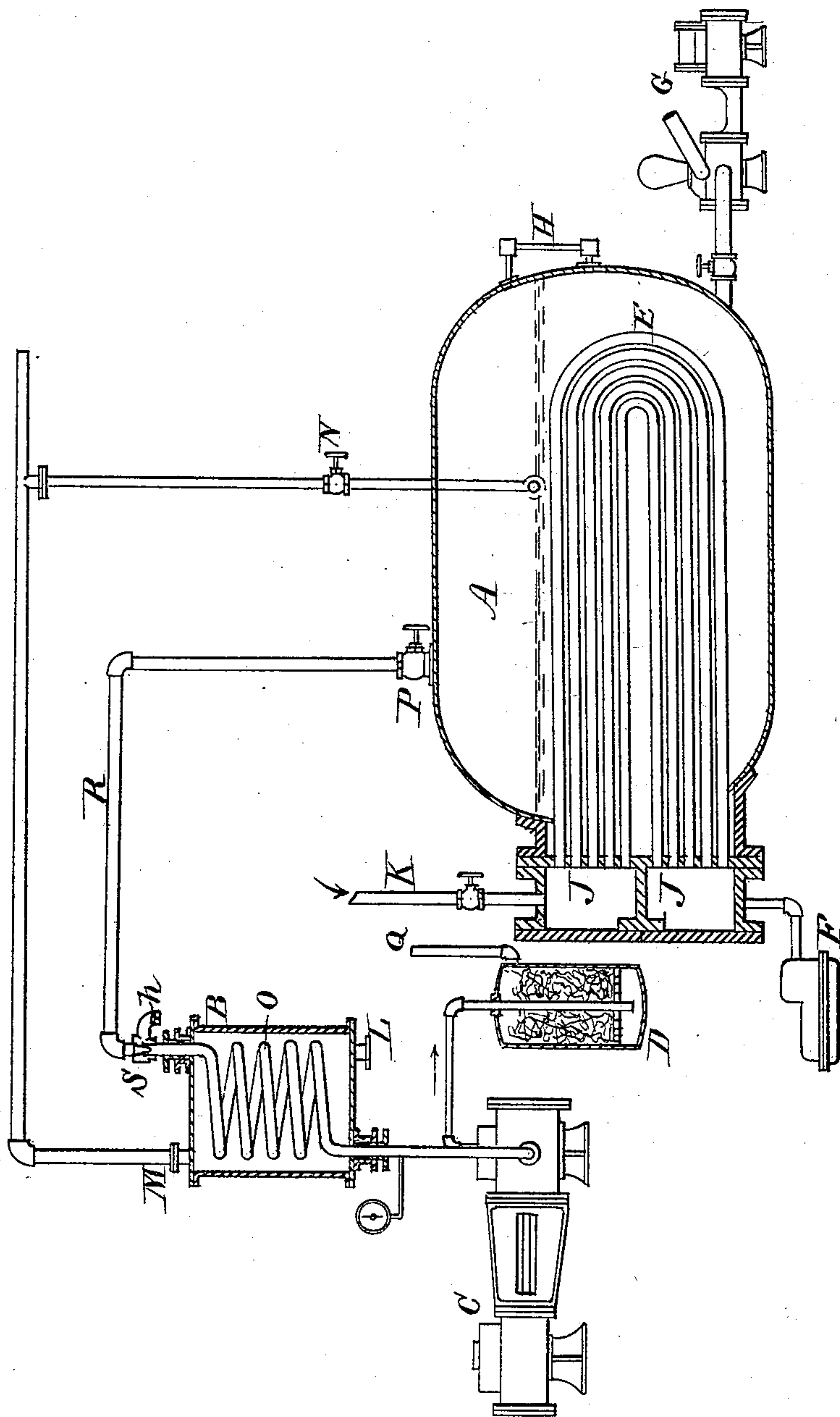


(No Model.)

G. W. BAIRD.  
STEAM GENERATOR OR EVAPORATOR.

No. 450,361.

Patented Apr. 14, 1891.



WITNESSES

*Thos Williamson*  
*George H. Rogers*

INVENTOR

*G. W. Baird.*

# UNITED STATES PATENT OFFICE.

GEORGE W. BAIRD, OF WASHINGTON, DISTRICT OF COLUMBIA.

## STEAM GENERATOR OR EVAPORATOR.

SPECIFICATION forming part of Letters Patent No. 450,361, dated April 14, 1891.

Application filed September 26, 1890. Serial No. 366,209. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE W. BAIRD, an engineer officer in the Navy of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Steam Generators or Evaporators, of which the following is a specification.

The object of my invention is to supply pure water for steam-boilers and other purposes; and it is an improvement on my device shown in my patents of August 23, 1887, No. 368,642, and December 24, 1889, No. 417,803.

Referring to the drawing, the figure is an elevation, part in section.

