No. 695,956. Patented Mar. 25, 1902.

E. SOLOMIAC.

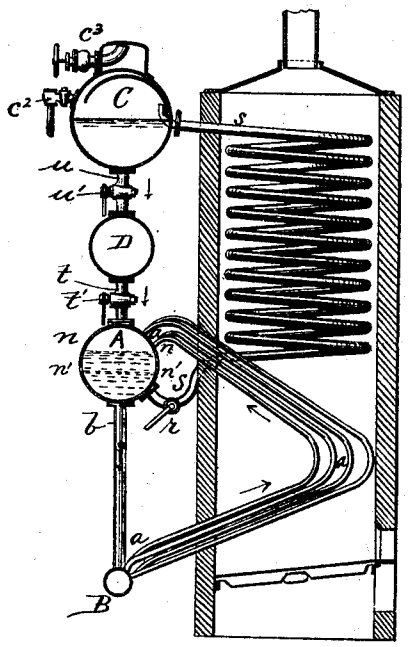
BOILER.

(Application filed Mar. 31, 1900.)

(No Model.)

6 Sheets—Sheet 1.

FIG. 1.



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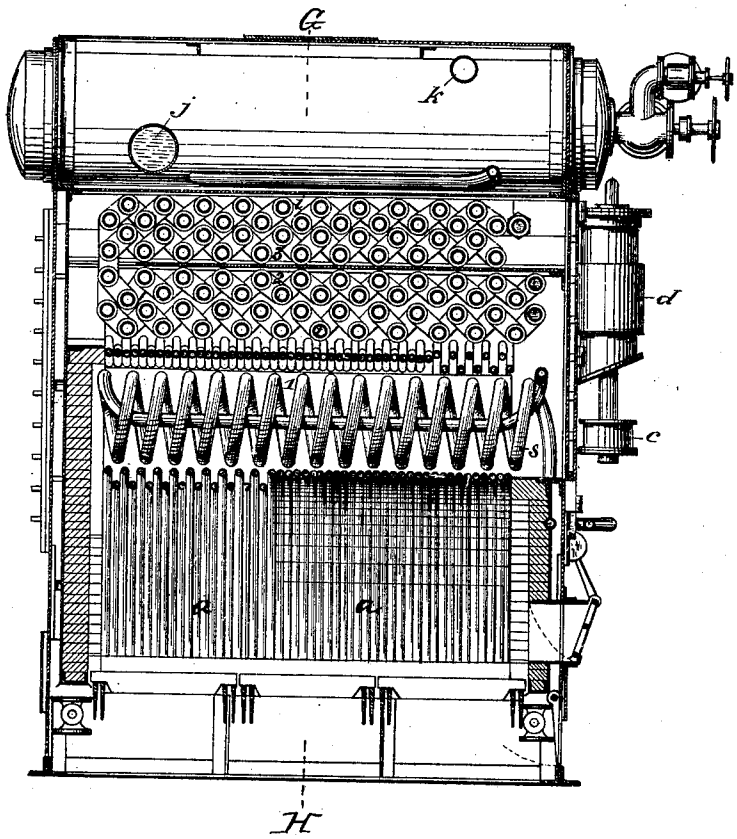
E. SOLOMIAC.

BOILER.

(Application filed Mar. 31, 1900.)

(No Model.) 6 Sheets--Sheet 2.

FIG. 2.



