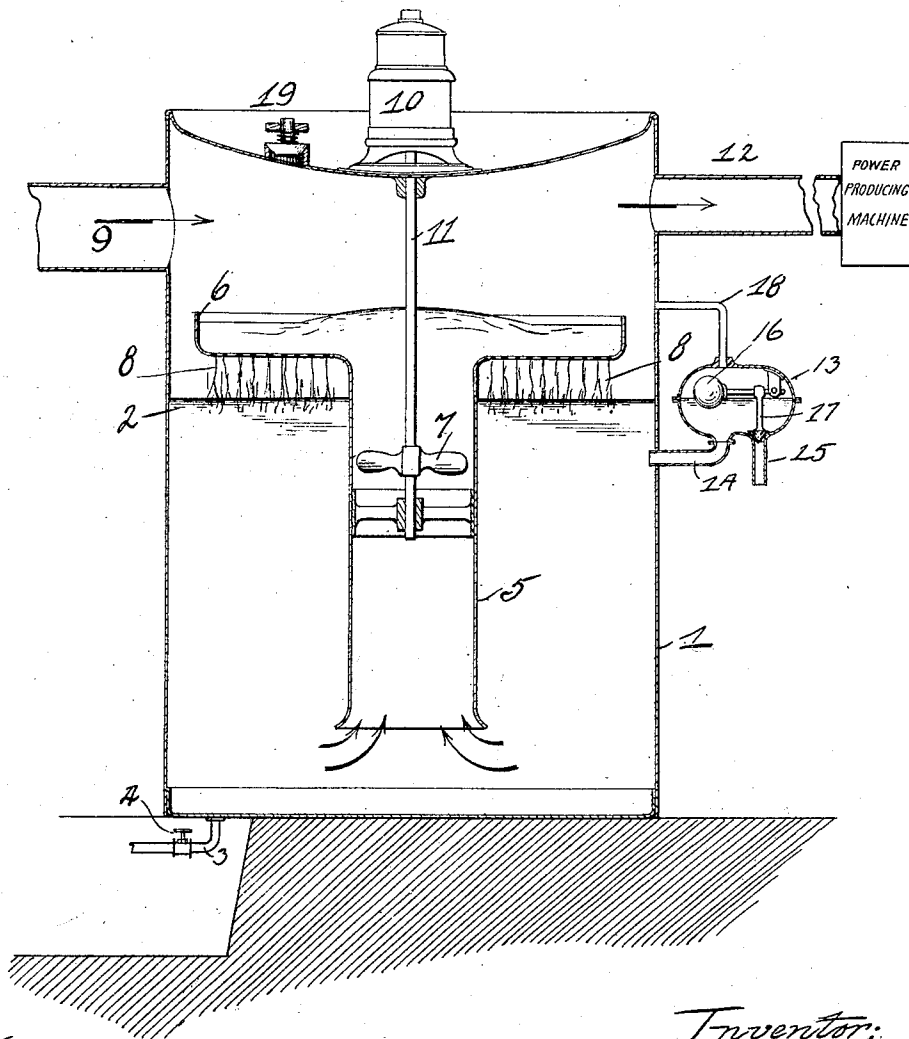


No. 884,610.

PATENTED APR. 14, 1908.

A. C. E. RATEAU.  
STEAM REGENERATOR.  
APPLICATION FILED DEC. 31, 1904.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

AUGUSTE CAMILLE EDMOND RATEAU, OF PARIS, FRANCE.

## STEAM-REGENERATOR.

No. 884,610.

Specification of Letters Patent.

Patented April 14, 1908.

Application filed December 31, 1904. Serial No. 239,165.

*To all whom it may concern:*

Be it known that I, AUGUSTE CAMILLE EDMOND RATEAU, citizen of France, residing at Paris, France, have invented a certain new and useful Improvement in Steam-Regenerators, (patented in France May 25, 1904, No. 340,844,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to steam regenerative accumulators, and has for its object the provision of an improved apparatus whereby exhaust steam from engines may be brought to a proper condition and pressure to render such exhaust steam adaptable for further use, particularly for power purposes, though I do not wish to be limited to the use to which such regenerated steam is put.

