

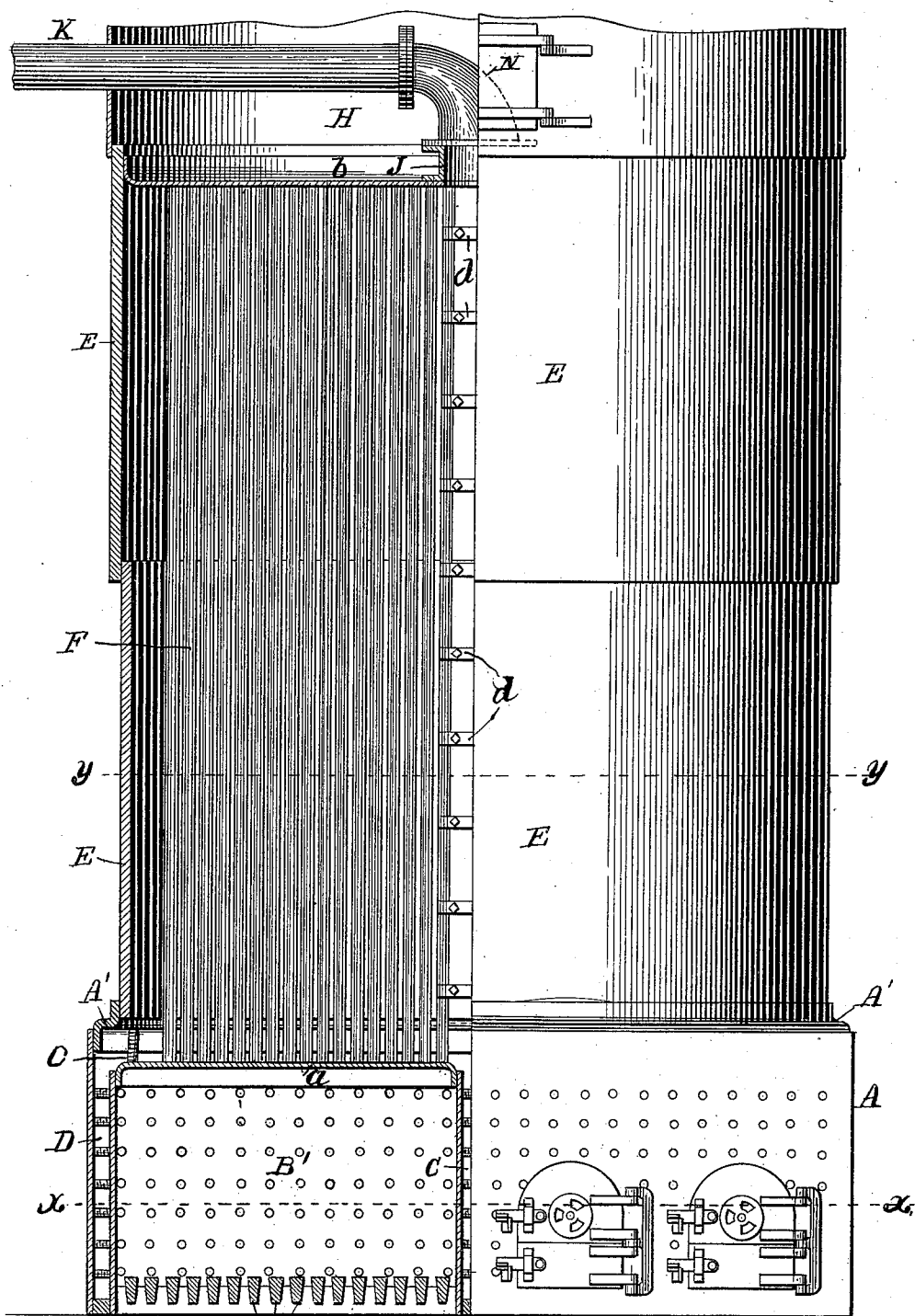
E. KENDALL.

VERTICAL TUBULAR STEAM BOILER.

(Application filed Aug. 16, 1898.)

(No Model.)

4 Sheets—Sheet 1.



Witnesses:
Arthur G. Pundall
J. B. Dayton.

Fig. 1.

Inventor:
Edward Kendall,
by N. C. Lombard
Attorney,

No. 617,509.

