

(No Model.)

C. HERSCHER.
STERILIZED AND DRINKABLE WATER.

No. 501,784.

Patented July 18, 1893.

Fig. 1.

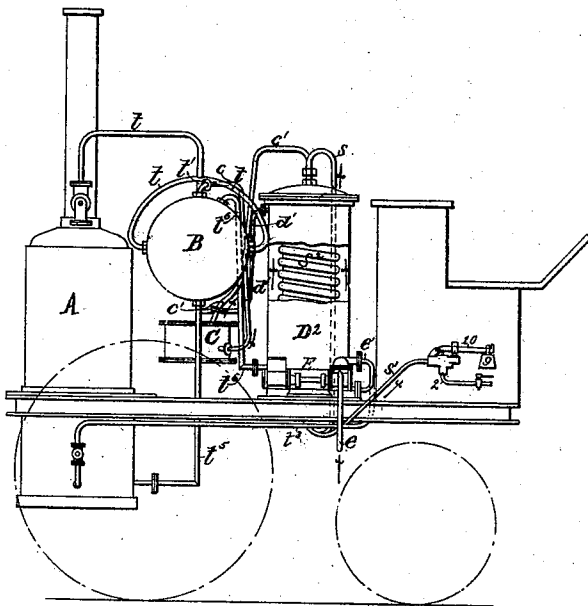


Fig. 2.

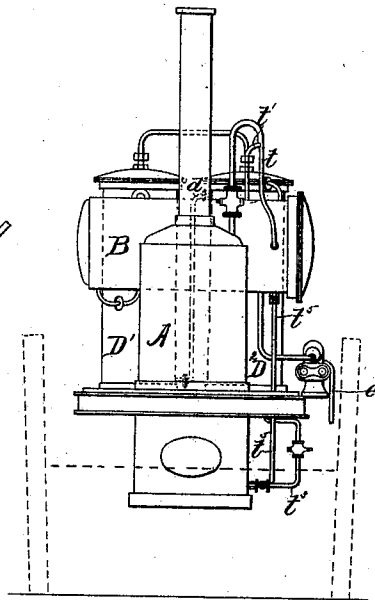


FIG. 6.

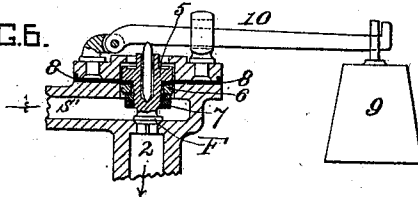


Fig. 4.

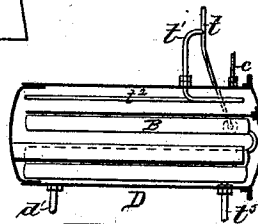


FIG. 3.

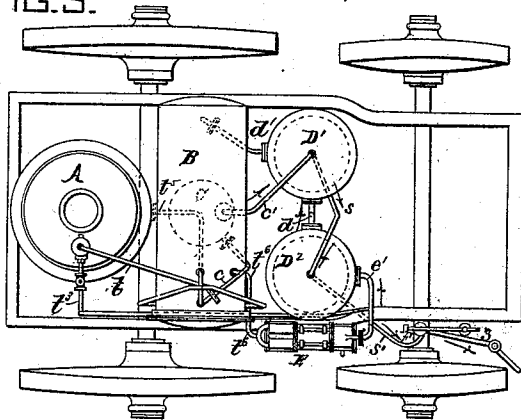
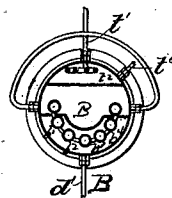


Fig. 5.



WITNESSES:

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UNITED STATES PATENT OFFICE.

CHARLES HERSCHER, OF PARIS, FRANCE.

STERILIZED AND DRINKABLE WATER.

SPECIFICATION forming part of Letters Patent No. 501,784, dated July 18, 1893.

