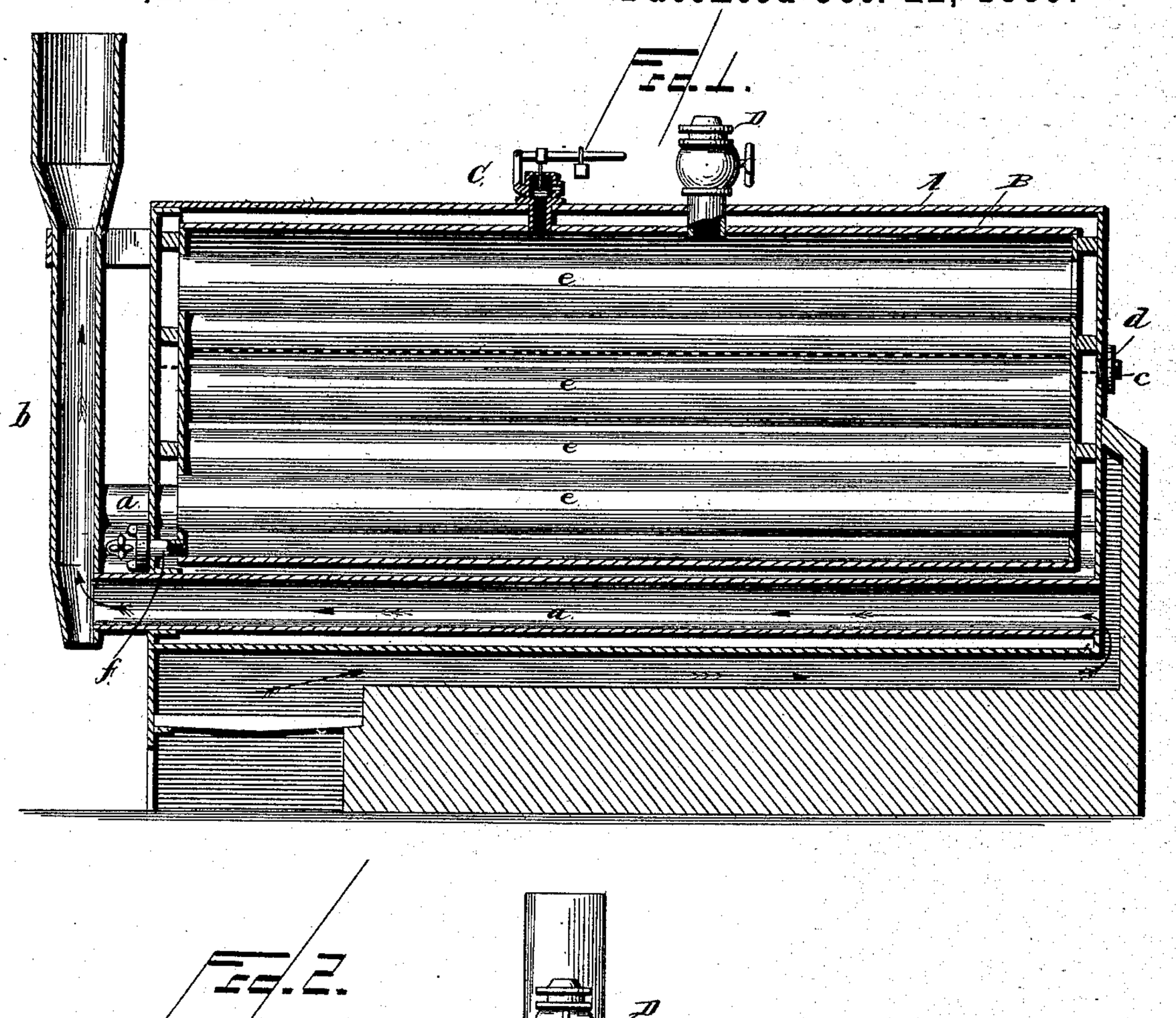
