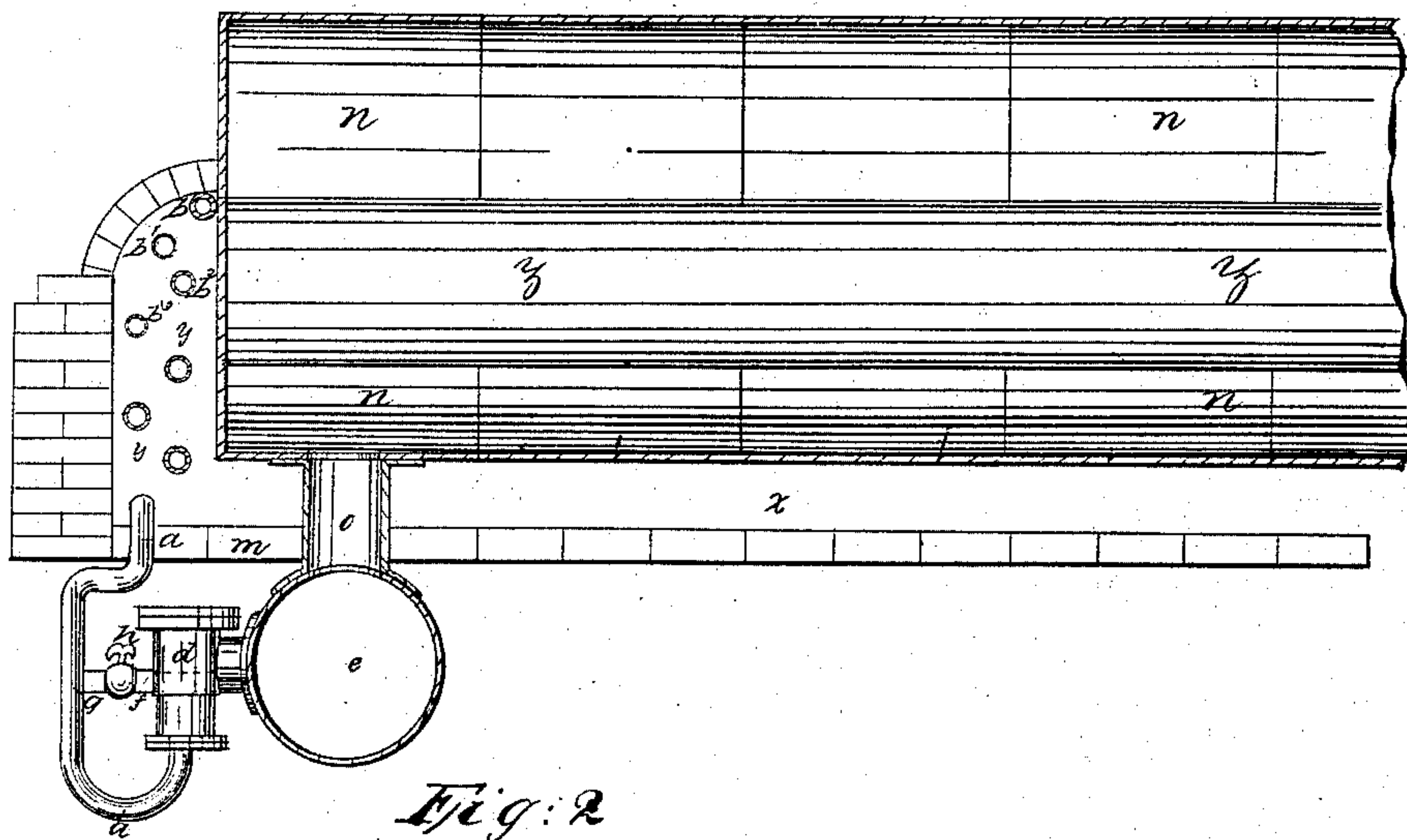
