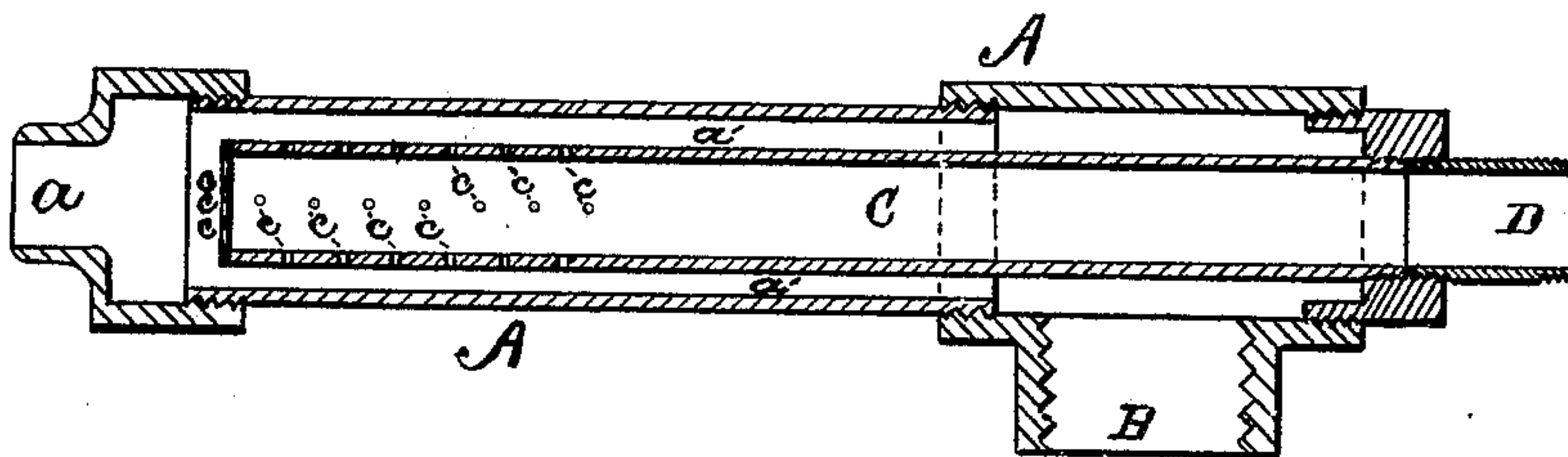


R. THRUSH.

HEATERS FOR STEAM BOILERS.

No. 176,381.

Patented April 18, 1876.



Witnesses.  
John C. Tunbridge  
A. D. Wagner

Inventor.  
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# UNITED STATES PATENT OFFICE

ROBERT THRUSH, OF NEW YORK, N. Y.

## IMPROVEMENT IN HEATERS FOR STEAM-BOILERS.

Specification forming part of Letters Patent No. **176,381**, dated April 18, 1876; application filed February 1, 1876.

*To all whom it may concern:*

Be it known that I, ROBERT THRUSH, of the city, county, and State of New York, have invented certain new and useful Improvements in Heaters for Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The object of my invention is to heat the feed-water of steam-boilers, and to utilize the exhaust steam for this purpose; and this I accomplish by means of the apparatus illustrated in the accompanying drawing, which shows the same in longitudinal section.

A and C are two concentric pipes, the inner pipe C extending nearly the length of the outer pipe A, which communicates with a pump or injector at the end *a*, is closed at the opposite end, through which the pipe C passes, and communicates through a lateral branch, B, with a pipe leading from the exhaust-pipe of a steam-engine. The pipe C communicates with a water-supply or reservoir, and may have at or near its end a series of perforations, *c*, through which water is discharged into the pipe A in fine streams. The exhaust steam admitted to the outer pipe flows through the annular chamber *a'*, and in its rapid passage strikes the streams of water, breaking them up, subdividing them so that there is a thorough contact between the particles and the steam, which is thus rapidly deprived of its heat, the water being heated to a high degree with a corresponding rapidity as it passes with the steam from the apparatus to the pump or injector.

It will be seen that the inlet B is so situated that the steam must flow nearly the entire length of the pipe C before coming in direct contact with the water, whereby the water in the pipe C is heated before it passes there-

from, so that in some instances it is sufficient to enject the water from the end of the pipe without subdividing it.

The chief feature of my invention is the construction, whereby a practicable feed-water heater is afforded without the use of the usual cumbersome casings, which, in many instances, cannot be employed.

It will be seen that this result is effected by employing concentric tubes but little if any larger in diameter than the exhaust-pipe, constructed so as to be connected to the latter and to the water-pipe without any other fittings than are requisite to screw the several pipes together.

I am aware that condensers have been made with plain and perforated tubes extending within enlarged casings; but these are necessarily bulky and expensive to apply, while, owing to the construction of my improved heater, it may be made of a size to constitute a salable article of manufacture as easily applied and removed, in the line of any pipe, and supported thereby as an ordinary valve-cock.

Without claiming, broadly, a steam-casing inclosing a feed-water tube, I claim as my invention—

As a new article of manufacture, a feed-water heater, consisting of an outer steam-pipe, its inlet B, and nozzle *a*, at the end, and the inner water-pipe C extending through the steam-pipe, through the narrow annular steam-chamber *a'*, and open or perforated at the end, all constructed substantially as described, to pass the exhaust steam through the narrow annular space between the pipes, and discharge the steam and water through the end nozzle *a*.

In testimony that I claim the foregoing as my own I hereto affix my signature in presence of two witnesses.

ROBERT THRUSH.

Witnesses:

OLIVER DRAKE,  
JOHN C. TUNBRIDGE.