

No. 756,822.

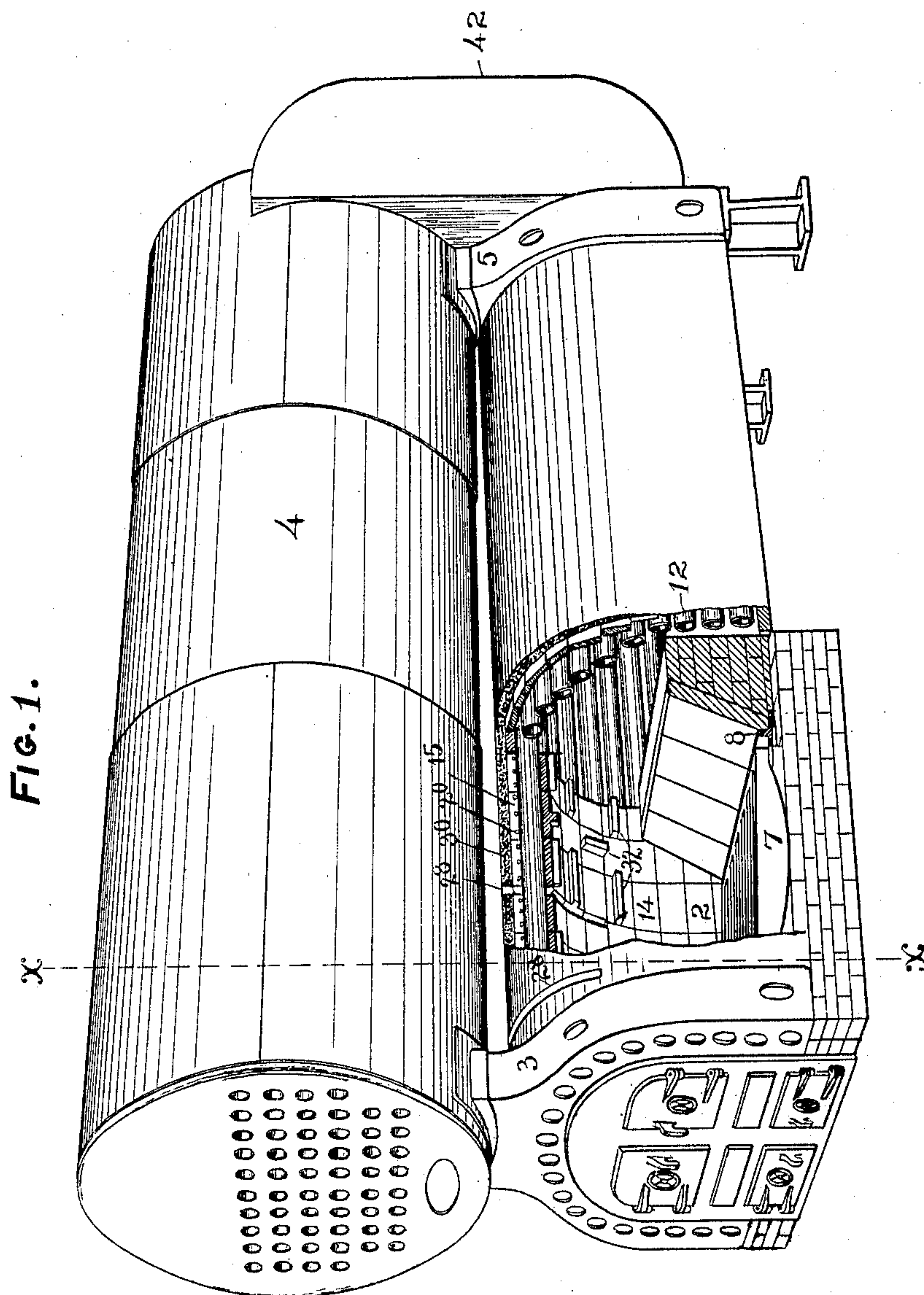
PATENTED APR. 12, 1904.

