

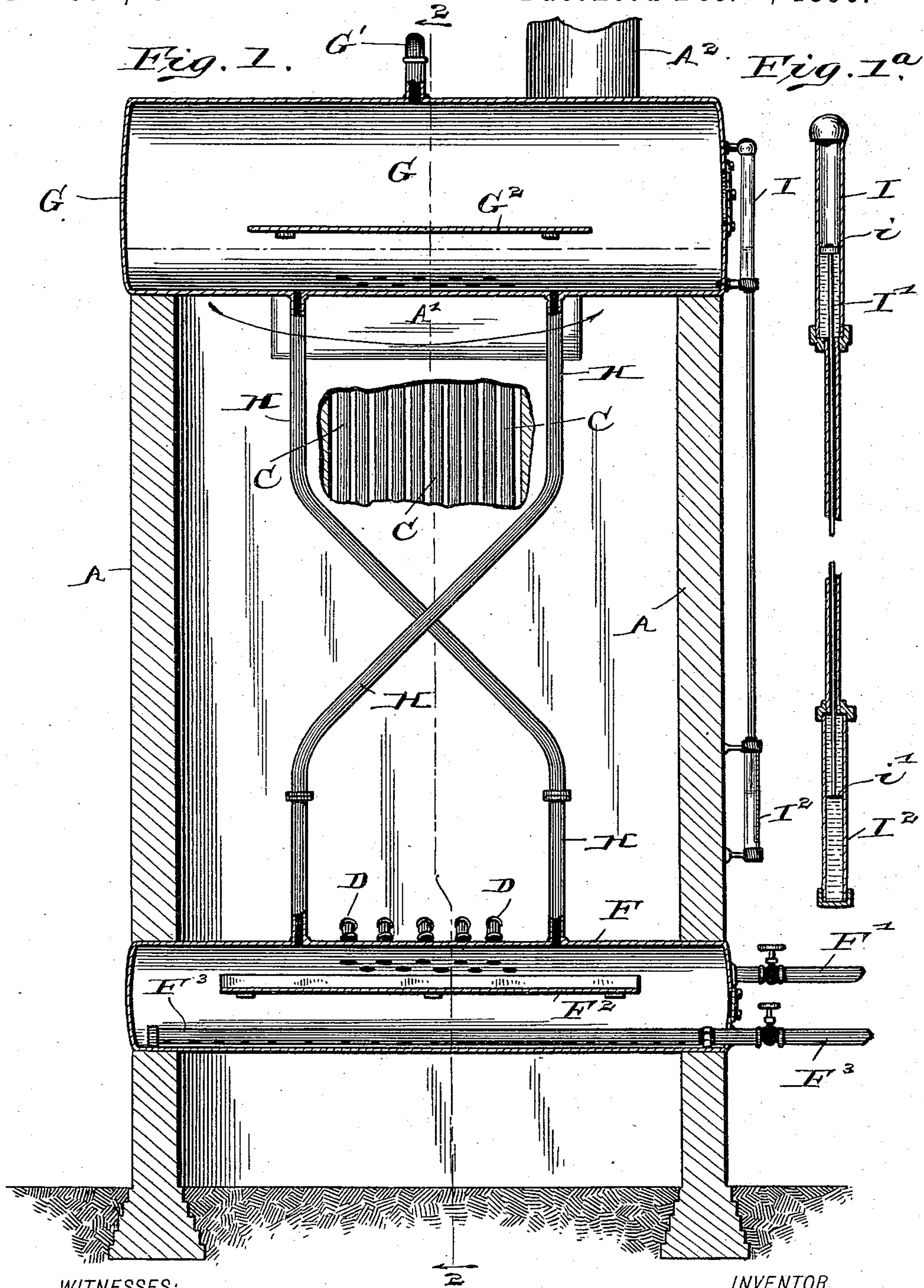
(No Model.)

3 Sheets—Sheet 1.

A. R. COOPER.  
STEAM BOILER.

No. 572,194.

Patented Dec. 1, 1896.



