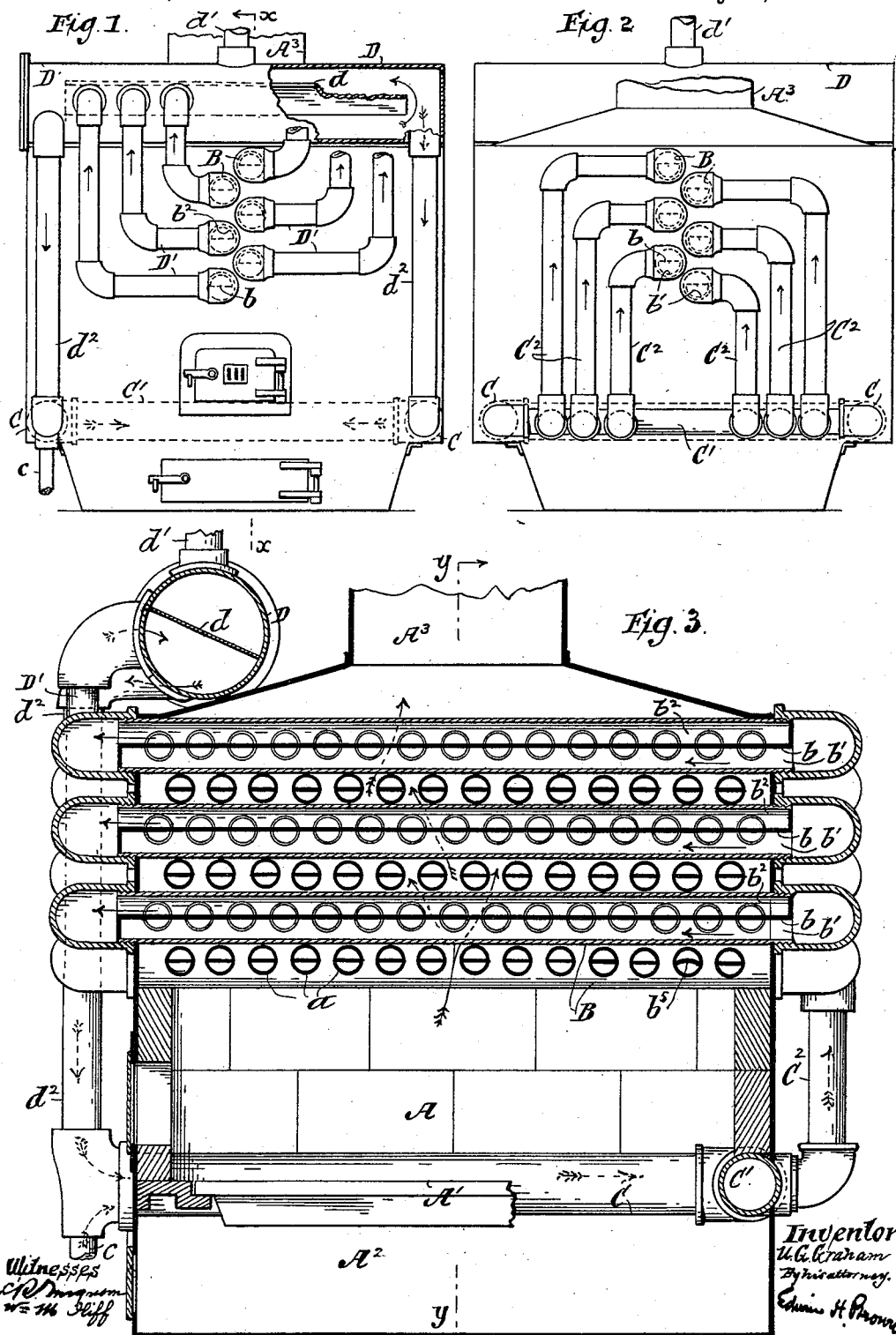


U. G. GRAHAM.
STEAM BOILER.

No. 455,318.