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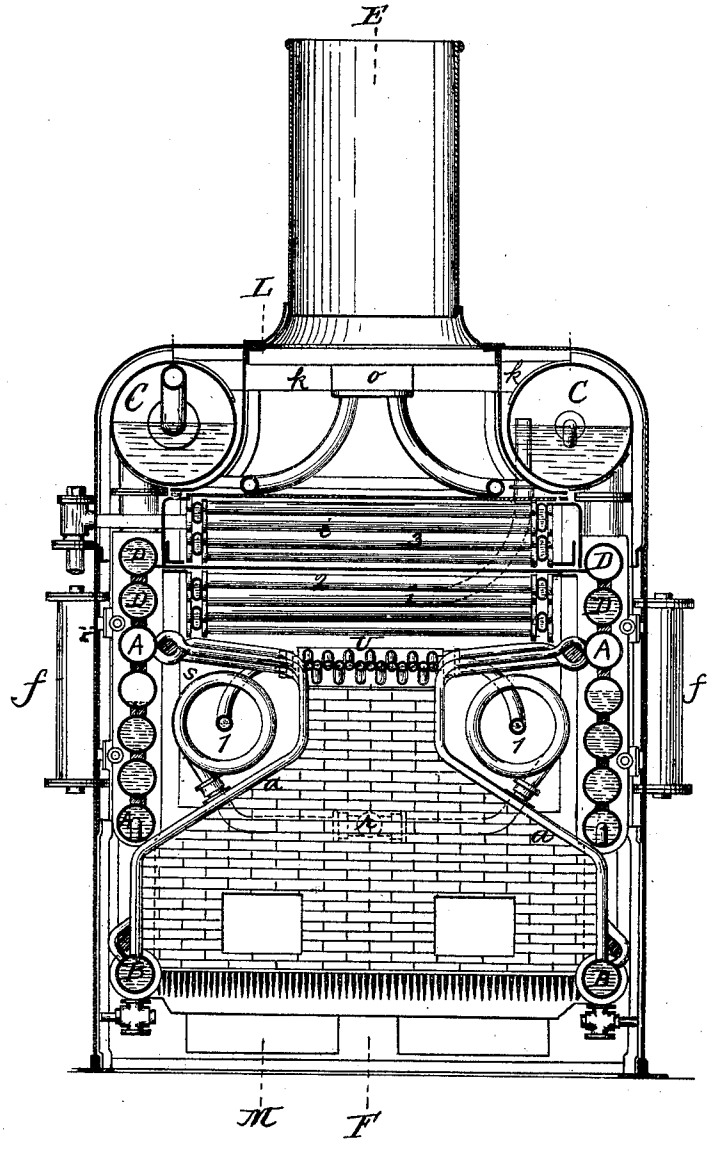
E. SOLOMIAC.

BOILER.

(Application filed Mar. 31, 1900.)

(No Model.) 6 Sheets—Sheet 3.

FIG. 3.



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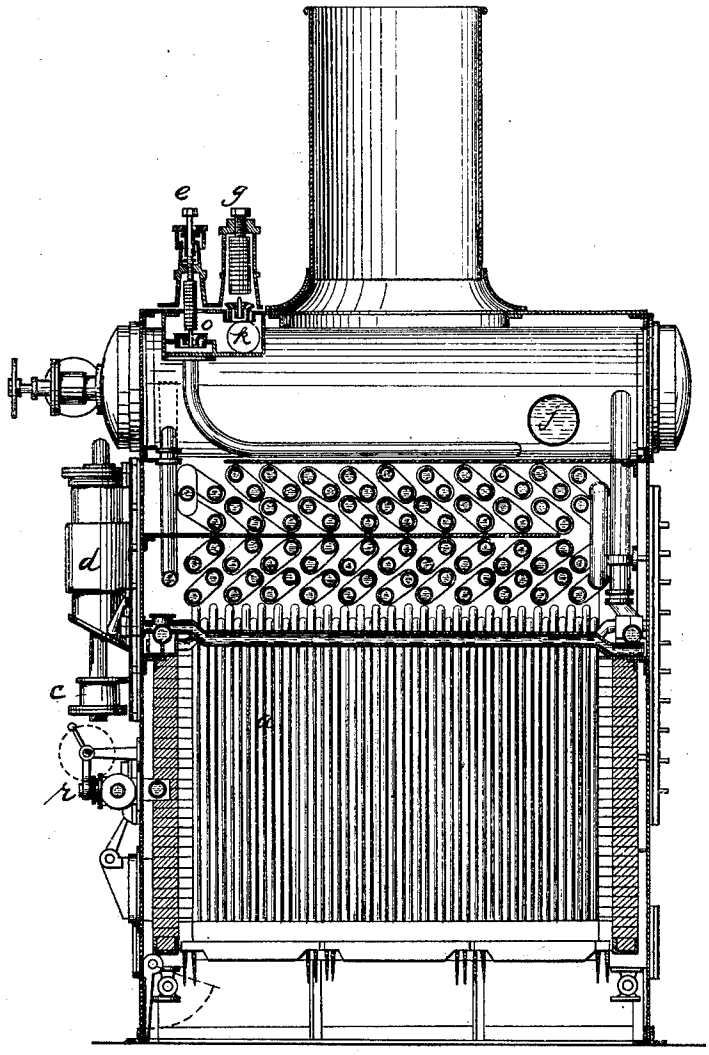
E. SOLOMIAC.

BOILER.

(Application filed Mar. 31, 1900.)

(No Model.) 6 Sheets—Sheet 4.

FIG. 4.



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No. 695,956. Patented Mar. 25, 1902.

