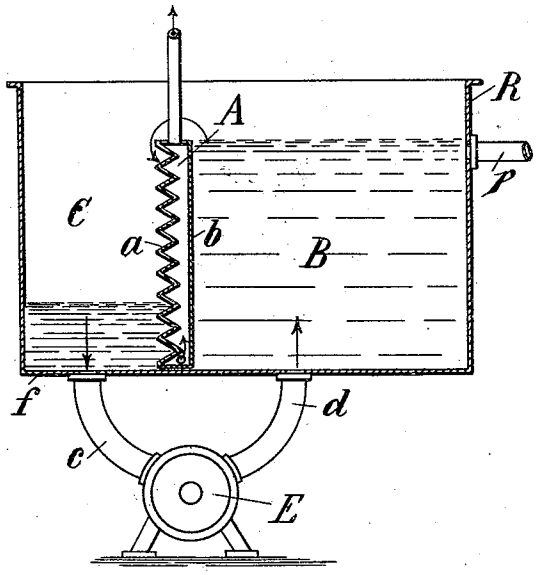
(No Model.) 3 Sheets—Sheet 1.

P. BENDER.

APPARATUS FOR COOLING LIQUIDS.

No. 479,778. Patented Aug. 2, 1892.

Fig. 1.



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(No Model.) 3 Sheets—Sheet 2.

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Fig. 2.

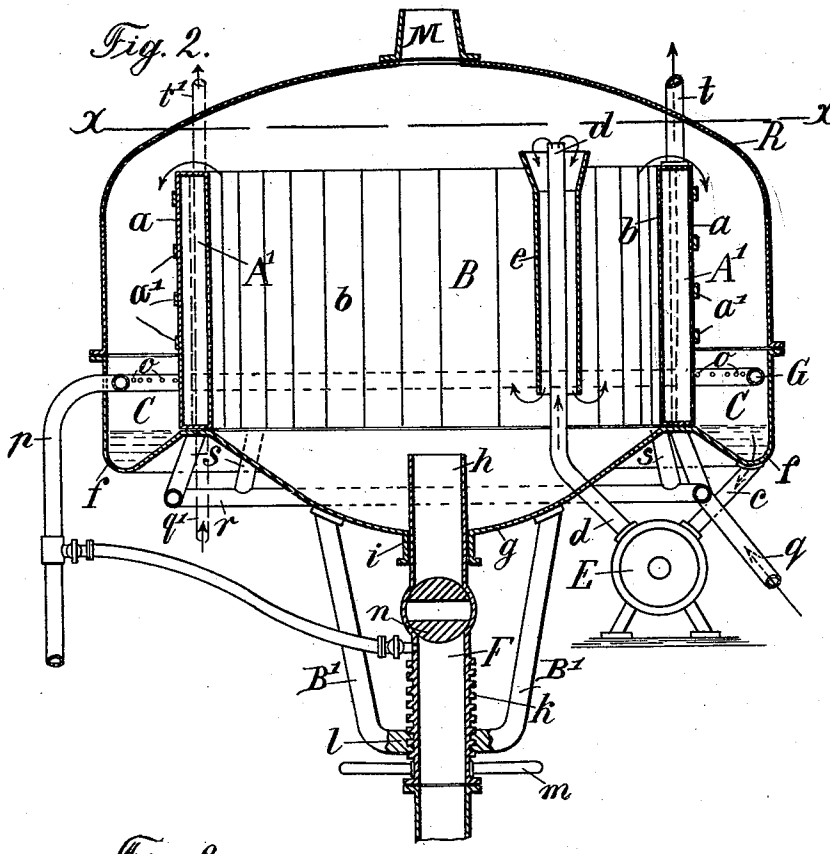
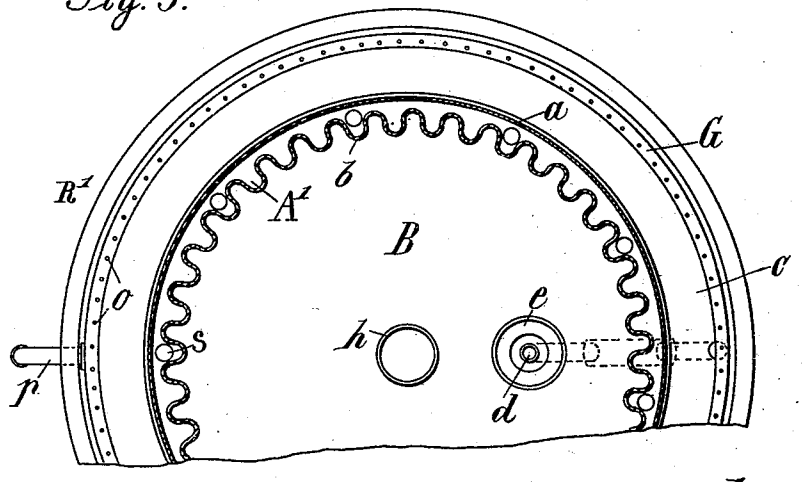


