

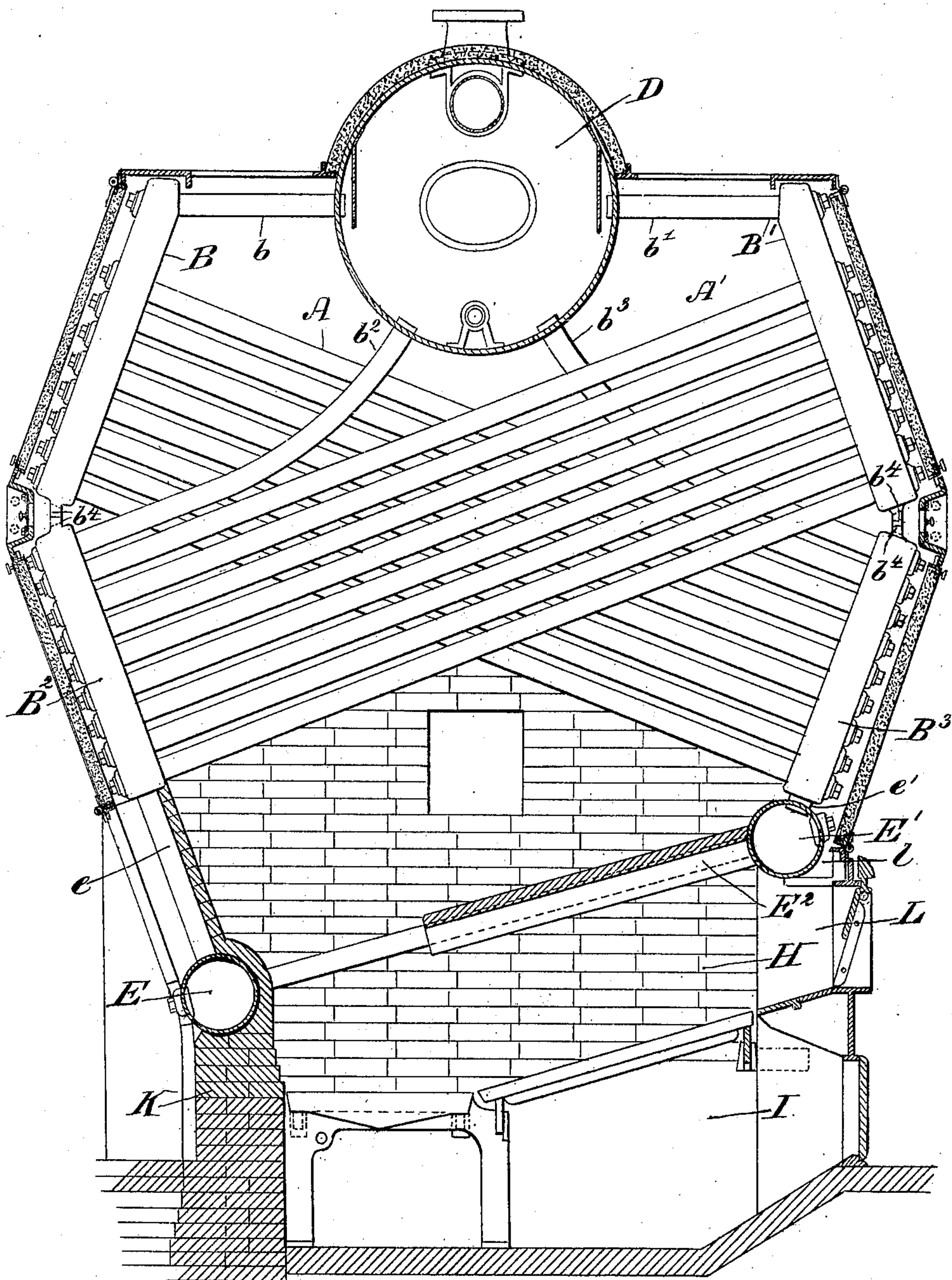
A. WORTHINGTON.
WATER TUBE BOILER.
APPLICATION FILED NOV. 24, 1909.

983,339.

