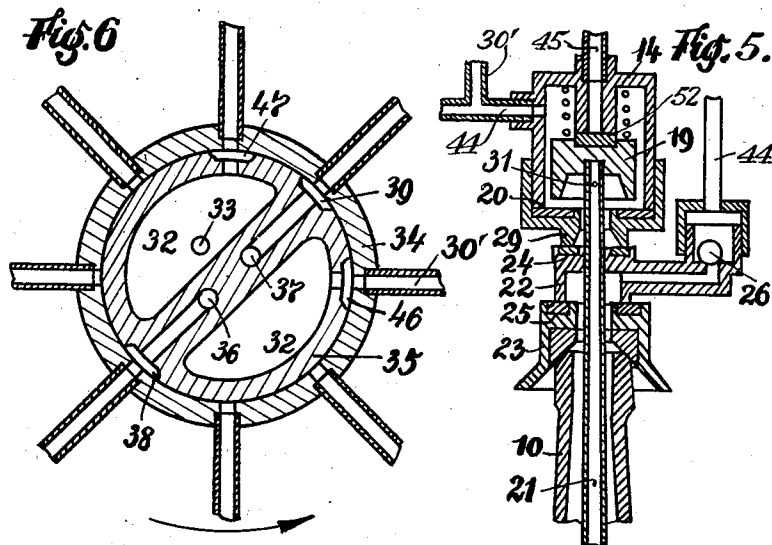
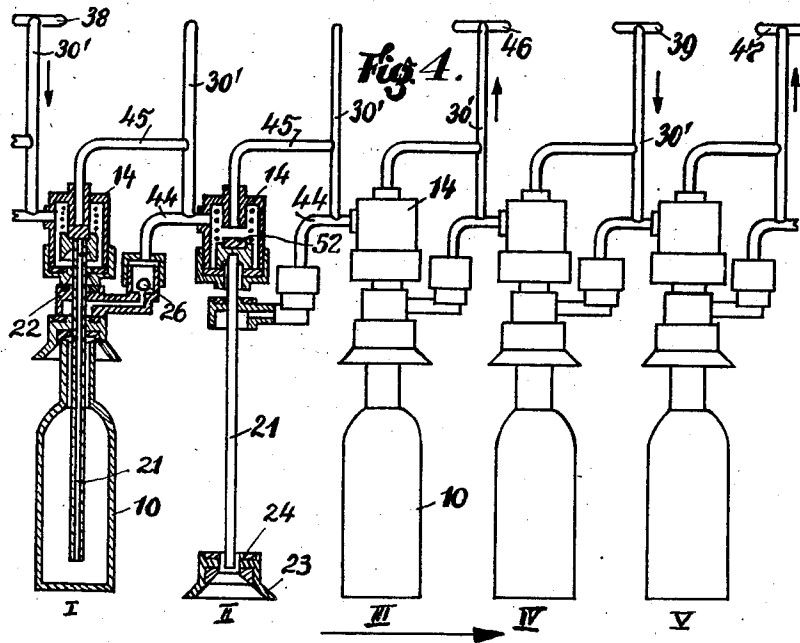
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APPARATUS FOR STERILIZING CONTAINERS

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3 Sheets-Sheet 3.



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UNITED STATES PATENT OFFICE

2,014,750

APPARATUS FOR STERILIZING
CONTAINERS

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The filling of bottles with liquid and subsequently the closing of the same by means of individual machines which however are interconnected by means of a conveyor arrangement so that an associated automatic or semi-automatic aggregate is obtained, is known. Nevertheless in the aggregates so formed the bottles are filled without attention being given to the sterile mode of operation.

According to the method constituting the subject of the present invention the aggregate known per se is to be used for the sterile filling and sterile closing of bottles with corresponding individual machines converted for sterile operation and if necessary also a conveyor arrangement adapted for ensuring the maintenance of the sterile condition. As with the present state of the art, the bottles coming from the cleaning machine are not sterile. According to the present process an automatic or semi-automatic sterilizer is provided in front of the filling machine in association with the conveyor or incorporated with the conveyor arrangement between the cleaning machine and the filling machine. In carrying out the process, this sterilizer may be the last station of the cleaning machine or the first preliminary treating station of the filling machine or the bottles on the conveyor arrangement between the cleaning machine and the filling machine may be subjected to the sterilization by an auxiliary sterilizing apparatus during the conveyance on the conveyor arrangement. In order to carry out the sterile treatment of the bottles up to the closure of the same, in further development of the method, the filler associated with the aggregate and subsequently the closure machine are also constructed for sterile operation. A further improvement of the aggregate is afforded in that parts of the conveyor arrangement or the entire conveyor arrangement conveying the bottles from one machine to other machines, whether transport members or gripper members or the like, are maintained sterile wholly or in part, e. g., by covering.