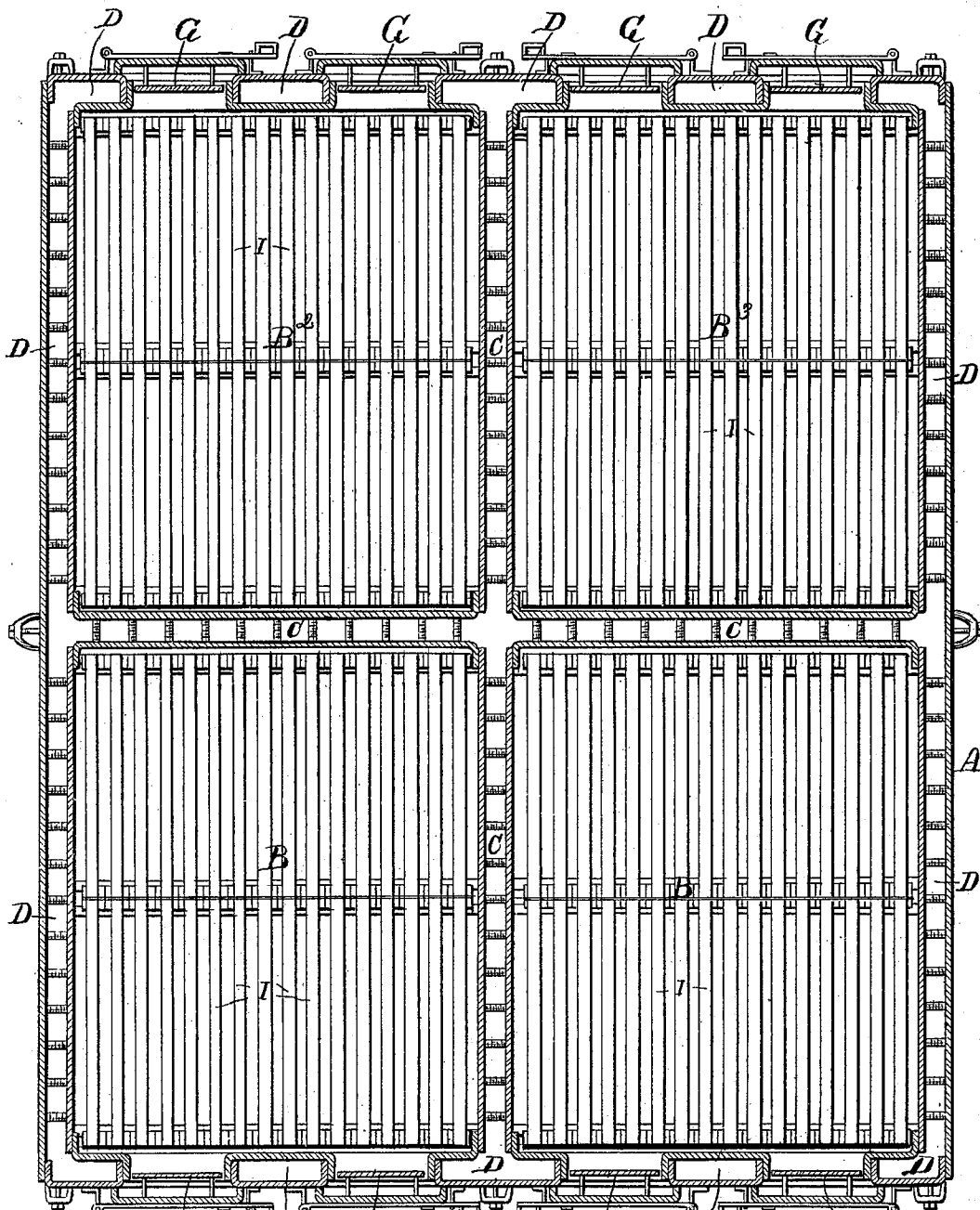
Patented Jan. 10, 1899.

E. KENDALL.
VERTICAL TUBULAR STEAM BOILER.

(Application filed Aug. 16, 1898.)

(No Model.)

