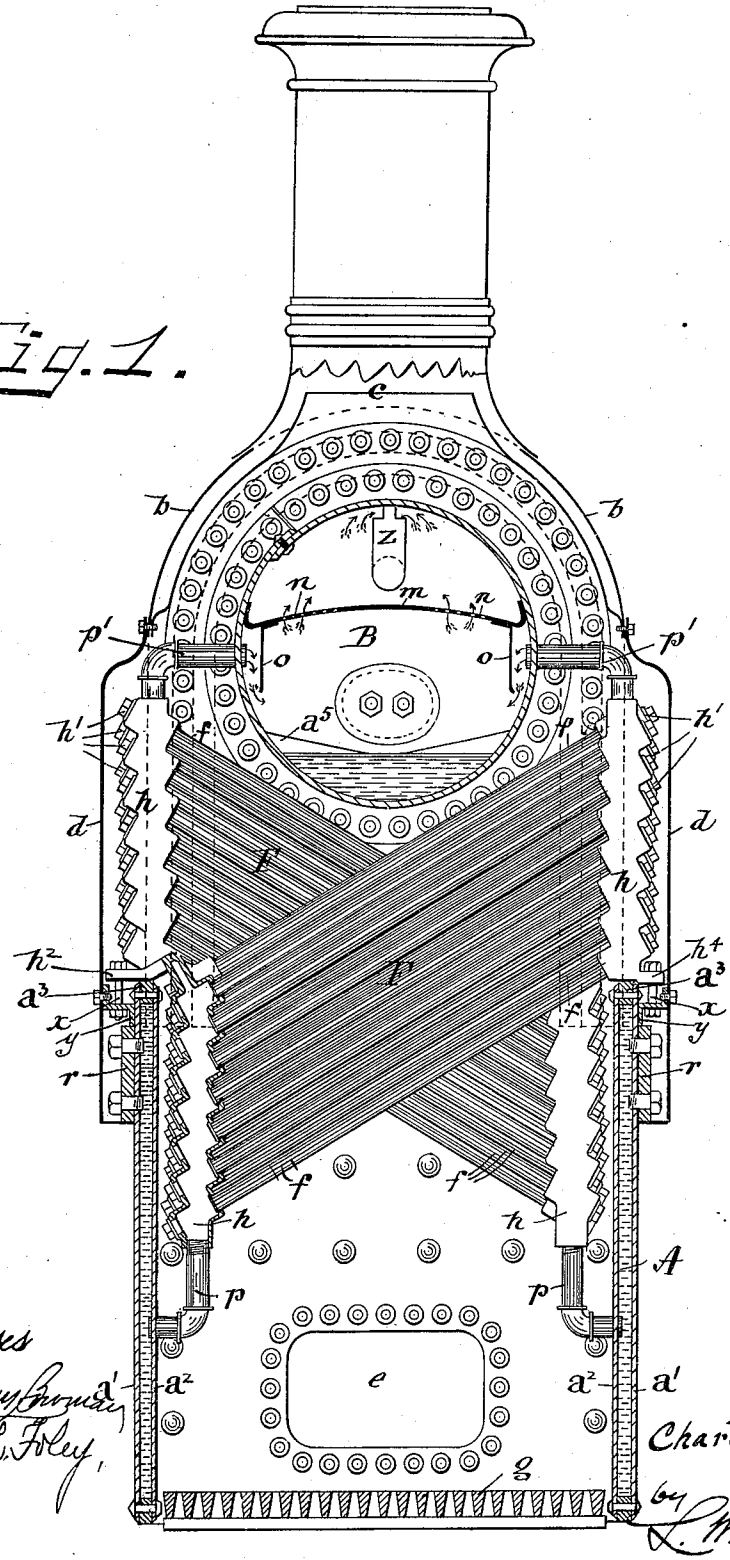
(No Model.) 3 Sheets—Sheet 1.

C. H. FOX.

STEAM BOILER.

No. 568,438. Patented Sept. 29, 1896.

Fig. 1.



