(No Model.) 2 Sheets—Sheet 1

N. YAGN.

APPARATUS FOR STERILIZATION OF WATER.

No. 545,116. Patented Aug. 27, 1895.

Fig. 1.

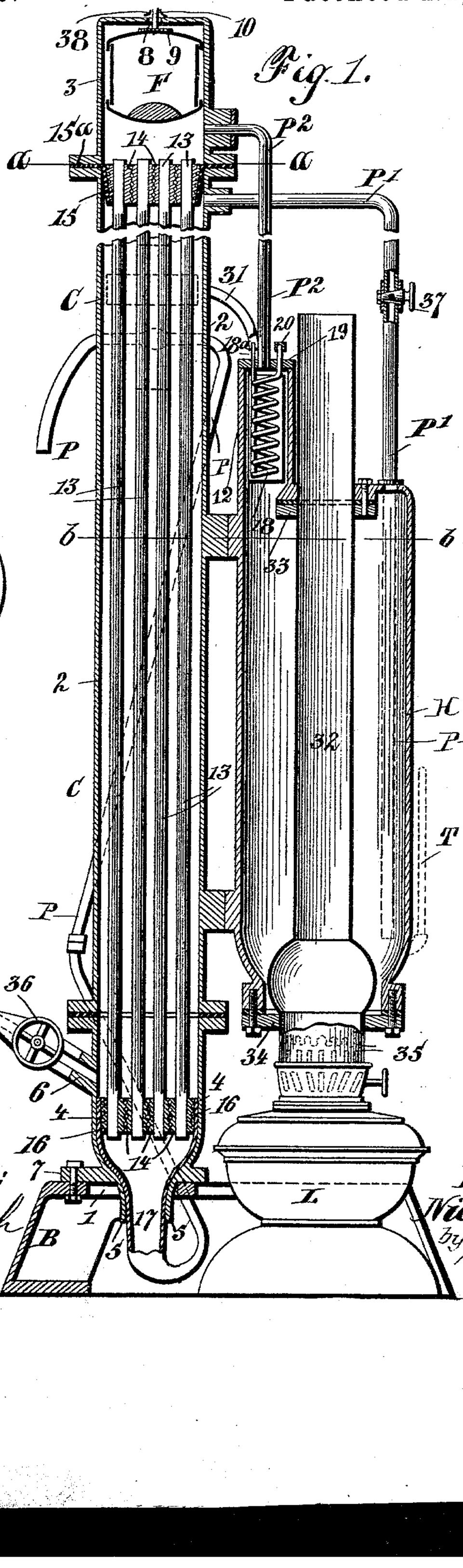
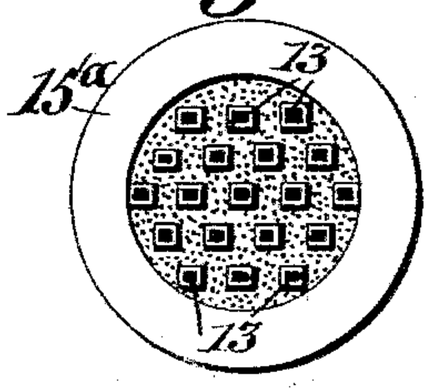


Fig. 3.



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(No Model.) 2 Sheets—Sheet 2.

N. YAGN.

APPARATUS FOR STERILIZATION OF WATER.

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Fig. 2.

