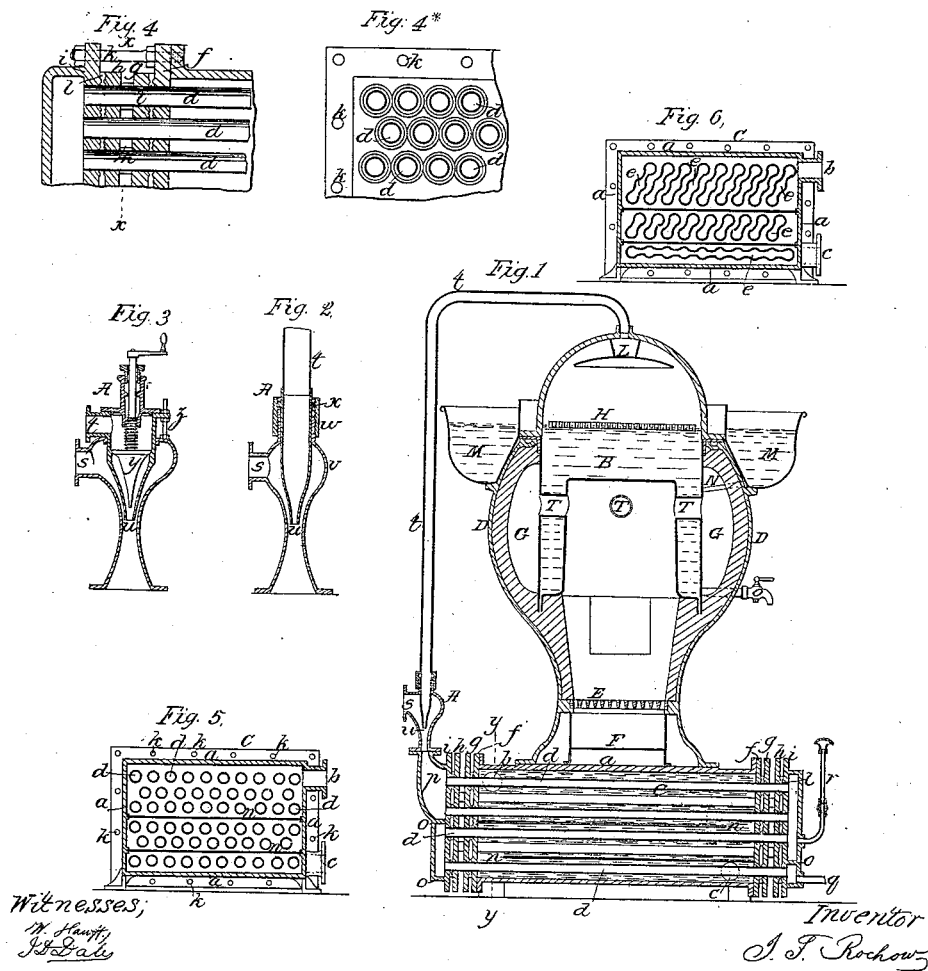


*J. F. Rochow,*  
*Steam-Boiler Condenser.*  
*N<sup>o</sup> 48,839.*                      *Patented July 18, 1865.*



# UNITED STATES PATENT OFFICE.

J. F. ROCHOW, OF NEW YORK, N. Y.

## IMPROVED POTABLE-WATER APPARATUS.

Specification forming part of Letters Patent No. 48,839, dated July 18, 1865.

*To all whom it may concern:*

Be it known that I, J. F. ROCHOW, of the city, county, and State of New York, have invented a new and Improved Fresh-Water Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable those skilled in the art to make and use the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a longitudinal vertical section of this invention. Fig. 2 is a detached sectional view of the air-injector on a larger scale than the previous figure. Fig. 3 is a modification of the same. Fig. 4 is a detached longitudinal vertical section of the double joint of my condensing apparatus. Fig. 4\* is a transverse vertical section of the same, the line *xx*, Fig. 4, indicating the plane of section. Fig. 5 is a similar section of the same, taken in the plane indicated by the line *yy*, Fig. 1. Fig. 6 is a modification of the parts shown in the previous figure.

