P. M. C. MAUVERNAY.

METHOD OF HEATING LIQUIDS.

APPLICATION FILED MAR. 25, 1908.

911,829. Patented Feb. 9, 1909.

Fig. 1

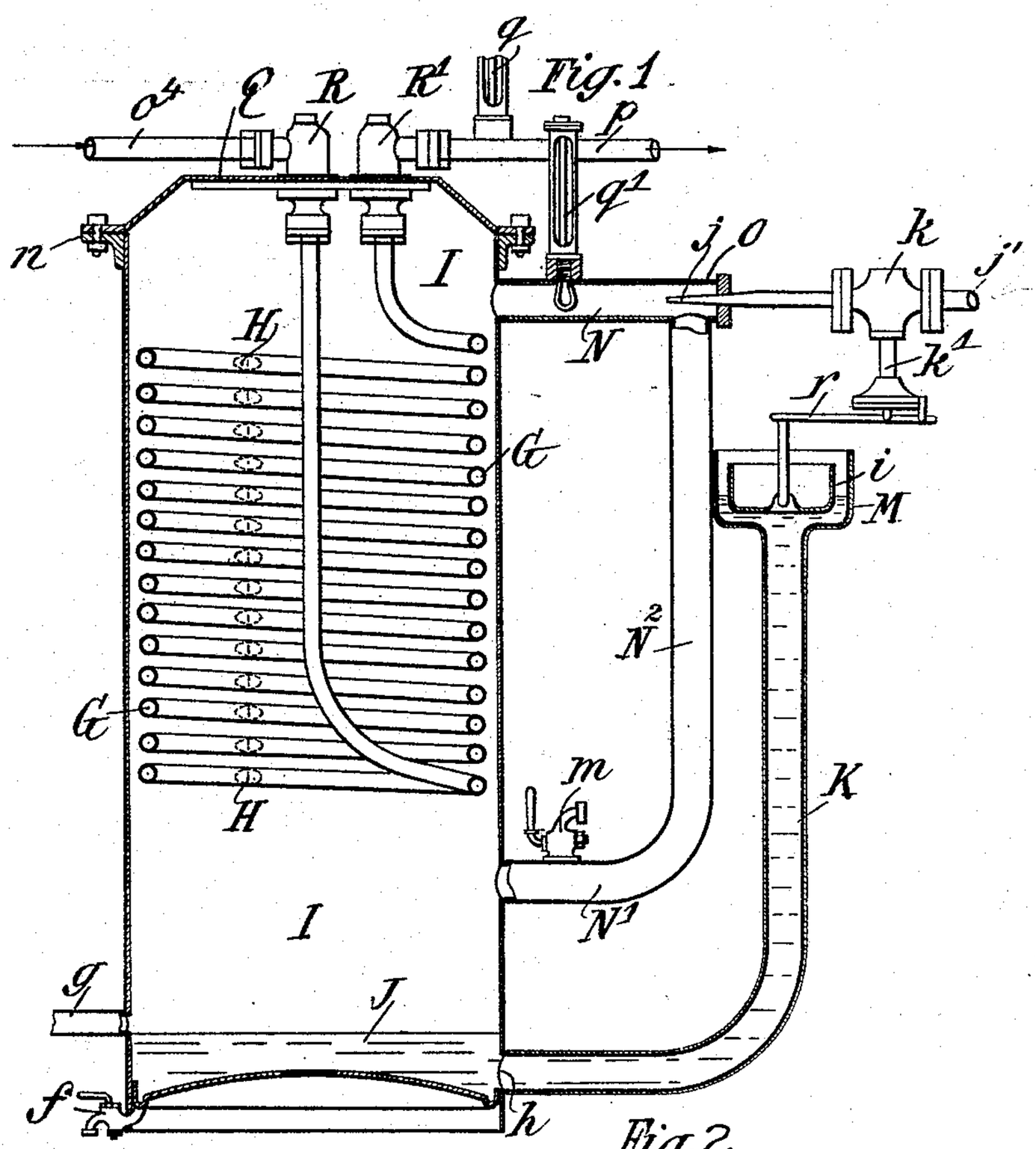


Fig. 2.

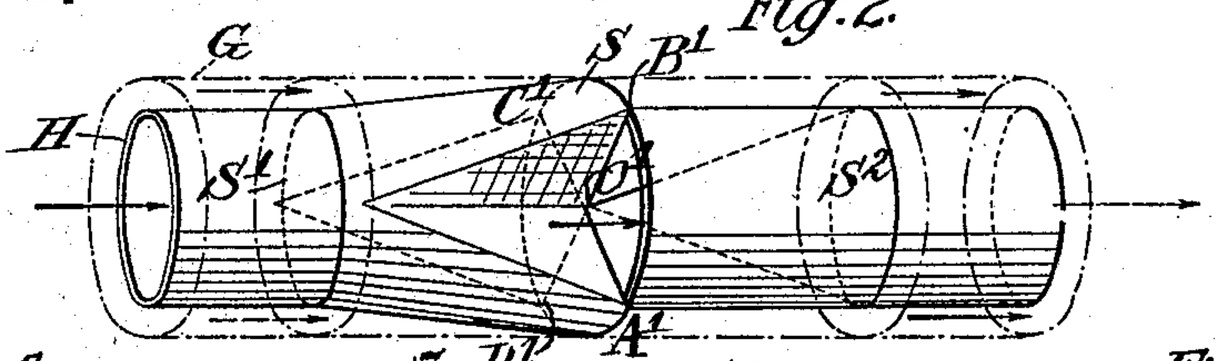


Fig. 4.

