No. 616,531. Patented Dec. 27, 1898.

F. G. GASCHE.

VERTICAL WATER TUBE BOILER.

(Application filed Mar. 3, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

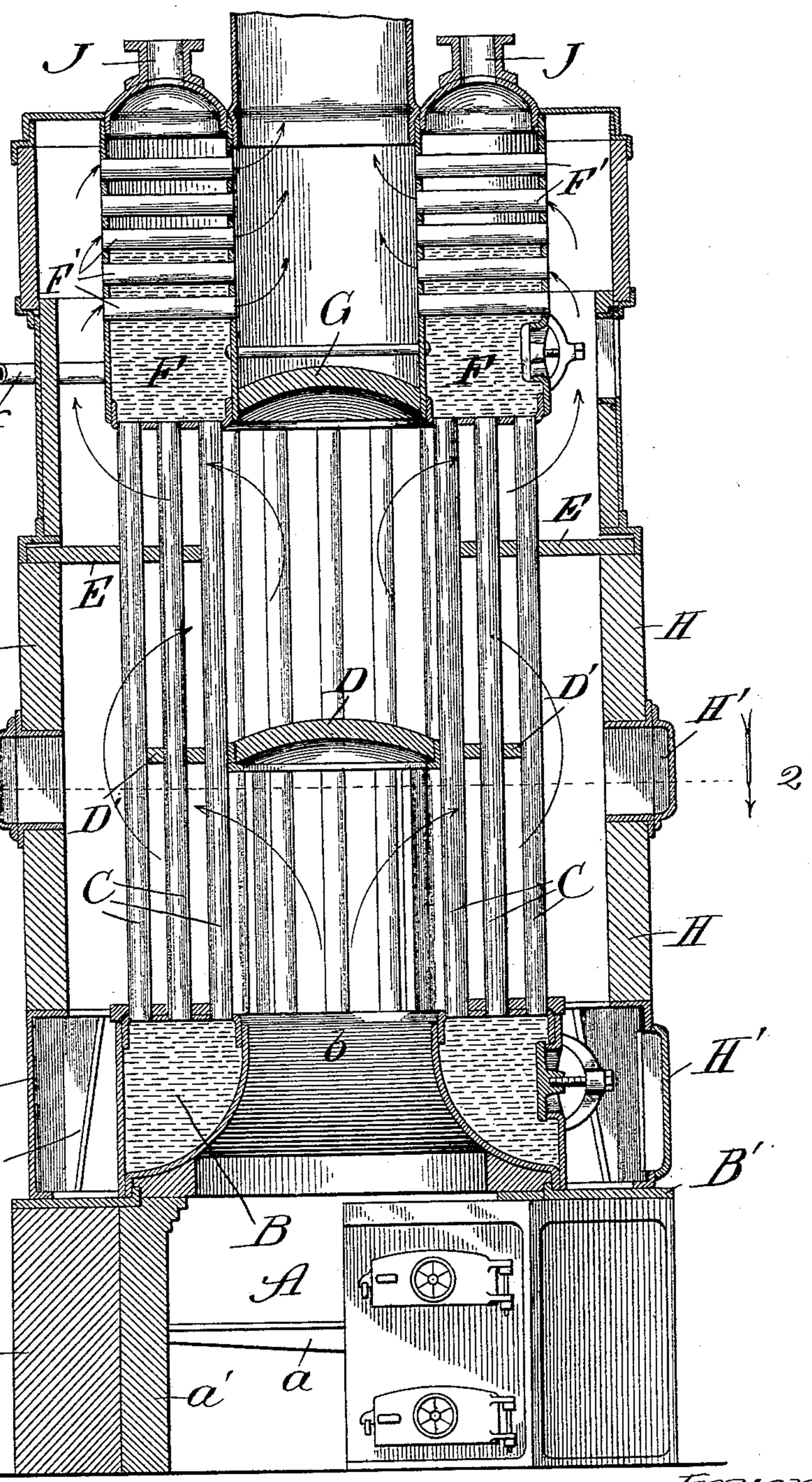

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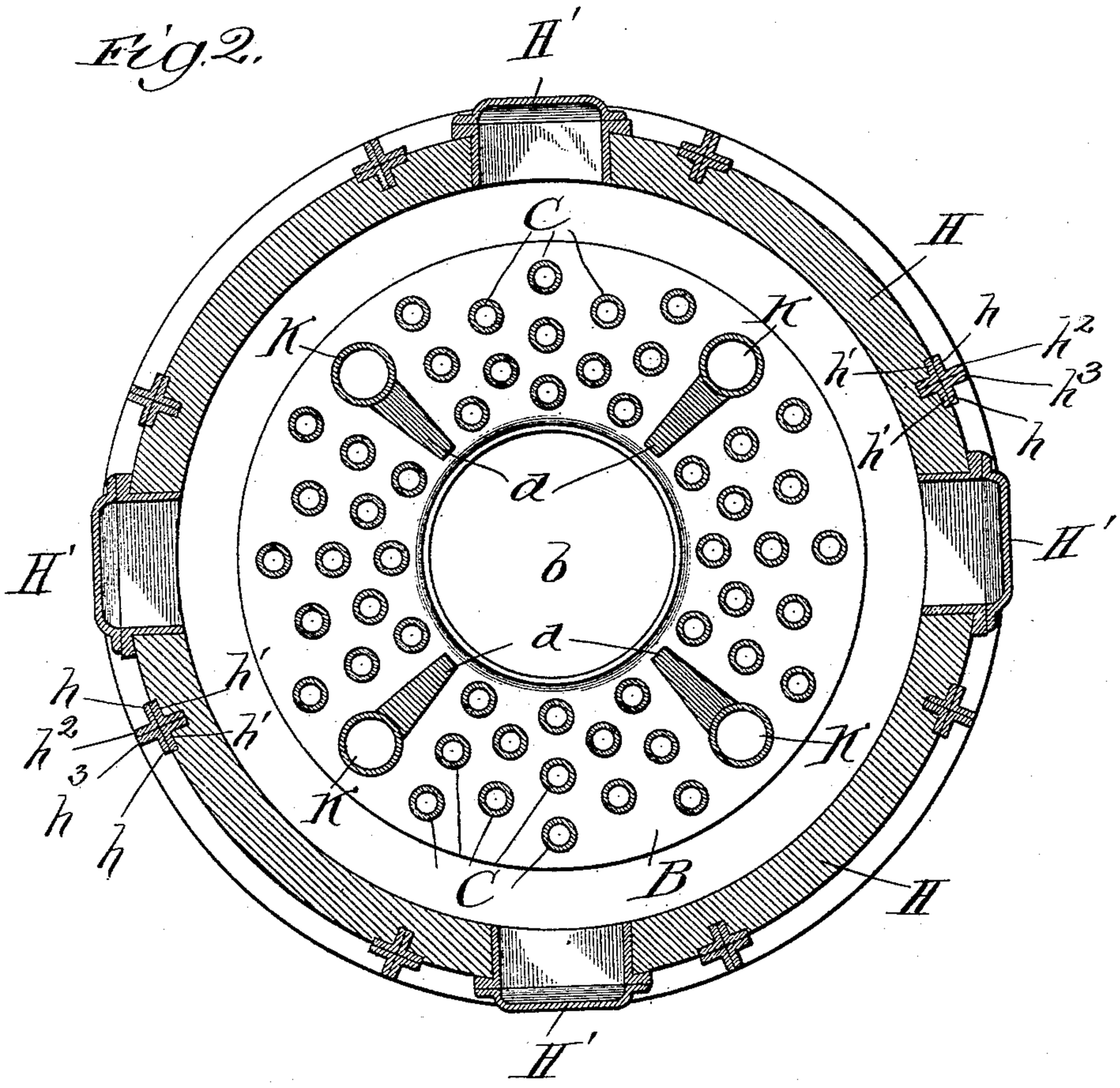
Fig. 2.



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VERTICAL WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 616,531, dated December 27, 1898.

Application filed March 3, 1898. Serial No. 672,345. (No model.)

To all whom it may concern:

Be it known that I, FERD G. GASCHE, a citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in Vertical Water-Tube Boilers, of which the following is a specification.

In the drawings, Figure 1 is a vertical sectional elevation of my improved boiler; and Fig. 2 is a sectional plan view taken in the line 2 of Fig. 1, looking in the direction of the arrow.

