

No. 617,510.

Patented Jan. 10, 1899.

E. KENDALL.
HORIZONTAL TUBULAR STEAM BOILER.

(Application filed Aug. 16, 1898.)

(No Model.)

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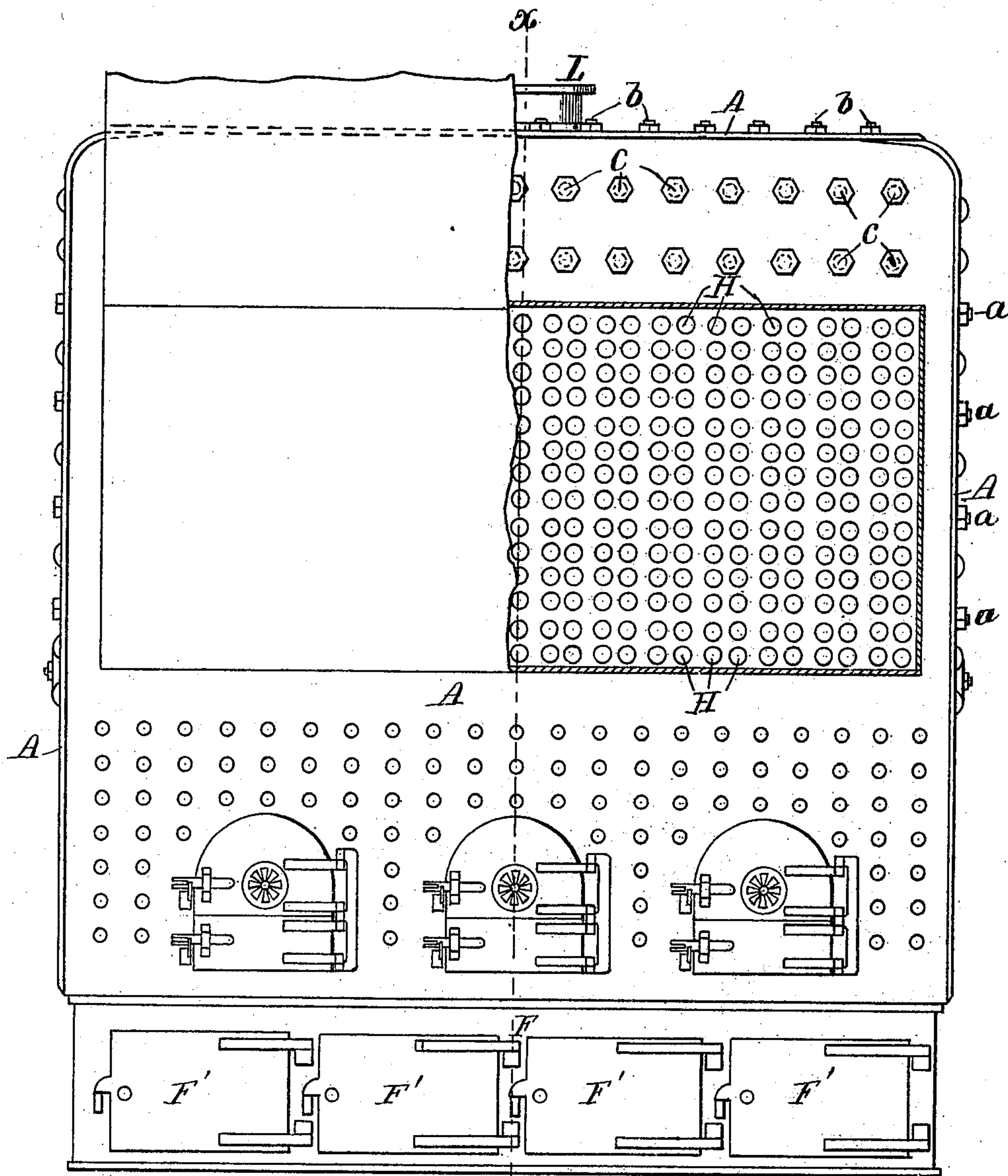


Fig. 1.

X

Witnesses:

Arthur B. Randall.

J. W. Dayton.

Inventor:

Edward Kendall.

by N. P. Lombard

Attorney.