Thus it is possible to make bottles sterile, to fill them in a sterile manner and to close them in a sterile manner with automatic or semi-automatic conveyance and hitherto this has not been known. In this way the aseptic mode of operation which hitherto has been possible only for manual operation on a very small scale can also be applied on a large scale. Material advantages are thereby afforded to large branches of industry. Thus for example in the manufacture of beverages from fresh fruit juices it is made

possible to fill the fruit or grape juices free from bacteria into bottles, unfermented and sterile. Here the sterile operation is of greatest importance as otherwise in the case of a treatment which is not free from bacteria, the juices ferment 5 whereas with perfect sterile filling they last without limit. Hitherto the filling of these juices on a large scale has not been possible in the absence of suitable machines and thus the turnover of this beverage which is important from the point 10 of view of economics has been small. Also the present process affords important possibilities to the brewery, thereby altering fundamentally the handling of bottled beer. Hitherto the beer has been rendered sterile by heating in the bottles 15 for attaining the property of keeping for protracted periods (export beer). In this way important nutriment materials were destroyed and the flavour of the beverage was altered in an unfavourable manner. Since a recent filtration 20 method makes it possible to sterilize the beer in the cold, the large scale industry has lacked suitable arrangements for filling the beer in a sterile manner into sterile bottles.

The present process also renders this possible. 25 However not only beverages but all other liquids which have to be filled into vessels in a sterile manner can be handled with the plant according to the present process.

The process of sterilization of the vessels is 30 carried out in such manner that the vessels are continuously sterilized and the sterilization medium is completely removed from the vessel after a more or less long period of operation. In particular a gas is used for sterilization and after 35 its action on the inner walls of the bottle is driven out by another gas which is neutral and is free from bacterial. The bottles pass through the arrangement serving for carrying out the process either in circles or rectilinearly, the bot- 40 tles being sterilized in succession and then freed from the sterilization agent. The sterilization medium and the means for expelling the same can flow through the bottles in the same direction as their motion or in the opposite direction. 45

If sulphurous acid or the like is used as sterilization agent then either moist air can be added for attaining a better effect or else, and this appears more simple, the sulphurous acid is passed directly through water. Thereby the sulphurous 50 acid vapours carry water particles along with them or take up water vapour and thus convey with them into the vessel to be treated the moisture which is requisite for sterilization.

In the accompanying drawings, Fig. 1 shows di- 55

agrammatically a complete cleaning, sterilizing, filling and closure applying aggregate with automatic charging of the cleaning machine and with circular sterilizer and Fig. 2 shows diagrammatically an equivalent aggregate with semi-automatic cleaning machine and longitudinally extending sterilizer. Figs. 3 to 7 show arrangements for sterilizing the vessels or bottles. Fig. 3 is a section through an embodiment of the entire apparatus. Fig. 4 shows the connection of the individual inlet valves in a modified form. Fig. 5 is an enlarged section through an inlet valve or inlet socket of the embodiment shown in Fig. 4 in the filling position. Fig. 6 shows a section through the corresponding distributing apparatus of the arrangement. Fig. 7 shows an arrangement for moistening with water the sulphurous acid which is to be used as sterilizing medium.

The cleaning machine 1, Fig. 1, transfers the bottles automatically to the band conveyor 2. From this the cleaned bottles first pass to the sterilizer 3 in which if desired the sterilizing medium is again removed in a sterile fashion. Then the bottles pass over the conveyor band 2 to the sterile filler 4, then back to the conveyor band 2 and on to the sterile closure applying machine 5 and then back again to the conveyor band 2.

Even if a sterilizing station is incorporated therewith the cleaning machine need not operate automatically with delivery from and to the conveyor band for carrying out the present process. It is sufficient if as shown in Fig. 2 the bottles or vessels are placed on the conveyor 2 manually. In Fig. 2 the sterilizer is shown as a longitudinally extending machine 6 which passes the bottles directly to the sterile filling machine 4. In this case the sterilizer itself constitutes the conveyor bringing the bottles to the filling station. The filling machine could also work directly with the closure applying machine in a similar way.

However in order to extend the process also to those closures which cannot be closed by machines, e. g., yoke closures, it is not necessary to include the closure machine in the aggregate.

