A. L. FOREMAN.

BOTTLE WASHING MACHINE.

APPLICATION FILED MAY 13, 1915.

1,256,482.

Patented Feb. 12, 1918.

5 SHEETS—SHEET 1.

Fig. 13.

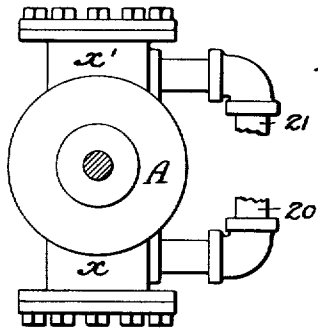


Fig. 1.

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5 SHEETS—SHEET 2.

Fig. 2.

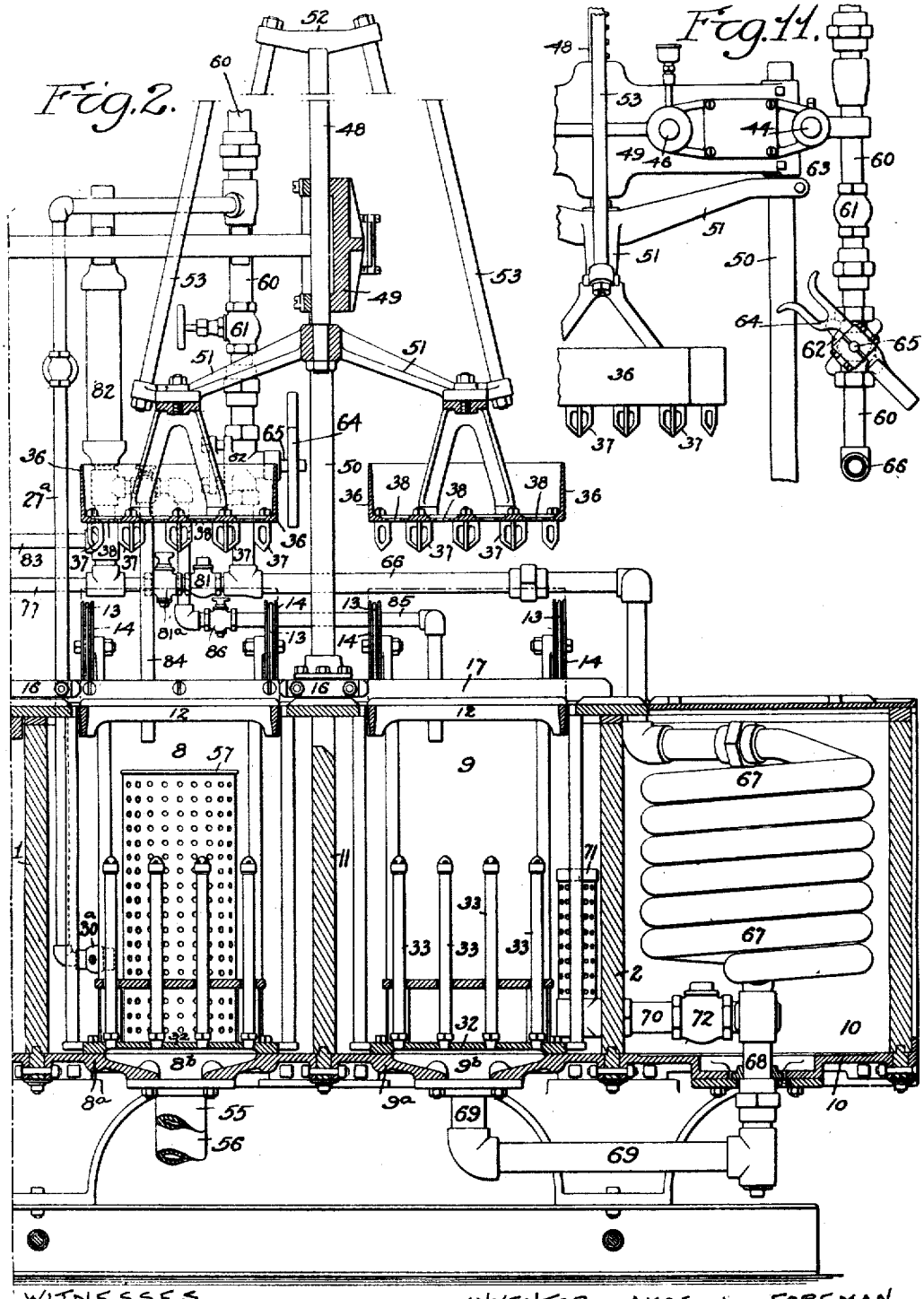


Fig. 4.

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5 SHEETS—SHEET 3.

