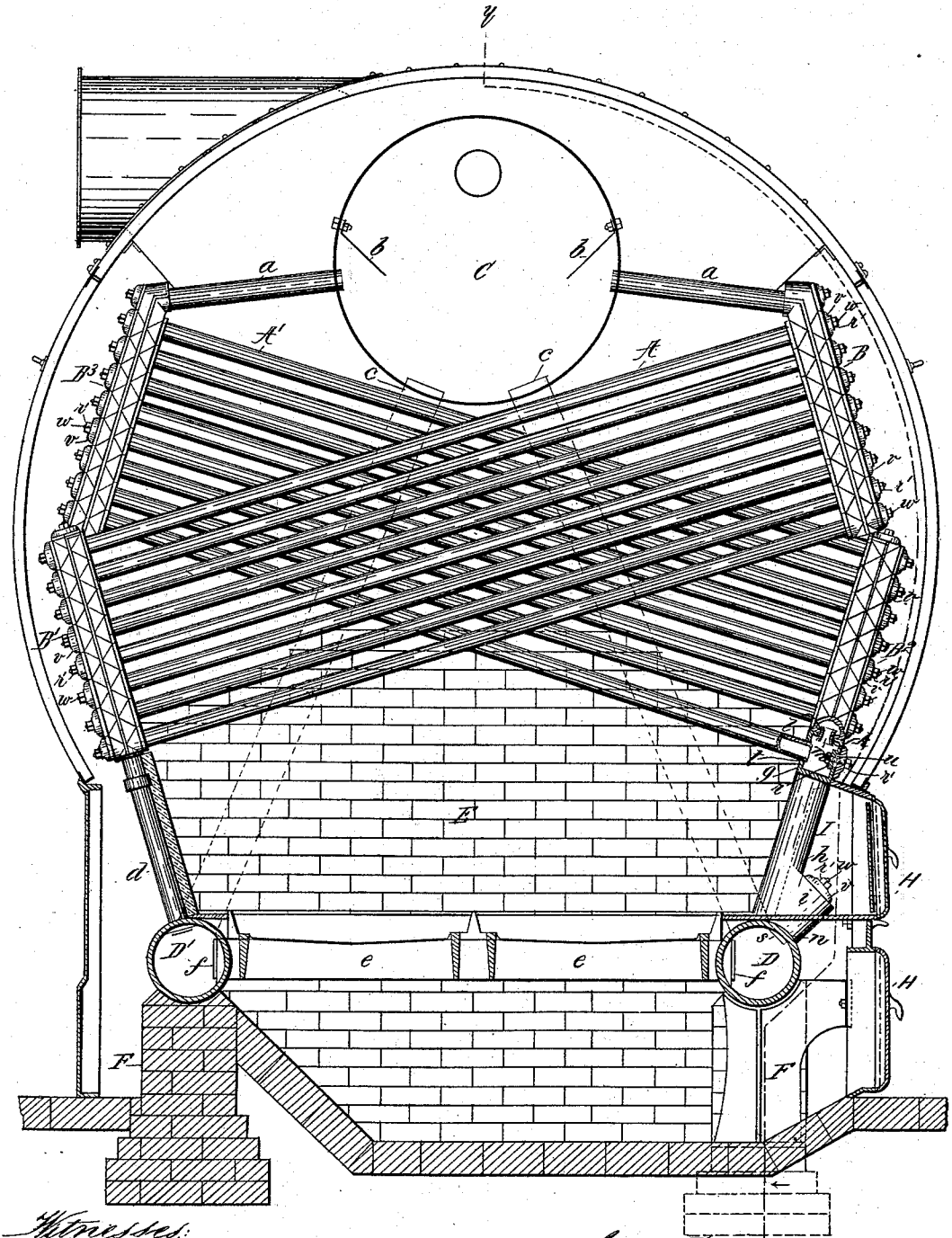
(No Model.) 3 Sheets—Sheet 1.

A. WORTHINGTON.

SECTIONAL STEAM BOILER.

No. 524,877. Patented Aug. 21, 1894.

FIG. 1.



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(No Model.) 3 Sheets—Sheet 2.