Patented Feb. 7, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



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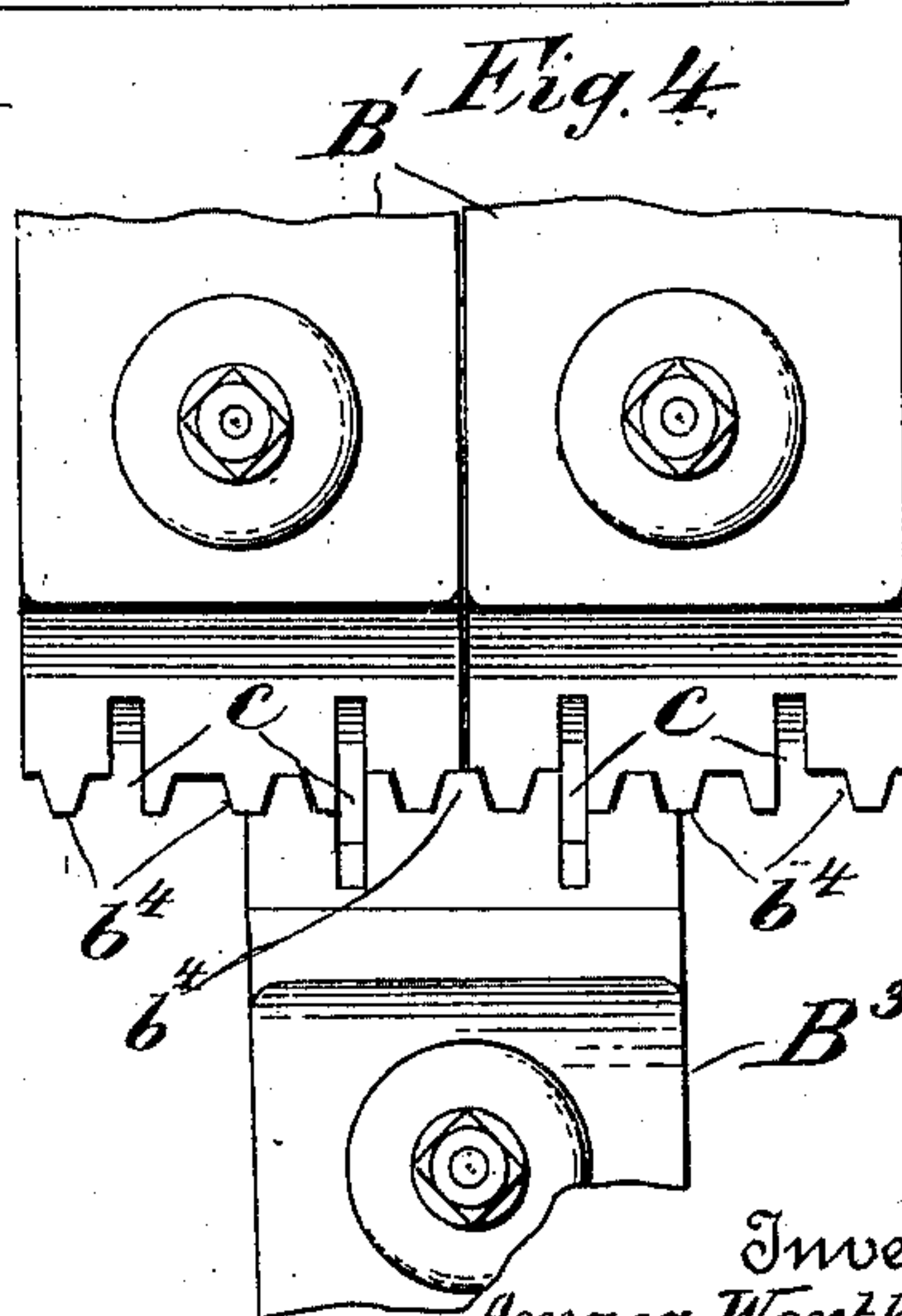
