

(No Model.)

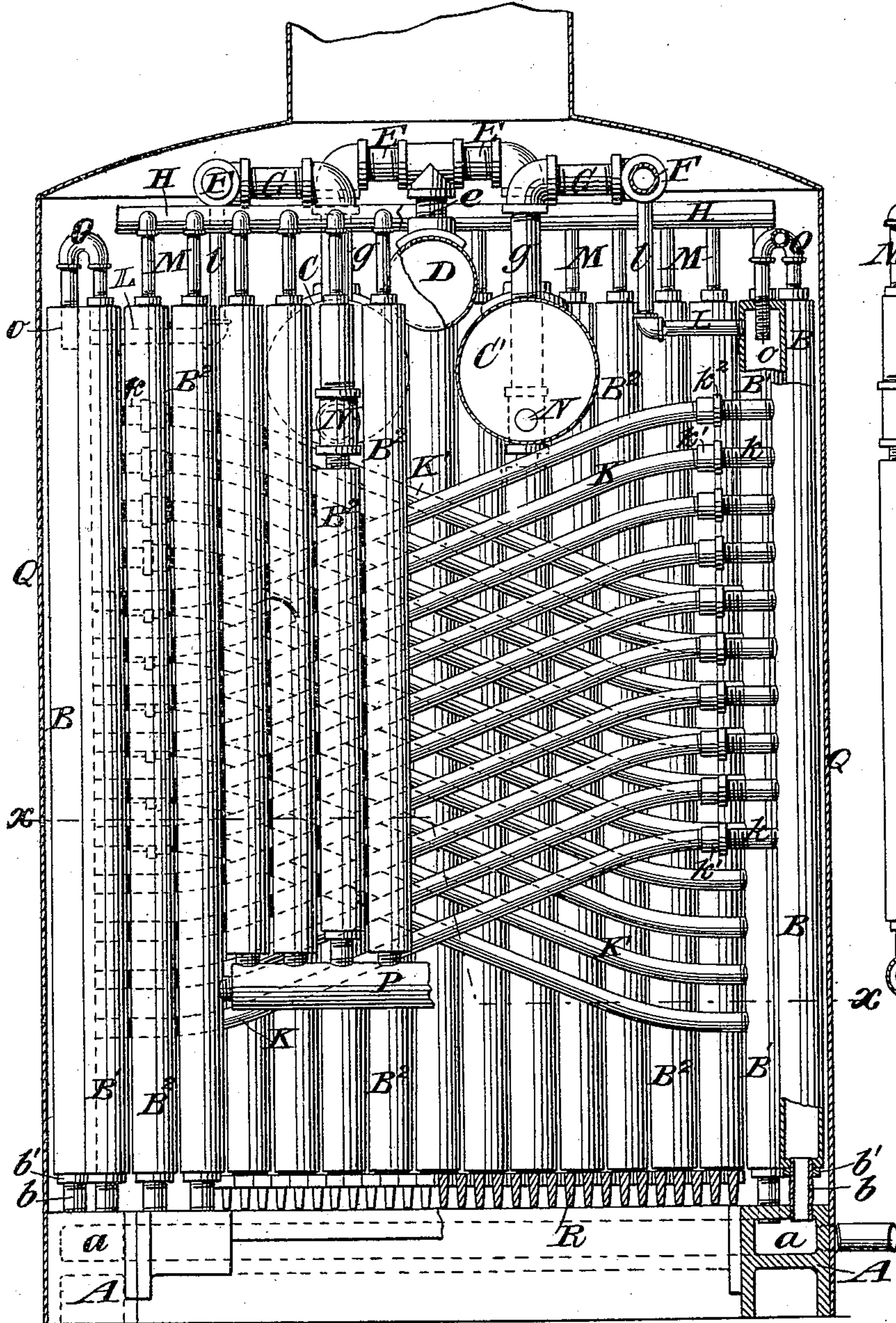
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H. SKINNER.  
TUBULAR BOILER.

