(No Model.) 5 Sheets—Sheet 1.

A. CATCHPOLE.

STEAM AND HOT WATER BOILER.

No. 588,952. Patented Aug. 31, 1897.

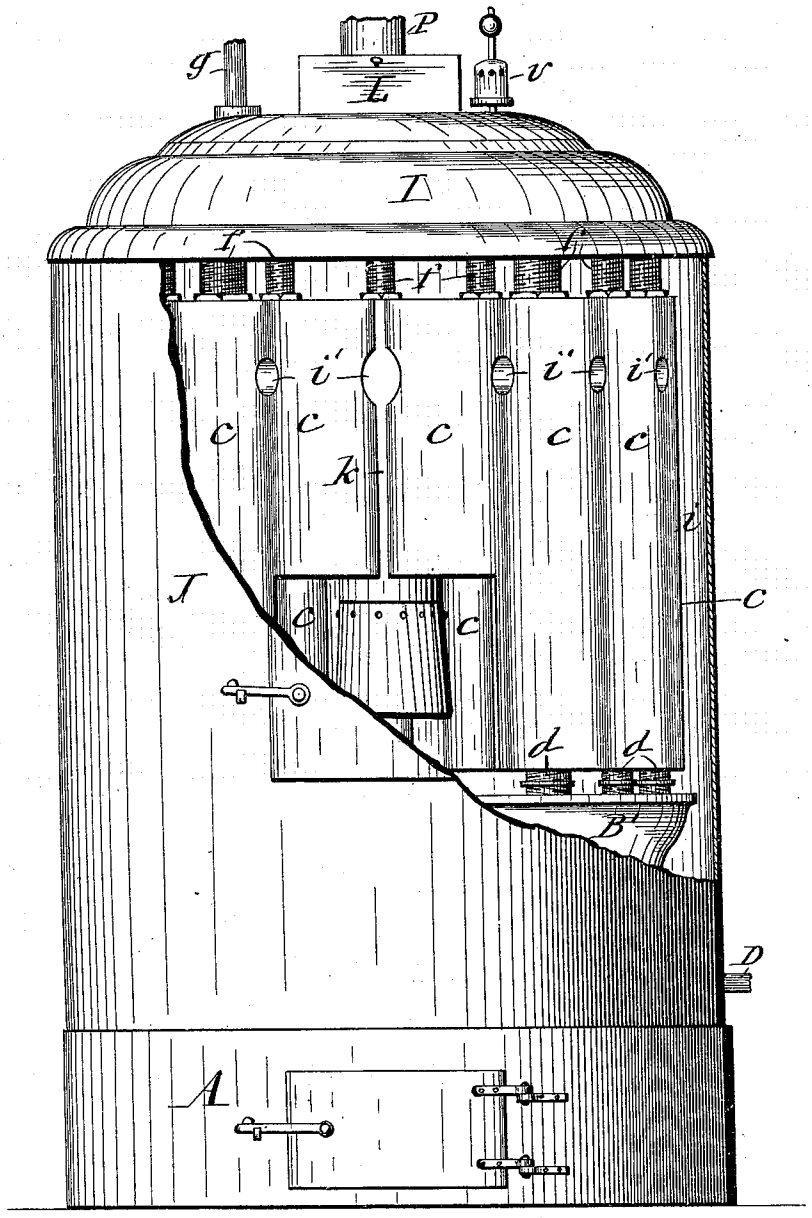


Fig. 1

