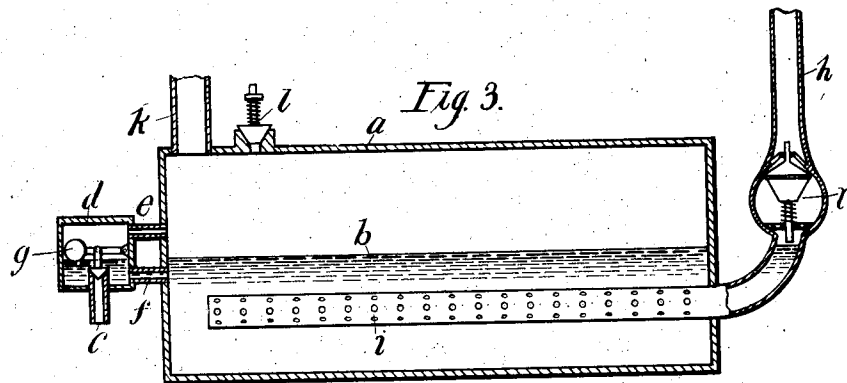
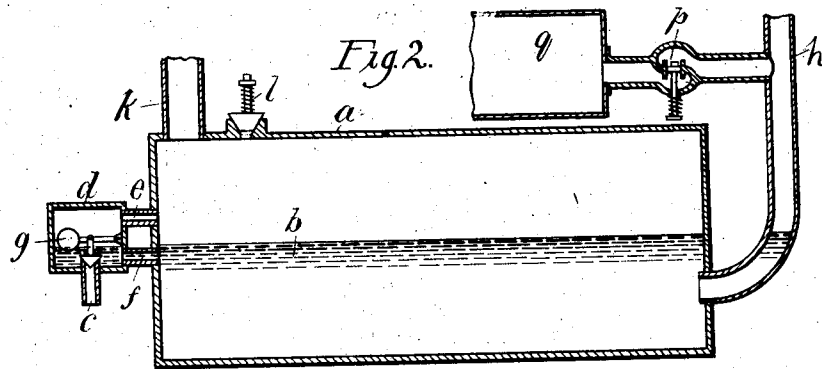
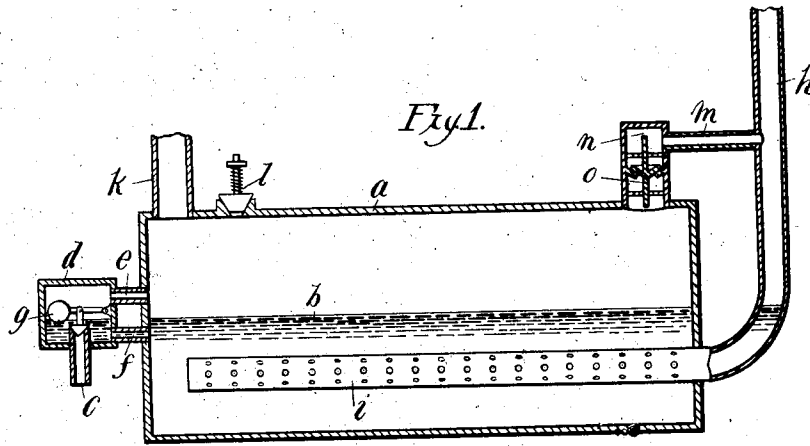


No. 839,319.

PATENTED DEC. 25, 1906.

A. C. E. RATEAU.
STEAM REGENERATIVE ACCUMULATOR.
APPLICATION FILED MAR. 3, 1905.



Witnesses:

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UNITED STATES PATENT OFFICE.

AUGUSTE CAMILLE EDMOND RATEAU, OF PARIS, FRANCE.

STEAM-REGENERATIVE ACCUMULATOR.

No. 839,319.

Specification of Letters Patent.

Patented Dec. 25, 1906.

