(No Model.)

J. CHRISTIANSEN.

BOILER.

No. 435,353. Patented Aug. 26, 1890.

Fig 1.

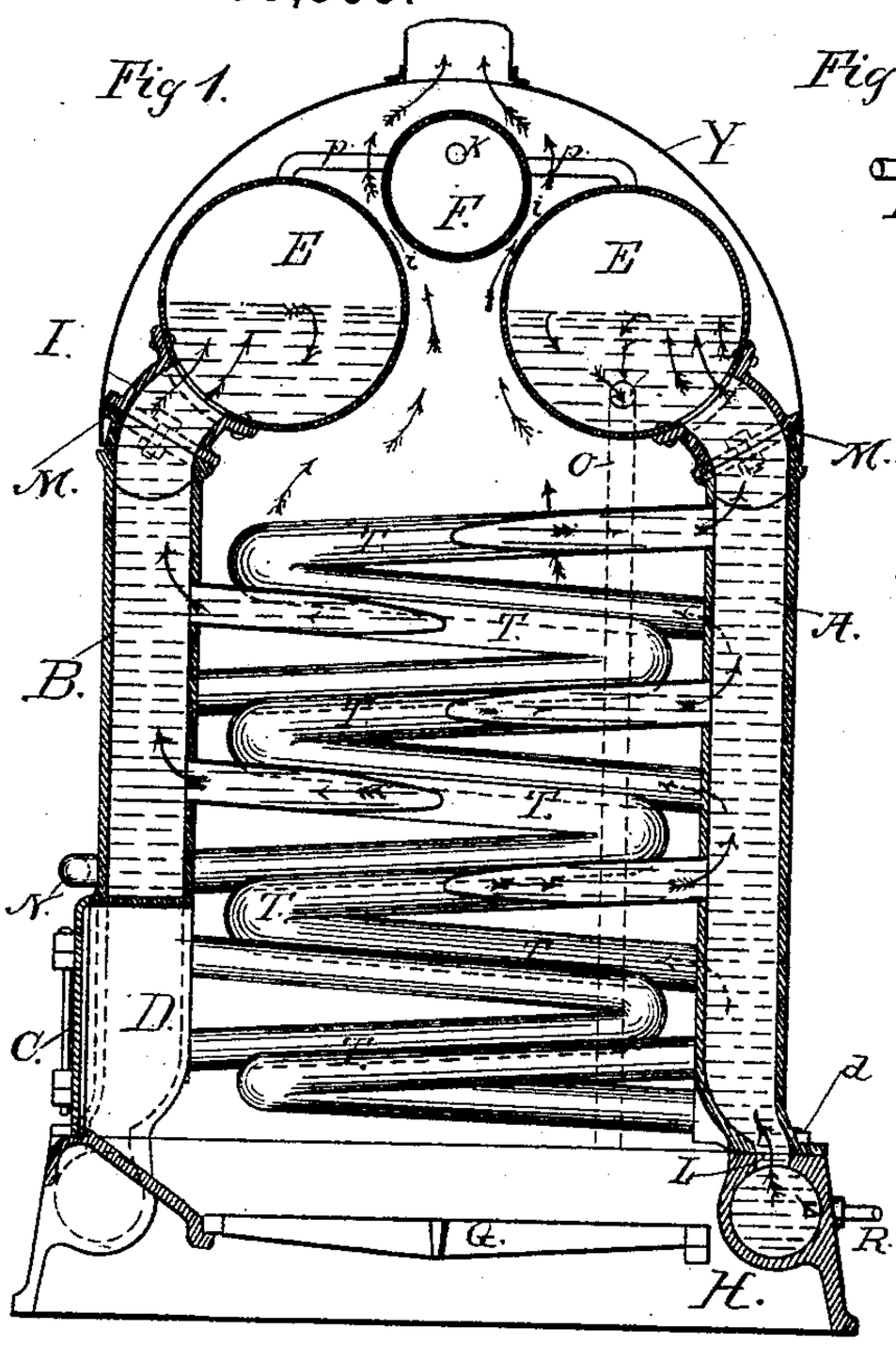


Fig 2.

