(No Model.)

L. E. SOLIGNAC.

STEAM BOILER.

No. 592,891. Patented Nov. 2, 1897.

FIG. 1

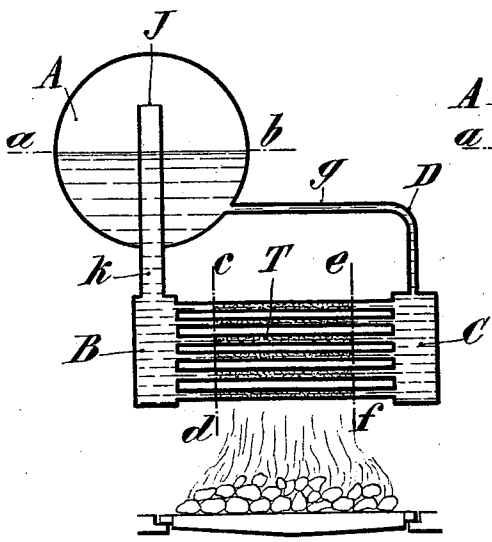
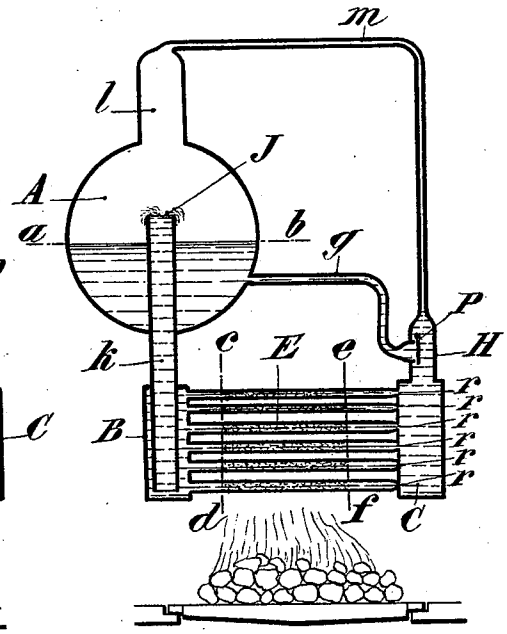


FIG. 2



Witnesses:
L. M. Hashchleger,
Fred. C. Howe.

Inventor
Louis E. Solignac,
By Briesen & Knauth
his Attorneys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

LOUIS EDMOND SOLIGNAC, OF PARIS, FRANCE.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 592,891, dated November 2, 1897.

Application filed December 21, 1896. Serial No. 616,432. (No model.) Patented in France April 16, 1896, No. 255,609.

To all whom it may concern:

Be it known that I, LOUIS EDMOND SOLIGNAC, of the city of Paris, France, have invented Improvements in Steam-Boilers, (for which I have obtained Letters Patent in France for fifteen years, dated April 16, 1896, No. 255,609,) of which the following is a full, clear, and exact description.

Circulation has heretofore been obtained in boilers in two ways—viz., by the force of gravity or by propulsion effected by means of a pump or ejector; but experience has shown that besides giving rise to serious objections these means cannot produce an active circulation.

This invention, which forms the subject of the present application for Letters Patent, has for its object to remedy these objections, and in order that its advantages over the means above mentioned may be readily understood I have illustrated, in—

Figure 1 of the accompanying drawings, a type of boiler wherein the circulation is dependent on the action of gravity. Fig. 2 illustrates the principle of my improved system, the means employed being represented diagrammatically in both figures.

In the arrangement of parts shown in Fig. 1 it will be seen that the water in the position of rest fills all the parts of the apparatus below the water-level *a b* in the vessel A. In heating the nest of tubes T there is produced at their central part, which is the most exposed to the furnace heat and which part may be considered as comprised between the two planes *c d* and *e f*, globules of steam, tending to simultaneously force the water into the pipe *g*, which supplies this water to the header C, and also into the header B, connected with the discharge-pipes K, whose upper ends open at J into the steam-space A. The pipes K rising above the level *a b* in chamber A, great resistance is opposed to the discharge of the water on account of the difference of level of the water and of overflow-mouth J. The consequence of this twofold flow is that the circulation of the steam takes place in the reverse direction to that which had been intended, the pressure in header C and pipe *g* being less than that in header B in consequence of the difference of height of the water-level and of the orifice of pipe K.