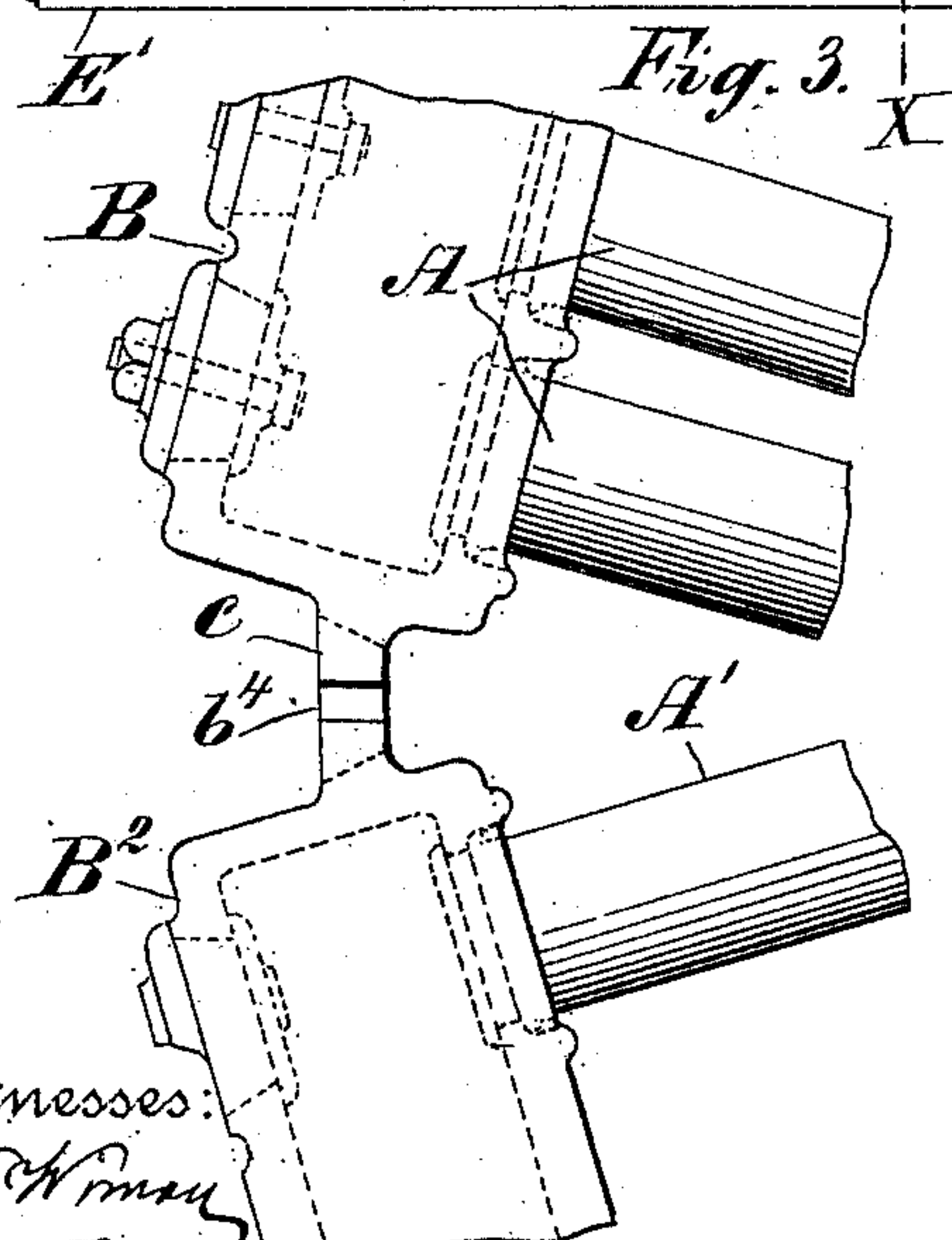
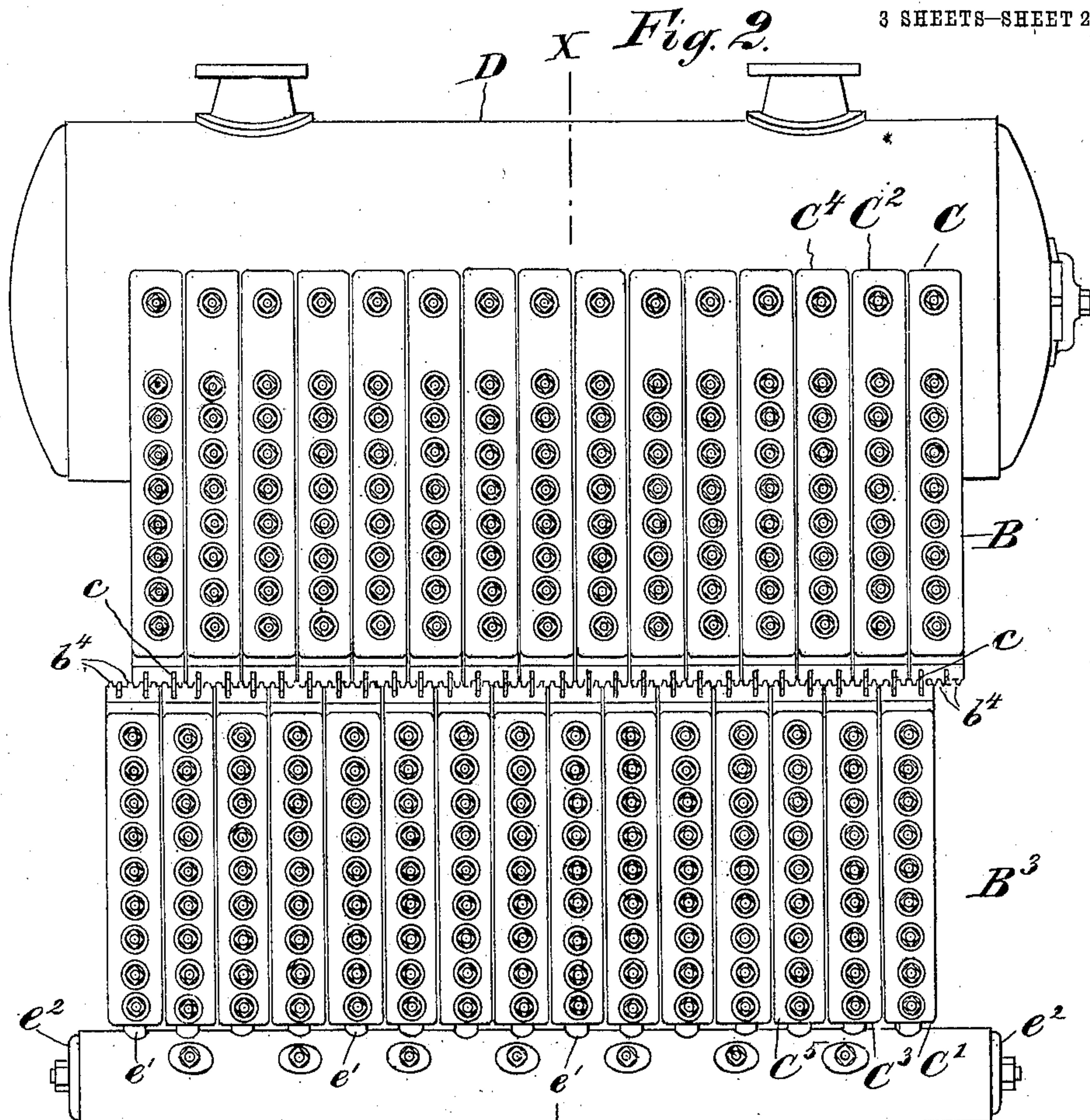
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 5.

