J. B. PENTZ.

STERILIZER.

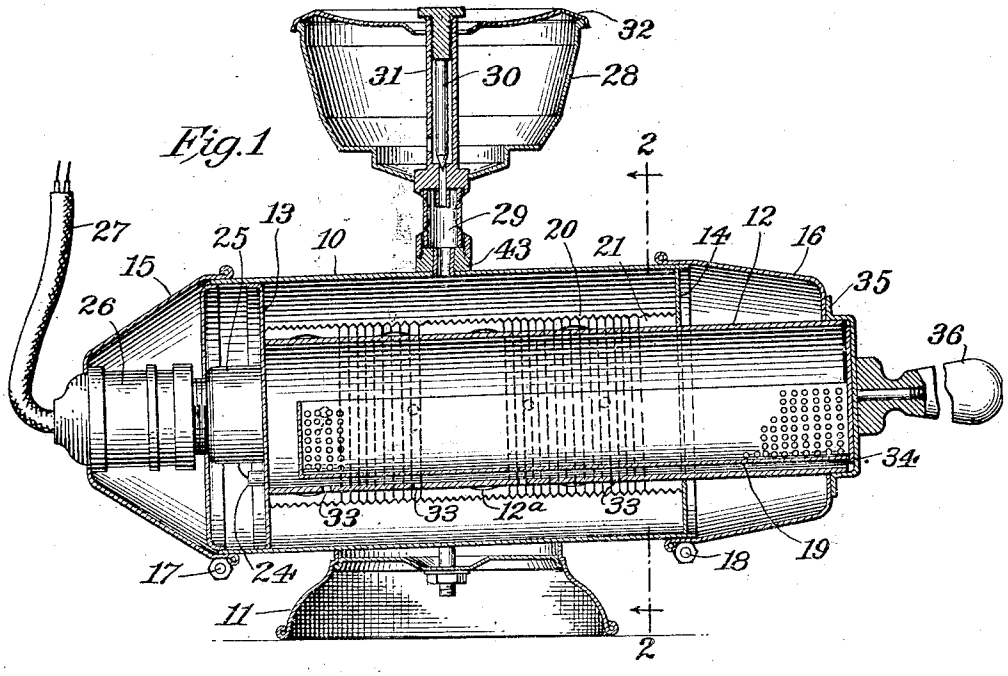
APPLICATION FILED JUNE 25, 1919.

1,377,726.

Patented May 10, 1921.

2 SHEETS—SHEET 1.

Fig. 1



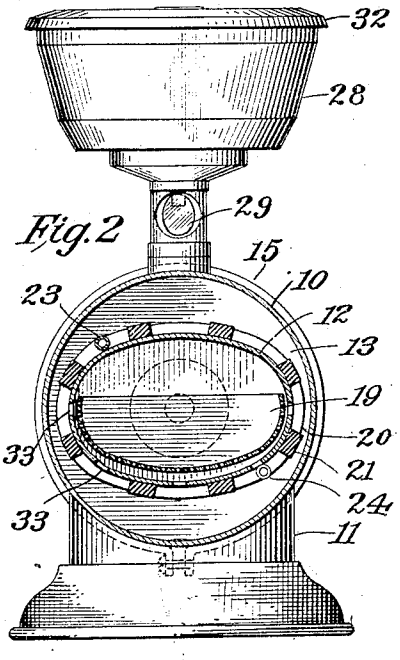
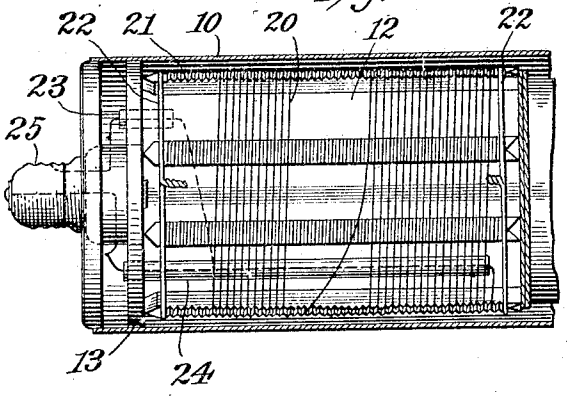