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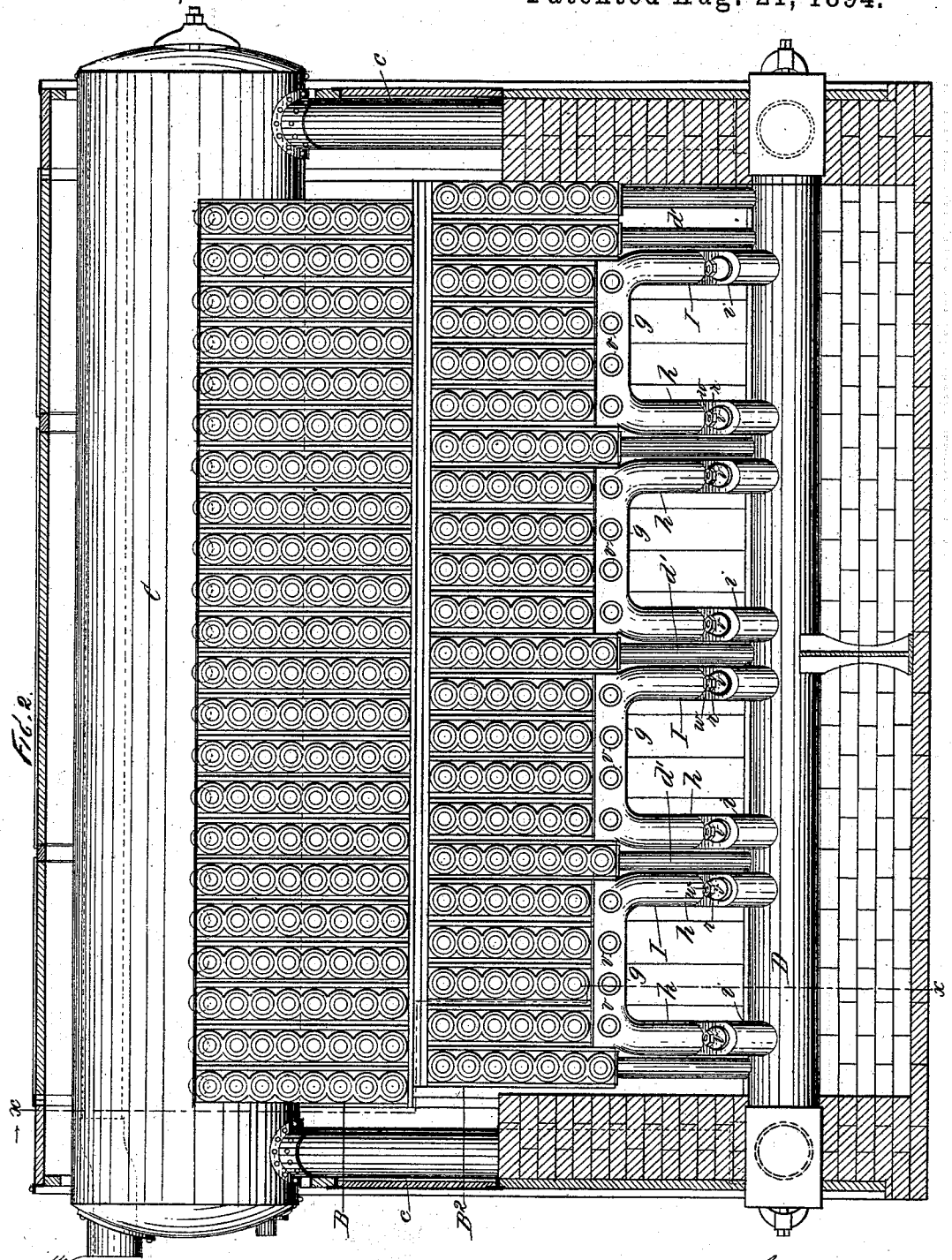