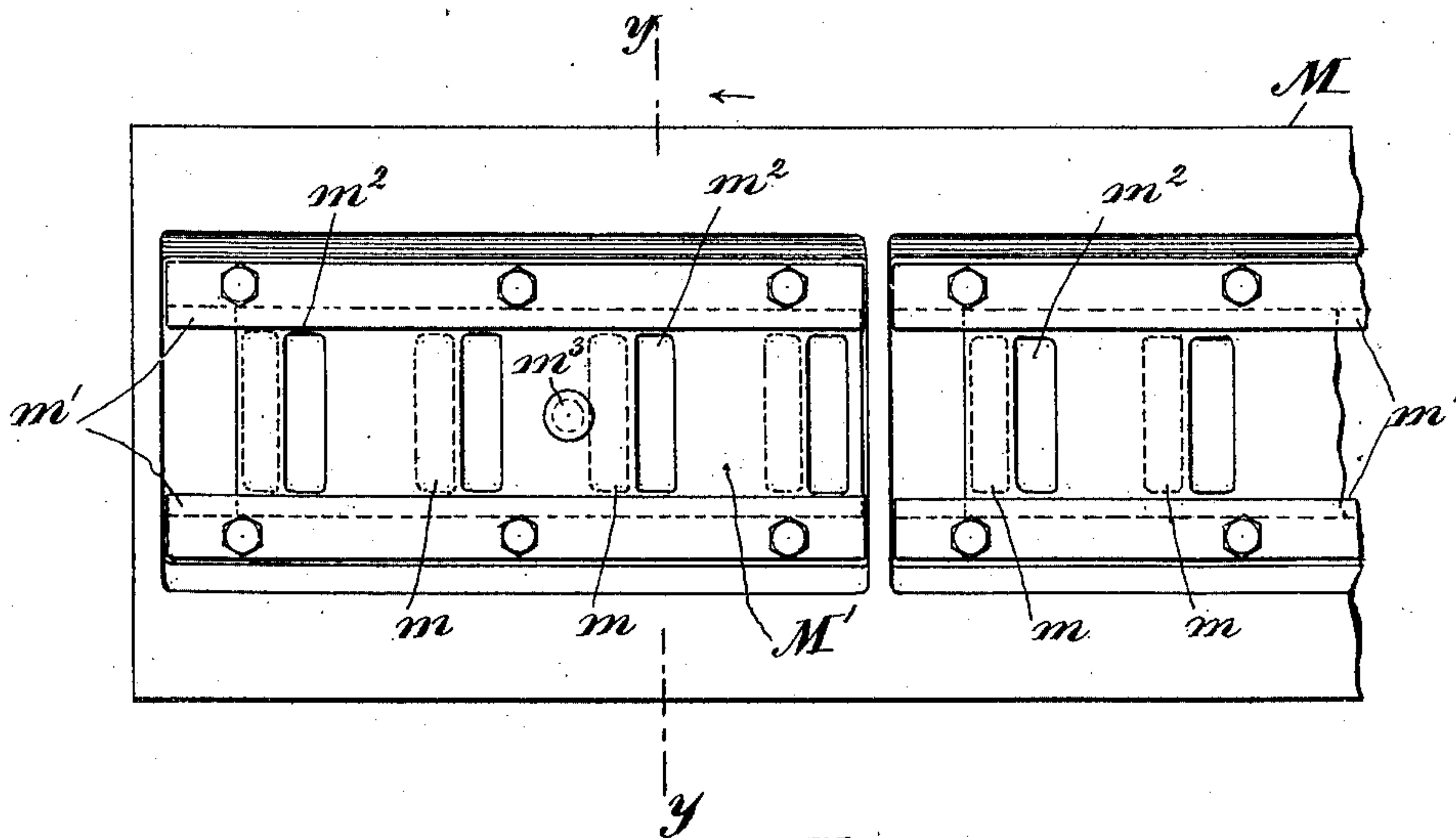