A is the evaporator or generator, provided with the U-shaped tubes E, the ends of which enter the steam-chests J, the lower chest being connected to the trap F by a pipe, by which the water of condensation is automatically discharged from the tubes E. Steam is supplied to the chest J by the pipe K, which leads from a boiler or receiver.

G is a brine-pump, H the water-gage, and I the feed-pipe to the evaporator.

B is a condenser formed by a coil O within a casing, the upper end of the coil being connected by pipe R to the steam-space of the generator, and is provided with the valve P. The lower end of the coil leads to the air-pump C, which pumps the water condensed in the coil through the filter D and out through pipe Q to the boiler or storage-tank.

By means of a circulating-pump (not shown) sea-water is pumped in the condenser at opening L and out at M, and is discharged at any convenient point. Part of the circulating water, the temperature of which has been raised by contact with steam-coil O, is fed into the generator through pipe I by opening valve N, the vacuum causing the water to enter.

S is an aerator placed between the condenser and evaporator, and is formed by the end of the pipe R entering the end of coil O, leaving sufficient space for the pump to draw in air through check-valve H' when a vacuum is formed.

The operation is as follows: Steam from a boiler or receiver is entered into steam-chest

J through pipe K. This steam heats coil E. Air-pump C is started, which creates a vacuum in the condenser and in the evaporator, say, of twenty-five inches of mercury. The circulating-pump (not shown) forces water into condenser at I and out at M. By opening valve N a feed is obtained. This feed-water is vaporized by the heat of the coils and is boiled at a temperature, due to the vacuum, about 135° Fahrenheit. This vapor passes to the condenser, where it is condensed in contact with the cold coils. It is then pumped through the filter D and is discharged at Q, whence it is delivered to tanks or other storage. If sea-water be used for circulation and for feeding the evaporator, the water in the evaporator becomes denser and denser, owing to the solid matter in solution becoming proportionately greater. At the temperature employed in steam-boilers the water precipitates the sulphate-of-lime scale on the heating-surfaces; but if the water be boiled at a lower temperature, as in my evaporator when employing a vacuum, a greater portion of this sulphate of lime remains in solution. For example, one hundred parts of sea-water at 158° Fahrenheit will hold in solution 0.248 part of sulphate of lime, while at 212° it will hold but 0.217, and at 284° it precipitates all the sulphate of lime. Now, a temperature of 284° is due to only thirty-eight pounds boiler-pressure. Marine boilers now use one hundred and sixty pounds pressure. At 68° (the normal temperature of sea-water) one hundred parts of sea-water will hold 0.241 part sulphate of lime in solution. In twenty-six inches of vacuum water will vaporize at 153°. It will thus be seen that by vaporizing in a vacuum the capacity of the water for holding this salt in solution is sensibly the same as that of normal sea-water, and when the evaporator is operated in that way the precipitation of sulphate-of-lime scale is almost entirely prevented.

The steam-trap F is provided for the purpose of keeping the boiler (or receiver) pressure in the coils, and the water from the trap is returned to the main boiler. The brine-pump G is provided as a substitute for the blow-off cock, as there is a vacuum in the



evaporator. The vacuum enables the operator to regulate the feed by the valve N without the use of a feed-pump.

5 If steam from the low-pressure receiver of a triple-expansion engine be used, about the same range of temperature may be utilized as hitherto, where using ordinary boiler-pressure in the coils and discharging the evaporator against the atmosphere. For example, 10 the pressure in the low-pressure receiver is sometimes twenty-five pounds to the square inch, absolute pressure, and has a corresponding temperature of  $240^{\circ}$ . Then, if we discharge into twenty-five inches of vacuum, due 15 to a temperature of  $135^{\circ}$ , we have a range of  $240^{\circ} - 135^{\circ} = 105^{\circ}$  between the inside and outside of the coils. With such a range the evaporator is very efficient, as is well known.

20 The greater economy will be effected when using the steam which has already been passed through one or more cylinders, for then its sensible heat has already been converted into work, and of the remaining total heat a larger percentage is latent and is utilized by the evaporator. This is one of the 25 few physical means by which the latent heat of vaporization has ever been utilized.

The vapor being generated at a lower temperature will bring over less of organic and of volatile matters, and with an equal subsequent aeration will become sooner oxidized and made potable. 30

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is— 35

1. The combination of the evaporator with the air-pump and the brine-pump, substantially as shown and described. 35

2. The combination of the evaporator with the air-pump, the condenser, and the brine-pump, substantially as shown and described. 40

3. The combination of the evaporator with the air-pump, the condenser, the feed-pipe, and the brine-pump, substantially as shown and described. 45

4. The combination of the evaporator with the air-pump, the condenser, the filter, the feed-pipe, and the brine-pump, substantially as shown and described.

G. W. BAIRD.

Witnesses:

THOM. WILLIAMSON,  
GEORGE W. ROUZER.