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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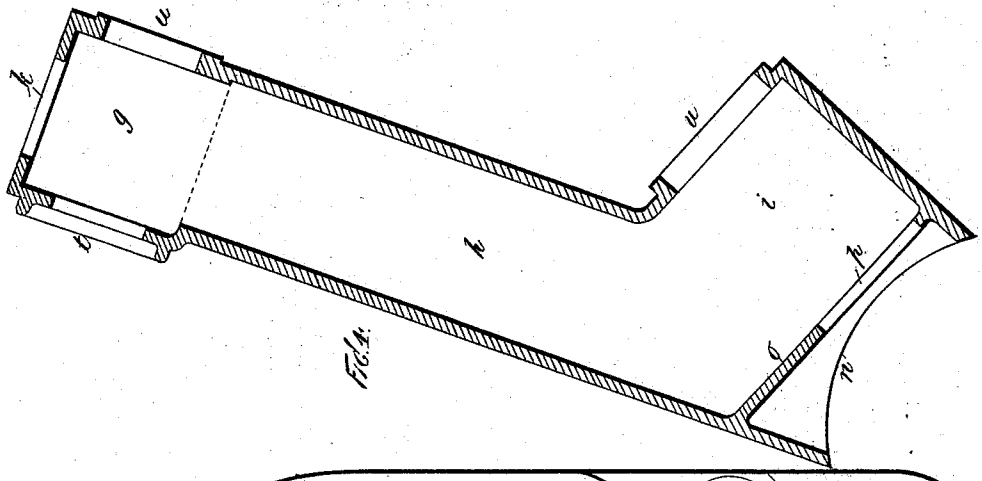

FIG. 4.