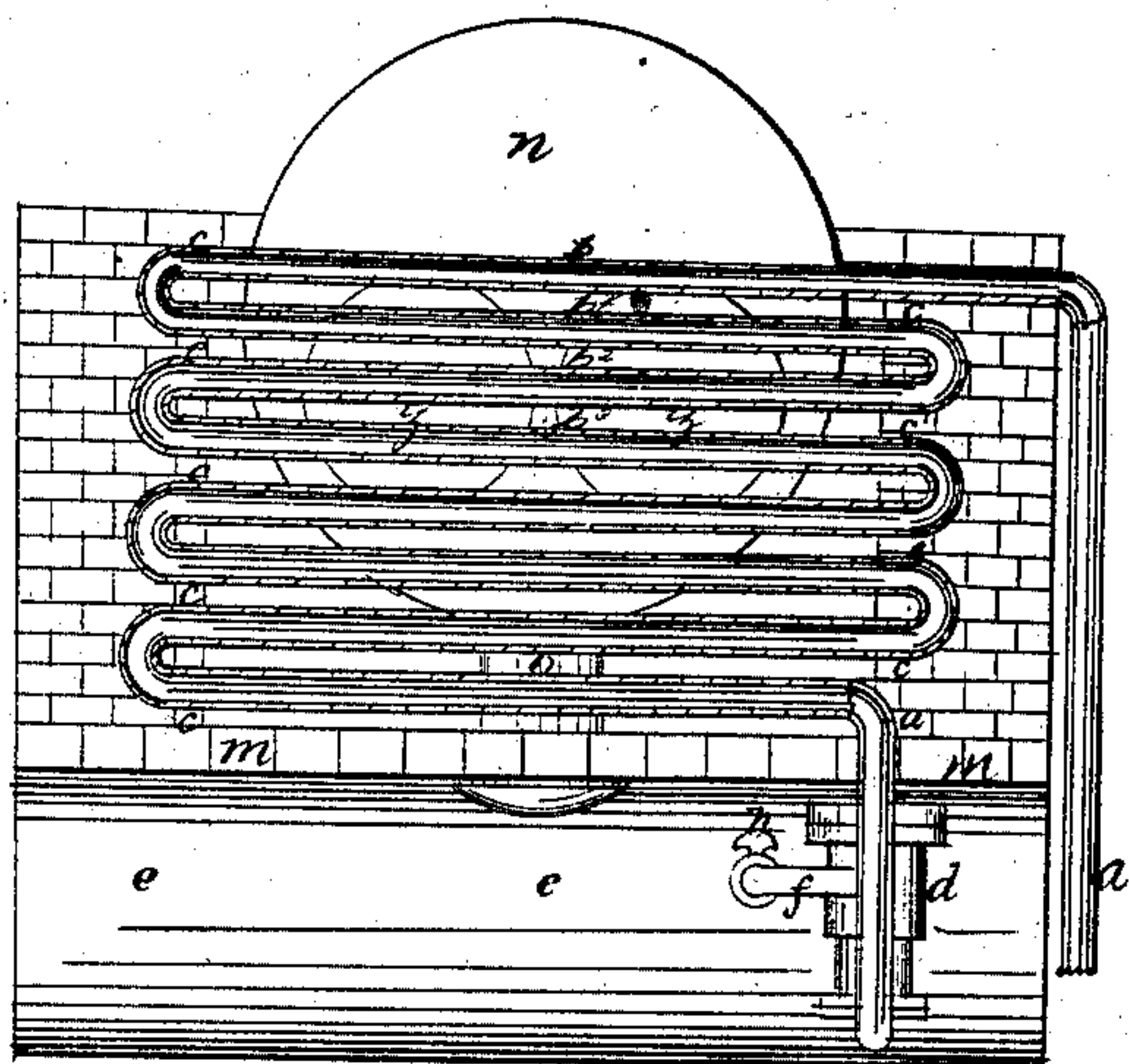