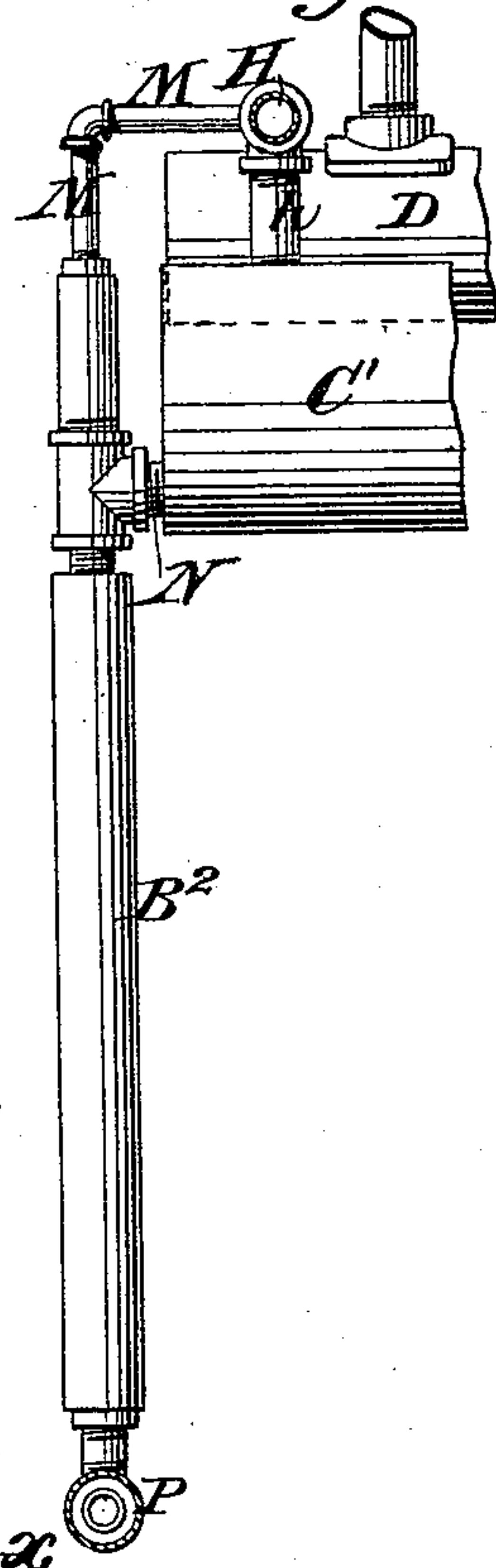
No. 448,890.

Patented Mar. 24, 1891.