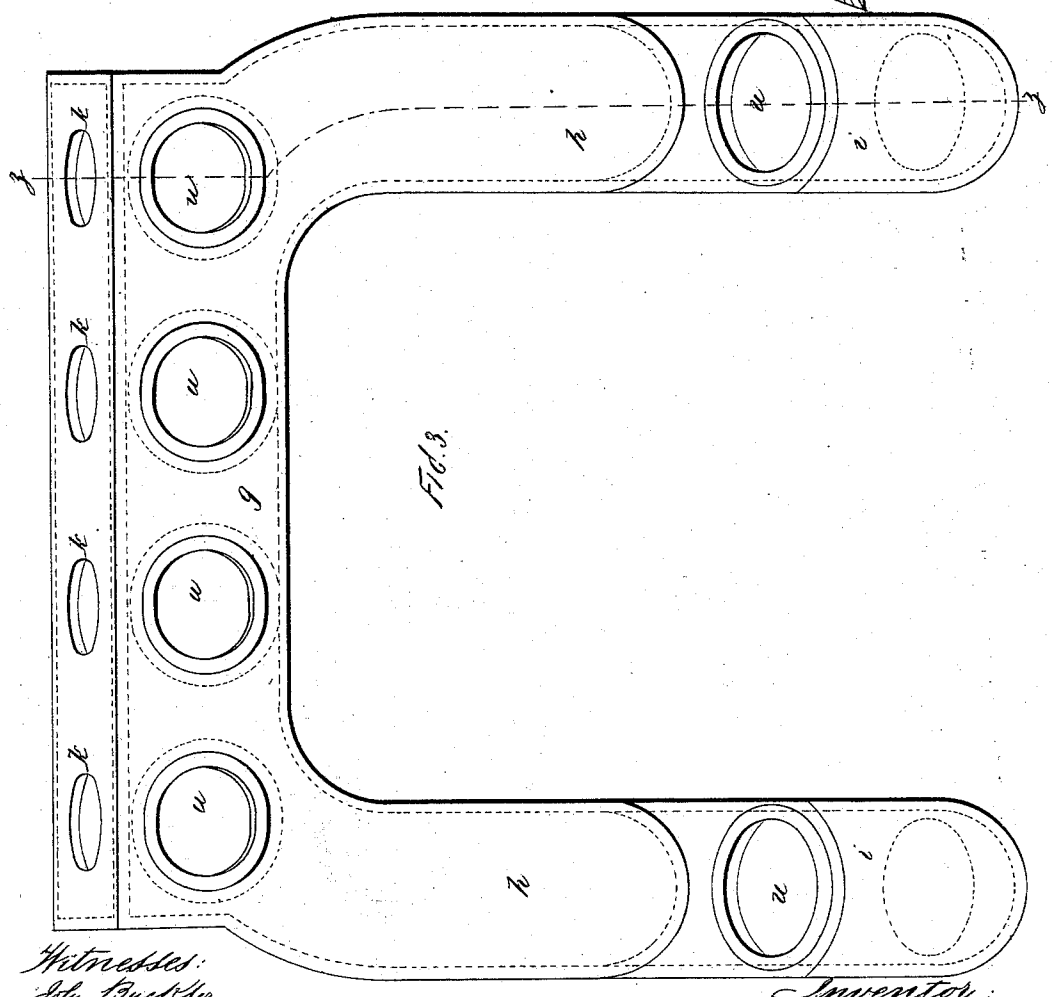

FIG. 3.

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UNITED STATES PATENT OFFICE.

AMASA WORTHINGTON, OF BROOKLYN, NEW YORK.

SECTIONAL STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 524,877, dated August 21, 1894.

Application filed June 2, 1893. Serial No. 476,403. (No model.)

To all whom it may concern:

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

My invention, while relating to sectional steam boilers generally, has reference more particularly to that class of such boilers in which a series, or plurality of series, of water tubes is or are combined with appropriate steam and water drums and co-operate therewith.

In Letters Patent of the United States No. 424,528, which were granted to me April 1, 1890, I have shown and described a sectional boiler of the class above mentioned in which a plurality of series of water tubes, alternately inclined in opposite directions and placed side by side, are connected at their lower ends with the water drums through the intermediaries of headers and downflow pipes, and at the upper ends are connected with the steam and water drum through separate headers or pipes in which they are secured, the space below the series of water tubes constituting the fire box in which the grate bars are arranged, and the firing or stoking of the boiler being accomplished at the ends thereof where the furnace doors are located. This construction of parts, and arrangement of the doors in the end of the fire box, while efficient and desirable in most instances, has been found inconvenient in practice when a certain length of boiler or number of series of water tubes has been exceeded, principally because of the fact that, as the firing or stoking is done at the end of the fire box or furnace, it is found impossible to properly supply the fuel to, and distribute it over, the grate bars, when that length of boiler, or number of series of water tubes, has been exceeded, and, in consequence thereof, it becomes necessary, when a greater amount of steam is required, to construct a number of separate boilers, the use of which, in some locations, is inconvenient and impracticable.

The object of my present invention is, therefore, to obviate this defect, and provide a construction and arrangement of parts which shall be more efficient in operation than those heretofore in use, and which shall, at the same time, permit of the length of the boiler, or the number of series of water tubes employed being increased to any reasonable limit, without in any way increasing the number of steam or water drums, the distance from the doors of the fire box to the rear of the furnace, or the distance within which the firing or stoking of the boiler will have to be effected.

To these ends, the invention consists, first, in the arrangement of the doors of the fire box upon the side of the furnace, instead of at its end, whereby the distance within which the firing or stoking of the boiler will have to be accomplished will only be that of the width of the boiler and furnace and the number of doors may be increased to any practicable number, dependent upon the length of the boiler used, or the number of series of water tubes employed, and, second, in the construction of the boiler whereby this change in the arrangement of the doors in the fire box is permitted and its efficiency increased, 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 furnace constructed in accordance with my invention, taken in the plane *x x* of Fig. 2; Fig. 2, a vertical longitudinal section of the same, taken in the plane *y y* of Fig. 1; Fig. 3, a front elevation of the water arch, and Fig. 4, a vertical transverse section of such water arch, taken in the plane *z z* of Fig. 3.

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

A A′ indicate the water tubes, which, in my preferred form of construction, are arranged in series with the individual tubes of each series disposed the one above the other, and B B′ B^2 B^3 the water tube headers in which the ends of the water tubes A A′ are respectively secured by expanding the same in suitably shaped orifices formed therein. The series of water tubes A, with its headers B B′, are inclined to the horizon in one direction, and are alternated with the series of water tubes A′, which, with its headers B^2 B^3, are similarly inclined in the opposite direc-

tion. As thus disposed, the series of water tubes lie side by side in a horizontal direction, and the length of the boiler depends upon the number of series of water tubes arranged in that relation.