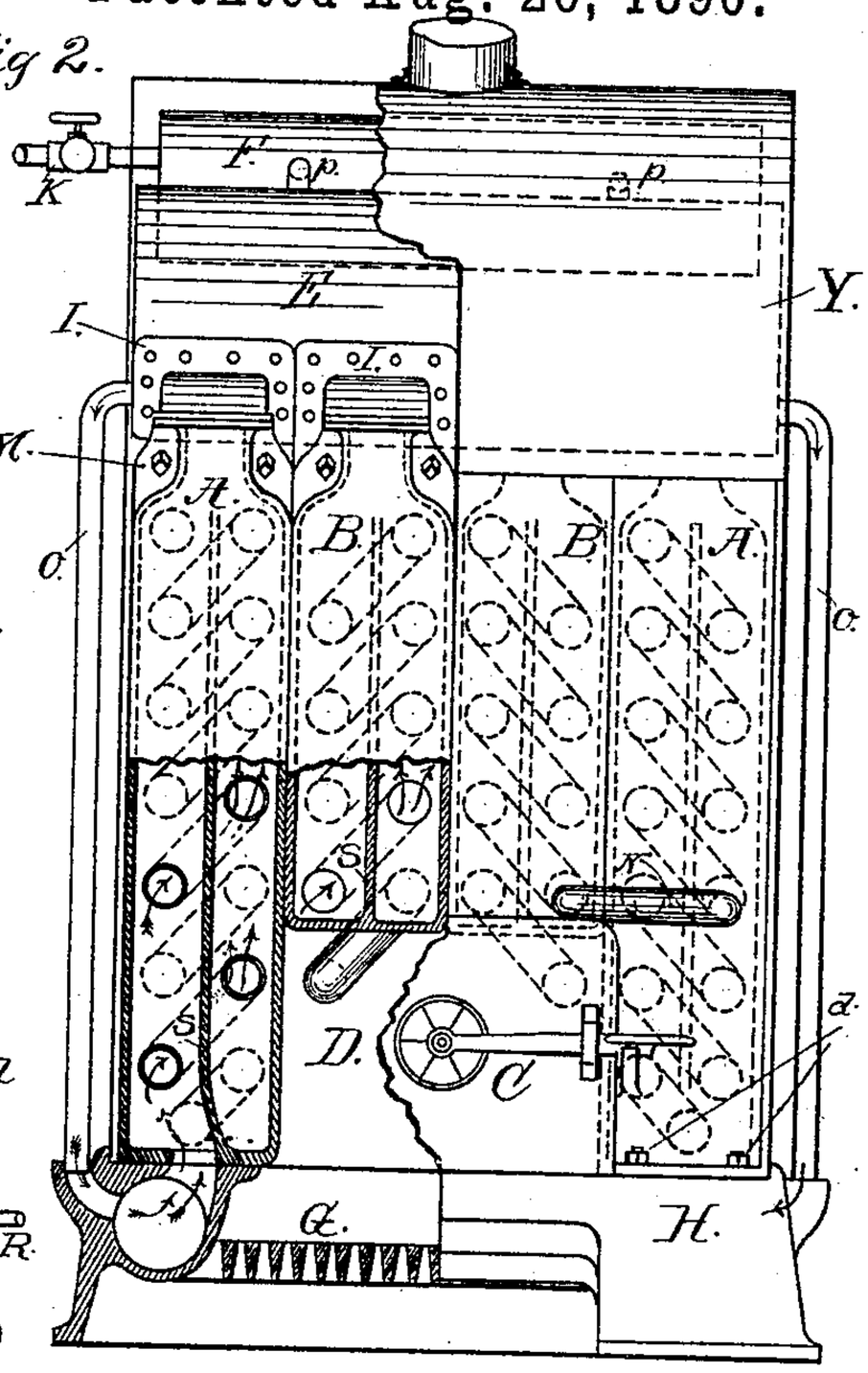


Fig 3.

