

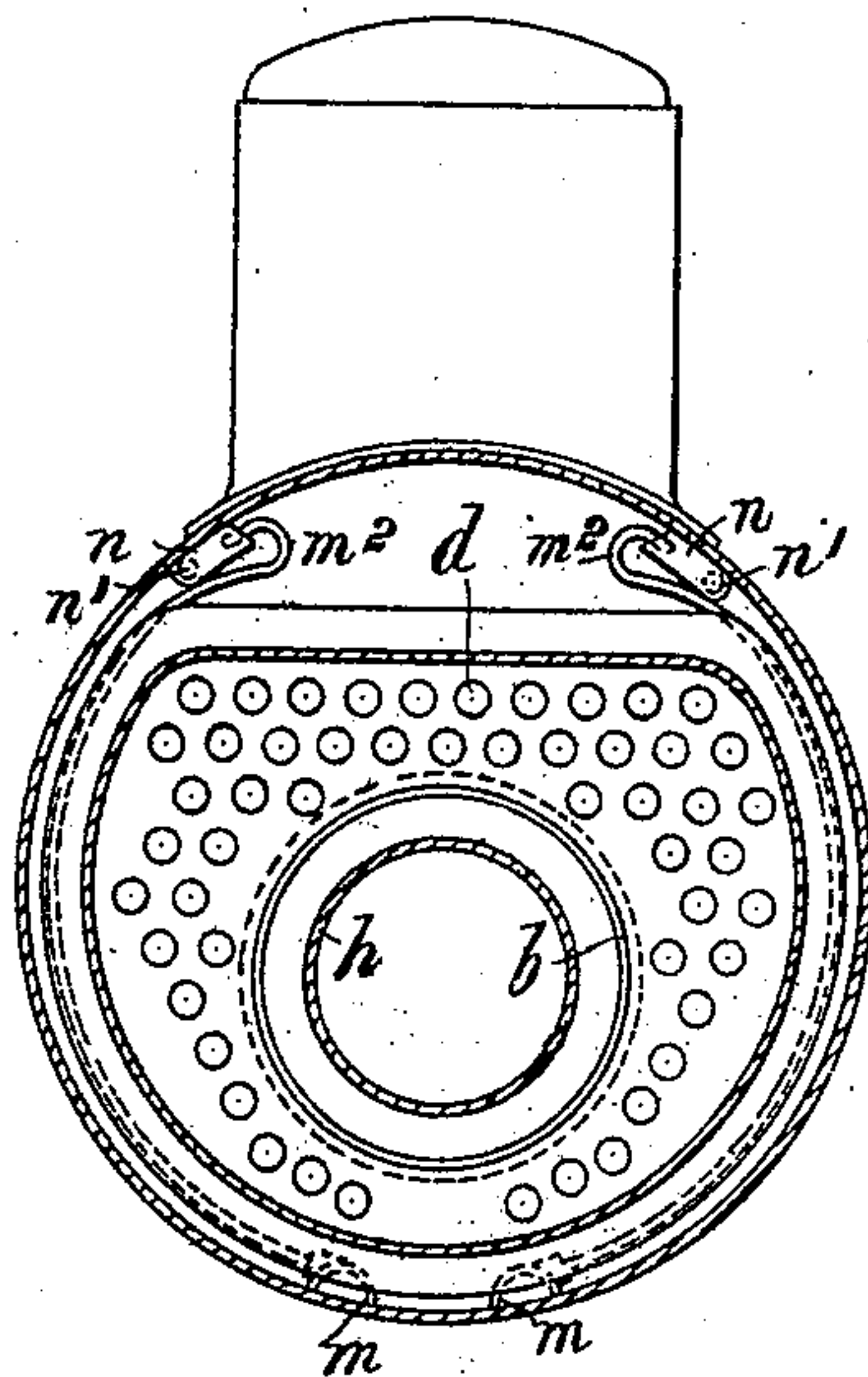
