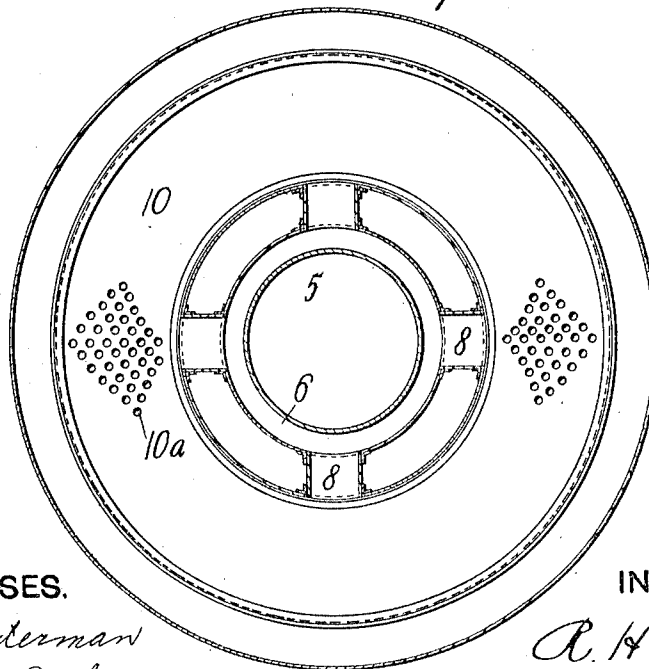
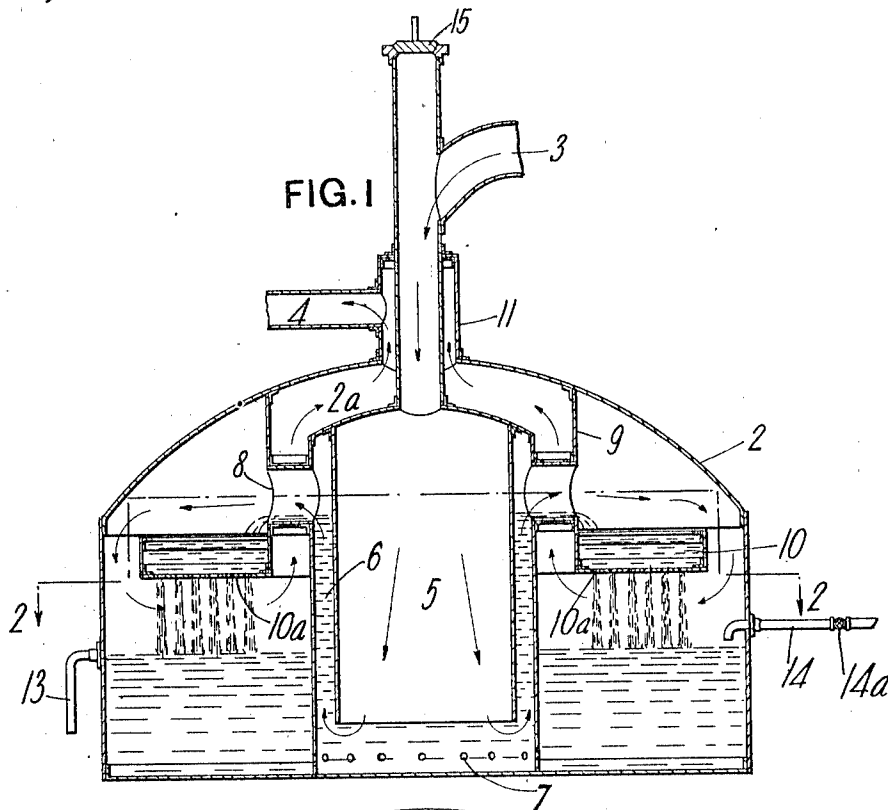


R. H. STEVENS.
 APPARATUS FOR REGENERATING STEAM.
 APPLICATION FILED FEB. 5, 1910.

1,061,573.

Patented May 13, 1913.



WITNESSES.

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FIG. 2

UNITED STATES PATENT OFFICE.

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APPARATUS FOR REGENERATING STEAM.

1,061,573.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed February 5, 1910. Serial No. 542,253.

To all whom it may concern:

Be it known that I, RICHARD H. STEVENS, of Munhall, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Apparatus for Regenerating Steam, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—
Figure 1 is a sectional elevation of apparatus constructed and arranged in accordance with my invention. Fig. 2 is a sectional plan of the same on the irregular line II—II of Fig. 1.