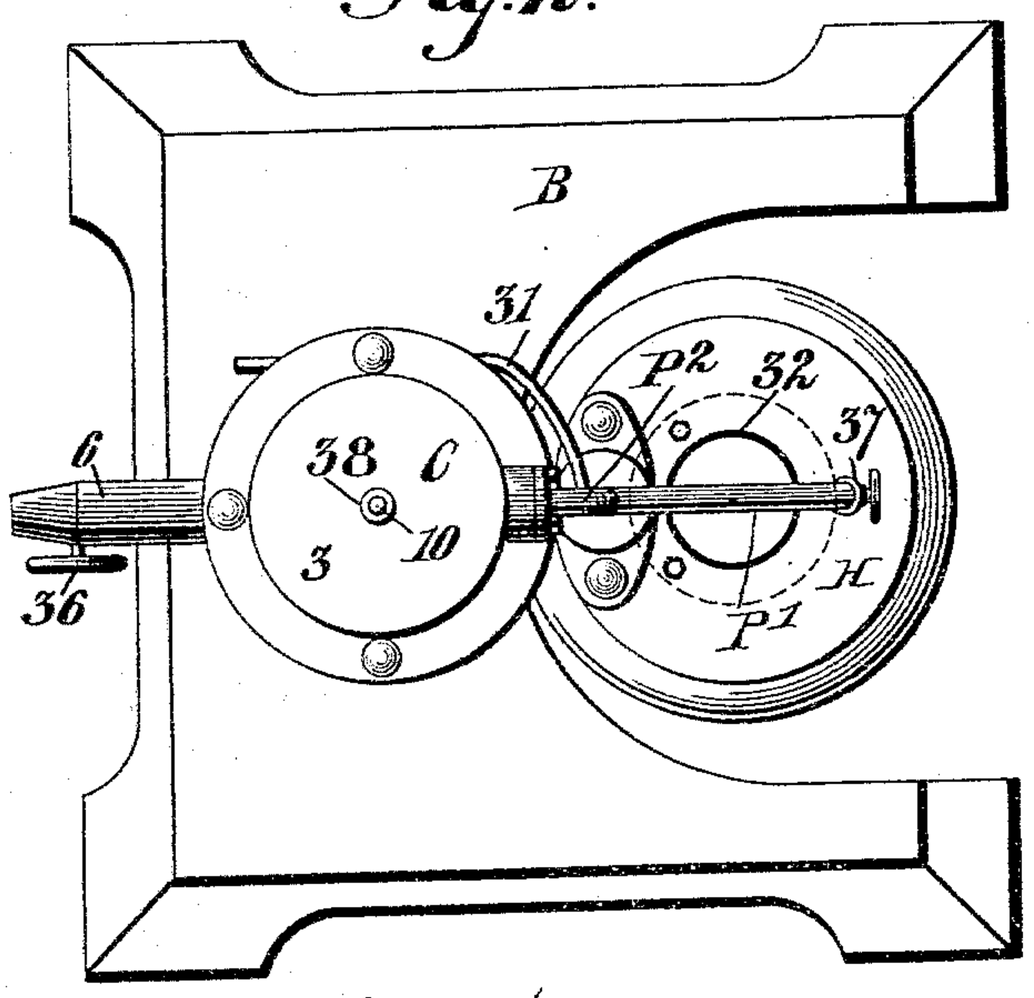


Fig. 4.

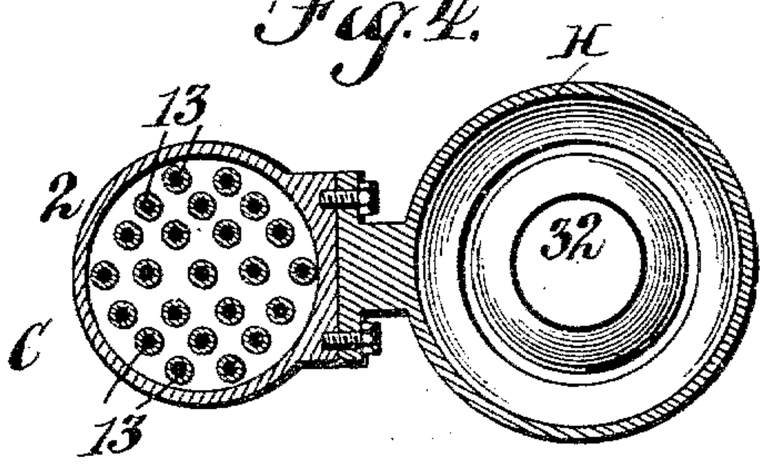


Fig. 5.