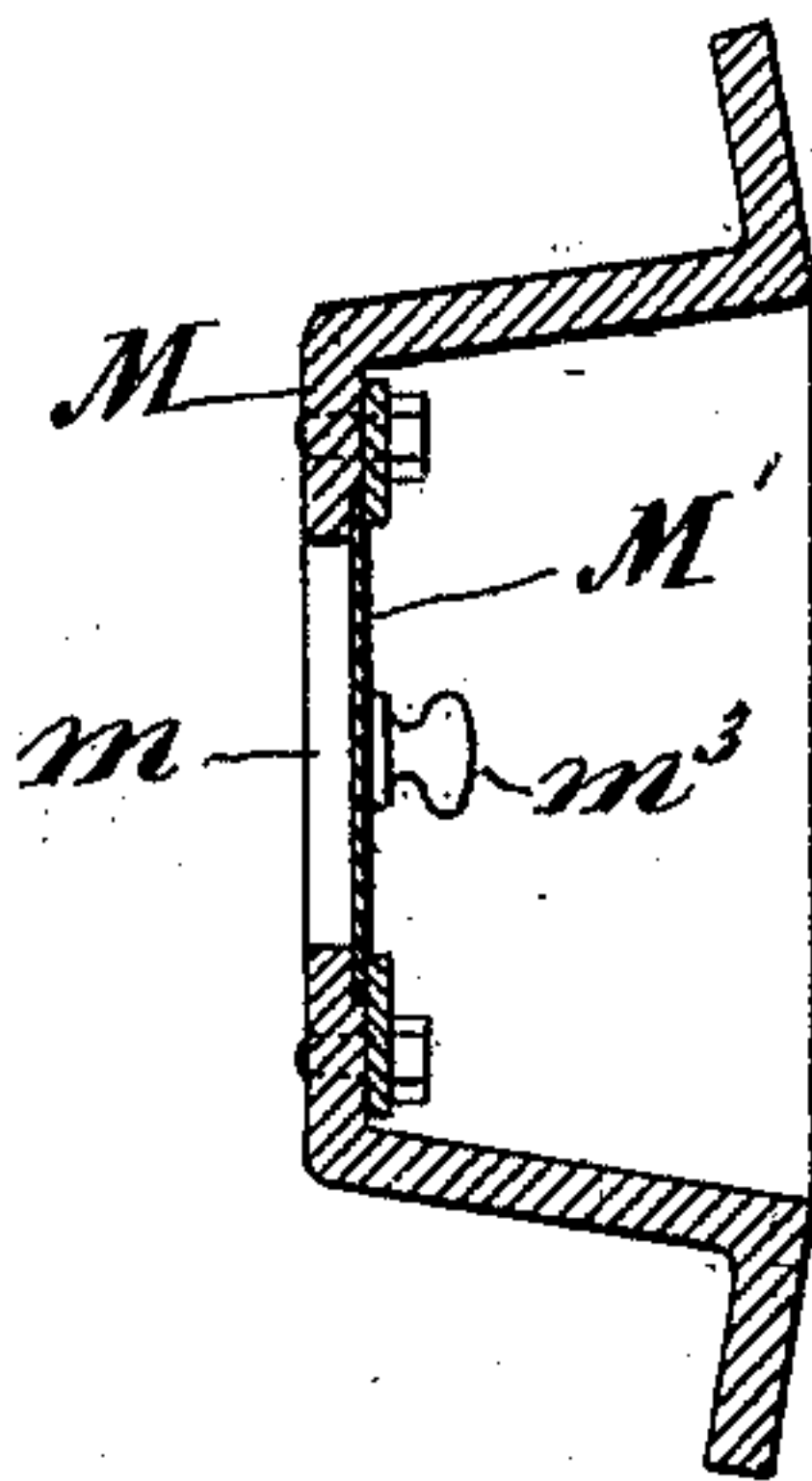