The particular construction of sterilizer shown in Fig. 3 has a stationary pedestal 7 on which is mounted the rotary table 8 which carries the cylinders 9 actuated in known manner by compressed air for lifting the plates 11 supporting the bottles 10. The table 8 carries a pillar 12 which has at the top a plate 13 carrying the individual inlet sockets 14. In the centre of the column 12 is a stationary tube 15 about which is disposed a double stuffing box 16 which is connected by means of the tube 17 with the annular space 17' which is connected with the individual lifting cylinders 9. Compressed air is introduced into the centre of the tube 15 by the tube 18.

Each inlet socket 14 has a valve 19 which seats against the sealing surface 20. Secured to this valve is the blower pipe 21 which dips into the bottle 10, and is rigidly secured to the sleeve 22 and passes through the funnel 23 for centering the bottle. The sleeve 22 carries at the top a sealing surface 24 and the centering funnel has a sealing surface 25. The sleeve 22 is connected with a pipe 27 by way of a non-return valve 26, the pipe 27 leading to a distributor 28. The tube 27 is resiliently yielding so that under the pressure of the centering funnel 23, the sleeve 22 can move upwardly somewhat so that its sealing surface 24 abuts against the seating 20 of the inlet socket 14. In this way a seal is provided between socket 14 and sleeve 22 and at the same time a seal with

respect to the centering funnel 23 is furnished at 25 so that the gas penetrating into the inlet socket 14 through the pipe 30 when the valve 19 is raised, must pass into the blower pipe 21 through the lateral aperture 31 therein without being able to escape into the outer air. This arrangement is provided at each of the inlet sockets 14.

The pipes 27 from the sleeves 22 lead to the chamber 32 of the distributor 28 which is connected with the outer atmosphere by way of a tube 33, if necessary by way of a filter.

The pipes 30 from the inlet sockets 14 are secured to the rotary head 34 of the distributor in which is disposed the fixed cone 35 which has three bores. One bore connects with the pipe 33 already mentioned; another bore is connected with a pipe 36 by means of which the sterilizing medium is introduced into the device. The third bore connects with a tube 37 through which a gas, such as air free from bacteria, is introduced for washing the sterilizing medium out of the bottles. In the rotation of the head, the apertures of the tubes 30 in the rotary head 34 of the distributor 28 pass in the corresponding positions over recesses 38 and 39 in the stationary head 35 which in turn are connected with the pipes 36 and 37, Fig. 6. In this way first the sterilizing medium and then the gas (sterile air) serving for washing out the sterilizing medium are directed in succession into the pipes 30. It is however also possible to introduce the sterilizing medium in such way that for a short time it is blown into the bottle and then left in the bottle without further supply of sterilizing medium or with a reduced supply before the scavenging agent drives the sterilizing medium out of the bottle again.

The rotary part of the distributor 28 is sealed relatively to the stationary part 35 by means of the stuffing box 40, an annular chamber 41 being provided on the cone 35 and being connected by way of the bore 42 with the pipe 33 leading to the outer atmosphere. In this way any sterilizing gas which passes between the sealing surfaces of the head 34 and the cone 33 is prevented from exerting a pressure against the stuffing box 40. This gas is led into the outer atmosphere from the chamber 41 by way of the aperture 42 and the pipe 43.

The mode of operation of the arrangement is as follows:

The table 8 and with it the pillar 12 and the distributing sockets 14 secured thereon are rotated. The bottles to be sterilized are positioned in known manner on the plates 11 of the lifting cylinders and then at the appropriate position are lifted by the lifting pistons so that the blower pipe 21 dips into the appropriate bottle. The centering funnel 23 has already brought the bottle into the correct position and seals it at the top. At the same time by pressing the bottle against the centering funnel the blower pipe 21 is lifted so that the seal 25 of the funnel 23 abuts against the lower part of the sleeve 22 and this with its sealing surface 24 abuts against the seating 20 of the distributing socket 14. In addition the valve 19 is raised from its seating 20 against the action of a superimposed spring. In the meantime the tube 30 of the corresponding inlet socket has arrived at the groove 38 of the cone 35 so that the sterilizing medium now passes through the tube 36 into the tube 30 and thus into the inlet socket 14. As the valve 19 is open the gas passes through the bore 31 into

the blower pipe 21 and thus into the bottle 10. It flows through the bottle and can escape therefrom through the annular space 43 which is provided between the bore of the centering funnel 23 and the blower pipe 21. The sterilizing gas then passes into the sleeve 22 and opens the non-return valve 26 so that it can pass through the pipe 27 into the chamber 32 of the distributor and thence through the pipe 33 into the outer atmosphere.