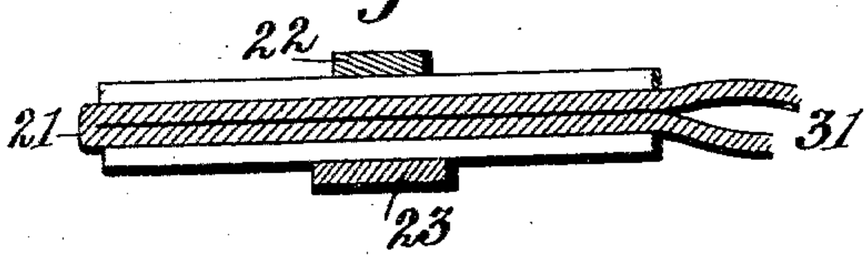


Fig. 6.

Fig. 7.

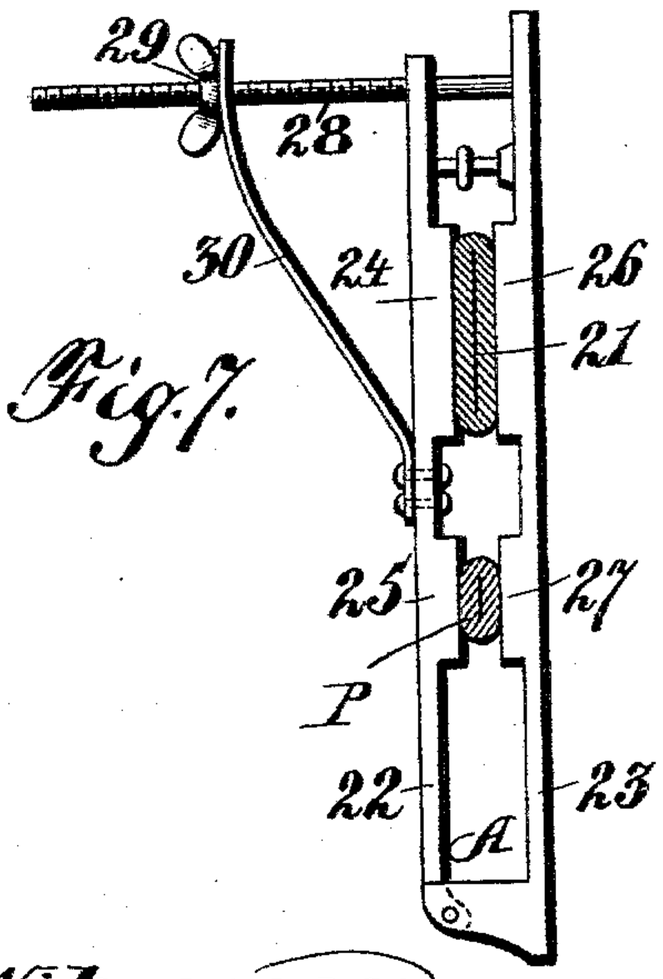
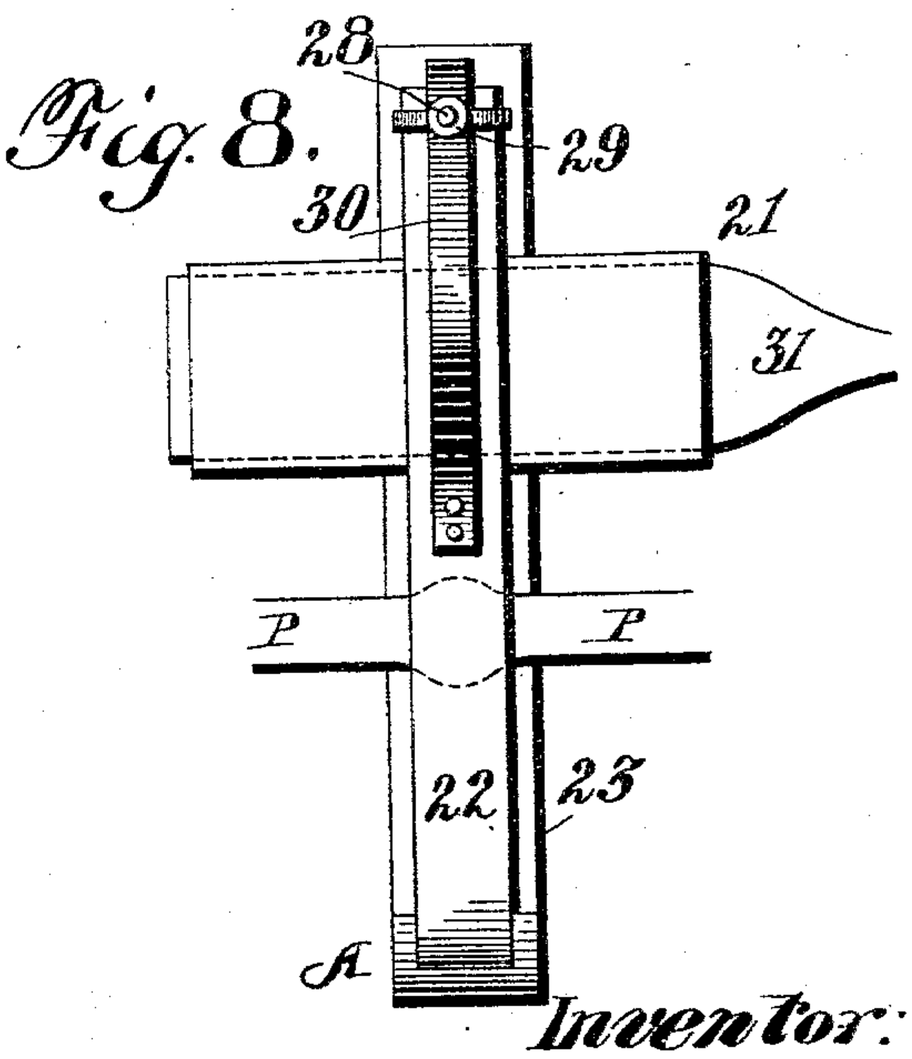