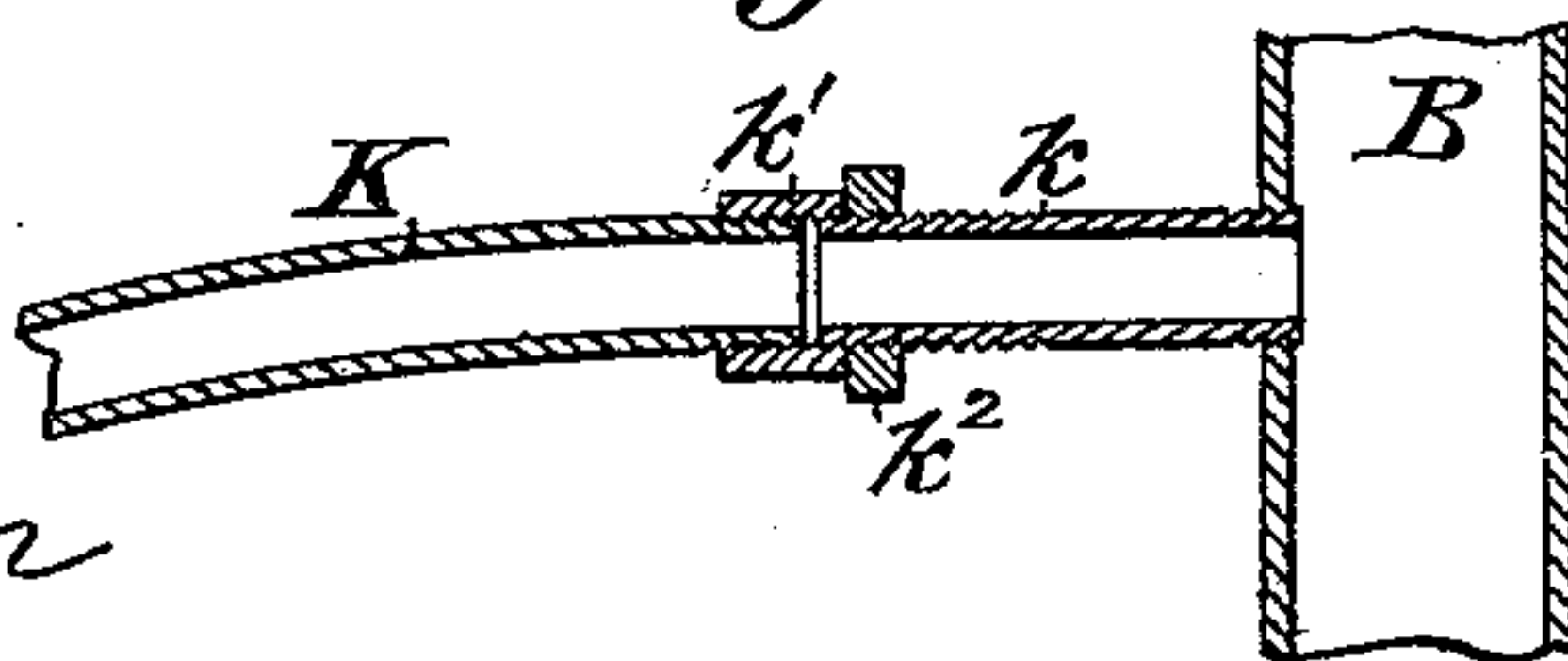
*Fig. 1.*



*Fig. 4.*



*Fig. 5.*



Witnesses:

Olundgren  
B. H. Kayser

Inventor:

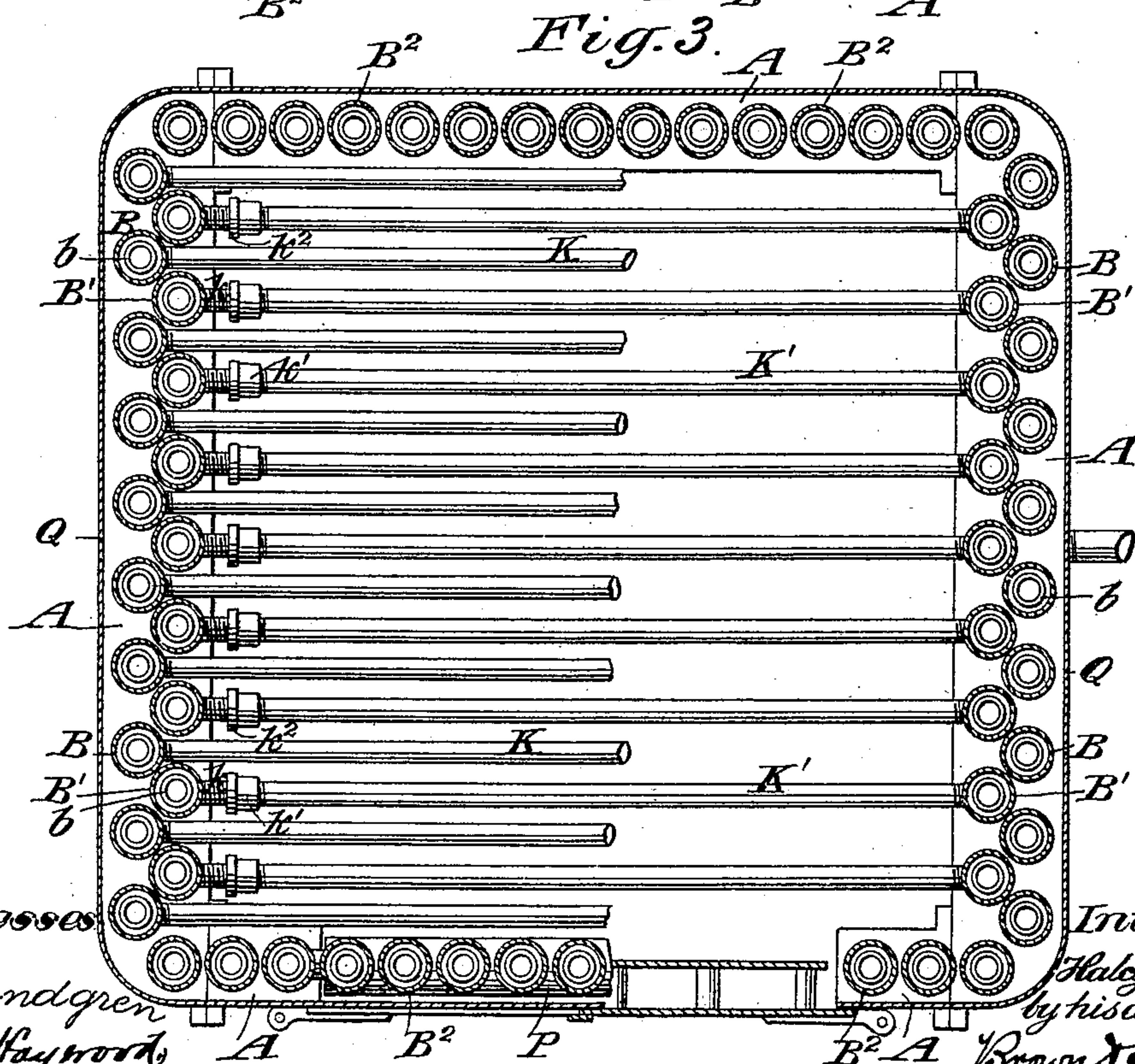
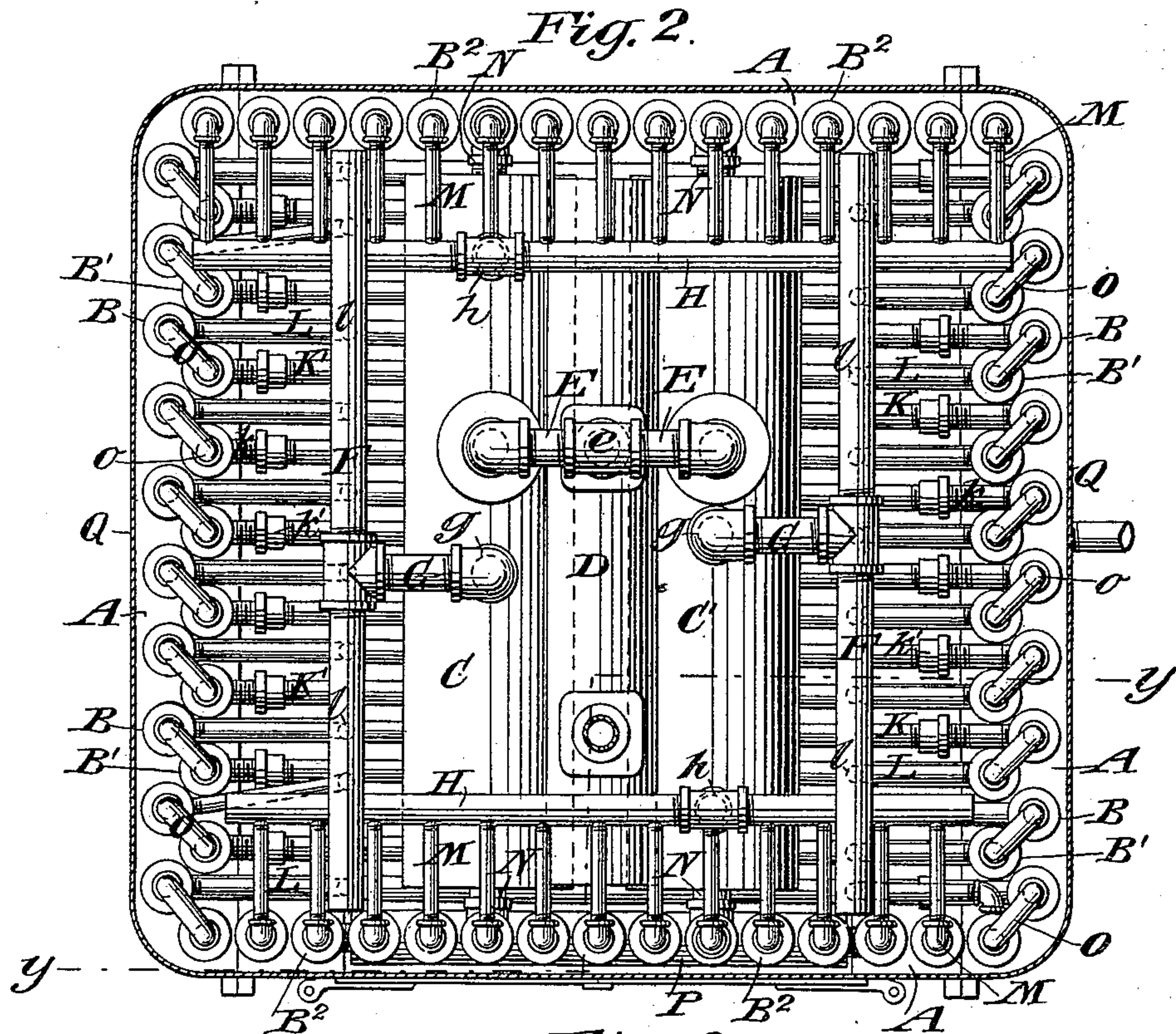
Halcyon Skinner  
by his attorneys  
Brown & Seward