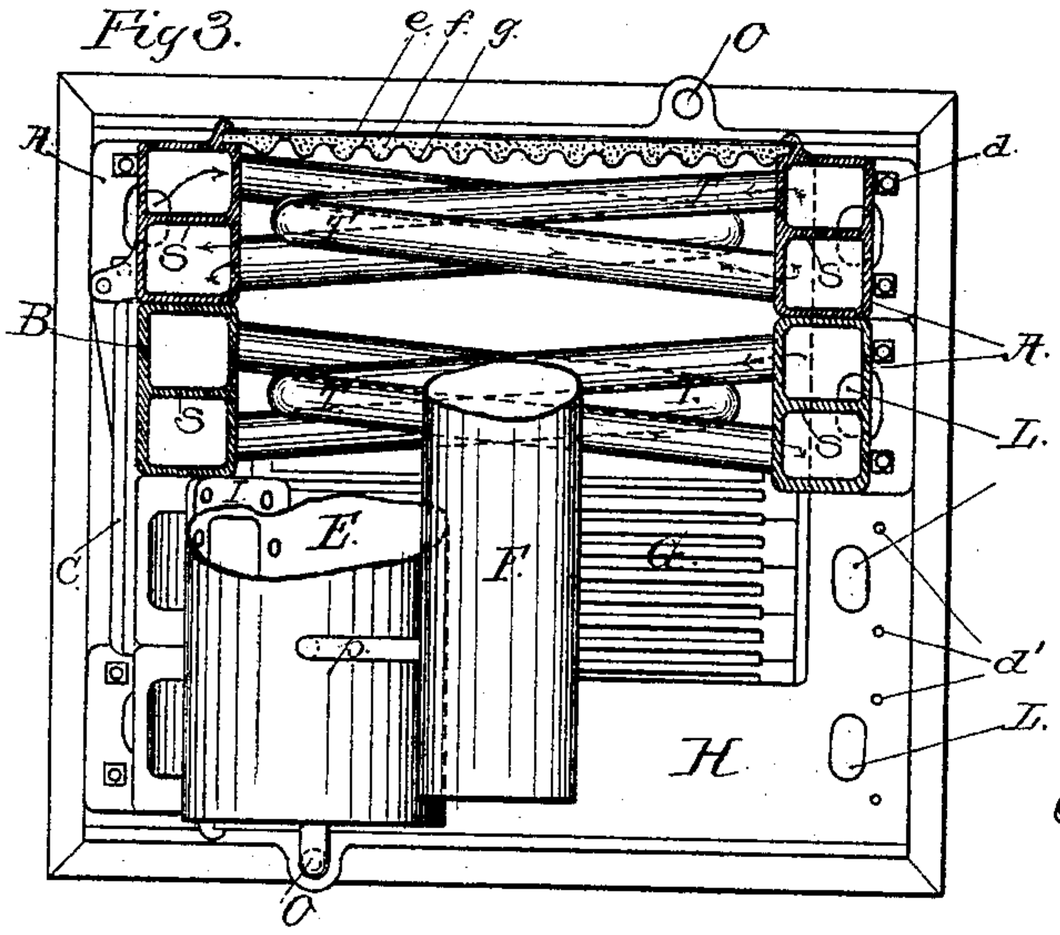


Fig 4.

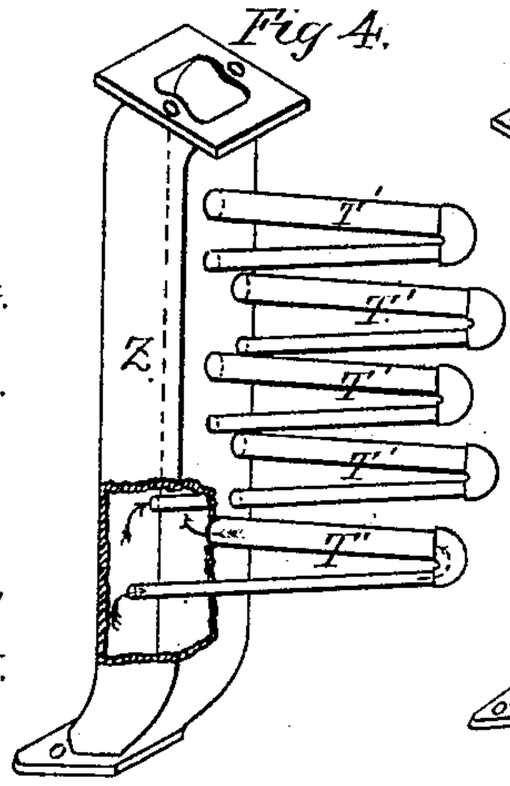
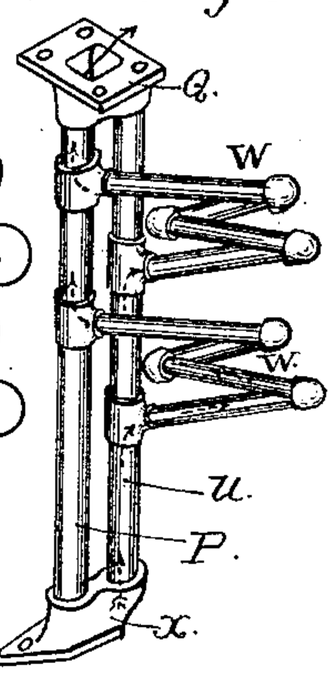


Fig 5.