Fig. 8.



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UNITED STATES PATENT OFFICE.

NICHOLAS YAGN, OF ST. PETERSBURG, RUSSIA.

APPARATUS FOR STERILIZATION OF WATER.

SPECIFICATION forming part of Letters Patent No. 545,116, dated August 27, 1895.

Application filed May 16, 1893. Serial No. 474,470. (No model.)

To all whom it may concern:

Be it known that I, NICHOLAS YAGN, a subject of the Emperor of Russia, and a resident of St. Petersburg, in the Empire of Russia, have invented certain new and useful Improvements in Apparatus for the Sterilization of Water; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

My invention has for its object the provision of means whereby an uninterrupted supply of sterilized water can be obtained at a comparatively small expense, and whereby the attendance and labor usually connected with such apparatus are avoided, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical sectional elevation, and Fig. 2 a top plan view of a sterilizing apparatus embodying my invention. Figs. 3 and 4 are transverse sectional views taken on lines *a a* and *b b* of Fig. 1; and Figs. 5 to 8, inclusive, are detail views of the thermostatic regulator.

Similar symbols indicate like parts wherever such may occur in the above-described figures of drawings.

The apparatus illustrated in the drawings is automatic in its operation, the water being supplied thereto under sufficient head or pressure, and said apparatus consists, essentially, of a heater or boiler, a normally constant source of heat and water supply, and a cooler consisting of a cooling-chamber and a suitable radiator therein through which the sterilized water coming from the boiler is caused to flow, the radiator being connected with the boiler and with a discharge-pipe, respectively, while the cooling-chamber is connected with the water-supply and boiler, respectively, and a valve controlling the outflow of sterilized water, said valve being itself controlled by the temperature of the water within the boiler.

