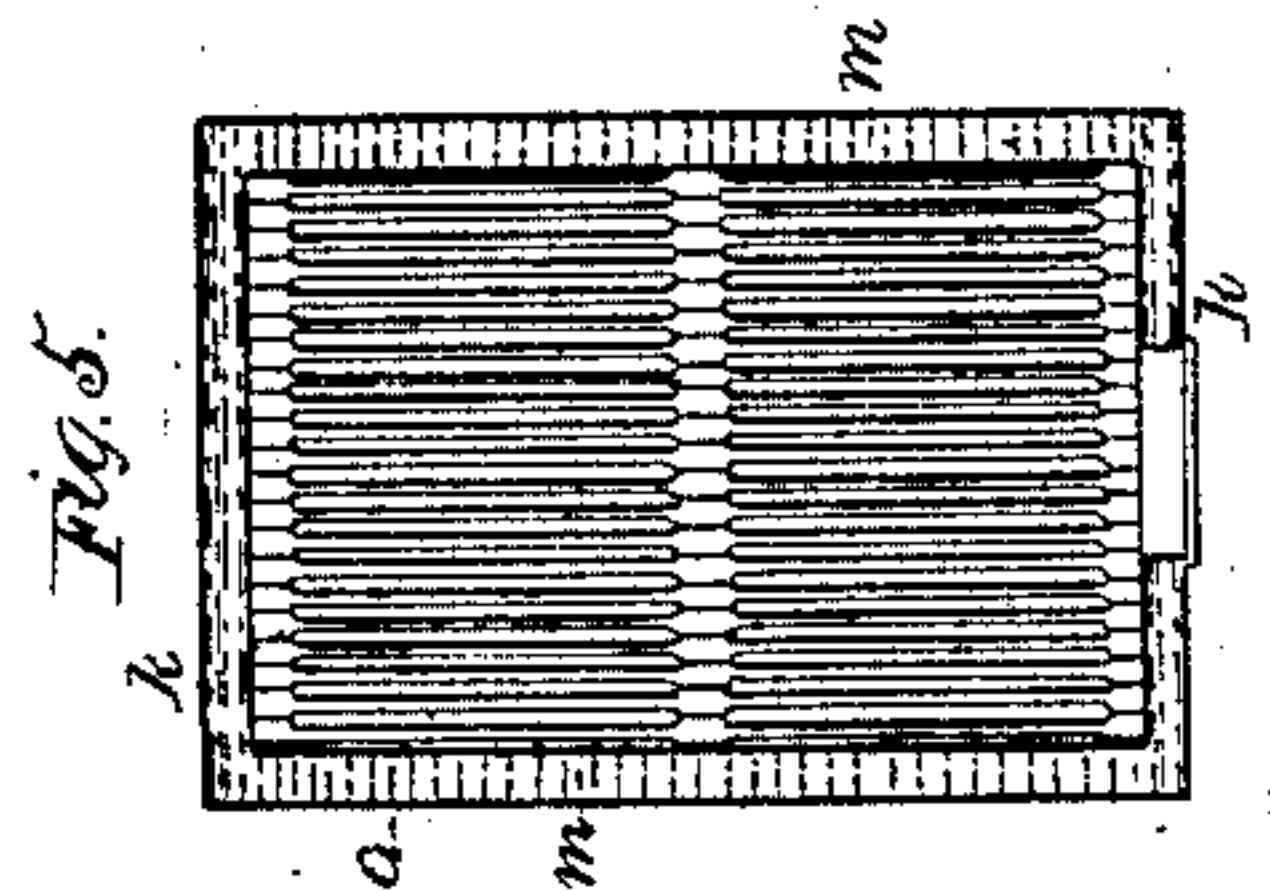
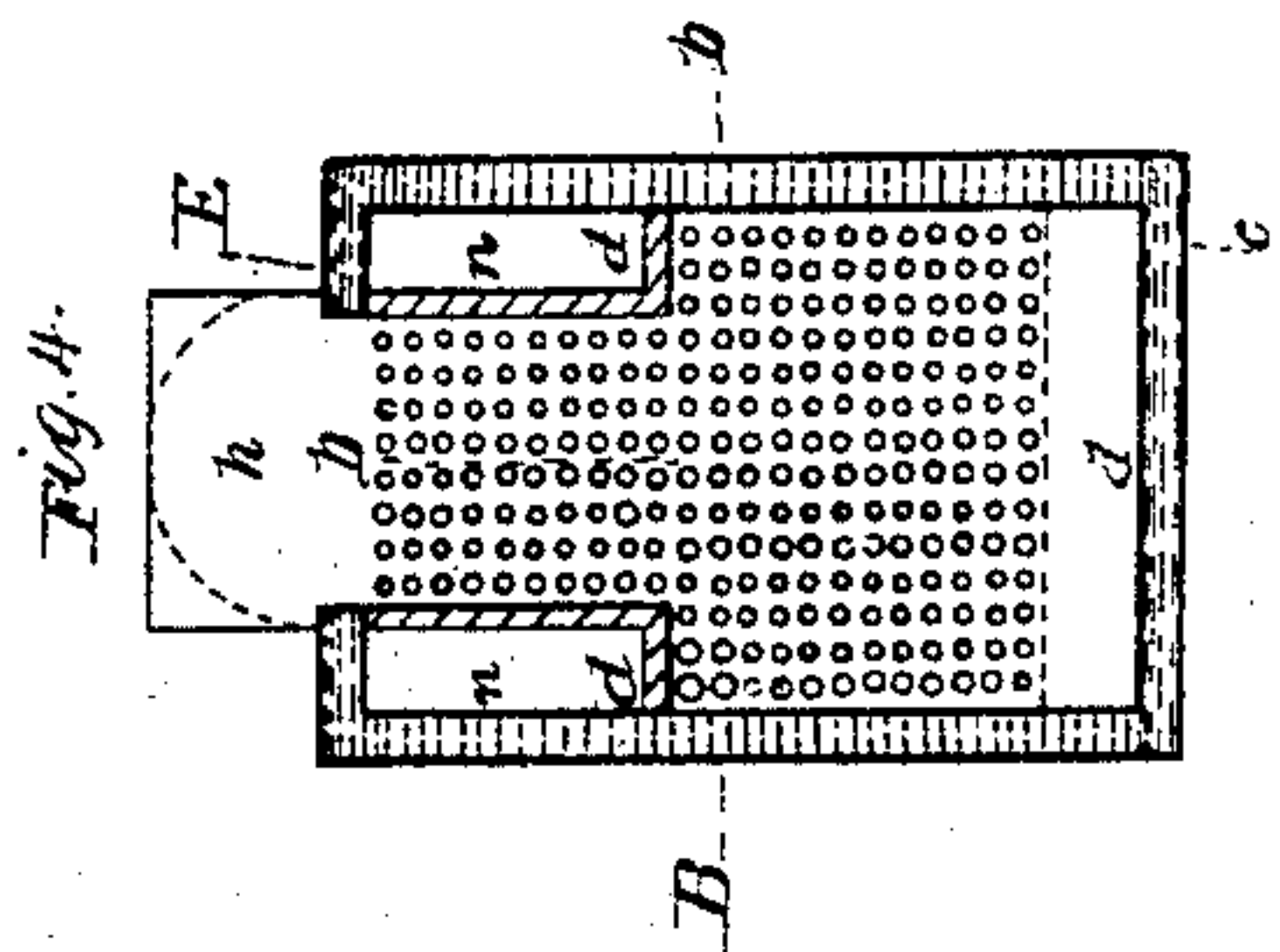
