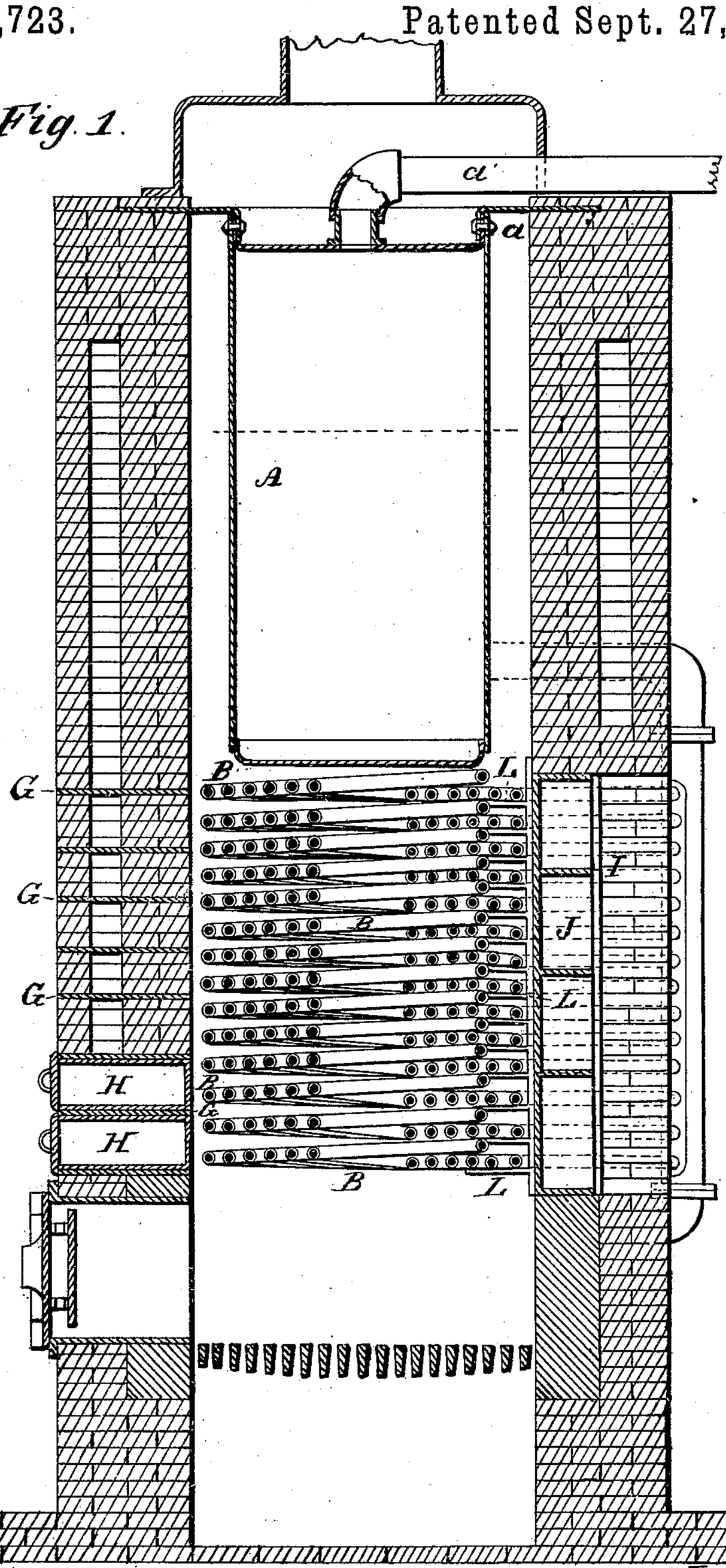
(No Model.) 3 Sheets—Sheet 1.

A. D. BROCK.

STEAM BOILER.

No. 370,723. Patented Sept. 27, 1887.

Fig. 1.



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W. C. Schaffer

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by F. B. Brock atty

(No Model.)

