(No Model.)

3 Sheets—Sheet 1.

J. GALT.

HOT WATER BOILER.

No. 541,737.

Patented June 25, 1895.

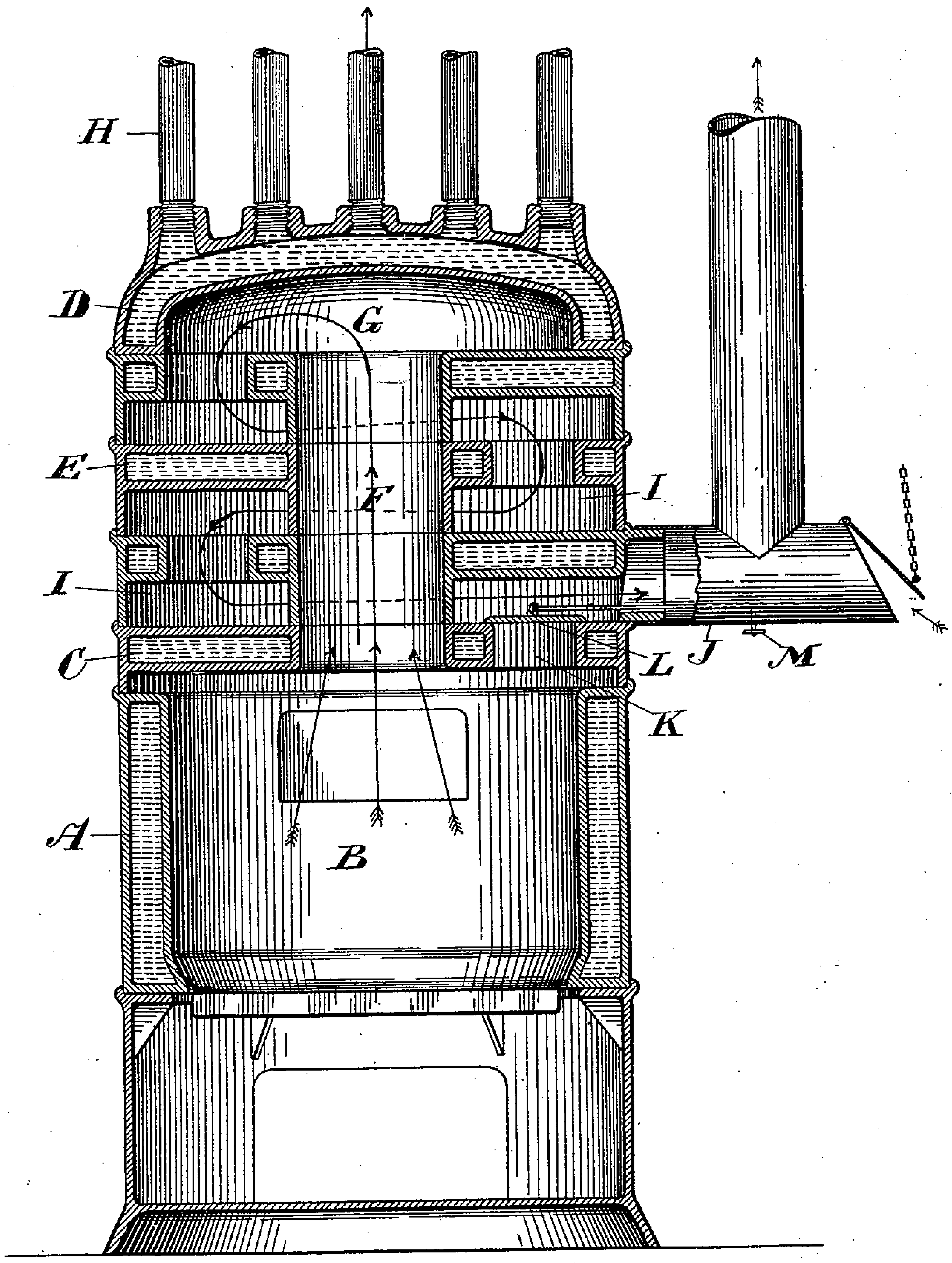

Fig.1

Witnesses

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Donald C. Ridout

Inventor:
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(No Model.) 3 Sheets—Sheet 2.