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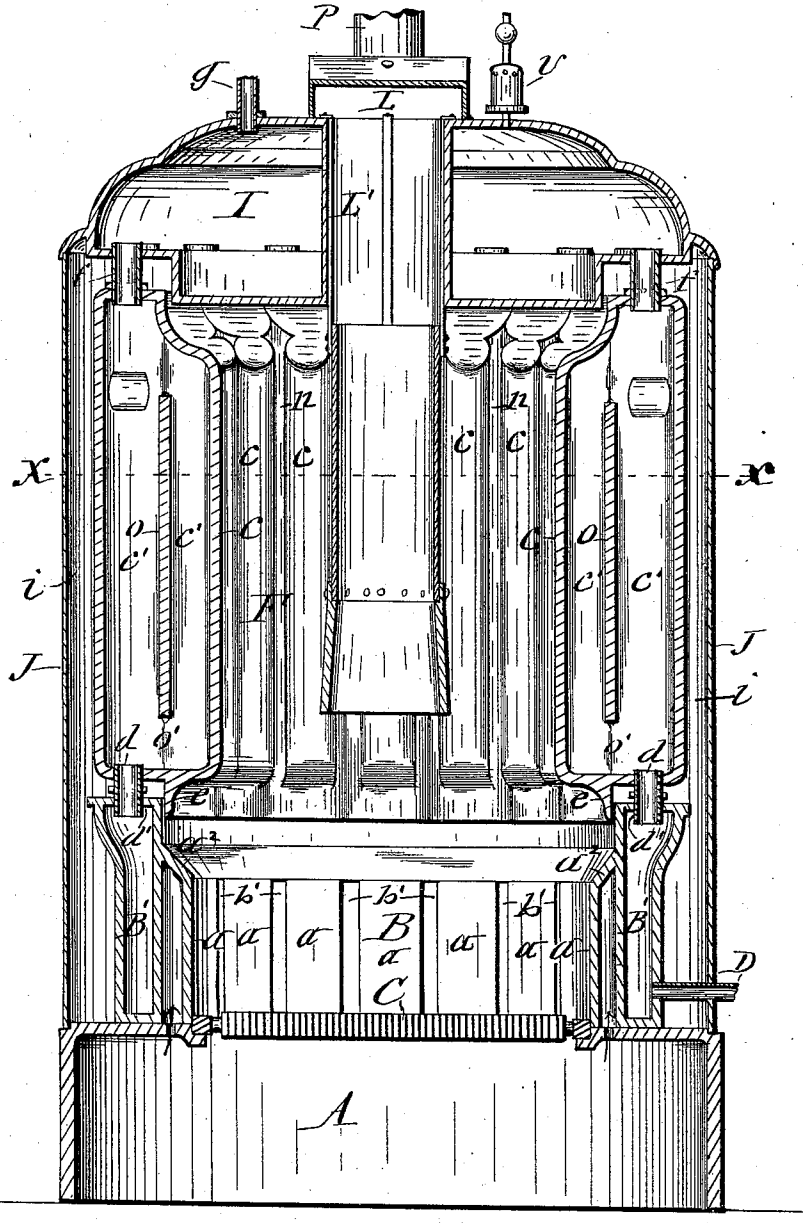


Fig. 2.

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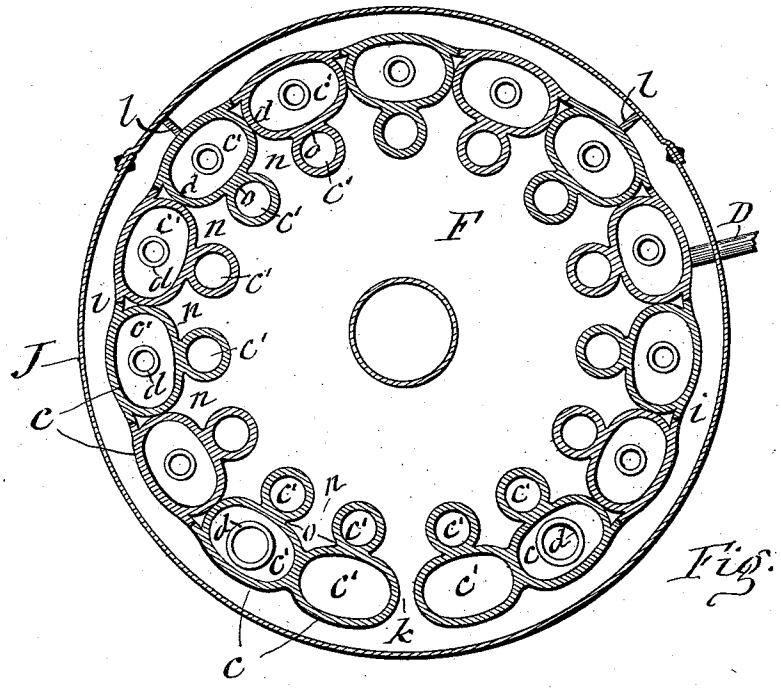