In the meantime in the further motion of the entire table the appropriate tube 30 has left the groove 38 of the cone 35 and it remains closed until it comes in front of the groove 39 of the distributor cone 35, Fig. 6, which groove is connected with the pipe 37. The scavenging gas, which may be air which has been rendered free from bacteria, now passes through the pipe 37 into the tube 30 and thus in the same way into the blower pipe 21 whereby this air washes the sterilizing medium out of the bottle 10, said medium escaping into the outer atmosphere by way of the non-return valve 26 and the pipe 27 as well as the chamber 32 and the pipe 33.

The space between the groove 38 and the groove 39 is so dimensioned that the sterilizing medium remains for a predetermined period in the bottle and thus kills all the germs or bacteria contained therein.

The same operation is repeated for each individual bottle. The bottles then leave the device completely sterilized and freed from the sterilizing medium wholly or only in part and can be directly transferred to the filling and closing appliances, which if desired may be connected with the arrangement by some suitable conveyor arrangement. Also the filling members could be incorporated in the sterilizing device after the sterilizing members so that the filling of the bottles with liquid is effected in the same apparatus.

As soon as the bottles are removed from the machine after lowering the plates 11, the centering funnel 23 again moves downwardly and the valve 19 closes under the action of its spring, so that no gas can escape into the outer atmosphere should the inlet socket perform the next cycle in the absence of a bottle.

In the embodiment of the arrangement shown in Fig. 4, substantially the same arrangement is provided, but in this case the sterilizing gas emerging from a bottle does not pass into the outer atmosphere directly but into the preceding bottle before it passes to the outlet so that the same gas passes through the individual bottles in succession. In order to attain this, every sleeve 22 is connected with the inlet socket 14 for the next bottle above the non-return valve 26 by means of a flexible pipe 44. The valve 19' of each socket is in addition constructed as a double valve so that at the top a valve face 52 can also close the aperture of the pipe 45 connected thereto. The pipe 45 leads to the next pipe 30' and serves as a bridging conduit in the event of no bottle being positioned on the plate in which case the valve 19' correspondingly seals its lower seating. In this construction the pipe 27, Fig. 3, is no longer necessary and is omitted. In Fig. 4 the bottle is missing from the position II and accordingly the centering funnel 23 is at the bottom of the blower pipe 21. The sterilizing gas thus passes from the groove 38 of the cone 35 Fig. 6 through the pipe 30' into the inlet socket 14 for the first bottle, position I, and, as the valve 19' is open at the bottom, the gas

passes into the bottle and subsequently through the sleeve 22 by way of the ball valve 26 through the pipe 44 into the next inlet socket 14, position II. As there is no bottle here, the valve 19' of this socket is closed at the bottom but at the top the aperture of the bridging pipe 45 is exposed so that the gas can now flow directly through this pipe into the pipe 30' of the third inlet socket 14, position III, and so on through each bottle to the subsequent bottle.

In this construction two further grooves 46 and 47, Fig. 6, are provided on the fixed cone 35 of the distributor 28 which connect the corresponding pipes 30' with the chamber 32 and thus by way of the pipe 33 with the outer atmosphere. Thus the gas passes through the bottles in positions I and III and then passes through the corresponding tube 30' and to groove 36 by way of the pipe 33 into the outer atmosphere.

In the next position IV the pipe 30' is connected with the groove 39 so that the scavenging air now passes through the bottle through the pipe 30', and then at 47 back into the chamber 32 and from thence by way of 33 into the outer atmosphere. The spacing of the grooves 38, 46, 25 39 and 47 is correspondingly chosen in order to be able to make the period of operation of the sterilizing medium and the period of scavenging shorter or longer in accordance with the desired relationships.

In the example shown the sterilizing medium and the scavenging medium flow through the bottles in the same direction as the bottles move through the apparatus. One or both media however could be directed through the bottles in counter-current to this direction of motion.

In some circumstances, for the purpose of increasing the effect of the sterilizing medium, air and particularly moist air can be admixed therewith.

The process can be used not only for bottles but also for vessels of any kind. It is not limited to gaseous sterilizing media.

An arrangement is shown in Fig. 7 which serves for moistening the sterilizing medium with water or with any other liquid exerting a favourable influence on the sterilization.