In practicing my invention, I employ a vessel in which there is disposed a liquid, preferably water, which vessel is provided with an overflow pipe or passage that maintains the said liquid at or below a given level, the said vessel being also provided with an entrance for the exhaust steam, an exit for the regenerated steam, and a valve acting as a back pressure controlling valve, whereby the steam is prevented from exceeding a predetermined pressure, so that it will not raise the pressure in opposition to the incoming exhaust steam, which, in such case, obviously will produce an unsatisfactory operation of the engines from which the exhaust steam is supplied.

The opening through which the steam is received into the vessel is desirably, though not necessarily, located entirely above the limiting level fixed for the liquid, as is also the back pressure regulating valve. The exit opening for the regenerated steam is located above the limiting level of the liquid in order that the water will not escape therewith. With a vessel thus equipped and constructed, there is also provided an agency other than the exhaust steam, as said exhaust steam acts upon the water, for effecting a violent agitation of the water or other liquid, whereby a greater surface of liquid is exposed to the steam than would be afforded if the water remained quiescent. The agency that I prefer to employ for effecting the agitation of the water is a mechanically moving element, such as a pump that circulates the water.

The object of providing a body of liquid

in the vessel is set forth in my United States Patent No. 761,606, patented May 31, 1904. Obviously such a body acts as a heat accumulator to receive heat when the incoming exhaust steam is above a predetermined temperature and to give off heat when the steam is below a predetermined temperature, whereby the temperature of the steam in the vessel is maintained substantially uniform and may be delivered from the vessel at a substantially uniform pressure or at pressures between predetermined limits.

In the apparatus of my aforesaid patent, the exhaust steam was employed directly to effect the agitation of the water, but in my present invention the steam preferably performs no very direct active part in agitating the water, this agitation being accomplished by means other than the exhaust steam acting directly upon the water, whereby the rate of agitation may be determined and the rate at which the heat is received by the water and is discharged therefrom may be regulated. This independently acting agency is preferably a motor driven element, such as a pump, preferably of the centrifugal class, the motor being operated by any suitable agency, even the exhaust steam itself, after it has been regenerated, the steam, when regenerated, being then capable of acting independently upon the liquid agitating mechanism of the steam to be regenerated. Any suitable source of power other than the steam to be regenerated, may be employed to operate the motor that actuates the liquid agitating mechanism. By means of the pump or other mechanically operating agency, a portion of the water may be elevated and allowed to return to the balance of the water in subdivided streams, these returning streams passing through the steam in the vessel, whereby the surface of the water to which the steam is subject is greatly enlarged, thereby very readily permitting the water to receive heat from the steam if such heat of the steam is above a given limit or whereby heat may be imparted from the water to the steam if the steam is below the given limit, whereby the heat of the steam in the vessel may be kept at a uniform temperature or temperature confined between predetermined limits.

Another feature of my present invention that may be practiced with either the above described method or the method of my afore-

said patent resides in preliminarily heating the water or other liquid by an agency hitherto unemployed, it being necessary preliminarily to heat the water, especially when it occurs in large volumes, since if this were not done there would be a risk of severe impacts of steam being produced by the rapid absorption of steam by the cold liquid. In my present invention, I employ a heated fluid which is caused to pass in the liquid from the exterior, this heated fluid being preferably a gas, which desirably is steam.

I will explain my invention more fully by reference to the accompanying drawing, showing a vessel equipped as above described, the vessel being indicated in vertical section, as are also most of the parts associated therewith.

The vessel 1 is adapted to contain a body of liquid, preferably water, which is preliminarily heated, preferably by means of steam admitted through a pipe 3 communicating with the interior of the vessel through the bottom thereof, there being employed a cut-off valve 4 for regulating the application of the heating steam. The means that I preferably employ for effecting the agitation of the water comprises a conveying tube 5 projecting into the body of water and extending above the same, this tube being provided with a dish-shaped top 6 whose bottom is perforated, so that the water forced up to the dish from the main body by the centrifugal pump 7 may flow through the bottom of the dish in many streams 8, said bottom constituting a liquid subdivider thereby greatly enlarging the surface of the water to which the exhaust steam entering through the piping 9 is subject, the water being caused to circulate as indicated by the lower arrows. Any suitable agency may be employed for operating the pump 7, there being indicated an electric motor 10 that rotates the shaft 11 carrying the blades of the pump. The steam that is regenerated is passed through the discharge opening or exit 12 which is located above the level of the body of water at or below which said water is maintained. As the water is likely to have its volume increased when the temperature is less than the temperature of the steam, causing a partial condensation of the steam, the level of the water is likely to climb, and I, therefore, provide one of many instrumentalities that may be employed for removing this excess of water. The instrumentality shown includes a chamber 13 supplied with water by a branch pipe 14 and having a discharge opening 15. There is provided in this chamber a float 16 whose arm carries a lever 17 that closes the opening 15 when the level of the water is at or below a predetermined point, but which valve frees said opening when the said level is above said point, to permit a discharge of water through said