Application filed March 3, 1905. Serial No. 248,188.

To all whom it may concern:

Be it known that I, AUGUSTE CAMILLE EDMOND RATEAU, a citizen of the United States, residing at Paris, France, have invented a certain new and useful Improvement in Steam-Regenerative Accumulators, 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 of such a type, for example, as that illustrated in my reissued Letters Patent No. 12,295, dated December 27, 1904, though the invention need not be restricted precisely to the apparatus disclosed in said patent. This type of apparatus comprises a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a discharge duct or opening for substantially preventing the liquid from exceeding a given level by permitting the excess of liquid to flow away from the vessel, and a steam-escape valve preventing the pressure within the vessel from exceeding a predetermined limit, said vessel having an outlet above the level of the liquid for conveying steam from the vessel. In apparatus of this class as hitherto constructed there is danger of the pressure within the accumulator forcing the liquid (water) back through the pipe that conveys the steam to be regenerated, which may occasion great damage, particularly where the steam to be regenerated is supplied from the exhaust of an engine, as is usually the case. Obviously the backflow of water through this pipe that supplies the steam to be regenerated to the cylinder of the engine would cause great inconvenience, if not material harmful results, as will be apparent to those skilled in the art. Such results are likely to happen when the engine stops, for then the pressure within the vessel of the accumulator is not sufficiently counteracted by any pressure remaining in the pipe that supplies the exhaust-steam to the regenerator. Such result may also be occasioned when the engine pumps from the pipe leading to the accumulator after the steam operating the engine has been cut off and before the engine has stopped, in which case the tendency of the steam within the accumulator to force the water back through the supply-pipe is sup-

plemented by the pumping action of the engine.

My invention resides in providing means for preventing the backflow of the water when the exhaust-pressure is removed or so reduced as to otherwise cause a backflow of the water. This result has been accomplished by means of a check-valve specifically claimed in my application, Serial No. 248,189, filed March 3, 1905, the invention, however, being broadly claimed in my present application, or by means of valves regulated by steam-pressure. Where steam-pressure-controlled valves are employed, I preferably provide a shunt or by-pass between the pipe that conveys the exhaust-steam to the vessel of the accumulator, in which by-pass there is included a valve that is so adjusted that when the pressure of the exhaust-steam is not below a predetermined value said valve will be closed; but when the pressure due to the exhaust-steam within the pipe is sufficiently reduced or is absent or when there is the pumping action heretofore specified the pressure from the vessel of the accumulator will be effective upon the valve to unseat the valve, and thereby permit steam to pass through the said by-pass into the exhaust-steam-supply pipe, whereupon sufficient pressure is established within the said pipe to prevent the backflow of water. I do not wish to be limited, however, to the source of supplemental pressure from which pressure is supplied to the pipe that conveys the exhaust-steam to the accumulator, as in practice it may be desirable to eliminate the by-pass between the pipe that conveys the exhaust-steam to the vessel of the accumulator and substitute for this by-pass a pipe leading to a supplemental source of pressure distinct from that afforded by the steam within the vessel of the accumulator; which supplemental source of pressure (that is, supplemental with respect to the pressure afforded by the exhaust-steam) may even be the boiler that supplies the steam to operate the engine from which the exhaust is passed to the accumulator.

I will explain my invention more fully by reference to the accompanying drawings, in which—

Figure 1 is a view in sectional elevation diagrammatically indicating the preferred embodiment of the invention. Fig. 2 is a

view in sectional elevation of a modification of my invention. Fig. 3 is another view in sectional elevation of another modification of my invention specifically claimed in my
5 copending application.

Like parts are indicated by similar characters of reference throughout the different figures.