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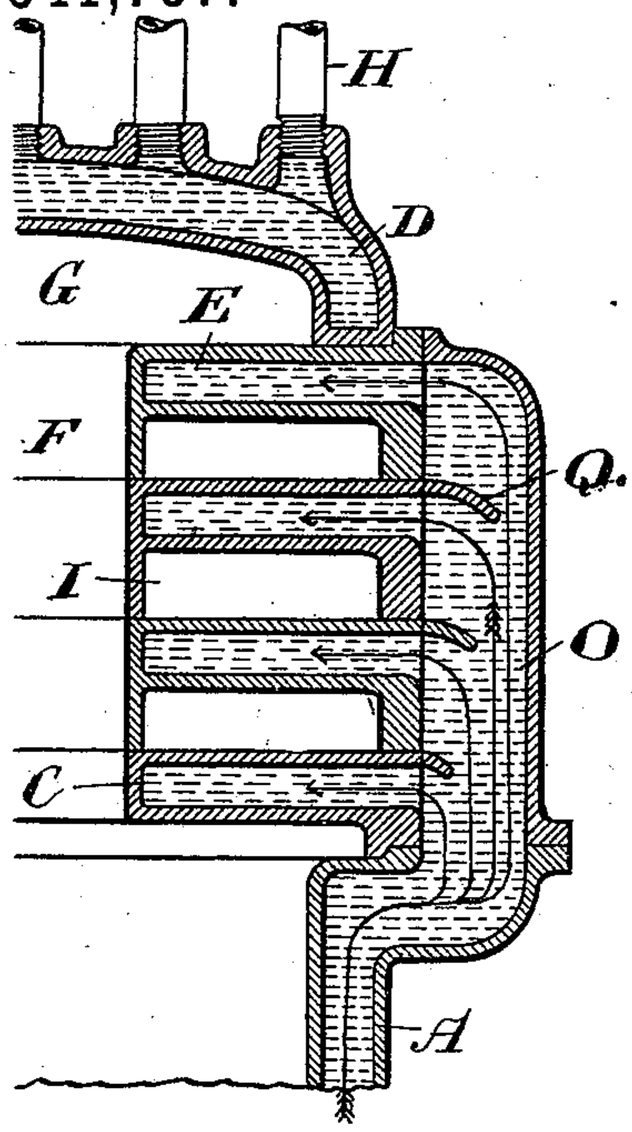

Fig. 3

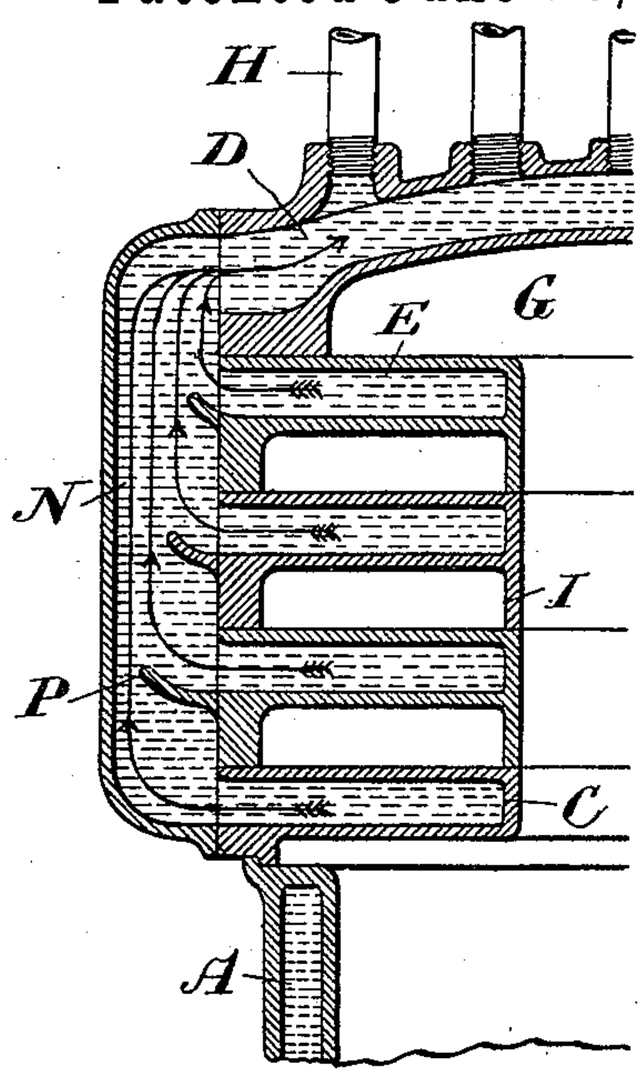

Fig. 2

Witnesses
W. J. McMillan
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by C. H. Riches
his atty

(No Model.)