WITNESSES:

INVENTOR

H. S. Neely,  
J. A. Walsh.

Ashley R. Cooper,  
By  
Chester Bradford,  
ATTORNEY.



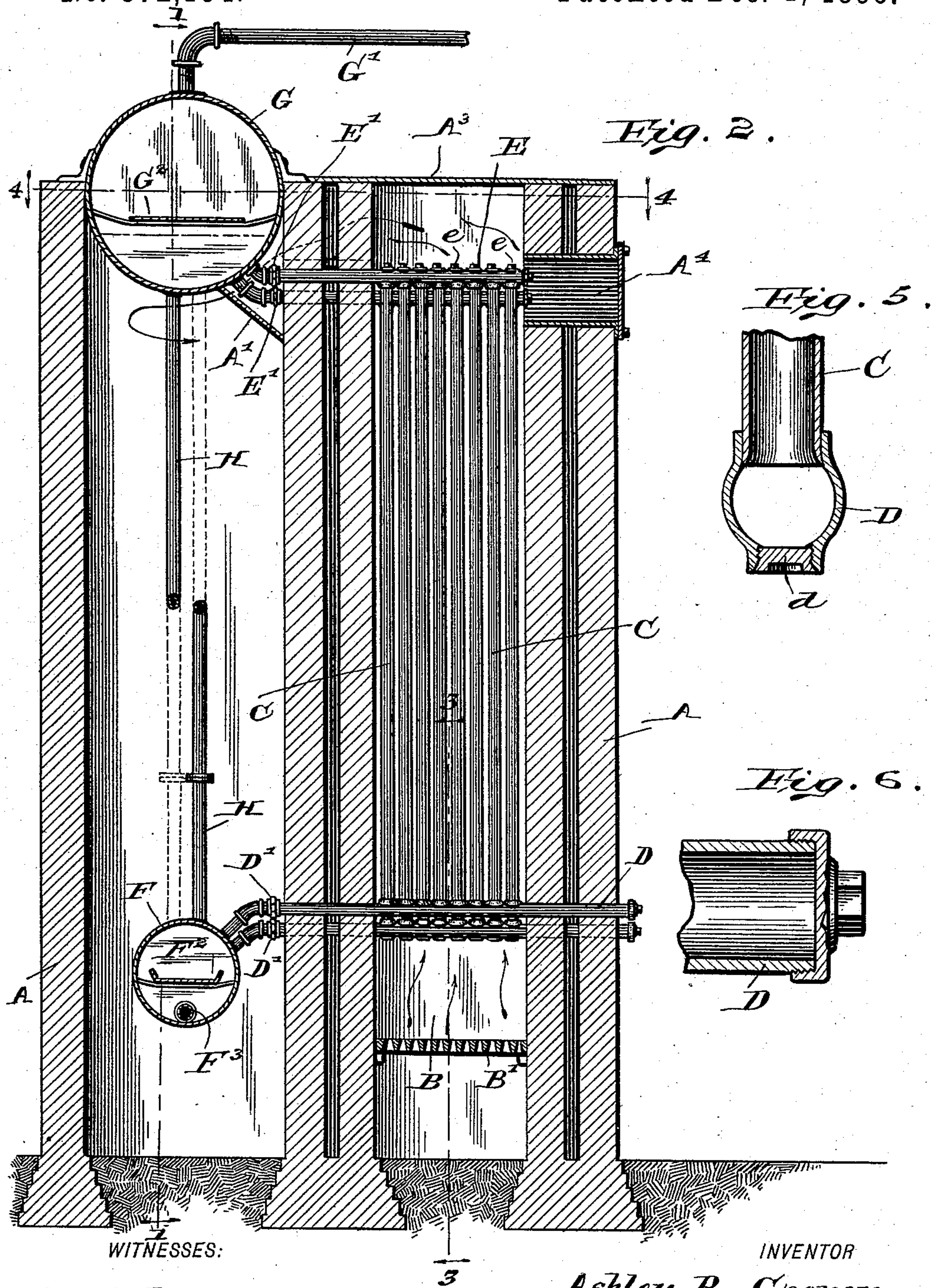
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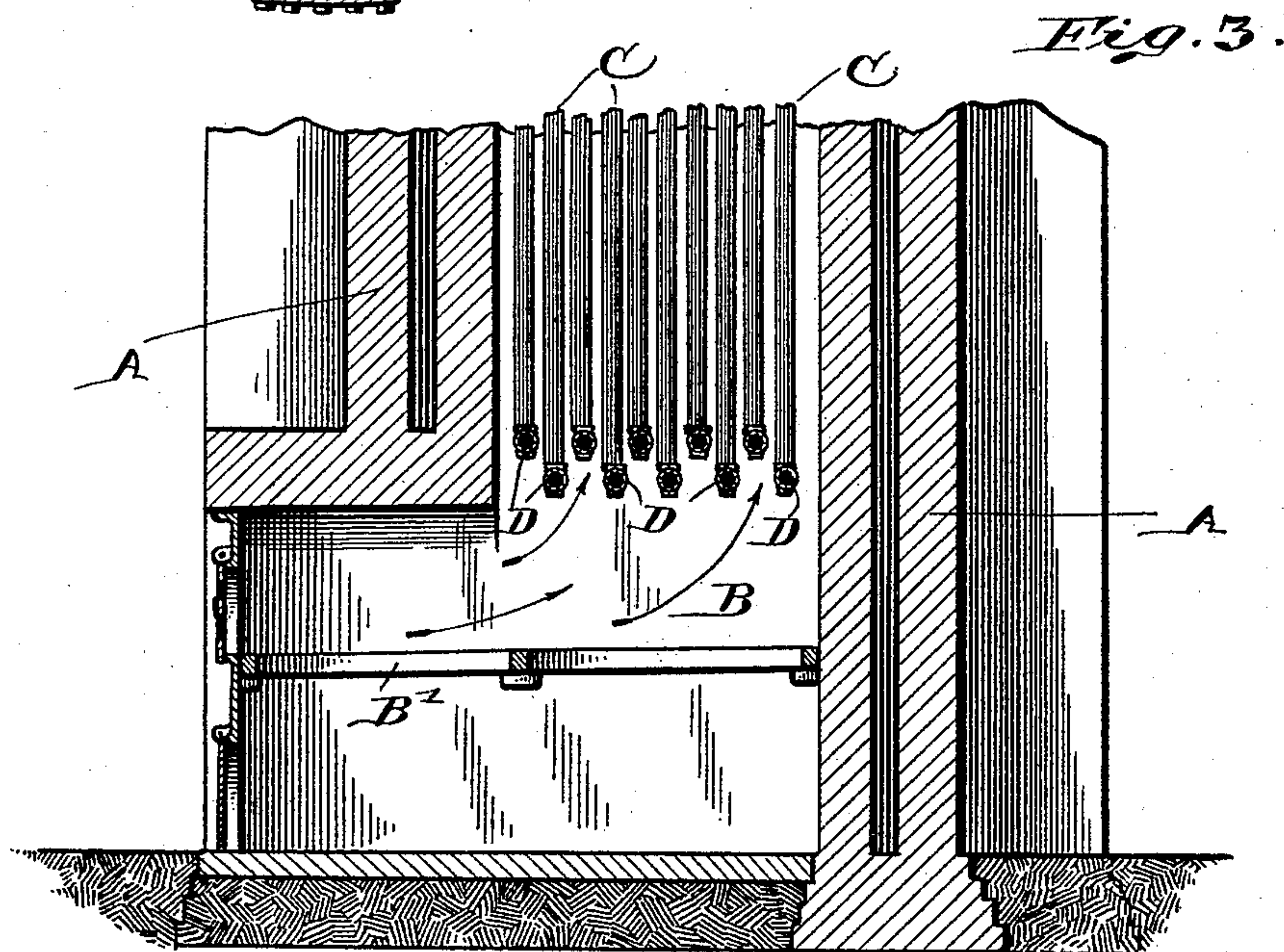