The container 49 provided with two covers 48 is constructed as a glass cylinder. It is half filled with water or H_2SO_4 . The SO_2 gas is introduced through the pipe 50 which extends almost down to the bottom of the container. It passes through the water, collects in the upper part of the container and flows out of the container through the pipe 51 into the vessels to be sterilized. The pipe 51 of Fig. 7 is connected with the tube 36 of Fig. 3. In the passage through the water it takes up so much moisture that the effect of the sterilization is materially improved.

Instead of making the container wholly of glass it may of course be made only in part of transparent material or provided with a suitable window or equipped with a device for indicating the liquid level.

I claim:—

1. In apparatus for sterilizing vessels, a rotatable table with lifting members for urging the vessels against a pressure controlled inlet nozzle, a source of gaseous sterilizing fluid, a source of compressed sterile air, and a distributor for connecting said nozzle with said sources in succession.

2. Apparatus as claimed in claim 1, wherein the inlet nozzle has an inlet socket, a centering funnel and a blower pipe, a sleeve arranged on

said nozzle between said socket and said funnel, said sleeve being displaceable with the blower pipe and being equipped with sealing surfaces to engage the inlet socket and centering funnel, and
 5 a conduit having a non-return valve connecting the sleeve with the outer atmosphere.

3. Apparatus as claimed in claim 1, wherein the inlet nozzle has an inlet socket, a centering funnel and a blower pipe, a sleeve arranged on
 10 said nozzle between said socket and said funnel, said sleeve being displaceable with the blower pipe and being equipped with sealing surfaces to engage the inlet socket and centering funnel, and a conduit having a non-return valve connecting the sleeve with the outer atmosphere,
 15 the blower pipe having a head serving as a closure valve of the inlet socket, said valve being lifted by pressure of the vessel urged against the blower pipe.

20 4. In apparatus for sterilizing vessels, centering funnels, a rotatable table having lifting members for urging the vessels against the centering funnels, inlet sockets each having a valve disposed above each centering funnel, sleeves arranged between said socket and funnels and attached to blower pipes, a source of gaseous sterilizing fluid, a source of sterile compressed air, a distributor for connecting said sockets with said sources in succession, said distributor having a
 25 chamber, and conduits connecting each of said sleeves with said chamber and means for discharging waste gas to the outside atmosphere.

5. Apparatus as claimed in claim 4, in which the distributor comprises a stationary cone on
 35 which seats a head rotatable with the table and serving as a housing, the conduits leading to the inlet sockets being connected with said housing, the ends of said conduits terminating adjacent grooves in the cone, said grooves being connected by conduits with the source of gaseous sterilizing fluid and with the source of compressed sterile air.

6. Apparatus as claimed in claim 4, in which the distributor comprises a stationary cone on
 45 which seats a head rotatable with the table and serving as a housing, the conduits leading to the inlet sockets being connected with said housing,

the ends of said conduits terminating adjacent grooves in the cone, said grooves being connected by conduits with the source of gaseous sterilizing fluid and with the source of compressed sterile air, said distributor cone fitting said housing with fluid sealing surfaces, the cone being provided with a recess for collecting gas passing the sealing surfaces.

7. Apparatus as claimed in claim 4, in which the distributor comprises a stationary cone on
 10 which seats a head rotatable with the table and serving as a housing, the conduits leading to the inlet sockets being connected with said housing, the ends of said conduits terminating adjacent grooves in the cone, said grooves being
 15 connected by conduits with the source of gaseous sterilizing fluid and with the source of compressed sterile air, said distributor cone fitting said housing with fluid sealing surfaces, the cone being provided with a recess for collecting gas
 20 passing the sealing surfaces, and a tube leading to said distributor, some of said conduits being disposed in said tube, said tube being connected with conduits for supplying compressed
 25 air to the lifting members.

8. Apparatus as claimed in claim 1, in which a plurality of said inlet nozzles are provided, said nozzles being connected by means of a bridging conduit with a sterilizing fluid supply conduit to the following inlet nozzle, said bridging conduit
 30 being opened and closed by means of a valve according to whether a vessel is missing or is present beneath the corresponding inlet nozzle.

9. Apparatus as claimed in claim 1, in which a plurality of said inlet nozzles are provided,
 35 said nozzles being connected by means of a bridging conduit with a sterilizing fluid supply conduit to the following inlet nozzle, said bridging conduit being opened and closed by means of a valve according to whether a vessel is missing or is present beneath the corresponding inlet nozzle, the valve of the bridging conduit being connected with the first-mentioned valve, said first-mentioned valve being secured to a blower
 40 pipe of the inlet nozzle.
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