4 Sheets—Sheet 2.



Witnesses: D G Fig. 2. G D Inventor:
Arthur F. Rausell,
J. H. Dayton, Edward Kendall,
by N. C. Lombard

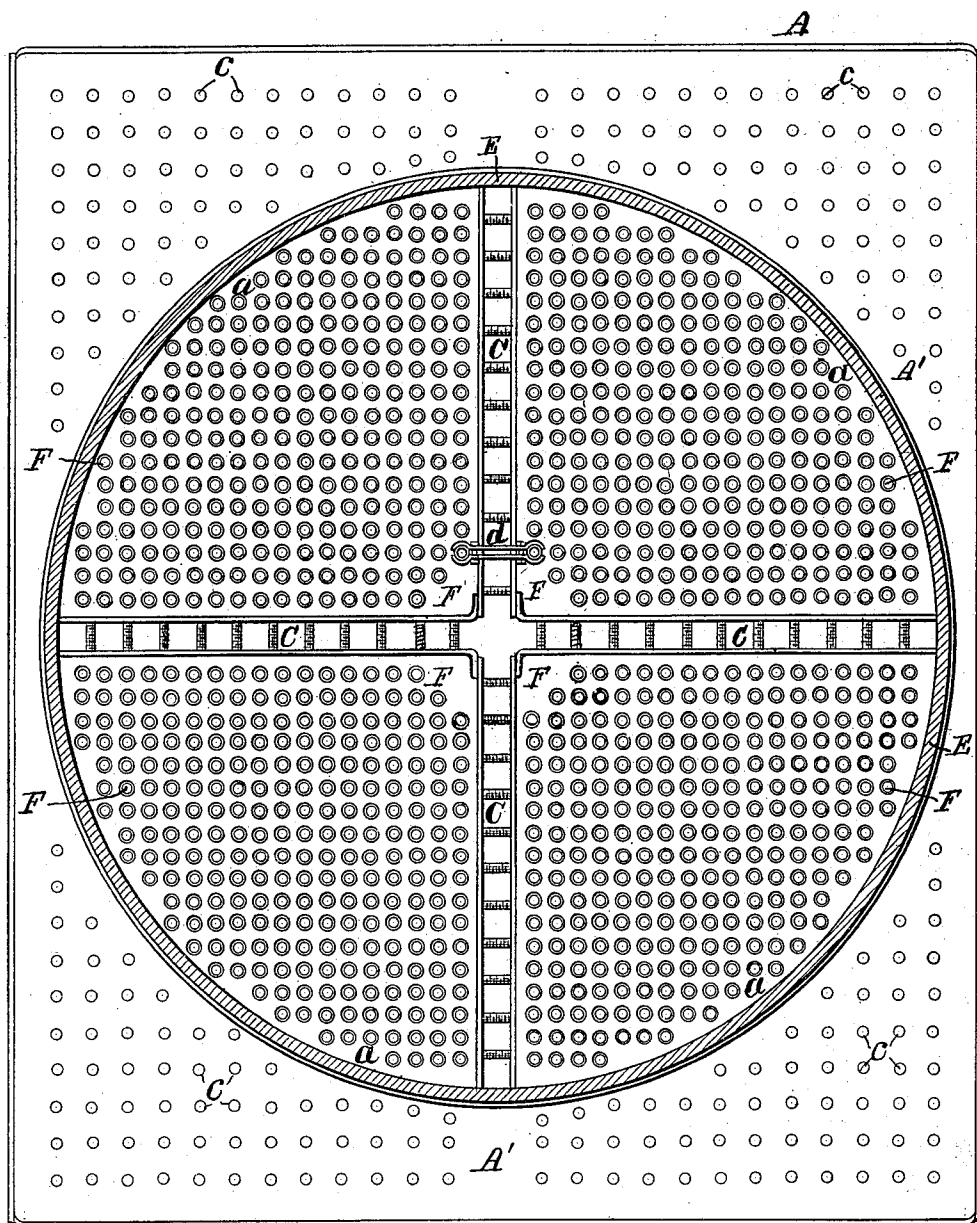
Attorney

E. KENDALL.
VERTICAL TUBULAR STEAM BOILER.

(Application filed Aug. 16, 1898.)

(No Model.)

4 Sheets—Sheet 3.



Witnesses:
Arthur C. Kendall
J. H. Dayton

Fig. 3.

Inventor:
Edward Kendall
by *N. P. Lombard*
Attorney.

No. 617,509.