Fig. 3

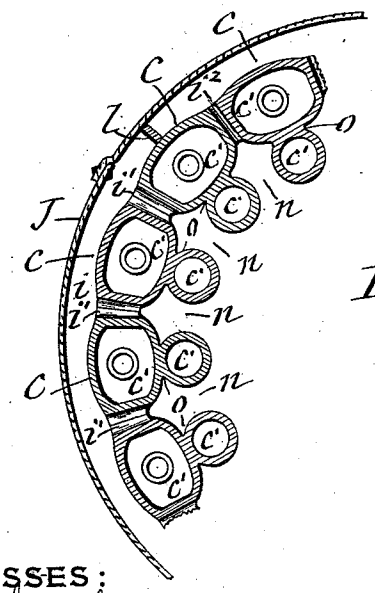


Fig. 5

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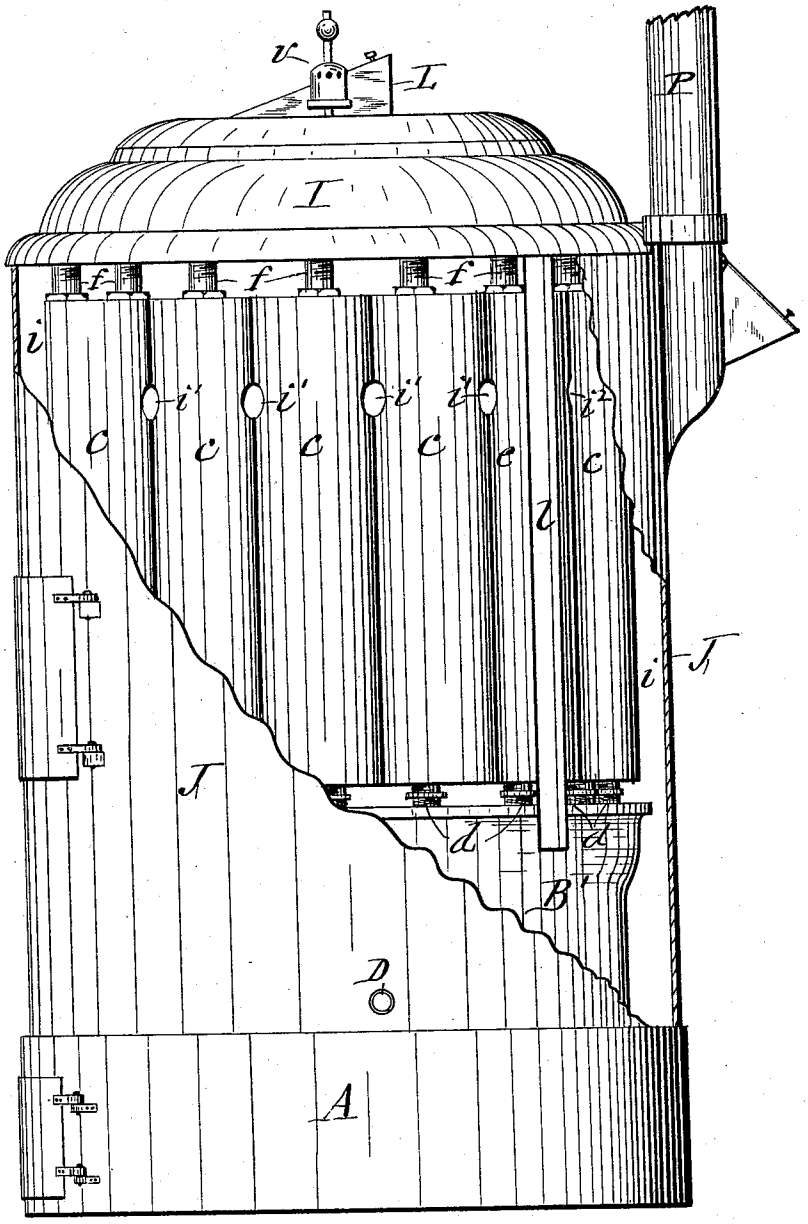