Similar letters of reference in all the figures indicate corresponding parts.

This invention consists, first, in the arrangement of an air-injector, in combination with the steam-supply pipe and with the condensing apparatus, in such a manner that the steam in its passage from the boiler to the condenser is impregnated with a sufficient quantity of fresh air to produce, after its condensation, thoroughly aerated and potable water; second, in the arrangement of a double packing, separated by a vertical channel on both ends of the condensing-tubes, in such a manner that in case one of the joints should leak easy access can be had to the same without opening the apparatus, and, furthermore, if a leakage takes place the condensing salt-water is not permitted to mix with the steam to be condensed or with the water which has already been condensed; third, in the arrangement of horizontal partitions between the ends of the condensing-tubes in such a manner that the number of pipes through which the steam or condensed water passes can be gradually reduced to the space required by the fluid or liquid passing through them; fourth, in the arrangement of channels or passages at the opposite ends of said partitions in such a manner that the condensing-liquid will be compelled to run in a direction opposite to the

fluid to be condensed or cooled, and the operation of condensing the steam and cooling the condensed water is facilitated.

B represents a steam-generator, which connects through a pipe, *t*, with the injector A. When the apparatus is to be used on a sailing-vessel the steam generator is constructed as shown in Fig. 1 of the drawings, though it must be remarked that my apparatus is applicable to steam-generators of any desired construction. The boiler B is composed of a cast-iron shell, D, lined with fire-brick, and provided with a grate, E, and ash-pit F. The flame or products of combustion rise on the inner shell of the boiler, pass through tubes T, thence around the outer shell of the boiler, and out through an ordinary smoke-pipe attached on the side of the stove. The boiler is fed with water from the trough M through the pipe N, the pressure within the boiler being so low that the water is capable to find its way into the boiler by its own gravity.

A wooden float, H, pierced with holes is placed on the surface of the water to prevent foaming, and a shield, L, is applied under the aperture leading to the pipe *t*, to prevent the rising steam from carrying particles of water with it. Through a pipe and cock, O, on the bottom of the boiler the sediment left by the salt-water is drawn off.

The injector A consists of a pear-shaped vessel, *v*, with a side opening, 5, on its widest part, and with openings at both ends. Through the upper opening enters the steam-pipe *t*, with a tapering nozzle, *u*, which projects into the contracted part of the vessel *v*, as shown in Figs. 1 and 2. The steam-pipe *t* passes through a cap, *w*, and it is provided with a collar, *x*, so that it can be turned round. Said cap screws on the upper end of the vessel *v*, and it catches over the collar *x*, so that by turning said screw-cap the nozzle of the steam-pipe can be depressed or raised in the vessel *v*.

Instead of constructing the injector as shown in Figs. 1 and 2 it may be constructed as shown in Fig. 3. In this case the steam-pipe *t* passes in through the side of the vessel *v*, and the nozzle *u* forms a valve-box furnished with a tapering valve, *y*. Said nozzle is fastened to the vessel *v* by screws *z*, so that the same can be depressed or raised in the vessel.

The operation of the steam is as follows: The steam on passing through the contracted noz-

zle *u* assumes a large velocity, and enters the vessel *v* in the form of a jet in its narrowest part, causing a current of air to be drawn along, said air being made to enter through the pipe *s*. By these means steam intimately mixed with a large quantity of pure air enters the condenser, the amount of air which is allowed to enter the vessel *v* being regulated by means of the cap *x*. If the injector is constructed as shown in Fig. 2, or if it is constructed as shown in Fig. 3, the current of air is regulated by the screws *z*. In cases where pure air cannot be obtained I pass it through a purifier filled with powdered charcoal or other suitable material, said purifier being connected to the injector. The current of air produced by the steam-jet is strong enough to cause the air to pass through the purifier and to enter the vessel *v* free from impurities. By causing the air to enter the condenser mixed intimately with the steam each particle of water at the moment of its condensation is enabled to absorb the greatest possible quantity of air, so as to obtain a perfectly aerated and potable water.