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Witnesses

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Inventor:

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*Brown & Seward*



# UNITED STATES PATENT OFFICE.

HALCYON SKINNER, OF YONKERS, NEW YORK.

## TUBULAR BOILER.

SPECIFICATION forming part of Letters Patent No. 448,890, dated March 24, 1891.

Application filed April 5, 1890. Serial No. 346,713. (No model.)

*To all whom it may concern:*

Be it known that I, HALCYON SKINNER, of Yonkers, in the county of Westchester and State of New York, have invented a certain  
5 new and useful Improvement in Tubular Boilers, of which the following is a specification.

The object is to provide an eminently feasible structure in this type of boiler in which a  
10 great extent of boiler-surface shall be exposed to the direct action of the fire and in which a rapid circulation shall be maintained.

A practical embodiment of the features of my invention will be particularly described  
15 in connection with the accompanying drawings, in which—

Figure 1 is a view of the boiler in front elevation, partly in section, with casing removed, the line of section being denoted by  
20 *y y*, Fig. 2. Fig. 2 is a top plan view with top of casing removed. Fig. 3 is a horizontal section on the line *x x* of Fig. 1, the grate being omitted. Fig. 4 is a view in detail representing a partial side elevation of certain  
25 parts; and Fig. 5 is an enlarged view, in detail, of one of the connections.

A represents the base of the boiler, which forms a support for the tubular structure and contains a chamber *a*, extending around the  
30 lower margin of the structure and serves as a means of free communication between the lower ends of the series of tubes around the outside of the boiler. The form of the base in the present instance is substantially rectangular. Along the opposite sides of the  
35 boiler series of vertical tubes are arranged, two series on each side of the boiler, the tubes of the two series on each side being arranged in staggered order and in close proximity to  
40 one another.