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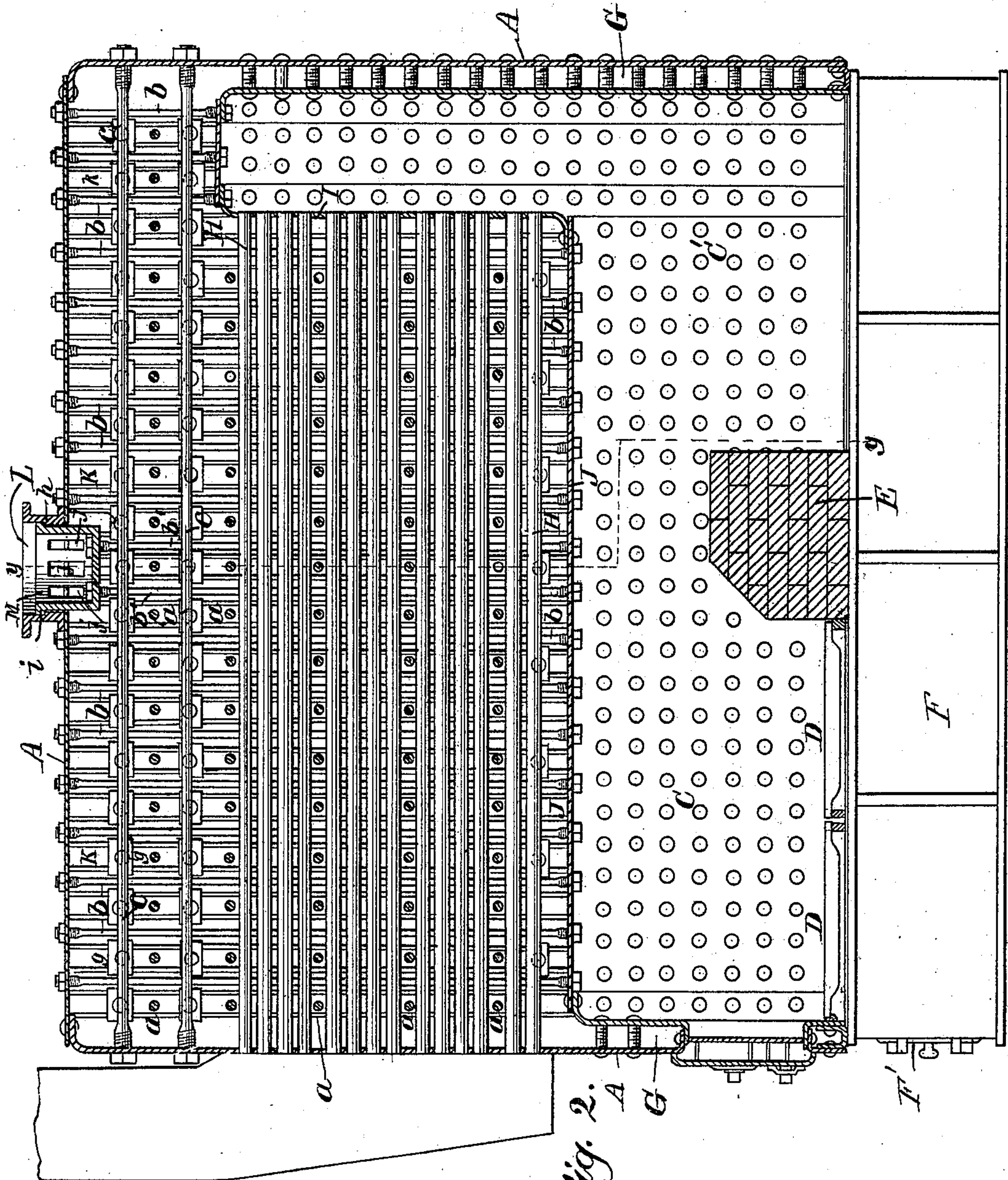
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4 Sheets—Sheet 2.



Witnesses:

Arthur D. Randall

J. H. Dayton

Fig. 2.