3 Sheets—Sheet 3.

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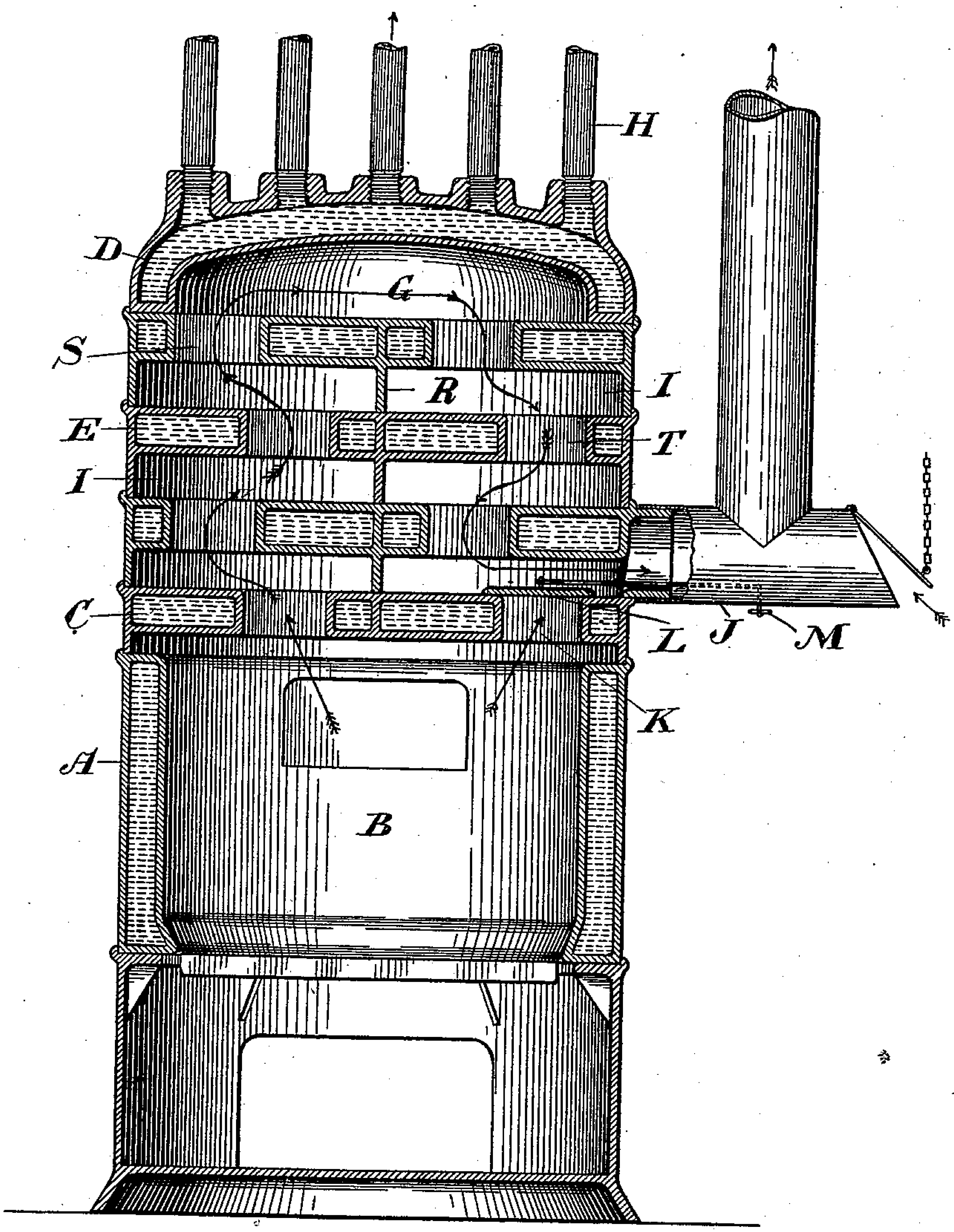

Fig. 4

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN GALT, OF TORONTO, CANADA.

HOT-WATER BOILER.

SPECIFICATION forming part of Letters Patent No. 541,737, dated June 25, 1895.

Application filed March 22, 1894. Serial No. 504,742. (No model.)

To all whom it may concern:

Be it known that I, JOHN GALT, of the city of Toronto, in the county of York and Province of Ontario, Canada, have invented certain new and useful Improvements in Hot-Water Boilers; and I hereby declare that the following is a full, clear, and exact description of the same.