The condenser *C* consists of a box, *a a*, open on both ends, and furnished with metallic tubes *d*, as shown in Fig. 5; or, instead of round tubes, tubes of any other form—such, for instance, as shown in Fig. 6—might be used. These tubes are kept in place by the plates *f g h i*, which are bolted to each end of the condenser, as shown in Fig. 4. There are four plates on each end of the condenser, so as to constitute a double packing for the ends of the tubes. The plates *f* next the body of the condenser *a* are fastened to it by bolts *k*, so as to produce a tight joint, and between each pair of plates *f g* and *h i* is a piece of packing, *l*, of india-rubber or other suitable material. Said plates and packing-pieces are pierced with a suitable number of openings to admit the tubes *d*, and the openings in the plates are furnished with small rims, so that the packing, when compressed between said plates, will be forced up against the circumference of the tubes and tight joints will be produced.

The plates *h* and *g* are kept apart by intervening sleeves *m* placed over the tubes *d*, or in any other convenient manner, so that when the bolts *k* are screwed up tight said plates will be the desired distance apart all round, and the packing between both pairs of plates will be compressed simultaneously. The object of this double packing is that if any leakage of salt-water should occur around the tubes *d* or *e* through the first pair of plates said salt-water is not permitted to mix with the fresh water in the tubes, and pure fresh water is obtained from the apparatus under all circumstances.

The condenser *C* is divided into a number of compartments by the horizontal sheets *n n*, which are provided with channels at opposite ends, so that the circulating water which enters through the pipe *c* passes in a zigzag current through the condenser until it reaches the discharge-opening *b*.

The two heads, *i i*, on both ends of the condenser, in which the tubes *d* or *e* terminate, are boxes with partitions *o* arranged so as to allow the vapors entering through the conduit *p* to pass only through those tubes which are located in the upper compartment of the condenser; thence they pass at the opposite end of said condenser to the second compartment, and so on until they reach the condensing-tubes in the lowest compartment, from which the condensed water is drawn through the pipe *g*. The pipe *r*, provided with a stop-cock, allows the escape of any desired amount of surplus air. By this arrangement the steam passes inside the condensing-tubes always in an opposite direction to that of the condensing water outside of said tubes, and the condensed water passes off at the point where the cool condensing water enters, so that the condensed water will be cooled down within the box to the temperature of the condensing water. Furthermore, as the steam travels inside the condenser its volume gradually decreases until it is finally reduced to the volume of its weight of water, and if the several compartments of the condenser are also made to diminish in the same proportion, as is done in my condenser, the speed of the steam or condensed water passing through the condensing-tubes is about equal throughout wherever the condensing water passes through continually increasing compartments, so that its velocity is greatest at the point where the condensed water passes off, and consequently it retains at that point of the condenser nearly its original temperature, and the condensed water is cooled down to the lowest possible point.

It remains to remark that my injector may not only be used for the purpose of mixing air and steam, but also in any other apparatus where it is desired to mix intimately two or more different kinds of vapors before they enter the condenser.

What I claim as new, and desire to secure by Letters Patent, is—

1. The injector *A*, applied in combination with the steam-pipe *t* and condenser *C*, in the manner and for the purpose substantially as herein described.

2. The arrangement of a double packing at the ends of the condensing-tubes, with open spaces intervening between said two packings, substantially as and for the purpose set forth.

3. Constructing the condenser *C* with diminishing compartments, substantially as and for the purpose specified.

4. The horizontal partitions *o* between the ends of the condensing-tubes, in combination with the sheets *n* in the interior of the condenser, constructed and operating substantially as and for the purpose described.

J. F. ROCHOW.

Witnesses:

W. HAUFF,  
J. D. DALE.