Every time that the header B is emptied equilibrium is established between the globules or pockets of steam in the nest of tubes and the chamber A, in which case by the action of gravity a fresh quantity of water rushes into the nest of tubes and header B and causes a repetition of the objection above indicated. The tubes T are therefore subjected to successive superheatings during the period of upward flow and sudden coolings after the return of the water, the effect being to prejudice the strength of the tubes. Attempts have been made to remedy the objection by placing in the water-supply pipe—at D, for example—a circulation apparatus, such as a pump, ejector, &c.; but when the water circulating in the apparatus attains the temperature corresponding to the pressure a pump acts imperfectly and the delivery is so reduced as to be insignificant, while an ejector is incapable of working at such high temperatures.

The apparatus which I have invented and which forms the subject of the present application avoids the objections to the methods hereinbefore explained and is represented in Fig. 2 of the accompanying drawings.

The apparatus comprises, first, a chamber A, forming a reservoir of water and steam; second, an assemblage of tubes E in connection by their opposite ends with the headers B and C, the end of each tube where it enters the header C being provided with a reducing-ferrule; third, one or more pipes K, extending down to near the bottom of header B and upward into the steam-chamber A to point J; fourth, a pipe *g*, connecting header C with chamber A, the lower end of said pipe opening into a box H, provided with a balanced non-return valve *p* for preventing the water passing from C to A; fifth, a relief-pipe *m* of small diameter connecting valve-box H with the crown of a dome 1, rising from reservoir A. Thus arranged, on heating the tubes there is also formed in the portion comprised between the planes *c d* and *e f* pockets or globules of steam which tend to force the water into the headers B and C, whence it rises simultaneously in pipes *k* and *m*, and the balanced valve *p* in box H closes. Owing to the small sectional area of pipe *m* the rise therein of the

water to the level of J only necessitates a very slight backward flow of the water in the tubes E. The reducing-ferrules *r* considerably retard the flow of the water in the reverse direction to that of the normal circulation. This is important, as the choking of the sectional area of the tubes at the ferrules assists in directing the flow of the water through pipe K. Thenceforth the backward flow ceases, and the steam, having for abutment the valve *p* and the liquid column which rises in relief-tube *m* and the ends of the ferrules, drives out into reservoir A the whole of the liquid contained in header B. Equilibrum of pressure is then established between the tubes and valve-box H at the back of the valve *p*. The valve now opens, permitting the refilling of the header C, the ferrules allowing the water to flow freely during the period of equilibrum, and thenceforth the circulation is definitely established in the predetermined direction. The ferrules further serve to limit to the minimum requisite for insuring an efficient vaporization the quantity of water in action, and consequently facilitate the operation of discharge through pipe K.

I claim—

1. In a steam-boiler, the combination of a series of steam-generating tubes, each provided at its front end with a constricted opening for the purpose of retarding the flow of water in the reverse direction to that of the normal circulation and also to assist in directing the flow through the circulation-pipes, a receiver for the fluid which has traversed the generating-tubes, and a pipe independent of the circulating-pipes and of smaller diameter than the generating-tubes leading from the feed of the generating-pipes to the steam-chamber and connecting with a dome on the reservoir, all as hereinbefore described and for the purpose specified.

2. In a steam-boiler, the combination of a series of steam-generating tubes, circulating-pipes connected with said generating-tubes and with a reservoir, a balance-valve in the path of said circulating-pipes, said valve being adapted to close when fluid passes in one direction through said circulating-pipes and to open when the fluid passes in an opposite direction, and a relief-pipe in communication with the chamber of the valve and with the reservoir, substantially as described and for the purposes specified.

The foregoing specification of my improvements in steam-boilers signed by me this 8th day of December, 1896.

LOUIS EDMOND SOLIGNAC.

Witnesses:

EDWARD P. MACLEAN,

HENRI MULLER.