W. W. BONSON.
COMBINED BOILER AND FURNACE.

APPLICATION FILED MAY 11, 1903.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses

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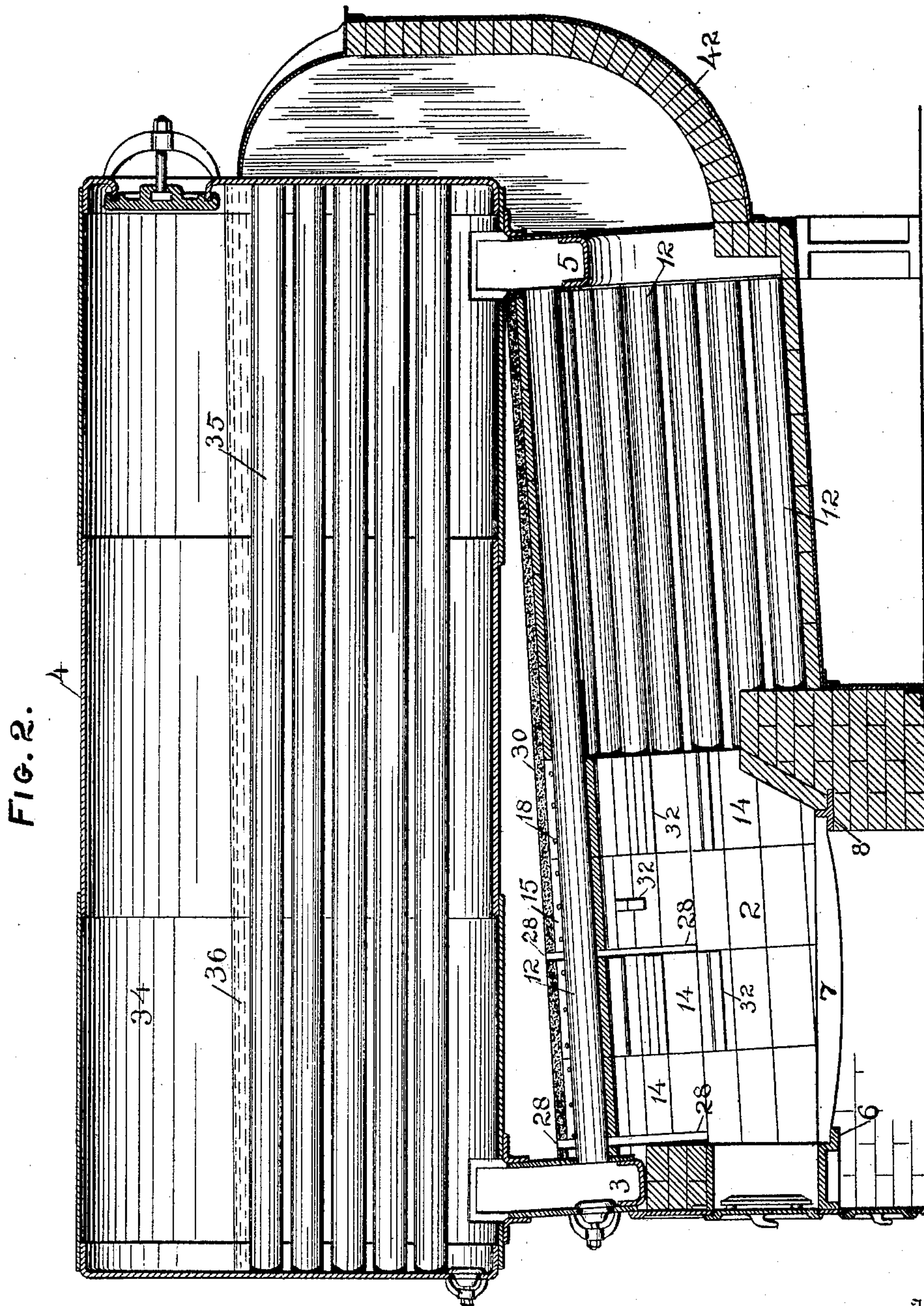