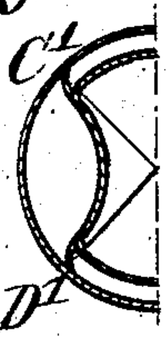


Fig. 3.

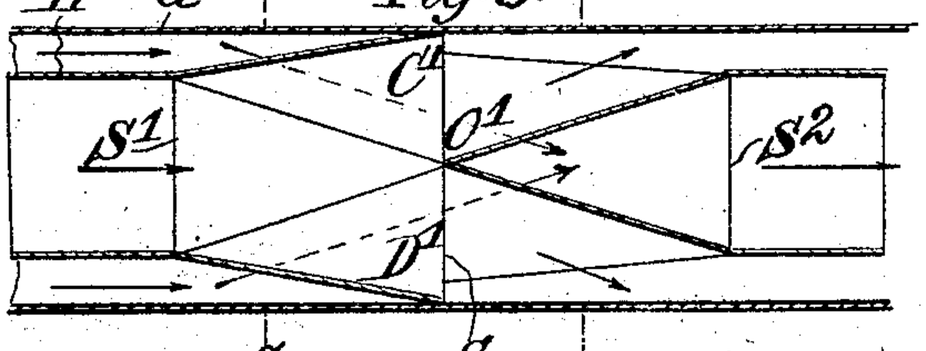
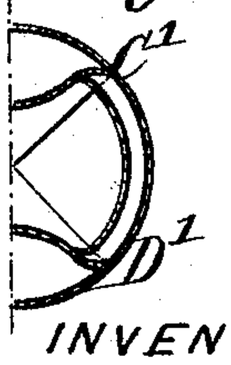


Fig. 5.



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METHOD OF HEATING LIQUIDS.

No. 911,829. Specification of Letters Patent. Patented Feb. 9, 1909.

Application filed March 25, 1908. Serial No. 423,250.

To all whom it may concern:

Be it known that I, PIERRE MARIE CLAIR MAUVERNAY, a citizen of the Republic of France, residing in Lyon, (Rhone,) France, have invented certain new and useful Improvements in the Heating of Liquids, of which the following is a specification.

The present invention relates to an improved method for heating or heating and cooling under pressure a continuous flow of liquid.

The invention has been specially devised for effecting the sterilization of liquids, but it is generally applicable for heating or heating and cooling liquids as aforesaid.

According to the invention the liquid is sent under pressure through a coil containing inverting devices adapted to direct the central flow of liquid to the walls of the coil and the peripheral flow towards the center, and the liquid is heated in this coil.

Such being the distinguishing features of the invention, I will proceed to describe, with the aid of the accompanying drawings, a transportable apparatus for carrying out the process of sterilizing liquids.

Figure 1 is a section of the apparatus. Fig. 2 is a perspective view of one of the "inverters" hereinafter described, disposed in the coil. Fig. 3 is a longitudinal section of one of the inverters. Fig. 4 is a half cross-section thereof on line 7—7 of Fig. 3. Fig. 5 is a half cross-section thereof on line 8—8 of Fig. 3.

The apparatus consists of an externally heated coil G through which the liquid to be heated flows under pressure. The temperature can be regulated at will as about to be explained. The pressure may be secured and controlled by any usual or suitable means.

In order that the heating in the coil shall be satisfactory and extend to every part of the liquid, care must be taken that the liquid at the center of the pipe, and which flows the fastest, does not leave the apparatus without being raised to the sterilizing temperature. This result is attained by inverting devices which are designated as a whole by the letter H, disposed in the coil and serving to direct the central flow to the periphery, and conversely to direct the annular peripheral flow to the center. The inverter H is within the pipe G, indicated in dotted lines in Fig. 2, and the complete inversion is effected between the planes of cross-section indicated at S′ and S², the central plane of cross-section being indicated at S. The circular cross-section S is divided into four sectors by equidistant radii from the center O′, the extremities of which radii are indicated at A′, B′, C′ and D′. The segment A′, D′, O′ of the circle, and the diametrically opposite segment C′, D′, O′, communicate at the left with the space outside of the inverter H, and at the right with the space inside of said inverter, thus effecting the inversion of the liquid from the outside to the center of the pipe as the liquid travels from the left to the right. The segments B′, C′, O′, and A′, D′, O′, on the other hand open communication between the center of the inverter H at the left and the outside of the inverter at the right, so that as the liquid travels from left to right the central part of the stream is transferred to the outer part of the pipe. It will be seen that this inverter centralizes the peripheral flow and directs the central flow to the periphery. The effect of the cylindrical portions at the ends is to render the currents again parallel. By fitting a certain number of these devices in the coil I am enabled to insure that the central and peripheral flow shall be equally heated and that the liquid shall not leave the apparatus before it has been heated throughout to the desired temperature.