Fig. 3.



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(No Model.) 3 Sheets—Sheet 3.

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APPARATUS FOR COOLING LIQUIDS.

No. 479,778. Patented Aug. 2, 1892.

Fig. 4.

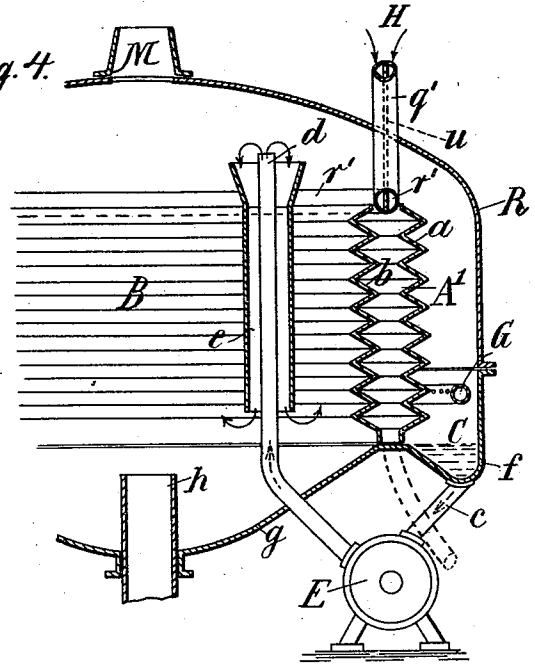
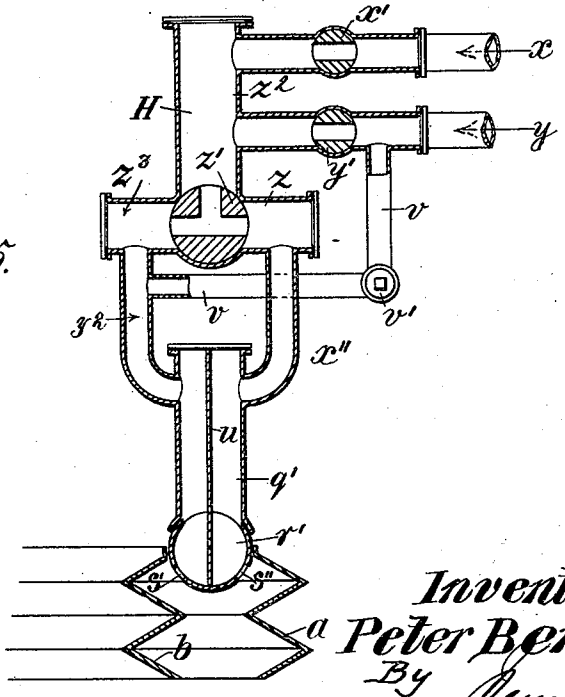


Fig. 5.



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UNITED STATES PATENT OFFICE.

PETER BENDER, OF MANNHEIM, GERMANY.

APPARATUS FOR COOLING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 479,778, dated August 2, 1892.

Application filed February 23, 1892. Serial No. 422,486. (No model.) Patented in Belgium December 29, 1891, No. 97,754; in France December 29, 1891, No. 218,351, and in Switzerland December 29, 1891, No. 4,469.