My invention relates to the regeneration of steam and the object of the invention is to provide an improved apparatus for effecting the exchange of heat between a body of steam and of water whereby an intermittent supply of high pressure steam is utilized to provide a continuous supply of low pressure steam and a body of water is employed to store the heat of the high pressure steam when the supply of high pressure steam exceeds the demand of low pressure steam, and to furnish the heat necessary to supply a constant supply of low pressure steam when the demand exceeds the supply of low pressure steam.

A further object of the invention is to provide improved apparatus by which the steam and water are caused to circulate within the regenerator and the steam passing into and through the regenerator is brought into intimate contact with the water contained in the regenerator.

In the drawings, 2 represents a regenerator chamber having an inlet pipe 3 by which steam is led into the regenerator from the exhaust of a steam engine or other source of steam, and 4 is an outlet pipe through which steam is led from the regenerator 2 to a turbine or other low pressure power unit in which the regenerated steam is utilized.

As shown in the drawings, the steam inlet 3 is connected with the upper end of a cylindrical compartment 5 located in the interior of the regenerator 2 and having an open lower end. The compartment 5 is surrounded by an annular chamber 6 which has closed upper and lower ends. The wall of the chamber 6 adjacent to the lower end of the chamber is provided with a series of small openings 7 by which water or other fluid can pass into or out of the chamber

2 into the chamber 6, in order to restore the levels of the water in the two chambers.

At the upper end of the partition forming the compartment 6 is a series of branch outlet openings 8 by which communication is afforded between the compartment 6 and the surrounding regenerator chamber at a height above the level of the water maintained in the regenerator chamber 2. The chamber 2 is divided by a cylindrical or tubular partition 9 into two compartments and the lower end of the wall 9 is provided with an annular water trough 10 having a multiplicity of small holes or openings 10^a in its bottom through which water is kept constantly flowing in a large number of small streams. The inner compartment formed by the partition wall 9 in the regenerator chamber 2 is connected by the extension 11 with the outlet pipe 4, as is clearly shown in Fig. 1.

13 represents the overflow pipe by which the body of water is maintained at a predetermined level in the chamber 2, and 14 is a water inlet pipe by which water is supplied to the regenerator, the supply being controlled by the valve 14^a. A relief valve 15 is provided on the upper end of the connection leading from the inlet pipe 3 to the inner chamber 5 of the regenerator by which the pressure in the chamber 2 is relieved when exceeding a predetermined amount.

In using apparatus like that shown in the drawings, the regenerator is supplied with a body of water, which is preferably heated before being put into the chamber 2. The relief valve 15 is then closed and steam is supplied to the regenerator through the inlet pipe 3. The incoming steam passes from the pipe 3 into the enlarged chamber 5 and causes the water in the chamber 6 to rise and flow through the outlets 8 into the annular spraying trough 10. The steam also passes downwardly through the pipe 5 and upwardly through the chamber 6 formed by the concentric walls of the chambers 5 and 6 and then passes outwardly through the branch pipe 8 into the regenerator 2, as is indicated by the arrows. The steam, on its entry into the chamber 2, passes over the surface of the water in the annular trough 10 and is directed and caused to pass under this trough and through the large number of small streams of water which are flowing through from the perforations 10^a in the bottom of the trough 10 and then passes up-

wardly through the annular passage 2^a formed between the walls of the chamber 6 and the partition 9, and outwardly through the neck or connection 11 into the outlet pipe 4. The regenerated steam is carried by the outlet pipe to a low pressure steam turbine, steam engine or other place of use.

It will readily be seen that as the steam is caused to pass through the regenerator 2 it is brought into intimate contact with and highly heats the water and the temperature of the water and the steam is rendered substantially equal in the chamber 2. When the steam required by the low pressure unit connected to the outlet pipe 4 of the regenerator exceeds the supply, the heated water in the chamber 2 will vaporize and will give up in the form of steam enough steam to form a substantially constant supply.

By the use of my improved apparatus the fluid is broken up into a multiplicity of fine streams and, owing to the large surface of the fluid brought into contact with the steam, causes a very intimate mixture of the two, which results in the sought for increase in the interchange of heat.

Modifications in the construction and arrangement of the apparatus may be made without departing from my invention.

I claim:—

1. A steam regenerator comprising a vessel to contain a heat storing fluid having a fluid overflow outlet and having a partition separating the vessel into steam-receiving and steam-regenerating chambers, said partition having openings connecting the chambers below the level of the overflow outlet, a steam inlet opening into the receiving chamber, a steam outlet opening out of the regenerating chamber, depending partitions within the chambers terminating above the overflow outlet and forming separate compartments within the chambers, a passage directly connecting the chambers, and a trough in one compartment of the regenerating chamber having a perforated bottom, said trough being positioned above the level of the overflow outlet to receive fluid discharged from said passages and spray the outgoing steam therewith.