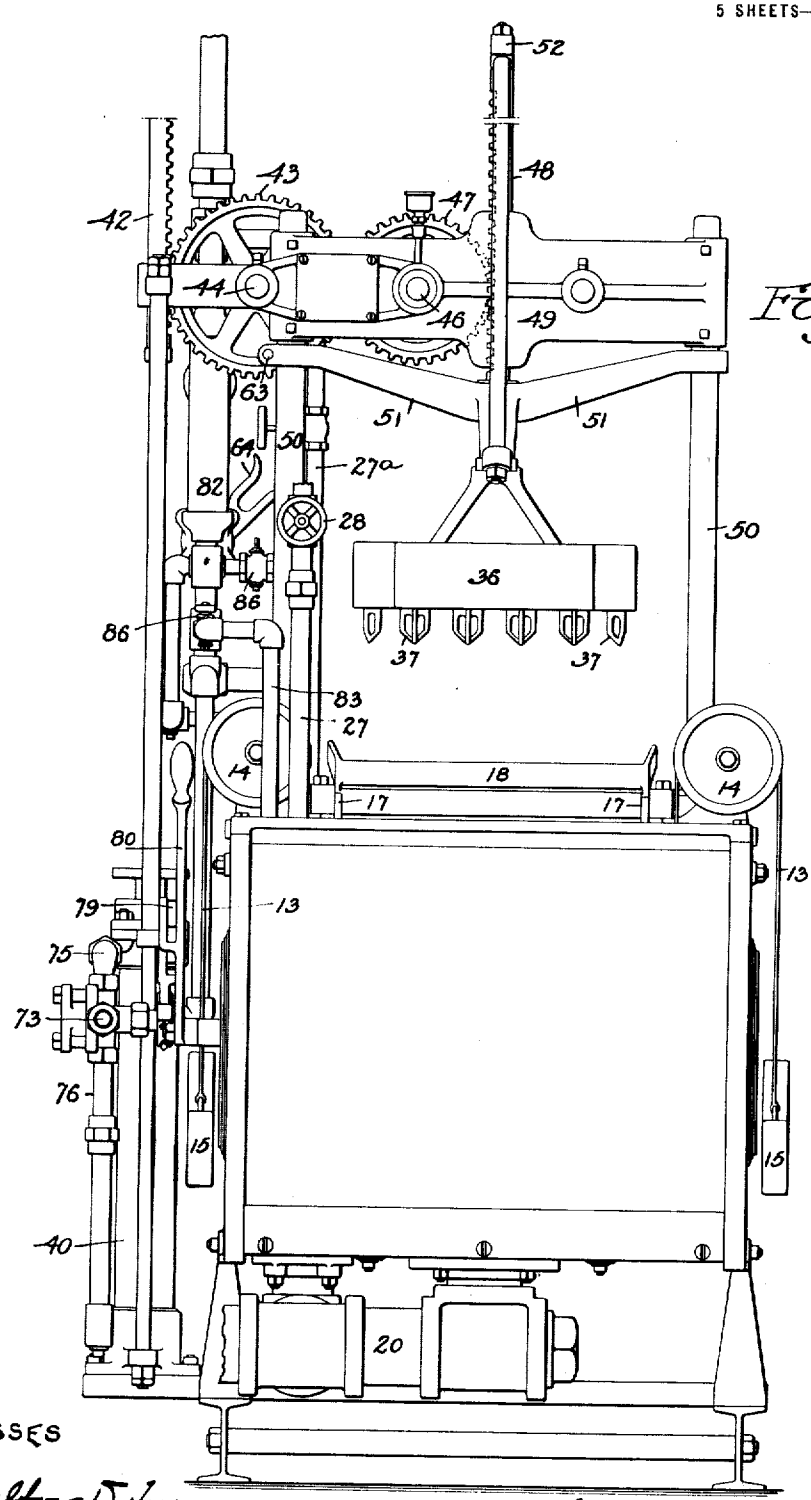


Fig. 3.

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5 SHEETS—SHEET 4.