For purposes which will hereinafter appear, the tubes of the series B are placed nearer together than the diameter of one of the tubes, and opposite each space, between two of the  
45 tubes B, a tube B' is located with its exterior surface in proximity to the tubes B. The tubes B B' are connected with the base A by means of short tubes or nipples *b*, which are conveniently screwed into the face at one end  
50 and at the opposite end threaded for a distance sufficient to admit of being screwed into

the end of one of the tubes and receive a lock-nut *b'* for adjusting them in position.

The tubes of the series B B' are connected in pairs at their upper ends by return-bends  
55 O, which extend from the top of one of the tubes B up, over, and down into the top of the tube B', adjacent thereto. The end *o* of the return-bend O which extends into the top of the tube B' is projected downwardly within  
60 said tube to a point below the outlet-pipe L, which will be hereinafter referred to.

The tubes of one of the series B and B' are connected with the tubes of the series B B' on the opposite side of the boiler by tubes  
65 K K', located at intervals throughout the length of the tubes B B' and extending from their point of connection with one of the tubes in a slanting direction upwardly to their connection with the tube on the opposite side.  
70 As represented in the accompanying drawings, the tubes of the series B on the left are each connected with their corresponding tubes on the right by a series of slanting tubes K, which extend upwardly from the  
75 left toward the right, and each of the tubes B' on the right is connected with its corresponding tube on the left by a series of tubes K', which extend upwardly in a slanting direction from the right toward the left. It,  
80 moreover, follows from the arrangement of the series of tubes on the right and left, as hereinabove particularly referred to, that the distance between the axes of the tubes of two vertical series of cross-tubes K K' will be less  
85 than the diameter of one of the tubes B or B', so that these vertical series of cross-tubes are brought into closer proximity to one another, and a greater amount of boiler-surface is thereby exposed to the direct action of the  
90 fire, while at the same time the circulation is direct from the cross-tube into its upright. In order to allow for expansion and contraction, the tubes K K' are slightly bent, as shown. The connection of the cross-tube with its up-  
95 right at the lower end may be effected by simply screwing the end of the tube into the upright, and its connection at the upper end may be conveniently effected by screwing a short tube-section *k*, Fig. 5, into the upright, coupling the end of the cross-tube K by a threaded  
100 collar *k'*, for example, and adjusting the same



by means of a lock-nut  $k^2$ , screwed onto the end of the short tube.

The tendency of the slanting tubes, arranged as above described, each series slanting upwardly in the opposite direction from the series immediately adjacent thereto, is to gradually divert the flame and products of combustion from the middle portion of the fire-chamber off toward the sides, exposing thereby the cross-tubes throughout their entire length to substantially uniform heat, and also directing the heat toward the vertical tubes.

Above the cross-tubes  $K K'$  two horizontal separating-drums  $C C'$  are located. In the present instance they are shown extending from front to rear. The said separating-drums communicate with the series of side tubes by horizontal tubes  $L$ , communicating with the side tubes a short distance below their upper ends and connected with horizontal tubes  $F$ , extending parallel with the series of side tubes by upright tubes  $I$ , the horizontal tubes  $F$  being connected with the drums by tubes  $G$ , having a downwardly-turned section  $g$ .

The boiler is provided at its front and rear with a single series of tubes  $B^2$ . The tubes  $B^2$  communicate with the base  $A$  in a manner similar to that described in connection with the tubes  $B B'$ , and at their upper ends they communicate with horizontal tubes  $H$  by means of branch pipes  $M$ . The tubes  $H$  communicate with the drums  $C$  and  $C'$  through drop connections  $h$ . The drums  $C C'$  are connected at their opposite ends with the upright tubes  $B^2$  by means of short horizontal tubes  $N$ , which serve as a means of support for the drums. In front of the furnace the upright tubes  $B^2$  along the central portion are stopped short of the base and are connected with a cross-tube  $P$ , the ends of the latter being connected with the full-length tubes at the right and left for purposes of support and free circulation. The space left by the shortening of certain tubes at the front affords access to the fire-pot.

