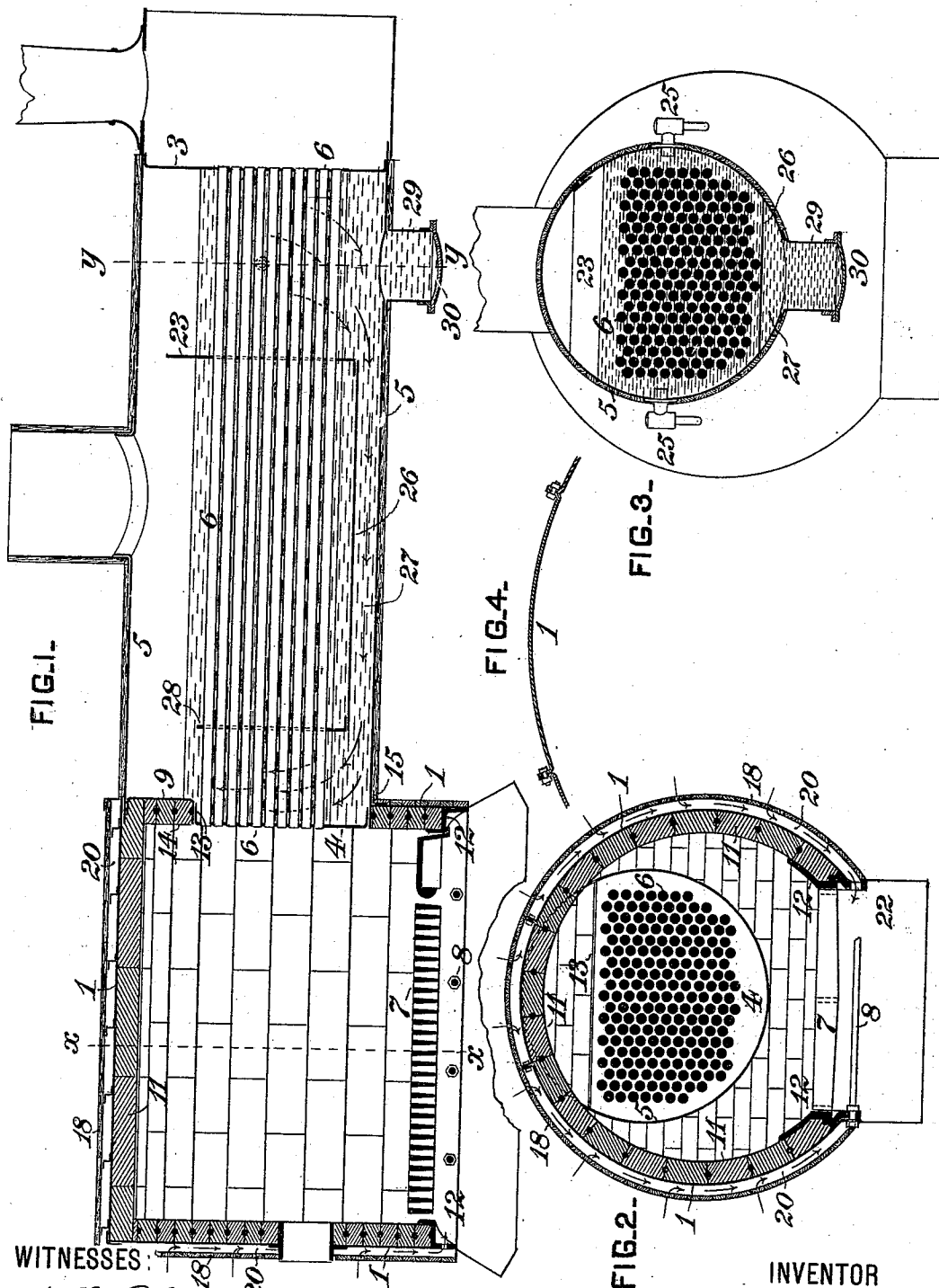


(No Model.)

M. N. FORNEY.
STEAM BOILER.

No. 510,636.

Patented Dec. 12, 1893.



WITNESSES:

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MATTHIAS N. FORNEY, OF NEW YORK, N. Y.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 510,636, dated December 12, 1893.

Application filed June 23, 1893. Serial No. 478,646. (No model.)

