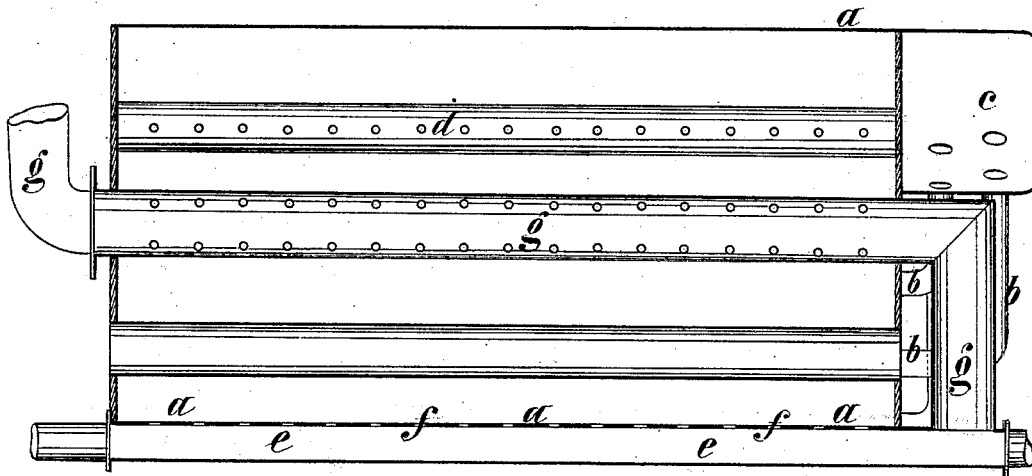


L. KNIGHT.  
 Steam-Boilers.

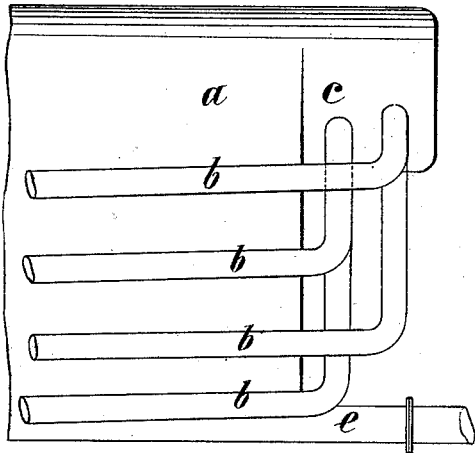
No. 209,899.

Patented Nov. 12, 1878.

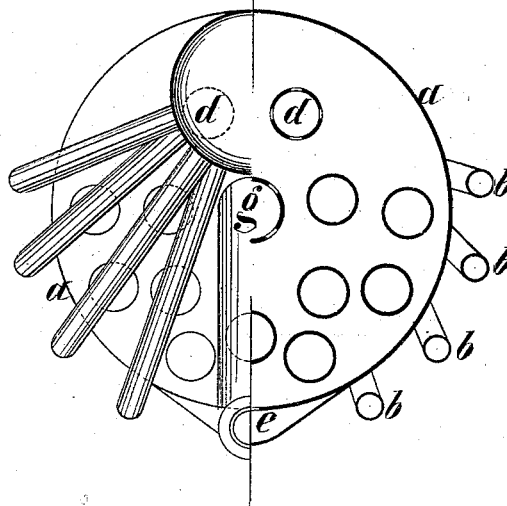
*Fig. 1*



*Fig. 2*



*Fig. 3*



*Witnesses*  
*L. G. Garretson*  
*R. L. Garretson*

*Inventor:*  
*Luther Knight*  
*Amos S. ...*

# UNITED STATES PATENT OFFICE.

LUTHER KNIGHT, OF ARLINGTON, VERMONT, ASSIGNOR OF ONE-HALF HIS  
RIGHT TO WILLIAM C. ALLEN, OF CAMBRIDGE, NEW YORK.

## IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **209,899**, dated November 12, 1878; application filed  
November 1, 1877.