Fig. 2

Fig. 3



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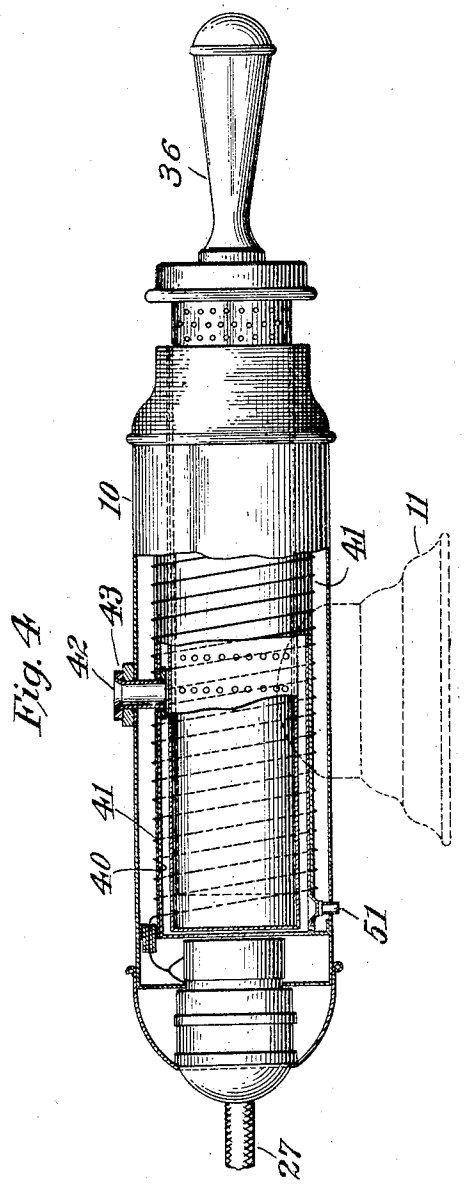


Fig. 4

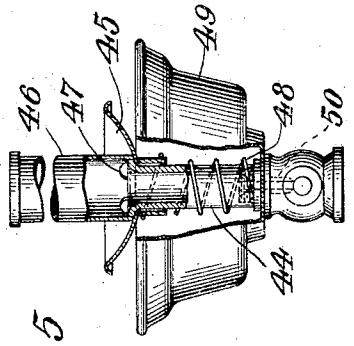


Fig. 5

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UNITED STATES PATENT OFFICE.

JAMES B. PENTZ, OF NEW YORK, N. Y.

STERILIZER.

1,377,726. Specification of Letters Patent. Patented May 10, 1921.

Original application filed March 4, 1915, Serial No. 11,951. Divided and this application filed June 25, 1919. Serial No. 306,525.

To all whom it may concern:

Be it known that I, JAMES B. PENTZ, a citizen of the United States, residing at the borough and county of Richmond, city and State of New York, have invented certain new and useful Improvements in Sterilizers, of which the following is a full, clear, and exact description.

The invention which forms the subject of the present application (a division of my co-pending application Serial No. 11,951, filed March 4, 1915) relates to sterilizing devices for surgical instruments and other articles.

Experience with, and careful study of, practically all known methods of sterilization for a considerable period have led me to the conclusion, shared by many other surgeons and bacteriologists, that there is great need for an apparatus which shall be unfailingly perfect in its results but which will at the same time be quick and convenient to use. To this end I have devised my present invention, which has for its chief object to provide a sterilizing apparatus which shall be practically instantaneous in its effects and yet render the instrument or appliance sterile in the true sense of the word. A further object is to provide a simple and durable apparatus of low cost. To these and other ends the invention consists in the novel features of construction and combinations of elements hereinafter described.

In practising my invention in the preferred manner the instruments or other articles to be sterilized are subjected, in the presence of vapor, to a temperature exceeding the boiling point of the liquid from which the vapor is produced, the heating of the article being effected in a vessel or container which is not hermetically sealed but is open to the atmosphere for the escape of the steam, or vapor, as the case may be. Heretofore, subjecting the instrument, in the presence of steam, to a temperature above the boiling point of water at atmospheric pressure has always implied the use of a closed receptacle and a pressure therein corresponding to the temperature. It is well known that, however effectual such a procedure may be, it is slow, at times requiring hours for the attainment of perfect results. Why this is so I am not able to explain with certainty, but the fact remains. On the contrary, by the use of my sterilizer the time of complete sterilization is counted by seconds instead of minutes or hours, and in fact the time is usually so short—five or six seconds or even less, depending generally upon the temperature employed—that the method for all practical purposes can be called instantaneous.