This invention relates more particularly to that class of heater commonly termed a hot water boiler or sectional boiler, which is built up of a series of water sections arranged one above the other, and in circulation with each other. Heretofore in this class of heaters the first water section above the fire pot and the fire pot water section, when the fire pot was employed as such, were the sections that were subjected to the direct radiation of the heated products of combustion within the combustion chamber, with the consequent result that a very large percentage of the value of the heated products of combustion was lost to the heater. This loss may be explained in the following manner: The water within the first water section being subjected to a more intense heat than the water in any of the remaining water sections circulates much more rapidly than the water in any of the said remaining water sections, with the result that the force of the passage of the water from this first water section into and through the outflow partially chokes or arrests the passage of the water from the remaining water sections into the same outflow, materially restricting and affecting the proper circulation of the water through the apparatus, and reducing the value of the apparatus as a heater. In addition to the foregoing defects it might here be stated that where the products of combustion are caused to circulate from section to section only in their upward direction, only a small percentage of the heat which they contain is absorbed by the respective water sections, and the available heat of the products of combustion failing to be absorbed by the respective water sections, passes from the heater upward to the outlet to the chimney, and is wasted. As the heated products of combustion rise toward the top of the heater their motion becomes more rapid, owing to the fact that little or no obstruction is offered to their passage, with the result that the intermediate and topmost water sections have the opportunity of absorbing but a very small percentage of the heat from the products of combustion, thus rendering the boiler dependent to a very large extent upon the lowermost water sections for its heated water supply. In all of those heaters which I have had the opportunity of investigating the water sections each discharge into the outflow or head, usually located on the outer side of the water sections, and as far remote from the heated products of combustion and the combustion chamber as possible, and still remain an inseparable part of the heater; thus compelling the heater to depend almost entirely on the first water section for the force of the circulation or discharge through the outlet pipes.

In all of those hot water boilers heretofore presented to the public the top of the heater has generally been a metallic plate having an outlet for the heated products of combustion to pass through during their course to the outlet to the chimney.

In all of those heaters which I have had an opportunity of examining the course of the products of combustion has been an upward one from the combustion chamber, to the outlet to the chimney.

It is the object of this invention to devise a heater in which the course of the heated products of combustion will be upward to the topmost water section, and then downward to the first water section above the combustion chamber, in order that those heated products of combustion will operate directly upon the head or delivery section to give a rapid circulation or discharge through the outflow pipes, and provide a proper circulation of water through the respective water sections of the heater. To accomplish this I have designed the heater as hereinafter more fully described and more particularly set forth in the claims, and illustrated in the accompanying drawings.

In the drawings, Figure 1 is a vertical sectional view of my heater. Figs. 2 and 3 are similar views taken at right angles to the line

on which Fig. 1 is taken to illustrate the outflow and inflow. Fig. 4 is a view of an alternative form.

Like letters of reference refer to like parts throughout the specification and drawings.

A refers to the fire pot water section, B the combustion chamber, C the first water section above the fire pot, D the topmost water section, and E the water sections intermediate between the first water section A and the topmost water section D.

It will be noticed by reference to the drawings that the water section C is located above and in circulation with the fire pot water section A, and that the intermediate water sections E are located one above the other, and are in circulation with each other, and with the first water section C and topmost water section D.

By reference to Fig. 1 of the drawings it will be noticed that a direct passageway F is formed centrally through each of the water sections C and E, and forms the means of communication from the combustion chamber B to a secondary chamber G, located below the topmost water section D. The side walls of the direct passage F close off communication from the said direct passageway F and the chambers between the intermediate water sections, in order that all gases and heated products of combustion will be compelled to pass from the combustion chamber B to the secondary chamber G to allow of the topmost water section D being heated nearly to the same degree as the first water section A, to cause a rapid circulation of the water in the said topmost water section, and provide a proper and rapid circulation of water through the outflow pipes H. The outflow pipes H are directly connected to the topmost water section D, and are consequently in direct circulation with the water within the said water section, instead of being connected to a head located on the outer side of the heater, as has heretofore been the case. The gases after ascending to the secondary chamber are directed downwardly from the secondary chamber through each of the intermediate water sections E, and caused to circulate through each of the chambers I between the respective intermediate water sections before reaching the outlet J to the chimney.

