No. 681,755. Patented Sept. 3, 1901.

S. THURSTENSEN.

WATER TUBE BOILER.

(Application filed Mar. 28, 1901.)

(No Model.) 4 Sheets—Sheet 1.

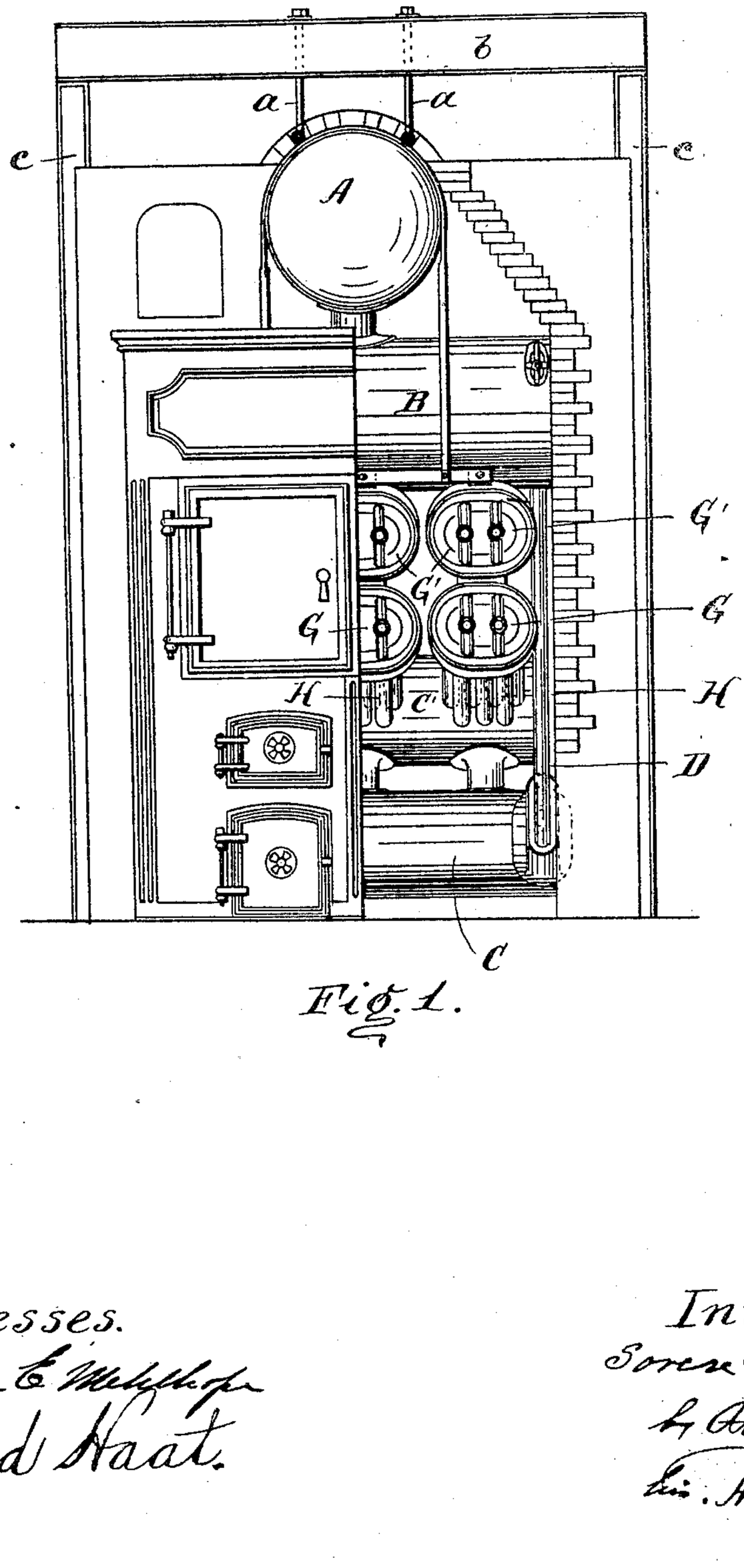

Fig. 1.

Witnesses.
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(No Model.) 4 Sheets—Sheet 2.