Witnesses
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Charles H. Fox
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by L. M. Rose, atty

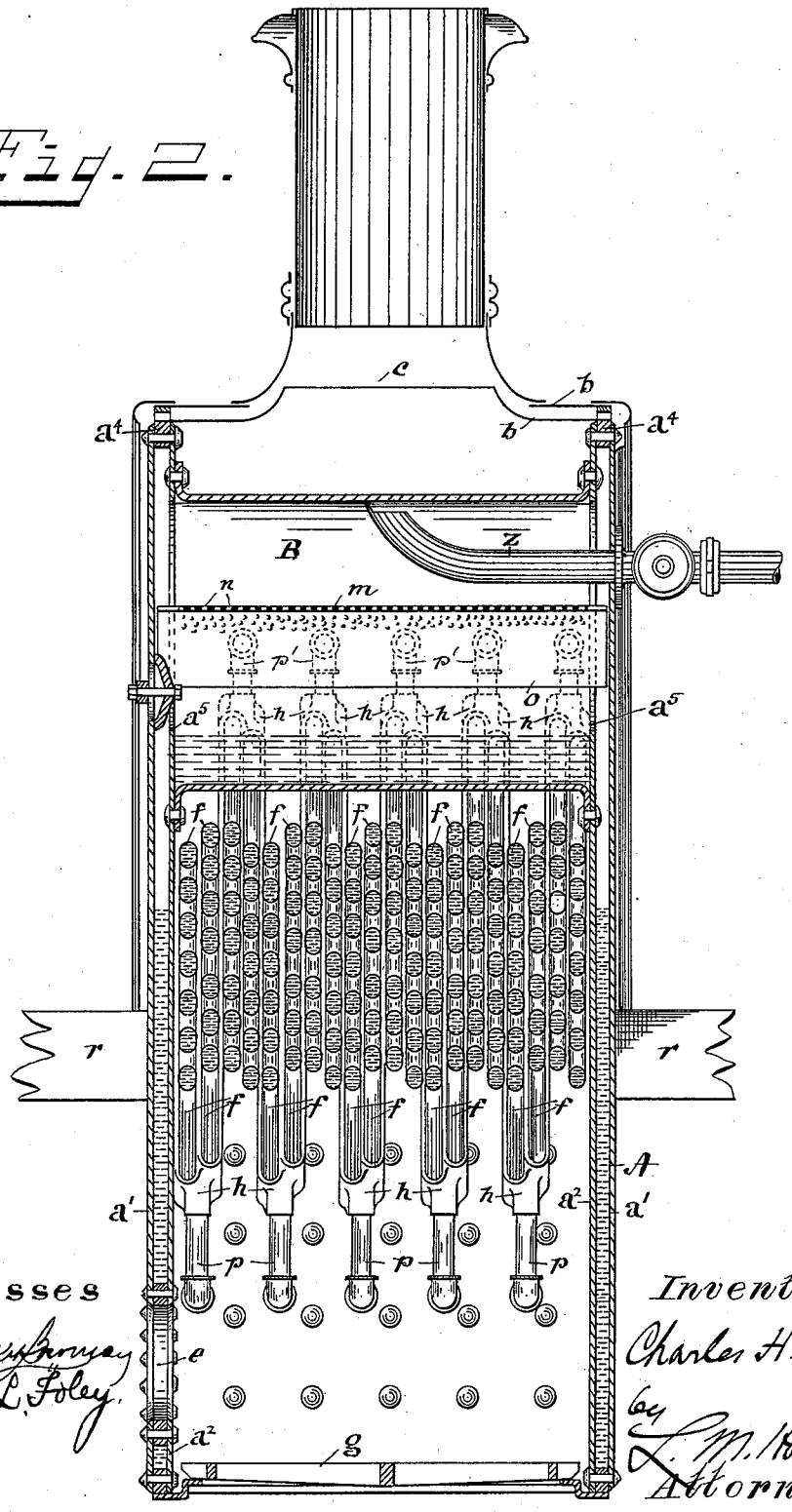
(No Model.) 3 Sheets—Sheet 2.

C. H. FOX.

STEAM BOILER.

No. 568,438. Patented Sept. 29, 1896.

Fig. 2.



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(No Model.)

3 Sheets—Sheet 3.

C. H. FOX.

STEAM BOILER.