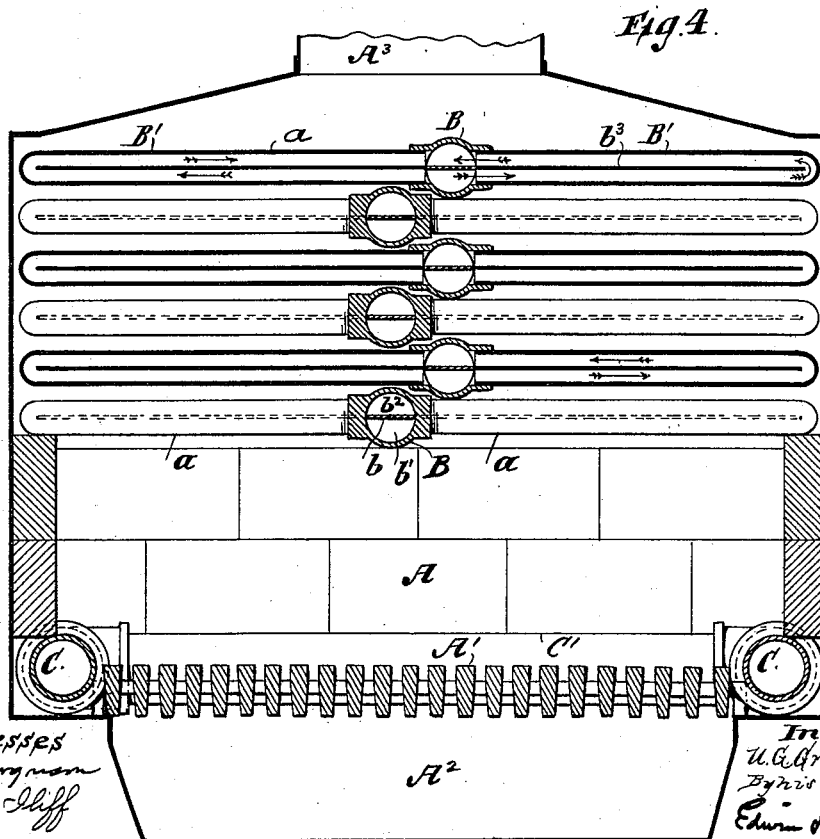
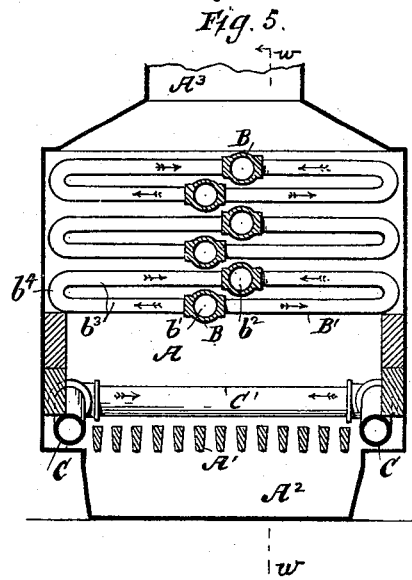
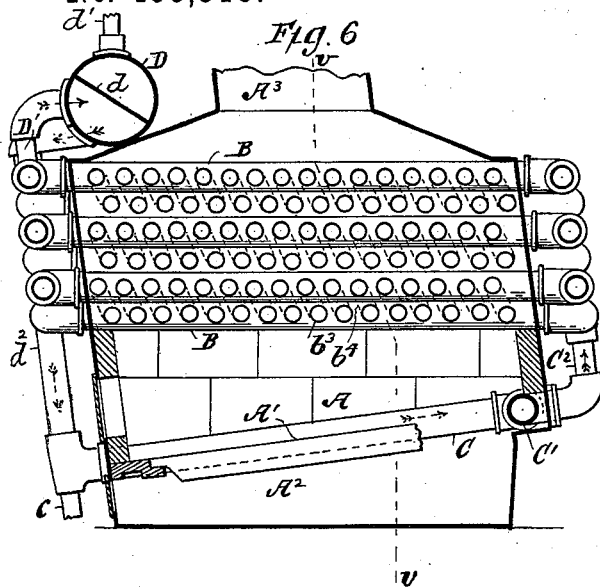
Patented July 7, 1891.



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Witnesses
C. H. Brown
Wm. H. Hoff

Inventor
U. G. Graham
By his attorney
Edwin H. Brown

UNITED STATES PATENT OFFICE.

ULYSSES G. GRAHAM, OF NYACK, NEW YORK, ASSIGNOR OF ONE-HALF TO
LANCELOT COPLESTON, OF SAME PLACE.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 455,318, dated July 7, 1891.

Application filed August 22, 1890. Serial No. 362,792. (No model.)

To all whom it may concern:

Be it known that I, ULYSSES G. GRAHAM, of Nyack, Rockland county, and State of New York, have invented a certain new and useful Improvement in Steam-Boilers, of which the following is a specification.

This invention relates particularly to steam-boilers having water-tubes around which the products of combustion circulate; and the object is to provide a complete circulation and break up the water before it reaches the steam-chamber, where the water and steam separate, the water flowing back into the boiler.

I will describe a boiler embodying my invention, and then point out the novel features in the claims.

In the accompanying drawings, Figure 1 is a front elevation of a boiler, partly in section, embodying my invention. Fig. 2 is a rear elevation. Fig. 3 is an enlarged section through the line *x x* of Fig. 1, looking in the direction of the arrow. Fig. 4 is a section through the line *y y* of Fig. 3. Fig. 5 is a section through the line *v v* of Fig. 6, showing a slightly-modified construction. Fig. 6 is a sectional side elevation through the line *w w* of Fig. 5.