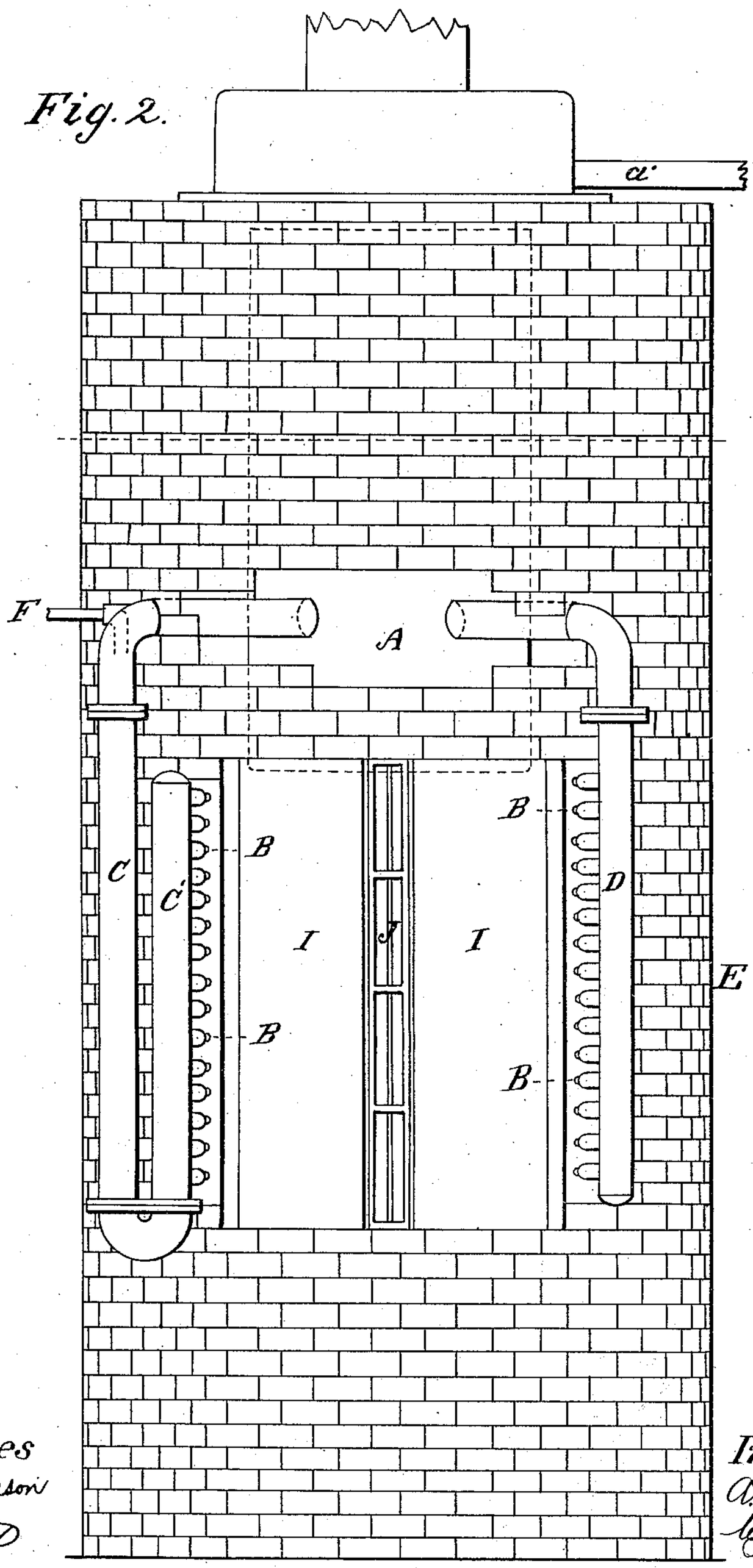
3 Sheets—Sheet 2.

A. D. BROCK.

STEAM BOILER.

No. 370,723. Patented Sept. 27, 1887.

Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

A. D. BROCK.

STEAM BOILER.

No. 370,723. Patented Sept. 27, 1887.

Fig. 3.