The preferred form of my invention is illustrated in the accompanying drawings, in which—

Figure 1 shows the complete apparatus in longitudinal vertical section.

Fig. 2 is a cross section on line 2—2 of Fig. 1.

Fig. 3 is a detail side view of the inner heating element, the outer protective casing being in section.

Fig. 4 is a side view, partly in longitudinal section, of a modification of the sterilizer shown in Fig. 1.

Fig. 5 is a side view, partly broken away, of a liquid reservoir for use with either sterilizer.

The outer casing 10 is preferably cylindrical in form and mounted in a slightly inclined position on a supporting base 11. The inner heating element is in the form of a chamber 12 preferably elliptical in cross section, provided at one end with a head 13 and near the other with a radial flange or collar 14 to support the chamber centrally in the casing 10 and spaced from the walls thereof. Removable caps 15, 16, of conical form, are provided for the ends of the casing and are fastened against accidental displacement by means of binding bolts 17, 18. Each cap is formed with a central aperture, that in cap 15 being provided for the electrical connections hereafter described and that in cap 16 to permit insertion and withdrawal of the drawer or cage 19.

In the present apparatus the heat is produced preferably by the flow of current through a resistance wire 20 wound around the chamber 12, but insulated therefrom by means of insulating strips 21, of porcelain or other suitable material arranged longitudinally on the chamber and held in place by wires or bands 22, the insulating strips or bars being serrated, as shown to receive the wire 20 and insure proper spacing of its turns.

Notches 12ª in the strips 21 next to the chamber 12 permit surplus water, discharged on the top of the chamber as hereafter described, to run freely down the sides of the chamber. The terminals of the heating element pass through insulating tubes or bushings 23, 24 into electrical connection with an ordinary plug 25 on the head 13. Connection with a source of current is made by means of a socket 26. Preferably the socket is overlapped by the edge of the aperture in the cap 15, as shown in Fig. 1, to prevent accidental unscrewing of the socket as the plug (not shown) at the other end of the cord 27 is screwed into its socket. Removing the cap 15 will of course permit removal of the socket 26.

On the casing 10 is a reservoir 28 for the liquid used (by preference ordinary water) having a sight feed 29 through which the water is delivered onto the heating element. A needle valve 30, threaded in a tubular support 31, controls the flow of water so that the delivery may be drop-by-drop at any desired rate. The lid 32 is merely dropped on the reservoir, and may be removed instantly for cleaning or filling the reservoir. In the bottom and sides of the chamber I provide a number of apertures 33 to permit free ingress of steam into the chamber.

The tray or drawer 19 is foraminous, preferably throughout its entire length, though for convenience the perforations or apertures are shown only at the ends. It is usually semi-elliptical in cross section, but enough smaller than the chamber 12 to leave a space between the two, at least at the bottom, as clearly shown in Figs. 1 and 2, to permit free access of the steam. On the outer end of the tray or drawer is a cap 34 having a flange 35 engaging at several points the projecting end of the chamber 12 and thereby aiding in supporting the tray inside the latter. It is not intended, nor is it even desirable, in the absence of a steam escape opening elsewhere, that the cap make a close fit with the chamber-end, and in fact the chief object of providing the cap and flange is to deflect escaping steam radially outward and so protect the hand more effectually when the handle 36 is grasped to insert or remove the drawer.

In practising my method in the preferred manner with the apparatus described, the current is turned on and the reservoir supplied with water. In a few minutes, depending on the strength of the current, the size and nature of wire 20, etc., the chamber 12 becomes highly heated, inside and out, say to a temperature of from 200° to 300° C. The valve 30 is now opened and the water thus allowed to issue, preferably drop by drop. The heat generated by the heating element vaporizes the water, and the steam thus produced passes into the interior of the sterilizing chamber 12 through the openings 33 in the walls thereof. The tray 19 with the non-sterile instruments or other articles lying loose therein, is now inserted into the chamber 12 (if not already in the chamber), thus exposing the contents of the tray to the heat radiated from the hot walls of the chamber and to heat carried to said contents by the steam. How long the instruments should be left in the tray depends largely upon the temperature inside the sterilizer. For example, instruments bearing large quantities of typhoid bacilli were rendered completely sterile in six seconds, when the temperature was about 293° C., in ten seconds at 275° C., and in fifteen seconds at 235°–250° C. I am not aware that results comparable to these have ever been attained with any practical heat-process of sterilization heretofore known.