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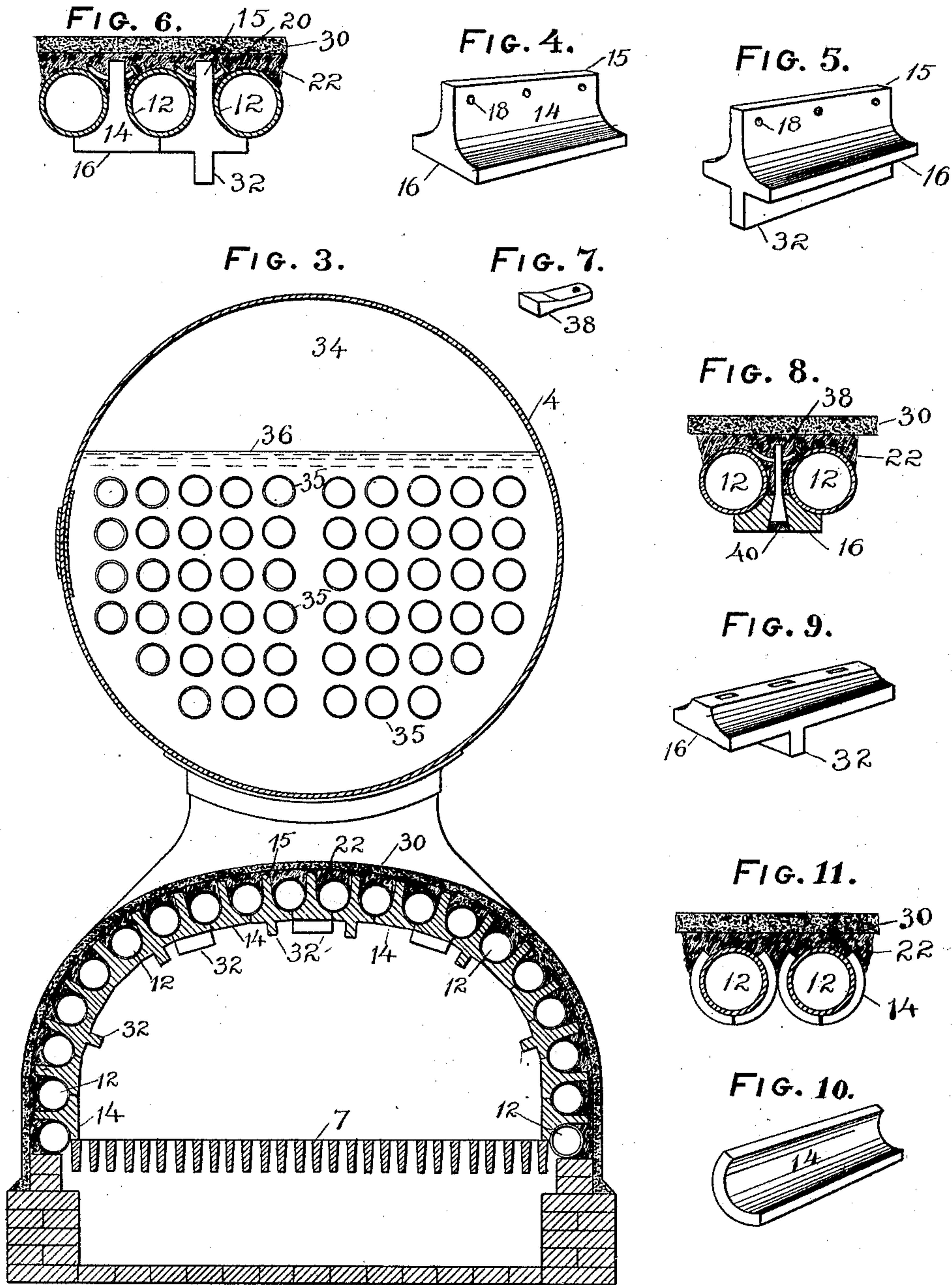
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UNITED STATES PATENT OFFICE.