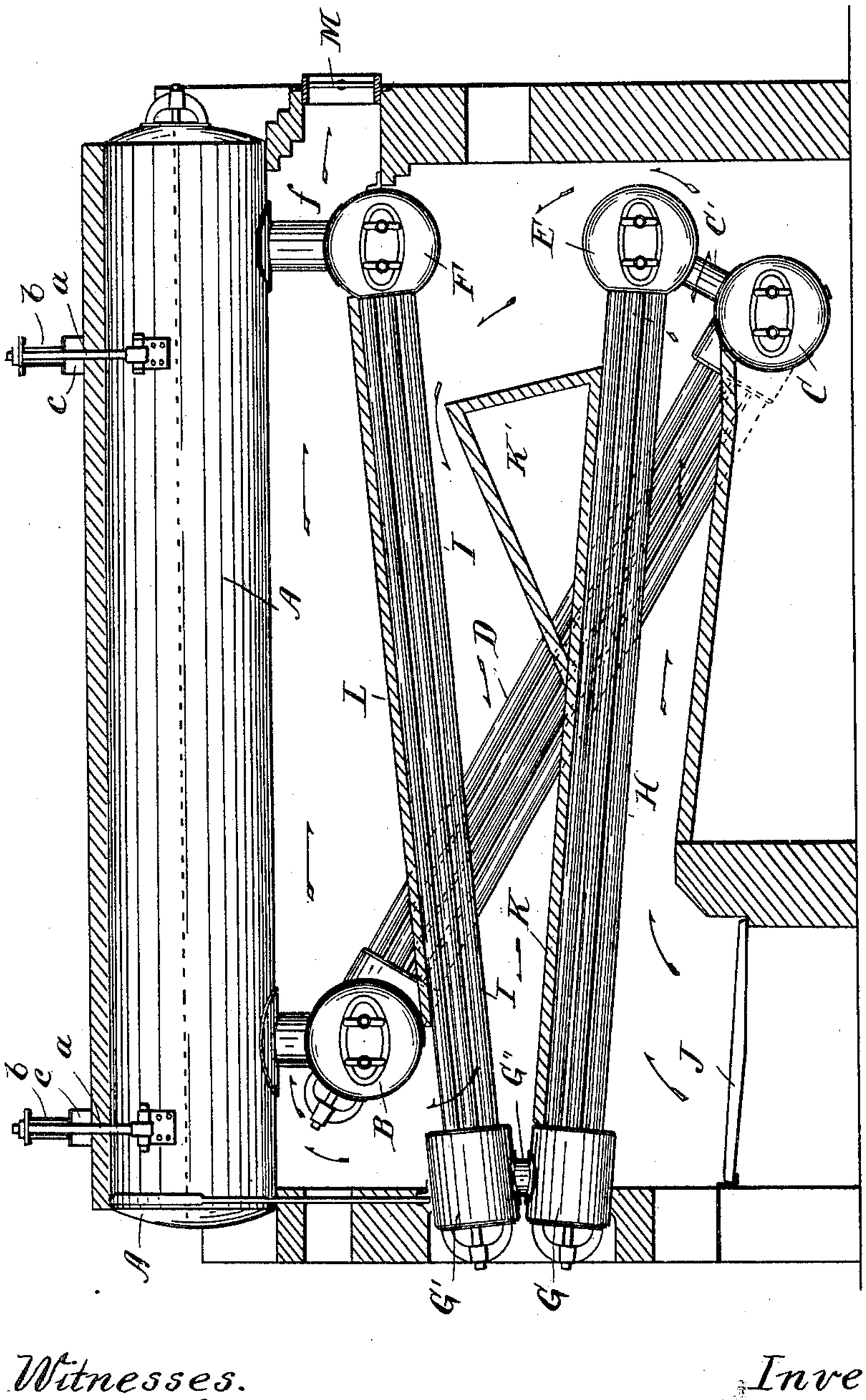

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

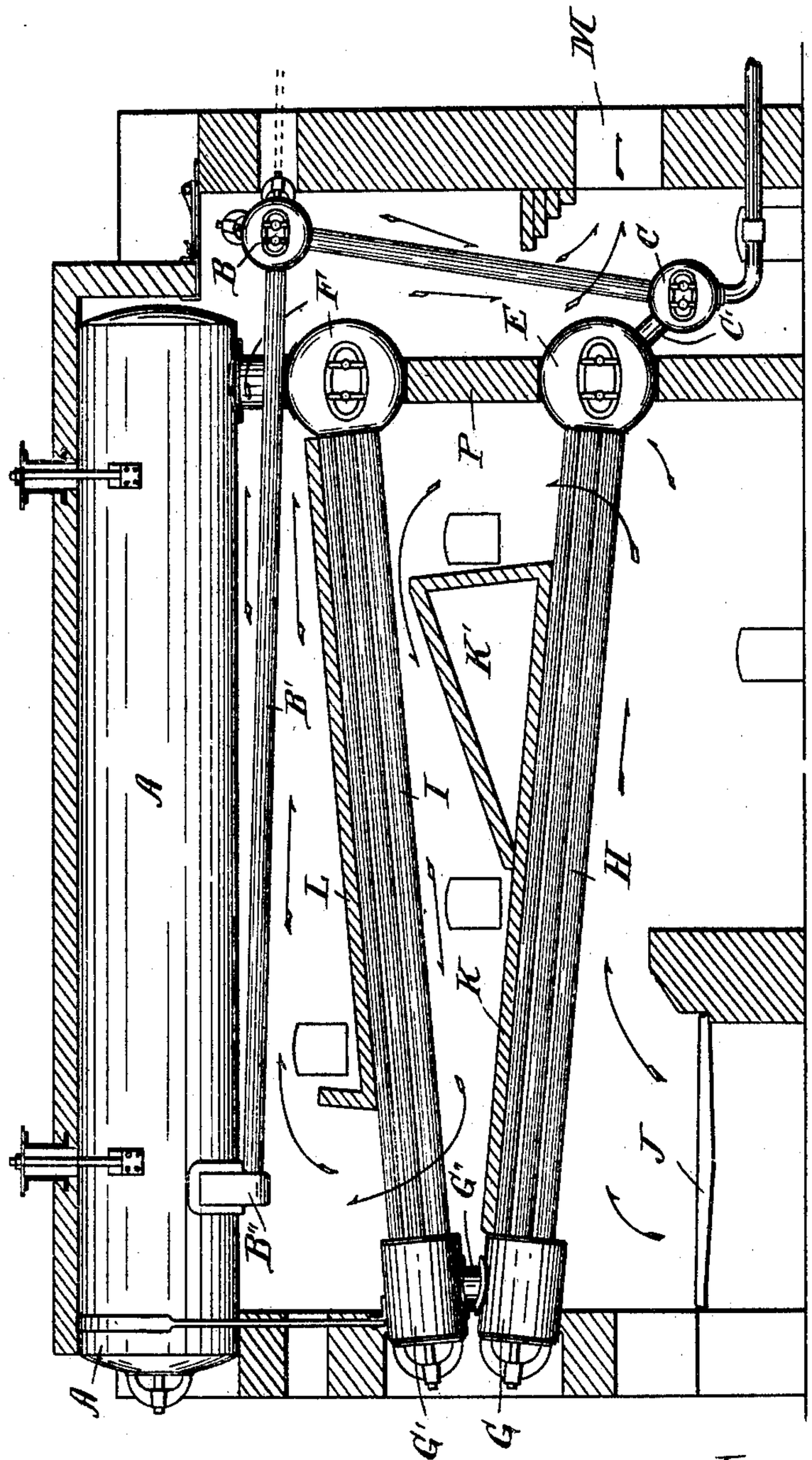

Fig. 3.

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No. 681,755. Patented Sept. 3, 1901.

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WATER TUBE BOILER.

(Application filed Mar. 28, 1901.)

(No Model.) 4 Sheets—Sheet 4.