Upon removing the tray, moisture in the form of a film or in drops is usually found on the instruments, but the latter speedily dry of their own heat. Moreover, they usually cool quickly to a safe handling temperature for the reason that seldom if ever do they attain, except possibly at their surfaces, the temperature to which they were subjected in the sterilizing chamber. This is shown by the fact that with the sterilizer running at its maximum temperature a thermometer placed therein required 26 seconds to reach 150° C., 40 seconds to reach 200° C., 1 minute and 3 seconds to reach 250° C., 1 minute and 25 seconds to reach 275° C., and 2 minutes and 23 seconds to reach 300° C. It is not necessary to insert the tray far enough to close the sterilizing chamber; but if the tray is no longer than necessary to accommodate the instruments the latter may project out of the chamber if the tray is not pushed home; in which case the parts that project say an inch or more may not be completely sterilized, though the parts well inside the chamber will be made perfectly sterile.

I am not able to explain to my complete satisfaction just why the method described is so effective, since it contravenes the previously accepted theories that would apply. But the fact remains that the process is demonstrably superior in efficiency and convenience to boiling or baking, and to the use of steam under high pressure and at a corresponding temperature.

Water and steam are referred to herein as the most convenient for the purpose, and in fact I know of none better, but other liquids may be used; and it is within the spirit of my invention to use an aqueous solution of a volatilizable germicide, but I have not observed that any better results are obtained thereby. I also prefer to generate the steam or other vapor by discharg-

ing a liquid upon or into the heated sterilizing chamber, or at least into the outer casing, but the generation can be effected at a more remote point and the vapor conveyed to the sterilizing chamber through suitable pipes.

The sterilizer shown in Fig. 4 differs from that shown in Fig. 1 practically only in respect to the heating element. The latter, in Fig. 4, comprises a sheet metal tube or chamber 40 covered with a layer of refractory insulating material, preferably mica or mica-composition, on which the resistance wire 41 is mounted, as by winding the same helically thereon. The heat thus generated heats the tube 40 and the water or other liquid is delivered to the inside of the same through the short tube 42 at the top from any suitable reservoir, for example one like that shown in Fig. 1 or that shown in Fig. 5. In the latter, which is formed at the bottom to screw on the nipple 43, the needle valve is omitted and the central tube 44 is imperforate at the bottom and open at the top. Slidable vertically on this tube is a cup 45 attached to the bottom of a tubular stem 46 capable of vertical movement on said central tube and having drain apertures 47 at the bottom. A spring 48, encircling the tube 44 holds the cup and stem yieldingly in their upper position, against the flared upper end of the aforesaid tube. When water is to be delivered to the sterilizer the stem is pressed down, carrying the cup down into the reservoir 49, causing the cup to receive water therefrom. Upon release of the stem the cup is raised to the position shown in Fig. 5, carrying with it a quantity of liquid, which runs out through the drain opening 47 into the tube 44 and thence through the nozzle 50 into the sterilizer. This method of liquid-supply eliminates trouble due to leaky valves and consequent flooding of the sterilizer, since only a limited quantity of liquid is delivered at each actuation of the measuring cup. A drain tube 51, Fig. 4, permits immediate escape of any excess liquid from the sterilizer.

It is not necessary that the articles to be sterilized be heated before they are placed in the sterilizer. It is more convenient and is apparently quite as effective to introduce them at whatever temperature they may happen to have, which is usually ordinary room temperature.

It is to be understood that the invention is not limited to the apparatus herein specifically illustrated, but can be embodied in other devices without departing from its spirit as defined by the following claims.

What I claim is:

1. In a sterilizer for surgical instruments and other articles, a casing, a drawer removably inserted in the casing to hold articles to be sterilized, adapted to admit steam to its interior and permitting communication with the atmosphere, the drawer within the casing being spaced therefrom to provide a steam space, and means inside the casing and outside of the drawer to heat the latter, whereby articles in the drawer are subjected to steam from said steam space at a high temperature and at atmospheric pressure.