The vessel *a* of the accumulator is that in
10 which the exhaust-steam is regenerated, this vessel *a* being designed to contain liquid *b*, which is prevented from exceeding a predetermined level by means of the discharge duct or opening *c*, that projects within a vessel
15 *d*, which communicates with the vessel *a* through pipes *e* and *f*, located above and below the level that is desired for the liquid *b*, respectively, a float-valve *g* opening and closing the communication between the
20 pipes *c* and the vessel *d*, according to the level of the liquid in the vessels *a* and *d*. Piping *h* affords communication between the supply of steam that is to be regenerated, such as the exhaust-piping of an engine, the
25 piping *h* directing steam into the liquid, for which purpose said pipe may be provided with a horizontal perforated extension *i*, extending substantially the length of the vessel *a*, as indicated in Figs. 1 and 3, or which
30 may terminate at the wall of the vessel *a* immediately adjacent to the piping *h*, for with either construction the steam is led into the water from said piping *h*, the water serving to operate upon the steam thus admitted
35 hitherto in a manner now well understood by those skilled in the art and explained in my aforesaid patent, which operation need not here be specifically described. An outlet *k* is provided above that level of the liquid *b* to
40 which said liquid desirably is limited, so that the regenerated steam may be conveyed from said vessel without carrying with it the water of the vessel, whereby such regenerated steam may be effectively adapted to
45 operate steam-driven motors or engines. In view of the fact that the steam within the vessel *a* may fluctuate widely in pressure and in order that the regenerated steam may be supplied to the load it is to operate at a
50 pressure not exceeding a given limit a safety or steam-escape valve *l* is employed, which valve is only unseated when the pressure in the vessel *a* exceeds the limit for which the said valve is set to accomplish the result desired.
55

In order that the pressure within the vessel *a* may not force the liquid *b* back through the piping *h* and in order that the engine that may be connected with said piping *h*
60 may not pump said liquid through the pipe after the operating-steam has been cut-off from the engine and before the said engine is brought to a stop, I provide the apparatus shown in Fig. 1 or Fig. 2 or Fig. 3, that serves

to prevent such backflow of said liquid. In
65 Fig. 1 this supplemental apparatus resides in a by-pass *m*, that includes as a component part thereof a valve-chamber *n*, this by-pass or shunt being connected between the vessel
70 *a* at a point above the liquid *b* and the piping *h*. The valve *o* within the valve-chamber *n* is so weighted or balanced that it will not open when the pressure within the piping *h*, due to the exhaust or low-pressure steam
75 flowing therein, is at or above a predetermined value, such low-pressure steam exerting pressure upon the upper side of the valve *o*, while the steam within the vessel *a* exerts pressure upon the lower side of said valve, said latter pressure, under conditions just
80 mentioned, then not serving to effect the elevation of the valve. When, however, for any reason the pressure of the steam upon the upper side of the valve *o* is below the predetermined value, the pressure of the steam
85 within the vessel *a* will effect an elevation of the valve *o*, whereupon steam is admitted from the said vessel to the piping *h* at a point above the level of the liquid *b*, so that the liquid in the said vessel is prevented from
90 rising within the piping *h*. The pressure in the vessel *a* may fluctuate, in which case the lower limit placed for the steam-pressure within the piping *h* may correspondingly
95 fluctuate. Obviously the level of the liquid *b* may fluctuate within certain limits in the operation of the accumulator.

In Fig. 2 a valve *p* is interposed between a supplemental source of steam-pressure *q* and the piping *h*. I speak of the source of steam-
100 pressure as being "supplemental," by which term I mean that it is supplemental with respect to the source of low-pressure steam that supplies the piping *h*. The valve *p* is so set that when the pressure in the piping *h* is
105 below a predetermined value said valve will open to admit steam from the source *q*, the steam admitted from this source being of sufficiently high pressure to restore the pressure within the piping *h* or provide sufficient
110 pressure within said piping to prevent the steam within the vessel *a* from forcing the water *b* back through said piping and to prevent any pumping action of the engine from drawing this water.
115