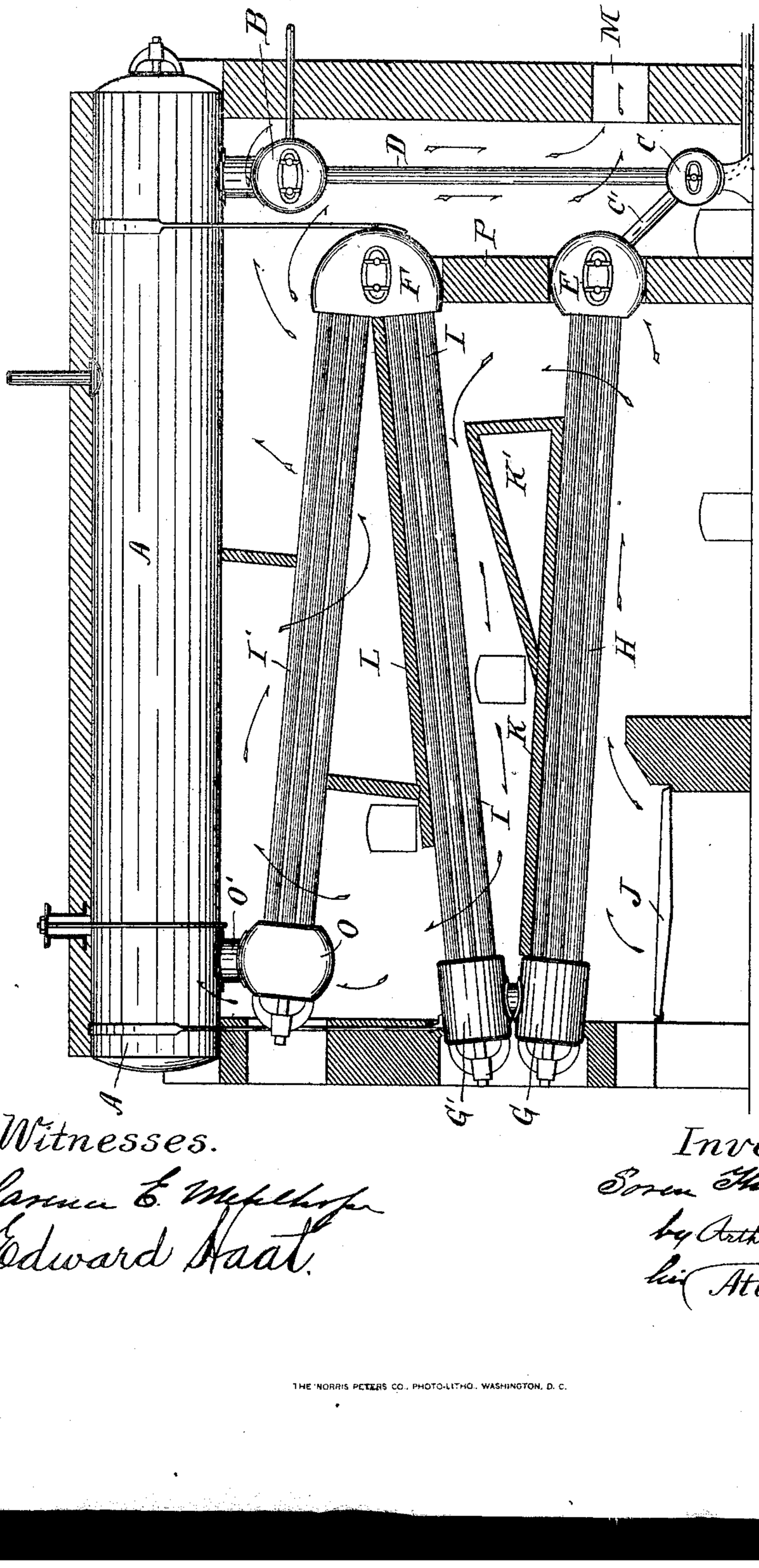

Fig. 4.

Witnesses.
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UNITED STATES PATENT OFFICE.

SOREN THURSTENSEN, OF LOUISVILLE, KENTUCKY, ASSIGNOR TO HENRY VOGT MACHINE COMPANY, OF SAME PLACE.

WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 681,755, dated September 3, 1901.

Application filed March 28, 1901. Serial No. 53,311. (No model.)

To all whom it may concern:

Be it known that I, SOREN THURSTENSEN, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented a certain new and useful Improvement in Water-Tube Boilers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of my specification.

My invention relates to water-tube boilers; and it consists of certain novel arrangements of the water tubes and drums and of the furnace-flues whereby the efficiency of the boiler is increased, its construction simplified, and its life lengthened.

One object of my invention is to furnish a water-tube boiler so constructed that the water-tubes are readily got at for inspection and cleaning and that any one of said tubes may be removed without removing any of the others.