*Snowdon & Wilkins,*  
*Steam-Boiler Water-Heater.*  
*N<sup>o</sup> 68,663.                      Patented Sep. 10, 1867.*

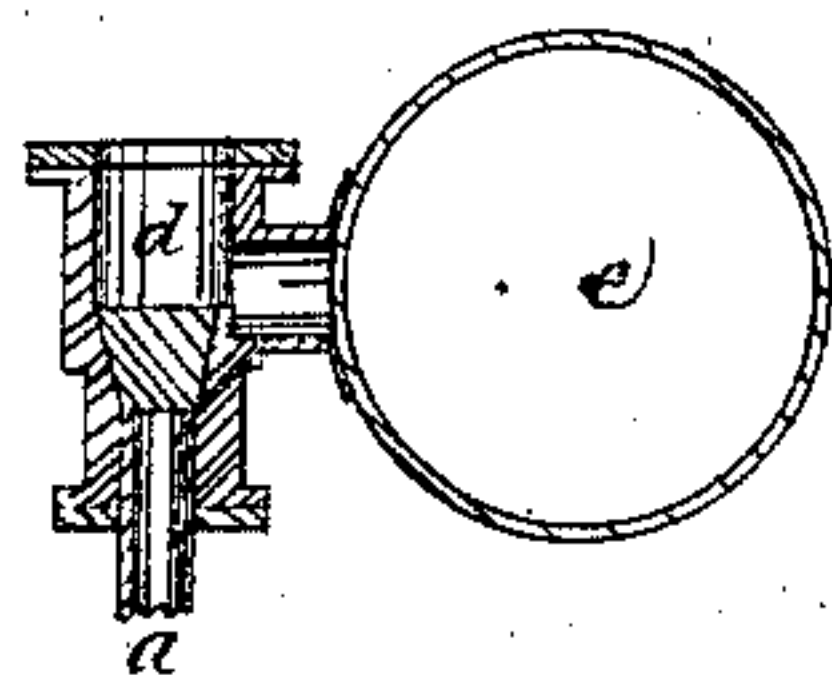
*Fig: 1*



*Fig: 2*



*Fig: 3*



*Witnesses:*  
*Allan B. Bakerwell,*  
*W. D. Lewis*

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*John N. Snowden*  
*Henry Wilkins*  
*by Bakerwell & Christy*  
*their Attorneys.*



# United States Patent Office.

JOHN N. SNOWDON AND HENRY WILKINS, OF BROWNSVILLE, PENNSYLVANIA.

Letters Patent No. 68,663, dated September 10, 1867.

## IMPROVEMENT IN STEAM-GENERATORS.

The Schedule referred to in these Letters Patent and making part of the same.

### TO ALL WHOM IT MAY CONCERN:

Be it known that we, JOHN N. SNOWDON and HENRY WILKINS, of Brownsville, in the county of Fayette, and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Heating Feed-Water for Boilers; and we do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a longitudinal vertical section of a flued-steam boiler, and

Figure 2 is a transverse section, showing the feed apparatus, mud-drum, rear end of the boiler, etc.; and

Figure 3 is a vertical section through the check-valve.

Like letters of reference refer to similar parts of each.

The nature of our invention consists in the arrangement of the feed-water pipes of a steam-boiler, such that the water shall be heated to a temperature equal or nearly equal to that of the water in the boiler before entering the boiler.

To enable others skilled in the art to make and use our invention, we will proceed to describe its construction and operation.

