

No. 611,952.

Patented Oct. 4, 1898.

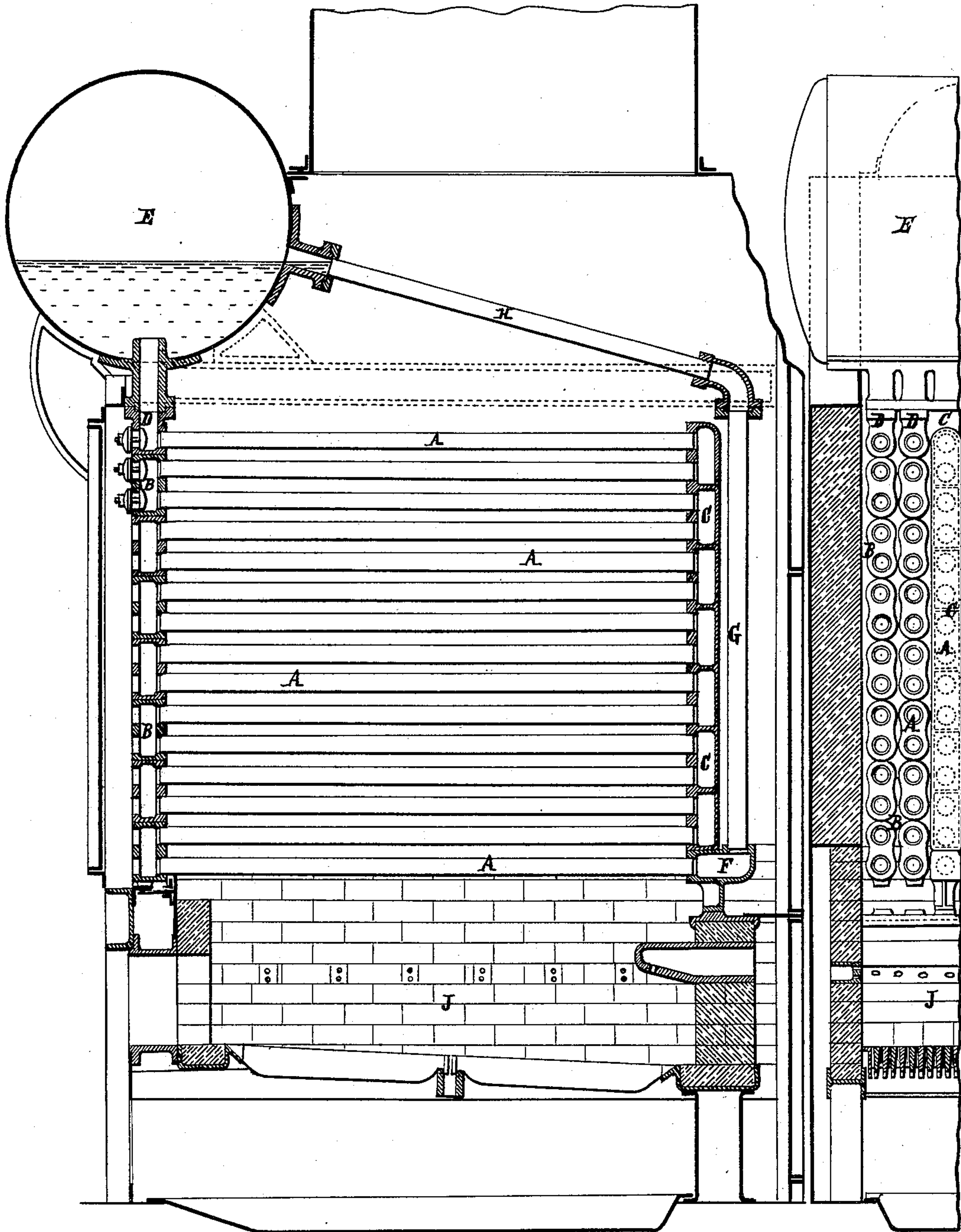
H. WORKMAN.
WATER TUBE STEAM BOILER.

(Application filed Dec. 4, 1897.)

(No Model.)

FIG. 1.