WILLIAM W. BONSON, OF DUBUQUE, IOWA.

COMBINED BOILER AND FURNACE.

SPECIFICATION forming part of Letters Patent No. 756,822, dated April 12, 1904.

Application filed May 11, 1903. Serial No. 156,549. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM W. BONSON, a citizen of the United States, residing in the city and county of Dubuque and State of Iowa, have invented certain new and useful Improvements in a Combined Boiler and Furnace; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention has relation to improvements in combined furnaces and boilers, with special reference to those adapted to be used in connection with steam-boilers; and one of the objects is to provide a furnace wherein complete combustion can be secured and heat applied to the water in the boiler with the minimum loss.

Another object is to provide means for introducing air into the combustion-chamber over the fuel for the purpose of aiding combustion.

A further object is to so construct the furnace that it will not be readily burned out, and should one part of the furnace be burned out, deteriorated, or fall the remainder of the furnace will stand.

It consists of a fire-grate which is arched over with water-tubes, preferably running longitudinally with the grate, and to the under side of the arch thus formed and over the grate is set a lining for the fire-box.

It also consists in apertures between or through the lining of fire-brick or tiling for introducing the air above the grate-bars and preferably in the arch of the lining, where the products of combustion immediately pass when released.

It further consists in projections secured to the lining of the fire-box and projecting into the fire-box whereby the air and products of combustion are thoroughly mixed before passing out of the combustion-chamber.

The mode of construction whereby these objects and others are accomplished and the manner in which they are applied will be specifically set forth in the following specification to be read in connection with the drawings accompanying the same.

Figure 1 is a perspective view of the furnace 50 and boiler over the furnace, part cut away. Fig. 2 is a longitudinal section through the middle of the boiler and furnace. Fig. 3 is a vertical or cross section through the line *xx* of Fig. 1. Fig. 4 shows a perspective view of one form of tiling or fire-brick. Fig. 5 shows another form of fire-brick. Fig. 6 shows an end view of the fire-brick shown in Figs. 4 and 5 in position and a section of the water-tubes and fire-clay above the tubes and the non-conducting covering. Fig. 7 is an iron center for a fire-brick. Fig. 8 is an end view of Fig. 7 and a section of its surroundings. Fig. 9 is a form of brick having projections running at right angles to the body of the brick and used with the iron center shown in Fig. 7. Fig. 10 shows another form of fire-brick, and Fig. 11 shows the same in position.

Like figures of reference denote corresponding parts in each of the drawings.

Referring to the drawings, 2 designates the furnace, and 4 the boiler, set over the furnace. Attached to the front and rear ends of the boiler are water-legs 3 and 5, which open into the boiler and permit a free circulation of the water in the boiler with the water in the water-legs and water-tubes presently to be described.

The furnace is constructed with the usual grate-bars 7, resting at their front ends on a bearing-bar 6 and extending back and resting in the rear on the bridge-wall 8.

In the front and rear water-legs of the boiler are inserted water-tubes 12, preferably in the form of an arch over the grate commencing nearly on a horizontal plane with the grate-bars, as shown in Figs. 2 and 3. These water-tubes 12 are set slightly sloping from the rear to the front and a short distance apart. I prefer to have these tubes 12 run longitudinally with the furnace-grate; but it is manifest that they may run at an angle, curving over the grate, and be connected with the boiler or water-legs in any convenient manner. Beneath these water-tubes 12 there is formed an arch of fire-brick or tiling in substantially the following manner: A convenient form of constructing the brick 14 is shown in Fig. 4 and