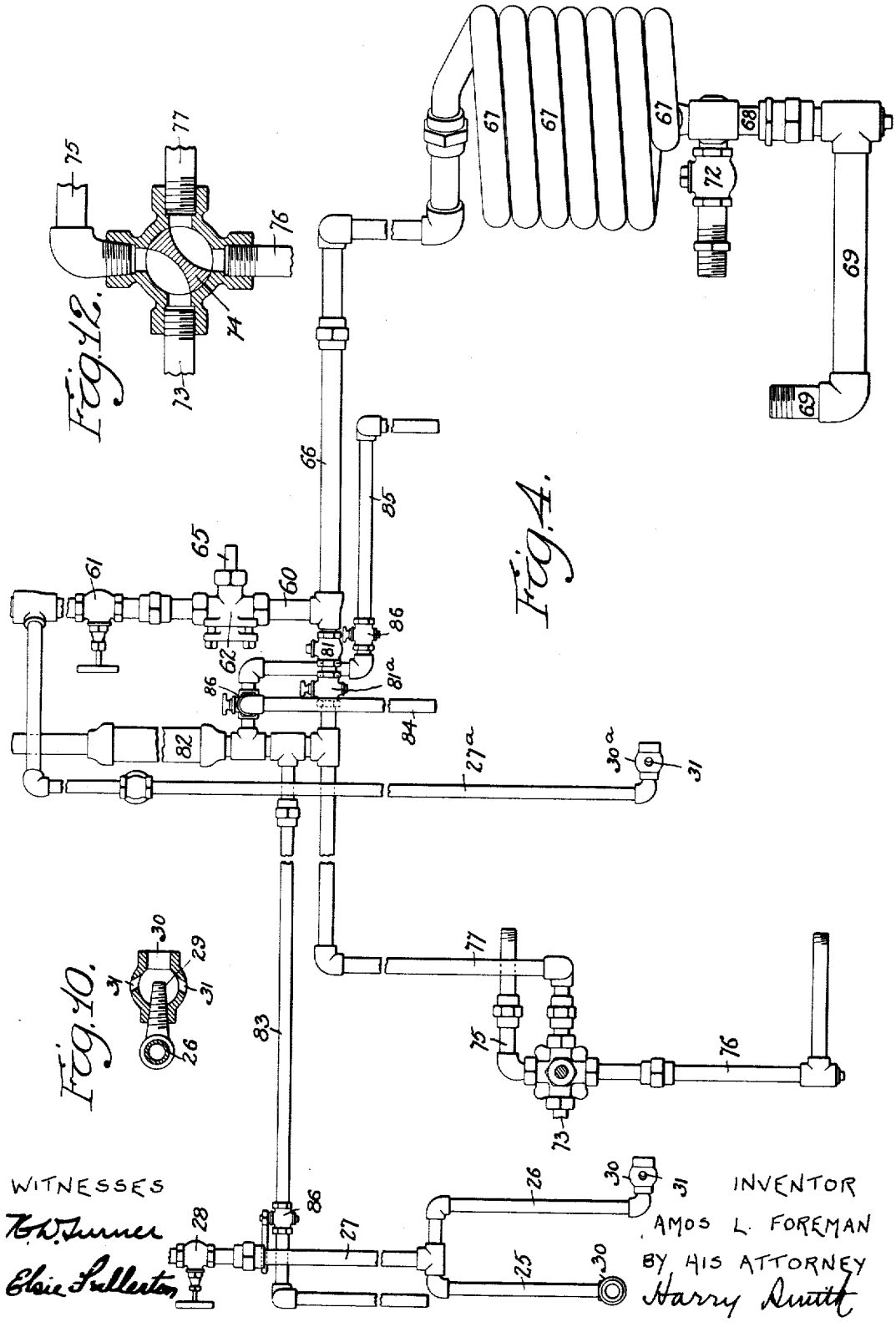


Fig. 4.

Fig. 12.

Fig. 10.

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5 SHEETS—SHEET 5.

Fig. 7.

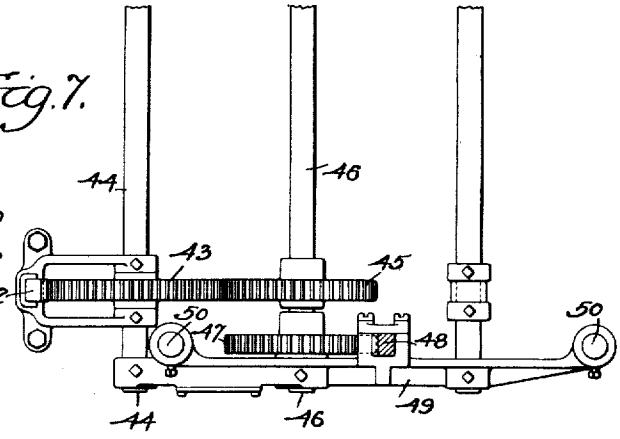


Fig. 5.