The heating of the coil G may be effected at an automatically constant temperature to any desired degree by the following method, which I call mixed-steam or vapor heating, and which consists in employing as the heating fluid a mixture of gas and saturating steam or vapor in proportions depending upon the particular case.

The coil G is inclosed in a strong cylindrical iron casing I closed at the bottom by a plate J fitted with a purge cock *f*. The cylinder I is provided with four pipe connections. The first *g* carries off the condensation water to an automatic discharge; the lowermost connection *h* communicates by a rising pipe K with a small reservoir M containing a float *i*, and lastly there are the two large connections N and N¹ connected together by a bent pipe N². The pipe N is fitted with a connection O having a nozzle *j* through which steam is discharged as a jet. The nozzle *j* is connected to the valve *k* which regulates the admission of the steam from the boiler or generator. A blow-off cock *m* is fitted on the pipe N¹.

The top of the casing I is closed by a cover Q seated upon an angle iron ring *n* fitted on the lip of the casing I; the cover is clamped on and carries the coil. It is formed with two holes into which are screwed the elbow connections R R¹. The former is connected to the pipe *o*⁴ which brings the liquid from the pump, and R¹ is connected to the pipe *p* which conveys the heated liquid to a vessel or reservoir. The ends of the coil G are connected to the elbows R R¹ inside the cover, and one or more thermometers are provided for observing the temperature of the liquid flowing through the coil.

The heating is effected as follows: In the steam pipe *j*¹ leading from the boiler to the nozzle *j* is fitted a suitable valve *k* adapted to partially or entirely open or shut off the pipe. This may be a plug valve, flap valve, or other suitable valve. The spindle or plug *k*¹ for opening this valve is connected by a lever *r* to the float *i*, so that when the float is in its highest position the valve is closed, and when it falls to the bottom of the vessel M the valve is fully open. By means of this arrangement the pressure in the casing I is kept constant and equal to the atmospheric pressure plus the height of the water column between the level in the float reservoir M and the connection *g*.

Assuming that a constant pressure has been attained, the operation will be as follows: The float *i* being in its lowest position and the bottom of the casing I filled with water, steam is turned on. The steam entering by the nozzle *j* raises the pressure in the casing until the water forced into the pipe fills the reservoir, lifts the float *i*, and closes the steam admission valve *k*. The casing I is now filled with a mixture of air or gas and steam or vapor, the temperature of which corresponds with the proportion of saturating steam or vapor contained in the mixture (Dalton's law of mixture of gases and vapors). If cold liquid be now passed into the coil G a portion of the steam condenses, and in so doing heats the liquid, the pressure falls, and a further quantity of steam is admitted, bringing the mixture again to the original temperature. The operation then proceeds regularly; the steam or vapor admitted expands in the air or gas in the casing and mixes therewith in the pipe N², maintaining this mixture at a constant temperature by heating by its condensation the liquid in the coil G to substantially the same temperature. To raise this temperature it is only necessary to open the blow-off cock *m*, by which means the volume of mixture escaping from *m* is replaced by the same volume of unmixed steam or vapor; the proportion of steam or vapor in the mixture is thus increased and its temperature raised. The temperature is indicated by the thermometer *q*¹. If the blow-off cock *m* be closed, the temperature keeps constant, since the proportion of air contained in the mixture and the pressure of the mixture are kept constant by the controlling device. The maximum temperature attainable is that corresponding to the pressure (atmospheric pressure plus the column of water) of the saturating steam or vapor, when the heating is being effected by unmixed steam or vapor. To reduce the temperature it is only necessary to inject air or a gas into the casing I. The proportion of saturating steam or vapor is thus reduced and the temperature falls. The minimum temperature is that of the liquid circulating in the coil G. This heating is thus effected by a saturating vapor expanded in an inert gas. It may be styled "mixed vapor heating".

What I claim is:—

1. The method of heating liquid, which consists in passing the liquid under pressure through a coil, heating it in said coil at a constant temperature, and successively inverting the central and the outer parts of the liquid as it passes through said coil.

2. The method of heating liquid, which consists in passing the liquid under pressure through a coil, heating it in said coil at a constant temperature, successively inverting the central and the outer parts of the liquid as it passes through said coil, and retaining the heated liquid under pressure at the desired temperature in a reservoir without interruption of the flow.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

PIERRE MARIE CLAIR MAUVERNAY.

Witnesses:

PACAUD THÉODORE LÉON GILBERT,

MARIN VACHONY.