No. 611,953. Patented Oct. 4, 1898.

H. WORKMAN.

WATER TUBE STEAM BOILER.

(Application filed May 21, 1898.)

(No Model.)

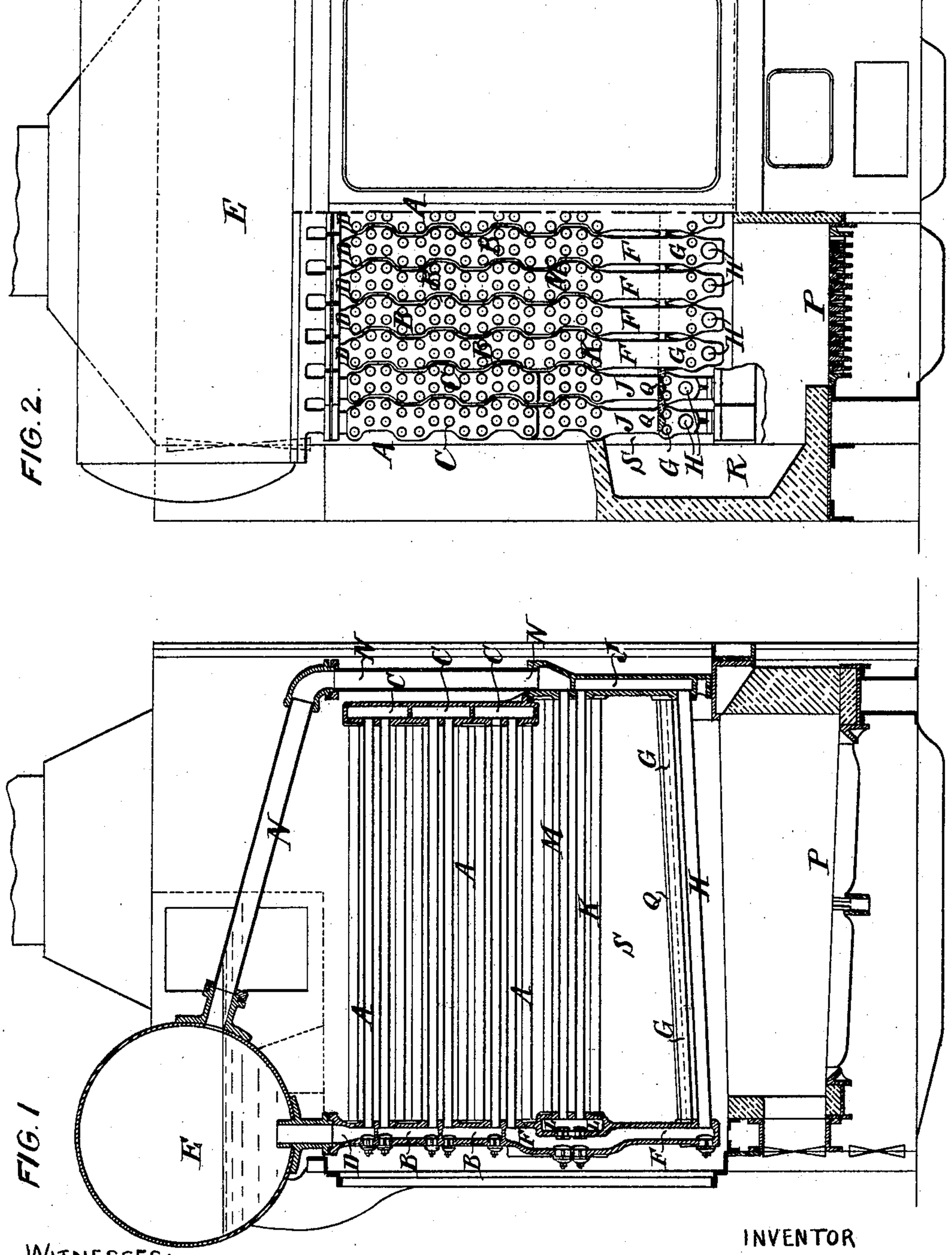

FIG. 2.