Application filed March 24, 1891. Serial No. 386,278. (No model.) Patented in France December 17, 1890, No. 210,273; in Belgium February 3, 1891, No. 93,645; in England February 4, 1891, No. 2,051; in Italy February 11, 1891, No. 29,066; in Germany February 18, 1891, No. 62,114; in Spain April 27, 1891, No. 11,736, and in Austria-Hungary August 13, 1891, No. 6,978 and No. 28,319.

To all whom it may concern:

Be it known that I, CHARLES HERSCHER, engineer, of Paris, in the Republic of France, have invented an Apparatus for Obtaining
5 Sterilized and Drinkable Water, (for which Letters Patent have been granted in France, No. 210,273, dated December 17, 1890; in Belgium, No. 93,645, dated February 3, 1891; in Germany, No. 62,114, dated February 18,
10 1891; in Spain, No. 11,736, dated April 27, 1891; in Italy, No. 29,066, dated February 11, 1891; in Austria-Hungary, No. 6,978 and No. 28,319, dated August 13, 1891, and in England, No. 2,051, dated February 4, 1891,) of
15 which the following is a specification.

The problem of obtaining an effectual sterilization by means of heat, of water destined for human consumption is one of those whose solution is most imperatively demanded by
20 the progress of modern hygiene. One of the most simple processes consists in boiling the water, under atmospheric pressure that is to say at a temperature of 100° centigrade. This method is very useful and is sufficiently effect-
25 ual in many instances. But when absolutely perfect sterilization is required and the water has to be completely deprived of living organisms it is necessary, as recent bacteriological researches have proved, to raise the
30 temperature of the water to a degree considerably higher than 100° and to maintain this temperature for a certain period. On the other hand it is a long established fact that in order to enable water to retain those prop-
35 erties that render it drinkable it is advisable to maintain it under pressure during the heating and cooling process. This pressure prevents or partly prevents the gas held in solution in the water from escaping from the
40 liquid under the influence of the heat and it also prevents certain salts from being precipitated. Moreover during the cooling the pressure facilitates the re-dissolving of the portion of the gases which has been liberated
45 during the heating.

The apparatus forming the object of the present application for a patent has for its object to produce cheaply and abundantly water sterilized and yet drinkable or retaining
50 its freshness by the two means combined as

hereinbefore set forth. This apparatus is also constructed so as to present every guarantee for the efficacy of these two means. This guarantee is obtained by the apparatus ceasing to act whenever anything interferes
55 either with the sterilization or with the palatability of the water supplied by the apparatus.

In order that the apparatus which has to produce the results hereinbefore set forth may
60 be really practical, it is essential that the operations which it has to perform should be regulated and at the same time controlled in an automatic manner in order to be certain that the water which is supplied shall always
65 comply with this double condition of being sterilized and palatable or drinkable. With this object it is so arranged as to comply with the following conditions namely:

First. With regard to the sterilization the
70 water is heated in the apparatus to a suitable temperature of from 120° to 130° centigrade for example and is maintained at this temperature during the necessary time or from ten to
75 fifteen minutes. If from any cause the necessary degree of heat is not attained the apparatus immediately ceases to act. In like manner this degree of heat cannot be greatly
80 exceeded (so as to needlessly diminish the drinkable nature of the water) owing to the arrangement of the heating apparatus.

Second. With regard to the palatability or drinkability the sterilized water is regularly cooled before it leaves the apparatus. It is maintained at a certain pressure during the
85 whole of the time that it circulates in the apparatus and this pressure (which is solely for the purpose of preserving the palatability) does not require to be in proportion to the temperature necessary for the sterilization.
90 It may be affirmed on the contrary that the more the temperature is raised the more the water will be certain to retain its original drinkable quality. This pressure must not be allowed to fall below a certain predeter-
95 mined limit in order to avoid impairing the palatability; it cannot rise above a certain higher limit lest the parts of the apparatus suffer injury.