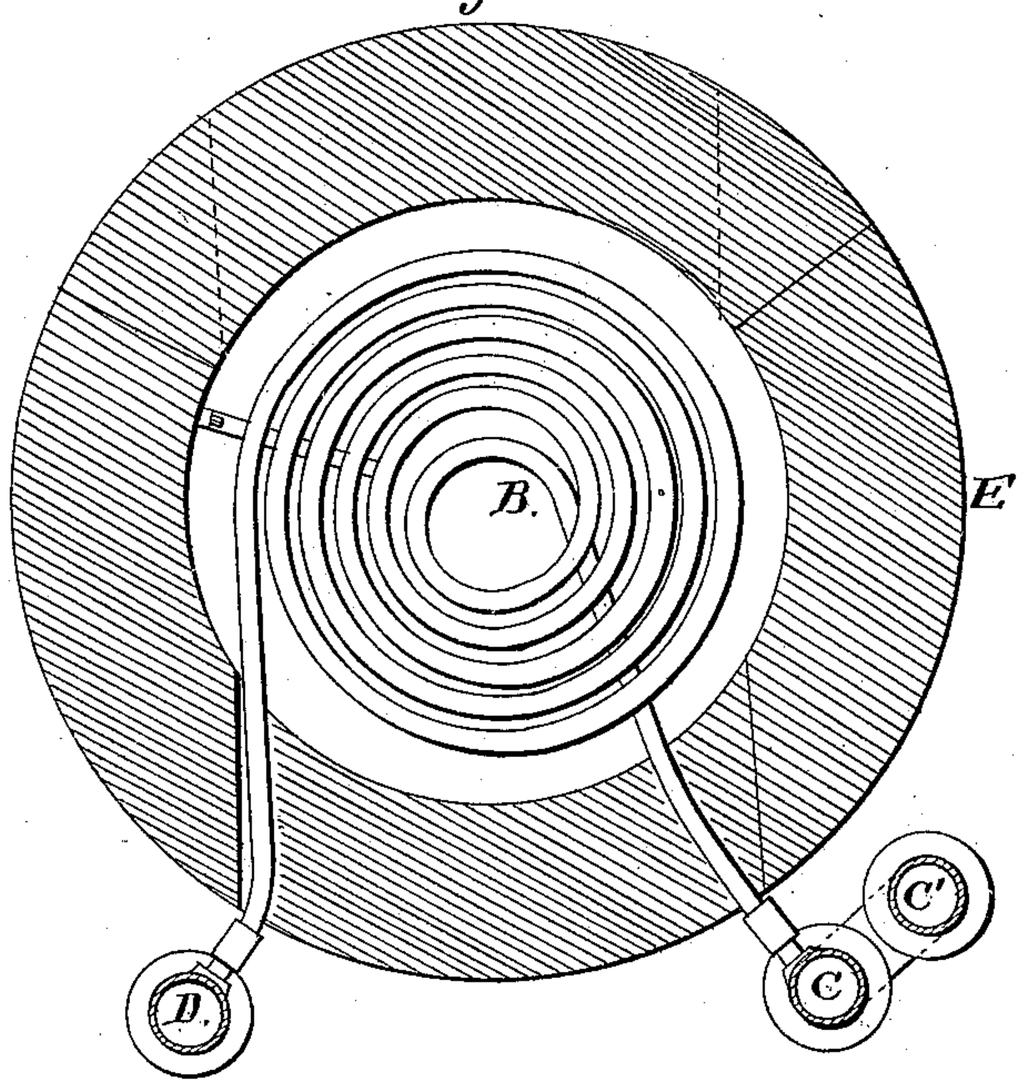
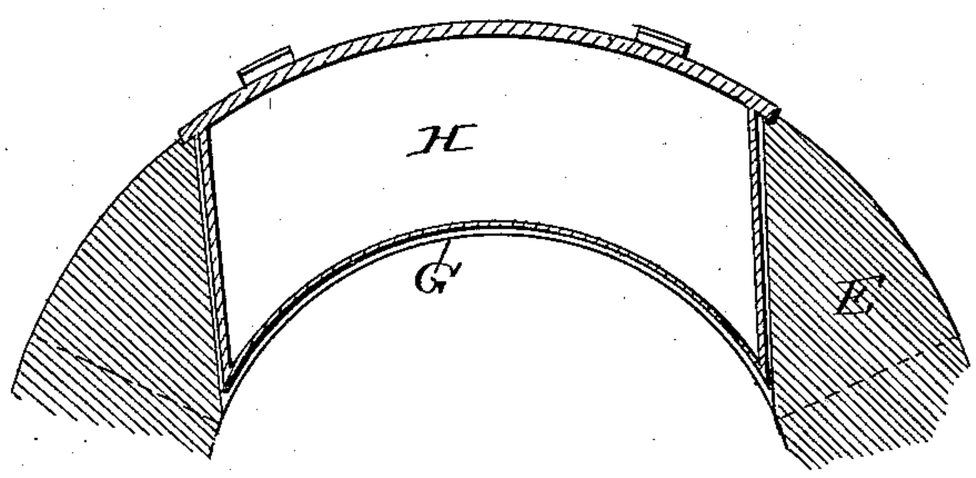


Fig. 4.