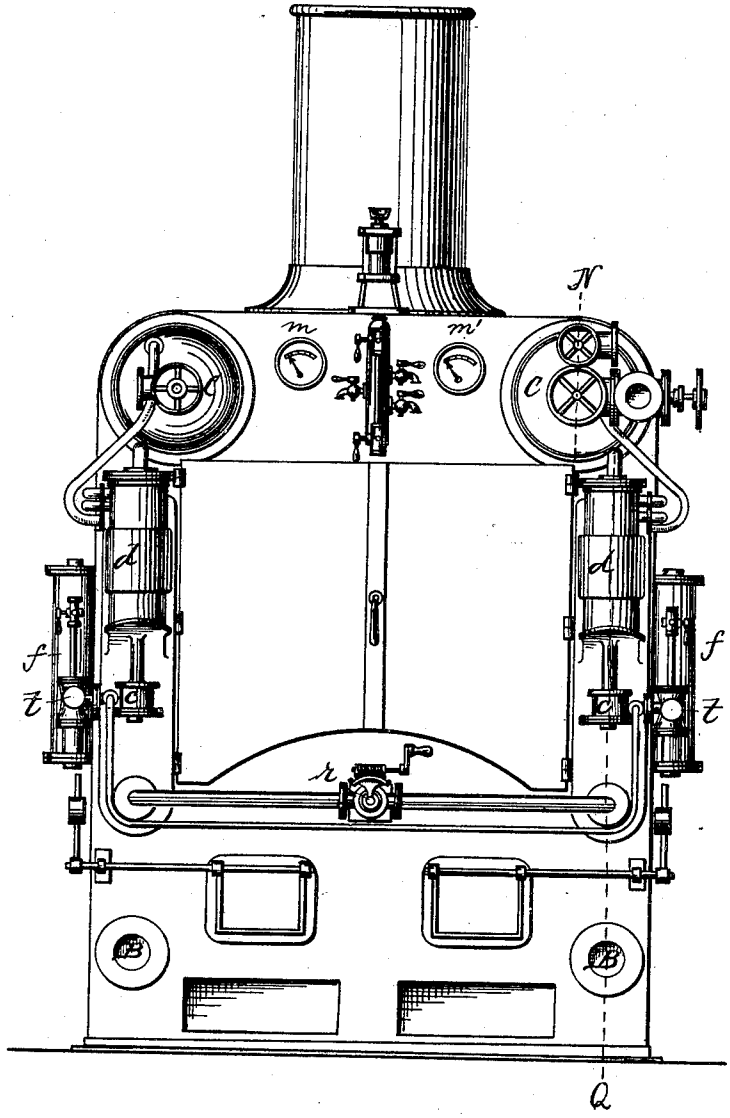
E. SOLOMIAC.

BOILER.

(Application filed Mar. 31, 1900.)

(No Model.) 6 Sheets—Sheet 5.

FIG. 5.



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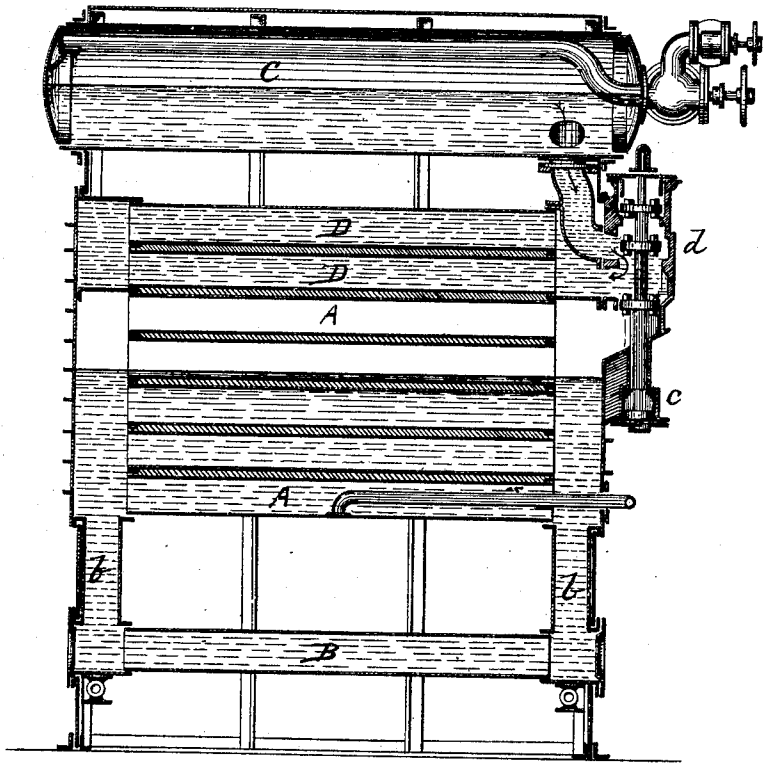
E. SOLOMIAC.

