

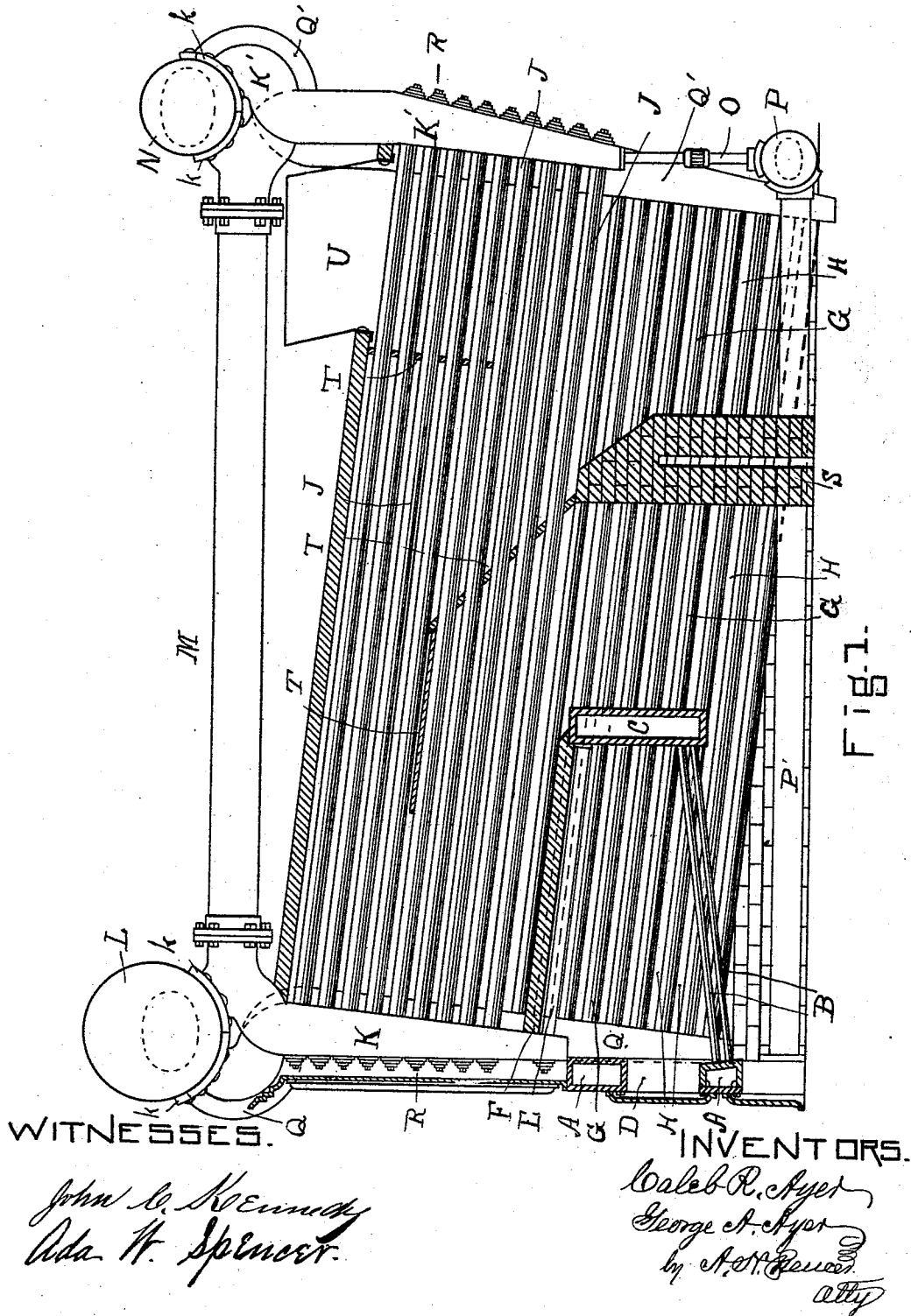
(No Model.)

2 Sheets—Sheet 1.

C. R. & G. A. AYER.
STEAM BOILER AND FURNACE.

No. 498,501.

Patented May 30, 1893.