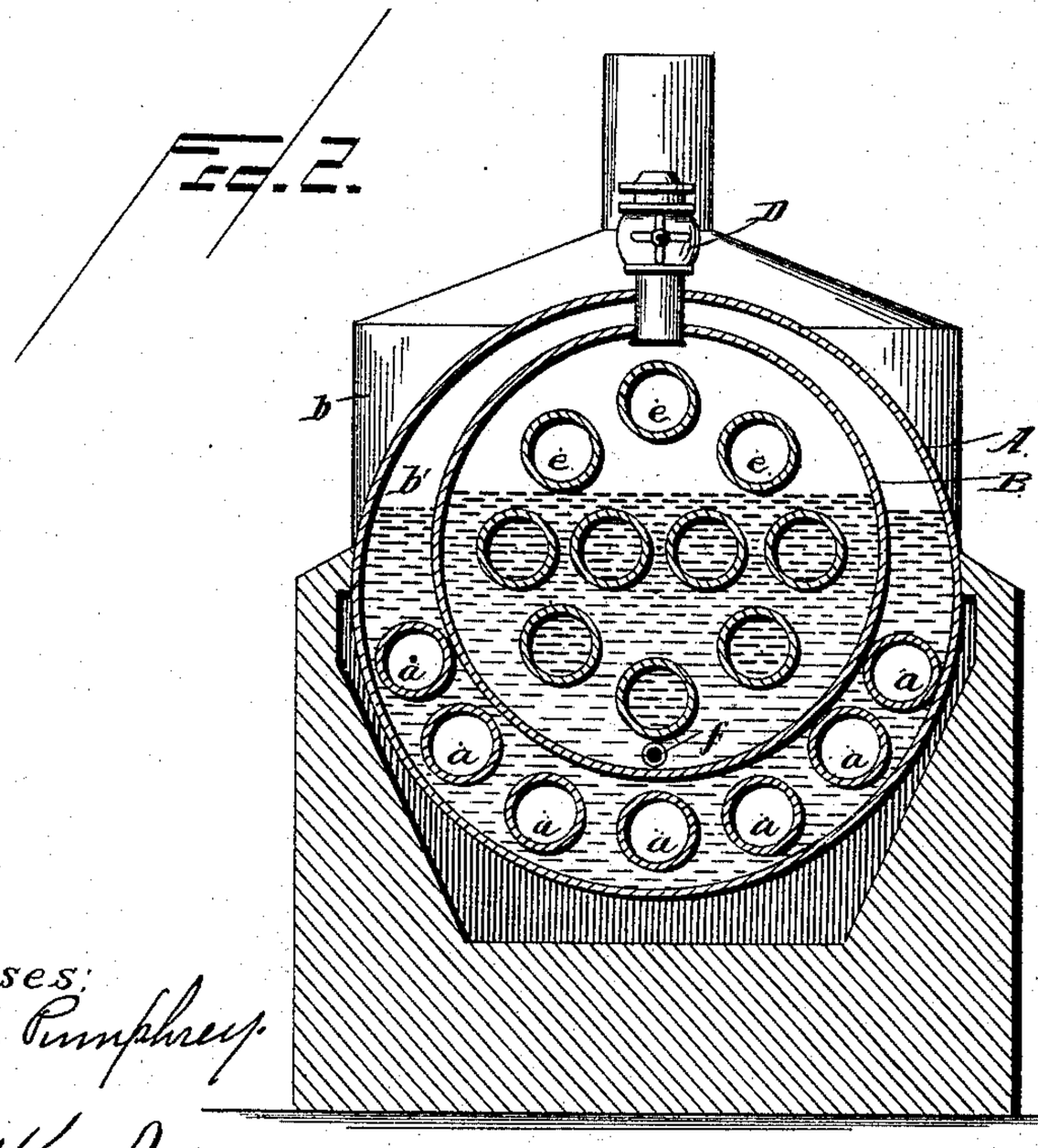
(No Model.)