BOILER.

(Application filed Mar. 31, 1900.)

(No Model.) 6 Sheets—Sheet 6.

FIG. 6.



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UNITED STATES PATENT OFFICE.

EMILE SOLOMIAC, OF PARIS, FRANCE.

BOILER.

SPECIFICATION forming part of Letters Patent No. 695,956, dated March 25, 1902.

Application filed March 31, 1900. Serial No. 10,948. (No model.)

To all whom it may concern:

Be it known that I, EMILE SOLOMIAC, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Boilers, of which the following is a specification.

My present invention relates to improvements in boilers, and has for its object to provide an improved boiler, the principal or leading feature of the invention being to utilize the differences of the pressure or overpressure to obtain automatically a water circulation in the boiler.

The invention further consists in the devices for creating two or more pressures, which are necessary for securing the perfect circulation and for controlling the latter.

The improvements consist in the construction, novel combination, and arrangement of parts, fully described hereinafter, and specifically pointed out in the appended claims, reference being had to the accompanying drawings, wherein—

Figure 1 shows a diagram serving to explain the principle involved by the invention. Fig. 2 is a vertical longitudinal section on line L M of Fig. 3 through a marine boiler to which the invention is applied. Fig. 3 is a vertical transverse section on line G H of Fig. 2. Fig. 4 is a vertical longitudinal section on line E F of Fig. 3. Fig. 5 is a front elevation. Fig. 6 is a vertical longitudinal section on substantially line N Q of Fig. 5.

In the diagram of Fig. 1, A represents a steam-collector, B a water distributing or feed pipe in the vaporization system of tubes. *a a b b* are the return-pipes leading from the collector A to the distributer B. These parts, termed the "lower generator," constitute a system similar to those which are ordinarily constructed for torpedo-boats and is of similar operation. The vaporization-tubes *a a*, arranged in front of the firing, receive water at the bottom or base from the distributer B, and they discharge same, together with steam generated, into the collector A. Then the water flows back through the tube *b b* into the distributer B, from which it is again distributed into the vaporization system.

The reservoir C, which is larger than A, constitutes the main steam and water reservoir.

D is an intermediate smaller reservoir, the three reservoirs being placed at different heights, as shown. From the lower part of the collector A leads a winding pipe S S, connecting said collector to the reservoir C and forming the main heating-surface of the apparatus. Near the connection of said winding pipe with the collector A, I provide a cock r for establishing and intercepting the communication and for controlling the flow, as hereinafter described. The pressure or tension of the steam in the reservoir C is lower than that in the lower generator before referred to. Under these conditions when the cock r is turned on the water flows from the collector A into the reservoir C after circulating through the winding pipe S S at a velocity depending on the difference between the two pressures and on the relation of the area of the opening in the cock to the cross-section of said winding pipe. It will be seen that the proper manipulation of the cock r enables one to change the velocity of the water flow within the winding pipe as desired. Thus I obtain between the collector A and the reservoir C a continuous water circulation.

Now the water within the reservoir C at the lower pressure must be returned into the collector A at the higher pressure, for which purpose I provide the intermediate reservoir D, the function of which is that of a steam-balance chamber. Said reservoir is connected with the collector A by means of the tube t, having a suitable cock t' or equivalent, and to the reservoir C by means of another tube u, also provided with a cock u' and opening at the bottom of said reservoir C. The latter and the winding pipe S S, together with the cock r, constitute what I term the "upper generator" with contradistinction to the lower generator above described. The water is fed at c^2 and steam is taken off at c^3.