Connected with the upper ends of the headers B B^3, by tubes *a*, is the steam and water drum C, which preferably extends throughout the entire length of the boiler, and is provided on its interior, over the ends of the tubes *a*, with deflectors, *b*, by means of which the currents of water passing upward through such tubes will be deflected downward; while below the series of water tubes A A′, in positions substantially under their respective lower ends, and connected with the steam and water drum C, by downflow tubes, *c*, are water drums, D D′, one of which, the drum D′, for instance, is connected with the lower end of the headers B′ by tubes, *d*.

Located under the water tubes A A′ and steam and water drum C, is the fire box or furnace E, which is provided with suitable grate bars, *e*, that, as here shown, are supported at their ends by the water drums D D′, which connected by pipes, *f*, preferably extended throughout the length of the boiler are, in turn, supported by suitable masonry piers, F, or otherwise.

The parts as thus far described, and the manner in which they are inclosed, are or may be the same as those of the corresponding parts shown and described in the Letters Patent aforesaid, to which reference may be had, and require no further description herein.

In my present invention, the doors H of the fire box or furnace E, instead of being located at the end of the boiler, whereby the fuel is supplied under the tubes in a direction transversely of them, as is the case with the construction shown in the aforementioned Letters Patent, are arranged along the side or sides thereof in such a manner as to permit of the fuel being supplied longitudinally of the tubes under their ends, whereby the distance back from the doors within which the firing or stoking is effected will be the same no matter how many series of water tubes A A′, arranged side by side, may be employed, or what the consequent length of the boiler may be—see Figs. 1 and 2. To provide for this location of the doors of the fire box or furnace upon its side, whereby the stoking is effected transversely of the boiler the tubes *d′*, by means of which the lower ends of the headers B^2 are connected with the water drum D, are dispensed with at the points where the doors are to be located, and water arches, I, of substantially the form of the doors or stoke holes, employed in lieu thereof for making this connection. These water arches are best shown in Figs. 3 and 4, and consist of the body portion *g* and the depending portions or legs *h h*, the former of which is preferably made of a rectangular form in cross section, while the latter, in my preferred form of construction, are made of a circular form, and are provided at their lower ends with the off set portions *i i*, by means of which facility in securing them to the water drum D is afforded, although, as will be understood, the exact form of these water arches, and the manner in which they are secured to the water drum D, are not essential, so long as the arches are of the proper shape to be secured to the headers B^2 and drum D, and permit of the fuel being passed in below them and above the water drum. In some instances I construct these water arches with their body portions, *g*, of such length that, when such arches are placed side by side, these body portions will extend as a practically continuous chain throughout the series, in which event the intermediate tubes *d′* will be dispensed with, and the entire row or series of headers B^2 connected with the water drum D through water arches I as shown, for instance, in Fig. 1. In other instances, I make the body portion *g* of the arches of such length, and so locate the arches, themselves, as to permit of one or more of the headers B^2, intermediate any two of the adjoining arches, being connected with the water drum D through tubes *d′*, and this is the construction and arrangement of parts shown in Fig. 2 of the drawings. Again, in some instances, I make the headers B^2 of such a length as to receive and accommodate the lower ends of all the water tubes A′ of the series, and in this case the depending portions or legs *h h* are made of such length as to permit of the arches being located entirely beneath all the water tubes, while, in still other instances, I make these headers B^2 of a length to receive the lower ends of all the water tubes A′ of the series but that of the lower one, and this is the form I have also shown in the drawings, and is the one I prefer in practice, as the water tubes A′ of the series are thereby brought down farther into the fire box or furnace and in closer relation to the fire. But in whichever of the ways mentioned these arches may be constructed, they are provided in the upper side of their body portions *g* with a series of orifices *k*, which register with corresponding shaped orifices, *l*, formed in the lower ends of the headers B^2, and the water arches and the headers B^2 co-operating therewith, are secured together by a short sleeve or thimble *m*, which is expanded in each pair of these orifices *k l*, as shown. The lower ends of the depending portions or legs *h h* of the water arches I are curved out, or otherwise formed to fit the surface of the water drum D, as shown at *n*, and the under wall *o* of the off set portions *i* is likewise provided with an orifice *p*, which registers with a correspondingly shaped orifice formed in the water drum D, whereby to afford means for securing the lower ends of these depending portions or legs *h h*, to the drum D by a short sleeve or thimble, *s*, which is expanded in each co-operating pair of orifices *o p*, in the same manner as in the sleeve or thimble *m* in the orifices *k l*. By these means provision

is made for the free and uninterrupted circulation of the water through the water tubes and drums, without in any way interfering with the stoking of the fire box of furnace through the side thereof.