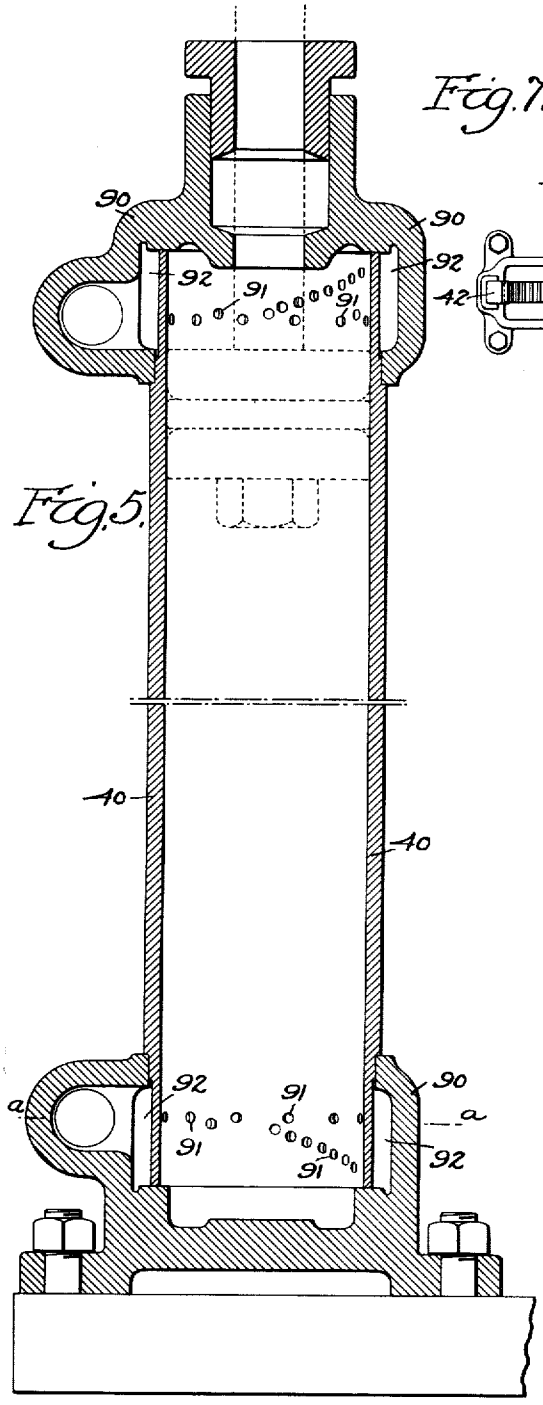


Fig. 8.

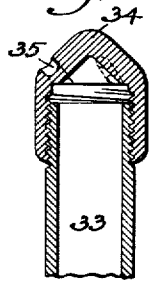


Fig. 9.

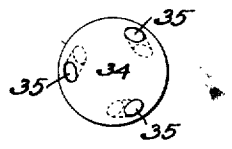
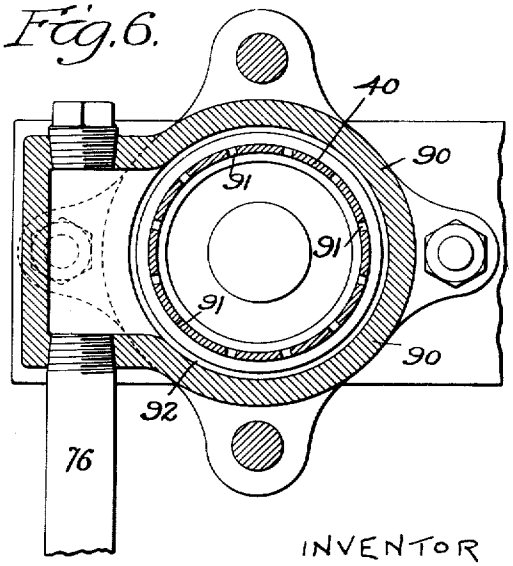


Fig. 6.



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UNITED STATES PATENT OFFICE.

AMOS L. FOREMAN, OF BALTIMORE, MARYLAND.

BOTTLE-WASHING MACHINE.

1,256,482. Specification of Letters Patent. Patented Feb. 12, 1918.

Application filed May 13, 1915. Serial No. 27,802.

To all whom it may concern:

Be it known that I, AMOS L. FOREMAN, a citizen of the United States, residing in Baltimore, Maryland, have invented certain Improvements in Bottle-Washing Machines, of which the following is a specification.

The bottle washing, rinsing and sterilizing machine which constitutes the subject of my present invention is of the same general type as that forming the subject of my application Serial No. 547,034, filed March 3d, 1910, the main objects of my present invention being to dispense with the use of brushes or equivalent devices for removing the accumulation of foreign matter from the interiors of the bottles, reliance for this purpose being placed upon the forcible projection of jets of washing fluid, water or steam against the surfaces to be cleaned; to effect final sterilization by the successive contact first of water jets, then of saturated steam jets, and then of live steam jets with the interior of each bottle, and to so direct the jets as to cause a rapid swirling movement of the relatively thin film of fluid in contact with all portions of the inner wall of each bottle.