To all whom it may concern:

Be it known that I, MATTHIAS N. FORNEY, of the city, county, and State of New York, have invented a certain new and useful Improvement in Steam-Boilers, of which improvement the following is a specification.

My present invention more particularly relates to boilers for locomotive engines, but is not, however, limited in application to that class of engines, and may, without variation of principle, be employed in connection with other engines and for other uses. It is particularly adapted to the general class or type of locomotive exemplified in Letters Patent of the United States No. 485,344, granted and issued to me under date of November 1, 1892.

The object of the invention is to provide a boiler having a fire-box lined with fire-brick or other refractory material, and of simple and cheap construction, in lieu of the form of fire-box ordinarily heretofore employed in locomotive boilers, in which the fire is inclosed by water legs or walls, formed by double plates having an interposed water space. Fire-boxes of such type are expensive both as to construction and to maintenance, are difficult to stay properly, and are liable to frequent failure when in use, involving much expense, and not infrequently, danger and accidents from explosions.

My invention, generally stated, consists of a cylindrical shaped fire-box, the inside peripheral surface of which may be lined with voussoir shaped bricks, of uniform shape and size, and which will have great stability, owing to the self sustaining form of the arched lining.

My invention further consists in means for circulating air on the outside of the fire-box, to conduct away the heat which would otherwise be radiated from its surface.

The improvement claimed is hereinafter fully set forth.

Fire-boxes or furnaces for steam boilers have heretofore been constructed with refractory linings, instead of water spaces around the fire, and, in fact, a fire-box of masonry, consisting, in whole or in part, of fire-bricks, is the most common form of furnace for ordinary stationary boilers. These furnaces are, however, usually made of a rectangular form,

combined often with an arched crown. This has also been the case with the few fire-brick lined fire-boxes which have thus far been used in locomotive and portable engines, and as a result, owing to the shocks and jars to which engines of this class are subjected in service, the lining of the fire-boxes is difficult to keep in its place. In order to obviate this objection, the outside shell or metal casing of the fire-box is, under my invention, of cylindrical or approximately to a cylindrical form, excepting that portion on its under side which is left open to receive the grate. This shell or casing is connected to any ordinary form of boiler, and projects rearwardly therefrom, in the manner of the ordinary locomotive fire-box. The boiler and fire-box are, in order to bring the tubes, grates, &c., into more convenient relation to each other, connected together eccentrically as hereinafter more fully described.

In the accompanying drawings: Figure 1 is a longitudinal section through the center line of a steam boiler, illustrating an application of my invention; Fig. 2, a transverse section through the fire-box, on the line *x, x*, looking toward the right; Fig. 3, a similar section through the waist of the boiler on the line *y, y*, looking toward the left; and Fig. 4, a transverse section, on an enlarged scale, through the top plate of the fire-box, showing its connections.

The main body or waist of the boiler may be of the ordinary cylindrical form of construction, provided with a series of fire tubes, secured in heads at each end in the usual manner. This form of fire-box may also be used in connection with water tube boilers of various forms.

The drawings represent a fire-box of the form which I prefer, applied to an ordinary cylindrical fire tubular boiler, but my invention is not limited to such specific form of fire-box, or to its application to such specific type of boiler. In the drawings the fire-box shell, 1, is shown of cylindrical shape in Fig. 2, with the lower or bottom portion cut away or left open to receive the grate 7. The parts of this cylindrical shell, on each side of the opening for the grate, are connected together by transverse rods or bars 8, the one in Fig. 2 being

shown broken away, in order to enable other parts to be represented more clearly. The boiler and fire-box are connected together eccentrically, that is to say, the center line of the boiler is, as shown in Fig. 2, located above that of the fire-box, so that their tops are flush. This construction provides considerable room for fire between the lower row of tubes and the top of the grate. The peripheral part of the fire-box is lined with voussoir shaped fire-bricks 11, which are, preferably, of uniform shape, and are built into arched form, so as to be held securely in their respective positions. It will be apparent that such a lining might be used if the form of the external shell were not of a true cylindrical form. Its cross-section might, for example, be oval, elliptical or polygonal in form, and it could then be lined with voussoir shaped bricks, which would be reciprocally held in their places; therefore my invention is not confined to fire-boxes whose form is exactly cylindrical, but is intended to cover all forms whose inside peripheral surface may be lined by a continuous arch, the members of which are reciprocally held in their respective positions.