No. 568,438. Patented Sept. 29, 1896.

Fig. 3.

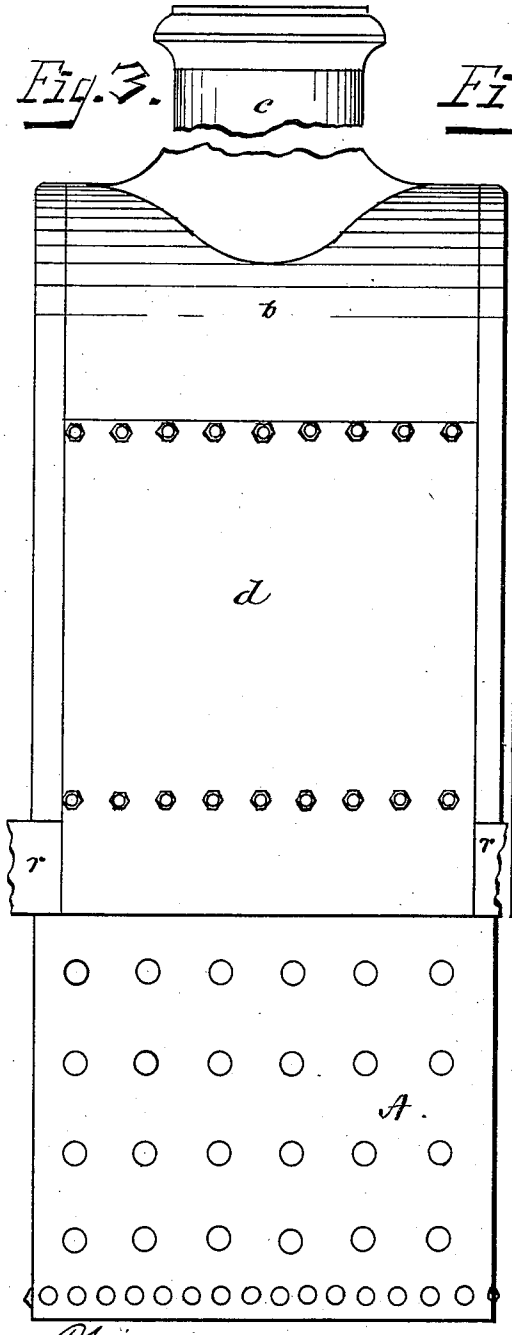
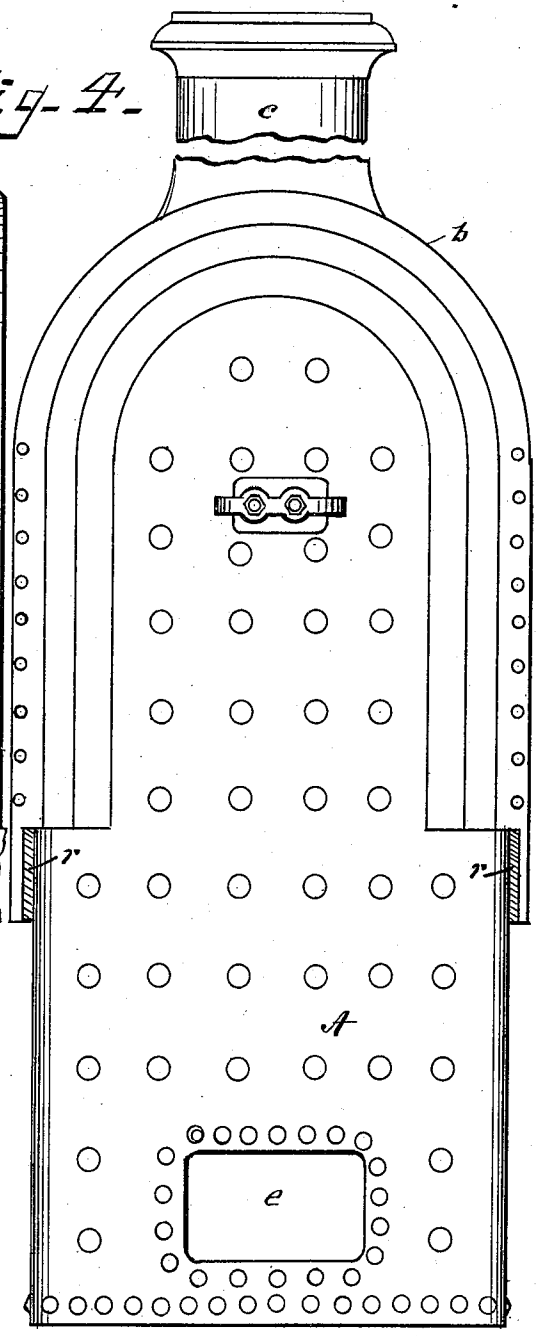