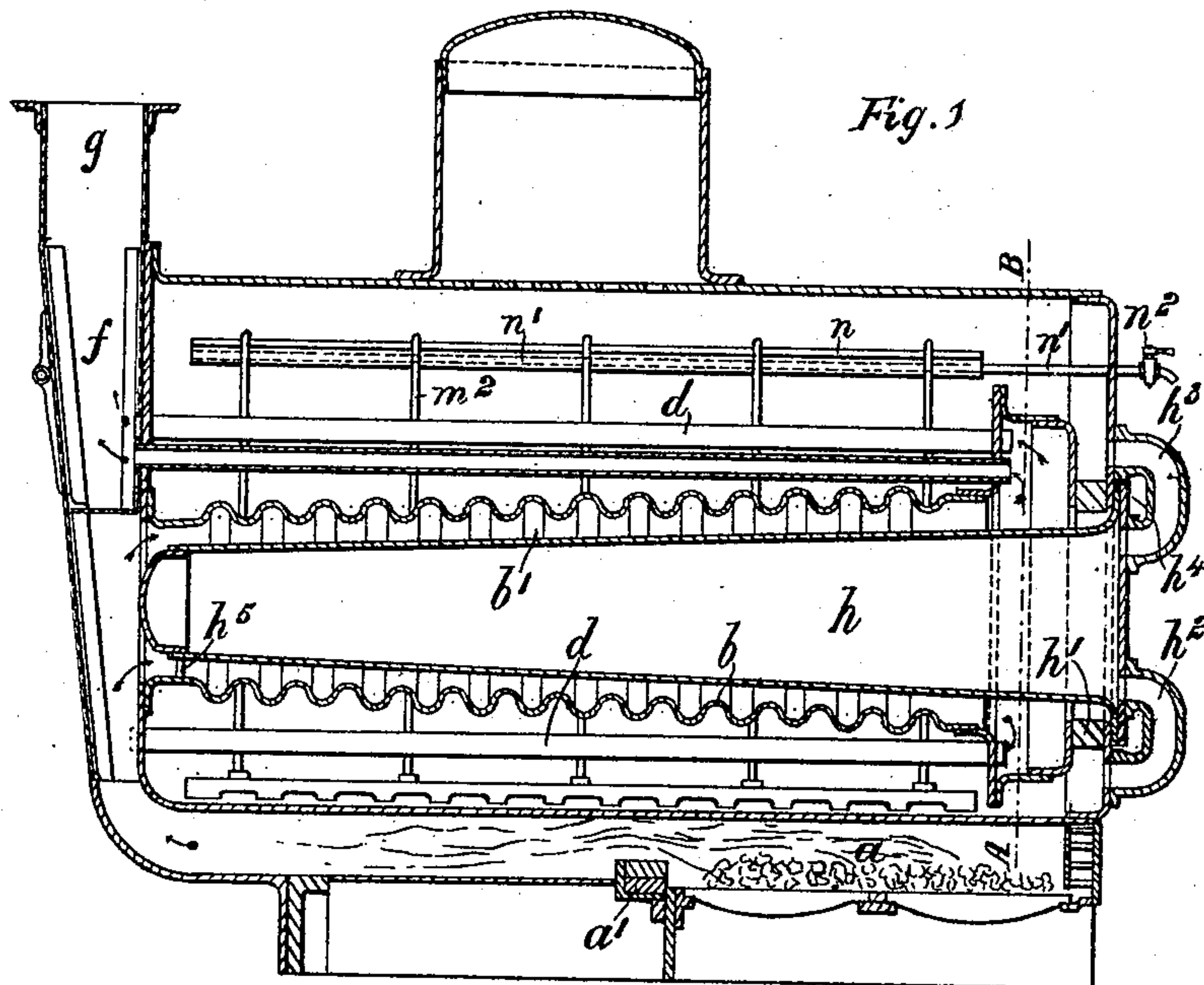
(No Model.)