By providing the heater with a direct passageway from the combustion chamber to a secondary chamber immediately below the topmost water section, the topmost water section can be heated nearly to the same degree as the said water section above the combustion chamber, and by directing downwardly the gases and heated products of combustion from the secondary chamber through the chambers I between the respective intermediate sections, all of the heat can be absorbed by the water in the respective water sections before reaching the outlet to the chimney. In addition to the utilization of all of the heat, a proper circulation of the water within the heater can be kept up, and the circulation of the water from each of the intermediate water sections into the top and outflow section will not be interfered with by the circulation of the water from any of the other water sections into the same outflow.

In order to facilitate the starting of the fire within the combustion chamber I provide the combustion chamber with a direct passage K from the combustion chamber to the outlet J to the chimney. This direct passage K is closed by a damper plate L operated by a lever M. In the starting of a fire within the combustion chamber the damper plate L is moved to open the direct passage K from the combustion chamber B to the outlet J to the chimney, and after the fire has received sufficient headway the damper plate L is moved to close the direct passage K, and cause the products of combustion to pass from the combustion chamber B to the outlet to the chimney J by means of the direct passage F, secondary chamber G and chambers I between the respective sections.

By reference to Fig. 2 of the drawings it will be noticed that the boiler is provided at its side with an outflow N, and an inflow O. Each of the intermediate sections E is provided with an upwardly curved lip P extending into the outflow N, and the lip P on the lowermost of the intermediate sections E is longer than the lip P on the next adjacent of the intermediate sections E, in order that the lip P of the lowermost of the intermediate sections will direct the outflow of the water from the first sections C against the outer side of the outflow N, and prevent the circulation of the water from the said sections C interfering with the circulation of the water from the first intermediate section into the said outflow N. It will also be noticed by reference to Fig. 2 of the drawings that a sufficient clearance is left between the lips P of the intermediate sections and the outer wall of the outflow N, to permit of the free circulation of the water in the said outflow. The lip, P on the next adjacent of the intermediate sections E is slightly shorter than the lip P on the first of the intermediate sections E, and this reduction in the length of the lips P continues until the topmost of the intermediate sections is reached. Each of the sections E and C at the opposite side of the heater is provided with a lip Q extending outwardly into the inflow O. The lip P on the section C is the shortest of the lips Q, or, in other words, extends the least distance into the inflow O. The lip Q on the lowermost of the intermediate sections is slightly longer than the lip Q on the section C, the lips increasing in length as the sections are more remote from the first section C, in order that each lip will have an opportunity of directing the water into its respective section, without interfering with any of the lips above it, and without receiving any interference from those lips below it.

In Fig. 4 in place of providing the heater with a direct central passage F I have provided each of the chambers I between the respective water sections with a central partition R, and have provided a zigzag passage S on one side of the said partition from the combustion chamber B to the secondary chamber G, while on the other side of the partition I have provided a downward zigzag passage T from the secondary chamber G to the outlet J to the chimney. I have provided the combustion chamber with a direct passage K from the combustion chamber to the outlet J to the chimney, which is closed by a damper plate L similar to the one hereinbefore described, operated by a lever M, the remaining features in this case being similar to those hereinbefore described.

From the foregoing description it will be readily understood that the essential feature of the invention is the direct upward current of heated products of combustion to the topmost outflow and water section, then their downward course from the topmost water section to the outlet to the chimney.

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

1. In a hot water boiler, the combination of the combustion chamber, a series of water sections arranged in vertical succession and provided with upward curved lips decreasing in length successively from the bottom lip to the top one, and oppositely arranged downward curved lips decreasing in length successively from the top lip to the bottom one, a secondary combustion chamber below the topmost water section, an upward passage from the combustion chamber to the secondary chamber, an outlet to the chimney below the secondary chamber and near to the combustion chamber, and downward passages from the secondary chamber to the chimney, substantially as and for the purpose specified.

2. In a hot water boiler, a series of water sections, each of the water sections provided with an upwardly curved lip extending into the outflow to prevent the upflow of the water from the lower water sections interfering with the outflow of the water from the said section, and provided with a downwardly curved lip extending into the inflow to direct the water from the inflow into the respective water section, substantially as described.

3. In a hot water boiler the combination of a combustion chamber, a series of water sections located above the combustion chamber, a secondary chamber located below the topmost water section, an upward passage from the combustion chamber to the secondary chamber, a downward passage from the secondary chamber to the outlet to the chimney, a central partition separating the upward passage from the downward passage, and the outflow pipes connected to the topmost water section, substantially as described.

Toronto, March 17, 1894.

JOHN GALT.

In presence of—
DONALD C. RIDOUT,
J. E. CAMERON.