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

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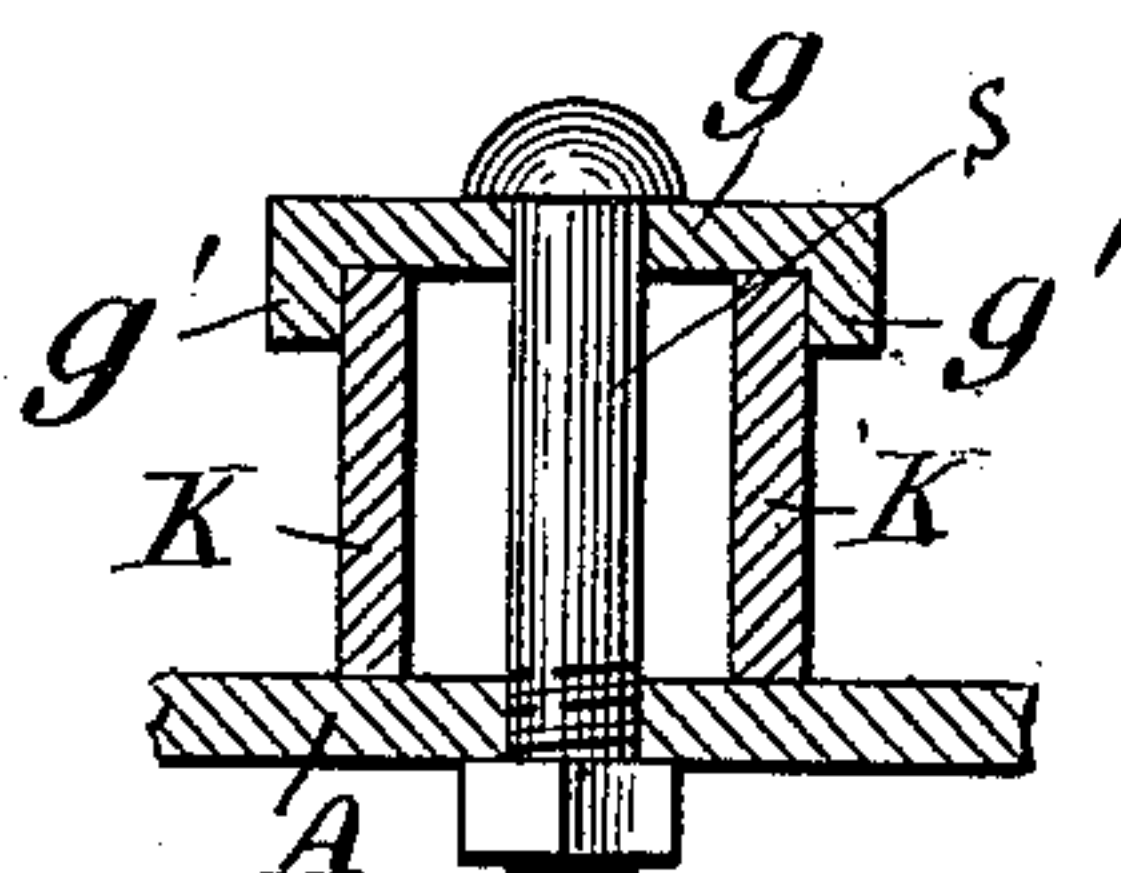
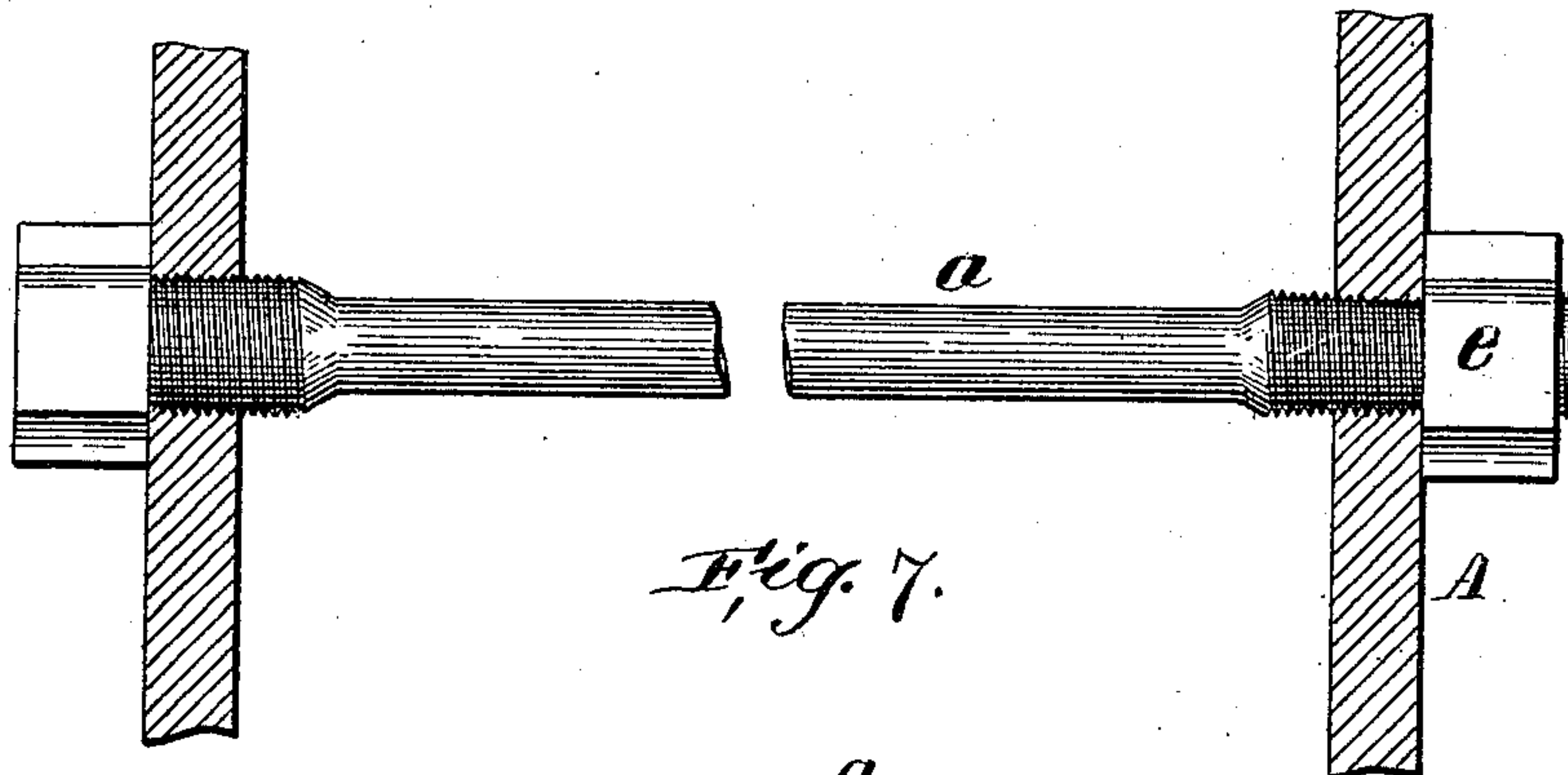
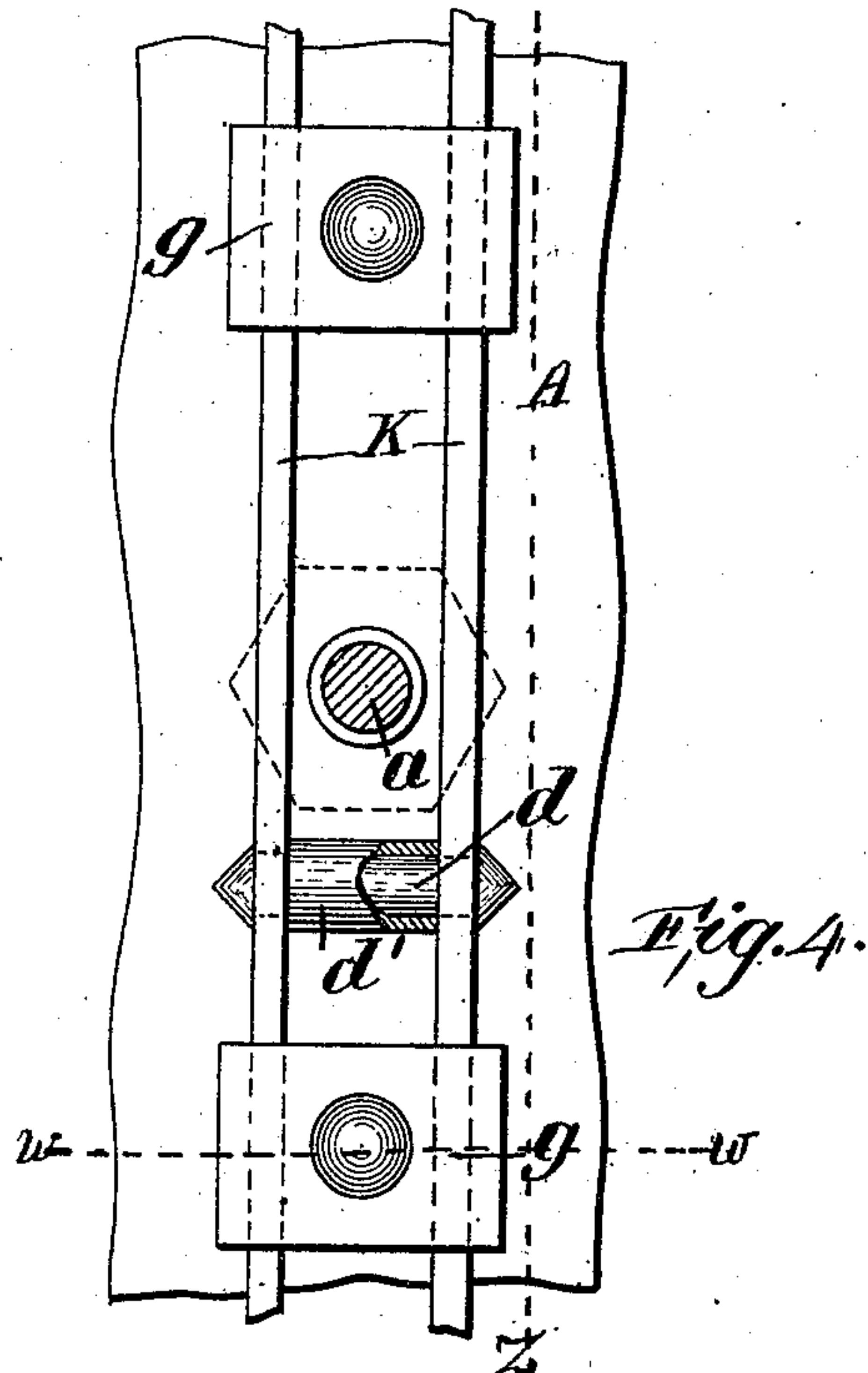