The apparatus, except the source of heat, is shown in the drawings as supported from a forked base B, in the top of which is formed an opening 1 for the passage of the discharge-pipe for the sterilized water. To said base is bolted the lower cylindrical portion 4 of the cooler C, said lower portion 4 having a suitable base flange 7 and being provided with an outlet branch 5, that is made slightly flaring outwardly, and with a valved inlet branch 6 for connection with the source of water supply. To the lower cylindrical portion 4 of the cooler C is bolted the cylindrical body 2, and to said body 2 is bolted the upper portion or cap 3, said parts 2, 3, and 4 being provided with suitable bolt-flanges for the purpose. In the upper end of the cap 3 is formed a gas or vapor port 8, adapted to be closed by a disk-valve 9 on the stem 10 of a float F, said valve performing the function or a pressure-regulating valve. The cap 3 of the cooler is also provided with an inlet branch to which one end of the inlet-pipe P^2 is connected, and within the cooler C is arranged a radiator consisting of a bundle of interspaced tubes 13, that may be secured in position in any desired manner, so as to form a cooling-chamber between the tube ends. I prefer, however, to secure said tubes within the cooler in the following manner: The upper and lower ends of the tubes are preferably of polygonal form in cross-section, Fig. 3, and to each of said ends is applied a rubber sleeve 14, the walls of which are of sufficient thickness to suitably space the tubes 13. Said sleeves may be cylindrical, as they will readily take the form of the tube ends, owing to their elasticity. The tubes, with their sleeves, are now bundled and finally tied together by means of a non-corrosive wire or by means of cord, after which the upper packed end of the bundle of tubes is inserted fluid-tight into a conical sleeve 15 of any suitable material and provided with an annular flange 15^a, by means of which it is secured between the bolt-flanges on the cap 3 and the upper end of the shell or body 2 of the cooler C, as shown. By bundling the tubes 13 as described the rubber sleeves are compressed and form fluid-tight joints between the individual tubes, while any space that may exist between the conical bearing-sleeve 15 and the tubes may be filled out with tow or other suitable material or by means of a rubber sleeve, so as to form a fluid-tight joint with said conical sleeve, the upper end of the

bundle of tubes performing the function of a stopper relatively to the sleeve 15.

To the lower end of the bundle of tubes and their rubber packing-sleeves 14 is applied the enlarged end 16 of a discharge-pipe P, which pipe may be a flexible one throughout, or the enlarged end thereof, together with another portion hereinafter referred to, may be made of a flexible material, as may be desired or found most convenient. The neck 17 of the enlarged end 16 of the discharge-pipe P is of considerably greater cross-sectional area than that of the pipe itself, said area being gradually reduced to that of said pipe. The walls of the neck 17 are also of increased thickness and about fit the neck 5 of the lower portion 4 of the cooler. The arrangement is here also such that the lower end of the bundle of tubes, together with the enlarged end 16 of the discharge-pipe P, will perform the function of a stopper relatively to the base-section 4 of the cooler C, while the pressure of the water within the neck of the pipe will also tend to expand said neck tightly against the neck 5 of the said base-section 4.