Similar letters of reference indicate like parts in all the figures of the drawings.

Referring by letter to the drawings, A designates the furnace or fire-chamber; A', the grate; A², the ash-pit below the grate, and A³ the outlet for smoke and products of combustion.

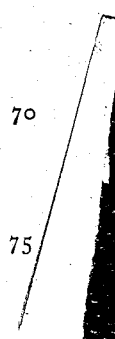
B designates a series of manifold pipes extending lengthwise of and above the fire-chamber A. These pipes B are arranged one above the other at the central portion of the boiler-casing and are shown as staggered. Each pipe B has a series of holes or perforations at opposite sides throughout its length, and the ends of laterally-extending pipes B' are fitted into these holes *a*, so as to communicate with the interior of the pipe B. The outer ends of the pipes B' are closed. Each pipe B has a diaphragm *b*, extending longitudinally through it, so that each pipe is divided into two portions or chambers *b'* *b*² not communicating with each other excepting through the pipes B', which are also manifold

or provided with a longitudinal diaphragm *b*³. The diaphragms *b*³ in the pipes B' do not extend entirely to the ends of said pipes; but the diaphragms *b*³ and also the diaphragms *b* extend across the full inner diameter of the respective pipes.

C designates a feed-water pipe extending along the furnace adjacent to the grate and receiving water from any source of supply through the pipe *c*. The pipe C communicates with a transverse water-pipe C' at the rear of the furnace, and this pipe C' communicates with the respective pipes B through vertical pipes C². It will be observed that the pipes C² communicate with one chamber only of the pipe B. In this case the chamber *b'* and the other chamber *b*² communicate with a steam-chamber D through pipes D'.

All portions of the pipes B and B' are designed to be filled with water, and it will be seen that water entering the chamber *b'* of the pipe B will circulate through the pipes B', beneath the diaphragms *b*³, around the ends thereof, and back over the top of the diaphragms to the chamber *b*², thence to the steam-chamber D, all as indicated by the arrows.

The steam-chamber D extends over the top of the boiler-casing and has transverse partition or separator *d* within it. This separator *d* is here shown as transversely inclined, the highest edge being above and adjacent to the water and steam entrance from the pipes D'. The separator *d* does not extend the full length of the chamber D, but is so constructed that steam may pass around the ends, as shown by the arrow in Fig. 1. By this construction it will be seen that water and steam entering the chamber D will strike against the separator *d*, the steam passing around the ends thereof, as before stated, to the steam-pipe *d'*, and the water falling to the bottom of the chamber D is conducted back to the pipe C through return-tubes *d*², which, as shown, provide a communication between the chamber D and the pipe C. As before stated, each pipe B is in effect two pipes, and in Figs. 5 and 6 I have shown an analogous arrangement of pipes for conveying the water and steam, but in which two pipes B are em-



ployed, which are equidistant to the chambers $b' b^2$, heretofore described. In this example the chambers $b' b^2$ are connected by means of the pipes B' , having a return-bend 5. b^4 , the inner walls b^3 being the diaphragm.

At b^5 in Fig. 3 I have shown a diaphragm as curved transversely. All of the diaphragms may be thus curved, giving a larger area of chamber in the lower portion than 10 the chamber in the upper portion of each pipe.

Having described my invention, what I claim is—

1. In a steam-boiler, the combination, with the feed-water pipe, of a number of manifold 15 or chambered pipes, a chamber of each of said pipes having an independent connection with the feed-water pipe, and the chambers communicating one with the other through laterally-extending pipes, substantially as 20 specified.

2. In a steam-boiler, the combination, with pipes, each having a longitudinal diaphragm extending transversely and forming two chambers closed at opposite ends, of later- 25 ally-extending pipes providing a communication between said chambers, substantially as specified.

3. In a steam-boiler, the combination, with a feed-water pipe, of a series of manifold 30 pipes independently communicating with the feed-water pipe, pipes extending from the manifold pipes, providing a communication

between the chambers thereof, and a water and steam chamber communicating with each of the manifold pipes and return water-pipes, 35 substantially as specified.

4. In a steam-boiler, the combination, with water-pipes substantially such as described, of a steam and water chamber connected with said pipes, a separator in the chamber ar- 40 ranged longitudinally of and inclined transversely to the length of the chamber, the said separator being within the line of discharge of the water-pipes and made shorter than the chamber, whereby openings are provided for 45 the passage of steam, and a pipe or pipes for conducting water from said chest to a feed-pipe, substantially as specified.

5. The combination, with the horizontal water-pipes having longitudinal diaphragms 50 forming chambers therein, of pipes extending from opposite sides of the first-named pipes and having longitudinal diaphragms, providing a communication between the chambers of the first-named pipes and inlet 55 and outlet pipes for the above-named pipes, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ULYSSES G. GRAHAM.

Witnesses:

S. E. GARDNER,

L. COPLESTON.