FIG. 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

HAROLD WORKMAN, OF DULLATUR, SCOTLAND.

WATER-TUBE STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 611,952, dated October 4, 1898.

Application filed December 4, 1897. Serial No. 660,814. (No model.)

To all whom it may concern:

Be it known that I, HAROLD WORKMAN, B. Sc., a subject of the Queen of Great Britain and Ireland, and a resident of Dullatur, in the county of Dumbarton, Scotland, have invented certain Improvements in Water-Tube and other Steam-Boilers, of which the following is a specification.

Mysaid invention has mainly for its object, by an improved construction and arrangement, to increase the efficiency of water-tube steam-boilers.

A boiler made with my improvements comprises a stack of water-tubes which are horizontal, or approximately so, and which constitute the main heating-surface, the furnace being placed beneath the stack of tubes. The tubes are formed into a number of vertical sets or sections, and those of each section, which may consist of one or more vertical rows of tubes, are connected at their ends by junction-boxes in a manner to form in each case one or more serpentine water-passages from top to bottom.

It is an important feature of my improved arrangements that the water flows downward through the stack of tubes, the water and steam flowing upward through return-tubes. The action of the furnace and fire-gases is most intense on the bottom tubes, the intensity becoming gradually less as the fire-gases reach one upper tier of tubes after another. The descending water is consequently subjected to increasing heat in proportion as it descends and very completely utilizes the heat of the fire-gases, which become reduced to a comparatively low temperature on reaching the top of the stack of tubes. Heat remaining in the fire-gases may be further utilized by being made to act on tubes arranged in the uptake and having the feed-water passed through them.

In order that my said invention and the manner of performing the same may be properly understood, I hereunto append a sheet of explanatory drawings, to be hereinafter referred to, and showing a boiler as made with my improvements.

Figure 1 of the drawings is a vertical sec-

tion; and Fig. 2 is a vertical section, as at right angles to Fig. 1, of my improved boiler.

In the boiler shown in the drawings there is a stack of horizontal water-tubes A, arranged in vertical sections, each section comprising a single vertical row of tubes. The tubes are fixed at their ends in junction-boxes B C, those B at one end consisting of a vertical set of separate boxes, each connecting two tubes, while a single vertical box C is shown at the other end, being made with compartments, each connecting two tubes. Separate junction-boxes may, however, be used at both ends of the tubes. The top tube A of the stack is, at one end, fixed in a box D, communicating with the bottom or lower part of a water-and-steam drum E, and its other end communicates through the box C with the second or next lower tube, which communicates through a box B with the third tube, and in a similar way communication is made between each tube and the next lower only alternately at opposite ends, so that a continuous serpentine passage is formed through the tubes of each vertical section from top to bottom of the stack. The bottom tube of the stack communicates through a junction-box F with a vertical tube G, which communicates through a tube H and junction-boxes with the water-and-steam drum E. The furnace J is directly under the stack of tubes, and its heat acting most strongly on the lower tubes causes an upward flow of water and steam through the ascension tubes G H, while water descends through the tubes A forming the stack, and a rigorous circulation is maintained.

The arrangement and manner of combining the water-tubes are susceptible of variation, the feature of the downward flow of the water through them being essential in applying my invention.

The furnace may be of any suitable form in use with water-tube boilers.

A complete boiler may consist of a single stack of water-tubes A, arranged with furnace and accessory parts as hereinbefore described, or it may consist of two stacks connected to a single water-and-steam drum, the

return-tubes G being between the two stacks, or more than two stacks of water-tubes may be combined.

What I claim as my invention is—

- 5 A water-tube steam-boiler having horizontal or approximately horizontal water-tubes in a stack and connected alternately at opposite ends, the uppermost tubes being connected to the lower part of a water-and-steam
10 drum, and the lowermost tubes being connected to the upper part of the same drum, in combination with a furnace below the stack

of tubes, whereby the bottom tubes are subjected to the greatest heat, and the water is caused to flow downward through the stack 15 of tubes, substantially as herein set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HAROLD WORKMAN.

Witnesses:

EDMUND HUNT,
DAVID FERGUSON.