By means of the described construction of cooler it can readily be dismembered for the purpose of cleaning the same, as well as each individual tube 13, and any suitable material may be employed in the construction of said tubes, though in practice I prefer to make them of sheet brass or copper, tinned inside and out to prevent corrosion and to readily transmit heat. At its upper end the body 2 of the cooler C is provided with an outlet branch, to which one end of the valved outlet-pipe P′ is connected, and to said cooler is bolted or otherwise secured the boiler H, which is preferably of cylindrical form and open at both ends and provided at its upper end with a tubular extension 12, open at its lower end, in which extension is arranged a worm 18, one end of which projects through the cover 19 of said extension and is closed by a suitable cap 20 of any suitable material, preferably of rubber, the worm 18 being preferably made of copper; and by removal of the cap the worm may be supplied with a suitable fluid for purposes presently explained. The outlet branch 18^a of the worm 18 is connected by means of a flexible pipe 31 with a rubber bulb or sack 21, that is normally compressed in a clamp A, Figs. 5 to 8, composed of two parts 22 23, hinged together at one end and provided, each, with two projections 24 25 and 26 27, respectively, the rubber or compressible bulb or sack 21 being held between the projections 24 and 26, while the flexible discharge-pipe P or a flexible portion interposed in said discharge-pipe is held and more or less compressed by and between the projections 25 and 27 of the sections 22 and 23 of the clamp A. The section 23 of the clamp A has secured to its free end a screw-threaded rod 28, that extends freely through section 22 of said clamp, and on said rod works a thumb-nut 29, that serves as an abutment for the free forked end of a leaf-spring 30, secured to section 22 of said clamp, by means of which both the bulb or sack 21 and the discharge-pipe P are sufficiently compressed to prevent any liquid or vapor flowing into said sack and through said discharge-pipe. It will readily be seen that if the worm is supplied with a liquid whose boiling-point is the same or preferably slightly higher than that of the water to be sterilized the latter cannot flow through the discharge-pipe P until, by expansion of the liquid in the worm 18 and the generation of vapor, the bulb or sack 21 is sufficiently expanded to force the clamp-sections apart against the stress of the spring 30 to release said discharge-pipe. Furthermore, the pressure exerted by the clamp A upon the sack 21 and the discharge-pipe P is readily regulated by means of the thumb-nut 29, thus affording a means for regulating the temperature and pressure under which the water from the boiler is allowed to flow from the apparatus and insuring the sterilization of the water, so that when the supply of water and heat to the boiler and the outflow of water therefrom are once adjusted the sterilization goes on without further attention—that is to say, the apparatus operates automatically.

The regulator-clamp may be located at any desired point; but in order to shorten the connection between the bulb or sack 21 and the worm I prefer to secure the section 22 of the regulator to the cooler-shell, as shown in dotted lines in Fig. 1.

The boiler H is connected with the cooling-chamber of the cooler C by means of a valved pipe P′, which pipe serves to supply said cooler with water to be sterilized. Centrally of said boiler is a metallic heater flue or chimney 32, preferably of thin sheet-copper, of substantially the form of a lamp-chimney, provided with bolt-flanges 33 34, by means of which and a suitable packing—as asbestos, felt, or cloth—said chimney is connected fluid-tight with the boiler H, said flanges constituting the boiler-heads, and, as shown in Fig. 1, said chimney projects sufficiently above said heater to insure the necessary draft.

The source of heat shown in the drawings as an example is an ordinary petroleum or kerosene lamp L, which can be slipped into the base B of the apparatus, between the forks thereof and the central heating flue or chimney 32, fitted to its gallery 35. As will be seen, the boiler H is constructed on the principle of the Russian tea-boiler or samovar, except that the source of heat, instead of being charcoal burned on a suitable grate, is here a lamp L. My object in substituting a lamp for a grate is to avoid all supervision and regulation of the amount of heat supplied to the heater for definite periods of time, and also for the reason that the combustible is very cheap; but it will be understood that I do not limit myself to the use of a lamp, especially when large volumes of water are to be steril-

ized, in which case the heat may be obtained from a grate-fire supplied with any desired fuel or from a gas burner or burners, and where steam is available either live or exhaust steam may be used, the chimney 32 being in this case replaced by a steam-coil. When the water to be sterilized is contained in a reservoir the latter should be located above the apparatus, so that sufficient head or pressure may be obtained to induce a continuous flow through the apparatus, and, of course, this will not be necessary in the sterilization of water supplied to the apparatus from a service-main.