Another object of my invention is to convey the hot gases from the furnace in contact with the water-tubes in such manner as to completely exhaust the heating efficiencies of said gases before they escape to the smoke-stack.

The various advantages of my improved construction will appear fully as I proceed with my description.

In the drawings like letters of reference indicate like parts of the boiler.

Figure 1 is a front elevation of my improved boiler with one door removed, so as to show the internal construction of the boiler. Fig. 2 is a longitudinal section through the same. Fig. 3 is a similar section of a modified form of my improved boiler, and Fig. 4 is a similar section of still another modification of my improved boiler.

I will first describe the preferred form of my boiler, as illustrated in Figs. 1 and 2. Arranged at the top of my boiler is the steam and water drum A, running the full length of the boiler. This is supported by the columns *c*, cross-pieces *b*, and rods *a*, although it may be supported in any other convenient manner. At the forward end of the boiler and immediately below the steam and water drum and connecting with the same is the feed-water drum B at right angles to the steam and water drum and running the full width of the boiler. Parallel to the drum B in the rear at the bottom of the boiler is arranged a similar drum C, this latter being the mud-drum. The drums B and C are connected together at the ends by means of the water-tubes D. I prefer to make these water-tubes D four in number, as by this arrangement they take up a minimum of space. However, I do not mean to limit myself to this arrangement, as the four tubes might be replaced by one tube or by any other number of tubes. Arranged at the rear of the boiler and parallel to the drum C and at points above the same are the two drums E and F. A series of pairs of headers are arranged at the forward end of the boiler at a point about midway in elevation between the drums E and F. These headers I have lettered G and G′. The headers G are connected with the headers G′ by means of the tubes G″. Each header G is connected to the drum E by a series of downwardly-inclined water-tubes H, preferably ten in number, and each header G′ is similarly connected to the drum F by a series of upwardly-inclined water-tubes I, also preferably ten in number. The drums C and E are connected together by tubes C′, one for each set of headers, and the drum F is connected to the rear end of the steam and water drum A by the tube *f*. All of the drums are provided with manholes at each end to permit access to the same for cleaning and repairs. The drum B is provided with hand-holes at each end opposite the series of tubes D, so as to permit the removal of any one of said tubes. All of the tubes H, D, and I are made straight, and therefore no difficulty is encountered in removing them. Any one of the tubes H and I may be removed through the headers G or G′. The series of pairs of headers G G′ might be replaced by a single header extending the width of the boiler with manholes opposite each series of tubes H and I, but I find that the arrangement as first described, of a separate header at the forward end for each series of tubes, is preferable, as giving room for unequal expansion of said tubes. The grate J is arranged at the forward end of the furnace. The bank of tubes H is covered with tiling K to within a short distance

of the drum E. At this point the tiling is carried upward and forward in triangular form K', the highest point of the triangle coming within a short distance of the bank of tubes I. The bank of tubes I are covered with tiling L from a point below the drum B to the drum F. Tiling is also carried from the top of the brickwork at the back of the grate to the drum C, so as to convey the hot gases in close contact with the bank of tubes H. The purpose of this arrangement of tiling is to cause the hot gases from the grate to come first in contact with the bank of tubes H, then pass up through said tubes at their rear ends and around the drum E up to the rear ends of the tubes I, then forward in close contact with said tubes I to the forward ends of the same, then up through said forward ends to the drum B and the steam and water drum A, thence backward in contact with said steam and water drum to the opening M, which leads into the uptake. The progress of the gases is indicated by the arrows. The progress of the gases, as thus described, causes most of the heat of said gases to be exhausted in heating the water in the tubes H and I, so that when they reach the steam and water drum A most of their heat has been exhausted. This is of great advantage, since in case the water has been allowed to fall below the proper point (indicated by dotted lines) the gases are not sufficiently hot to injure the walls of the steam and water drum.

The arrangement of drums and water tubes as described gives a complete circulation of water, as follows: from the feed-drum B, through the tubes D, to the mud-drum C, to the drum E, through the tubes H, to the headers G G', through the tubes I, to the drum F, to the drum A, whence the water passes to the feed-drum B.

With the arrangement of the feed-drum and connections between the feed-drum and water-drum, as just described, at each side of the boiler the width of the boiler is increased by twice the diameter of the water-tubes D. By placing the feed-drum at the rear and the water-tube connections between said feed-drum and the mud-drum also in the rear the width of the boiler is decreased and space economized that much. This is done in the two modifications that I will now describe.