Operation: Assuming the water in the collector A to be on level $n n$, the cock t' is open, while the cock u' is closed, whereby the steam-chamber D is in communication with the collector A only, and therefore filled with steam at the higher pressure. The control-

ling-cock being open to a greater or less extent in accordance with the velocity of circulation to be obtained, the level n n will be lowered in the collector A and water will flow from the latter into the reservoir C through the winding pipe S S by the action of the differences of pressure. When said level begins to lower in the collector A, the cock t' is turned off and the cock u' turned on, whereby the excess of steam will flow into the reservoir C and I obtain the pressure in both reservoirs corresponding to that in reservoir C. Now water will flow from the reservoir C into D by the action of gravity, the chamber D being filled completely. During this action the level n n has lowered to n' n'. Now the cock u' is turned off and the cock t' turned on, the pressure in collector A being then quickly produced in the chamber D, from which water flows into the collector A, which discharges steam at the pressure therein into said chamber, whereby the level rises again to the line n n in the collector A when the areas of the water flow have been properly adjusted. Thus the return of water is effected by pulsations produced at regular intervals. Therefore the circulation is intermittent, which is not at all objectionable, since the parts securing such circulation are placed outside of the firing. On the other hand, the flow of water of the heating-surface formed by the winding pipe S S will be continuous and regular, which forms the principal features of the conditions to be obtained.

The lower generator operates independently of the upper generator, and its function is to maintain the pressure in collector A. To this end said generator must generate somewhat more steam than is necessary in order to obtain a constant discharge.

It will be understood that the cocks t' and u' may be operated automatically.

In the constructions shown in Figs. 2 to 6 the collectors A, chambers D, and distributers B are formed of superimposed tubes connected at each end by means of a vertical box, into which said tubes are suitably secured. The tubes a constitute a partition in the firing over one portion thereof, said tubes being arranged apart from each other over another portion for the passage of the combustion-gases. The tubes a, together with the collectors A, constitute a first flue for the return of the flame. In the free space above the firing and between the chambers D, I provide flues 2 3 of suitable cross-section and receiving a feed-water reheater formed of horizontally-coiled tubes i. The reservoirs C are connected by means of a lower tube j and an upper one k. The helicoidal winding tube S leads from the bottom of the collector A to the reservoir C. A series of interconnected tubes U, forming the top of the firing, is connected to said winding tube and the reservoirs C. r is the cock for controlling the water circulation. D represents the steam-chambers, communicating with the collectors or with the corresponding reservoirs through balanced cylindrical slide-valves actuated by means of pistons reciprocating in cylinders c. Receptacles f, secured outside of the collectors A, contain a float. These floats follow the oscillations of the water-line in the collectors A, and the up-and-down movements of said floats actuate the feed-valves t of the cylinders c. e is the valve of the lower generator, opening into a box O, communicating with the reservoirs C through the tube k. g is the valve of the upper generator, opening into the atmosphere. Two gages m and m', arranged on the front side, are connected with the lower generator and the upper generator, respectively. x represents the nozzles through which steam is taken off for the engine. z represents the nozzle through which steam is taken off for the feed-pump, and y is inlet-valve feed-water.

The quick circulation between the lower and upper generators is produced in the helicoidal winding tube S, arranged in the flues I and in the interconnected tubes U, forming the top of the firing and submitted to the radiations thereof. The improved boiler has a large firing, which is a principal condition for the obtaining of a good combustion, and the gases flow in opposite directions to the water in the winding tubes, as indicated by the arrows.

It is manifest that the form, size, and arrangement of the improved boiler may be changed or modified in various respects without departing from the scope of the invention. The firing may be arranged for burning coal or other solid material, as well as oil or other liquid and gaseous materials. The interconnected tubes may be formed of suitable reservoirs or otherwise and the lower and upper generators may be combined in any desired number and otherwise arranged without departing from the spirit of the invention.

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

1. The combination with a lower reservoir, a water-distributer arranged below the reservoir, a connection between the lower part of the reservoir and the distributer, and a connection between the latter and the upper part of the reservoir, of an upper reservoir, a valved connection between the lower part of the lower reservoir and the upper part of the upper reservoir, and means for heating the connection between the two reservoirs and between the water-distributer and the upper part of the lower reservoir.

2. The combination with a lower reservoir, a water-distributer arranged below the reservoir, a connection between the lower part of the reservoir and the distributer, and a connection between the latter and the upper part of the reservoir, of an upper reservoir, a valved connection between the lower part of

the lower reservoir and the upper part of the upper reservoir, a reservoir located intermediate the two first-named reservoirs, a valved connection between the lower reservoir and the intermediate reservoir, a valved connection between the upper reservoir and the intermediate reservoir, and means for heating the connection between the lower part of the lower reservoir and the upper part of the upper reservoir and the connection between the water-distributer and the upper part of the lower reservoir.

In testimony whereof I have hereunto set my hand in presence of two witnesses.

EMILE SOLOMIAC.

Witnesses:

ADOLPHE STURM,

EDWARD P. MACLEAN.