consists in a thin upper portion 15 and a widened base 16. Near the top are perforations 18. This brick is inserted between the tubes 12, (see Fig. 6,) with the part 15 projecting up between the tubes 12 and the curved upper part of the base fitting snugly against the tubes, and through the perforations 18 are inserted keys or pins 20, which hold the brick snugly against the tubes by which the brick are sustained. For the purpose of further completing the arch of the furnace and more securely holding the brick 14 between the tubes 12 there is poured around the upper portion of the tubes 12 and also around the brick 14 and the pins 20 fire-clay 22, as shown in Fig. 6. In this manner the entire arch over the grate which forms the lining of the furnace is formed of these fire-brick, held by their contact with and between the water-tubes 12. These fire-brick may be made in various forms, and in Figs. 7 and 8 I have shown a modified form in which a part is made of brick formed around the base of an iron key 38 and filled in with fire-clay 40 in such a manner that the iron will not come in contact with the flame, but still add largely to the strength of the brick. This brick is inserted between the tubes and held in position by the keys or pins 20 in the same manner as the other brick 14. In Figs. 10 and 11 I have shown the brick 14 of circular shape made in two sections, compassing the under part of the tubes 12 and extending nearly two-thirds around it and held in between the tubes by the fire-clay 22 and in contact with each other.

For the purpose of introducing air into the combustion-chamber over the fuel and at the top of the combustion-chamber some of the fire-brick are set with a space 28 between them, as shown in Fig. 2. In this manner the air will pass into the combustion-chamber at and near the top over the fuel and in the place where the air is most needed for aiding combustion. The roof of the furnace thus formed is covered with a layer of asbestos 30 or any non-conducting material.

For the purpose of more thoroughly mixing the oxygen of the air with the smoke, gas, and other products of combustion some of the brick 14 are provided with projections 32, which project into the fire-box, and thus arrest somewhat the movements of the air and products of the combustion and cause them to be thoroughly mixed while they are passing through the combustion-chamber. Part of the brick may be provided with the projections 32, running at right angles to the water-tubes, as shown in Fig. 9.

From the end of the fire-box proper to the rear end of the tubes 12 the fire-brick may be placed over the top of the tubes and allow the fire to come in direct contact with the tubes, or the same arrangement and construction as has been shown in the fire-box may be con-

tinued to the end of the tubes 12; but I prefer that over the rear of the furnace the brick shall be set so as to form an arch over the tubes 12 and rest thereon.

Over the furnace and the tubes 12 is set a boiler 4, provided with the steam-space 34 and the fire-flues 35, through which the fire passes, with water-space 36 around the tubes and the water-space connected with the tubes 12 by the front and rear water-legs 3 and 5. At the rear end of the boiler and tubes 12 a back connection 42 is attached for directing the products of combustion from the furnace into the flues 35 of the boiler.

The manner of using my device is substantially as follows: The water is introduced into the boiler and passes down through the water-legs 3 and 5, filling the water-tubes 12 and filling the boiler above the flues. The fire is then started upon the grate in the fire-box. Combustion takes place, and the heated gases rise from the fuel on the grate-bars until they strike the lining of fire-brick above the grate-bars, when they will pass backwardly along this lining of fire-brick, back along the water-tubes to the back connection, thence forward through the smoke-flues of the upper boiler 4, and out through the chimney. As the combustion continues, the lining of the combustion-chamber will become intensely heated, and as fire-brick possess the properties which enable them to retain their surfaces at the same temperature as the products of combustion coming against them the particles of carbon thrown off and the gases released from combustion of the fuel will be immediately ignited upon coming in contact with the brick and air supplied through the openings 28, and the combustion will become complete by the thorough mixing of the air with the products of combustion as they pass against and around the projections 32. As soon as the water-tubes become heated the water will begin to circulate through them from front to rear and up into the boiler through the water-leg 5 and down from the boiler through the water-leg 3, and in this manner there will be such a rapid circulation that there will be little or no deposit either in the boiler or water-tubes. The flues in the boiler will also be free from deposit, since the smoke and other products of combustion have been consumed before reaching the boiler-flues. Hence the heat will be readily taken up by the water and very little of it lost.