The operation of my improved sterilizing apparatus may be briefly described as follows: The worm 18 is first supplied with a liquid the boiling point of which is substantially that of the water to be sterilized, by removal of the cap 20, after which said cap is again secured in place. Said liquid may, for instance, be water previously boiled. The stop-cock or regulating-valve 36 in the feed-branch 6, as well as the stop-cock 37 in the supply-pipe P′ that connects the heater with the cooler, are now opened and the liquid allowed to flow into the apparatus until it is completely filled, the thermostatic regulating-clamp A closing the discharge-pipe P and compressing the expansible bulb or sack 21. The water will flow into the cooling-chamber of the cooler C around its tubes by pipe P′ to heater, and from heater through its extension 12 around worm 18, through pipe P^2 to cooler-cap 3, through the radiator-tubes 13 to discharge-pipe P, the air in the apparatus passing out through air-port 8 in cap 3 until the entire apparatus is filled, or substantially filled, with water, when the float F will rise and its valve 9 close the air-port 8. The supply-valve 36 is now closed and the lamp L fitted to the chimney 32 and lighted. As soon as the water in the heater has been heated to the boiling-point of the liquid in the worm 18, vapors will be generated in the latter that will exert pressure within the bulb or sack 21 and expand the same against the tension of the clamp-spring 30, and the clamp A will open, relieving the discharge-pipe P from pressure and allowing the water to flow out of the apparatus. At the beginning the outflow of water will be more or less spasmodic or at intervals and in small quantities as it is driven out of the radiator, and during the preliminary heating of the water the air-port 8 in the cooler-cap 3 is preferably closed by means of a screw-cap or a rubber cap 38, or simply by securing the valve-stem in position with the valve on its seat by means of a peg or the like. The vapor or steam generated in the heater H will quickly drive out all the water from the cap 3, the radiator-tubes 13, and the discharge-pipe P until steam or vapor only will issue from the latter pipe. The steam or vapor is allowed to escape for a few minutes, so as to insure the complete sterilization of the interior surfaces of the passages for the sterilized water. The supply-valve 36 is now opened again and shortly thereafter water, instead of vapor or steam, will flow out of the discharge-pipe P, owing to the condensation of said vapors or steam due to the cooling of the tubes 13 by the cooler inflowing water, so that after the apparatus has been at work for a short time there will be a continuous flow of sterilized water through pipe P of approximately the same temperature as the inflowing water, so that the expense and inconvenience of special cooling devices are dispensed with. Should the supply of water to the apparatus be such as to result in a lowering of the temperature of the water in the boiler below the boiling-point of the liquid in the worm 18, the pressure in the bulb or sack 21 will at once be reduced correspondingly and the spring 30 will close the clamp not only upon the sack, but upon the discharge-pipe P, and stop the outflow until the temperature of the water in the boiler H has again reached the boiling-point of the liquid in the worm 18.

Inasmuch as the apparatus will be nearly completely filled with water after being at work for a little while, the float F will hold the valve to its seat and prevent the escape of the gases evolved from the water, as well as the vapors generated, so that said gases upon cooling will again combine with the water and a material loss thereof is prevented. On the other hand an accumulation of gases or vapors in the cooler-cap 3 that would result in an excessive pressure cannot take place, as such pressure will be exerted upon the water in the cooler and discharge-pipe, thereby increasing the overflow and lowering the level of the water in the cooler-cap, causing the float F to drop, thereby unseating the valve 8 and thus relieving the apparatus of excessive pressure. Since but a small proportion of air dissociated from the water in the process of boiling can escape, the sterilized water, instead of becoming flat and unpalatable, as is the case when boiled in an open vessel and then transferred to a closed vessel and allowed to cool, will remain palatable. If desired the boiler H may be provided with a thermometer T, as shown in dotted lines in Fig. 1, though this is not absolutely necessary, but simply a convenience, inasmuch as the regulator is also a temperature-indicator, the escape of steam or vapor from the discharge-pipe P indicating sufficiently the temperature of the water in the boiler H. When once properly at work the apparatus needs no further attention, except to see that the lamp L is supplied with combustible from time to time and that the feed-tank is supplied with water; but when the supply of water is derived from a constant source, as a service main, and a gaseous fuel also derived from a constant source, as a service main, is employed, even this attention is dispensed

with after the volume of liquid flowing to the apparatus and the volume of gas supplied to the boiler have been properly adjusted.