Witnesses.
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Henry E Rich

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UNITED STATES PATENT OFFICE.

JOHN CHRISTIANSEN, OF QUINCY, ASSIGNOR OF ONE-HALF TO ARTHUR BURNHAM, OF BOSTON, MASSACHUSETTS.

BOILER.

SPECIFICATION forming part of Letters Patent No. 435,353, dated August 26, 1890.

Application filed November 13, 1889. Serial No. 330,239. (No model.)

To all whom it may concern:

Be it known that I, JOHN CHRISTIANSEN, a citizen of the United States, residing at Quincy, in the county of Norfolk and Commonwealth of Massachusetts, have invented a new and useful Steam-Boiler, of which the following is a specification.

My invention relates to an improvement in portable sectional water-tube boilers; and my improvement consists in constructing such boilers of a series of water-legs standing upon a hollow base and connecting with overhead domes, each of said water-legs being divided into two compartments, one of which connects directly with the hollow base and both of them communicating with the overhead dome, and said compartments are further indirectly communicating with each other by means of a number of V-shaped tubes, the two open ends of which are inserted into the face of the water-leg, the bent tube projecting into the fire-box of the boiler.

The objects of my invention are, first, to construct a portable sectional water-tube boiler which shall be safe against destructive explosions; second, to construct a portable sectional water-tube boiler in which a much higher pressure can be carried than is now the common practice without diminishing the factor of safety against rupture and without increasing the cost and the weight of the boiler as compared with other boilers of equal capacity; third, to construct a portable sectional water-tube boiler which shall have a perfect circulation and in which the heat from the furnace shall be effectively absorbed by the water-tubes and other water-covered surfaces, and which therefore shall be efficient and economical in operation; fourth, to construct a portable sectional water-tube boiler which shall be easy of access for inspection and repairs. I attain these objects by the arrangement as illustrated in the accompanying drawings, in which—

Figure 1 represents a vertical section of the boiler; Fig. 2, a front elevation with part of the sheet-iron casing covering the top removed, as also part of the furnace-door, and two of the water-legs are shown partly in section. Fig. 3 is a top view with casing removed and the water-legs shown in section. Fig. 4 is a perspective view of a cast-iron water-leg with V-shaped tubes, and Fig. 5 a perspective view of a water-leg constructed of wrought-iron pipes with steel-casting fittings at top and bottom.

H is a hollow base made of cast-iron, cast-steel, or other suitable material. It contains the grate G, the space below the same forming the ash-pit, which is accessible through an opening in the side of the base directly below the furnace-door. Openings L L L are provided in the top of the base into the hollow space with bolt-holes *d' d'* on each side of them, which holes and openings correspond with openings and holes in the bottom flange of the water-legs A A A, which are secured to the hollow base by bolts *d d*. (Shown in all three views.) There are eight water-legs, as shown in this case—four on one side and four opposite on the other side. There may be more or less, according to the size of the boiler. Of these eight water-legs only six reach the hollow base, the two center ones B B being left shorter than the rest in order to form an opening D for the furnace-door C. They are connected to the domes E E overhead the same as all the other water-legs in the following manner: The two domes E E have fittings I riveted on permanently. These fittings have flanges M, corresponding to similar flanges on top of the water-legs, said flanges inclining upward and outward, so that when the bolts in same are removed, as well as the bolts in the flange at the base, each water-leg can be easily and independently removed or withdrawn and as easily again replaced, which would not be the case were the top and bottom flanges parallel. Each of the water-legs has an inside vertical partition S, reaching from the bottom of same to near the top, dividing the water-leg into two vertical compartments, both of which communicate at the top with the steam-dome, but only one of which communicates at the bottom with the hollow base H. The two compartments thus formed adjacent to each other in each leg are further indirectly connected with each other by the insertion into each of them of the two open ends of a number of V-shaped tubes

TTT, the tubes being placed in vertical rows, but each of them in an oblique direction, in such a manner that the lower member enters the compartment communicating directly with the base, whereas the upper member enters the compartment communicating directly with the steam-dome, the tube forming thus a steady ascent and enabling an unimpeded circulation, the cool water from the base entering the lower member. The heat from the furnace causes a rapid movement upward, and the steam formed from the water in its ascent through each tube is disengaged in the most direct manner by entering and ascending the compartment communicating directly with the steam-dome. The short water-legs not connected with the hollow base H receive their water-supply by overflow from the domes, or I may connect said short legs with the adjoining long one by a pipe N, (see Figs. 1 and 2,) thus establishing direct connection with the hollow base and circulation the same as in the long water-legs.