To all whom it may concern:

Be it known that I, PETER BENDER, a subject of the German Emperor, residing at Mannheim, Germany, have invented certain new and useful Improvements in Apparatus for Cooling Liquids, (for which Letters Patent have been granted in Belgium No. 97,754, dated December 29, 1891; in France No. 218,351, dated December 29, 1891, and in Switzerland No. 4,469, dated December 29, 1891;) 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 marked thereon, which form a part of this specification.

This invention relates to apparatus for cooling liquids, and has for its object certain improvements whereby liquids may be rapidly and economically cooled, the invention consisting in structural features and in combinations of parts, as will now be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional elevation of a cooling apparatus embodying my invention. Fig. 2 is a like view of a modified form of the same, Fig. 3 being a transverse section of a portion thereof, taken on or about on line x x of Fig. 2. Fig. 4 is also a sectional elevation of a portion of the apparatus, illustrating a further modification in the construction; and Fig. 5 is a detail sectional view of the feeding devices for the cooling agent or agents.

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

The primary object of the invention is to so construct the cooling apparatus as to provide as large a cooling-surface as is possible relatively to the capacity of the apparatus, and this I accomplish by dividing the apparatus into three compartments or chambers—namely, a receiving-chamber, an exhaust-chamber, and a cooling-chamber interposed between the receiving and exhaust chambers and over which cooling-chamber the liquid is caused to circulate. This arrangement is shown in its simplest form in Fig. 1, in which—

R indicates a cooling vessel or tank divided into a receiving and exhaust chamber B and C, respectively, by a hollow partition A of less height than the vessel R, said hollow partition constituting the cooling-chamber and extending transversely across said vessel R, the cooling agent—as, for instance, cold water or other desired or preferred cooling agent—being supplied to the chamber A and exhausted therefrom through suitable pipes or conduits, which I have deemed unnecessary to show. The liquid to be cooled is fed to the receiving-chamber through pipe p and comes in contact with the inner wall b of the cooling-chamber A, the height of which, as stated, is less than that of the vessel R, so that said liquid will flow over the cooling-chamber and down along the opposite wall a thereof into the exhaust-chamber C, from which it may be drawn off by any suitable exhaust-pipe.

In order to increase the cooling-surfaces of the chamber, the vertical wall a thereof may have a zigzag or undulating form in section, as shown, and, if desired, both walls may be so constructed. The vessel R may be open at the top, so as to allow free access of air to the liquid to assist and promote the cooling. This, however, is not desirable in the cooling of certain liquids—as beer, for instance—in which case the vessel may be closed and sterilized air or a gas admitted to the beer in the receiving-chamber, as will hereinafter appear.

In the cooling of beer it may become necessary to bring the same repeatedly in contact with the cooling-surfaces b a of chamber A, and this may be effected by means of a pump E, having its suction and discharge respectively connected with the exhaust-chamber C and receiving-chamber B, the supply of beer to the latter chamber being cut off as soon as the quantity of beer in vessel R is sufficient to establish a circulation through the pump from one chamber to the other along and over the cooling-chamber A.

In Fig. 2 I have illustrated a cooling apparatus more especially designed for the cooling of beer, the vessel R′ being closed, a suitable manhole M being provided that is normally closed by a cap or cover. (Not shown.) The cooling-chamber A in this apparatus has an inner undulating or vertically-corrugated wall b, both the vessel and cooling-chamber being cylindrical, while the outer wall a of said chamber A has offsets a', and said chamber