In making my improved vertical water-tube boiler I make a combustion-chamber A of a desired size, provided with grate-bars *a*, so that a fire can be maintained in the combustion-chamber. The wall forming the combustion-chamber may be of any desired construction, but preferably of brick A′, with a refractory lining *a′* to enable it to withstand the heat. I arrange above the combustion-chamber an annular water-chamber B, provided with a central opening *b* of less sectional area than the area of the top of the combustion-chamber. This annular water-chamber rests on the top of the combustion-chamber and preferably upon a ring base-plate B′, as shown in Fig. 1. By making the central opening through the water-chamber of less sectional area than the area of the top of the combustion-chamber a throat or diminished space is provided through which the heat, gases, and products of combustion pass on their way through the boiler. The opening in the water-chamber is preferably formed by having the inner wall converging inwardly and upwardly, as shown in Fig. 1, so as to avoid objectionable joints or abrupt angles, which is the more desirable, as this part is exposed to the intense heat of the combustion-chamber. I arrange a desired number of vertical water-tubes C above the annular water-chamber, with their lower ends inserted into a tube-sheet, forming the top of the water-chamber. This causes the tubes to communicate with the interior of the water-chamber. At a desired distance above the annular water-chamber I arrange an arch D, formed of refractory material, which arch is provided around its periphery with an extending flange D′, provided with holes, through which the water-pipes pass. I prefer to make this extending flange of separate pieces, segmental in form instead of integral with the arch D, as shown in Fig. 1, which enables me to put the parts together more readily than if they were formed of one integral construction. I support the arch D on what may be termed "piers" *d*, which may be adapted to withstand the heat by being formed either of refractory material or by the circulation of water through them, as may be preferred. Above the arch at a desired distance I arrange an annular ring E, which extends in from the outer wall and is provided with holes through which the water-tubes pass. This annular ring is also preferably made of segmental pieces to facilitate the assembling of the parts together. Above the segmental ring I arrange an annular water and steam chamber F. The bottom of this water and steam chamber is provided with a tube-sheet, into which the upper ends of the tubes C are inserted, so that they will communicate with the interior of the chamber F. I also arrange a number of horizontal tubes F′ across the steam and water chamber, forming passages or communications from the exterior to the interior opening through such chamber. I arrange an arch G across the circular opening through the chamber F, as shown in Fig. 1. The annular water-chamber B and the annular water and steam chamber F may be provided with openings, closed in the usual way and permitting access to their interiors, as shown in Fig. 1. The surrounding case or shell H of the boiler is formed of segmental sections, as shown in Fig. 2, the interior lining of each section being formed of refractory material and the outside of metal plates. To attach these segments together, angle-irons are employed, as shown in Fig. 2. To effect the attachment, the flanges *h* and *h′* of the angle-irons are riveted together, with the plate interposed between them, and the flanges h^2 and h^3 are then bolted together. This explanation of the attachment of one set of angle-irons together will be sufficient to explain the attachment of all, as they are alike. By removing the bolts any desired segment of the outer shell or case may be removed, including its lining of refractory material, so that a new lining can be provided or other changes or repairs effected through the facility of access thus secured. Usual man-

holes H′ may also be provided, closed in the usual way to permit access, as shown in Fig. 1. The outer shell or case is of a size to permit a desired space between it and the tubes, as shown in the drawings. That section of the shell or case which surrounds the annular water-chamber not being exposed to intense heat need not be lined with refractory material, but may be an annular ring I, of metal, provided with inwardly-projecting ribs or brackets *i*, as shown in Fig. 1. This section of the shell or case being open at the top, as shown in Fig. 1, permits soot or flue-dust which is precipitated from the gases to be caught and accumulated without interfering with the operation of the boiler. Of course it will be understood that all of the usual incidents and accessories—such as a feed-water pipe *f*, a safety-valve, blow-off pipes, and other similar details, (not shown)—common to boilers will be supplied by the constructor.

In operation the heat and gases pass up from the combustion-chamber through the contracted throat of the water-chamber, which causes an intimate and complete intermixture of the air and combustible gases, thus promoting comparatively complete combustion. They are then deflected by the arch D and caused to pass upwardly through the spaces between the pipes and around the extending flange, where they are again caused by the annular ring E to be deflected inwardly around its inner edge, whence they are again caused to pass outwardly by the arch G and the tube-sheet of the water and steam chamber F into the space between such chamber and the outer shell or case. They then pass through the horizontal tubes F′ into the circular opening in the water and steam chamber, and thus up through the smoke-stack, as indicated by the arrows. Such of these pipes as pass through the steam-space of the chamber serve to superheat the steam more or less as they are heated by the gases passing through them. The water in the annular water-chamber becoming heated passes up through the tubes into the water and steam chamber and being subjected to heat as it passes up through the tubes is converted into steam, whence it passes through the steam-nozzles J and is carried to the place of use. To permit water from the water and steam chamber to pass down into the annular water-chamber, I provide a desired number of pipes K, which are preferably of larger diameter and arranged more remote from the more intensely heated portions of the boiler than the others, as shown in Fig. 2. This permits a constant circulation of the water.

What I regard as new, and desire to secure by Letters Patent, is—

1. In a vertical water-tube boiler, the combination of a combustion-chamber, an annular water-tube chamber arranged above the combustion-chamber and provided with a central opening of less central area than the area of the top of the combustion-chamber, an annular steam and water chamber forming the top of the boiler provided with a central opening and water-tubes extending transversely from the outer shell to the inner shell so as to permit heated gases to pass therethrough and assist in the generation of steam, and a series of water-tubes vertically disposed connecting the lower annular water-chamber and the upper water and steam chamber together, substantially as described.

2. In a vertical water-tube boiler, the combination of a combustion-chamber, an annular water-chamber arranged above the combustion-chamber provided with a central opening of less sectional area than the area of the top of the combustion-chamber, water-tubes arranged upon and communicating with the annular water-chamber, an annular steam and water chamber arranged above the water-tubes provided with transverse tubes in its upper portion and communicating in its lower portion with the upper ends of the water-tubes and therethrough with the annular water-chamber, and means for deflecting the gases and products of combustion in a serpentine direction through the spaces between the water-tubes and into a space from which they pass through the transverse tubes on their way toward a point of egress, substantially as described.

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Witnesses:
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