Fig. 6.



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UNITED STATES PATENT OFFICE.

AMASA WORTHINGTON, OF NEW YORK, N. Y.

WATER-TUBE BOILER.

983,339.

Specification of Letters Patent.

Patented Feb. 7, 1911.

Application filed November 24, 1909. Serial No. 529,770.

To all whom it may concern:

Be it known that I, AMASA WORTHINGTON, a citizen of the United States, and a resident of the borough of Brooklyn, in the county of Kings, city and State of New York, have invented a certain new and useful Improvement in Water-Tube Boilers, of which the following is a specification.

My invention relates to what are known to the art as cross-tube boilers of the water tube class, and it has for its object to provide means for not only properly locating the vertically arranged series of tubes of the sections having one inclination between the vertically arranged series of tubes of the adjacent sections having an opposite inclination, and fixedly holding them in their adjusted position, but also for the removal of the ashes and other accumulations from the tubes of the various sections when desired.

To these ends the invention consists, first, in the peculiarities of construction of the headers whereby their meeting ends are adapted to engage and intermesh with each other; second, in the combination with the cooperating elevated and depressed headers, of means intermediate them whereby their meeting ends are adapted to positively engage with each other; third, in means whereby a jet of steam or air may be introduced between the meeting ends of the elevated and depressed headers to remove ashes or other accumulations from the various water-tubes, and fourth, in various other constructions and combinations of parts, all as will hereinafter more fully appear.

Referring to the accompanying drawings, which form a part of this specification, Figure 1, is a vertical transverse section of a boiler and setting constructed in accordance with my invention, taken in the line $x-x$ of Fig. 2; Fig. 2, a side elevation thereof, with the fire-box, the ash-pit and the setting removed; Fig. 3, a side elevation of a fragmentary portion of two cooperating sections, taken on an enlarged scale and showing the means by which the meeting ends of the cooperating elevated and depressed headers thereof are positively engaged; Fig. 4, an end elevation of a fragmentary portion of three sections, also taken on an enlarged scale and similarly showing the means by which the elevated and depressed headers are engaged with one another, with the passage-ways through which a jet of steam or

air may be introduced between the meeting ends of the headers to remove ashes and other accumulation from the various water-tubes; Fig. 5, a front elevation of a portion of one of the girths or plates that extend across the front and rear of the boiler, likewise taken on an enlarged scale and showing openings for affording access to the passage-ways through which a jet of steam or air may be introduced between the meeting ends of the cooperating headers, with means by which these openings may be opened and closed, and Fig. 6, a vertical transverse section, taken in the plane $y-y$ of Fig. 5.

In all the figures like letters of reference are employed to designate corresponding parts.