I have confined the description of my invention to a sterilizing apparatus more especially designed for domestic uses, and particularly to the sterilization of water; but I would have it understood that I do not limit my invention so such use only, as other liquids may be sterilized, and the volume of liquid so sterilized will depend solely upon the capacity of the apparatus; nor is it necessary that the heater should be secured to or supported from the cooler, as shown. Instead of an upright tubular cooler other forms of coolers may be used, so long as provision is made for the cooling of the sterilized liquid by means of the liquid to be sterilized. Instead of the float-valve for controlling the pressure in the apparatus, any other automatically-operating pressure-regulating valve may be employed. Inasmuch as the temperature of the liquid to be sterilized is considerably increased before it reaches the boiler, an economy in fuel is effected, and to prevent the entering liquid from commingling with the sterilized liquid at the point where it leaves the boiler, and thereby avoiding any possibility of non-sterilized water passing out of the apparatus, the supply-pipe P′ is preferably extended into the heater nearly to its bottom, as shown in dotted lines in Fig. 1.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In a sterilizing apparatus, the combination of a heater or boiler, appliances for cooling the sterilized liquid by means of the liquid to be sterilized, a flexible discharge pipe for the sterilized liquid, and a thermostatic regulator adapted to more or less compress said pipe and control the flow of liquid therethrough, for the purpose set forth.

2. In a sterilizing apparatus, the combination with a heater or boiler, appliances for cooling the sterilized liquid by means of the liquid to be sterilized, and a flexible discharge pipe; of a thermostatic regulator comprising a holder for a liquid whose boiling point is about the same as that of the liquid to be sterilized, said holder in contact with the liquid in the heater, an expansible bulb or sack connected with the holder, and a spring-actuated clamp operating to normally compress the bulb and flexible discharge pipe, substantially as and for the purpose set forth.

3. In a sterilizing apparatus, the combination with a boiler, of a cooler composed of an outer shell, a plurality of open ended radiator tubes provided at each end with an elastic packing and spacing sleeve, said tubes arranged in a bundle the packed ends thereof secured fluid tight in the shell whereby a cooling chamber is formed between said packed ends, a pipe in communication with one end of the radiator tubes and the boiler respectively, a discharge pipe in communication with the opposite ends of said radiator tubes, a pipe connecting the boiler with one end of the cooling chamber, and a water supply connected with said chamber at its opposite end, substantially as and for the purpose set forth.

4. The herein described means for securing the radiator tubes fluid tight within the cooler shell, comprising elastic packing and spacing sleeves at each end of the tubes, said tubes tied together at their ends, an elastic packing interposed between the tied and packed portion of one end of the bundle of tubes and the cooler shell, and a metallic sleeve applied to the tied and packed portion at the opposite end of the bundle, said sleeve secured fluid tight to the shell, substantially as and for the purpose set forth.

5. An apparatus for sterilizing liquids, comprising a boiler, and an upright cooler composed of a cylindrical shell 2, cap 3, and base portion 4 bolted together fluid tight, a conical sleeve 15 provided with an annular flange secured between the bolt flange at the upper end of the shell and that of the cap 3, a pipe connecting said cap with the heater, a pipe connecting the upper end of the shell 2 with said heater, and a feed pipe connected with the base portion 4 of the cooler, in combination with open ended radiating tubes, an elastic packing and spacing sleeve 14 on each end of the tubes, said tubes tied together in a bundle at the packed ends, the upper packed end of the bundle seated fluid tight in the sleeve 15, and an elastic discharge pipe encompassing the lower packed end of the bundle of tubes and fitted fluid tight into the base portion 4 below the feed pipe, whereby the condenser is divided into feed, radiating, cooling and outflow chambers, substantially as and for the purpose set forth.

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

NICHOLAS YAGN.

Witnesses:
N. TSCHEKALOFF,
ED. WANSCHEIDT.