In ordinary flued-steam boilers the heat passes from the fire under the front of the boiler *n* along the passage *x* to the rear, thence up the chamber *y*, entering the boiler flues *z z'*, passing through them the entire length of the boiler and out into the chimney. In our invention the water pipe *a* passes through the side wall of the boiler furnace into the chamber *y* at the rear of the boiler, thence across such chamber in a direction horizontal, or nearly so, thence back, and so back and forth, substantially as represented by *b b' b''*, etc., a sufficient number of times to insure the heating of the water therein to the desired temperature. The pipe *a* then passes through the foundation *m*, and by a check-valve at *d* communicates with the mud-drum *e*, which opens into the boiler *n* by the stand pipe *o*. By a doctor, force-pump, injector, or other equivalent device, we force the water along the pipe *a* through the zigzag series of pipes *b b' b''*, etc., where it becomes heated to the desired temperature by heat from the fire, as above described. It is then driven through the check-valve *d* into the mud-drum *e*, whence it supplies the boiler through the stand pipe *o*. The check-valve *d* is of the ordinary construction, and opens upward or toward the boiler *n* to admit water when forced in, as above described, and on the pressure in that direction being removed closes to prevent the water in the boiler from escaping into or through the heating pipes *b b' b''*, etc. As pipes in the chamber of a furnace, when running parallel to each other, near together, and one above the other, are liable to become covered and their interstices to be filled with ashes, soot, or other impurities, we usually arrange them under each other alternately in two or more vertical rows, as shown in fig. 1, *b''* coming under *b*, *b'''* under *b'*, and so through the series. In this way also we secure a more uniform application of the heat to the outer surface of the feed pipes, and consequently a more uniform expansion and contraction of the pipes as the heat is increased or diminished. The ordinary method of constructing a series of zigzag pipes, such as *b b' b''*, etc., and the method by which we generally construct them is to join them at or near the points *c c'* by elbows, the joints being made water-tight by cement, solder, screw-thread, or other device commonly in use. To prevent such joints from being injured by the heat we usually build them into the side wall or let them into recesses, as shown in fig. 2, and cover the joints with brick and mortar, or other material adapted to the purpose. It sometimes becomes necessary to draw off the water from the heating pipes described, particularly during very cold weather, when, if the fire is allowed to go out for any cause, the pipes *a b b'*, etc., if full, would be in danger of being bursted by the expansion of the water in freezing. In such case the water may be drawn off by a stop-cock of the ordinary construction inserted at any convenient point; but as the empty pipes would be liable to great injury from being overheated when the fire is renewed, before steam could be raised to fill them again, we commonly fill them from the water in the boiler, introducing for this purpose a pipe *f*, leading from the mud-drum *e* to the feed pipe at *g* back of the check-valve *d*. In this pipe *f* we fit a stop-cock, *h*, of the ordinary construction. This being opened, the water from the boiler *n* flows into the empty pipes *b b'*, etc. When they are filled the stop-cock *h* is closed, the fire kindled, steam raised, and water supplied to the boiler in the manner above described. By these devices we feed water into the boiler, heated to a temperature



equal or nearly equal to the temperature of the water already in the boiler, and thereby avoid the evils necessarily attendant on introducing water at a low temperature into a boiler heated to a high temperature.

We commonly use the devices above described in connection with an injector, and in such case the amount of steam necessary to operate the injector and feed-water into the boiler is considerably less than what is required when the water is fed directly into the boiler without having been previously heated, or is heated in pipes which are arranged wholly or chiefly inside the boiler. In other words, under the circumstances above stated, a less amount of steam carries the same quantity of water into the boiler, or with the same amount and pressure of steam on the injector the flow of water into the boiler is greatly increased. This feature of our invention is an important one, as it adds greatly to the practical efficiency and utility of the injector. The arrangement of pipes above described we employ also in connection with the cylindrical boiler. In such case the heat from the fire passes into the chamber *y*, as above described, and thence directly or by pipes or other device into the chimney or stack. The shape and general construction of the chamber *y* are not materially altered thereby, except to afford an exit to the chimney or stack for the smoke, gases, and surplus heat, and hence the arrangement of the feed pipes hereinbefore described will in such case be substantially the same. The chamber *y* must, however, in all cases, be constructed of sufficient size to afford room for such a series of pipes as those above described.

We do not limit ourselves in our invention to the arrangement of horizontal pipes alone, as we place such pipes at any desirable angle to each other or to the walls which enclose them, or construct them in the form of a coil of any desirable shape.

Having thus described our invention, what we claim, is—

The arrangement of a series of zigzag or coiled feed-water pipes in the heating-chamber *y* of the rear end of a steam-boiler, substantially as and for the purposes set forth.

In testimony whereof we, the said JOHN N. SNOWDON and HENRY WILKINS, have hereunto set our hands in presence of—

JOHN N. SNOWDON,  
HENRY WILKINS.

Witnesses:

A. S. NICHOLSON,  
GEO. H. CHRISTY.