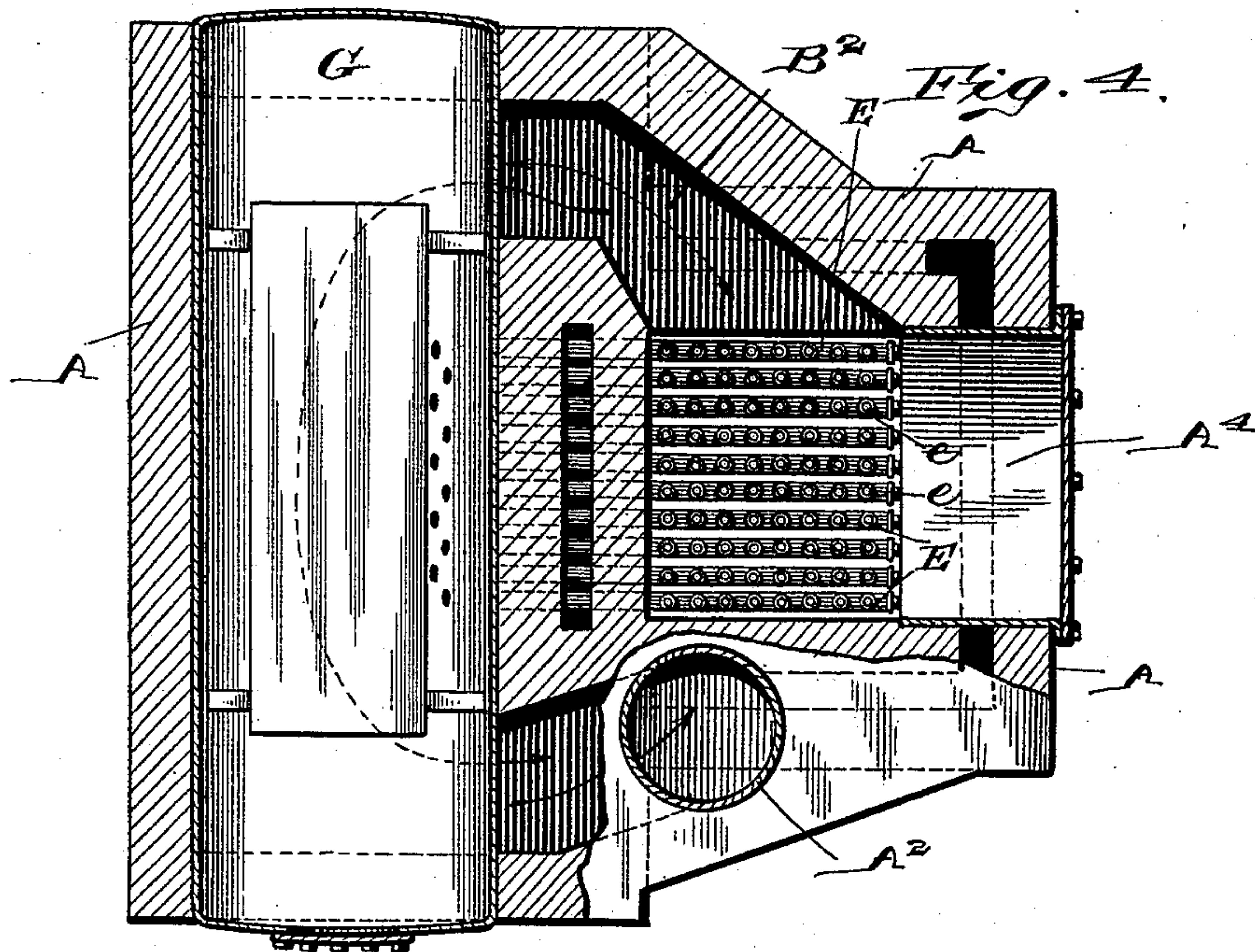
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# UNITED STATES PATENT OFFICE.