S. W. LUDLOW.

SAFETY STEAM GENERATOR.

No. 413,284. Patented Oct. 22, 1889.





Witnesses:
Walter H. Pumphrey.
Saml Ker, Jr.

Inventor
S. W. Ludlow
By Johnston, Reindel & Dyer
Attorneys

UNITED STATES PATENT OFFICE.

SAMUEL W. LUDLOW, OF MADISONVILLE, ASSIGNOR OF ONE-THIRD TO JOHN R. BROWNELL, OF DAYTON, OHIO.

SAFETY STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 413,284, dated October 22, 1889.

Application filed February 16, 1889. Serial No. 300,116. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL W. LUDLOW, a citizen of the United States, residing at Madisonville, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Safety Steam-Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to steam-generators, and has for its object an improved construction whereby greater safety is assured than in ordinarily-constructed steam-generators.

In the practical operation of steam-generators the largest percentage of explosions which occur are traceable to low water or the absence of water, which causes the metal to be excessively heated. The frequent overheating of the metal operates upon its fiber, reducing its tensile strength and rendering it liable to rupture under a very slight excess of pressure, or the introduction of cold water upon the overheated surface, when it is suddenly flashed into steam or gas. Practice has also demonstrated that boilers whose outer surface is exposed to the direct action of the products of combustion in a furnace, and from which a motor fluid is drawn, are frequently coated with calcareous matter, which prevents the water in the boiler from coming in contact with the inner surface thereof, and causes an effect similar to an absence of water. Again, the calcareous deposit or incrustation frequently becomes disengaged from the metal, suddenly exposing it to the action of the pressure within or the cold water, and results in bulging the metal, if not in an absolute rupture of the same.

The first-named cause of explosions—namely, low water—is due largely to the fact that comparatively few skilled engineers are employed for running or operating small boilers, and that persons employed in this capacity are frequently required to perform other duties, which necessitates their absence from the boiler, and from this cause their attention is diverted, the water in the boiler falls below the line established for safety, and the metal becomes burned. The second cause is due to the deposit of mud and calcareous matter in the water which is constantly pumped into the boiler to supply steam, coating the inner surface of the shell and the fire-tubes. By my invention both of these causes are removed and a boiler or steam-generator produced which is absolute proof against injury to the fiber of the metal by overheating, and in which incrustation cannot occur.

The invention will be hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, which form part of this specification, Figure 1 represents a vertical longitudinal section of a steam-generator embodying my invention, and Fig. 2 a vertical transverse section thereof.

Reference being had to the drawings and the letters thereon, A indicates an outer vessel, which is provided with a series of horizontal fire-tubes *a*, which communicate with the uptake in the stack *b*. The vessel A is filled with water to about the line indicated at *b'* through an aperture *c*, and is then hermetically sealed by a plug *d*. Within the vessel A is a steam-generator B, which is provided with a series of flues *e*, the majority of which are immersed, with the generator, in the water in the vessel A, and through which the water circulates freely. The steam-generator is suitably supported within the vessel A, so as to be enveloped by water and steam when in operation, and is provided with a feed-water pipe *f*, a safety-valve C, a steam-supply pipe D, and the usual appurtenances of a steam-generator, such as a sight-gage, gage-cocks, &c. (Not shown.)

Any liquid which will vaporize and conduct the heat of the products of combustion to the steam-generator B may be used in the outer vessel A. By the construction shown the water in the vessel A is used as a medium to conduct the heat of the products of combustion to the water in the steam-generator, is vaporized and surrounds the upper part thereof and the body of water is unchanged, thereby reducing the possibility of the formation of any incrustation to the minimum. The water for the outer vessel should be purified by filtration, distillation, or by chemical treatment before being introduced into the vessel, especially in large vessels. This body of wa-

ter being inclosed in a hermetically-closed vessel and used only as a heat-transmitting medium, the water-line cannot vary to any appreciable extent, and the danger due to exposing the metal to the products of combustion without being properly covered with water on the inside is entirely removed.

Having thus fully described my invention, what I claim is—

1. A steam-generator within a hermetically-sealed vessel exposed to direct heat and surrounded by a fluid in the hermetically-sealed vessel through which the heat is transmitted, substantially as described.

2. A steam-generator consisting of an outer vessel hermetically sealed and containing a heat-transmitting fluid, and an inner vessel containing a vaporizable fluid and surrounded by the fluid in the outer vessel, substantially as described.

3. A steam-generator consisting of an outer vessel hermetically sealed, having a series of fire-tubes extending through the body thereof, an inner vessel provided with flues, and a vaporizable fluid in which the inner vessel is enveloped, substantially as described.

4. A steam-generator consisting of an outer vessel hermetically sealed and containing vaporizable heat-transmitting fluid, and an inner vessel for generating steam as a motor or other power enveloped by said fluid, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

SAMUEL W. LUDLOW.

Witnesses:
S. A. TERRY,
D. C. REINOHL.