*To all whom it may concern:*

Be it known that I, LUTHER KNIGHT, of Arlington, in the State of Vermont, have invented certain new and useful Improvements in Steam-Boilers, of which the following is such a full, clear, and exact description as will enable any one skilled in the arts to which it most nearly appertains to make and use the same, reference being had to the annexed drawing, making part of this specification, in which—

Figure 1 is a longitudinal vertical section through a cylindrical tubular boiler with my improvements applied thereto. Fig. 2 is a side elevation of the same; and Fig. 3 shows an end elevation of one-half of the boiler, and also a transverse section of one-half thereof, showing the relation of the pipes and tubes inside and outside of the boiler.

The object of my invention is, first, to enlarge the heating-surface of the boiler; second, to perfect the circulation of the water in the boiler; third, to more perfectly collect the sediment and dirt deposited by the water and expel it from the boiler; and my invention consists of a series of pipes or tubes applied to the outside of the boiler in the heating chamber or flue, and arranged to communicate with the water-space of the boiler at both ends thereof, by which the tubular heating-surface of the boiler will be enlarged equal to the external surface of the tubes or pipes applied; and my invention consists, also, of a peculiar application of said pipes or tubes, in combination with one or more perforated tubes leading to and connecting with said pipes through a closed water dome or receiver, by which the circulation of the water in the boiler will be greatly improved; and my said invention consists, also, of a dirt or mud receiver or collector applied to the outside of the shell of the boiler and to the bottom side thereof, in combination with a series of perforations made in the shell of the boiler, to communicate with said receiver, and in combination, also, with a perforated tube or tubes in the boiler, arranged about at the water-surface of the boiler, and connected to said mud-receiver at both ends by suitable pipes, cocks, and valves, for the

purpose of collecting the sediment and dirt at the surface of the water and expelling it from the boiler, along with the mud settled in the bottom receiver, by opening a cock in a pipe provided for that purpose.

The shell of the boiler is shown in the drawing by *a*. The tubes applied to the outside of the boiler to enlarge the heating-surface thereof are shown by *b*. One end of these tubes enter the shell of the boiler near the front end thereof, and unite in the water dome or receiver, (shown by *c*.) The perforated tubes of the boiler, leading to the water-dome and connecting the water-space of the boiler at its rear end with the external pipes or tubes, are shown by *d*. The mud-collector at the bottom of the boiler is shown in the drawing at *e*, and the perforations in the bottom of the boiler at *f*. The perforated pipe or tube connecting to the mud-receiver, with the sediment upon the water-surface, is shown by *g*. This pipe is to be fitted with any of the well-known cocks or valves suitable for the purpose of operating the invention.

The front end of the pipe *g* is to be connected to the steam-space of the boiler and fitted with a suitable valve to start the circulation through the mud-receiver and blow-off.

From the foregoing description, the operation of the boiler will be apparent to those skilled in the art of steam-engineering. No special description, therefore, of the operation is necessary.

The idea of enlarging the evaporating power of a steam-boiler by combining tubes therewith in the fire-flue, and of increasing the circulation of the water through the agency of such tubes, is well known, and has been frequently practiced, and the idea of blowing the mud and sediment out of the boiler by means of pipes arranged in various ways has also been practiced. I do not therefore intend to claim the use of these devices, nor the practical application of these ideas, broadly; but

I claim as my invention—

1. The exterior pipes, *b*, in combination with the receiver *c* at the end of the boiler, and in combination with it, by which the combined circulation of the water in all the tubes is con-

centrated in said receiver, at the same time enlarging the heating-surface, the whole to be constructed and operated substantially as described.

2. The combination of tubes *b* outside of the boiler with perforated tubes *d* in the steam-space thereof, for the purpose of separating or breaking the water and perfecting its circulation and evaporation.

3. The horizontally - arranged perforated pipes *g*, the mud-collector *e*, and the perforated

bottom of the boiler, in combination, the parts being connected substantially as described, by which the mud is collected in the chamber at the bottom of the boiler, and by which the sediment is at the same time collected off of the surface of the water and blown out through the mud-chamber with the mud.

LUTHER KNIGHT.

Witnesses:

FRANKLIN SCOTT,  
D. D. O'BRIEN.