Between and above the drums  $C C'$  the steam-dome  $D$  is located, and is connected with the drums by pipes  $E$ , which extend upward and over to the common connection  $e$ . The whole is surrounded by a suitable casing  $Q$ , and a suitable grate  $R$  is provided at the base.

Because of the extent of boiler-surface exposed to the fire and the arrangement of the tubes in such a manner as to admit a very rapid circulation, the water at the upper portions of the vertical tubes  $D D'$  will become more or less agitated under the impulse of the rapidly-forming steam in the cross-tubes. In order to separate the water which might be carried along with the steam from the steam at the upper portion of the boiler-tubes and return it into the water portion of the boiler at the earliest moment, I provide the return-bends  $O$ , referred to in the above de-

scription, so that any water which is carried over from the series of vertical tubes, which receives the upper ends of the cross-tubes, will be carried down by the extended end of the return-bend past the steam-outlet  $L$ , while the steam will pass into the horizontal pipes  $L$  and thence into the drums  $C C'$ , from the upper portions of which the steam is taken and conducted to the steam-dome  $D$ .

It is evident that the boiler constructed as above described may be made of such dimensions as to accommodate itself to different spaces intended for its reception to suit the varying demands.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, with series of tubes arranged upon opposite sides of the boiler and connected by cross-tubes, one of the series upon one side of the boiler receiving the upper ends of the cross-tubes and another series on the same side receiving the lower ends of the cross-tubes, of return-bends connecting the tops of the series which receive the upper ends of the cross-tubes with the tops of the series of tubes which receive the lower ends of the cross-tubes, substantially as set forth.

2. In a steam-boiler, a series of intercommunicating boiler-sections, each section consisting of two vertical tubes located at opposite sides of the combustion-chamber, and a series of bent inclined cross-tubes connecting the two vertical tubes, and a water-base with which the vertical tubes communicate, the vertical tubes of one section being located in practical contact with and in staggered relation to the vertical tubes of the adjacent section, substantially as set forth.

3. In a steam-boiler, two series of vertical tubes arranged upon one side of the boiler and two corresponding series of tubes arranged upon the opposite side, the tubes of one of the two series on each side of the boiler being located opposite the spaces between the individual tubes of the other series and in practical contact with the adjacent tubes of the other series, the distance between two successive tubes of a series being less than the diameter of one of the tubes, and cross-tubes connecting each of the series on one side of the boiler with a series upon the opposite side of the boiler, substantially as set forth.

4. The combination, with two series of vertical tubes and outlet-pipes extending from below the upper ends of one of the series of tubes to a steam-chamber, of return-bends extending from the tops of the other series of tubes up, over, and down into the upper ends of the series of tubes with which the outlet-pipes engage, the ends of the return-bends projecting downwardly into said tubes below the said outlet-pipes, substantially as set forth.

5. The herein-described boiler, comprising a base having a water-chamber extending around the lower margin of the boiler, vertical tubes arranged in double series at the



sides of the boiler and in single series at the front and back of the boiler, cross-tubes connecting the series of vertical tubes at the sides of the boiler and having an upward slant alternately in opposite directions, separating-drums located above the cross-tubes, a steam-dome located centrally above the separating-drums, tubes extending parallel with the drums at the upper portion of the boiler and  
10 connected with the vertical tubes by branch

tubes, tubes extending transversely to the separating-drums and connected with the upper portions of the front and back, vertical tubes, and connections between the said tubes at the top of the boiler, the separating-drums, 15 and the steam-dome, substantially as set forth.

HALCYON SKINNER.

Witnesses:

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