In the claims I have designated such general forms as "cylindraceous" the dictionary meaning of which is "cylindrical or approaching a cylindrical form."

A seat or frame 12, which is preferably of cast iron, is riveted to the lower portion of the fire-box, said seat serving to support the fire-brick, and also to stiffen the plate-iron shell 1. An inwardly projecting flange 13, is turned on the upper part of the back tube sheet 4, and a narrow top section 9, flanged in the reverse direction, is riveted to the flange 13. A ledge or support is thus provided on top of the tube sheet, immediately over the tubes, on which the upper front lining bricks 14 rest, in order to protect the upper section 9 of the tube sheet, which is exposed to steam, from the heat in the fire-box. The front part of the fire-box shell is attached to the boiler by angle-iron, 15, which is placed a short distance in advance of the back end of the boiler, and provides a space wide enough to allow the lower front lining fire-bricks to come flush with the back tube-sheet. Both ends of the fire-box are lined with bricks of the ordinary form.

From Fig. 2 it will be seen that, in building up the inside lining of the fire-box, there will be difficulty in completing the arch, or in inserting the key stones on top when the remainder is in position. For this reason the central portion of the fire-box casing, 1, is made in a separate piece from the sides, and is attached thereto by flanges turned on the plates, and connecting bolts, as shown in Figs. 2 and 4. In lining the inside of the fire-box, the central section may be taken off and the arch completed through the opening left by its removal. After the arch is finished the

central section is again bolted to the side sections.

One of the objections which has been developed in fire-boxes of the general type to which my invention relates, is the fact that so much heat is radiated from their outside surfaces that they cause more or less discomfort to the attendants. To prevent this objectionable result, a casing or lagging 18, is connected to the outside of the fire-box shell or casing, an air space 20, being provided between the fire-box shell and the lagging. Openings are formed in the lagging to admit air into the space 20, which communicates, through openings 22, with the space below the grate, as shown in Figs. 1 and 2. The draft in the fire-box thus draws the heated air from the space between the lagging and the shell of the fire-box, creating an inward current into the openings in the lagging. The air is thus drawn into the space below and up through the grates, not only serving to keep the outside of the fire-box cool, but also to supply the fire with warm air.

In order to provide an air space between the shell and the lagging, iron bars of a Z shape, bent to conform to the shape of the outside of the shell, are interposed between the same and the lagging. The lower flanges of these bars serve to attach them to the shell, and the lagging can be fastened to the upper flanges.

While a form of boiler as herein described is not applicable, without modification, to ordinary locomotives, it is well adapted to the class of locomotives described in Letters Patent No. 485,344 before referred to. Ordinarily, there would not be room enough for the large fire-box described herein, which would interfere with the wheels, unless the boiler was placed higher than would be desirable. This form of boiler is however, well suited to the form and methods of construction described in the Letters Patent referred to.

The diaphragms 23 and 28, and circulating plate 26, shown in the drawings, are not claimed as of my present invention, as the same constitute the subject matter of a divisional application filed by me November 9, 1893, Serial No. 490,409.

I am aware that various forms of fire-boxes lined with fire-brick were known in the art prior to the invention, and I do not, therefore, broadly claim such feature.

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

1. The combination of a tubular boiler, and a cylindraceous fire-box, lined with refractory or fire resisting material, which is built in continuous arched form in said fire-box, substantially as set forth.

2. The combination of a tubular boiler, and a cylindraceous fire-box, lined with refractory material built in continuous arched form and connected eccentrically to the boiler, substantially as set forth.

3. The combination of a tubular boiler, a
cylindrical fire-box casing, composed of
side sections connected to the boiler, and a
removable top section interposed between the
5 side sections, and a lining of refractory or
fire resisting material, of arched form inside
of said casing, substantially as set forth.

4. The combination, in a steam boiler, of a
10 tube-plate having an offset or supporting
ledge above the tubes, and a facing of refrac-
tory material resting on said offset, and ad-
joining the portion of the tube sheet above
the same, substantially as set forth.

5. The combination in a steam boiler, of a
fire-box lined with refractory material, a lag- 15
ging or non-conducting covering inclosing
said fire-box, an air space interposed between
the fire-box and lagging, openings in the lag-
ging for the admission of air into said air
space, and openings from said air space for 20
the escape of air therefrom, substantially as
set forth.

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Witnesses:

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