2 Sheets—Sheet 1.

J. E. FRIEND.  
STEAM BOILER.

No. 582,416.

Patented May 11, 1897.



WITNESS

*Richard Wobbe*  
*Att. Wm. K.*

INVENTOR  
*John Edward Friend*

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(No Model.)

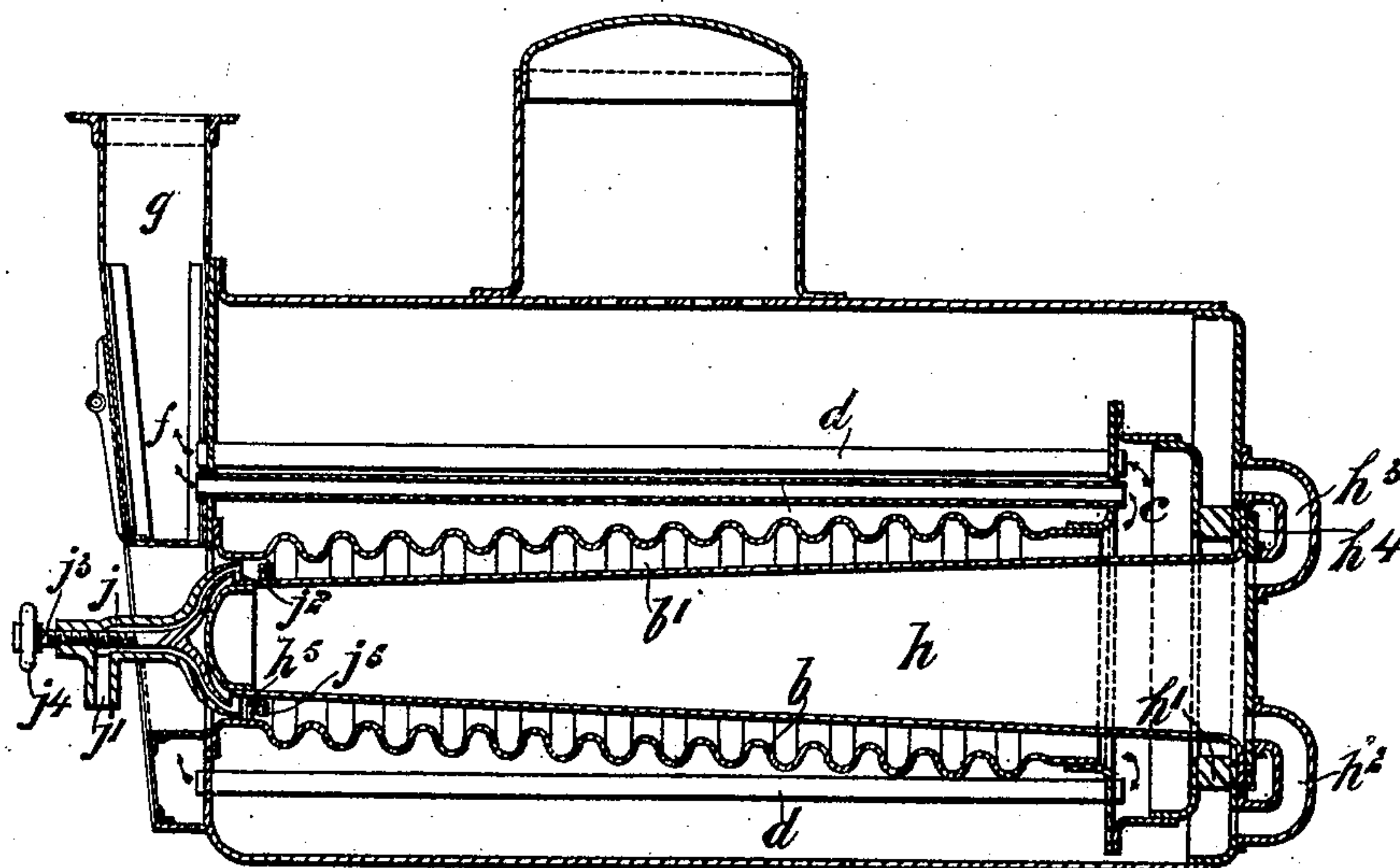
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*Fig. 3*



WITNESS:

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# UNITED STATES PATENT OFFICE.

JOHN EDWARD FRIEND, OF WELLINGTON, NEW ZEALAND, ASSIGNOR TO  
THE FRIEND'S STEAM GENERATOR AND IMPOROUS BUTTER BOX COM-  
PANY, LIMITED, OF SAME PLACE.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 582,416, dated May 11, 1897.

Application filed January 22, 1897. Serial No. 620,249. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN EDWARD FRIEND, a subject of the Queen of Great Britain, residing at 54 Lambton Quay, in the city of Wellington, in the Colony of New Zealand, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention relates to boilers for generating steam, and has for its object to provide a boiler having extensive heating-surface, so that steam may be rapidly raised either by gas or coal and having apparatus to prevent deposit of sediment at the bottom of the boiler when heated by a furnace underneath.

The object of the invention is carried into effect by constructing the boiler with features corresponding to those found on marine and locomotive boilers. The furnace is situated beneath the boiler and the products of combustion are conducted through a flue into a combustion-chamber and thence through tubes to the smoke-stack.

An essential feature of the invention consists in inserting a water-tube in the flue so as to leave an annular space between them for the passage of heated gases from the furnace. Such water-tube communicates with the boiler by means of suitable connecting-pipes, through which the water may circulate to keep the water in the tube constantly changing, and is fixed to the boiler by bolts which may be readily removed to take out the water-tube when it is necessary to repair the same or the flue or tubes. The fierce heat of the products of combustion is reduced as they pass through the annular space between the flue and water-tube, so that the ends of the tubes are not burned or made to leak. A difficulty well known to experienced boiler-makers is thus overcome.

By placing the furnace underneath and constructing the boiler with a flue somewhat similar to ordinary furnace-flues and employing ordinary tubes from the combustion-chamber to the smoke-box an increase of heating-surface is obtained considerably greater than in present forms of boilers.

When gas is used as the heating agent, a nozzle of special construction is employed to regulate the admission of the gas as required.