In the accompanying drawings—

Figure 1 is a central longitudinal section of the forward half of a bottle washing, rinsing and sterilizing machine constructed in accordance with my invention;

Fig. 2 is a similar section of the rear half of the same;

Fig. 3 is an end view looking in the direction of the arrow Fig. 1;

Fig. 4 is a side elevation of the pipe system of the machine;

Fig. 5 is a vertical section on enlarged scale of the cylinder of a hydraulic power device forming part of the machine;

Fig. 6 is a horizontal section on the line *a*—*a*, Fig. 5;

Fig. 7 is a top view of a part of the machine illustrating certain gearing used in connection with the crate lowering and raising mechanism;

Fig. 8 is an enlarged vertical section of one of the jet nozzles employed in connection with the washing, rinsing and sterilizing devices of the machine;

Fig. 9 is a top view of the same, and

Figs. 10, 11, 12 and 13 are detached views of certain elements of the machine not fully illustrated in the general views.

The main tank of the machine extends from end to end of the same and is divided by partitions 1 and 2 into three compartments, that adjacent to the front end of the machine being in turn divided by partitions 3 and 4 into three chambers 5, 6 and 7 (see Fig. 1) that nearest the rear end of the machine containing a single chamber 10 and the intermediate compartment containing two chambers 8 and 9 separated from one another by a partition 11, as shown in Fig. 2.

The bottles are treated while in an inverted position and while contained in their carrying boxes or crates, the latter with the bottles being fed intermittently forward over the top of the tank and such movement being arrested when the bottle carrying crate is over each of the chambers of the tank in order that the crate of bottles may be pushed down into said chamber and subjected to the action of the cleansing or other devices contained therein.

The continuity of the top structure of the tank is interrupted above each of the chambers 6 to 9, inclusive, for the reception of a crate supporting frame 12 which is supported upon ropes or chains 13 passing over sheaves 14 suitably mounted upon bearings at the sides of the tank, said ropes being provided with counterbalance weights 15 (Fig. 3) whose tendency is to maintain the frames 12 constantly in the elevated position shown in Figs. 1 and 2, while permitting them to be depressed into their corresponding chambers when the bottle carrying crates mounted upon them are subjected to pressure tending to cause such depression.

The intermittent forward movement of the crates is effected by means of pushers 16 carried by a frame 17 mounted upon the top structure of the tank and having at one end a handle 18 whereby it may be moved forwardly and backwardly, forward movement being imparted to it and to the boxes or crates when the frames 12 are elevated and backward movement being imparted to said frame 17 during the time that the bottle carrying boxes or crates are depressed into the chambers 6 to 9 of the machine, and hence interpose no obstruction to such backward movement. After each backward movement of the frame 17 a fresh crate of bottles is fed into the empty space above the chamber 5, as shown by dotted lines in Fig. 1, so that on the next forward

movement of said frame 17 this fresh crate of bottles will be fed into position over the chamber 6.

The chambers 5, 6 and 7 of the compartment at the front end of the machine contain lye or other washing solution for the bottles, the chamber 5 being in communication through a pipe 20 with the inlet member x of a suitably located force pump A (Fig. 13) and the chamber 6 being in communication through a pipe 21 with the discharge member x' of said pump. The chamber 7 is connected to the pipe 20 through a pipe 22 so that in the operation of the machine the cleansing fluid is being constantly discharged from the pump into the chamber 6 and drawn into the pump from the chambers 5 and 7, the fluid freely overflowing from the chamber 6 into the chambers 5 and 7 over the tops of their partitions 3 and 4.

In the chamber 5 are located strainers 23 which serve to catch and retain any relatively large particles of foreign matter carried by the washing fluid which passes through the chamber 5 on its way to the pipe 20, and in the chamber 7 is a vertical strainer 24 which performs a like function in connection with the washing fluid passing through the chamber 7 to the pipe 22, thereby preventing the clogging of the jet openings in the chamber 6 through which the cleansing fluid is injected into the bottles contained in said chamber, as will be hereinafter described.

The heating of the washing fluid in the chambers 5 and 6 is effected by means of steam pipes 25 and 26 contained in said chambers, these pipes receiving their supply of steam from a pipe 27 which is provided with a valve 28 whereby the volume of flow through the same can be conveniently regulated. The steam issues from each of the pipes 25 and 26 through a jet nozzle 29 contained within a tubular casing 30 which is of greater diameter than the nozzle and projects forwardly beyond the same, as shown in Fig. 10, this tubular casing having openings 31 therein for the entrance of water from the chamber 5 or 6 so that the action of the steam jet is to cause a forcible flow of fluid from the chamber through the casing 30 and thence back into the chamber again, thereby not only heating the fluid but setting up such a circulation of the same in the chamber as will effectually bring all portions of it into contact with the steam from the jet 29 and thus cause uniform heating of the cleansing fluid.