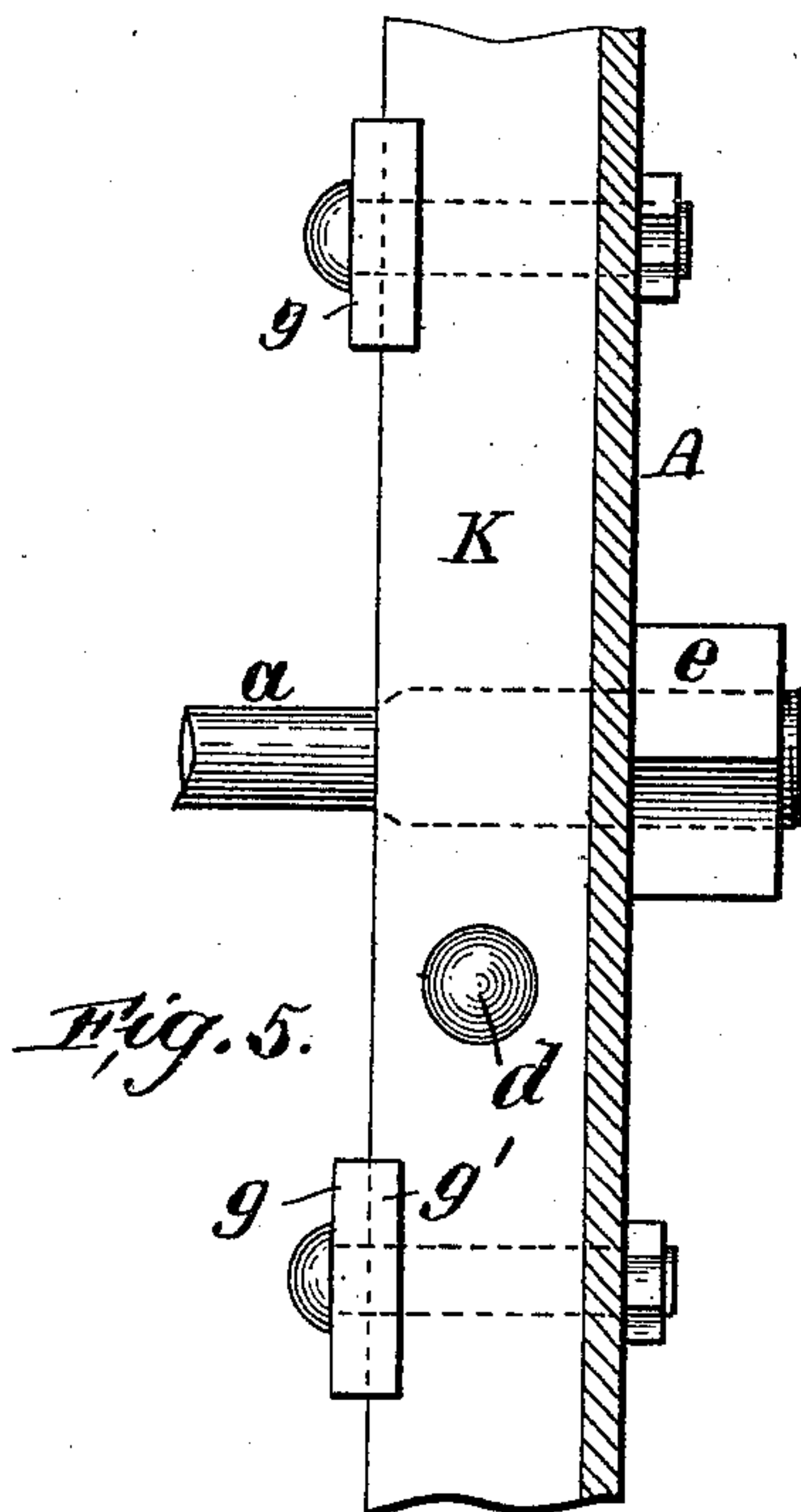
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(No Model.)