2. In a sterilizer for surgical instruments and other articles, a casing, a drawer removably inserted in the casing to hold articles to be sterilized, adapted to admit steam to its interior and permitting communication with the atmosphere, the drawer within the casing being spaced therefrom to provide a steam space, means in said steam space for heating the interior of the casing and drawer, and means for delivering water to the steam space for the production of steam; whereby articles in the drawer are subjected to steam at a high temperature and at atmospheric pressure.

3. In a sterilizer for surgical instruments and other articles, a casing having an open end, a hollow heating element arranged in the casing, a drawer for articles to be sterilized removably inserted into the heating element through the open end of the casing, adapted to admit steam to its interior and permitting communication with the atmosphere, and means for delivering water to the interior of the casing for the production of steam; whereby articles in the drawer are subjected to steam at a high temperature and at atmospheric pressure.

4. In a sterilizer for surgical instruments and other articles, a casing; a drawer for articles to be sterilized removably inserted in the casing, adapted to admit steam to its interior and permitting communication with the atmosphere; stationary heating element comprising an electrical resistance encircling the drawer inside the casing to heat the interior of the casing and drawer; and means for delivering water into the casing for the production of steam; whereby articles in the drawer are subjected to steam at a high temperature and at atmospheric pressure.

5. In a sterilizer for surgical instruments and other articles, a casing having an open end; a heating element arranged in the casing and comprising an open ended tubular body carrying an electrical heating resistance; a drawer for articles to be sterilized removably inserted into the heating element through the open end of the casing, the drawer being adapted to admit steam to its interior and permitting communication with the atmosphere; and means for supplying water to the interior of the casing for production of steam.

6. In a sterilizer for surgical instruments and other articles, a casing, a drawer removably inserted in the casing to hold articles to

be sterilized, adapted to admit steam to its interior and permitting communication with the atmosphere, a heating element inside the casing, and means carried by the casing for delivering water into its interior for the production of steam.

7. In a sterilizer for surgical instruments and other articles, a horizontally arranged casing of substantially cylindrical form having an open end, a drawer for articles to be sterilized removably inserted into the casing through the open end thereof, the drawer being adapted to admit steam to its interior and permitting communication with the atmosphere, heating means inside of the casing, a water reservoir mounted on the casing, and means for delivering water from the reservoir into the casing for the production of steam.

8. In a sterilizer for surgical instruments and other articles, a casing, a drawer for articles to be sterilized, and a heating element inside of the casing; a water reservoir mounted on the casing and having an open-topped delivery tube extending upwardly in the reservoir and discharging into the casing; and a cup movable downwardly in the reservoir to receive water therefrom and upwardly to discharge the water into the delivery tube.

9. In a sterilizer for surgical instruments and other articles, a casing; a drawer for articles to be sterilized, and a heating element, inside the casing; a water reservoir mounted on the casing and having a vertical delivery tube open at the top and closed at the bottom to the reservoir but discharging into the interior of the casing; a cup mounted on the tube and movable downwardly therein to receive water from the reservoir; and a spring for raising the cup to discharge the water into the delivery tube.

10. In a sterilizer for surgical instruments and other articles, a heating element comprising a chamber having openings for admission of steam and having an open end, and an electrical resistance carried by the chamber to heat the same.

11. In a sterilizer for surgical instruments and other articles, a heating element comprising a cylindrical chamber having openings for the admission of steam and having an open end for the introduction of articles to be sterilized, and an electrical heating device comprising a resistance wire surrounding the chamber.

12. In a sterilizer for surgical instruments and other articles, a casing, a removable drawer therein for the articles to be sterilized, adapted to admit steam to its interior, and means for heating the drawer.

13. In a sterilizer for surgical instruments and other articles, an unsealed casing adapted to have a substantially atmospheric internal pressure, a removable drawer in the casing for the articles to be sterilized, adapted to admit steam to its interior for contact with the articles, and means for heating the drawer.

14. In a sterilizer for surgical instruments and other articles, a steam chamber in communication with the atmosphere to maintain substantially atmospheric pressure therein, a drawer of foraminous material arranged in the casing, and means for heating the drawer.

In testimony whereof I hereunto affix my signature.

JAMES B. PENTZ.