Fig. 4.

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(No Model.) 5 Sheets—Sheet 5.

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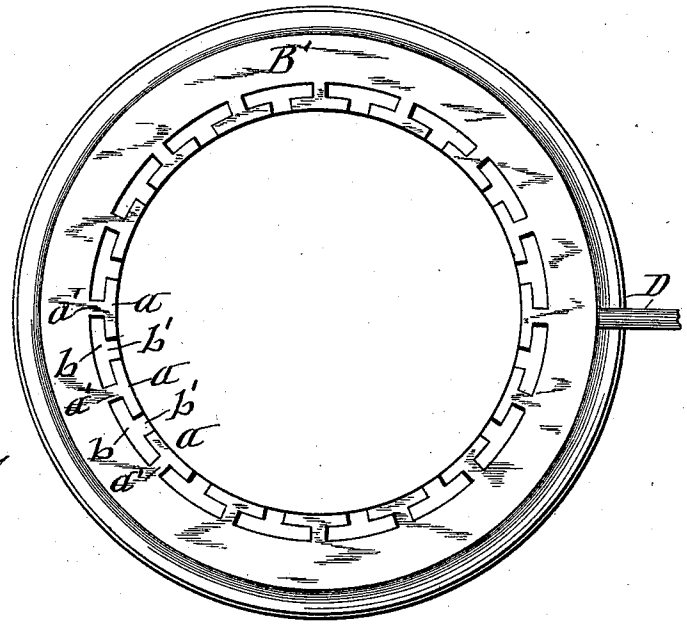


Fig. 7

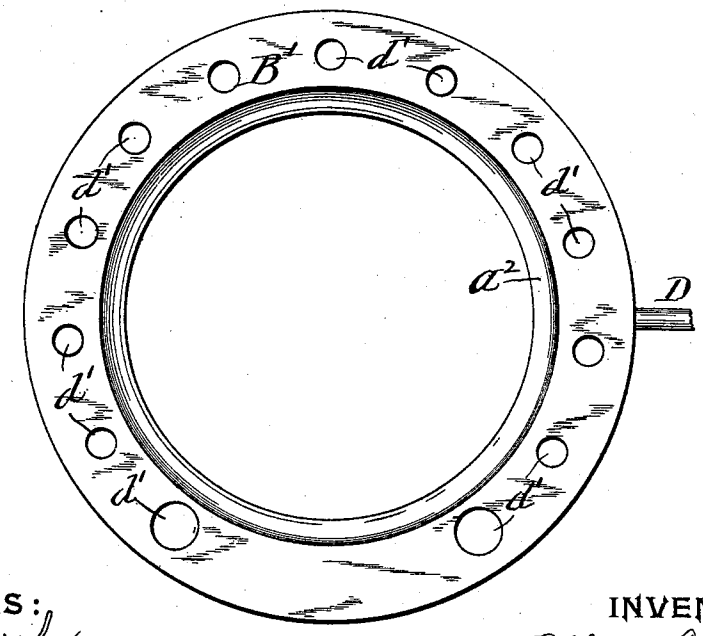


Fig. 6

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UNITED STATES PATENT OFFICE.

ALFRED CATCHPOLE, OF GENEVA, NEW YORK.