ASHLEY R. COOPER, OF MOORESVILLE, INDIANA.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 572,194, dated December 1, 1896.

Application filed February 24, 1896. Serial No. 580,384. (No model.)

*To all whom it may concern:*

Be it known that I, ASHLEY R. COOPER, a citizen of the United States, residing at Mooresville, in the county of Morgan and State of Indiana, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention relates to that class of steam-boilers in which the principal heating-surface consists of a series of pipes or tubes located within the combustion-chamber.

It consists in various details of construction and arrangements of parts whereby superior results are attained, all as will be hereinafter more particularly described and claimed.

Principal features are the arrangements by which the pipes are enabled to be removed without materially disturbing the main structure, by means of which the tubes may be cleaned without removal and by which a portion of the tubes may be disconnected without disturbing the remainder.

Referring to the accompanying drawings, which are made a part hereof and on which similar letters of reference indicate similar parts, Figure 1 is a vertical sectional view looking in the direction indicated by the arrows from the dotted line 1 1 in Fig. 2; Fig. 1<sup>a</sup>, an enlarged detail of the gage shown in Fig. 1; Fig. 2, a vertical sectional view as seen when looking in the direction indicated by the arrows from the dotted line 2 2 in Fig. 1; Fig. 3, a vertical sectional view of the lower end thereof as seen from the dotted line 3 3 in Fig. 2; Fig. 4, a horizontal sectional view as seen when looking downwardly from the dotted line 4 4 in Fig. 2; Fig. 5, a detail sectional view of the lower end of a fragment of one of the heating-pipes and the transverse pipe with which it is connected, illustrating also the form and construction of the ingress-plug; and Fig. 6, a detail sectional view of the outer end of one of the connecting-pipes and its cap.

In said drawings the portions marked A represent the walls of the furnace; B, the combustion-chamber; C, the heating-pipes; D, the connecting-pipes at the bottom of said heating-pipes; E, the connecting-pipes at the top of said heating-pipes; F, a drum at the bottom to which the pipes D connect; G, a

drum at the top to which the pipes E connect; H, pipes connecting the drums F and G, and I the gage.

The furnace-walls A are arranged to include the combustion-chamber and a second space within which the drums are located and to provide suitable supports for the drums F and G and the various pipes and attachments, as shown in Fig. 2. Those walls which are immediately alongside the combustion-chamber are preferably double walls having suitable dead-air spaces.

The combustion-chamber B is located directly below the pipes C and D, being both best shown in Figs. 2 and 3. The fuel is introduced over the grate-bars B' therein, and the products of combustion pass thence up around the pipes D, C, and E, and thence by way of the flue B<sup>2</sup> at the upper end around under the drum or cylinder G below the deflecting or protecting plate A' to the stack or chimney A<sup>2</sup>. Said products of combustion thus circulate not only among the pipes C, which embody the principal steam-producing surface, but also come in direct contact with the under side of the drum G.

The pipes C are arranged vertically within the upper portion of the combustion-chamber and connect at their lower and upper ends, respectively, with the pipes D and E. These pipes C are swelled into the openings provided therefor in the pipes D and E, forming a perfectly tight joint therewith, and when the plugs are removed from openings opposite to the ends thereof in said pipes D and E, as will be presently explained, are substantially open pipes throughout, and are easy to be cleaned, as may be desired.

The pipes D and E run transversely through the structure at the bottom and top, respectively, of the pipes C and are also connected, respectively, to the drums F and G. These pipes are provided with the plugs *d* and *e* opposite to the ends of the pipes C, which can be removed and said pipes left open for cleaning, as above stated. The plugs *d* are preferably formed as shown in Fig. 5, being in the form of a short machine-screw with a socket for a square wrench. Being provided with a socket instead of a projection enables these plugs to withstand the effect of the



products of combustion much better than the ordinary form could in such a situation. As will be noticed, the pipes C, D, and E are formed in groups, each group being separately  
 5 connected to the drums by means of unions D' and E', as shown most plainly in Fig. 2. If one or more pipes in any one of these groups should get out of order, such group can be easily cut off by uncoupling the proper  
 10 unions and plugging or capping the openings. In order to permit of easy access to the upper portion, the furnace is preferably covered with a removable plate A<sup>3</sup>, as also shown in Fig. 2. The pipes D and E are also accessi-  
 15 ble from the exterior of the furnace. The pipes D extend through to the outside, as shown in Fig. 2, and the pipes E are accessible through a hand-hole A<sup>4</sup>, as also shown in said figure and in Fig. 4.