Referring to Fig. 3, the steam-drum A, headers G and G', tubes H and I, and drums F and E are arranged as before. The feed-drum B, however, is arranged at the rear of the boiler instead of at the forward end, and the mud-drum C is arranged at the rear of the drum E. The drums B and C are connected by a series of tubes D, as before, and these tubes are separated from the rest of the boiler by means of the wall P, so as to be in cool relation to the rest of the boiler, as before. The feed-water drum B is connected to the steam and water drum A by means of a series of four or more tubes B', which are expanded at their forward ends in a saddle B'', secured to the drum A. The arrangement of the tubes H and I are covered with tiling substantially as before, and the currents of gases are, as indicated by arrows, substantially as before, except that after passing along in contact with the steam-drum they are carried down in contact with the tubes D to the opening in the uptake M, which in this case is at the bottom.

In the modification shown in Fig. 4 the steam and water drum A, headers G and G', the tubes H and I, the drums E and F, and the feed-drum B and mud-drum C are arranged in substantially the same way as the last modification, with the exception of the method of circulation of water to and through the steam-drum A. In the modification under discussion the circulation of water is toward the rear, whereas in the other two modifications the water circulates toward the front end of the steam-drum. An additional drum O is provided at the forward end of the boiler, extending at right angles to the same the full width of the boiler. A set of tubes I', corresponding to the sets H and I, connect the drum O and the drum F, and the drum O is provided with manholes opposite each set of tubes I', so that said tubes may be withdrawn or repaired. The drum O is connected with the steam and water drum A by means of the pipe O', thus completing the circuit. The circulation of the gases is as shown by the arrows. It will of course be understood that the number of steam and water drums A in either modification may be multiplied according to the size of boiler required, in which case of course the headers and banks of water-tubes would be increased accordingly.

Having thus described my invention, what I desire to claim as new and to cover by Letters Patent is—

1. In a water-tube boiler, an elevated steam and water drum, an elevated feed-drum at right angles thereto and connecting therewith, a mud-drum and water-tubes connecting said feed and mud drums in cool relation to the rest of the boiler, auxiliary drums intermediate the mud-drum and the steam and water drum, a series of headers at the forward end of the boiler, a series of inclined banks of straight water-tubes connecting said headers with said auxiliary drums, and suitable connections to make the water-circuit complete, substantially as and for the purpose described.

2. In a water-tube boiler, an elevated steam and water drum A, a feed-drum B, a mud-drum C, the water-tubes D, connecting the same in cool relation to the rest of the boiler, the auxiliary drums E and F, the series of headers G and G' at the forward end of the boiler, the banks of straight tubes H and I, with intermediate connections, substantially as described and for the purpose specified.

3. In a water-tube boiler an elevated steam and water drum A, a feed-drum B, a mud-

drum C, the bank of water-tubes D, connecting the two, the auxiliary drums E and F, and headers G and G′, the banks of straight water-tubes H and I, supplemental connections adapted to complete the water-circuit, and tiling covering said banks of tubes H and I, whereby the hot gases from the grate will be caused to travel substantially the length of and in proximity to the tubes and drums, all as described and for the purpose specified.

4. In a water-tube boiler, an elevated steam and water drum A, an elevated feed-drum B, at the rear of the boiler connected to the forward end of the boiler by a series of straight tubes, a mud-drum at the bottom and connected to said feed-drum by a series of straight tubes in cool relation to the rest of the boiler, the auxiliary drums E and F, the headers G and G′, the banks of tubes H and I, connection between the drums C and E, and between the drums F and A, and tiling covering said banks of tubes H and I, adapted to cause the gases to circulate, substantially as described and for the purpose specified.

5. In a water-tube boiler, an elevated steam and water drum A, a feed-drum B, at the rear of the boiler, and mud-drum C, the straight tubes D, connecting said feed and mud drums arranged in the coolest part of the furnace, the auxiliary drums E and F, a series of headers G and G′, the drum O, a series of banks of straight water-tubes H, I, and I′, and supplemental connections and tiling arranged and adapted to cause the hot gases to circulate in proximity to the various parts, substantially as described and for the purpose specified.

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Witnesses:
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