opening. There is also provided a steam pipe pass 18 to equalize the pressure upon the body of water within the chamber 13. I do not wish to be limited to any particular type of means for removing the excess of water from the vessel. In order that the regenerated steam may be supplied through the opening 12 at or below a predetermined pressure and in order that the steam pressure may not rise through the piping 9, there is employed a back pressure controlling valve 19 that operates to release the steam when pressure is excessive.

While I prefer the pipe 5 with its dish-shaped top 6, I do not wish to be limited to any particular structure for guiding the water in the paths it is to follow.

It will be seen that I have provided within the vessel a water or liquid fall by which the accessibility of the steam to the water is increased.

My invention finds great service where the exhaust steam is received in a fluctuating flow into the vessel, as, for example, where it is supplied from engines that are not regular in their operation.

It will be apparent that by means of my present invention the piping that directs steam to be regenerated into the liquid may be so located as to direct said steam into a portion of the vessel above the main body of liquid, for, in accordance with my present invention, the steam to be regenerated is not employed to effect circulation of the liquid.

An advantage that may be gained by the present arrangement over the apparatus of my prior patent No. 761,906, dated May 31, 1904, resides in the fact that the steam to be regenerated is relieved of the work of agitating the liquid, on which account the back pressure which is required when this work is imposed upon the steam to be regenerated is eliminated. Further back pressure may be eliminated when the steam to be regenerated is admitted above the main body of liquid.

I have claimed the method herein disclosed.

While I have shown the entrance opening for the exhaust steam near the top of the vessel, so that the exhaust steam will be admitted above the level of the liquid, I do not wish to be limited to such an arrangement.

The art of regenerative accumulators is distinct from the art of feed water heaters and condensers, each of the latter two devices including a tank or vessel and an ever changing supply of liquid which receives heat from the vapors and carries the same from the tank or vessel, whereas, on the other hand, regenerative accumulators, to which this invention relates, each include a tank or vessel and a body of liquid which is substantially constantly within the vessel, so that the heat imparted to it is retained within the vessel, whereby the proper function of the re-

generative accumulator may be performed. In steam regenerative accumulators, this liquid should preferably be water. In the claims I speak of a regenerative accumulator  
 5 in the sense here outlined. In presenting the claims I have not deemed it necessary to set forth essential characteristics of the regenerative accumulator to which this invention relates, as such are well understood in  
 10 the art.

It is obvious that changes may readily be made in the apparatus that I have herein illustrated without departing from the spirit of the invention, and I do not, therefore,  
 15 wish to be limited to the precise construction shown, but

Having thus described my invention, I claim as new and desire to secure by Letters-Patent:—

20 1. A steam regenerative accumulator in which liquid is employed as a heat retainer, in combination with pumping mechanism for effecting circulation of the liquid, and a motor for operating said mechanism and  
 25 itself operated from a source of power other than the steam to be regenerated.

2. A steam regenerative accumulator in which liquid is employed as a heat retainer, in combination with mechanism for agitating  
 30 said liquid, and a motor for operating said mechanism and itself operated from a source

of power other than the steam to be regenerated.

3. A steam regenerative accumulator in which liquid is employed as a heat retainer, in combination with mechanism for circulating said liquid, and a motor for operating said mechanism and itself operated from a source of power other than the steam to be  
 40 regenerated.

4. A steam regenerative accumulator in which liquid is employed as a heat retainer, in combination with pumping mechanism for effecting circulation of the liquid, and a motor for operating said mechanism.  
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5. A steam regenerative accumulator in which liquid is employed as a heat retainer, in combination with mechanism for agitating said liquid, and a motor for operating said mechanism.  
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6. A steam regenerative accumulator in which liquid is employed as a heat retainer, in combination with mechanism for circulating said liquid, and a motor for operating said mechanism.  
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In witness whereof, I hereunto subscribed my name this twenty-seventh day of October A. D., 1904.

AUGUSTE CAMILLE EDMOND RATEAU.

Witnesses:

PAUL JOSEPH ALEXIS CHALEIL,  
 ARCHIBALD R. BAKER.