

No. 705,682.

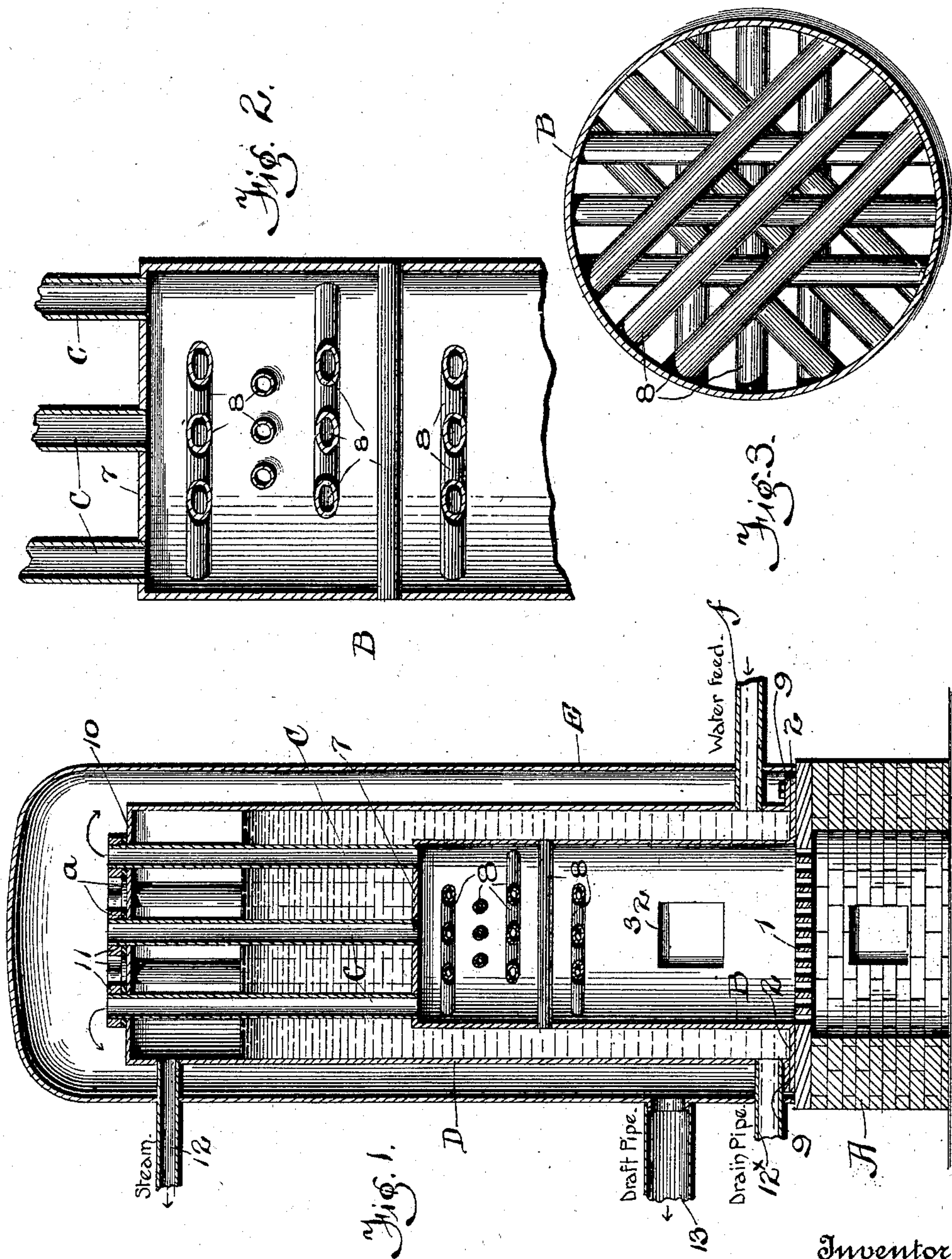
Patented July 29, 1902.

F. LOGAN.

STEAM GENERATING AND WATER HEATING BOILER.

(Application filed May 11, 1901.)

(No Model.)



Witnesses  
Horace G. Seitz  
Albert Popkins

Inventor  
Ferdinand Logan  
by Jas. L. Skidmore  
His Attorney.



# UNITED STATES PATENT OFFICE.

FERDINAND LOGAN, OF PHOENIXVILLE, PENNSYLVANIA.

## STEAM-GENERATING AND WATER-HEATING BOILER.

SPECIFICATION forming part of Letters Patent No. 705,682, dated July 29, 1902.

Application filed May 11, 1901. Serial No. 59,803. (No model.)