STEAM AND HOT-WATER BOILER.

SPECIFICATION forming part of Letters Patent No. 588,952, dated August 31, 1897.

Application filed November 25, 1896. Serial No. 613,465. (No model.)

To all whom it may concern:

Be it known that I, ALFRED CATCHPOLE, of Geneva, in the county of Ontario and State of New York, have invented new and useful Improvements in Steam and Hot-Water Boilers, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to the class of steam and hot-water boilers which are provided with a water-leg surrounding the fire-pot and with a steam or water crown communicating with the said water-leg by means of vertical water-flues; and the invention in one respect has special reference to the species of boilers in which the water-leg of the fire-pot is connected with the water or steam crown by means of vertical water-circulating loops; and in this respect the invention consists in an improved construction of said loops, forming a more compact and simpler water-wall surrounding the combustion-chamber with separate and distinct and direct vertical fire-flues in said wall, and at the same time forming in the central portion of the combustion-chamber a cylindrical space for the accommodation of a fuel-magazine; and the invention also consists in a novel construction of a series of shields on the inner side of the fire-pot, which shields form air-heating passages which are perfectly protected from obstructions incident to entrance of fuel into said passages, and at the same time cause heated air-currents to be admitted into the fire around the wall of the fire-pot; and the invention also consists in certain novel features of the details of the boiler hereinafter described, and set forth in the claims.

In the accompanying drawings, Figure 1 is a front elevation of a boiler embodying my invention. A portion of the outer jacket is broken away to illustrate the construction of that part of the boiler which is provided with the feed-door. Fig. 2 is a vertical transverse section of the same. Fig. 3 is a horizontal transverse section on line X X in Fig. 2. Fig. 4 is a side elevation, a portion of the jacket being broken away to show the fire-passages and gas-ports, respectively, at the front and rear of the baffle-plate. Fig. 5 is a transverse section of the water circulating and heating loops adjacent to the baffle-plate and showing the construction of said loops at the aforesaid fire-passages and gas-ports. Fig. 6 is a top plan view of the water-leg of the fire-pot, and Fig. 7 is an inverted plan view of the same.

Similar letters of reference indicate corresponding parts.

A represents the ash-pit; B, the fire-pot, which is mounted on the ash-pit and is provided with a suitable grate C. Said fire-pot is formed with the water-leg B′, which receives the return or feed water by a suitable pipe D, connected to the base thereof. In order to prevent the fuel from coming in direct contact with the said water-leg and becoming chilled thereby, I apply to the side of the water-leg facing the fire-pot a series of shields *a a*, extending around the inner side of the water-leg and preferably cast thereon or integral therewith, so as to protect said shields from excessive heat by the cooling influence of the water in the water-leg and at the same time conduct heat to the water-leg. These shields differ materially in construction from analogous devices heretofore applied to the walls of fire-pots in regard to construction and effects. Said shields consist of vertical plates *a a*, extending from the grate upward and elongated in the direction of the circumference of the water-leg B′ and united with said water-leg by vertical ribs *a′*, which project from the backs of the plates *a a* and preferably formed integral with said plates and water-leg. The successive plates form between them comparatively narrow vertical slots *b′ b′*, which prevent the fuel from passing through them and choking the laterally-elongated air-passages *b b*, formed back of said plates by the lateral projection of the latter from the ribs, as clearly shown in Fig. 7 of the drawings. These passages *b b* are open at the bottom to admit air thereat. The top of said passages are closed by a horizontal flange a^2, which projects from the water-leg and serves to divert the air-currents from the passages *b b* through the slots *b′ b′* into the fire in the fire-pot. Said air-currents become thoroughly heated in their ascent in the laterally-elongated passages *b b*, which are kept free from obstruction by the shields *a a*. Said passage of the air between the water-leg and shields aids in the protection of the shields from the destructive effects of the fire in the

fire-pot and at the same time absorbs heat and enters in a heated condition into the fire-pot and thus promotes combustion of the fuel, especially around the edge of the grate, where in ordinary fire-pots the fire is usually chilled to a greater or less degree.