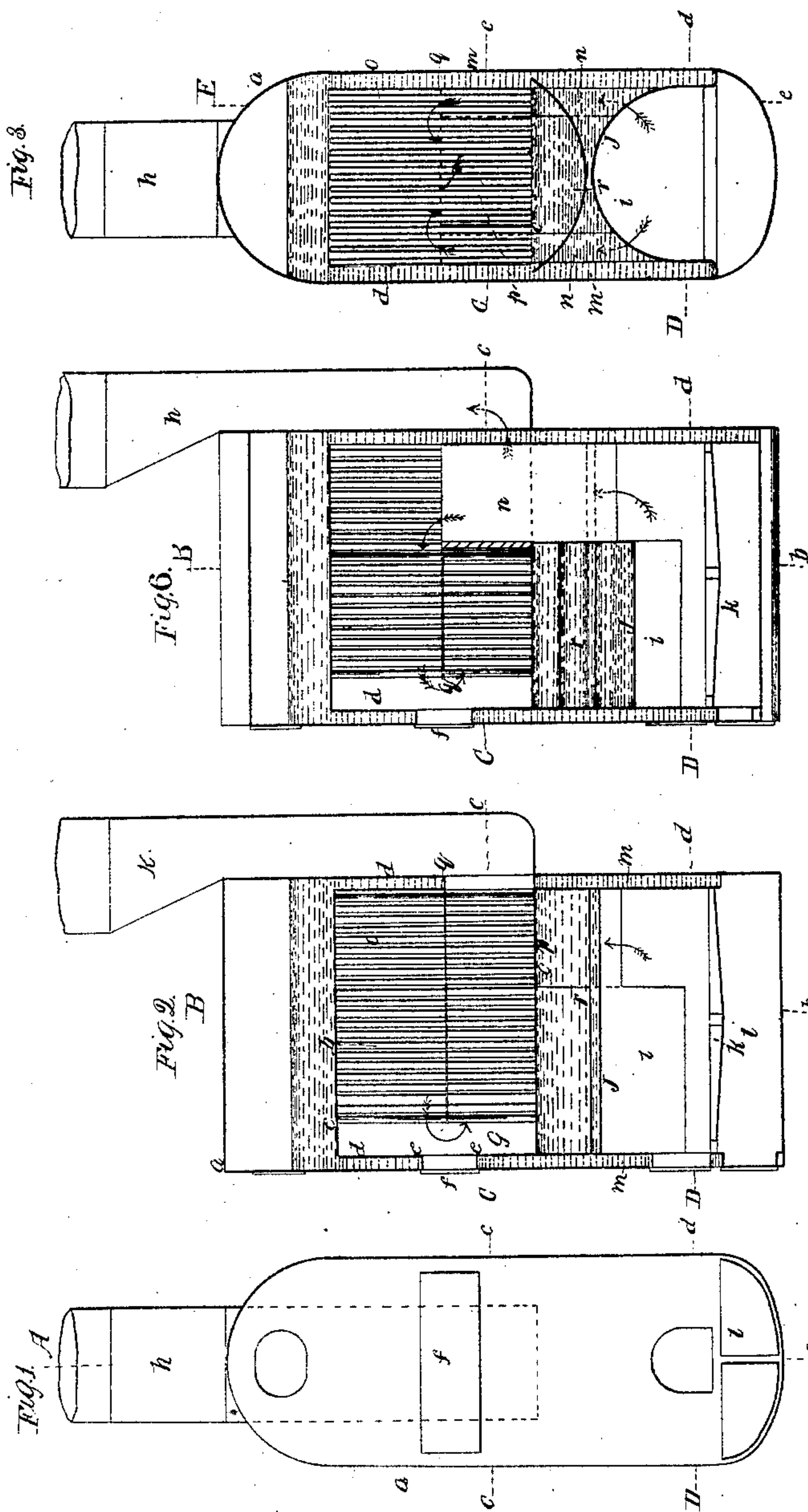