The following description with reference to 100

the accompanying drawings will explain how these conditions are obtained in an apparatus so constructed that the management of it may be intrusted to an unskilled person, without danger.

Figure 1 of the drawings represents the apparatus in elevation arranged upon wheels. Fig. 2 represents the apparatus in end elevation. Fig. 3 is a corresponding plan. Figs. 4 and 5 represent the sterilizing vessel in longitudinal and transverse section respectively. Fig. 6 is a detail view.

The boiler A (capable of resisting a working pressure of three kilograms for example) supplies steam for heating the water to be sterilized. This steam passing through the tube *t* circulates in the tubes *b'*, *b*², *b*³, *b*⁴ of the sterilizing vessel B and the water condensed in these tubes returns to the lower part of the boiler, through tube *t*⁵. On the same steam pipe *t* is a branch pipe *t'* leading to a worm *t*² in the upper part of the sterilizing vessel and passing out through tube *t*⁶ supplies steam for working the feed pump E. This steam for supplying the worm *t*² and the pump might be taken direct from the boiler. This pump draws impure water from a cistern or a pond, a well or other source through pipe *e* and forces it through pipe *e'* into a vessel D² (an exchanger of temperature) where it circulates from the bottom to the top about the coil or worm S² becoming heated in its passage. From the top of this vessel the water passes through pipe *d* to the lower part of a vessel D' similar to D² and becomes again heated in ascending around the worm in the vessel D'. From the vessel D' it passes by the pipe *d'* to the lower part of the sterilizer B in which it circulates for a sufficient time before issuing at the upper part. Here it is highly heated by the steam worms or coils of pipe. The water afterward passes through pipe *c* to the lower part of a clarifier C of any suitable composition, up through the clarifier out through pipe *c'* to the upper end of the worm in the vessel D'. Escaping at the lower part through pipes it enters at the upper part of the worm S² in the vessel D² leaving at the lower part and passing to the valve cock F, through pipe *s'*. This cock is so arranged that a predetermined pressure of the water (six kilograms for example) is requisite to move a piston or diaphragm. The movement of this piston or this diaphragm opens or uncovers an orifice of a certain area regulated in the construction of the valve and which allows the water to escape at a rate governed by the amount of pressure and the area of this orifice. A sectional view of this cock F is shown in Fig. 6. The valve-stem 5 is secured to a diaphragm 8 of rubber or other elastic material, by means of the ring 6 and screw nut 7. The lever 10 tends to hold the valve to its seat, and is provided with a weight 9 adapted to regulate the pressure. In normal working the pressure of the water entering by pipe *s'* overcomes the action of the weight 9, and raising the valve passes out

through the pipe 2. The pressure thus regulated by the valve cock is greater than that in the boiler so that the water under treatment can never be evaporated in the interior of the apparatus.

The steam motor of the pump and the water piston bear a certain proportion to one another. For example, supposing the boiler to be marked to bear a pressure of three kilograms; the valve cock to be adjusted for six kilograms and that the steam piston is made of a diameter of 0.^m 070 and the water or pumping piston a diameter of 0.^m 045 there will be obtained approximately for the aforesaid pressure of three and six kilograms forces equal to one hundred and sixteen kilograms and ninety-five kilograms or a motive power of twenty-one kilograms. With a pressure in the boiler of twenty-five kilos the force exerted on the two pistons becomes equal and the pump cannot work and as the boiler, owing to its valves cannot afford a pressure of steam above three kilos the maximum pressure that the pump can give is 7.2 kilos. The condensed steam returns as hereinbefore explained to the boiler A and in addition, in order to compensate for any waste that may occur a pipe *t*³ is provided being a branch on the delivery pipe of the pump and which conducts a certain quantity of water to the boiler. It will now be understood how all the conditions above specified are complied with. The water is heated in the first place in the temperature exchangers, D', D². Its heating is completed in the sterilizing vessel divided into three compartments as represented in Figs. 4 and 5. The first compartment is of small capacity and large heating surface in order that the water may be quickly heated to its maximum temperature. The second and third compartments are of relatively large capacity and contain in the one case two heating tubes and in the other case the coil or worm *t*² traversed by the steam which works the pump. This worm acts as a regulator; when the water which surrounds it is not of an elevated temperature the steam for working the pump is condensed therein and the latter ceases to work so that the delivery from the apparatus is stopped. By these means there is a certainty that the apparatus will only supply water which has actually been heated to the required temperature. The duration of the heating is regulated by the volume or capacity of the sterilizing vessel. It may here be observed that this duration depends in fact on the delivery and the latter is regulated as stated by the valve cock. When the flow ceases the duration of the period during which the water remains in the apparatus is prolonged but this does no harm and merely favors the sterilization. The heating tubes are sure to be always supplied with steam at a high temperature as the pump cannot work except on condition that the valve supplying steam to these tubes is open and that the pressure in the boiler is not below a given pressure (2.5 kilos for example). Finally