To prevent damage by deposit of sediment upon the bottom of the boiler when the same is heated by a furnace underneath, perforated troughs are laid inside and along the bottom and provided with pipes passing upward to longitudinal pockets above high-water level. It will be found that the circulation of the water through the pipes will carry up the sediment and deposit the same in the pockets. Perforated pipes are fixed near the bottom of the pockets, and, extending the whole length of the same, pass out at the end of the boiler, where they are fitted with blow-off cocks. Upon opening the cocks the sediment will be blown out and the pockets cleared of deposit. This arrangement of troughs, pipes, and pockets also has the effect of providing an escape for the air-bubbles, and, allowing the same to pass up the pipes, prevents priming.

In order that my invention may be most easily understood, I will now describe the same in detail, and in doing so shall refer to the accompanying drawings, whereon similar letters of reference indicate similar parts throughout the views.

Figure 1 is a longitudinal section of the boiler fitted for burning coal. Fig. 2 is a transverse section of the same on line A B, Fig. 1. Fig. 3 is a longitudinal section of the boiler arranged to burn gas.

Similar letters refer to similar parts.

Referring to the views, the furnace *a*, Fig. 1, is situated beneath the boiler, and the water at the bottom of the same is thus raised to a high temperature. The products of combustion pass over the usual brick arch *a'* and thence into the conical flue *b* and combustion-chamber *c*, eventually finding their way to the open air through the ordinary tubes *d*, smoke-box *f*, and smoke-stack *g*.

The water-tube *h* is conical in shape, corresponds to the flue, and, being of large dimension, occupies a greater part of the internal capacity of flue *b*, leaving merely an annular



space  $b'$  for the passage of heated gases, which expand as they pass through the increasing diameter of the annular space.

The tube  $h$  is admitted through the end of the boiler, through which a hole is cut and made good by means of ring  $h'$ . The ends of said tube  $h$  are closed, as shown, and the larger end is bolted at  $h^4$  to the boiler and perforated to connect with pipes  $h^2$  and  $h^3$ , which open into the boiler below and above the tube, respectively. The water may thus circulate from the boiler through the tube  $h$ . The smaller end of the water-tube rests upon any suitable supports  $h^5$ . It will be seen that by means of this tube  $h$  a heating-surface nearly as great as that of flue  $b$  is added to the boiler.

When gas is used as the heating agent, the nozzle  $j$  is employed. Gas suitably mixed with a proper proportion of air is admitted at  $j'$  and is preferably driven by a fan. The jet of flame issues from the annular orifice  $j^2$ , which may be regulated by screw  $j^3$  and hand-wheel  $j^4$ . The flame plays upon a ring of asbestos  $j^5$ , which soon rises to a high temperature and insures the complete combustion of the gas. It is further useful in relighting the gas should the latter be accidentally extinguished.

Troughs  $m$  laid along the bottom of the boiler are perforated at  $m'$  and have pipes  $m^2$  passing upward and around the interior of the boiler to pockets  $n$ . By the circulation of the water the sediment will be carried up through the tubes  $m^2$  and deposited in pockets  $n$ . Perforated pipes  $n'$  are fixed near the bottom of pocket  $n$ , extend the whole length of the same, and, passing out at the end of the boiler, are provided with cocks  $n^2$ , by opening which the pockets may be cleared of deposit.

I wish it to be understood that I do not confine myself to the exact details hereinbefore set forth, as these may be modified in several ways by a skilled person without departing from the spirit of my invention—as, for example, the type of boiler may be altered and my improvements adapted to a boiler without tubes  $d$ .

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. In combination in a boiler, a conical flue extending through the same, a conical water-tube  $h$  within the flue, the smoke-box at the large end of the flue, the fire-tubes extending from said smoke-box through the upper part of the boiler to the chimney and the connections between the conical water-tube and the upper and lower water-spaces of the boiler, substantially as described.

2. In combination, the flue extending through the boiler, the smoke-box within the boiler at one end of the flue, the water-tube let in through the wall of the boiler and through the smoke-box, and the ring  $h'$  about the water-tube and between the smoke-box and the boiler-shell, substantially as described.

3. In combination with the boiler having the flue extending through it with the smoke-box at one end of the flue within the boiler, the water-tube extending through the flue and having its flanged end fitting against the boiler-shell, the ring about the tube and between the boiler-shell and the smoke-box and the tubes connecting the water-tube with the upper and lower water-spaces of the boiler, substantially as described.

4. In combination with the boiler, the pipe extending from the lower to the upper part of the boiler to convey the sediment and the upper pocket or receiver into which said pipe discharges with means for blowing the same out, substantially as described.

5. In combination, the perforated troughs laid along the bottom of the boiler, the pipes extending upwardly therefrom, the receiving-pocket at the upper ends of the said pipes and the means for blowing out said pocket, substantially as described.

JOHN EDWARD FRIEND.

Witnesses:

THOS. E. CRISP,  
J. S. KEMP.