A divides the vessel into receiving and exhaust chambers B and C, respectively. The bottom g of the vessel below the receiving-chamber is concave or dome-shaped and forms a receptacle for the settlement of sedimentary matter that may be contained in the beer and has an exhaust-pipe h, that is adjustable relatively to the bottom at its point of greatest depth. As shown, the pipe extends fluid-tight through a stuffing-box i and is provided with a screw-thread k, that works in a threaded bearing l, formed in a bracket B′, secured to bottom g, said pipe carrying a hand-wheel m or equivalent device, by means of which it is revolved for the purpose of adjustment. The pipe h has a valve n, which is closed when the apparatus is at work, the pipe being so adjusted as to project some distance above the bottom g of the vessel R, so as to prevent any sediment entering the same. After the contents of the vessel have been exhausted, except such beer as may be contained in the receptacle formed by the bottom g, and it is desired to draw off accumulated sediment the stop-cock n is opened and the pipe h is gradually lowered, the clear liquid being first drawn off from the sediment into a receiver, which is removed as soon as the beer flowing from pipe h carries sedimentary matter with it, which latter and what little beer remains is then exhausted into a separate receiver. The bottom f below the exhaust-chamber C is substantially V-shaped to form a pocket, which admits of the withdrawal of the contents of said chamber by means of a pump without too much agitation. The chamber C is connected with the suction of the pump E, the discharge of which is connected with the receiving-chamber B, and preferably by means of a pipe d, that is carried up slightly above the upper edge of the cooling-chamber A and is contained in a distributing-pipe e, into which it discharges, said pipe e being open at both ends and terminating at its upper or receiving end in a funnel. By means of this arrangement the beer may be pumped from the exhaust-chamber back into the receiving-chamber without agitating the same too much. The cooling agent is supplied to the cooling-chamber A through branches s s, connected with the distributing-pipe r and the supply-pipe q, whereby the cooling agent is fed to the cooling-chamber at different points and the walls thereof are kept at a uniform temperature, said cooling agent being exhausted through pipe t. The beer to be cooled may be brought into intimate contact with a fluid medium—such as a gas or air—which latter under certain conditions of use is previously sterilized. The gas or air is supplied through pipe G, provided with perforations o, and through the feed-pipe p, connected with pipe G and with the source of gas or air supply.

In the cooling of certain liquids it is desirable that they be subjected to varying cooling temperatures, which may be readily effected by dividing the cooling-chamber A vertically into two chambers, as shown in dotted lines in Fig. 2, and supplying to said chambers cooling agents of different temperatures, in which case the supply-pipe q and exhaust-pipe t may be used in conjunction with one of the chambers, supply and exhaust pipes q' t', respectively, being provided for the other chamber. In this manner the outer wall of the cooling-chamber A may be kept at a lower temperature than the inner wall, or vice versa. This may also be accomplished without dividing the cooling-chamber by the construction shown in Figs. 4 and 5, the cooling-chamber A being constructed in the form of a bellows, both the inner and outer walls b and a having a zigzag shape. The distributing-pipe r', as well as the feed or supply pipe q', is divided by a partition u into two supply-ducts, the cooling agents of different temperature being projected against the walls b and a through ports s' and s'' in said distributing-pipe r', which encompasses the upper end of the cooling-chamber A. The two ducts in pipe u are connected by branch pipes y'' x'' with the opposite ends of the horizontal branch z of a T-shaped coupling-pipe H, whose vertical branch z^2 is connected with the two feed-pipes x and y, respectively, each provided with a stop-cock or valve, (indicated by x' and y',) the T-coupling being provided with a three-way valve z'. The feed-pipe y is further connected with the branch y'' of pipe q' by a pipe v, provided with a valve v'. If the valve v' is closed and the three-way valve z' in the position shown in Fig. 5, the valves x' and y' being open, a cooling agent of a given temperature may be supplied to the cooling-chamber A. By closing the valve y', opening the valve v', and turning the three-way valve z' to the right, so as to cut off the communication between branches z^2 z^3 of coupling H and the branch y'' of pipe q', cooling agents of different temperatures may be supplied to the branches y'' x'' and the corresponding ducts of the pipes q' and r', as will be readily understood.

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

1. A cooling apparatus comprising a tank or vessel divided into feed and exhaust chambers by a hollow partition of less height than the vessel and means for supplying a cooling agent to and exhausting the same from the hollow partition, for the purposes set forth.