20 The drum F, as best shown in Fig. 1, is a combined water-supply and mud drum. The water enters through the pipe F' near the top and its force is discharged above the plate F<sup>2</sup>, which is interposed between the lower  
 25 side thereof and the openings which lead into the pipes D, thus to a great extent cutting off communication between said pipes and the mud or settlings in the bottom of said drum. The blow-off pipe F<sup>3</sup> is positioned in  
 30 the bottom of the drum in suitable position to blow off the mud and other sediment.

The drum G constitutes also the steam-dome, and from this the main live-steam pipe G' leads. The plate G<sup>2</sup> is positioned in this  
 35 drum where it will extend over the openings through which the pipes E discharge, and thus intercept the force of the discharge and prevent bubbling of the water, so that dryer steam is produced.

40 The pipes H connect the drums G and F. As shown in Fig. 1, they are preferably crossed, so that the expansion and contraction thereof shall have no effect upon the position of the drums themselves, the angling portions be-  
 45 ing capable of flexing sufficiently to provide for such expansion and contraction.

The water circulation is into the drum F through the pipe F', thence by the pipes D to the pipes C, thence through the pipes E to  
 50 the drum G, and thence back through the pipe H to the drum F, the heat which comes in contact with the pipes D, C, and E causing the water to rise continually in said pipes and producing a constant circulation.

55 As the drum G is at considerable height, and as it is necessary that the sight-gage be much lower in order to be convenient, I have devised an extension-gage, as illustrated in Fig. 1<sup>a</sup>. The principal portion of this gage is  
 60 attached to the end of the drum G and contains a float i, connected to a long rod I', which passes down through a tube connected

to the bottom end to a glass portion I<sup>2</sup>, and has an indicator i' on its lower end and with-  
 in said glass portion. As the water rises and  
 65 falls in the drum or boiler G it, by means of the float, operates to move this pointer i', as will be readily understood.

Having thus fully described my said invention, what I claim as new, and desire to se-  
 70 cure by Letters Patent, is—

1. The combination, in a steam-boiler, of the surrounding walls, the combustion-chamber therein, vertical pipes within said combustion-chamber, horizontal pipes connect-  
 75 ing the upper and lower ends of said vertical pipes, a second space within the structure, upper and lower drums mounted within said space, the cross-pipes connecting said drums, a flue leading from the upper end of the com-  
 80 bustion-chamber around and beneath the upper drum, and thence to the smoke-stack, substantially as shown and described.

2. The combination, in a steam-boiler, of vertical steam-generating pipes, horizontal  
 85 connecting-pipes therefor, a steam-drum and a mud-drum connected to said horizontal pipes, a passage for the products of combustion leading from the combustion-chamber to beneath said drum, and a deflecting or guard  
 90 plate A' arranged below said steam-drum and protecting the horizontal pipes where they are attached thereto from the products of combustion, substantially as shown and de-  
 95 scribed.

3. The combination, in a steam-boiler, of a series of groups of straight vertical steam-generating pipes, a horizontal upper and lower pipe to each group, a mud-drum at the  
 100 bottom, and a steam-drum at the top with which said horizontal pipes, respectively, connect, and detachable unions inserted in said horizontal pipes, whereby any group of  
 105 said steam-generating pipes can be cut off at will, substantially as shown and described.

4. In a steam-boiler, the combination, of the surrounding walls divided into two compart-  
 110 ments one of which is the combustion-chamber and the other of which contains the water-supply and mud drum in its lower part and the steam-dome in its top, the vertical heating-pipes in the combustion-chamber, the horizontal pipes connecting them with the  
 115 water-supply and steam-dome, and the cross-pipes connecting said water-supply drum and steam-dome, all substantially as set forth.

In witness whereof I have hereunto set my hand and seal, at Indianapolis, Indiana, this  
 23d day of January, A. D. 1896.

ASHLEY R. COOPER. [L. S.]

Witnesses:

CHESTER BRADFORD,  
 JAMES A. WALSH.