By this mode of construction it will be observed that each particle of the various products of combustion will be so thoroughly mixed with the air that they will be supplied with sufficient oxygen to ignite and complete their combustion before coming in contact with any cooling-surface and largely before passing out of the fire-box. It will also be seen that some of the heat is imparted to the water-tubes sus-

5 taining the fire-brick; but as the temperature of the water in the tubes does not rise higher than the temperature of the steam they will be considerably cooler than the brick and will protect the brick from deteriorating or burning out and crumbling to pieces.

10 It is manifest that different material may be used for the lining of the fire-box and a different mode of applying it to the water-tubes over the grate without departing from the spirit of my invention and that this furnace may be applied in connection with most of the types of water-tube boilers.

15 Having now described my invention, what I claim is—

1. In a combined boiler and furnace, a grate, water-tubes above the grate, and fire-brick provided with projections and suspended from the water-tubes over the grate forming a lining for the fire-box with air-holes there-
20 through.

2. In a combined boiler and furnace, a grate, water-tubes above the grate, a lining for the fire-box attached to the under side of the tubes over the grate and said lining provided with openings therethrough to introduce air into the fire-box above the fuel.

3. In a combined boiler and furnace, a grate, water-tubes set over the grate, a lining for the fire-box secured beneath the water-tubes and over the grate, and projections secured to the inner side of the lining of the fire-box.

4. In a combined boiler and furnace, a grate, water-tubes set over the grate, a lining for the fire-box, projections on the inner surface of the lining, and means for introducing the air into the upper portion of the combustion-chamber.

5. In a combined boiler and furnace, a boiler provided with flues, a water-leg at each end of the boiler, water-tubes connected to both of the water-legs, a grate beneath the water-tubes, a lining covering the full length of the fire-box and secured beneath the water-tubes over the grate.

6. In a combined boiler and furnace, a boiler provided with flues, water-legs, water-tubes connected to the water-legs, a fire-box extending from the water-legs to the bridge-wall having a grate and fire-brick attached to the under side of the water-tubes over the grate and a combustion-chamber extending from the

bridge-wall to the rear water-leg and provided with fire-brick over the water-tubes.

7. In a combined boiler and furnace, a boiler, 55 fire-flues through the boiler, a water-leg at each end of the boiler, in combination with a furnace consisting of a grate, water-tubes set over the grate and connected with the water-legs, a lining set between the water-tubes and grate, and projections secured to the lining and extending into the combustion-chamber. 60

8. In a combined boiler and furnace, a boiler provided with fire-flues, water-legs, a grate, water-tubes set over the grate and connected to the water-legs, a lining for the combustion-chamber set between the water-tubes and grate, projections attached to the lining and means for introducing air into the combustion-chamber above the fuel. 70

9. In a combined boiler and furnace, a boiler provided with fire-flues, a water-leg at each end of the boiler, water-tubes connected to the water-legs and forming an arch over the furnace, a grate, fire-brick secured to and between the water-tubes forming a lining for the furnace over the grate and provided with openings through said lining, and projections attached to the fire-brick. 75

10. In a combined boiler and furnace, a boiler provided with fire-flues, a furnace having a covering formed of water-tubes and fire-brick beneath the tubes, water-legs opening into the boiler and connected together by the water-tubes which form a covering for the furnace, and a back connection providing fire communication between the furnace and the fire-flues of the boiler. 80

11. In a combined boiler and furnace, a boiler provided with fire-flues, a furnace provided with a grate, water-tubes with fire-brick beneath the water-tubes forming a covering for all the furnace, a water-leg at each end of the boiler connected together by the water-tubes of the furnace and means for introducing air into the furnace over the fuel. 85

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM W. BONSON.

Witnesses:

M. M. CADY,
B. A. GROTE