L. KNIGHT.

Circulating Steam-Boiler.

No. 163,082. Patented May 11, 1875.

Fig. 1.

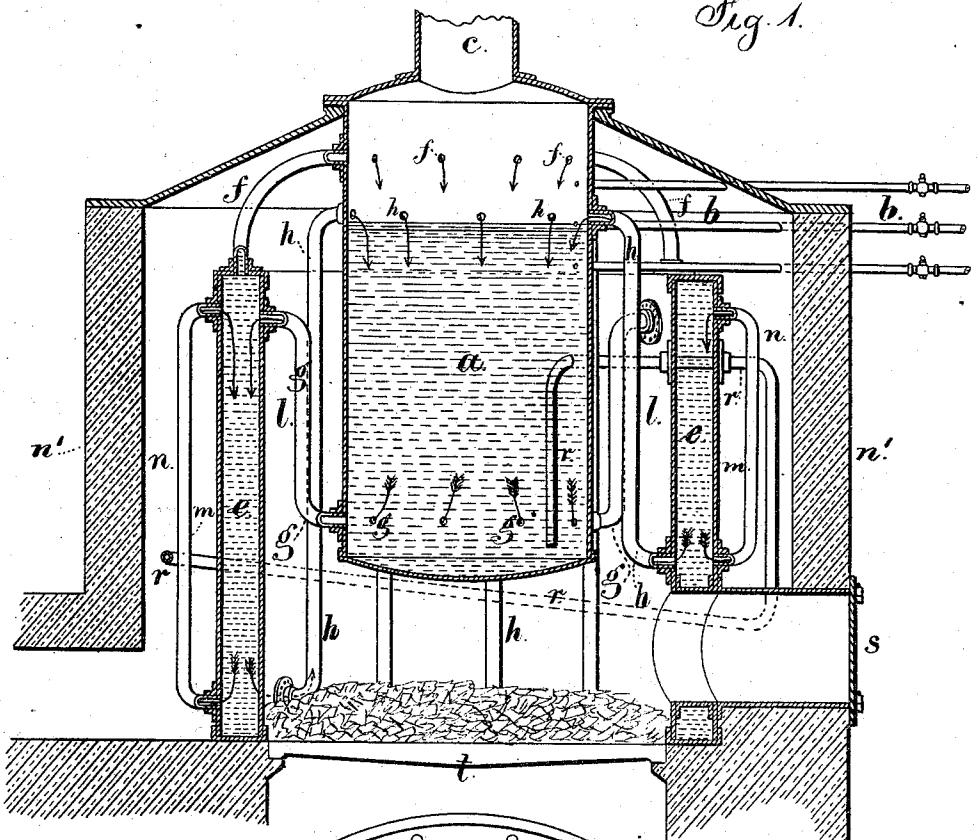
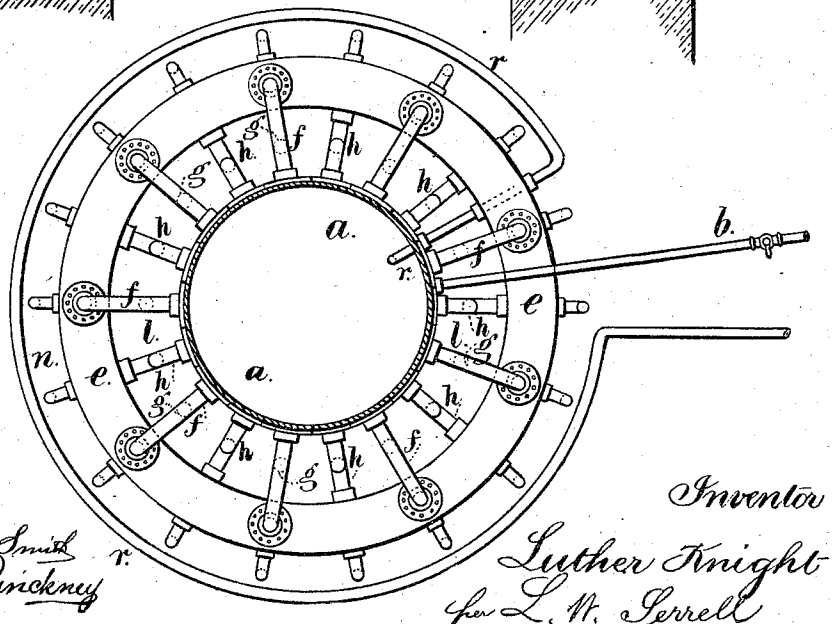


Fig. 2.