Patented Jan. 10, 1899.

E. KENDALL.
VERTICAL TUBULAR STEAM BOILER.

(Application filed Aug. 16, 1898.)

(No Model.)

4 Sheets—Sheet 4.

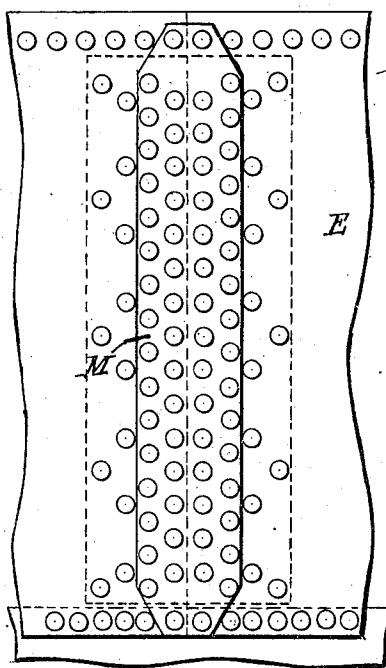


Fig. 4.

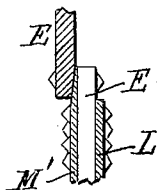


Fig. 7.

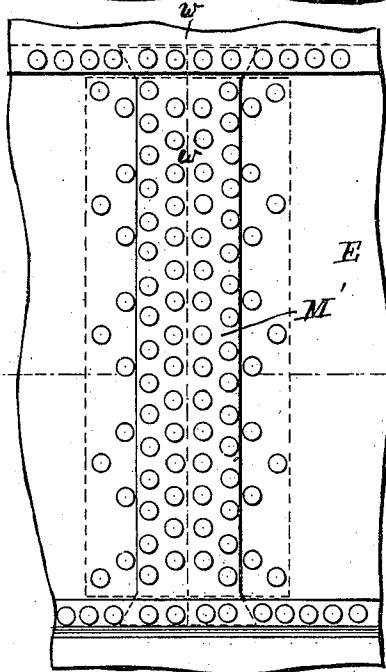


Fig. 5.

Witnesses:

Arthur G. Pauder
J. H. Dayton

Inventor:

Edward Kendall,

Fig. 6. L

by N. C. Lombard

Attorney.

UNITED STATES PATENT OFFICE.

EDWARD KENDALL, OF CAMBRIDGE, MASSACHUSETTS.

VERTICAL TUBULAR STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 617,509, dated January 10, 1899.

Application filed August 16, 1898. Serial No. 688,718. (No model.)

To all whom it may concern:

Be it known that I, EDWARD KENDALL, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Vertical Tubular Steam-Boilers, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to vertical tubular steam-boilers, and has for its object the production of steam-boilers capable of resisting a very heavy pressure with the minimum of weight of material; and it consists in certain novel features of construction, arrangement, and combination of parts, which will be readily understood by reference to the description of the accompanying drawings, and to the claims hereto appended, and in which my invention is clearly pointed out.

Figure 1 of the drawings is a sectional elevation of a boiler illustrating my invention. Fig. 2 is a horizontal section on line *x x* on Fig. 1. Fig. 3 is a similar section on line *y y* on Fig. 1. Fig. 4 is an elevation of a portion of the upper section of the cylindrical shell and illustrating the manner of securing its butted edges together. Fig. 5 is a similar view of a portion of the lower section of the cylindrical shell and its battens. Fig. 6 is a section on line *z z* on Fig. 5, and Fig. 7 is a vertical section on line *w w* on Fig. 5. Fig. 1 is drawn to a slightly-smaller scale than the other figures.

In the drawings, A is a rectangular base in which are formed four independent furnaces B, B', B², and B³, said furnaces being separated from each other by the water-legs C C and inclosed on their outer sides by the water-legs D D, the walls of all of said water-legs being very strongly stayed, as shown in Figs. 1 and 2. Each furnace has a tube-sheet *a*, which extends beyond the circle of the cylindrical shell E, forming in part a plain crown-sheet to the front portion of said furnace. In that portion of each sheet *a* which is beneath the space inclosed by the shell E are set the lower ends of a cluster of tubes F, the upper ends of which are set in the tube-sheet *b* at the upper end of the main cylindrical shell E in a well-known manner.