*J. Montgomery,*  
*Steam-Boiler Fire-Tube.*

*N<sup>o</sup> 20,167.*

*Patented May 4, 1858.*





# UNITED STATES PATENT OFFICE.

JAMES MONTGOMERY, OF BROOKLYN, NEW YORK.

## IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. 20,167, dated May 4, 1858.

*To all whom it may concern:*

Be it known that I, JAMES MONTGOMERY, of the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation; Fig. 2, a longitudinal vertical section taken at the line A *a* of Fig. 1; Fig. 3, a cross vertical section taken at the line B *b* of Fig. 2; Fig. 4, a horizontal section taken at the line C *c* of Fig. 3, and Fig. 5 a horizontal section taken at the line D *d* of Fig. 2.

The same letters indicate like parts in all the figures.

My present invention relates to improvements on the tubular steam-boiler secured to me by Letters Patent bearing date the 26th day of December, 1845, and reissued to me on an amended specification on the 15th day of August, 1848. The said original steam-boiler so patented as aforesaid consists of a series of vertical water-tubes, the lower ends of which communicate with the lower part of the boiler and their upper ends with the upper part of the boiler, so that when the flame and other heated products of combustion from a suitable furnace act upon the outside surface of the said tubes the rarefaction of the water in the said tubes shall induce an upward motion or circulation of the water through them, which water enters at the lower and discharges from the upper ends of the said tubes, there being water-spaces around the series of tubes, and connecting the upper and lower parts of the boiler to admit of a downward circulation of the water to supply the lower ends of the tubes, the sum of the area of the horizontal section of the said water-ways being about equal to the sum of the area of the horizontal section of the series of tubes, that there may be an equal capacity for the downward as for the upward circulation; and my said original invention also consists in dividing the flue-space, which passes among the series of tubes, into an upper and a lower flue-space by means of a diaphragm so arranged that the

flame and other heated products of combustion from the furnace shall first pass through the upper flue-space and then through the lower flue-space, and then to the chimney, thus acting first on the upper half of the length of the tubes and then on the lower half, that the upper ends of the said tubes may receive a more intense heat than the lower ends, and thereby promote the circulation of the water and the evolution of the steam therefrom.