By practical tests of my improved boiler and its fire-pot I have found that perfect combustion of the fuel is obtained adjacent to the wall of the fire-pot and no clinkers are formed on the center of the grate.

Upon the water-leg are mounted the series of water circulating and heating loops *c c*, which form the inclosing wall of the combustion-chamber F over the fire-pot. To render these loops detachable for repairs or renewal when required, I connect them to the water-leg by means of right and left screw-threaded nipples *d d*, screwed into correspondingly screw-threaded holes *d' d'* in the top of the water-leg and in the lower ends of the loops. Said nipples are protected from the fire in the fire-pot by means of flanges *e e*, depending from the loops and lapping onto the inner side of the water-leg, as shown in Fig. 2 of the drawings.

I denotes the dome or crown, consisting of an annular chamber which is mounted on the upper ends of the aforesaid loops and connected thereto by tubular thimbles *f f*, through which the steam or hot water passes from the loops to the crown, which latter has attached to it the pipe *g* for conducting the steam or hot water to the radiators located in the apartments of the building to be heated. A pipe D, attached to the base of the water-leg B', returns the cool water from the radiators to said water-leg.

The water-leg and combustion-chamber are inclosed in a jacket J, extending from the ash-pit to the crown I and forming a passage *i* for the products of combustion around the exterior of the fire-pot and loops, as shown in Figs. 1, 2, and 4 of the drawings.

In opposite sides of the rear portion of said passage are baffle-plates *l l*, extending from the top of the passage part way toward the bottom thereof, and the loops *c c* in front of said baffle-plates are formed with transverse or radial openings or passages *i'* in the adjacent sides of their upper end portions. The products of combustion rising from the fire-pot pass through the openings *i' i'* into the passage *i*, wherein they are deflected toward the bottom thereof by the baffle-plates *l l* and thence rise in the rear portion of the passage *i* to the smoke-pipe P. In said tortuous passage of the products of combustion the water circulating through the loops *c c* absorb the heat and become effectually heated thereby.

The loops which are located back of the baffle-plates are provided in their adjacent sides with small ports i^2 for the escape of gases from the combustion-chamber to the smoke-pipe while introducing coal through the magazine-door L, which is mounted on the crown I directly over the vertical fuel-passage L', formed in the said dome. To form the opening or fire-door N in the wall of the combustion-chamber F, I shorten the two front loops *c c*, so as to extend them from the top of the combustion-chamber only part way toward the water-leg B' and join each to the next long loop. The said two short loops are disposed with a space *k* between them to allow the products of combustion to pass around the exterior of the front portion of the combustion-chamber.

In order to obtain a more perfect circulation of the water and at the same time heat the same more rapidly with a minimum consumption of fuel, I form each of the loops *c* with a plurality of internal vertical water-circulating flues *c' c'*, communicating with each other at opposite ends of the loop, so as to allow the water to rise in one and return in the other, and thus produce a sinuous or tortuous travel of the water. The flues in the loop are disposed one back of the other, so as to expose one directly to the impingement of the products of combustion rising from the fire-pot, and by the greater heat applied to said flue the water is expanded more rapidly therein and caused to rise toward the crown I, while the cooler outer flue *c'* allows the water to descend and enter again into the hotter inner flue *c'*. Said flues being perpendicular obviates the accumulation of sediment therein.

I prefer to form the loop of two flues *c' c'*, disposed one back of the other as aforesaid, and in order to expose them more effectually to the products of combustion I elongate the outer flue laterally, so as to cause it to abut with its sides against those of the adjacent loops and form a section of the inclosing wall of the combustion-chamber F. The inner flue *c'* of the loop I form smaller and preferably cylindrical to form at opposite sides thereof vertical fire-flues *n n*, as shown in Fig. 3 of the drawings. A partition *o* between the flues *c' c'* extends part way the length thereof, and leaves at opposite ends of said partition passages *o' o'* for the circulation of the water, as aforesaid.