the water cannot be heated to excess because the heat is supplied to it by steam from a boiler and the temperature of such steam is necessarily limited. The valve cock insures that the pressure necessary to retain the palatability of the water is always present.

The apparatus hereinbefore described is susceptible of modifications in its form and construction. For example it may be a fixture or be mounted on wheels. The boiler may be of any construction and be heated either by coal or by gas. It may even be dispensed with altogether when the steam can be obtained from another source. The pressure of the steam that it supplies and the pressure for which the valve cock is regulated may be regulated according to circumstances. In like manner the number of temperature exchangers may be varied and they may be of any suitable dimensions. In certain cases a hand pump may be employed in place of the steam pump. Lastly although the air normally contained in the drinking water remains therein during the transit of this water or at any rate is redissolved therein under the combined action of pressure and refrigeration the water may be further aerated if desired by introducing a certain quantity of air from the pump.

I claim as my invention—

1. In an apparatus for sterilizing liquids, the combination of a feed-pump and a sterilizing vessel, with means for controlling the action of the feed-pump by the temperature of the liquid in the sterilizer whereby a certain sterilization of the liquid is assured.

2. In an apparatus for sterilizing liquids, the combination of a temperature exchanger, and a sterilizing vessel, with a feed pump to force the liquid through the apparatus, and means to control the action of the feed pump by the temperature of the liquid in the said sterilizing vessel, substantially as set forth.

3. In an apparatus for sterilizing liquids, the combination of a feed pump, with a ves-

sel B provided with means for heating the liquid, a steam coil ² in the said vessel, one end connected with the steam supply and the other end leading to the said pump, substantially as and for the purpose set forth.

4. In an apparatus for sterilizing liquids, the combination of a feed pump, with a vessel B for sterilizing the liquid provided with steam pipes in the lower part thereof to heat the liquid, and a steam coil in the upper part thereof in contact with the liquid, a steam supply pipe leading to the said steam pipes and having a branch pipe leading to the said coil, and a pipe connecting the other end of the coil with the feed pump, all substantially as and for the purpose set forth.

5. In an apparatus for sterilizing liquids, the combination of a feed pump and a sterilizing vessel provided with an outlet pipe, with a pressure valve in the said outlet, all substantially as and for the purposes set forth.

6. In an apparatus for sterilizing liquids the combination of a feed-pump, a sterilizing apparatus provided with an outlet pipe, and means for controlling the action of the feed pump by the temperature of the liquid in the sterilizing apparatus, with a pressure valve in the said outlet pipe from the sterilizing vessel to control the duration of heating therein, all substantially as set forth.

7. In an apparatus for sterilizing liquids, the combination of a feed-pump, a sterilizing vessel and an outlet pipe therefrom with a boiler to supply steam to the sterilizing vessel, and a pressure valve in the said outlet, having a greater pressure than that in the boiler, all 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.

CHARLES HERSCHER.

Witnesses:

JOSEPH DELAGE,
ROBT. M. HOOPER.