4 Sheets—Sheet 4.



Witnesses:
Arthur O. Randall.
J. H. Fayton.

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

UNITED STATES PATENT OFFICE.

EDWARD KENDALL, OF CAMBRIDGE, MASSACHUSETTS.

HORIZONTAL TUBULAR STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 617,510, dated January 10, 1899.

Application filed August 16, 1898. Serial No. 688,719. (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
5 new and useful Improvements in Horizontal Tubular Steam-Boilers, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to horizontal tubular
10 steam-boilers, is designed especially for marine boilers, and has for its object the production of a boiler capable of resisting very high pressures with the employment of the minimum of weight of material in its construction
15 and also to furnish great power while occupying the minimum of space; and it consists in certain novel features of construction, arrangement, and combination of parts, which will be readily understood by reference to
20 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 front elevation of a boiler embodying my invention with
25 about one-half of the uptake or smoke-box cut in section. Fig. 2 is a vertical longitudinal section on line *x x* on Fig. 1. Fig. 3 is a transverse vertical section on line *y y* on Fig. 2. Fig. 4 is an inside elevation of a small
30 portion of one of the side plates of the boiler-shell and illustrating the manner in which said plates are reinforced to resist the heavy pressure to which they may be subjected. Fig. 5 is a sectional elevation of the same
35 parts, the cutting-plane being on line *z z* on Fig. 4. Fig. 6 is a transverse section on line *w w* on Fig. 4, and Fig. 7 is an elevation of one of the stay-bolts. Figs. 4, 5, 6, and 7 are drawn to an enlarged scale.

40 In the drawings, A represents the outside shell or casing, which is substantially rectangular and very nearly a cube in form, above the ash-pit B.

C is the furnace or fire-pot, provided with
45 the grate-bars D, and E is the bridge-wall, extending across the rear of the grate, as shown in Fig. 2.

F is the ash-pit casing, and F' the ash-pit doors, of any well-known construction.
50 (Shown only in elevation in Figs. 1 and 2.)

The furnace C and rear combustion-chamber C' are surrounded by the water-legs G, of well-known construction.

H H are fire-tubes arranged horizontally and set in the front wall of the shell A and
55 the rear tube-sheet I, said tubes serving as stays for said tube-sheet and that portion of the wall A in which they are set in a well-known manner.