The described boiler is provided with a suitable safety-valve *v*, which is attached to a pipe secured to and communicating with the crown I.

What I claim as my invention is—

1. In combination with the fire-pot formed with a water-leg and a steam or hot-water crown over the combustion-chamber, a series of vertical water circulating and heating loops, each of which consists of two tubes disposed one contiguously throughout its length on the inner side of the other and separated by a vertical diaphragm, forming a portion of the wall of each of said tubes, said diaphragm extending part way the lengths of the tubes and forming transverse water-passages at opposite ends of the diaphragm, as set forth and shown.

2. In combination with the fire-pot formed with a water-leg, and a steam or hot-water

crown over the combustion-chamber, a series of vertical water circulating and heating loops, each of which consists of a laterally-elongated outer tube constituting a section of the inclosing wall of the combustion-chamber, and a smaller tube attached throughout its length to the inner face of said outer tube and communicating with the same at opposite ends thereof, said inner tube forming with the adjacent inner tubes vertical fire-flues extending the entire lengths of said inner tubes and separated by vertical partitions formed by the junctions of the inner tubes with the outer tubes, substantially as set forth and shown.

3. In combination with the fire-pot formed with a surrounding water-leg, a series of water circulating and heating loops rising from said water-leg and forming the inclosing wall of the combustion-chamber over the fire-pot, nipples interposed between said loops and water-leg and detachably uniting said parts, and flanges depending from the loops and lapping onto the inner side of the water-leg to protect the aforesaid nipples from the fire in the fire-pot, as set forth.

4. In combination with the fire-pot and a jacket inclosing the boiler, a combustion-chamber rising from the fire-pot and provided in the upper portion of its front and sides with radial fire-passages and in its rear portion with lateral vents for escape of gases from the combustion-chamber to the spaces between the same and inclosing jacket, vertical baffle-plates in said space extending from the top thereof part way toward the bottom and the smoke-pipe attached to the back of the jacket, as set forth.

5. In combination with the fire-pot formed with a surrounding water-leg, a series of water circulating and heating loops rising from said water-leg and forming the inclosing wall of the combustion-chamber over the fire-pot and formed with radial fire-passages in the upper parts of the adjacent sides of the side and front loops, a steam or hot-water crown over said combustion-chamber and connected to the upper ends of the loops, a jacket forming a smoke-passage around the exterior of the series of loops, baffle-plates extending from the top part way toward the bottom of the rear portion of said smoke-passage, and the smoke-pipe attached to the top of the rear portion of said jacket, as set forth.

6. In combination with the fire-pot formed with a surrounding water-leg, a series of vertical water circulating and heating loops mounted on and communicating with said water-leg and forming the inclosing wall of the combustion-chamber over the fire-pot, a steam or hot-water crown over said combustion-chamber and connected to the loops, two of said loops extending from the top of the combustion-chamber part way toward the aforesaid water-leg to form the fire-door, said short loops being disposed with a fire-passage between them and joined to the adjacent long loops, a jacket forming a smoke-passage around the exterior of the series of loops, baffle-plates extending from the top of the rear portion of said smoke-passage part way toward the bottom thereof, and the smoke-pipe attached to the back of the jacket, as set forth.

7. The improved water-legged fire-pot provided on its inner wall with shields consisting of vertical plates extending from the grate upward and elongated in the direction of the circumference of the water-leg and united with the water-leg by vertical ribs on the backs of the plates, the successive plates forming between them vertical slots communicating with laterally-elongated fire-passages formed back of the plates, substantially as set forth.

In testimony whereof I have hereunto signed my name this 27th day of October, 1896.

ALFRED CATCHPOLE. [L. S.]

Witnesses:

J. J. LAASS,

M. A. LEYDEN.