Fig. 4.



Witnesses,
James Whittemore
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Charles H. Fox,
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UNITED STATES PATENT OFFICE.

CHARLES H. FOX, OF CINCINNATI, OHIO.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 568,438, dated September 29, 1896.

Application filed May 4, 1896. Serial No. 590,069. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. FOX, a citizen of the United States, residing at Cincinnati, Ohio, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention relates to steam-generators of the class known as "sectional water-tube boilers," its object being to produce a compact generator of high steaming capacity and of simple, durable, and economical construction, adapted to portable-engine service, &c., as well as for stationary engines.

To this end my invention consists in the generator constructed as hereinafter set forth, producing a self-contained boiler, requiring no brick or other extraneous setting, and possessing all the advantages incident to the sectional water-tube type and the water-leg type combined.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical cross-section of the boiler through the fire-box shell, showing the tube-sections in elevation, one of the manifolds being cross-sectioned to show construction. Fig. 2 is a vertical cross-section in the fore-and-aft plane of Fig. 1. Figs. 3 and 4 are front and side views showing the exterior elevation.

Referring now to the drawings, A designates the fire-box of the boiler, which is a rectangular water-leg formed by outer and inner sheets a' a^2, respectively, with water-space between. The water-leg is continued to half-height at the sides, as indicated, forming a ledge a^3, Fig. 1; but to full-height, as at a^4, concentric with a connecting-drum at the rear and front, Fig. 2. A cylindrical drum B connects the inner sheets a^2 front to rear at the top of the boiler, the sheets being perforated correspondingly with the inner circumference of the drum, so as to connect the interior drum-space with the water-leg. The space between the front and rear elevated portions of the water-leg, above and at the sides of the drum, is covered by a cylindrical dome-sheet b, out of which rises the chimney c, and the side openings down to the water-leg are covered by removable plates d.

The usual fire-door opening e and grate g are provided.

The inner open space of the fire-box beneath the drum B above the grate is occupied by a series of adjacent removable tube-sections F, each consisting of a number of parallel straight tubes f, set at their ends in vertical "manifolds" h at an inclination to the general axis of the manifolds. Each section has preferably two sets of tubes in adjacent vertical series, the connections of one being offset or "staggered" in relation to those of the other, in different horizontal planes. The manifolds h are constructed with "stepped" surfaces at right angles to the longitudinal axes of the tubes f at the engaging sides and are correspondingly formed at the opposite sides and perforated for the insertion of screw-plugs h' in the prolonged axes of the tubes f to afford access for convenience of cleansing or removal of the tubes.

Each tube-section is supported at opposite ends by its manifolds, the upper manifold resting directly upon the ledge a^3, formed by the half-high water-leg, and the lower upon the corresponding ledge a^3, at the opposite side of the fire-box, by means of a projection h^2 from the upper end of the manifold, and each manifold is further secured against displacement by bolts x, engaging the feet h^2 at the top of the lower manifolds, and corresponding lugs h^4 at the bottom of the opposite upper manifolds, with brackets y on the water-leg A, as shown in Fig. 1. Any number of tube-sections may thus be arranged side by side, alternating in relatively opposite inclinations, the lower manifolds being thus maintained vertically wholly within the fire-box space, while the upper manifolds rest in the vertical upward prolongation of the water-leg plane. Each upper manifold has a pipe connection p' at the top, into the adjacent side of the drum B, and each lower manifold connects at the bottom by a pipe p, into the adjacent side of the water-leg A.