Each of the chambers 5 to 10, inclusive, is closed at the bottom by a base plate 5^a, 6^a, 7^a, 8^a, 9^a or 10^a, specially constructed with reference to the particular function which it is intended to perform in connection with the chamber to which it is applied, thus the base plates of the chambers 6, 8 and 9 are centrally recessed to form chambers 6^b, 8^b and 9^b communicating at the bottom with the pipe whereby fluid under pressure is supplied thereto, each of these chambers being closed at the top by a plate 32 from which project upwardly as many pipes 33 as there are bottles in a crate, these pipes being so disposed that as the crate of bottles is pushed down into the chamber the various pipes will enter centrally the mouths of their respective bottles and will extend upwardly into the interiors of the bottles, it being understood that the bottle crates are so constructed as to properly support the inverted bottles and prevent them from dropping out of the crates.

Each of the pipes 33 is provided at the top with a conical cap 34 (Figs. 8 and 9) having formed therein a plurality of tangential nozzles 35 from which the fluid under pressure will issue in the form of upwardly and forwardly directed jets which forcibly strike the inner wall of the bottle and serve not only to remove adhering particles of foreign matter from said inner wall but also to cause rotation of the bottle so as to bring all portions of the surface of said inner wall under the action of the jets, the latter, as the bottles are depressed, beginning their action upon the inside of the bottle at the mouth and gradually advancing their plane of action upwardly through the bottle toward the bottom of the same as the depression of the bottle into the chamber of the tank continues, such action being reversed as the bottles are raised from the chamber. The effect of the tangential jets is to cause a rapidly rotating film of fluid which is relatively thin but is in intimate contact with the inner wall or bottom of the bottle and acts powerfully to remove any particles of foreign matter which may be adhering to said inner wall or to the bottom of the bottle.

At the same time that the bottle is thus being cleansed internally the outside of the same is likewise being cleansed by contact of the same with the fluid contained in the chamber in which the bottle is immersed, the level of said fluid in the chambers 5, 6 and 7 being normally in line with the tops of the partitions 3 and 4. Not only is the fluid contained in each of the chambers in constant motion but the bottles themselves are in rotation about their axes because of the action of the tangential jets of fluid upon the inner surfaces of the bottles as before explained, hence effective cleaning both of the insides and the outsides of the bottles can be effected without the use of brushes or equivalent scrubbing or cleansing devices.

The depression of the bottle carrying crates in the chambers 6, 7, 8 and 9 is ef-

fected by means of depressors 36 which have depending fingers 37 for entering between the inverted bottles in the crate and properly centering said bottles in respect to the jet pipes 33. Each of the depressors 36 constitutes a shallow tank with openings 38 in the bottom of the same so disposed that one of these openings is directly above each of the bottles in the crate. As the depressor is thrust down into the washing fluid, hot water, or other liquid contained in the chamber below, it becomes filled with said liquid and as the depressor rises above the level of liquid in the chamber the liquid contained in said depressor gradually flows therefrom through the openings in the bottom thereof, and pours over the bottoms of the inverted bottles in the crate, thereby removing from said bottoms of the bottles any foreign matters which may have been deposited thereupon.

As before explained the lifting movement of the crates is effected by the action of the counterbalance weights upon the crate supporting frames 12, and depression of the crates is effected by means of a hydraulic power cylinder 40 located at one side of the tank and having a piston with rod 41 provided at its upper end with a rack 42, the latter engaging a spur wheel 43 on a shaft 44, which spur wheel is in mesh with another spur wheel 45 on a shaft 46, the latter carrying spur wheels 47 which are in mesh with rack bars 48 vertically guided in suitable bearings in crossheads 49 mounted upon vertical supporting rods 50 at opposite sides of the tank, as shown in Fig. 3.

The rack bars 48 carry spiders each consisting of a member 51 at the lower end of the rack bar and another member 52 at the upper end of the rack bar, these upper and lower members being connected by suitable braces 53 so as to provide a rigid structure which carries a pair of depressors 36, one spider carrying the depressors for the chambers 6 and 7, as shown in Fig. 1, and the other carrying the depressors for the chambers 8 and 9, as shown in Fig. 2. When, therefore, the piston is moved from the top to the bottom of the cylinder 40 the depressors will be lowered and the bottle carrying crates will be forced down into the chambers 6, 7, 8 and 9, and when the piston is caused to travel upwardly in the cylinder 40 the depressors will be raised and the bottle carrying crates will be lifted from the chambers by the supporting frames 12.