The upper plate A' of the rectangular base A, which surrounds and is riveted to the

lower end of the shell E, is strongly stayed to the front portion of the sheet *a* by the screw-stays *c c*, as shown in Fig. 3.

Each furnace is provided with two firing-doors G, as shown in Figs. 1 and 2, and the products of combustion from each furnace pass upward therefrom through its own cluster of fire-tubes F to the smoke-box H, a portion of which is shown only in Fig. 1, where said products from all of said furnaces are intermingled and pass to the open air through a common smoke-stack. (Not shown.) The water and steam spaces are so connected that there is free circulation throughout the same notwithstanding the fact that the furnaces are independent of each other.

I represents the grate-bars of the furnaces.

The ash-pit is omitted from the drawings, as it forms no part of my present invention.

J is a short section of a pipe, secured to the upper tube-sheet *b* at its center and surrounding an opening in said sheet, through which steam may escape to and through the steam-pipe K. (Shown in Fig. 1.)

The sheets of which the cylindrical shell E is formed are of extra thickness, and therefore they are butted at their vertical joints and have wide battens L on the inside and covering said joint and a narrower batten M or M' upon the outside, as shown in Fig. 6.

The outside batten M on the upper sheet of the shell E has its corners at top and bottom cut away on a taper, and each end has only two rivets passing through said batten and the lapped portions of the upper and lower sheet and of the upper sheet of the shell and the sheet of the smoke-box.

The outside batten M', overlapping the vertical joint in the lower sheet of the main shell E, has its thickness reduced at both ends by scarfing, as shown in Fig. 7, to permit it to enter between the lapped portions of the upper and lower sheets of the cylindrical shell and between the overlapping portions of said lower sheet and the upturned flange of the upper sheet of the rectangular base A, and to compensate for said reduction in thickness the end portions of said batten are made wider than its main body and four rivets pass through each end thereof, as shown in Fig. 5.

Between the four clusters of tubes F there is a space, about twenty inches, more or less,

in diameter, in which there are no tubes, down which a man may descend when necessary for repairs or cleaning, a ladder, composed of a series of bars *d d*, clamped to two of the fire-tubes at equal distances, as shown in Figs. 1 and 3, being provided for the purpose.

The smoke-box H is provided with a door N, through which access is had to the interior thereof, and by disconnecting the steam-pipe from the short pipe or thimble J access may be had to the interior of the boiler proper and a descent be made to the tube-sheets *a* by the use of the ladder composed of the slats or bar *d*, as hereinbefore described.

By the construction herein described, in which practically four boilers are incased in one casing, a very material reduction is made in the weight of material required in the construction of a boiler of a given power over what would be required to obtain the same power by constructing four separate or independent boilers, and as a consequence a considerable saving in expense and in space occupied is also made.

Another important advantage is obtained by the employment of the water-legs C, which separate the several furnaces from each other, and the fact that the chamber inclosed by the cylindrical shell E extends over all of the tube-sheets *a* and that as a consequence of such construction the constant ebullition of the water caused by the formation of steam tends to prevent the deposition of sediment upon said tube-sheets and to cause said sediment to be deposited in the water-legs instead, where it will do much less harm.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a vertical tubular steam-boiler, the combination of a rectangular base, a plurality of independent rectangular furnaces located within said base; water-legs separating and surrounding said furnaces; an independent cluster of vertical fire-tubes located above the inner portion of each furnace and extending from said furnace to and communicating with a common smoke-box; and a cylindrical shell mounted on said rectangular base and inclosing all of said clusters of tubes and forming a water and steam chamber common to all of said furnaces.

2. In a vertical tubular steam-boiler, the combination of a cylindrical shell or casing; a rectangular base, upon which said shell is mounted, and having a length and breadth greater than the diameter of said shell; four independent rectangular furnaces located within said base and each extending beyond the circumference of said cylindrical shell, whereby a greatly-increased area of grate-surface is obtained; and an independent cluster of fire-tubes extending from the inner portion of each furnace upward within said shell or casing to a common smoke box or chamber, the several clusters of tubes being arranged around a well or untubed space in the center of said shell as and for the purposes described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 12th day of August, A. D. 1898.

EDWARD KENDALL.

Witnesses:

N. C. LOMBARD,
DANIEL W. HASKINS.