In the Letters Patent for my said invention the furnace is described and represented as being located in front or at the side of the series of water-tubes, and in consequence the entire boiler occupies a greater horizontal area than is desirable for many purposes, and the object of my present application is to avoid this difficulty; and to this end my present invention of improvements consists in arranging the series of vertical or nearly vertical water-tubes between an upper and a lower and connecting vertical water-spaces, when the said lower water-space is made directly over the fire-chamber and the products of combustion are made to return and pass over said lower water-space and among the vertical water-tubes; and my said invention also consists in combining with and interposing between the crown-sheet of the furnace and the lower ends of the series of vertical water-tubes a shield-plate to protect the lower ends of the tubes from the intense heat of the crown-sheet of the boiler and to conduct the vapor generated on the crown-sheet of the furnace to the water-spaces outside of the series of tubes.

In the accompanying drawings, *a* represents the outer shell of the boiler, and *b* a series of vertical water-tubes secured to the upper and lower tube-sheets, *c c*. These tube-sheets are firmly connected by side and end plates, *d d*, which plates are connected to the shell of the boiler in the usual or any suitable manner, leaving sufficient space between the shell and the plates *d d* for the downward circulation, and the plates *d d* are also connected by plates *e e*, or flanges, with the edges of a door, *f*, to give access to the outside of the tubes and around the edges of the flue-space *g*, leading to the chimney *h*.

The furnace *i* is placed below the lower tube-sheet *c*, with a suitable arched crown-sheet, *j*,



grate *k*, and ash-pan *l*, which parts may be constructed in any suitable manner, the said furnace being surrounded by water-legs *m* to prevent the furnace from burning out and to economize fuel, as is usual in steam-boilers. There are two vertical flues, *n n*, extending from the sides of the furnace and near the rear end, passing up through the crown-sheet *j* and through the lower tube-sheet *c* and through the diaphragm (to be presently described) and up into the upper flue-space among the tubes.

The space between the upper and lower tube-sheets is divided into an upper and lower flue-space, *o* and *p*, by a diaphragm or horizontal plate, *q*, which extends to within a short distance of the forward series of tubes. The vertical flues *n n* open into the upper flue-space, *o*, above the diaphragm *q*, one on each side and near the back, so that the flame and other heated products of combustion from the furnace pass up the two vertical flues, around and among the upper half of the length of the tubes to the front, thence around the front end of the diaphragm, and then back under the diaphragm and among the lower half of the tubes to the chimney at the back.

Between the lower tube-sheet *c* and the crown-sheet *j* there is a shield or plate, *r*, in the form of an inverted arch, and which extends each side a little beyond the tube-sheet. This shield does not, however, extend the whole length of the boiler, as sufficient space must be left all around between its edges and the outer shell of the boiler for the free passage of water to supply the lower ends of the tubes with water to insure the circulation so essen-

tial to the efficient generation of steam. The sole purpose of the shield is to deflect to the sides the steam generated on the crown-sheet of the furnace, where the heat is necessarily very intense, and which, if not deflected, would rise and enter the lower ends of the tubes, and thereby prevent the free entrance of water. By this arrangement the whole area of the furnace of whatever magnitude required can be placed within the shell of a boiler of the capacity required for the series of tubes. It will be obvious that, if desired, the shield can be dispensed with.

I do not claim vertical tubes in boilers connected with water-spaces above and below, except under an arrangement like that set forth—viz., where the lower water-space is immediately over the fire and the draft of the furnace returns over said space and among the tubes, as set forth—that is to say,

I claim—

1. The arrangement of the series of tubes placed vertically, or nearly so, between an upper and a lower and connecting vertical water-spaces when said lower water-space is made directly over the fire-chamber and the draft is returned over said lower space and among the vertical tubes, as set forth.

2. The arrangement of the shield-plate, in combination with and interposed between the crown-sheet of the furnace and the lower ends of the series of water-tubes, substantially as and for the purpose specified.

JAMES MONTGOMERY.

Witnesses:

WM. H. BISHOP,  
JOEL B. WILSON.