*To all whom it may concern:*

Be it known that I, FERDINAND LOGAN, a citizen of the United States, residing at Phoenixville, in the county of Chester and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Generating and Water-Heating Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in water-heating or steam-generating boilers of that kind or class usually known as "upright" or "vertical" boilers, wherein the draft courses from the combustion-chamber up through the boiler-flues in vertical direction; and the objects are to simplify and improve the existing art by providing a boiler which is economical in the consumption of fuel, effective in production of caloric results and reduction of smoke, and which may be readily repaired and cleaned.

Another object is to so construct the boiler that all rivets and stay-bolts are dispensed with.

With these objects in view the invention consists in the novel construction of parts and their operative aggroupment, as will be hereinafter fully specified and then particularly pointed out and distinctly claimed.

I have fully and clearly illustrated the invention in the accompanying drawings, forming a part of this specification, and wherein—  
Figure 1 is a vertical central section through the boiler and inclosing casing, showing the general arrangement of the parts. Fig. 2 is a detail view of the interior cylindrical portion of the boiler, showing the water-circulating pipes and vertical flues. Fig. 3 is a cross-sectional plan view of the combustion-chamber of the boiler, showing the irregularly-arranged and staggered circulating-pipes of the boiler.

Referring to the drawings, A designates the foundation on which the boiler is supported. This supporting-foundation may consist of a metal base or may be built up of suitable walls of masonry. On the top of this foundation is arranged and supported a proper fire-grate 1.

B designates the interior cylindrical case

of the boiler, seated on and secured to the annular flange or plate of the grate and formed with a comparatively broad annular flange 2, which supports the cylinder, as indicated. From the inner edge of this flange 2 the interior shell or case of the boiler extends vertically to such height as may be required, according to the size and capacity of the boiler fixed upon. In the boiler at the lower portion is arranged a suitable opening 3, as shown in Fig. 1, through which opening the fuel is supplied to the fire-pot or combustion-chamber. The top of the interior cylinder B is closed by a crown head or disk 7, in which are formed a plurality of apertures in which the lower ends of the fire-tubes C engage and are secured in any proper manner. In the interior cylinder B, at a proper height over the combustion-chamber, are secured a plurality of water-tubes 8, arranged in irregular relation with their ends opening through the shell into the water-space of the boiler. The layers or tiers of each series of these water-tubes 8 in vertical succession are placed on parallel planes at different heights and in staggered relation to each series, so that as the products of combustion ascend through the irregularly-occurring interstices thus formed through the nest of water-tubes each successive layer lies in the path of the ascending fumes and is presented directly in contact therewith, whereby each water-tube is impinged by and largely enveloped by the flame or heat, and the smoke and unconsumed products thus retarded in their course to the draft-tubes, so that a very material part of the heat produced is directly in the nest and much of the smoke or unburned products are consumed and eliminated.

D designates the outer cylindrical shell of the boiler, made of larger diameter and greater length than the shell B, which it incloses and surrounds, as indicated in the drawings. At the base of the shell D is formed an annular flange 9, which fits down on the annular flange 5 of the interior shell B, the two being secured together by suitable fastenings. In the head 10 of the shell D are formed openings in which and through which the upper ends of the fire-tubes C extend and are held by means of screw-nuts 11 on the projecting threaded ends of the fire-tubes.



C designates the fire or draft tubes of such number as may be required by the size and capacity of the boiler. These fire-tubes have their lower ends secured in the crown-plate of the interior shell B and extending vertically have their upper ends screw-threaded and projected through the apertures in the head 10 of the shell D and secured by fastening-nuts 11, as indicated. In order to accommodate or compensate for the contraction and expansion of the tubes in their relation lengthwise to the other parts, the upper ends at their point of projection through the head of the boiler are provided with expansive packing *a*, such as asbestos or similarly-affected durable material.

At the lower portion of the boiler is let in a water-feed pipe *f*, and at a suitable point in the boiler is fixed a steam discharge or delivery pipe 12 for conveying the steam to the point desired, and at the lower portion of the boiler is let in a pipe 12<sup>x</sup> for the purpose of draining the water therefrom as desired.

Over the boiler is arranged a metal shell or casing E, extending above the head or top of the boiler and reaching down to the base thereof. This shell or casing E is of greater diameter than the boiler, so that an annular draft-space surrounds the boiler within the shell, and since it is intended to utilize the heat discharged through the fire-tubes the exit draft-pipe 13 is placed adjacent to the base of the outer shell E.

It will be perceived from the foregoing description and by reference to the drawings that by reason of the superimposed flanges at the base of the boiler and the particular arrangement of the elements composing the apparatus I am enabled to dispense with all the usual stay-bolts, braces, and rivets, the relation of the parts being insured by the fastenings through the base-flanges and the interposition of the draft-flue pipes. It will thus readily be observed that the construction and arrangement provide a boiler economically manufactured without endangering its utility and durability.