Attest:
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M. B. Chapple

Inventor:
A. D. Brock,
by G. B. Brock
Atty.

UNITED STATES PATENT OFFICE.

ALVAN D. BROCK, OF WASHINGTON, DISTRICT OF COLUMBIA.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 370,723, dated September 27, 1887.

Original application filed October 19, 1882, Serial No. 74,650. Divided and this application filed September 12, 1883. Serial No. 106,263. (No model.)

To all whom it may concern:

Be it known that I, ALVAN D. BROCK, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 represents a central vertical section of a boiler to which my improvements have been attached. Fig. 2 represents a rear elevation of the same. Fig. 3 is a transverse section of a boiler, showing my improvements, and Fig. 4, a detail view hereinafter referred to.

The invention relates to steam-boilers of the water-tube type.

The objects of the present improvements may be generally expressed as, first, to give free accessibility for the easy removal of any one or more of the water-tubes through the side of the casing; second, the removal of all joints from the action of the fire; third, consequently all joints are made outside of casing, or in such position that they can be coupled or uncoupled from the outside; fourth, the arrangement of the circulation-tubes and water-tubes, so that the juncture of the two is made from the outside of the boiler; fifth, to secure unlimited freedom for expansion of the water-tubes and connections, and therefore, sixth, safety from explosion because of unequal expansion; seventh, security from the distribution of water exposed to the fire into small masses, admitting of thin heating-surface pipes for the rapid transmission of heat, which, if ruptured, result in no material injury; eighth, rapid and effective circulation of water; ninth, ease of transportation; tenth, enormous capacity, and eleventh, therefore, great capability of quickly generating a working-pressure. I attain these objects by the mechanism illustrated in the accompanying drawings.

The boiler consists, essentially, of a reservoir, A, water-tubes B, and circulation tubes or chambers C D.

The reservoir A, I prefer to make superimposed or above the level of the water-tubes in most cases; but in some instances I may arrange it at one side, or in any position where it will work with good results. It may, moreover, be of any desired shape or construction suitable for the purpose. It has been built with longitudinally-arranged fire-tubes, so that all the draft was through such tubes. In the drawings it is shown constructed of boiler-iron, without fire-tubes, and supported by ears *a* bolted thereto and received into the brick-work, the products of combustion passing up exteriorly of the reservoir. The steam-pipe *a'* leads from the top thereof, and connection is had with the circulation-tubes C D below the water-line, as shown in Fig. 2.

The water-tubes B, as shown in the drawings, are single flat helical coils. They may, however, be double coils or of cylindrical or other practical shape. I also contemplate the use of straight tubes in different combinations, as such may be used in my invention with satisfactory results. Whatever the kind or configuration of pipe I may employ may be, I connect one end with the circulation-pipe C and the other end with the circulation-pipe D, thereby placing each and every one of the series of water-tubes into communication with the reservoir A.

The mechanical construction and arrangement of the circulation-tubes C D are different, and they serve as a means and communication for a very rapid and efficient circulation of water between each tube B and the reservoir. The tubes or chambers C D are arranged outside the casing or brick-work E, so that the junction or coupling of the water-tubes B may be effected with the chambers C D from the outside.

The circulation-tube C has a return-bend, C', which which the water-tubes communicate directly. From the point of junction with the reservoir to the bottom of the bend in this siphon-shaped or return-bend chamber C it is preferably without or free from taps, save when provision is made for the entrance of the feed-water pipe F. The bend C' of the siphon-shaped tube is tapped for the reception of one end of each of the water-tubes B, and the cir-

culation-tube D is tapped in like manner for the reception of the other end of each of the water-tubes, the connections being made, preferably, by right and left couplings.

The tube D is simply a pendent tube from the reservoir, closed at its lower end. The tube C has the upper end of its branch C′ closed. The return-bend of tube C and the bottom of tube D may have blow-off cocks, if desired. It is essential that the siphon-shaped circulation-tube have its return-bend at least as low as the level of the lowest water-tube B; or it may have its return-bend extend to or below the fire-box or indefinitely in that direction.