In order to permit the proper staying of the
60 side walls and the top plate of the outer shell A and the crown-sheet J of the furnace, said tubes are arranged in clusters, or, in other words, said tubes are so set that a greater space is left between two parallel rows of
65 tubes at suitable distances than between other rows in the same direction to permit the passage between said rows of tubes of horizontal and vertical stay-rods *a* and *b*, respectively, of extra size.

70 Above the tubes H and parallel therewith are inserted two rows of stay-rods *c c* to stay the portions of the front and rear sheets of the outer wall A which are above the upper row of said tubes, as shown in Figs. 2 and 3. 75

The stay-rods *a*, *b*, *b'*, and *c* are upset at both ends to increase their diameters for a short distance from each end, the diameter of said upset portion at one end of each rod being greater than the diameter of the upset
80 portion at its other end, and said upset portions have screw-threads formed thereon, which screw into threaded holes in the opposing plates which they are to stay, as shown in Fig. 7. That end of each stay-rod *a*, *b*, *b'*,
85 and *c* which has the largest diameter has formed thereon a fixed or integral head, and the opposite end has fitted thereon a nut *e*, which is screwed up against the outer surface of the boiler-shell, as shown in Figs. 1, 90 2, 3, 5, and 7.

The two vertical side plates of the outer shell that are parallel to the fire-tubes are reinforced by a series of pairs of rectangular
95 bars K K, each pair being connected together by rivets *d* and thimbles *d'*, as shown in Figs. 4 and 5, and are clamped to the inner surface of said plates at suitable intervals by means of the clamp-plates *g* and bolts *f*, said clamp-plates *g* being provided with lips *g'*, which
100 lock over and engage the outer surfaces of said bars K K, as shown in Figs. 2, 4, 5, and 6.

The top plate of the shell A has cut through it a circular opening coinciding with the di-
105 ameter of the short section of a pipe L, firmly

riveted to said plate and provided with the inwardly-projecting annular shoulder *h*, as shown in Figs. 2 and 3.

M is a cup-like casting or forging provided with the outwardly-projecting annular lip *i* around its upper end, the under side of which rests upon the shoulder *h*, when said cup is placed in position in the pipe L with its lower end projecting into the chamber of the boiler, as shown in Figs. 2 and 3. The vertical walls of the cup M have formed therein a series of openings *j*, through which steam may escape into the steam-pipe to be secured to the short section L, but not shown. The vertical stay-rods *b'* have their upper ends screwed into the bottom of said cup, and have nuts *b²* screwed thereon, said rods *b'* being made somewhat shorter than the rods *b*, as shown in Figs. 2 and 3.

By the construction herein described and arranging the fire-tubes in groups and employing stay-rods one and five-eighths of an inch in diameter in their main bodies and enlarged at their ends, as described, in connection with the reinforcing stiffening-bars on the insides of the side plates of the shell that are parallel to the said tubes a boiler may be produced capable of sustaining a pressure of three hundred pounds per square inch, thus rendering it possible to obtain a given power for propelling a ship from a boiler occupying less space, weighing less, and costing less money than the boilers required to produce the same power as heretofore constructed.

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

1. In a steam-boiler having a rectangular casing or shell, the combination with the flat side walls of said casing or shell that are parallel to the fire-tubes, of a series of vertical rectangular stiffening-bars arranged in pairs and secured to the inner surfaces of said flat side walls by the clamp-plates *g* and bolts *f*; and a series of horizontal stay-rods connecting said side walls at intervals between said pairs of stiffening-bars.

2. In a steam-boiler of the kind described, the combination with the rectangular shell and the horizontal fire-tubes; of a steam-discharge pipe-section provided with an inwardly-projecting annular shoulder; a cup-like casting provided with an outwardly-projecting annular lip or rim at its upper end to rest upon the shoulder in said pipe, and with a series of openings through its vertical wall for the passage of steam; a series of vertical stay-rods screwed through the crown-sheet of the furnace and the top plate of the boiler-shell; and a plurality of similar but shorter stay-rods screwed through said crown-sheet and through the bottom of said cup, each of said stay-rods having a fixed or integral head on one end and a nut screwed upon its other end as set forth.

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.