Within the chambers 6, 8 and 9, which are equipped with the pipes carrying the jet nozzles, are disposed fixed vertical guide rods 54 which, by contact with the sides and ends of the crates, serve to maintain the same in their proper relation to the nozzle pipes and prevent lateral shifting of the bottles out of line with the nozzles. The chamber 8 is a rinsing chamber in which the bottles are subjected to the action of clean hot water introduced under pressure into the chamber by means of a pipe 55 which communicates with the discharge end of a suitable pressure pump conveniently located, the inlet end of said pump being in communication, through a pipe 56, with a strainer vessel 57 contained in said chamber 8 and serving to provide for the outflow of the water therefrom to the pump preparatory to its return to the nozzle pipes 33 through the pipe 55.

Between the washing chamber 6 and the rinsing chamber 8 is interposed the chamber 7 which receives the final drip from the previously washed bottles and prevents any carrying over into the rinsing chamber 8 of the lye or other fluid with which the original washing of the bottles was accomplished, for, owing to the rapid whirling motion of the body of liquid in the newly washed bottles said liquid does not drain rapidly from the bottles as they are lifted from the chamber 6 but continues to drain therefrom after they have passed into the chamber 7, sufficient time, however, being afforded in the transit of the bottles from the washing chamber 6 into and through the chamber 7 to insure the complete drainage of the washing fluid from the bottles before they reach the rinsing chamber 8.

The heating of the water in the rinsing chamber 8 or the maintenance of this heat is provided for by means similar to those employed in heating the washing fluid in the chambers 5 and 6, that is to say, by means of an injector 30^a supplied with steam from a valved branch pipe 27^a leading from a main steam pipe 60, as shown in Figs. 2 and 4. The main steam pipe 60 has a valve 61, whereby the volume of flow through the same can be regulated as desired and it also has a valve 62 whereby flow through it may be established or cut off as desired, this valve being automatically opened and closed by the rising and falling movements of the spider which carries the depressors operating in conjunction with the chambers 8 and 9 of the tank, the lower member 51 of said spider carrying a pin 63 (Fig. 3) which cooperates with a forked arm 64 (Figs. 3 and 11) on a stem 65 of the valve 62 so as to open said valve when the spider descends and close it as the spider rises.

The steam pipe 60 has a branch 66 leading to the upper end of a coil 67 in the chamber 10 of the tank, the lower end of said coil discharging through pipes 68 and 69 into the jet pipes 33 in the sterilizing chamber 9 of the tank, said pipe 68 having a branch pipe 70 which communicates with a drain pipe 71 in said chamber 9, and said pipe 70 being provided with a check valve 72 which opens toward the pipe 68.

The hydraulic cylinder 40 is supplied with

water under pressure from a pipe 73 which communicates with a fourway valve 74 (Fig. 12) the casing of said valve having three other branches 75, 76 and 77, the branch 75 leading to the upper end of the cylinder 40, the branch 76 leading to the lower end of the cylinder, and the branch 77 constituting the exhaust pipe through which water can escape from either end of the cylinder.

The valve 74 is provided with an arm 78 which is connected by a rod 79 to an operating lever 80 at one end of the tank, as shown in Fig. 1, said valve 74 when in one extreme position opening communication between the inlet pipe 73 and the pipe 75 and between the pipe 76 and the exhaust pipe 77, as shown in Fig. 12, and when in the other position reversing these conditions, that is to say, opening communication between the inlet pipe 73 and the pipe 76 and between the pipe 75 and the exhaust pipe 77, whereby proper manipulation of the lever 80 may be caused to force the piston either downwardly or upwardly in the cylinder 40. The exhaust pipe 77 communicates with the branch steam pipe 66 through a check valve 81 which opens toward the steam pipe 66 and when said valve, or a stop valve 81[a] adjacent thereto, is closed, water may be diverted from the pipe 77 into a stand pipe 82 in which it is free to rise and fall as its volume increases or diminishes.

When the valve 62 in the steam pipe 60 is open steam under pressure has free access to the pipe 66 and coil 67 and closes the check valve 81 but when said valve 62 is closed the flow of steam into the pipe 66 and coil 67 is cut off and the steam commences to condense, which reduces the pressure in said pipe and coil to a point below the pressure in the exhaust pipe 77 of the hydraulic cylinder, and in the stand pipe 82, and the check valve 81 then opens and permits a flow of cold water into the pipe 66 and coil 67 so as to hasten the condensation of steam therein and produce a partial vacuum in the coil. This causes the check valve 72 to open and permits flow of water from the sterilizing chamber 9 through the strainer 71 and pipe 70 into the lower end of the coil, the latter becoming quickly filled with water.