A and A^1 indicate the water-tubes and B, B^1 , B^2 , and B^3 , the headers with which these tubes respectively cooperate. These water-tubes are preferably disposed in a number of series, with the individual tubes of each series arranged the one above the other in a vertical row, and are secured at their opposite ends in their appropriate headers, which are provided with suitably formed orifices in which the ends of the tubes enter and are expanded. As thus arranged these series of water-tubes A and A^1 constitute, with their respective headers, separate and distinct sections C, C^1 , C^2 , etc., which, in the completed boiler, lie side by side throughout its length, with the sections made up from the respective series of tubes and their cooperating headers alternating with each other and inclined in opposite directions with respect to the horizon. With the various sections thus arranged, there may be employed the usual steam and water drum D, the mud-drums E and E^1 having the detachable caps e^2 , the respective connecting tubes b , b^1 , b^2 , b^3 , and e , and e^1 the fire-box H, the ash-pit I, the supporting pier K and standards L, as well as the usual casing or setting, all as are shown and described in an application for Letters Patent, filed by me in the United States Patent Office Nov. 17th, 1909, and serially numbered 528,550, or otherwise, as may be preferred.

While the general construction of the boiler to which my invention is applicable is or may be as thus indicated, my invention is directed more particularly to the headers B, B^1 , B^2 , and B^3 , and to the means whereby the cooperative elevated and de-

pressed members thereof are adjusted and located to bring their respective water-tube sections into proper positions relatively to one another in a lateral direction and positively restrain them in these positions. In the construction of these headers B, B¹, B², and B³, any convenient or approved form of cross-section may be adopted. I prefer however, to construct them of a rectangular cross-section, or of a form approximating thereto, and of the proper lengths to suit them to their intended location. Instead however of constructing these headers with plain flat ends, as has been customary heretofore, I form each of the meeting ends of the respective elevated and depressed headers B and B¹, and B² and B³, with a series of transversely arranged teeth *b*⁴, which extend outward longitudinally therefrom and are adapted to engage and intermesh with the corresponding teeth on the end or ends of the cooperating header or headers when brought into relation with it or them. As thus provided the elevated headers B and B¹, instead of resting at their lower plain flat ends directly upon the upper plain flat ends of their cooperating depressed headers B² and B³, when brought into relation with them, they rest upon those ends through the intervention of these laterally arranged and longitudinally extending teeth *b*⁴, which engage with one another, as shown more particularly in Figs. 3 and 4. In being thus equipped with these teeth *b*⁴, which intermesh with one another when brought into the proper relationship, provisions are made for not only permitting of the adjustment of the elevated headers B or B¹ of the water-tube sections having one inclination laterally with respect to their cooperating depressed headers B² or B³ of the sections having an opposite inclination, and vice versa, but also for positively restraining their respective sections in their adjusted position; and, in order to permit of bringing the axes of the series of water-tubes of the various sections having one inclination into vertical planes coinciding with the middle of the spaces between the adjacent series of water-tubes of the sections have an opposite inclination and maintaining them in these positions, the teeth *b*⁴ and intervening spaces are so arranged upon the ends of the cooperating elevated and depressed headers as to permit of the requisite adjustment of the sections to bring the water-tubes into those relationships. With the teeth *b*⁴ and intervening spaces thus arranged, the adjustment of the water-tube section, will, as is obvious be effected when required by disengaging the teeth *b*⁴ on the lower end of the elevated headers B or B¹ from the corresponding teeth on the upper engaging the teeth of the elevated headers B² or B³, then moving the respective section

C, C² or C⁴, etc. in the required lateral direction to the proper extent, and then engaging the teeth of the elevated headers with those of the depressed headers, when the adjustment will be accomplished and the parts positively held in their adjusted positions by that engagement.

With the means for effecting the adjustment of the various sections laterally with respect to one another and for positively holding them in adjusted positions, means by which the ashes and other accumulations may be removed from the various water-tubes is also employed. These means consists of passage-ways *c*, which are constructed through the material in which the teeth *b*⁴ are formed, at the meeting ends of the cooperating elevated and depressed headers, and are of the proper shape and dimensions to permit of the ingress of an appropriate pipe, through which a jet of steam or compressed air may be introduced between the various series of water-tubes to effect that result.

In some instances, as where the material at the ends of the headers in which the teeth *b*⁴ are formed projects a sufficient distance to accommodate them, the passage-way or passage-ways *c* appropriate to each of the headers may be constructed wholly within the material of that particular header. It is preferred however to form these passage-ways with a portion of each in one of the cooperating headers, and the remaining portions thereof in the other, and to so locate these portions in them that, when the sections embracing these headers are adjusted to bring their respective series of water-tubes A and A¹ into the proper positions, the two portions of these passage-ways shall register with one another and thereby form the completed passage-ways, as shown in Figs. 2 and 4.

