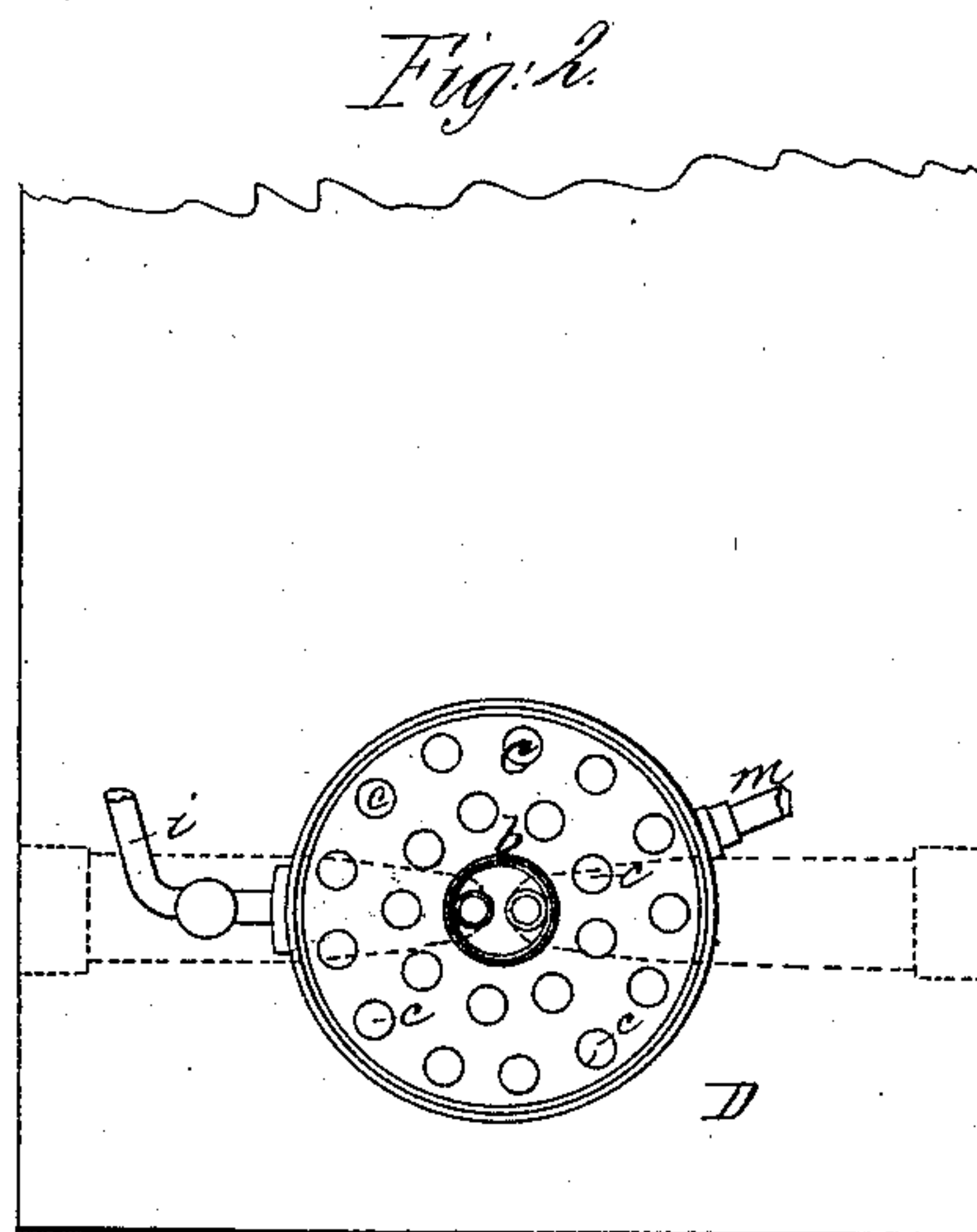
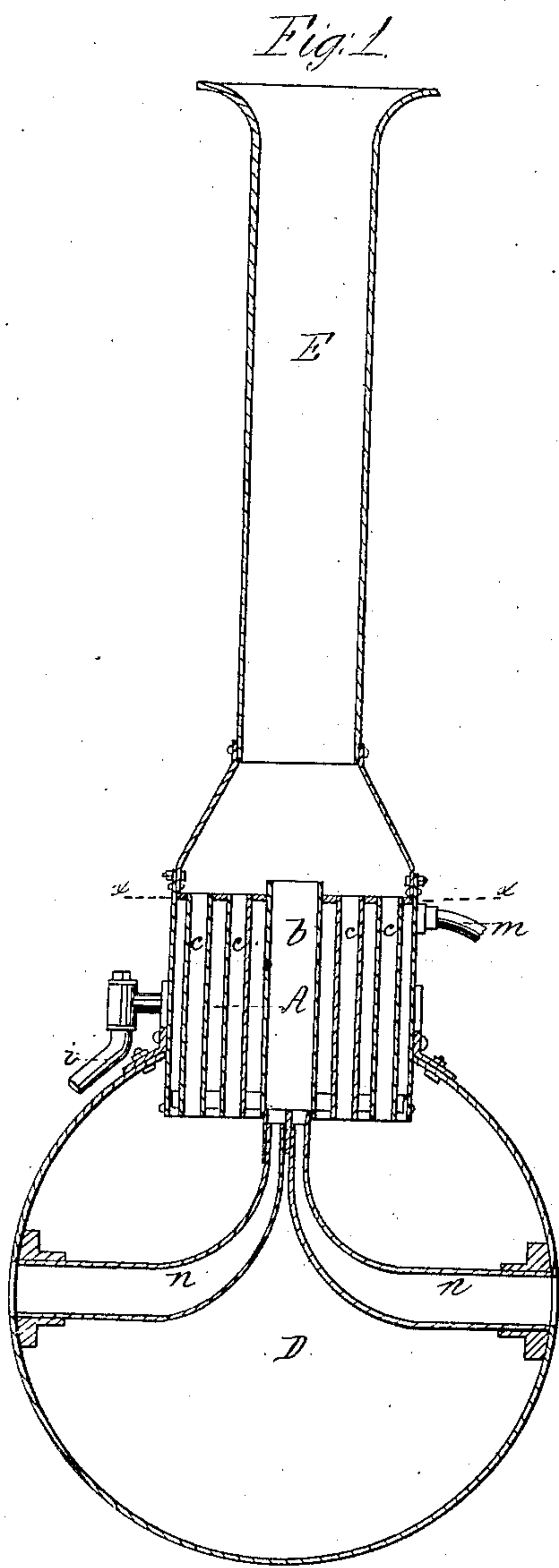