The inner sheet a^2 is preferably allowed to extend somewhat above the bottom of the drum B at each end to form a dam a^5, with a shallow V-shaped margin, Fig. 1, to insure retention of water in the drum when working

the boiler with a scant water supply, or as a protection against accident, and I may also, in connection with this feature, introduce the feed-water into the drum, but these are not material to my invention.

I also introduce in the drum, at or just above its horizontal diameter, a flat or slightly-curved plate *m*, with lines of perforations *n* near each side, Fig. 1, to assist in screening the entrained water from the steam and insuring delivery of dry steam to the steam-delivery pipe Z. To the under side of this plate, near each side, I attach a suspended plate or apron *o*, which serves to divert the water entering from the manifold connections *p'* downward around the sides of the drum B, and thus prevent unnecessary mechanical agitation while steaming.

In the drawings I have shown the boiler as supported at opposite sides upon braces *r*, (of a vehicle;) but it may rest upon the bottom, if preferred, or be supported in any other manner.

The mode of operation and use are as follows: The tube-sections, standing at an inclination in the direct path of the heated products of combustion, cause an upward movement of the water from the lower part of the water-leg through the manifolds and tubes into the drum, which necessitates a contrary movement outward from the drum into the elevations of the water-leg, and thence downward into the intakes of the lower manifolds. The dams a^5, as will readily be seen, insure a constant supply of water in the drum to the predetermined level, and the general construction insures a quick circulation of water to every part.

The facility for renewal and repair offered by this construction will be obvious. By removing the side plates *d* the entire system of tube-sections is exposed. A tube-section can then be readily detached and removed without disturbing any other connection, and, the apertures of the boiler being plugged, the boiler can be used until proper repairs are effected and the tube-section replaced. Tubes can be cleaned interiorly without removing the tube-sections from position. It will also be observed that at all exposed portions of the boiler—that is, at the outer sides of the water-leg and its extensions—the circulation is downward, consistently with the natural effect of external cooling by radiation, while at all central parts exposed to the heat the circulation is upward; also, that the internal horizontal area of the fire-box space enlarges above the water-leg sides out to the plates *d*, which enlargement is favorable to the expansion of the gases of combustion and assists the proper action of the fuel.

The boiler is particularly adapted for marine service by reason of its compactness in horizontal dimensions, large heating-surface, vigorous circulation, and facility afforded for repairs. Its size may be increased to any extent by providing an increased number of the tube-sections and lengthening the drum and fire-box without necessarily increasing the width, so that a boiler of great capacity can occupy a narrow space horizontally, which in marine service is a desideratum.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In a steam-boiler, the combination of a water-jacketed fire-box, a steam-drum above and connected directly with the same, and a series of inclined tube-sections connected at their lower ends at opposite sides within the fire-box to the water-leg, and at their upper, at correspondingly opposite sides, to the drum, substantially as set forth.

2. In a steam-boiler, a water-jacketed fire-box, having vertical extensions of the water-leg at opposite ends, a drum connecting and opening through the inner sheets of said extensions, and a series of inclined tube-sections connected at their lower ends to the water-leg at opposite inner sides of the fire-box, and at their upper ends to the drum at relatively opposite sides, substantially as set forth.

3. In a steam-boiler, a rectangular water-jacketed fire-box, having vertical water-leg extensions, a drum connecting and opening through the inner sheets thereof, and forming a continuation of the inclosed water-space, and a series of adjacent, inclined, independent and removable tube-sections resting at opposite sides upon the water-jacketed fire-box, and having pipe connections from the lower end of each tube-section into the water-jacket of the fire-box, and at the upper end into the sides of the drum, substantially as set forth.

4. In a boiler of the character indicated, the combination of the water-leg vertically extended at opposite ends; a drum connecting said vertical extensions, and dam-plates at opposite ends of said drum, as set forth.

5. In a boiler, of the character indicated, the combination of a water-jacketed fire-box, an upper, connecting-drum, and a series of independent, detachable tube-sections supported upon the boiler, independently of their tube connections therewith, substantially as and for the purpose, set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES H. FOX.

Witnesses:
L. M. HOSEA,
FRANK K. BOWMAN.