Witnesses.

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UNITED STATES PATENT OFFICE.

LUTHER KNIGHT, OF ARLINGTON, VERMONT.

IMPROVEMENT IN CIRCULATING STEAM-BOILERS.

Specification forming part of Letters Patent No. **163,082**, dated May 11, 1875; application filed February 9, 1875.

To all whom it may concern:

Be it known that I, LUTHER KNIGHT, of Arlington, in the State of Vermont, have invented an Improvement in Steam-Generators, of which the following is a specification:

In this generator there is a central vessel, that is connected, by pipes, with a surrounding annular boiler. The heated products of combustion pass up between the central vessel and annular boiler, and return downward within an inclosing-case. There are circulating-pipes outside the annular boiler, and pipes from the top of the annular boiler to the steam-space of the central vessel, so that there will be a circulation, and any steam will escape, and the annular boiler will remain full, because the water-line is above the top thereof. The pipes that are inserted between the central vessel and annular boiler pass from the upper portion of one to the lower portion of the other, so that a circulation will be maintained of the water in the two vessels.

In the drawing, Figure 1 is a vertical section of the generator, and Fig. 2 is a plan of the same with the outer case removed.

The central vessel *a* is of a suitable size. The upper portion forms the steam-space, and the gage pipes and cocks *b* serve to indicate the height of the water, which should not be allowed to descend below the lower gage-cock. The steam is conveyed away by the pipe *c*. The annular boiler *e* is made of two cylindrical shells, united by ring-plates at top and bottom, and from the top of the annular boiler the pipes *f* pass to the steam-space of the central vessel *a*. Circulating-pipes *g* and *h* are applied in the flue *l* between the vessel *a* and annular boiler *e*. One set, *g*, starts from near the bottom of the central vessel *a*, and enters near the top of the boiler *e*. The other set commences near the bottom of *e*, and connects with *a* above the water-line. These tubes being in the flue, the water in them becomes more highly heated than the water in either the annular boiler *e* or central vessel *a*; hence there is an upward circulation in these tubes *g h*, tending to produce a downward circulation in the respective vessels *a e*, as indicated by the arrows, Fig. 1. The upper ends of the tubes *f h* will generally be above the water-line, and the circulating hot water will issue in jets; hence the steam will pass away from the same more freely than from the ordinary flat surface of the water. Outside the annular boiler *e* are the circulating-tubes *m*, that are connected at their upper and lower ends to the said boiler *e*, and these tubes *m*, being in the outer flue *n*, between the boiler *e* and wall or flue-case *n'*, absorb considerable heat, and aid in heating the water.

The circulation of the water through all parts of the boiler prevents the deposit of sediment, and lessens the risk of any portion burning out from the heat expelling water therefrom, and the risk of explosion is lessened, because a constant circulation is maintained.

This steam-generator is very simple and compact, and exposes a very large surface to the action of the heat.

The feed-water is forced into the boiler through the tube *r*, that surrounds the flue *n*, and then passes down within the central vessel *a*, nearly to the bottom thereof, so that the coolest water is brought to where the fire is the most direct-acting.

The fire-door *s* and grate-bars *t* are of usual character, and the products of combustion escape by the flue *u*.

I do not claim annular boilers, as these have been used with a central cylinder and intermediate circulating-pipes.

I claim as my invention—

1. The central vessel *a*, annular boiler *e*, and circulating-tubes *g*, passing from near the lower part of the vessel *a* to the upper part of the boiler *e*, in combination with the tubes *h*, that connect, from the lower part of the boiler *e*, to the vessel *a* near or above the water-line, as and for the purposes set forth.

2. The circulating-pipes *f*, passing from the top of the annular boiler *e* to the central vessel *a* above the water-line, in combination with the circulating-pipes *g*, as set forth.

Signed by me this 13th day of January, 1875.

LUTHER KNIGHT.

Witnesses:

GEORGE H. PHILLIPS,

CHARLES A. BUNDY.