2. A cooling apparatus comprising a tank or vessel divided into feed and exhaust chambers by a hollow partition provided with an irregular cooling-surface, said hollow partition being of less height than the vessel, and means for supplying a cooling agent to and exhausting the same from the hollow partition, for the purposes set forth.

3. A cooling apparatus comprising a vessel divided into feed and exhaust chambers by a hollow partition of less height than the vessel, means for feeding the liquid to be cooled

to one of said chambers, and means for causing the liquid to continuously circulate from one chamber to the other, comprising a pump having its suction connected with the exhaust-chamber and its discharge with the feed-chamber of the vessel, and means for supplying a cooling agent to the hollow partition, as and for the purposes set forth.

4. A cooling apparatus comprising a vessel divided into feed and exhaust chambers by a hollow partition of less height than the vessel and a pipe connected with the last-named chamber for injecting air or a gas into the liquid contained therein, for the purpose set forth.

5. A cooling apparatus comprising a closed vessel divided into feed and exhaust chambers by a hollow partition of less height than the vessel, a pump having its suction connected with the exhaust-chamber and its discharge with the feed-chamber, a supply and an exhaust pipe connected at different levels with the hollow partition for supplying thereto and exhausting therefrom a cooling agent, and a perforated pipe within the exhaust-chamber, near the bottom thereof, for the introduction of air or a gas into the liquid, for the purpose set forth.

6. A cooling apparatus comprising a vessel divided into feed and exhaust chambers by a hollow partition of less height than the vessel and means for supplying cooling agents of different temperatures to the inner faces of the opposite walls of the hollow partition, comprising two supply-ducts arranged at the upper end of the hollow partition and having ports opening toward the opposite inner faces of the walls of said partition and suitable feed-pipes for feeding cooling agents of different temperatures to said ducts, for the purpose set forth.

7. A cooling apparatus comprising a vessel divided into feed and exhaust chambers by a hollow partition having zigzag-shaped vertical walls *b* and *a* and means for supplying cooling agents of different temperatures to the inner faces of said zigzag walls, comprising two ducts arranged at the upper end of the hollow partition, said ducts having ports *s'* and *s''* facing said opposite inner faces of the walls of the partition, and suitable feed-pipes connected with the ducts, as set forth.

8. In an apparatus of the class described, the combination, with the cooling-chamber A, having two supply-ducts at its upper end, of the T-coupling H, provided with the three-way valve *z'*, pipes *y'' x''*, connected with the supply-ducts of the chamber A and with the horizontal branch *z* of the T-coupling on opposite sides of the valve, the feed-pipes *x* and *y*, connected with the vertical branch of the T-coupling and provided with a suitable valve, and a valved branch connecting pipe *y* with branch *y''*, as and for the purpose set forth.

9. A cooling apparatus comprising a cylindrical vessel, a hollow cylindrical partition, of less height than the vessel, dividing the same into a cylindrical inner feed-chamber, a like outer exhaust-chamber, a concave bottom for said inner chamber, and an exhaust-pipe extending axially through and adjustable in said bottom, for the purpose set forth.

10. A cooling apparatus comprising a vessel, a hollow partition of less height than the vessel and dividing the same into feed and exhaust chambers, means for supplying a cooling agent to and exhausting the same from the partition, and means for causing the liquid to circulate from one chamber to the other, comprising a pump having its suction connected with the exhaust-chamber and its discharge with a pipe *d*, extending into the feed-chamber above the upper edge of the partition, and a receiving-pipe *e*, open at both ends and encompassing the pipe *d*, substantially as and for the purpose set forth.

11. A cooling apparatus comprising a cylindrical vessel, a like hollow partition of less height than the vessel and dividing the same into an outer cylindrical exhaust-chamber and a like inner feed-chamber, a substantially V-shaped bottom for the outer chamber below the hollow partition, a concave bottom for the inner chamber, also below the hollow partition, means for feeding a cooling agent to and exhausting the same from the hollow partition, a pump having its suction connected with the exhaust-chamber and its discharge with the feed-chamber, and an exhaust-pipe extending through the concave bottom and adjustable vertically therein, substantially as and for the purpose set forth.

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