*Baldwin & Clark,*  
*Steam-Boiler Water-Heater.*  
*N<sup>o</sup> 9,312.      Patented Oct. 12, 1852.*



# UNITED STATES PATENT OFFICE.

MATTHIAS W. BALDWIN, OF PHILADELPHIA, AND DAVID CLARK, OF SCHUYLKILL HAVEN, PENNSYLVANIA.

## IMPROVED APPARATUS FOR HEATING FEED-WATER OF STEAM-BOILERS.

Specification forming part of Letters Patent No. 9,312, dated October 12, 1852.

*To all whom it may concern:*

Be it known that we, MATTHIAS W. BALDWIN, of the city and county of Philadelphia, and DAVID CLARK, of Schuylkill Haven, in the county of Schuylkill, and both of the State of Pennsylvania, have invented certain new and useful improvements in the method of heating feed-water for steam-boilers by the waste heat of the exhaust-steam and spent gases as they pass to the chimney, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which make part of this specification, and in which—

Figure 1 is a vertical transverse section through the chimney and smoke-box of a locomotive-boiler provided with my improved heating apparatus, and Fig. 2 is a horizontal section of the same at the line *xx* of Fig. 1.

Various attempts have heretofore been made to heat the feed-water for steam-boilers by the waste heat of the exhaust-steam from the engine and that of the spent gases from the furnace. The mode of proceeding to effect this object has usually been to place a tubular vessel for containing the feed-water in the lower part of the smoke-pipe, so that the mixed smoke and steam as they pass up will come in contact with the tubes and heat the water in the vessel. This mode of heating the feed-water has not proved successful in practice, and in our opinion chiefly because of the very great tendency of the ashes to adhere to the tubes and incase them in a hard incrustation when brought in contact therewith while mixed with steam and vapor. This incrustation of caked ashes upon the tubes of the heater by reason of its being one of the best non-conductors of heat very effectually insulates the feed-water from the heat of the escape steam and smoke, so that it passes through the heater without having its temperature materially raised.