As thus formed in either of the ways specified these apertures *c* may be located in various positions with respect to the water-tubes A and A¹. In the drawings however, they are shown as so disposed with respect to the different series thereof that they severally lie opposite the ends of the spaces between them, whereby to permit of the steam or air introduced through them being applied to the series of tubes lying on their opposite sides. In being thus arranged, the boiler setting is provided on its front and rear, opposite the meeting ends of the elevated and depressed headers, with a strip M, which will preferably extend across from one of its ends to the other, and will be provided with a series of apertures *m* formed through it opposite the passage-ways *c*, whereby access to these passage-ways may be permitted when desired. In their normal conditions these apertures *m* will remain closed, and in order to maintain

them in that condition, while yet permitting of their being opened and closed when access to the passage-ways *c* is required, various means may be employed. It is preferred however to employ for this purpose plates M^1 , which are severally fitted to slide longitudinally in suitable guide-ways m^1 secured to the front of their respective girths or strips *M*, and are provided with orifices m^2 , corresponding in number and in the distance they are located apart to the apertures *m* in the strips *M* with which they respectively cooperate. As thus provided, whenever these plates M^1 are moved in one direction, the orifices m^2 with which they are severally provided will be brought into register with the apertures *m* in their respective strips *M* and these apertures thereby opened. On the other hand, whenever these plates are moved in an opposite direction, the orifices m^2 with which they are provided will be carried to one side and out of registry with the apertures in their cooperating strips, with the result that these apertures *m* will be thereby closed. Thus by simply sliding the plates M^1 in one and the other direction the opening and closing of the apertures *m* in their respective strips *M* will be effected; and in order to provide for effecting this back and forth sliding movement of the plates when desired, they are each provided with a knob m^3 , which is secured to the plate in a convenient position for engagement by the hand of the operator. Thus, as will be seen, a water-tube boiler of the cross-tube variety is produced, in which, not only are provisions made for adjusting the various sections thereof laterally with respect to one another, whereby to locate their respective series of water-tubes at the same distance apart throughout the length of the boiler, and for positively restraining them in adjusted positions, but means provided whereby the removal of all ashes and other accumulation from the various water-tubes and the other parts of the boiler may be effected as well. Moreover, while in the foregoing I have described the best means contemplated by me for carrying my invention into practice, it is to be understood that I do not limit myself strictly thereto, as it is obvious that the same may be modified in various respects without departing from the spirit thereof.

Having now described the invention, and specified certain of the ways in which it is or may be carried into effect, the following is claimed.

1. A header for a water-tube boiler con-

structed with appropriate orifices for the reception of the ends of its cooperating water-tubes and which header is provided with a longitudinal row of transverse teeth or projections extending outward from its end, substantially as described. 60

2. The combination, with elevated and depressed headers of a water-tube boiler having oppositely inclined water-tube sections, of means interposed between the meeting ends of such headers through which the adjustment of the elevated headers laterally with respect to the depressed headers may be effected and such headers positively restrained in adjusted position, substantially as described. 65 70

3. The combination, in a water-tube boiler having oppositely inclined water-tube sections, with an elevated sectional header provided with transverse teeth projecting from the lower ends of its sections, of a cooperating depressed sectional header provided with corresponding transverse teeth projecting from the upper ends of its sections and interlocking with the teeth on the elevated header, substantially as described. 75 80

4. The combination, in a water-tube boiler having oppositely inclined water-tube sections, with the elevated headers provided with transverse teeth, of the cooperating depressed headers also provided with transverse teeth intermeshing with the teeth of the elevated headers, said headers being provided with openings forming a series of passageways between their meeting ends, substantially as and for the purpose described. 85 90

5. The combination, with a series of intermeshing elevated and depressed headers provided with a series of passage-ways between their meeting ends for the introduction of a pipe, of a strip arranged in front of such meeting ends and provided with a series of apertures corresponding with said passage-ways disposed opposite such passage-ways, and a plate arranged to slide longitudinally of said strip and provided with orifices corresponding with the apertures in the strip, whereby the opening and closing of said apertures may be effected by sliding such plate in one and the other direction, substantially as described. 95 100 105

In testimony whereof I have hereunto set my hand in the presence of two witnesses this 23rd day of November, 1909. 110

AMASA WORTHINGTON.

Witnesses:

C. R. APPLELE,
GRACE T. DIXON.