In addition to the orifices *k o*, the water arches I, when made of a form to receive the lower ends of the lowest water tubes of the series A′, as shown in Fig. 1, are likewise provided with a series of orifices *t*, which are formed through the sides of the body portions *g*, and receive the lower ends of such of the water tubes A′ as are expanded therein.

To provide for easy access to the water tubes and to the uniting sleeves or thimbles, the headers and portions of the water arches in line therewith, respectively, are provided with suitable orifices, *u*. These orifices are made of the proper size and shape to suit them for the purposes for which they are intended, and are closed, when the boiler is in use, by appropriately shaped covers *v* which are held thereon by bolts *w*, extending therethrough and through clamps *r*, with their outer ends engaging with nuts, *r′*, that are screwed thereon, as shown.

The water drums D D′, being so located as to receive all the sediment that may be deposited in the boiler, will of course be supplied with the usual blow off cocks, whereby to blow off the same when required to remove such sediment; and the entire boiler may be inclosed in masonry or otherwise, as is usual with boilers as ordinarily constructed.

From the above, it will be seen that I provide means whereby steam boilers may be extended to any reasonable length without in any way increasing the distance within which the firing or stoking must be accomplished, which distance, in practice, will be seldom greater than that of the width of the boiler itself. It will be likewise seen therefrom that, as the series of water tubes are arranged transversely of the boiler and its setting, with one of their ends over the fire doors or stoke holes, over which such tubes will have to be removed when required, no further or different space is demanded for such removal than what is actually necessary for the fireman or stoker to fire or stoke the boiler, and that, in consequence thereof, the additional space required for such removal at the side with the boilers heretofore in use having their fire doors or stoke holes at their end or ends, amounting in some cases to four feet or more, is obviated, and the space required for the occupancy of the boiler and its setting reduced to the minimum.

Although in the foregoing, I have described certain of the embodiments of my invention which, on the whole, I consider the preferred forms to be employed in practice, I wish it distinctly understood that I do not limit myself strictly thereto, as it is obvious that the same may be modified in various ways, without departing from the spirit of my invention.

Having now described my invention and shown certain ways in which the same is or may be carried into practice, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a sectional steam boiler, the combination, with a plurality of series of oppositely inclined water tubes, a steam and water drum, and a water drum both of which drums are extended longitudinally of such boilers, of a water arch interposed between and connecting one of such series of water tubes with the water drum, whereby to form a door or stoke hole, with the water arch extended above and the water drum below the same, and a fire box or furnace below such water tubes, substantially as described.

2. In a sectional steam boiler, the combination, with a plurality of series of inclined water tubes, a steam and water drum, and a plurality of water drums extended longitudinally of the boiler, of a water arch for connecting one of the series of water tubes with one of the water drums, whereby to form a door or stoke hole with the water arch extended above and the water drum extended below the same, means for connecting the other series of water tubes with the other water drum, and for connecting both series of water tubes with the steam and water drum, and a fire box or furnace located below the water tubes, substantially as described.

3. In a sectional steam boiler, the combination, with a plurality of series of oppositely inclined water tubes, a steam and water drum, a plurality of water drums extended longitudinally of the boiler, and tubes for independently connecting the steam and water drum with the water drums and for connecting such water drums, of a water arch for connecting one of the series of water tubes to one of the water drums, whereby to form a door or stoke hole with the water arch extended above and the water drum extended below the same, tubes and headers for connecting the other series of water tubes with the other series of water drums and for connecting both series of water tubes with the steam and water drum, and a fire box or furnace located below the water tubes, substantially as described.

In testimony whereof I have hereunto set my hand this 22d day of May, 1893.

AMASA WORTHINGTON.

Witnesses:
SYLVANUS L. TRIPPE,
WM. E. TREFCER.