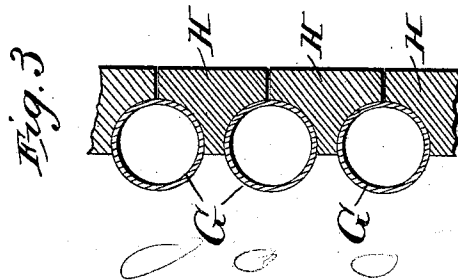
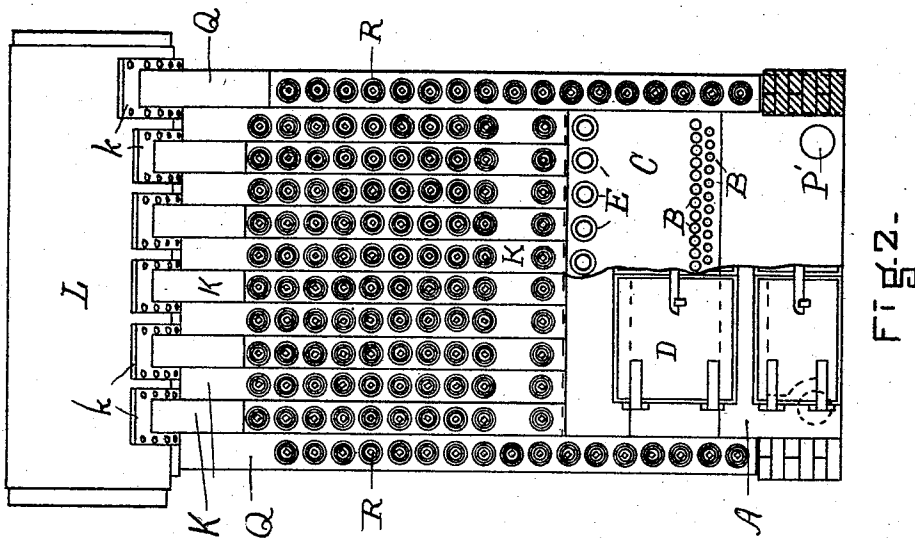
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WITNESSES.

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UNITED STATES PATENT OFFICE.

CALEB R. AYER, OF BOSTON, AND GEORGE A. AYER, OF WORCESTER,
MASSACHUSETTS.

STEAM-BOILER AND FURNACE.

SPECIFICATION forming part of Letters Patent No. 498,501, dated May 30, 1893.

Application filed May 10, 1892. Serial No. 432,441. (No model.)

To all whom it may concern:

Be it known that we, CALEB R. AYER, of Boston, in the county of Suffolk, and GEORGE A. AYER, of Worcester, in the county of Worcester, State of Massachusetts, have jointly invented certain new and useful Improvements in Steam-Boilers and Furnaces, of which the following, taken in connection with the accompanying drawings, is a specification.

Our present invention combines a down-draft furnace with a sectional, water-tubular steam-boiler, under an arrangement of parts which disposes the water tubes in the path of the current and utilizes the fuel to the utmost in generating steam. The fire box or furnace is peculiar, having a grate and an upper surface formed of water tubes mounted at each end in water boxes, and side walls of similarly-mounted tubes having interposed space-pieces fitting the curvature of the tubes. The grate and roof-tubes approach each other as they recede from the feed-door located between them, and they all enter a water box at their inner ends which is free to yield as they expand and contract, and which deflects the caloric current downwardly between the grate tubes, whence it passes by a circuitous path among the water tubes of the boiler. These tubes, with the "headers" into which their ends are inserted, are arranged in sections, side by side, each section standing vertically, the headers in an upright position and the water pipes running obliquely one above the other. The headers diverge or become broader as they rise from bottom to top and are offset reversely at the top, alternately to right and left, so as not to be contracted before entering the steam-drum with which they all connect at the top. This gradual enlargement of the headers affords a proper clearance, and promotes the circulation, making each section independent of those adjacent to it, each header at the lower end of the tubes having a water supply from an enlarged pipe at the base of the boiler, and each flanged and riveted at its upper

end to the steam drum which connects them all transversely. The two drums communicate by means of a cross pipe. A plate of fire brick or the like covers the roof tubes of the fire box, and other like plates deflect the caloric current and lengthen its journey while in contact with the various tubes. Headers similar to those described connect the several tubes constituting the water-tube wall at each side of the boiler.

In the drawings Figure 1 is a longitudinal vertical section through one of our improved boilers, and Fig. 2 is a front elevation, partly in vertical transverse section. Fig. 3 is a sectional detail showing the side wall tubes and space pieces.

A represents the hollow front wall of the furnace, containing water for supplying the tubes B B of the water grate. These tubes are preferably arranged in a zigzag relation to each other, as shown, the lower series of less diameter than the upper so as to give increased space between them, in order that any cinders passing the upper tier will readily pass between the tubes of the lower tier.