The operation may be stated as follows: The products of combustion rising from the fuel in the combustion-chamber encounter the first and lowermost series of water-tubes and pass through the spaces between them and are interrupted by the intersecting series of water-tubes in the plane immediately above, where they are deflected and in a manner retarded, so that their full effects are applied to the surfaces of the water-tubes in this upper series. From these upper tubes the products of combustion not dissipated by application proceed upward through the interstices of each successive layer or series of water-tubes, being continually applied with their full effects to each water-tube and deflected therefrom in a large measure in lateral directions and against the interior side and crown surface of the combustion-chamber of boiler until they escape through the vertical flue-

pipes at the top of the boiler, where they impinge against the dome or inner surface of the inclosing case and are directed downward through the space between the outer casing and the boiler and escape well depleted of smoke and heat through the draft-exit pipe.

By the construction and arrangement a material saving of fuel is made and full effects of the products of combustion being applied to the inner surface of the boiler and at the same time impinging against and enveloping the varying crossing water-tubes the greater quantity of caloric products is utilized and the result is speedy and effective heating of the water and generation into steam.

What I claim is—

1. The combination in an upright water-heating or steam boiler, of an inner boiler-cylinder having a combustion-chamber, a plurality of water-tubes across the interior of the cylinder in the combustion-chamber, arranged in parallel planes at different heights and at different planes in relation to the axis of the boiler whereby each layer or series of water-tubes intersect interstices between adjacent series, an outer boiler-shell forming a water-space between the two shells or cylinders, a plurality of vertical flue-tubes extending from the crown of the inner boiler-shell through the head of the outer boiler-shell, inlet and outlet pipes for the boiler, and an outer metallic shell provided with an outlet-pipe below the plane of the exit ends of the flue-tubes to direct the draft, substantially as described.

2. In an upright water-heating or steam boiler, a combustion-chamber; an annular water-chamber surrounding the combustion-chamber; connections between opposite sides of the water-chamber and extending through the combustion-chamber to permit of the passage of water therethrough; flue-pipes leading from the combustion-chamber, above said connections, through said water-chamber; and an annular draft-flue surrounding said water-chamber to provide an exterior heating to the water-chamber, substantially as described.

3. The combination in an upright water-heating boiler, of an inner boiler-cylinder having a combustion-chamber, a plurality of water-tubes disposed across the combustion-chamber arranged in parallel planes at different heights, and in different planes in lateral relation to each other, whereby each layer or series intersect interstices between adjacent series, an outer boiler-shell longer and of greater diameter than the inner one, a water-space being formed between the two boiler-shells, a plurality of vertical pipe-flues extending from the crown of the combustion-chamber through the head of the outer boiler-shell, inlet and outlet pipes for the boiler, and an outer inclosing metal shell covering the boiler and arranged to form an annular draft-space surrounding the boiler between its inner face and the outer face of the boiler and



provided with a draft-pipe adjacent to its lower end, substantially as described.

4. The combination in an upright water-heating or steam boiler, of an inner boiler-cylinder formed with an annular base-flange, an outer boiler-cylinder of greater diameter than the inner cylinder and formed with an annular base-flange adapted to set upon the base-flange of the inner cylinder, fastening-bolts extending through the superimposed base-flanges, and vertical fire-tubes extending between and connecting the crown of the inner boiler-cylinder and the head of the outer cylinder whereby said inner and outer cylinders will form a unitary structure secured at the base thereof, substantially as described.

5. The combination in an upright water-heating or steam boiler, of an inner boiler-cylinder formed with an annular base-flange, an outer boiler-cylinder over the inner cylinder and formed with an annular base-flange adapted to set upon the base-flange of the inner cylinder, fastenings securing the superimposed flanges together, water-tubes across the interior of the inner boiler-cylinder arranged in parallel planes at different heights and at different planes in relation to the axis of the boiler whereby each layer or series of water-tubes intersect interstices of adjacent series, and flue-tubes opening from the crown of the inner cylinder and extending through the head of the outer cylinder, whereby said inner and outer cylinders will form a unitary

structure secured at the base thereof, substantially as described.

6. The combination in an upright water-heater and steam-boiler, of an inner boiler-cylinder formed with an annular base-flange, an outer boiler-cylinder over the inner cylinder and formed with an annular base-flange to set upon the flange of the inner cylinder, fastening-bolts through the superimposed base-flanges, water-tubes across the interior of the inner boiler-cylinder arranged in parallel planes at different heights and at different planes in relation to the axis of the boiler, so that each layer of the series intersect the interstices of adjacent series, flue-tubes opening from the crown of the inner cylinder and extending through the head of the outer cylinder, a feed-pipe to conduct water to the boiler, a steam-pipe to convey steam from the boiler, and a pipe to discharge water from the boiler, an outer inclosing case covering the boiler and arranged to form an annular draft-space between its inner face and the outer face of the boiler, and a draft-pipe adjacent to its lower end, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

FERDINAND LOGAN.

Witnesses:

T. L. HODGE,  
H. W. STONE.