FIG. 1

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. 611,953, dated October 4, 1898.

Application filed May 21, 1898. Serial No. 681,352. (No model.)

To all whom it may concern:

Be it known that I, HAROLD WORKMAN, a subject of the Queen of Great Britain and Ireland, and a resident of Dunluce, Dullatur, in the county of Dumbarton, Scotland, have invented certain new and useful Improvements in Water-Tube Steam-Boilers, (for which I have applied for British Patent, No. 25,164, dated October 30, 1897,) of which the following is a specification.

My said invention comprises new or improved arrangements or combinations of the parts of water-tube steam-boilers of the kind having stacks of tubes through which the water flows downward automatically.

According to my present invention I combine with what may be distinguished as the "upper descending tubes" one or more lower groups of tubes in each section, which tubes, with suitable junction-boxes, are arranged to act as water-ascending tubes, the lowest of these being connected to the lowest of the other higher descending tubes, and the highest of the ascending tubes being connected by one or more return-tubes for each section to a water-and-steam drum. The lower tubes may be arranged so as to form a combustion-space above the lowest layer of tubes; and 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, showing in two vertical sections Figures 1 and 2 as at right angles to each other a boiler as made with my improvements.

In the boiler shown in the drawings there is an upper portion of horizontal or slightly-inclined water-tubes A, arranged in vertical sections, each section comprising a double row of tubes A. There may be only one or more than two vertical rows of tubes in each section. The tubes A are fixed at their ends in junction-boxes B C, made with compartments arranged so that in each section groups of four tubes A communicate through the junction-boxes with each lower or upper set of four tubes alternately at opposite ends, so that a continuous serpentine passage is formed, and the water flows through successive lower groups of tubes alternately in opposite directions between the junction-boxes B C. The top group of four tubes A in each section is at one end fixed in a box D, which communicates with the lower part of a water-and-steam drum E, which may comprise the sole steam-space or which may be connected to a higher steam-drum.

The lowest group of four water-descending tubes A in each section are connected at one end by a long junction-box F with two small tubes G and one larger tube H, which tubes G H are connected through a similar box J with a group of tubes K, which in their turn communicate through a small box L with another group of tubes M, which latter are connected by a return-tube N for each section to the water-and-steam drum.

The fire-gases from the furnace or furnaces P beneath each stack of tubes are prevented from ascending directly among the tubes by a lining of fire-clay Q or other suitable material placed on and between the group of tubes G, and the fire-gases pass by a lateral flue R (which may be on one side or on each side) into a combustion-space S, between the tubes G and K. The tubes G, H, K, and M act as water-ascending tubes, and the greater heat from the furnace acting on these ascending tubes causes a vigorous flow of the water (mixed with steam) through them and the return-tubes N in a general upward direction to the drum E. The fire-gases ascending among the tubes have their heat more and more absorbed as they rise, and the water becomes more and more heated as it descends through the descending tubes A.

What I claim as my invention is—

1. In a water-tube steam-boiler, a stack of horizontal or slightly-inclined tubes in two portions, an upper and a lower portion, the tubes in the upper portion being connected with each other to form continuous zigzag or backward and forward and generally downward passages from the uppermost tubes, a water-and-steam drum, to the lower part of which the uppermost tubes are connected, the lowermost tubes of the upper portion of the stack being connected with the lowermost tubes of the lower portion, and the uppermost tubes of the lower portion being connected to the water-and-steam drum, while the uppermost and lowermost and intermediate tubes of the lower portion are connected with each other

to form zigzag or backward and forward passages, the flow of water being downward through the upper portion and upward through the lower portion of the stack, substantially as herein set forth.

2. A water-tube steam-boiler comprising a stack of horizontal or slightly-inclined tubes connected with each other, the lowermost tubes being at a distance below the next higher tubes to form a combustion-space, with a furnace-space and a lateral flue on one side or on each side connecting the said furnace-space with the combustion-space, the said lowermost tubes having their interstices closed, as and for the purpose herein set forth.

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

HAROLD WORKMAN.

Witnesses:

GEORGE PATTERSON,

JAMES EAGLESOM.