The grate-tubes rise obliquely to a transverse water-box C, which closes the inner end of the fire-box and enforces a downward draft through the grate,—the draft inlet being the fuel feed-door D. The top of the fire-box is formed by the reversely-inclined tubes E, entering the upper part of the water-box C and rising thence to communicate with the lower part of each of the front sectional "headers" hereinafter described. The water box C is not connected to the sides of the furnace, and hence may yield laterally as the grate and roof tubes expand and contract. A slab of fire-brick F extends from the water-box C to the header, above the series of tubes E, closing any air-passage between them.

The side walls of the fire-box and of the boiler, are shown as formed of a succession of inclined water tubes G, placed one above another, with interposed space-pieces H, fitting the curvature of said tubes so as to close the openings between them. They will project

but slightly if at all beyond the vertical central line of such tubes, leaving the inner half of the tubes exposed to the fire. These tubes and space-pieces will be dispensed with when the boiler has the ordinary brick setting.

The body of the boiler is made up of a series of parallel sections arranged in vertical planes, each section being composed of a succession of oblique water tubes J, connected at their ends to the upright headers K K', and rising gradually from rear to front, parallel with the roof tubes E of the fire-box. These headers are of cast or wrought metal, with parallel sides, as in Fig. 2, but with edge walls diverging regularly from bottom to top, as in Fig. 1, to afford full vent for the steam formed and to promote the proper circulation of the water. This gradual enlargement of the headers K continues up to the point of their discharge into the steam drum L, which connects them all transversely. Their upper ends are offset alternately to right and left so as, without reducing their area, to give space between and around them for riveting their curved terminal flanges $\frac{1}{2}$ to the drum L. This peculiarity will be clear from Fig. 2, where only the alternate headers which are offset to the front are shown so riveted, the others being secured to the right, lower side of said drum, as seen in Fig. 1. These latter ones may not only communicate with the drum L, but also, as shown, may connect, by a pipe M, with a water drum N, to which the several headers K' at the rear end of the boiler are secured, being alternately offset and flanged as described.

Water is supplied to the lower ends of the headers K' through the supporting tubes O which rise from the transverse feed-water pipe P connected to the main pipe P'. Headers Q Q', similar to those described for the pipes J, receive the ends of the inclined tubes G which form the side walls of the boiler and of the fire-box. These headers are offset, and flanged, and riveted to the drums L and N as described with regard to the series K and K', and they are similarly supplied with water at their lower ends and diverge as they ascend for like reasons. Screw caps R, in the outer faces of the headers give access to the ends of the several tubes G and J where required. A transverse brick barrier S is shown in Fig. 1 deflecting the caloric current upwardly, and other deflectors T, of fire-brick or like mate-

rial, direct the current in a circuit among the tubes, as denoted by the arrows.

U is the uptake.

We claim as our joint invention—

1. In a sectional steam boiler, the inclined, parallel water tubes united at their ends in adjacent vertical sections, having the headers K K' offset alternately to right and left and riveted to the drums, substantially as set forth.

2. The combination of adjacent series of inclined pipes J, and upright headers K K' diverging upwardly and reversely offset as described, with the transverse drums L N and connecting pipe M, substantially as set forth.

3. In a downward draft boiler, the side walls formed of the inclined tubes G, connected in series one above another, and the space pieces H serving to close the openings between adjacent tubes, leaving the tubes exposed laterally to the action of the fire, in combination with upwardly diverging headers Q Q' with which the tubes G engage, and with transverse steam drums L M, at the upper ends of said headers, substantially as set forth.

4. A boiler and down-draft furnace, provided with a series of tubes mounted in and communicating with water boxes at their ends, in combination with a zigzag water grate, in which the tubes of the lower series are of less diameter than those of the upper series, said tubes and boxes forming a water lining upon all faces of the fire box, substantially as set forth.

5. A boiler and down-draft furnace having a front water wall, a water grate, and a series of water pipes in the top of the fire box, in combination with a thin, flat, upright water box, extending transversely across and forming the entire inner end of the fire box, and being free to yield laterally with the expansion and contraction of said water pipes and grate tubes, substantially as set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses, on this 22d day of April, A. D. 1892.

CALEB R. AYER.
GEORGE A. AYER.

Witnesses:

C. S. PITMAN,
VICTOR E. BURKE.