I make provision for the ready removal of any one or more of the water-tubes B, should it become impaired or burn out, or for any other cause. When using flat coils, as shown in the drawings, I place a series of thin metallic plates, G, of the form shown in Figs. 1 and 5, between every three or four courses of brick-work.

When it is desired to remove any one of the coils or water-tubes B, the brick-work E is torn away between two of the adjacent plates sufficient to allow the horizontal withdrawal of the coil, the disconnection with the circulation-tubes being previously made from the outside, as set forth.

In lieu of the brick-work between the segmental plates, I may provide for the removal of the water-tubes by leaving a space large enough for the withdrawal of the tubes B between the series of plates G, which would ordinarily be closed by a closed removable sheet-iron chamber, H, the interior of which serves as a non-conducting air-space. This modification, as also that first described, is shown by Figs. 1 and 4.

The openings heretofore described are shown made in the front of the boiler-casing and opposite the circulation-tubes C D. However, if desired, the water-tubes B may be withdrawn through the back of the boiler and between the tubes C D. Figs. 1 and 2 illustrate these points. An opening is shown therein large enough for the removal of all the tubes B. It has a central skeleton casting, J, between which and the sides of the opening is a filling of removable fire-clay, I I.

L L represent a series of projections arranged for the support of the coils B. They may be of any desired construction, and are attached to the brick-work, or to a vertical bar or pipe connected therewith. They may be placed at one or more points for the support of the coils. The reservoir A may be composed of a nest of water-tubes, if desired, having free communication.

When the boiler is fired, the water in the water-tubes B becomes heated, its specific gravity is lessened, and it rises, flowing out of the tubes. The circulation-tube D gives the water free access to reservoir A in this upward tendency—that is, the pipe or chamber D presents a route of less resistance than that presented by circulation-tube C. The water, in attempting to flow upward, would have to flow downwardly through the branch C′ of tube C before it could rise to the reservoir. When, under the continued action of the products of combustion, steam is generated and the water in the boiler raised to a very high temperature, the circulation of the water is still maintained. This is due to the comparative difference in the temperature between the water in the water-tubes in immediate contact with the incandescent fuel and that in the circulation-tube C, flowing from the reservoir. Moreover, the return-bend in circulation-tube C, being below the level of the water-tubes B, presents a column of water, through which the steam and water in water-tubes B (in direct contact with the fire, and consequently of lighter specific gravity than the water in the return-bend) would have to force itself, a condition of things contrary to known laws. Thus a rapid, constant, and efficient circulation of water is provided downwardly through circulation-tube C, into and through the water-tubes B, and outwardly and upwardly through circulation-tube D, back to the reservoir A. The circulation of the water is kept up perfectly, no matter how much the fire may be forced; and I believe that by this plan three square feet of heating-surface may be made, under intense heat, to equal ten square feet under the ordinary firing-temperature.

This application is a divisional application of the original application of A. D. Brock and F. B. Brock for a steam-boiler, filed October 19, 1882.

What I claim is—

1. The combination, with the reservoir of a water-tube steam-boiler, of a circulation-tube arranged substantially as described, the upleading branch of which has connections with the whole series of independent water-tubes, whereby said connections may be coupled and uncoupled from the outside of the brick-work or casing of the boiler.

2. In combination with the reservoir of a steam-boiler, circulation-tubes, as C C′, the upleading branch C′ of which has connections with the whole series of water-tubes, and arranged outside the boiler-casing and connected with the reservoir below the water-line, said water-tubes or a series of coils communicating at one end with the siphon-shaped tubes and at the other end with the reservoir by means substantially as described.

3. A series of coils and a water-reservoir in combination with two circulation-tubes, as C C′ and D, arranged outside the boiler-casing and connecting the coils and reservoir below the water-line, one of which tubes, C C′, is siphon-shaped, and both tubes have connections with the whole series of water-tubes B, substantially as described.

4. In combination with a steam-boiler hav-

ing flat coils, a casing or brick-work provided with a series of vertically-arranged openings made by the interposition of suitable supporting-plates, the openings being closed by means substantially as described.

5. A boiler casing or brick-work having an opening the horizontal walls of which are formed of plates, as G, and closed by removable chambered doors H, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ALVAN D. BROCK.

Witnesses:
F. B. BROCK,
W. T. JOHNSON.