The object of our invention is to remedy this defect in former heaters by preventing the caking of the ashes upon the tubes. The method we have adopted to attain this object is to prevent the mixture of the steam and smoke before they have passed the tubes of the heater by causing the jets of steam to pass up through a central tube in the heater to create a draft in the chimney, while the

smoke is drawn up through a surrounding series of tubes and mixes with the steam above. In this way the smoke is brought in contact with the tubes of the heater, while unmixed with the steam and therefore in a dry state, in which state the ashes and dust which are held in suspension by the smoke have little if any tendency to adhere to the tubes.

The accompanying drawings represent our improvements as applied to a locomotive-boiler, the heater *A* being an upright cylindrical vessel with upright tubes passing through it, and is made in the same manner as a tubular boiler. In this instance the central tube *b* for the steam is of larger diameter than the surrounding smoke-tubes *c*. This vessel is secured to the top of the smoke-box *D*, and is surmounted by the chimney or smoke-pipe *E*, into which it may, if deemed advisable, be extended. The water is forced into the heater through pipes *i* entering its sides, by force-pumps worked in the usual manner, and passes out at the top of the heater to the boiler through a pipe *m*. The blast-pipes *n* enter the smoke-box in the usual manner and their nozzles enter the lower end of the central tube *b* in the heater. The lower end of this tube is closed tightly round the nozzles so as to exclude the smoke entirely, and thus compel it to pass to the chimney through the surrounding tube *c* exclusively, while the steam is confined exclusively to the central tube *b*. The spent gases from the furnace after leaving the rear end of the tubes of the boiler collect in the smoke-box *D*, and are then drawn up through the tubes *c* by the draft created by the jet of steam. The steam, as it passes up within the central tube *b*, imparts heat to the water in contact with the outside of the same, and the smoke in like manner gives out its heat to the water through the sides of the tubes *c*, as it passes up into the chimney above. It is obvious from this arrangement that the steam and smoke will pass through the tubes of the heater separately, and as neither by itself tends to form an incrustation upon the tubes a good conducting-surface is always presented to absorb the waste heat from the steam and smoke on the outside of the vessel, and transfer it to the feed-water within.

If the bottom of the central tube *b* were left open around the nozzles so that the smoke



could pass through with the steam, an incrustation would be formed on the tube that would insulate its surface so effectually that scarcely a particle of the heat of the mixed smoke and steam could pass into the feed-water. Thus the whole of the waste heat of the steam and so much of that of the smoke as mixes with the steam would be lost; or, if the smoke should pass through the outside tubes unmixed with the steam and should then be drawn into the lower end of a central tube with its bottom closed round the nozzles, the latter projecting into the tube above the orifice at which the smoke enters, the waste heat of the steam would be lost by reason of the incrustation of the tube, (as in the case of its bottom being left open round the nozzles,) and, in addition, a deposition of indurated ashes, &c., would be made in the central tube so rapidly as to contract it to an extent that would greatly impair and at length destroy the draft of the furnace by stopping the communication between it and the chimney. All these difficulties, and others which might be

specified, if necessary, are obviated by means of our invention, which separates entirely the steam and smoke until after they have passed the heater.

What we claim as our invention, and desire to secure by Letters Patent, is—

The arrangement of a heater for the feed-water of steam-boilers with respect to the chimney smoke-box and the blast-pipes of the escape-steam, substantially as herein described, so that the heated smoke and gases from the smoke-box and the exhaust-steam from the cylinder shall pass separately through the heater in distinct tubes or channels in such manner that they cannot mix until both have passed the heater, as herein set forth.

In testimony whereof we have hereunto subscribed our names.

M. W. BALDWIN.  
DAVID CLARK.

Witnesses:

HENRY SIMPSON,  
DANIEL MCSHINLEY.