In Fig. 3 there is not provided any means for supplying steam to the piping *h* in the manner indicated in Figs. 1 and 2, but said piping is provided with a valve *r*, desirably a float-valve, that is subject to the pressure
120 from the steam within the piping *h* normally to maintain said valve from its seat, whereupon the said steam may be passed through the valve-opening into the vessel *a*, but which valve is subject to the pressure of the
125 steam from the interior of the vessel *a* when the pressure in the piping *h* has been sufficiently reduced, so that the said valve is

seated to prevent the water from flowing back through the piping, the vehicle through which the pressure within the vessel *a* is exerted upon the said valve to seat the same on the conditions last specified being the liquid or the water *b*. I do not wish to be limited to the connection of the by-pass connected with the vessel *a*, as any connection that will make the valve in said by-pass subject to regenerated steam-pressure comes within the scope of my invention.

It is obvious that many changes may be made in the apparatus of my invention without departing from the spirit thereof, and I do not, therefore, 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, the following:

1. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a duct or opening for substantially maintaining the liquid at a given level, a steam-escape valve, said vessel having an outlet above said level for conveying steam from said vessel, a by-pass between a portion of the accumulator containing regenerated steam and said piping, and a valve in said by-pass subject to regenerated-steam pressure and pressure of steam within said piping to check backflow of liquid through said piping.

2. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a duct or opening for substantially maintaining the liquid at a given level, a steam-escape valve, said vessel having an outlet above said level for conveying steam from said vessel, a by-pass between a portion of the accumulator containing regenerated steam and said piping, and a valve in said by-pass for admitting regenerated steam to said piping to check the backflow of liquid through said piping.

3. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a duct or opening for substantially maintaining the liquid at a given level, a steam-escape valve, said vessel having an outlet above said level for conveying steam from said vessel, and a valve between said piping and a source of steam-pressure and subject to pressure of steam in said piping and said source to check the backflow of liquid through said piping.

4. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a duct or opening for substantially maintaining the liquid at a given level, a steam-escape valve, said vessel having an

outlet above said level for conveying steam from said vessel, and a valve between said piping and a source of steam-pressure to check the backflow of liquid through said piping.

5. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a duct or opening for substantially maintaining the liquid at a given level, a steam-escape valve, said vessel having an outlet above said level for conveying steam from said vessel, and a valve subject to regenerated-steam pressure and to pressure of steam within said piping and serving to check backflow of said liquid through the piping.

6. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a duct or opening for substantially maintaining the liquid at a given level, a steam-escape valve, said vessel having an outlet above said level for conveying steam from said vessel, and a valve subject to regenerated-steam pressure serving to check backflow of said liquid through the piping.

7. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a by-pass between a portion of the accumulator containing regenerated steam and said piping, and a valve in said by-pass subject to regenerated-steam pressure and pressure of steam within said piping to check backflow of liquid through said piping.

8. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, a by-pass between a portion of the accumulator containing regenerated steam and said piping, and a valve in said by-pass for admitting regenerated steam to said piping to check the backflow of liquid through said piping.

9. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, and a valve between said piping and a source of steam-pressure and subject to pressure of steam in said piping and said source to check the backflow of liquid through said piping.

10. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, and a valve between said piping and a source of steam-pressure to check the backflow of liquid through said piping.

11. In a steam-regenerative accumulator in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, and a valve subject to regenerated-

steam pressure and to pressure of steam within said piping and serving to check backflow of said liquid through the piping.

12. In a steam-regenerative accumulator
5 in combination, a vessel containing liquid as a heat-carrier, piping for directing steam into the liquid, and a valve subject to regenerated-steam pressure serving to check backflow of said liquid through the piping.

In witness whereof I hereunto subscribe to my name this 8th day of February, A. D. 1905.

AUGUSTE CAMILLE EDMOND RATEAU.

Witnesses:

P. J. A. CHALEIL,
JOHN BAKER,
EDWARD W. DIEUL.