2. A steam regenerator comprising a vessel to contain a heat storing fluid having a fluid overflow outlet and having a partition separating the vessel into an inner steam-receiving and outer steam-regenerating chambers, said partition having openings connecting the chambers below the level of the overflow outlet, a steam inlet opening into the receiving chamber, a steam outlet opening out of the regenerating chamber, depending partitions within the chambers terminating above the overflow outlet and forming separate compartments within the chambers, at least one passage directly connecting the outer compartments of said

chambers, and a trough in the outer compartment of the regenerating chamber having a perforated bottom, said trough being positioned above the level of the overflow outlet to receive fluid discharged from said passages and spray the outgoing steam therewith.

3. A steam regenerator comprising a vessel to contain a heat storing fluid having a fluid overflow outlet and having a partition separating the vessel into an inner steam-receiving and outer steam-regenerating chambers, said partition having openings connecting the chambers below the level of the overflow outlet, a steam inlet opening into the receiving chamber, a relief valve on said inner steam-receiving chamber, a steam outlet opening out of the regenerating chamber, depending partitions within the chambers terminating above the overflow outlet and forming separate compartments within the chambers, passages directly connecting the outer compartments of said chambers, and a trough in the regenerating chamber having a perforated bottom, said trough being positioned above the level of the overflow outlet to receive fluid discharged from said passages and spray the outgoing steam therewith.

4. A steam regenerator comprising a vessel to contain a heat storing fluid having a fluid overflow outlet and having a partition separating the vessel into annular steam-receiving and steam-regenerating chambers, said partition having openings connecting the chambers below the level of the overflow outlet, a steam inlet opening into the receiving chamber, a steam outlet opening out of the regenerating chamber, depending partitions within the chambers terminating above the overflow outlet and forming separate annular compartments within the chambers, at least one passage directly connecting the outer annular compartments of said chambers, and a trough in one compartment of the regenerating chamber having a perforated bottom, and secured on the lower end of the depending partition in position to receive fluid discharged from said passages and spray the outgoing steam therewith.

5. A steam regenerator comprising a vessel to contain a heat storing fluid, a partition extending upwardly within said vessel from the bottom thereof and having a closed upper end forming an inner steam-receiving and an outer steam-regenerating chamber, a partition depending from the closed upper end of the steam-receiving chamber forming separate steam-receiving and discharge compartments therein, a partition depending from the top of the steam regenerating chamber forming inner and outer compartments within the steam-regenerating chamber and having a trough on the bottom thereof, the bottom of said trough having a series

of perforations therein, an overflow outlet on the vessel for the heat-storing fluid, the depending partition in the regenerating chamber terminating above the level of said overflow outlet, a plurality of openings in the partition forming the steam-receiving and regenerating compartments connecting said compartments below the level of the overflow outlet, a passage connecting the outer compartment in the steam receiving chamber with the outer compartment in the regenerating chamber, a steam inlet connecting into the inner compartment of the steam receiving chamber, and a steam outlet leading from the inner compartment of the steam regenerating chamber.

6. A steam regenerator comprising a cylindrical vessel to contain a heat storing fluid, a cylindrical partition extending upwardly within said vessel from the bottom thereof and having a closed upper end forming an inner steam-receiving and an outer steam-regenerating chamber, a partition depending from the closed upper end of the steam receiving chamber forming an inner steam-receiving and a discharge compartment therein, a cylindrical partition depending from the top of the steam-regenerating

chamber forming annular inner and outer steam-regenerating compartments therein, an annular trough on the bottom of said depending partition having a perforated bottom, an overflow outlet on the vessel, the depending partition in the regenerating chamber terminating above the level of the overflow outlet, a series of openings in the partition forming the steam-receiving and steam-regenerating chambers connecting said chamber below the level of the overflow outlet, a plurality of passages connecting the outer annular compartment in the steam-receiving chamber with the outer annular compartment in the steam-regenerating chamber above the level of said overflow outlet, a steam inlet connecting into the top of the inner compartment in the steam receiving chamber, and a steam outlet connecting out of the inner compartment in the steam-regenerating chamber.

In testimony whereof, I hereunto set my hand.

RICHARD H. STEVENS.

Witnesses:

W. H. CORBETT,
CHAS. E. NATCHER.