O O are circulating-pipes connecting the domes below the water-line with the hollow base H, which connection establishes a complete circulation in the boiler. I employ two domes E E in preference to one, which, in order to have the same steam-disengaging surface on the water-line, would have to be of twice the diameter, and hence would be able to sustain only half the pressure which the domes E E will sustain. Another reason is that the two domes, in connection with a third dome F, placed directly above and parallel to domes E E, and from which I obtain dry and superheated steam, enables me to regulate the opening from the fire-box into the chimney to any desired dimension by contracting the space between the three domes until the combined area of the openings *i i* (see Fig. 1) shall be about equal to the area of the chimney. I thus force the fire-gases through long and narrow slits or openings, and in this manner utilize more effectively the heat generated in the furnace.

R is the feed-connection to the hollow base, and K the steam-pipe from the dome F.

p p are pipes connecting domes E E to dome F.

Y is a sheet-iron casing with smoke-pipe connection inclosing the domes.

e, *f*, and *g*, Fig. 3, are respectively corrugated iron, mineral wool, or other refractory material and an outside casing employed on the two sides of the boiler parallel to the water-tubes, extending from the base to under the domes, in order to prevent radiation and waste of heat. I also use a water-leg, as shown in Fig. 4 in a perspective view. This water-leg F has no inside vertical partition and is simply a box-leg, open at top and bottom to connect with the domes and base in the same manner as those above described. This water-leg has V-shaped tubes projecting from its face, which tubes are set straight in a vertical position above each other's two vertical rows side by side in one face. The tubes have members of unequal length, the bottom one being the longest, projecting into the interior of the water-leg and as near to the rear wall of the same as will permit of free access of the water into the tube, whereas the top member is flush with the inside face of the front wall. This is for the purpose of obtaining for circulation the colder water, and also that the flow of water into the lower member shall not be impeded by the steam issuing from the top members, which are directly below the lower members of the tubes above them. I also make the top members of said V-shaped tubes of a larger diameter than the bottom members, in such proportion as is conditioned by the increasing volume of the water and steam in their ascent through the tubes.

I also construct my boiler with water-legs, as shown in Fig. 5. For some purposes and where extremely high pressures are to be carried the application of a cast water-leg such as described is not desirable. In such case I construct a water-leg composed of two upright pipes U and P, Fig. 5. These two pipes are connected at top and bottom by steel fittings Q and X. Tube P being closed at the bottom, but both of them open at the top, I form thus a water-leg in every respect equal to that shown in Figs. 1, 2, and 3, having two separate compartments. Now I connect these two tubes U and P either by V-shaped tubes, as heretofore described, or by a double-V-shaped tube or a tube in the form of a letter W, and which in Fig. 5 is designated by that letter. In using this latter form of a tube I save one-half of the connections with the tubes U and P and have more flexibility or less rigidity in the connections, and still I have an equally effective circulation, which takes place precisely as heretofore described and as indicated in Fig. 5 by arrows.

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

1. In a portable sectional boiler, the combination of a mud-drum, a furnace, and steam-domes with a series of water-legs, each constructed with a horizontal flange at the bottom for connection with the mud-drum and an outwardly inclined flange at the top for connection with the steam-dome, and having a vertical partition forming two adjacent vertical compartments of equal relative position to the furnace, both compartments open to the steam-dome, but only one open to the mud-drum, and said compartments connected by return-bend water-tubes crossing the fire-box in such a manner that the tube starting from the compartment in direct communication with the mud-drum shall in its return enter the adjacent compartment at a point higher than that from where it started, substantially as described.

2. In a portable sectional water-tube boiler, the combination of a water-leg having a ver-

tical partition forming two adjacent vertical compartments, both open to the steam-dome, but only one communicating directly with the mud-drum, with V-shaped or return-bend tubes placed in an oblique position and in vertical rows above each other and connecting said two compartments, the tubes of opposite water-legs interlocking with each other, substantially as described.

3. In a portable sectional water-tube boiler, a series of water-legs, each composed of two vertical pipes U and P, united at top and bottom by fittings Q and X and connected by return-bend V-shaped tubes, substantially as described.

JOHN CHRISTIANSEN.

In presence of—
GEO. L. GILL,
HENRY E. RICH.