When the valve 62 is again opened pressure of steam forces the water from the coil 67 through the pipes 68 and 69, closing the check valve 72 and forcing into the bottles in the chamber 9, from the jet nozzles on the pipes 33 in said chamber, first water contained in the lower portion of the coil 67, then the hotter water from the steam which was condensed in said coil by contact with the water therein and which, at the same time, heated said water, and then live steam as the water due to condensation is ejected from the coil and the live steam follows it, the effect of this action being the complete sterilization of the bottles and the heating of the same to a high temperature prior to their removal from the machine. As the inverted bottles leave the machine they contain a rotating body of live steam but as the body of the bottle is also at a high temperature the steam will not be condensed by contact with the inner wall of the bottle but by contact with the central core of air, and will be discharged through the inverted mouth of the bottle, the inner wall of the bottle, after such discharge, being perfectly dry.

Communicating with the stand pipe 82 at points above its connection with the exhaust pipe 77 are three branch pipes 83, 84 and 85, communicating respectively, with the chambers 5, 8 and 9 of the tank, each of these branch pipes being provided with suitable stop valves 86 so that, when desired, the contents of the stand pipe may be drained therefrom into each or either of said tanks 5, 8 and 9, in order to replenish the volume of liquid therein if such action becomes necessary.

At each end of the hydraulic cylinder 40 is a head 90 (Figs. 5 and 6) surrounding the end portion of the cylinder and extending inwardly beyond that portion of the same which contains perforations 91 through which the water is admitted to and exhausted from the end of the cylinder. Contained in the head 90, and surrounding the perforated portion of the cylinder, is a chamber 92 with which communicates the pipe 75 or 76 through which water is conducted to or from the end of the cylinder.

The perforations 91 are disposed in angular relation to the axial line of the cylinder 40 so that as the piston in the cylinder moves away from either head 90 it will uncover one after another of said openings in succession and will thus provide for a gradually increasing area for the inflow of the water under pressure behind it, and as the piston approaches either head of the cylinder the number of openings through which the water can escape is gradually decreased, hence not only will the piston start to move slowly and gradually increase in speed but its movement toward each head of the cylinder will be gradually checked and any shock or jar at the termination of its movement in either direction will thereby be avoided.

I claim:—

1. The combination, in a bottle washing, rinsing or sterilizing machine, of a liquid containing vessel, a fluid pressure nozzle projecting upwardly therein and having tangentially disposed discharge apertures, and means for moving an inverted bottle downwardly and upwardly past said apertures

and into and out of the liquid in the vessel whereby jets of fluid will be directed under pressure tangentially against the inner walls of the bottle to cleanse the same and will cause said bottle to rotate in contact with the surrounding liquid so as to simultaneously clean the outside of the bottle.

2. The combination, in a bottle washing or rinsing machine, of a liquid containing chamber, a vertically yielding support for a crate of inverted bottles, a crate depressor consisting of a tank having openings in the bottom thereof, and means for raising and lowering said depressor whereby, when it is depressed, it will receive a charge of liquid from the chamber below and, as it rises, will discharge said liquid through the bottom openings onto the bottoms of the inverted bottles.

3. The combination, in a bottle washing, rinsing or sterilizing machine, of a series of chambers, means for conveying crates of inverted bottles forwardly over said chambers in succession, and means for depressing the bottle carrying crates, said means comprising a rack bar, means for raising and lowering the same, a spider mounted upon said rack bar and projecting in opposite directions therefrom, and a plurality of depressors mounted upon the oppositely projecting bottom members of said spider.

4. The combination, in a bottle washing, rinsing or sterilizing machine of a series of chambers, means for conveying crates of inverted bottles forwardly over said chambers in succession, and means for depressing the bottle carrying crates in succession as they are brought into line with the chambers, said means comprising a rack bar, means for raising and lowering the same, a spider mounted upon said rack bar and comprising upper and lower members and braces connecting the same, and a plurality of depressors mounted upon the oppositely projecting bottom members of said spider.

5. The combination, in a bottle washing, rinsing, or sterilizing machine, of a series of chambers, means for conveying crates of inverted bottles forwardly over said chambers in succession, means for depressing the bottle carrying crates into said chambers in succession as they are brought into line therewith, said means comprising a rack bar, means for raising and lowering the same, and a cross head disposed at a higher level than said chambers and provided with a guide for said rack bar.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

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Witnesses:

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HAMILTON D. TURNER.